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S. HRG. 114–376

THE STATUS OF DROUGHT CONDITIONS THROUGHOUT THE WESTERN UNITED STATES AND ACTIONS STATES AND OTHERS ARE TAKING TO ADDRESS THEM

HEARING

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE

ONE HUNDRED FOURTEENTH CONGRESS

FIRST SESSION

JUNE 2, 2015



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

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THE STATUS OF DROUGHT CONDITIONS THROUGHOUT THE WESTERN UNITED STATES AND ACTIONS STATES AND OTHERS ARE TAKING TO ADDRESS THEM

TUESDAY, JUNE 2, 2015

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

The Committee met, pursuant to notice, at 10:05 a.m. in Room SD–366, Dirksen Senate Office Building, Hon. Lisa Murkowski, Chairman of the Committee, presiding.

OPENING STATEMENT OF HON. LISA MURKOWSKI, U.S. SENATOR FROM ALASKA

The CHAIRMAN. Good morning. We are calling to order the Full Committee on Energy. Welcome to everyone this morning.

We are meeting today to discuss drought conditions. I do not know about the rest of you, but I was completely dumped on yesterday. [Laughter.]

The CHAIRMAN. I had never seen it rain so hard. I was thinking about drought as we were battling the wet weather here, but truly the drought conditions that are facing the Western United States have garnered the attention of so many of us.

Much of the West has been in varying degrees of drought for the past 15 years now. According to a survey released last week by the U.S. Drought Monitor, approximately 57 percent of the West is now experiencing moderate to exceptional drought. All or parts of nine states in the worst shape range from severe to exceptional drought, and the impacts are significant.

California, in the midst of its fourth year of severe drought, has for the first time imposed mandatory 25 percent reductions on water use by residents and businesses.

Many farmers in California continue to face unprecedented reductions in water delivery by the Bureau of Reclamation and the states which are often their primary sources of water. These farmers have contracts with Reclamation and the state, but today, in the absence of water their livelihoods are being dramatically impacted. Drought is leaving behind hard decisions for these folks.

Decisions where they are saying, you know, which fields do they lay fallow? Do they change certain crops that they plant? Do they plow under crops such as fruit trees?

I was out in Fresno several months ago and saw whole fields of beautiful citrus trees, healthy citrus trees, that were literally bull-

dozed over because there was no water. In certain cases the drought has led farmers to go out of business entirely. Of course the impacts are not just on our farmers but with some communities no longer having running water and individuals in farming communities losing jobs.

There is much discussion regarding what drives water release decisions in the state.

During the course of California state's four year drought, for example, many have said that the large amounts of water that had been released at various times and in various forms or held back from release had been done to ensure protection of fish at the expense of cities, towns and farmers.

Indeed we have heard repeatedly that farmers in the state use 80 percent of the state's water. So the question needs to be asked is that accurate? My understanding is that the California Department of Water Resources has reported that state-wide water use looks more like this. Ten percent urban use, forty-one percent agricultural use, and a majority of 49 percent use for environmental management, wetlands, delta outflow, wild and scenic designation and in-stream flow requirements.

One of the very real questions that we should discuss regarding California's circumstances and potentially elsewhere is to what extent is the very important balance between water for fish under State and Federal law being given equal, legal support for that of water delivery to meet the needs of people in cities, towns and farms? And if the balance is not equal, then why not? Are there regulatory imbalances? Can the Federal Government be helpful in addressing imbalances?

Elsewhere in the West the situation, while perhaps not quite as dire, is trending that way. In Washington State the Governor declared a statewide drought emergency on May 15th. In Oregon the Governor has declared a state of drought emergency in seven counties with another eight requesting designation.

Across the Colorado River Basin, where 40 million residents in seven states rely on water from Lake Powell and Lake Mead on the Colorado River for residential, industrial and agricultural needs, the drought in varying degrees has been a fact of life for now some 15 years. The strains are starting to show, most notably at Lake Mead where lake levels have fallen 130 feet in the last 15 years. At the current rate in the next few years, users in Arizona and elsewhere could see reductions in their state allocations under the Colorado River Compact. Hydropower operations at Lake Mead and Lake Powell could also be curtailed in coming years.

As a brief aside, I have mentioned in this Committee and in others that potential hydropower impacts remind us of the very strong nexus between energy and water. The strain that drought puts on that nexus is something that I am watching and am very concerned about.

In the face of the challenges stemming from drought water users, Federal and State officials and others are working to ensure delivery of water where it is needed. These actions include State and Federal officials working together to facilitate water transfers and farmers agreeing to delay the date of deliveries of water to benefit

species. Of course, many farmers have turned to groundwater consumption to meet their needs.

So there are some hard questions, I think, that need to be asked here. Are current actions sustainable in the face of multiyear droughts? Are all affected parties giving sufficient attention to long term planning and related actions? What is the Federal Government's most appropriate role in addressing longer term solutions given tight budgets and that much of what happens with water in the West is actually managed by the states? Are there innovative efforts on the ground that should be replicated? Also what new ideas for water storage, conservation and use might we consider?

We have an impressive panel of witnesses here today. In particular I look forward to hearing from those who are on the ground on how they are meeting the challenges. I look forward to everyone's thoughts on how we can be helpful here.

I will turn to my colleague, Senator Cantwell and note to the Committee that we have a vote scheduled at 10:30 so we will keep the hearing going and just ask members to go vote and then come back.

Senator Cantwell.

STATEMENT OF HON. MARIA CANTWELL, U.S. SENATOR FROM WASHINGTON

Senator CANTWELL. Thank you.

I would like to thank Chairwoman Murkowski for scheduling this important hearing. As you mentioned, in my state the Governor has declared a drought emergency, as has been done in 11 other states. I hope that we can use this hearing to better understand the magnitude of the impact of these droughts across many of our Western states.

I want to emphasize too, that we hope to have a robust discussion today about solutions. Things that we can do and things that we can plan for in the future. What is working, what is not working? What are the Federal Government actions that need to be addressed to face drought issues over the long term? And if drought conditions are likely to become the new normal, what do we need to do to usher in a new era of solutions?

This year many states are experiencing the warmest winter on record. In my state mountain snowpacks, which keeps our rivers flowing in the spring and summer, are now at nine percent of normal levels, and 11 snow sites monitored by the Department of Agriculture were snow free this year for the first time ever.

For example, Hurricane Ridge, which is one of the most visited parts of our state in Olympic National Park, is normally covered in feet of snow at this time of year but is completely snow free this year. It is actually a pretty startling sight to many Washingtonians. As a result of such low snow pack, 78 percent of the state's streams are running below normal and runoff is projected to be the lowest it has been in 64 years.

On May 15th the Governor declared a statewide drought emergency and has been working with communities to mitigate the impacts, particularly in rural communities which have been hard hit. For example, in the Yakima Basin which is the state's most productive agricultural region, irrigation districts are rationing water

and farmers are facing significant cuts. The Washington Department of Agriculture predicts the crop loss could be as much as $1.2 billion this year across the state.

So I want to make sure that our Federal agencies are working hand-in-hand with the states to provide relief and assistance and to try to address this issue moving forward.

Meanwhile our communities are bracing for a severe fire season which also will provide many challenges.

So it is very important to me that we look at responding to the long term changes that are before us, and the ways that we do business in managing water in the midst of this major crisis and that we think about the paradigm shift that is in front of us as we face these warmer seasons.

We need to develop 21st century strategies for water management that not only respond to the drought conditions of today but prepare us for an uncertain future. This requires new ways of thinking and collaboration which means exploring all options, not just incremental change at this point in time.

I think the Yakima Basin project in my state is an example of long term water basin planning which has not been done in the past in which interest groups from farmers to fishermen to tribes to environmentalists are working together to try to implement the best plan over the long term. I think that there are four areas that we should consider moving forward.

One, we need more collaborative water sharing agreements. Just like with the Yakima Basin this empowers communities to take action at a local level and be part of crafting solutions.

Second, we need to be more flexible in drought operations. This includes the way we build, manage and finance storage and other infrastructure and how we support those efforts at the local level. I know a lot of people do not even want to talk about storage because they start thinking about how long it takes to get it permitted and authorized. I am not talking about rolling back environmental laws, but I think we have to think creatively about how we build storage now. We need to, even if it is small scale storage like what is being done with the Yakima Basin project.

We need to do a better job of leveraging science and technology. I am amazed at what Israel has done as a country with such little water resources and yet continue to be such agricultural producers. So we need to make sure that we are deploying new technologies that help improve efficiencies in everything from our hydroelectric dams to agriculture to our homes.

Finally, we need to do a better job of planning for the future instead of just simply reacting.

I hope, Madam Chair, that we can, in the future, get some of our climate scientists from Oak Ridge here. Senator Alexander is a member of our Committee and they have an incredible science on what will be impacting us as a nation. They have the modeling. I think we should look at what these new normal conditions mean to us as a nation because, I think, we can see what the economic impact is going to be from an agricultural perspective. I think it is going to be great. So we need to do a better job planning for the future. We need to do all that we can now at the Federal level to be flexible in our response; to make sure we are making the right

kind of investments to help ensure that our states can deal with these droughts and that our communities will be better protected in the future.

Once again, thank you for your leadership in having this hearing. I look forward to hearing from the witnesses including Tom Loranger, who is the Water Resources Manager from the Department of Ecology in Washington State. I look forward to hearing from all of the witnesses today on this important topic.

The CHAIRMAN. Thank you, Senator Cantwell.

With this we will begin hearing from our witnesses this morning.

Again, a very distinguished panel, thank you, all of you, for being here.

We will begin with the Honorable Michael Connor, who is the Deputy Secretary for the Department of the Interior.

He will be followed by Mr. Thomas Buschatzke, who is the Director of the Water Planning Division for the Arizona Department of Water Resources. Thank you for coming from the West to be here.

Also from the West, from Washington, we have Mr. Tom Loranger, who is the Water Resources Program Manager for Washington State Department of Ecology.

He will be followed by Mr. James Ogsbury, who is the Executive Director for the Western Governors' Association. He will be giving us the perspective from the Western states.

Mr. Cannon Michael is the President of Bowles Farm and he is testifying on behalf of the Family Farm Alliance, welcome to the Committee.

Wrapping up the panel is Ms. Betsy Cody, who is a Natural Resources Policy Specialist at CRS.

So we welcome all of you.

With that, Mr. Connor, we will lead off with you. When the vote is called, you will see various members of the Committee leaving, but I would ask that we just move through the testimony this morning. I know that you have a hard stop at noon, so we want to try to accommodate that. Please limit your oral testimony to five minutes, and your full written statement will be incorporated as part of the record.

Mr. Connor, welcome.

STATEMENT OF HON. MICHAEL CONNOR, DEPUTY SECRETARY, U.S. DEPARTMENT OF THE INTERIOR

Mr. CONNOR. Thank you, Chairman Murkowski, Ranking Member Cantwell, members of the Committee. For the record I am Mike Connor, Deputy Secretary at the Department of the Interior. I want to thank you for the opportunity to testify on the subject of drought and the actions the Department and its Bureaus are taking to address the serious water resource issues affecting much of the West.

I will briefly summarize my very lengthy written testimony.

The Department is acutely aware of the drought-related challenges and worries confronting families, farmers, tribes, businesses, cities and the environment throughout the West. We are committed to doing all we can to address the situation. We understand the implications for Western communities and the need for continuous action to build long-term water supply reliability and resiliency.

Given the current and future impacts associated with climate change and other stressors we have no choice but to adjust and adapt.

To that end, the Department is taking a multifaceted approach and marshalling every resource at its disposal to assist Western communities impacted by drought. The Department has instituted a multipronged strategy that encompasses short-, medium- and long-term dimensions. Given the significant infrastructure owned and operated by the Bureau of Reclamation, an urgent response to drought requires a focus on immediate day-to-day operations.

Reclamation and its partners are taking any and all actions to more effectively manage water and maximize supplies for human use while maintaining environmental conditions necessary to protect fish and wildlife, as well as protect the interests of other water users.

This year, the fourth year of a historic drought in California, litigation has been minimal while Federal agencies, State agencies, water users and non-governmental interests have worked together on drought strategies and other agreements to share limited water supplies. The collaboration and cooperation has been as historic as the drought itself.

Beyond addressing the current crisis we are also making a strategic investment to stretch limited supplies and minimize conflicts over the next several years. As an illustration, just two weeks ago Secretary Jewell traveled to Los Angeles where she announced the total of $49.5 million in grant assistance to co-fund a host of locally driven, water conservation projects under the Water Smart program. These grants join hundreds of millions of dollars to date invested by this Administration and supported by Congress to help families across the West confronted by the historic drought.

Finally, we continue to assess and plan for long-term actions required to improve our understanding of water resources as well as to secure agreements and infrastructure and technology investments needed to address unsustainable water uses that are the source of significant conflict today and likely to get worse in the future.

The Department views this as an all hands effort with actions occurring across the Department. The National Park Service, Bureau of Land Management, Fish and Wildlife Service, Bureau of Indian Affairs and Geological Survey are all working aggressively with our partners.

Our work is dovetailing with that of other agencies like the Department of Agriculture, as part of the Administration-wide, National Drought Resilience Partnership, a forum to align Federal drought policies across the government and help communities manage the impact of drought.

These efforts rely, in no small measure, on the cooperation of a broad array of stakeholders, Governors, tribal leaders, state and local water authorities, conservationists, farmers, ranchers and so many others. From California Central Valley to the Yakima River Basin, from grazing lands and timber lands to park lands and Indian country, collaboration is enabling flexibility to reduce water consumption, prevent water loss, preserve endangered species, protect recreational assets and provide irrigation to water starved

farm lands. Our experience has taught us, however, that to be successful ultimately, we must be dedicated beyond near-term results and commit for the long-term.

Take the Colorado River Basin as an example. That Basin has been the beneficiary of collaborative efficiency measures for the last 15 years. Most recently though the intentionally created surplus program developed in 2007 with the seven basin states as well as agreements forged in 2010 and 2012 with the Mexican Government, through those efforts approximately one million acre feet of water has been conserved, effectively delaying the time at which it will reach critical levels in Lake Mead.

Unfortunately the drought continues to outpace our conservation efforts and potential shortages in the lower basin are now possible in 2016 and 2017, underscoring the need for continued collaboration and extraordinary operational measures into the future.

Successfully confronting the challenges of drought will take considerable investment and ongoing commitment. The Department and this Administration will not lose focus on our duty to help Western communities dealing with drought. We know that neither the Federal Government nor the communities that we serve can simply build, conserve, recycle or regulate our way out of these challenges or rely on only one option to meet the challenges that we face. Rather, we understand the need to take a multifaceted, long-term approach to diversifying our Western water portfolio in working to achieve lasting results.

Thank you for the opportunity. I look forward to your questions.

[The prepared statement of Mr. Connor follows:]

Statement of Michael Connor
Deputy Secretary
U.S. Department of the Interior
before the
Energy and Natural Resources Committee
U.S. Senate

"Status of Drought Conditions Throughout the Western United States and Actions States and Others Are Taking to Address Them"
June 2, 2015

Chairman Murkowski, Ranking Member Cantwell and members of the Committee, thank you for the opportunity to testify about the drought situation in the western United States, and actions the Department of the Interior (Department) and its bureaus are taking to address this period of sustained drought. I am Michael Connor, Deputy Secretary at the Department of the Interior. My statement today provides a high-level summary of the impacts of drought across the West and reviews the broad set of coordinated actions the Department is taking to provide meaningful relief to those affected. My statement also summarizes where the Department's FY 2016 budget request would direct additional resources to these areas.

Let me assure the Committee that the Department is acutely aware of the drought-related challenges and worries confronting families, farmers, tribes, businesses, cities and the environment throughout the West, and that we are committed to doing all we can to address this situation. The drought is affecting the health and safety of certain communities as well as the economic livelihood of many others. Simply put, we understand the implications for western communities and the need to secure long-term water reliability and resiliency in the face of drought and the related impacts of climate change.

To briefly summarize, the Department is taking a multi-faceted approach and marshalling every resource at its disposal to assist western communities impacted by drought. This multi-prong strategy has short, medium, and long-term dimensions. For example, given the significant infrastructure and projects owned and operated by the Bureau of Reclamation (Reclamation), an urgent response to drought requires a focus on the day-to-day operations associated with many projects. Reclamation and its partners are taking any and all actions to more effectively manage water and maximize supplies for human use while maintaining environmental conditions necessary to protect fish and wildlife, as well as the interests of other water users. Beyond the operational and environmental monitoring actions needed to address the urgency of this crisis, we are making strategic investments designed to stretch limited supplies and minimize conflicts over the next several years. Finally, we continue to assess and plan for long-term actions needed to improve our understanding of water resources, as well as secure agreements needed to address unsustainable water uses that are the source of significant conflict today, and likely to get worse in the face of climate change and other stressors.

As one illustration of the Department's commitment, just two weeks ago Secretary Jewell travelled to Los Angeles where she announced $49.5 million in grant assistance to co-fund a host of locally-driven water conservation projects under the WaterSMART Program. Reclamation also is investing more than $24 million in grants for 50 water and energy efficiency projects in 12 western states this year. The Federal funding devoted to those 50 projects will be leveraged with at least 50 percent non-federal funding for a total of $133 million in improvements over the next two to three years. In addition, Secretary Jewell last month announced more than $23 million for ongoing construction at seven water reclamation and reuse projects. While these projects will not yield or save water this year, they add to the $113.5 million invested under WaterSMART over the past two years, which is already yielding benefits and helping to mitigate drought conditions. While these resources will help, the fact remains that today, literally hundreds of thousands of square miles of the western United States, particularly in California and Nevada, remain in the grips of an historic drought. Snowpack and precipitation levels are setting ever-lower records this year, and while the impacts vary by geography, the theme of reduced reservoir storage and critically dry watersheds is the same.

Recognizing the urgency of the situation, Reclamation's operation of its major Federal water infrastructure, especially in California during the 2014-2015 water year, has necessitated a number of extraordinary measures and new agreements with multiple parties. These efforts are succeeding in facilitating unprecedented levels of cooperation in managing water during times of shortage. Within the Central Valley Project, agreements have been crafted to reschedule when water is transferred and delivered; to aggressively manage the remaining stores of cold water for the benefit of endangered salmon and other fish; and to work with the State Water Resources Control Board to help enforce laws prohibiting illegal diversions. The objective of these measures is to preserve as much water in storage as possible.

Wherever feasible, the State of California, Reclamation, U.S. Fish & Wildlife Service, and National Marine Fisheries Service have also worked together to adjust export pumping, fine-tune reservoir releases, and control Delta salinity in the Sacramento-San Joaquin Bay Delta for the benefit of fish species and water users. With the aid of additional fish monitoring and other scientific advances, we have found ways to deliver more water without increasing impacts on fish. These operational changes, negotiated amongst Reclamation, wildlife agencies, the state of California, the water user community, non-governmental organizations and the environmental community, have enabled the conservation of nearly 300,000 acre-feet of water that would otherwise not have been saved. The Department and Reclamation this year have negotiated agreements with the State of California and water users on the Sacramento, Stanislaus and San Joaquin Rivers to deliver water, flexibly manage and operate the system to serve multiple beneficial purposes that include water for cities and rural communities, farms, fish and wildlife and their habitats. We remain committed to implementing these agreements, and revisiting them with our partner agencies and stakeholders when conditions on the ground reflect changed

circumstances. This suite of actions will also help increase the amount of water that can be transferred to areas of the state that have the greatest need for additional water supplies.

This year, the drought has extended north, and in Washington State, Governor Inslee on May 15 declared a statewide drought emergency. Once again, recognizing the need for immediate action, Reclamation is now holding two Water Transfer Work Group meetings per month on the Yakima River Basin, aiming to speed up any potential water right transfers. Reclamation, the Washington State Department of Ecology (Ecology), and the Yakama Nation have been working closely on water supply and drought issues in the Basin since supplies began to be reduced, holding about four meetings since mid-March. This coordination is helping the State and Reclamation partner on many on-the-ground projects. Using state drought funding, Ecology is working with Reclamation and the Kittitas Reclamation District (KRD) to install siphons between Easton and Tillman Creek, allowing the use of Reclamation's KRD system to deliver about 10 cubic feet per second (cfs) to five tributaries providing instream flow for fish. Reclamation and Ecology are also working with Yakima-Tieton Irrigation District to use Reclamation's facilities to deliver about 2-3 cfs of water to the south fork Cowiche Creek providing instream flow for fish. Ecology will also allow junior well pumpers to begin using their emergency drought wells, and discussions about the payment of mitigation and pumping costs are now underway. Once again, the overall goal is to maximize water supply while maintaining environmental conditions to protect critical fisheries.

Amid these extraordinary operational efforts, Reclamation continues to proactively use its WaterSMART grant programs to improve water management and build long-term drought resilience in water-short areas. The WaterSMART grant awards announced last month by Secretary Jewell included two in Washington State for canal lining and pipeline projects, totaling $1.3 million in Federal funding but leveraging over $15 million in additional local funds. Millions more in 2015 WaterSMART awards were announced in Oregon, Utah and Idaho.

In the Colorado River basin—now in its 15th year of drought-Reclamation and four municipal entities[1] have entered into an agreement to jointly fund $11 million for the Pilot System Conservation Program (Pilot Program) to conserve water in Lakes Powell and Mead to benefit the Colorado River System. Reclamation is contributing $3 million for the Pilot Program and the other four funding partners will contribute $2 million each. The Pilot Program is being established to see if additional voluntary, measurable reductions in consumptive use of Colorado River water are a feasible and cost-effective method to partially mitigate the impacts of long-term historic drought on the Colorado River System. Pilot Program fallowing or system efficiency improvements may be implemented in many of the Colorado River Basin States and in Mexico. In response to an October 2014 solicitation, Reclamation has received 20 pre-proposals from 16 agricultural, municipal and industrial, and Native American entitlement holders for

[1] Central Arizona Water Conservation District; Metropolitan Water District of Southern California; Denver Water; and Southern Nevada Water Agency

conservation actions, including temporary agricultural land fallowing, turf removal, system efficiency improvements, water reuse, desalination, and conveyance improvements.

It's important to note that the Pilot Program is an additional measure that builds upon numerous actions taken in the Colorado River basin in the last 15 years to implement efficiency improvements and other conservation measures to maintain as much stored water as possible in Lake Powell and Lake Mead. Most recently, through the intentionally created surplus program developed in 2007 and the 2010 and 2012 agreements with Mexico on the Colorado River (Minutes 318 & 319 under the 1944 Treaty), approximately 1 million acre-feet of water has been conserved in the Lower Colorado River basin, reducing the risk of reaching critical elevations at Lake Mead. Unfortunately, the ongoing drought keeps outpacing our conservation efforts and there is now a significant chance in 2016 of the first ever lower basin shortage with increased chances of shortages in 2017.

The President's FY 2016 budget request expands on the activities already underway in FY 2015. The 2016 budget requests an increase in funding for the Drought Response program—a comprehensive new approach to drought planning and implementation actions such as water marketing solutions to address municipal water shortages, installing water measurement devices to improve efficiency and measure drought impacts, and other small-scale improvements to measurably increase water supply reliability. The 2015 and 2016 budgets include substantial funding for the WaterSMART Program described above, and increases for Resilient Infrastructure, the Drought Response program, and in 2016, implementation of the Administration's Open Data Policy to provide better access to water data, projections, tools, and other information to partners. Congress has provided substantial funding to support drought relief actions and we believe investment of these funds is yielding immediate benefits.

Reclamation is also requesting two changes in authorizations for which language is included in our FY 2016 request. The first is to extend the California Federal Bay-Delta Authorization Act, as amended, from 2016 to 2018, so the CALFED program can continue its critical mission—even more important given the current drought. Language is also included as part of the 2016 Budget to increase the authorized appropriations ceiling of Section 9504(e) of the Secure Water Act of 2009 from $300 million to $400 million.

Other Interior Actions

Our efforts to actively respond to drought conditions extend well beyond Reclamation activities. We are in the midst of coordinating numerous drought activities throughout the Department and the Administration, ranging from monitoring and forecasting water flows and drought; coordinating to protect fish and wildlife while ensuring water supplies continue, and managing drought affected public lands. The Department's bureaus responsible for significant land management activities also participate in the National Drought Resilience Partnership, and are participating members of the Western States Federal Agency Support Team (WestFAST), both

of which address drought issues and impacts. The following is a summary of recent or major drought activities underway at the Department.

Drought conditions, particularly in California, the Northwest, and Alaska, create challenges for the 2015 fire season. We expect that fire season will start earlier in those areas and fires will be larger and more intense. Increased wildland fire risk threatens public health and a variety of resources, including habitat for threatened and endangered species. The lack of snowpack creates large and uninterrupted areas of dry fuels at higher elevations__ resulting in more extensive fires and simultaneous fire seasons in both low and high elevations. The Department, along with our partners in the US Forest Service and the States, is closely monitoring fire weather and fuels conditions. Our firefighting resources and assets will be prepositioned and allocated during fire season to respond to those areas of greatest risk.

The U.S. Geological Survey (USGS) is an integral part of the Department's drought response, and is providing actionable, science-based information and tools as a participant in the National Drought Resilience Partnership. During drought, forecasting stream low-flow conditions can be critical for water apportionment and ecosystem protection. The USGS is measuring stream low flows throughout the drought-stricken regions. Stream flow gages are then adjusted to assure accurate, real time measurements of water availability. More broadly, the USGS is characterizing and predicting drought streamflow across the Nation. Estimates of drought flow frequency, duration, magnitude, and probability are needed throughout the United States to better understand and anticipate drought streamflow conditions. The USGS is expanding the capabilities of its coupled groundwater/surface-water flow model GSFLOW to provide an option that allows modelers to improve these low-flow forecasts for critical water-supply basins in which groundwater plays a significant role.

In addition to ground-based observations of hydrologic response in our surface and groundwater resources, USGS provides remote sensing data from earth observing satellites to evaluate drought conditions. The Vegetation Drought Response Index (VegDRI) integrates space-based observations of vegetation with other information about climate, land cover-land use, ecological setting, and soil characteristics to show drought's effect on vegetation at a 1-kilometer resolution.

The U.S. Fish and Wildlife Service (Service) is coordinating with federal, tribal, and state partners to protect Service trust resources while ensuring water supplies remain available to multiple users. Contingency planning is underway in many western regions and every effort is being made to avoid emergency releases, particularly in our Pacific Region. Additionally, our regions are addressing drought impacts by producing water inventories and assessments for national wildlife refuges, and facilitating research on drought effects on species with partner agencies.

This month the Army Corps of Engineers and Reclamation requested Emergency Consultation with the Service on installation and operation of an Emergency Drought Barrier at West False River in the Bay-Delta. The Service responded promptly with recommendations to minimize the effects of the emergency response on threatened and endangered species. The prompt response allowed construction to begin on an action needed to safeguard human life and property. Other extraordinary measures have been taken at the Coleman National Fish Hatchery in California, where twelve million young fall-run Chinook salmon were trucked to locations 200 miles downstream of the hatchery in the last several months. This action differs significantly from the Service's normal method of releasing fish into the river near the hatchery. The action was taken to provide flexibility in water operations and to prevent high mortality of the fish.

Our fish hatchery managers are acutely aware of low water issues associated with their hatcheries. In the Pacific Northwest, we don't expect any major changes in production numbers this year. However, multiple years of drought might require an early release of production fish to provide better outmigration conditions, in addition to reduced production numbers and rearing densities in the hatcheries.

The Bureau of Land Management (BLM) is also doing its part to carry out its mission while adapting to drought. Drought conditions across the West have significantly impacted BLM-managed rangelands, leaving limited water and forage for wildlife and livestock. Successive years of drought on public lands have reduced the vitality and production of forage, affected fisheries and aquatic wildlife through higher surface water temperatures, dried up springs and increased grazing concentration around remaining water sources, and have made forests more susceptible to insect and other pest damage.

The BLM's mission is to manage public land resources for a variety of uses, such as energy development, livestock grazing, recreation, and timber harvesting, while protecting a wide array of natural, cultural, and historical resources. The BLM works toward voluntary changes in use with grazing permittees but will issue decisions if necessary. In addition, the agency monitors water availability for wild horses and may arrange to haul water, collaborates with energy and timber operators to minimize fire risk, deploys fire-fighting equipment for quicker response, and proactively communicates fire and activity restrictions to the public. As part of these efforts, for example, BLM Director Neil Kornze and Deputy Director Steve Ellis held a series of meetings in May with local officials and stakeholders in Nevada and Utah to discuss how they can best collaborate and continue ongoing actions to address drought.

The National Park Service (NPS) is working to address the drought at various levels within the agency. The NPS Water Resources Division is assessing park water rights and their vulnerability to drought and resulting in calls for curtailment by state water right agencies. NPS also addresses drought via its participation in the Colorado River Steering Committee, which monitors drought related impacts on the river and associated reservoirs/parks, by conducting riparian assessment surveys of drought impacts on park wetlands, and by participating in

discussions with states water rights and resource managers to protect park water resources from drought impacts. Finally, many of the national parks and other land units have drought information and education pages on their websites describing specific ongoing activities related to drought monitoring and planning, and the impacts of drought on wildlife, trees/plants, fire management, and water resources.

Severe drought conditions are also impacting Native Americans living on Tribal land and public domain allotments throughout the Country. Many of these lands typically have had limited access to water resources even in average water years. Extreme drought conditions in the southwest and particularly California has exhausted limited water supplies for all aspects of life, with adverse impacts to health, sanitation, crops, range land, timber, and hardwood forests. Wildfires are also taking their toll in Indian Country.

The Bureau of Indian Affairs (BIA) has had limited funding available to combat or provide relief for drought conditions currently being experienced by the Tribes. Nonetheless, the BIA is keeping current with existing technologies and planning techniques and is offering technical assistance to Tribes when necessary. The BIA is continuously seeking additional funding sources with other federal departments, states and jurisdictions to provide much needed relief to the tribes. BIA works to promote regional partnering, and collaboration among all stakeholders within a given watershed to conserve water resources within these impacted areas. In addition, the Department continues to prioritize the implementation of Indian water rights settlements to provide infrastructure that improves water supply reliability for Tribes which, in turn, builds resiliency for tribal lands to weather times of drought.

Administration-Wide Actions

Looking to the future, we need to be prepared to manage the risks associated with drought that will be influenced by climate change. There are inherent uncertainties in climate change science and how climate change may affect drought, including with respect to geographic distribution, precipitation and temperature. However, based primarily upon temperature alone, impacts to Western water will be exacerbated through evapotranspiration, that is, the water utilized by plants, crops, and evaporated from soil moisture. A recent study released by Reclamation in February 2015 revealed that net irrigation water requirements in the West may be six percent higher in the second half of the 21st century compared to the second half of the 20th century, while reservoir evaporation may increase. Further, the National Climate Assessment (NCA) of 2014 concludes "there have been changes in heat waves and in floods and droughts over the last several decades," "future changes are projected," and "droughts in the Southwest and heat waves everywhere are projected to become more intense."

The Department's actions are part of an Administration-wide approach to address drought conditions and build resiliency in the face of long-term projections, which point to increasing challenges in water resource management. The National Drought Resilience Partnership

(NDRP) was launched as part of the President's Climate Action Plan to serve as a forum to align Federal drought policies and programs in support of state, tribal, and community efforts, and to leverage the work of existing federal investments such as the National Integrated Drought Information System (NIDIS), the development of a National Soil Moisture Network, and other interagency partnerships like the Reclamation-Natural Resources Conservation Service partnership to strengthen agricultural water use efficiencies. By linking information on monitoring, forecasts, outlooks, new technologies, and early warnings with long-term drought resilience strategies in sectors like agriculture, municipal water systems, energy, recreation, tourism and transportation, we can bolster our Nation's ability to manage threats to its finite water resources and mitigate impacts to communities and our economy. By marshalling Federal resources in specific Western watershed basins, the NDRP is also working to demonstrate how drought preparedness can be improved when the Federal government takes a coordinated, "all-in" approach to support local communities. The Administration has also provided information and access to drought relief programs at USDA; made strategic investments to address drought through funding programs at Interior, USDA, and EPA; and continues to improve and enhance scientific capabilities to respond to drought and a changing climate.

Conclusion

The Department is pursuing a coordinated 'all hands' approach to drought, and working aggressively with our partners. We recognize that more can always be done, and we know that combating drought is not about throwing money at the problem. Some in the communities we serve, particularly in the Central Valley, have told us, 'we don't want money, we want our water.' We have heard them and are using every tool available to provide water this year while continuing efforts to improve conditions in future years. Nonetheless, the fact remains that the hydrology in many areas of the West is at historic lows and shortages will continue despite the efforts of the Federal government and its state, local, and tribal partners. While this reality is daunting, the Department and this Administration will not lose focus on our duty to help the western communities dealing with drought after this budget year is over and after this session of Congress ends. Climate change is already exacerbating water scarcity in the West, and we understand that these effects will intensify over the coming decades. We know that neither the Federal government nor the communities we serve can simply build, conserve, recycle or regulate our way out of these challenges, or rely on only one option to meet the challenges we face. Rather, we understand the need to take a multi-faceted, long-term approach to diversifying our western water portfolio, and working to achieve lasting results. We stand ready to work with any and all Members of this Committee in that ongoing effort.

Again, I thank the Chairman, Ranking Member and all the Members of the Committee. This concludes my written statement. I would be pleased to answer questions at the appropriate time.
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The CHAIRMAN. Thank you, Deputy Secretary.
Mr. Buschatzke?

STATEMENT OF THOMAS BUSCHATZKE, DIRECTOR, ARIZONA DEPARTMENT OF WATER RESOURCES

Mr. BUSCHATZKE. Good morning, Chairman Murkowski, Ranking Member Cantwell and members of the Committee. I'm Tom Buschatzke, the Director of the Arizona Department of Water Resources. Thank you for providing me the opportunity to present Arizona's testimony regarding drought in the West, its impact on my state, our formula for offsetting and mitigating drought impacts and the role of the United States.

The arid nature of Arizona constantly reminds us of the value of every drop of water we have. Arizona has a diverse water supply portfolio. We use about seven million acre feet of water per year and the sources are 40 percent from the Colorado River, 40 percent from groundwater, 17 percent from instate surface water sources and three percent from reuse of reclaimed water.

Arizona has created institutions that provide certainty for our water users. It took political capital, compromise and hard choices over many decades to create the water delivery projects, laws, regulations and in trust state and interstate agreements that effectively manage our water. The result was worth the effort. Arizonans enjoy a high quality of life and a vibrant economy and will continue to do so even in the face of this drought.

Despite Arizona's successes water supply uncertainty and vulnerability remains. Managing that uncertainty and eliminating vulnerability is a part of Arizona's history and continues to be a key strategic goal for our state.

Drought on the Colorado River is at the top of our list of challenges. Arizona will lose 320,000 of its 2.8 million acre feet Colorado River allocation when a Tier One shortage is triggered. We will know in August 2015 if shortage will occur in 2016. The probability of a Tier One shortage in 2016 is 33 percent and increases to 75 percent for 2017.

Arizona shoulders the brunt of the shortage, about 84 percent of the total taken by Arizona, Nevada and Mexico. If Lake Mead continues to decline, Arizona will take larger reductions while California will continue to take no shortage.

Another challenge for Arizona and the Lower Basin is an issue referred to as the structural deficit. It is caused by the volume of water released from Lake Mead for beneficial use, evaporation and delivery losses exceeding the volume of water entering Lake Mead from Lake Powell even in a normal year. As a result, Lake Mead's elevation drops about 12 feet per year.

Greater than normal Colorado River flows into Lake Mead help offset structural deficit impacts, but drought has reduced that likelihood from happening.

Despite the impacts, uncertainties and vulnerabilities I have described, Arizona is not in a water crisis and is well-situated to deal with the drought, an outcome of good planning, good management at the 1980 Groundwater Management Act and its progeny. The Groundwater Act contains carrots and sticks. It mandates water

conservation, agricultural acreage is capped and new housing must have a 100-year, renewable water supply.

Municipal providers are required to have conservation and drought management plans. The act incentivizes saving water. Underground storage programs allow water to be stored underground and recovered later resulting so far in the storage of 5.6 million acre feet and another 3.4 million acre feet by the Arizona Water Banking Authority which is dedicated to backfilling Colorado River shortages.

The value of underground storage programs was quickly recognized by other states. Arizona stored 80,000 acre feet for California in the 1990's and another 600,000 acre feet for Nevada in the 2000's.

Maintaining the resiliency Arizona enjoys today will be a challenge. As I conclude my remarks I wanted to address the potential role of the Federal Government.

First, the Secretary of the Interior, water master in the Lower Basin of the Colorado River, should continue to be an effective partner in creating and implementing collaborative actions with the seven Basin states to create a sustainable Colorado River. However, it is imperative that any actions of the Secretary or the United States to aid drought stricken California not reduce Arizona's flexibility to manage its own water supplies. Arizona already takes the lion's share of Colorado River shortage. Federal actions that might further impact Arizona are not warranted and would not be equitable.

Second, the reliability and sustainability of the river is critical to Arizona Indian tribes and to the United States as trustee for those tribes. Essential Arizona project water is key to existing and future tribal water right settlements in Arizona.

Third, there is a need for augmenting the Colorado River which has been recognized in Federal legislation and Reclamation's 2012 Colorado River Basin Water Supply and Demand Study and in Arizona's Strategic Vision for Water Supply Sustainability.

Last, Arizona would like to see additional opportunities for Federal support of programs that conserve water that will benefit the entire system rather than one particular user, especially considering how much some users, like Arizona, have already done.

Thank you again for the opportunity to provide you with a snapshot of the Arizona experience.

[The prepared statement of Mr. Buschatzke follows:]

Testimony of Thomas Buschatzke
Director
Arizona Department of Water Resources

COMMITTEE ON ENERGY AND NATURAL RESOURCES
United States Senate
June 2, 2015

Chairman Murkowski, Ranking Member Cantwell and members of the Committee:

I. Introduction

My name is Tom Buschatzke and I am the Director of the Arizona Department of Water Resources. Thank you for providing me an opportunity to present testimony on behalf of the State of Arizona regarding the on-going drought in the western United States, how it is impacting my state, how we have prepared to offset or mitigate those impacts and how the United States may help Arizona meet the challenges presented by continued drought.

II. Background

The State of Arizona and its water users have a long history of developing water supplies and the necessary infrastructure to deploy those supplies to maximize their benefit to the citizens and businesses in our State. Sound management of those supplies has been a primary focus in our State and the arid nature of Arizona is a constant reminder of the value of every drop of water available to us. Arizona is fortunate to have a diverse portfolio of water supplies. Arizona currently uses about seven million Acre-feet of water per year statewide which comes from the following sources: the Colorado River-40%; Groundwater-40%; in state rivers-17%; and reclaimed water reuse-3%.

Arizona has a long history of collaboration and innovation to manage our water supplies. We have participated in interstate and international agreements to protect our Colorado River water supplies, beginning with the Colorado River Compact to recent agreements with Mexico through Minute 319. Arizona has created institutions over many decades that provide certainty for our water users. Some of those success stories include the Salt River Project, the Gila Project, the Wellton-Mohawk Irrigation and Drainage District, the Yuma County Water Users' Association, the Yuma Mesa Irrigation District, the North Gila Valley Irrigation and Drainage District, the Yuma Auxiliary Project-Unit B, the Central Arizona Project, the 1980 Groundwater Management Act, the Underground Storage and Recovery Act and the Arizona Water Banking Authority. Arizona and its water users have taken proactive measures and made hard choices over many decades to insure a high quality of life for our citizens and a vibrant economy and will continue to do so in the face of the on-going drought in the west.

Despite the actions and choices made by Arizona uncertainty remains and the vulnerability of our water supplies to drought is the subject of constant attention among water providers, water users and water managers around the state. Flexibility to manage water supplies and adaptation to drought conditions are part of Arizona's history and will continue to be a key management strategy now and in the future.

III. Challenges Imposed by the On-Going Drought

Arizona continues to experience drought and more than 85% of the State falls within "Abnormally Dry" to "Severe Drought" conditions. The Salt and Verde River watersheds are in the fifth consecutive year

of drought which has reduced the surface water supplies that are used in the Phoenix metropolitan area by municipal water providers and agriculture. That has resulted in an increase in groundwater pumping to backfill the reduction in those surface water supplies. The Salt and Verde River watersheds are also at increased risk to wildfires, as is the Gila River watershed, the other main source of Arizona's in-state river supplies. Allocations of surface water from the Gila River have also been reduced as a result of the drought. To address drought conditions and the impact on our water supplies and water users the Governor's Drought Interagency Coordinating Group has recommended that a Drought Declaration be adopted by Governor Ducey. That Declaration will allow aid to flow to farmers and ranchers from the United States Department of Agriculture for loss of production and it also raises public awareness regarding drought conditions affecting the State.

The west-wide drought presents some unique challenges for all Colorado River users and the State of Arizona. The Colorado River watershed is entering its 16th year of below average runoff due to drought. Arizona stands to lose 320,000 Acre-feet of its 2.8 Million Acre-feet Colorado River allocation when a Tier 1 shortage is triggered by Secretarial order pursuant to the 2007 Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations of Lake Mead. Under the Interim Guidelines a projection of the elevation of Lake Mead is made in mid-August for the first day of the next calendar year. If that projection shows Lake Mead falling below elevation 1,075 feet then a Tier 1 shortage is put into place starting on January 1 of that year. Today, Lake Mead is at elevation 1,076[1] feet. The probability of a shortage declaration in the Lower Basin of the Colorado River has been steadily increasing over the past few years. The probability of a shortage in calendar year 2016 is 33% and that increases to 75 %[2] for 2017. It is important to note that a Tier 1 shortage triggers reductions for Arizona, Nevada and the Republic of Mexico but not for California. Arizona shoulders the brunt of the shortage among the three states and Mexico, about 84% of the total.

Deeper shortages will occur if Lake Mead's elevation continues to decline. Between elevation 1,050 feet and 1,025 feet a Tier 2 shortage results in Arizona suffering a reduction of 400,000 Acre-feet and at elevation 1,025 feet Arizona loses 480,000 Acre-feet, a Tier 3 shortage. The probabilities of Tier 2 and 3 occurring have also been increasing as the drought continues. If Lake Mead's elevation continues to drop and falls below elevation 1,025 feet, the volume of shortage to Arizona is unknown at this time. This uncertainty creates a difficult task for Arizona: how to plan for a shortage that is unquantified but will undoubtedly be greater than 480,000 Acre-feet. As Lake Mead approaches elevation 1,000 feet, the near-term limit for diversions by Las Vegas, or continues to decline to dead pool at elevation 895 feet draconian shortages are likely to occur.

Low reservoir conditions in the Colorado River system impact not only water users, but directly impact the production of hydroelectric power from major dams on the River. For example, if Lake Mead falls below elevation 1,000 feet, the hydropower production from Hoover Dam will be cut in half. Glen Canyon Dam hydropower production is eliminated if Lake Powell falls below elevation 3,490 feet, and United States Bureau of Reclamation has indicated that impacts to power production could occur at elevation 3,525 feet.

Lake Mead's falling elevations are not tied strictly to reductions in flow of the Colorado River due to drought. A "structural deficit" in the water supplies available from Lake Mead to California, Nevada,

[1] Based on USBR Lower Colorado River Region's weekly Colorado River water supply report for May 18, 2015.
[2] Based on USBR Lower Colorado River Region's Colorado River April 24 Month Study and resulting projections of Lake Mead elevations.

Arizona and Mexico exists as an artifact of the "Law of the River", the complex set of laws, agreements, rules, regulations and operating criteria that govern the storage, use and delivery of Colorado River water. In short, in a normal year a set amount of water flows into Lake Mead but it is not enough water to cover releases for use, evaporation and delivery losses. That structural deficit results in an annual drop of about 12 feet in the elevation of Lake Mead. In wet years high flow in the Colorado River allows more than the normal amount of water to flow into Lake Mead so the elevation of the lake can rise and recover. The drought has limited high flows in the Colorado River so that Lake Mead is not receiving more than its normal annual inflow and water elevations do not have a chance to rebound.

The drought also causes other impacts indirectly related to reduced precipitation. The health of the watersheds of the Colorado, Salt, Verde and Gila Rivers is an increasingly important issue in the region. A number of national forests in Arizona were created primarily for watershed protection and are indicative of the fact that forest health and water supply are closely connected. The drought has exacerbated issues associated with poor forest management including fuels and timber management so that the risk to our forests from catastrophic wildfires is increasing.

IV. How Arizona Has Prepared For Drought

The water development projects put in place over the last century to utilize Colorado River water and in state rivers have created a solid foundation for meeting water demand with renewable water supplies. Yet, Arizona also recognized that reliance upon those renewable supplies made us vulnerable to potential shortages during drought.

To address that vulnerability Arizona took a giant leap forward in 1980 with the passage of the Groundwater Management Act. The Act was a hard fought compromise between agriculture, industry, mining interest and municipalities. It established a policy direction for the protection of central and southern Arizona's abundant groundwater supplies that were being mined at the time at an unsustainable rate.

Mandatory water conservation requirements for municipal, industrial and agricultural water users in that part of the state, termed "Active Management Areas" were elements of the Act. Agricultural acreage was capped and no new agricultural land was allowed to be put into production after 1980. New golf courses were limited in size and the amount of water they could use. New housing was required to show that it has a 100-year renewable water supply before it can be built. Community water systems, i.e., municipal providers, are required to have conservation and drought management plans in place. These aggressive water management actions reduced Arizona's water use over time while its population and economic output have increased. One result is that Arizona's dependence on groundwater has decreased from 53% in 1980 to 40% today. In addition, case studies included in the Colorado River Basin Study Phase 1 Moving Forward Report prepared by the United States Bureau of Reclamation show agricultural and municipal users in Arizona are some of the most efficient in the West. Arizona irrigation users in central Arizona and the Yuma area, average 80 - 85% on farm irrigation efficiency, while municipal water users in central Arizona have reduced per capita consumption by more than 20% since 2000.

The 1980 Groundwater Management Act incentivizes the conservation and conjunctive use of Arizona's surface water, Colorado River water, reclaimed water and groundwater and helps to protect water levels in aquifers in central and southern Arizona. To accomplish that goal, the Underground Storage and Recovery program was originally added to the Act in 1986 and later restructured in 1996. This suite of statutes allows for water to be stored underground and recovered at a later point in time. The

program has resulted in the storage of 9 million Acre-feet of water in our aquifers for Arizona. The Arizona Water Banking Authority, the Arizona Department of Water Resources, and the Central Arizona Project have prepared a plan to recover the water stored underground to further protect Arizona water users from the impact of shortage. The Arizona Water Banking Authority (AWBA), a state agency, was created in 1996 to allow for underground water storage for the specific purposes of supplementing Colorado River water supplies when shortages reduce supplies for tribal, municipal and industrial water users. The Arizona Water Banking Authority has stored 3.4 million Acre-feet of the 9 million Acre-feet total stored in Arizona. The value of underground storage was recognized by other States in the Colorado River Basin through the creation of interstate water banking agreements. Arizona stored 80,000 Acre-feet for California in a pilot program in the 1990's. That water has been recovered and delivered to California. Arizona stored another 600,000 Acre-feet for Nevada in the 2000's but that water has yet to be recovered and delivered to Nevada.

Arizona's history also includes a strong commitment to recycling and reuse of reclaimed water. One example of a major reuse program is the Palo Verde Nuclear Generating Station in the Phoenix metropolitan area. The Nuclear Generating Station contracts for 60,000 Acre-feet per year of treated municipal wastewater from the 91st Ave Wastewater Treatment Plant which serves five cities in the region. The 2010 agreement is for a 40 year term and replaces an earlier agreement from 1973.

To better monitor and adapt to drought conditions the State created the "*Arizona Drought Preparedness Plan, Operational Drought Plan*," in 2004. The plan provides information on drought contingency actions, ways to reduce water use during droughts and is designed to achieve more aggressive water savings as drought persists or worsens. It created a State Drought Monitoring Technical Committee that meets monthly to determine the drought status in Arizona. Local Drought Impact Groups feed information into that Committee. The Drought Interagency Coordinating Group reports annually to the Governor and makes recommendations for a drought declaration to be adopted. The Arizona Department of Water Resources publishes the "*Arizona Drought Preparedness Annual Report,*" that summarizes drought conditions and drought preparedness activities for the water year.

A holistic approach to water management was necessary to create the level of resiliency Arizona enjoys today. The programs authorized under the 1980 Groundwater Management Act and its progeny have left Arizona in a strong position to deal with the on-going drought at this moment in time. However, Arizona must continue to be proactive to insure that its resiliency will continue into the future. That will be a challenge for the State of Arizona.

V. The Role of the Federal Government

The Secretary of the Interior is the water master in the Lower Basin of the Colorado River and operates the entire Colorado River system pursuant to the "Law of the River" including the decree in *Arizona v. California*. The Secretary, through the Bureau of Reclamation, has taken preliminary steps to begin to address the Colorado River drought by participating in conservation efforts such as those included in the WaterSmart programs, Pilot System Conservation Agreement, and the Lower Basin Pilot Drought Response Actions Memorandum of Understanding. It is imperative that any actions of the Secretary of the Interior or the United States to aid drought stricken California be consistent with the Law of the River and not reduce the flexibility or impinge on Arizona's efforts to deal with the drought. Arizona already takes the lion's share of shortages and it is clear there is an increasing risk of deeper shortages on the River. Secretarial actions that might further impact Arizona are not warranted and would not be equitable.

Furthermore, the reliability and sustainability of the Colorado River system is critical to many Arizona Indian tribes and to the United States as trustee for those tribes. In partnership with the United States the tribes, and others, Arizona has settled 13 of 22 tribal water rights claims, in whole or in part. Central Arizona Project water from the Colorado River has been a key component of the water budgets for many of those tribal water rights settlements. Additional Central Arizona Project water is set aside for use in the settlement of the remaining tribal water right claims in Arizona. Insuring that Colorado River water is reliable is a necessity for the successful implementation of exiting settlements and for settling the remaining tribal claims in Arizona.

Augmentation of water supplies continues to be a key component for the future of Arizona. The need for augmentation to benefit Arizona was identified in the report entitled *"Arizona's Next Century: A Strategic Vision for Water Supply Sustainability,* January 2014." The December 2012 Colorado River Basin Water Supply and Demand Study, a joint effort by the seven Colorado River Basin States and the Bureau of Reclamation, identified augmentation as a potential solution to close a water supply and demand imbalance projected for 2060 in the Colorado River Basin study area. The importance of augmentation for the Colorado River has been recognized for many decades. In the Colorado River Basin Project Act the benefit of augmenting the supply of the Colorado River below Lee Ferry in the amount of 2.5 million Acre-feet was documented. (Public Law 90-537 90th Congress, S. 1004 September 30, 1968.)

In summary, Arizona would like to see additional opportunities for federal support of programs to conserve water that will benefit the entire Colorado River system rather than any one particular Colorado River water user.

The CHAIRMAN. Thank you. I appreciate your comments.
Let's go to Mr. Loranger.

STATEMENT OF TOM LORANGER, WATER RESOURCES PROGRAM MANAGER, WASHINGTON STATE DEPARTMENT OF ECOLOGY

Mr. LORANGER. Madam Chair Murkowski and members of the Committee, thank you for the opportunity to testify today. My name is Tom Loranger. I'm the Water Resources Manager with the Washington State Department of Ecology.

As Senator Cantwell mentioned current snow pack levels in Washington are nine percent of normal. This is the lowest we have on record. Because of the low snow pack, rivers with diminishing flows in irrigation districts already cutting off supplies to junior users, Governor Jay Inslee declared a drought in Washington in May. With the state's drought declaration relief can be provided for those experiencing hardship and to improve flows for fish.

Regarding agriculture in the state, currently difficult decisions are being made about what crops get priority water and how best to save fish. As Chairman Murkowski mentioned, the Washington State Department of Agriculture anticipates $1.2 billion in crop loss this year in the state. In the Yakima Basin, where the Bureau of Reclamation has built multiple storage projects, the drought means less water is available for junior water users. In the last two weeks we've already issued 30 emergency drought well permits to junior users in the Roza Irrigation District in the Yakima Basin.

In the Wenatchee Basin, Little Spokane Basin and other basins in the state, we've sent out curtailment orders already to junior users.

In the Walla Walla, we are actively working with irrigators, tribes and other water managers to develop leases and provide pulse flows for struggling salmon.

Regarding communities in the state, the largest municipalities, Seattle, Tacoma, Everett, have all indicated they will not experience water shortages this year. These utilities have taken proactive steps to store rainwater that fell in the winter time.

However, other utilities, particularly the smaller community systems, may experience problems. The drought response funding from the legislature will allow communities to rehabilitate or deepen wells as needed or construct interties with adjacent systems like we did in the 2005 drought.

Regarding flows for fish, in the Dungeness River on the Olympic Peninsula of Washington we have committed to 13 leases already where farmers will let 1,000 acres of farmland lie fallow. In return flows will get approved, particularly in that critical late summer period.

We are also in the process of leasing water from the Kittitas Reclamation District in the Upper Yakima, very sensitive tribes, very important to salmon in that basin.

Right now in the Walla Walla, water supplies and flows are extremely low which is impacting both irrigator's use and fish passage. And so currently partners are shifting flow from creek to creek to aid struggling salmon right now, Chinook and Bull Trout as well.

A challenging time for fish and farms in Washington. Key to the successful implementation of emergency drought response in Washington is the work we have done actively developing collaborative partnerships in these key watersheds like the Yakima, like the Dungeness, like the Walla Walla, around the state.

Ownerships include tribes, local governments, state governments, other water managers, Federal Government, so it's a new way of doing business where we have irrigators supporting flow enhancement projects for fish. We have fisheries' interests and tribes supporting water supply projects for out-of-stream use of water.

From these partnerships we've developed minimum flow requirements, flexible mitigation strategies and lease arrangements that make it easy to shift water around when we have to rapidly during drought.

A few examples. In the Yakima we have developed leasing arrangements to share water among irrigation districts and provide water for stream flow while land lays fallow. In addition all parties, including the Yakima Tribe, have agreed to a flexible mitigation approach for these big, large drought wells that when used where we can have mitigation water, not up front, but later on in the season.

The Yakima Integrated Strategy was developed working with all of these partners. When funded it will expand the reservoir capacity in the Yakima Basin, improve facility operations and improve fish passage and fish habitat, providing more water for these critical drought periods.

In the Dungeness watershed the Dungeness Irrigator's Association has agreed to voluntarily reduce their water diversions during these drought periods and periods of low flow. This is remarkable given that their water rights allow them to take more water. These irrigators are also entering into lease agreements so that water can be left in the stream during these critical drought periods.

In the Walla Walla, irrigators, tribes, and all levels of government are actively moving water around to protect the fishery and ensure use for irrigation. The Umatilla Tribe is trapping and hauling fish to cooler waters.

Thank you.

[The prepared statement of Mr. Loranger follows:]

Tom Loranger
Program Manager
Washington State Department of Ecology

Testimony for the Senate Committee on Energy and Natural Resources on Status of Drought Conditions in Washington State

Washington State is experiencing record low snowpack in the mountains this year. Current snowpack levels are 9 percent of normal, the lowest on record in the state.

With this very low snowpack, rivers with record low flows, and irrigation districts cutting off water to farmers, on May 15th Governor Jay Inslee declared a statewide drought for Washington.

Our upstream neighbor to the east, the State of Idaho has declared drought in five counties in the south central and eastern portions of the state due to low snowpack, below normal river forecasts.

Similarly, to the south of us, the State of Oregon has declared drought in 15 of 36 counties. Oregon's snowpack situation is even more dire than Washington States.

State law allows Ecology to declare a drought emergency if all or part of a geographical area is suffering from drought conditions. This is done with the written approval of the Governor.

Washington has a legal definition of drought. It requires that two conditions be met. The two conditions are:

- An area has to be experiencing or projected to experience a water supply that is below 75 percent of normal, and
- Water users within those areas will likely incur undue hardships as a result of the shortage.

Categories of Concern

With the statewide drought declaration and subsequent order relief can be provided for those experiencing hardships and to boost stream flows for fish.

Depending on how much funding is available from the Washington State Legislature, support may be provided for several activities including:

- Ensuring Reliable Public Water Supplies
- Aiding State Agriculture
- Protecting Fish and our Natural Resources

Current conditions

Agriculture

Dismal snowpack and low stream flows in many areas around the state, particularly in the Yakima Basin -- where the Bureau of Reclamation has built multiple storage projects -- means less water is available for junior water right holders.

Difficult decisions are being made about what crops get priority water and how best to save fish.

The Washington State Department of Agriculture anticipates $1.2 billion in crop loss this year.

Last week we issued approximately 25 drought well permits with approximately 25 more expected to be issued this year to members of the Roza Irrigation District. Emergency drought dollars will cover the cost of mitigation for these permits.

The "mitigation program" has been developed in cooperation with watershed partners in the Yakima including the Yakama Indian Nation and the Bureau of Reclamation. We have a plan in place to offset the impacts of these wells on instream flows by acquiring water rights from senior water right holders who are willing to fallow their lands.

In the Wenatchee Basin, Little Spokane Basin and in other watersheds, we have sent out curtailment orders to junior water users who must stop diverting water when instream flows are not met.

In the Walla Walla we are actively working with irrigators, tribes, and other water managers to develop leases and provide pulse flows to aid the upstream migration of salmon, steelhead and bull trout to more abundant, cooler waters.

Communities

The large municipalities of Seattle, Tacoma, and Everett have all indicated they will not experience water shortages this summer. These utilities have taken proactive steps to store rain water that fell this winter. They are projected to be able to meet their demand this year and not harm fish and wildlife because of their proactive management of water.

While many large water systems in the state have enough groundwater or reservoir storage to meet their customer needs and still meet instream flow agreements, other utilities, particularly smaller community systems may experience problems.

Drought response funding from the state legislature will allow communities to rehabilitate or deepen a well, or construct an intertie with an adjacent water system. These projects take time, and having funding earlier allows communities to complete their projects before conditions get to the point of crisis, later on in the summer and fall.

For example in the 2005 drought we provided funding to the City of Goldendale to deepen their municipal supply well and we provided funding to the Stevens County PUD and the Pend Oreille County PUD for developing interties to allow for more flexibility in water delivery.

Flows for Fish

For the Dungeness River on the Olympic Peninsula of Washington we have committed to 13 lease agreements to fallow about 1000 acres, which will result in 6 to 7 cubic feet per second more water during the critical late summer period.

We are also in the process of leasing water for flow enhancement from the Kittitas Reclamation District for sensitive tributaries in the Yakima Basin that are being impacted severely by this year's drought.

Right now in the Walla Walla, water supplies and flows are extremely low which is impacting fish passage and irrigation withdrawals.

Water is being shifted from creek to creek to keep water flowing for steelhead, Chinook and bull trout. In addition, we are working with water right holders to release pulse flows that provide sufficient flow for fish to move past these barriers, both upstream and downstream and the Umatilla Tribe is trapping hauling fish upstream to areas of cooler water.

Elsewhere, most of the serious impacts to fish and wildlife will happen in the summer and fall when flows drop even more.

Innovative Water Management

Partnerships

Key to the successful implementation of emergency drought response in Washington is the work we have done actively developing collaborative partnerships in many of the key watersheds in the states such as the Yakima, the Walla Walla, and the Dungeness.

The partnerships include tribes, local, state, and federal government and other water interests. This is a new way of doing business where irrigators support fish passage projects and fish interests support water supply projects. From these partnerships we have developed minimum flow requirements, flexible mitigation strategies, and lease arrangements to move water around quickly where and when it is needed.

Yakima Integrated Strategy

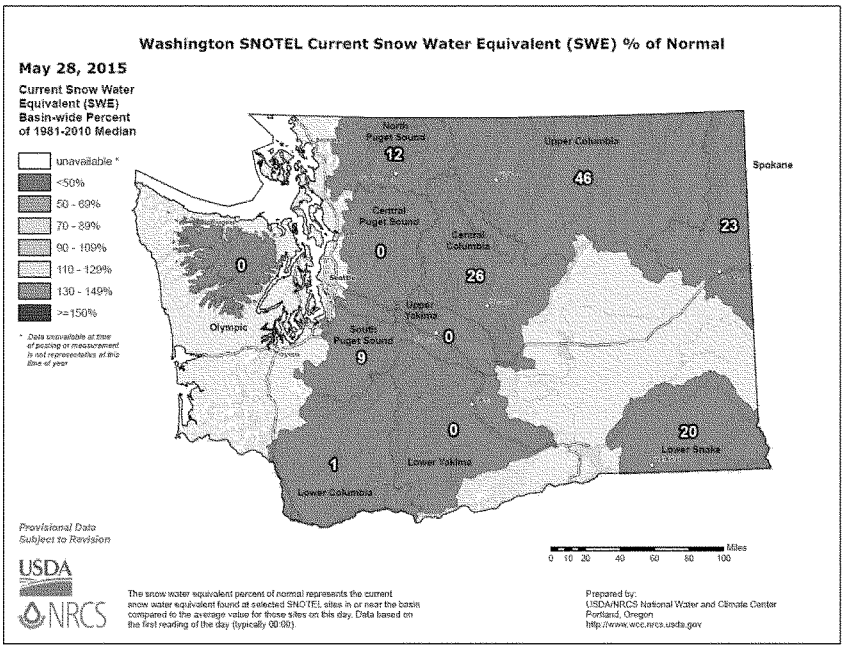
In the Yakima basin, partners have developed leasing arrangements to share water among irrigation districts and provide water for stream flow while land lies fallow. In addition all parties including the Yakama Tribe have agreed to a flexible approach for mitigation when drought wells are in operation rather than having the full amount of mitigation water up front and in play when the wells are turned on.

The Yakima Integrated Strategy, which is Phase 3 of the Yakima River Water Enhancement Project, was developed working closely with partners. When funded it will expand the reservoir capacity in the Yakima basin, improve facility operations, and improve fish passage and fish habitat. The Integrated Strategy will provide enhanced storage, improved operations, and improved habitat in the Yakima providing more water during periods of drought.

Dungeness
In the Dungeness watershed , the Dungeness Irrigator's Association has agreed to voluntarily reduce their water diversions during periods of low flows even though their water rights allow them to take more water. These irrigators are also entering into lease agreements so water can be left in stream during critical seasons.

Walla Walla
In the Walla Walla, irrigators, tribes, all levels of government are actively moving water around to protect the fishery and ensure use for irrigation.

Office of Columbia River
Since 2006 we have developed more than 300,000 acre-feet of water from the Columbia River for improved flows for fish and additional water for municipal and agricultural use through enhanced reservoir management and improved irrigation efficiency. This new water will be very important during times of drought.


Washington SNOTEL Current Snow Water Equivalent (SWE) % of Normal
May 28, 2015
Current Snow Water Equivalent (SWE) Basin-wide Percent of 1981-2010 Median
unavailable *
<50%
50 - 69%
70 - 89%
90 - 109%
110 - 129%
130 - 149%
>=150%
* Data unavailable at time of posting or measurement is not representative of this time of year
North Puget Sound
12
Upper Columbia
46
Spokane
23
Central Puget Sound
0
Central Columbia
26
0
Olympic
Upper Yakima
0
South Puget Sound
9
0
20
Lower Snake
1
Lower Yakima
Lower Columbia
Miles
0 10 20 40 60 80 100
Provisional Data Subject to Revision
USDA
NRCS
The snow water equivalent percent of normal represents the current snow water equivalent found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day. Data based on the first reading of the day (typically 00:00).
Prepared by:
USDA/NRCS National Water and Climate Center
Portland, Oregon
http://www.wcc.nrcs.usda.gov


Olympic National Park, Hurricane Ridge Mon Apr 27 2015 PST Time 11:11 Elevation 5,242
See http://www.nwac.us/weatherdata/hurricaneridge/now/ for Weather

The CHAIRMAN. Thank you, Mr. Loranger.
Mr. Ogsbury, welcome.

STATEMENT OF JAMES OGSBURY, EXECUTIVE DIRECTOR, WESTERN GOVERNORS' ASSOCIATION

Mr. OGSBURY. Thank you, Chairwoman Murkowski, Ranking Member Cantwell and members of the Committee. My name is Jim Ogsbury, and I am the Executive Director of the Western Governors' Association (WGA), an independent, non-partisan organization representing the Governors of 19 western states and three U.S. territories. It is an honor to appear before you today to discuss the critical issue of drought.

Well over a year ago Nevada Governor and current Chairman of WGA, Brian Sandoval, announced his intention to devote his energies as Chairman of the WGA on the critical issue of drought. This announcement was applauded by the Western Governors because as an issue it speaks to the strengths of WGA.

It is timely, it's actionable, it is bipartisan, it's a top priority of our Governors, and unfortunately, it's a perennial concern in the West. It's designed by Governor Sandoval. The Western Governors' Drought Forum is an effort that speaks to the pragmatic nature of Governors, who as Chief Executives are focused on practical, common sense solutions to state and regional challenges.

I will not belabor the severity of the present drought or its impacts. You and other witnesses have established that case, and there has been extensive coverage of the drought's impacts on California where snow levels are now zero percent of normal and the snow pack of the Sierra Nevadas has officially disappeared.

These severe conditions, however, are not limited to the Golden State. Washington Governor Jay Inslee, as you have heard, declared a state-wide drought emergency on May 15th, citing the fact that on the Olympic Peninsula where there should have been 80 inches of snow there were instead glacier lilies in bloom. Governor Kate Brown of Oregon, I believe, has declared drought emergencies now in 15 counties. Early May snow pack levels in the Boise River Basin of Idaho were the fourth lowest on record since measurements began in the 1940.

Western Governors' have individually taken decisive actions to prepare for drought and manage its impacts. California Governor Jerry Brown issued an Executive Order on April 1st mandating a 25 percent reduction in municipal water use. Governor Inslee has spearheaded Washington State's participation in the Yakima Basin Integrated Water Resource Management Plan which will empower water users in a rich, agricultural area to collaboratively address the risk of drought to agriculture, communities and the environment.

The Governors have also addressed drought collectively through the Western Governors' Drought Forum. The forum is a multifaceted enterprise that has organized drought workshops, hosted webinars, produced reports and engineered an online resource library for officials and water managers to share drought management best practices, case studies and innovations. WGA hosted a series of workshops throughout the West, each of which focused on

drought's impact on a particular economic sector including energy, agriculture, mining, manufacturing and tourism.

The lessons learned from these and other activities of the Drought Forum have been memorialized in an online resource library and will be summarized in a report that will be issued by the Governors later this month at their annual meeting in Lake Tahoe.

In wrestling with drought Western Governors have enjoyed productive partnerships with the Federal Government. Western Governors provided critical leadership for the original enactment and recent reauthorization of the National Integrated Drought Information System, NIDIS. This has led to continuing work with the National Oceanic and Atmospheric Administration on improved coordination and dissemination of drought and extreme weather data and analysis to support the resource management decisions of states.

Likewise, WGA supports the Cooperative Water Program and National Stream Flow Information Program of the U.S. Geological Survey as well as the snow survey activities of the Natural Resources Conservation Service. These programs provide valuable data and information to inform state water resource decisions.

WGA recognizes the value of State/Federal partnerships. The collaboration of Federal and State agencies to craft a unified operation plan in California, for example, led to an expedited water transfer process among other benefits.

Furthermore, WGA recognizes the importance of infrastructure investments, the value of streamlined permitting for infrastructure and the significance of Federal support for state and local watershed groups.

The Governors deeply appreciate the attention that this Committee is investing in the issue of drought and look forward to working with you to craft solutions that both apply the substantial resources of the Federal Government and respect the authority and expertise of states to manage water within their boundaries.

Thank you for the opportunity to appear here today.

[The prepared statement of Mr. Ogsbury follows:]

United States Senate Committee on Energy and Natural Resources
Testimony of James D. Ogsbury, Executive Director
Western Governors' Association
June 2, 2015

Madame Chairman and members of the Committee, I appreciate your invitation to testify today on behalf of the Western Governors' Association (WGA). My name is James D. Ogsbury and I am the Association's Executive Director. WGA is an independent, non-partisan organization representing the Governors of 19 western states and 3 U.S.-flag islands. I am honored to share with the Committee the perspective of the Western Governors regarding drought.

Drought Impacts in the Western States

I am here today because the members of my board—the Western Governors—are deeply concerned about drought in their states. Water availability is a perennial concern in the West, with drought visiting the region on a semi-regular basis. Currently, drought is most severe in California, where dire conditions earn daily headlines. When Gov. Jerry Brown announced mandatory water restrictions for his state on April 1, the snowpack was at 5 percent of normal. On May 21, snow levels were just 2 percent of average.

California is not the only state experiencing drought. Ninety-nine percent of Nevada is currently affected by some level of drought. Early May snowpack levels in the Boise River Basin of Idaho were the fourth-lowest on record since measurements began in 1940.[1] Washington's Governor Jay Inslee declared a statewide drought emergency on May 15, citing the fact that on the Olympic Peninsula, where there should have been 80 inches of snow, glacier lilies were in bloom. As of May 22, Governor Kate Brown of Oregon had declared drought emergencies in 15 counties. In making recent emergency declarations, the Governor said, "it may look green now, but we are going to experience one of the worst droughts in the history of our state."[2]

Even in states without gubernatorial drought declarations, specific regions are suffering. In Colorado, for example, much of the state has been lifted out of drought by a round of springtime storms. But while rain on the Front Range has filled some reservoirs to the point of flooding, the most recent scientific assessment still shows southwestern Colorado in moderate drought.

Drought has real and consequential impacts at both the landscape and the local level. Take, for example, the $1.2 billion in crop losses that the Washington State Department of Agriculture has

[1] Natural Resources Conservation Service. "Idaho Water Supply Outlook Report." May 1, 2015. ftp://ftp.wcc.nrcs.usda.gov/states/id/webftp/wsor/2015/borid515.pdf
[2] Governor Kate Brown, Oregon. "Governor Brown on Oregon's drought." Video posted on May 22, 2015. https://www.youtube.com/watch?v=UyDQEBEJm7I

predicted for its farmers this year. Or Outingdale, California, where water curtailments have forced residents to reduce their daily water use to just 50 gallons of water per person.[3]

Western Governors are deeply concerned about drought's devastating impacts on local communities and economies. As the Governors state in their policy resolution, *Water Resource Management in the West*, "the scarce nature of water in the West makes it a crucial resource for the communities, industries, habitats, and farms it supports. Clean, reliable water supplies are essential to maintain and improve quality of life."[4]

Governors have been responding to drought by taking action in their own states and acting together through the Western Governors' Drought Forum.

Governors Working to Manage Drought in their States

Governors are directing their top state officials to work with stakeholders and citizens on drought and water management. Gov. Brian Sandoval of Nevada created the Nevada Drought Forum in April to convene water managers and stakeholders to identify Nevada's specific drought policy needs—and the conservation practices that can help improve drought response.

In Colorado, Gov. John Hickenlooper has released a draft of the first-ever Colorado state water plan for public review. State water leaders have solicited input from water users, local governments, and stakeholders to design a strategic plan for meeting Colorado's future water needs.

Sixteen other states in the west have implemented water plans, strategies or visions. For instance, Gov. Matt Mead of Wyoming released his *Wyoming Water Strategy* earlier this year.[5] In that document, the Governor emphasized initiatives that will be useful in both wet and dry years, including a needs analysis for enhanced water monitoring climate, weather, snowpack, snowmelt, and stream flow data. The Strategy also includes infrastructure investments to make better use of existing water storage projects.

Governors are tapping into the resourcefulness of local communities to respond to drought. In Washington, the Yakima Basin Integrated Water Resource Management plan will enable water users in a rich agricultural area to collaboratively address the risk of drought to farming, fish and communities. In the Dungeness Basin on the Olympic peninsula, the state is leasing water from irrigators to increase water supplies later in the season for threatened Chinook salmon.

Since the 1990s, Arizona has stored water in groundwater basins through artificial aquifer recharge. This strategy has allowed Arizona to utilize its full entitlement of Colorado River

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[3] Marquis, Dave. "Foothill community of Outingdale in Stage 4 water emergency." ABC News 10. http://www.news10.net/story/news/local/california/2015/05/01/outingdale-water-emergency-river-consumnes/26686933/

[4] Western Governors' Association. "Water Resource Management in the West." Governors' policy resolution passed in 2014. http://www.westgov.org/policies/301-water/597-water-resource-management-in-the-west-resolution-wga

[5] Governor Matthew H. Mead. "Leading the Charge: Wyoming Water Strategy." 2015. http://waterplan.state.wy.us/plan/statewide/govstrategy/20150115-GovWaterStrategy.pdf

water and mitigate the effects of future shortages.[6] Even with this safeguard in place, the Arizona Department of Water Resources prepares an annual drought preparedness report to assess water availability and describe preparedness activities for the coming year.[7]

In Oklahoma, Gov. Mary Fallin has supported the work of business, agricultural, and community leaders in developing the Panhandle Regional Water Plan. Separately, the Governor has enacted the "Oklahoma Water for 2060 Act," which would limit her state's water consumption 45 years from now to current levels. Both initiatives are designed to develop strategies for water conservation, water re-use and augmentation.

All of the western states are taking pains to make the most of the water they have. In New Mexico, Gov. Susana Martinez and her state tourism department have made efforts to highlight the water recreational opportunities available to visitors, even during drought. For example, low reservoir levels may lead to a decrease in the popularity of motorized boating, but visitors can be directed to the option of paddle-crafts instead.

In Oregon, Gov. Brown is emphasizing public awareness of drought conditions with a social media campaign. Her agencies will use the hashtag #ORdrought across social media to keep Oregonians informed and prepared to adapt to drought conditions.[8] The Oregon Department of Forestry recently emphasized the connection between drought and wildfire on its website to increase awareness about the importance of fire prevention, particularly in the midst of drought.[9]

Governors are also taking unprecedented policy actions. Gov. Jerry Brown of California called for a 25 percent reduction in municipal water use across the state in an executive order issued on April 1. The EO included additional steps, such as streamlining state decision-making on water infrastructure projects and requirements for decreased irrigation of public spaces. The Governor has also strengthened existing partnerships with federal agencies, including the U.S. Bureau of Reclamation and the National Oceanic and Atmospheric Administration's Fisheries branch, to take a united approach to managing water and wildlife.[10]

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[6] "Water Banking through Artificial Aquifer Recharge: Arizona Water Banking Authority, Central Arizona Project, Arizona Department of Water Resources." Western Governors' Drought Forum online resource library. http://www.westgov.org/drought-forum/case-studies/327-water-supply/955-water-banking-through-artificial-aquifer-recharge

[7] "Arizona Drought Preparedness Plan and Annual Preparedness Reports." Arizona Department of Water Resources. http://www.azwater.gov/AzDWR/StatewidePlanning/Drought/ADPPlan.htm

[8] "Governor Brown Declares Drought Emergencies in 8 Counties." Newsroom of Gov. Kate Brown, Oregon. http://www.oregon.gov/newsroom/Pages/NewsDetail.aspx?newsid=730.

[9] "Getting burned . . . The cost of wildfire." Oregon Department of Forestry. http://www.oregon.gov/odf/Pages/newsroom/newsreleases/2015/NR1524.aspx.

[10] WGA has developed a case study about this collaborative effort titled "Cross-Agency Collaboration in Addressing Record Drought in California." Please find it and other case studies online at http://www.westgov.org/drought-forum/case-studies.

Governors Sharing Management Strategies through the Western Governors' Drought Forum

Drought is clearly a regional problem, which is one reason that Governors across the West have been sharing management strategies and policy options for drought response through the Western Governors' Drought Forum.

When Gov. Brian Sandoval created the Western Governors' Drought Forum a year ago, he charged WGA with developing a framework for state, industry, community and environmental leaders to share best practices on drought. We have accomplished that by reaching out to state water managers, industry leaders, scientific experts, and stakeholders for input through webinars, workshops and individual conversations.

For the first workshop last fall, WGA went to Oklahoma, when drought in the western part of the state had just entered its fourth year. While we were there, we learned about how the energy industry manages drought conditions.

Next, WGA went to Tempe, Arizona, where we heard about drought management in the mining, manufacturing and industrial sectors. We also heard the state's water resources director discuss desalination as a very real water supply option for his land-locked state. The session left no doubt that, while in the past, businesses may not have regarded water as a major constraint on siting a new operation, it is now a front-and-center consideration.

Then the Drought Forum traveled to the epicenter of drought: the Central Valley of California. We visited not just the central location, but – in many ways – the central topic regarding drought management: agriculture. California's agricultural industry is valued at $46.4 billion dollars.[11] We learned how farmers are conserving water through both precision irrigation technologies and basic soil stewardship. We also heard that regular communication between states, stakeholders and federal agencies is critical to navigating the multiple challenges posed by drought.

Next we went to Nevada, where the Drought Forum focused on water supply management for cities and states. The water managers in those meetings emphasized the importance of collaboration between water users and water managers, as well as flexible legal structures for moving water to where it is needed most.

We concluded the Drought Forum workshop series with a stop in Santa Fe, New Mexico, to talk about drought's impacts on tourism and recreation. The connection between drought and water quality is especially important in the context of tourism; people value clean water to swim in, fish from and raft through.

WGA staff gathered information during the workshop series, a webinar series, and resources shared by western states, utilities, and citizens.[12] The findings from the first year of the Drought

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[11] United States Department of Agriculture, National Agricultural Statistics Service. "California Agricultural Statistics 2013 Annual Bulletin." April 13, 2015.
http://www.nass.usda.gov/Statistics_by_State/California/Publications/California_Ag_Statistics/index.asp

[12] Meeting summaries, webinar recordings, case studies and informational resources are available at http://www.westgov.org/drought-forum/.

Forum will be included in a final report to be released at the June 2015 WGA Annual Meeting in Tahoe, Nevada.

In that report, WGA will emphasize the importance of basic snow and water monitoring in order to better understand drought conditions. We will talk about water reuse from a municipal, agricultural, and industrial and energy-production perspective. We will discuss the ways that westerners are making the most of the water they have through soil stewardship and forest management. And we will show how communication and collaboration with water users is an essential drought response tool for water managers.

The Western Governors' Association's Continuing Work on Drought

Though the Western Governors' Drought Forum is wrapping up its first year with a report on key findings, the Drought Forum is by no means ending. WGA has worked on drought for well over a decade, and we will continue that work as long as the issue remains a gubernatorial priority.

Drought intersects with many of the other policy issues in WGA's portfolio. Western Governors are managers of states with expansive forests, vast deserts and broad sagebrush and grassland landscapes, all of which provide habitat for wildlife. These lands are rich in both conventional and renewable energy resources. The scarcity of water in the West makes the management of both water supply and water quality crucial. Western Governors are well aware of the interrelatedness of forest health, wildlife, energy and water policy, and they recognize that drought has serious implications for each of these issues.

Water is used in oil and gas extraction and in cooling processes for power generation. Adequate water flows are essential to hydropower production.

Drought has implications for wildlife—not just for fish that rely on cool and steady streamflow, but also for large wildlife such as deer, elk, and bears that sometimes seek water and food in human communities when those resources are scarce in their own habitat.

Wildfire is exacerbated by drought. Dry conditions increase the likelihood of fire; low lake levels make it harder for firefighters to access water to combat wildfire.

Drought necessitates difficult decision-making for municipal water providers, reservoir operators, and state officials.

Western Governors applaud and encourage congressional attention to drought for a variety of reasons. Even though drought is concentrated in the West, the economic and policy implications extend to the rest of the nation. Drought puts federal lands at risk of wildfire. Federal reservoirs and water infrastructure are crucial mechanisms for making the most of available water. Data collection and drought science analysis performed by federal agencies—including the Natural Resources Conservation Service, the U.S. Geological Survey, and the National Oceanic and Atmospheric Administration—are all essential to understanding and managing drought. Moreover, the crisis brought on by drought is acting as a catalyst for innovation in states, communities and businesses. Congressional support of the steps

westerners are taking to conserve water and manage drought conditions will help the West—and the nation—through current and future drought conditions.

The Committee can support improved drought response by addressing imperatives the Western Governors set forth in their policy resolution titled *Water Resource Management in the West.*[13] The Governors emphasize the importance of infrastructure investments for the continuing conservation, development, and wise use of resources. The Governors also cite the value of streamlined permitting for infrastructure.

The Governors encourage adoption of conservation and efficiency strategies such as water reuse and recycling, desalination and reclamation of brackish waters, and reductions in household water use. They also call for Congressional support of state and local watershed groups to help them deal with water quality, growth and land management. The Governors highlight the value of basic water data for reliable information on water resources. And in a separate resolution on *Wildland Fire Management*, the Governors draw attention to the use of active forest and rangeland management as a means to prevent wildfire and promote healthy landscapes. Healthy forests and landscapes help maintain clean, reliable water.[14]

Madame Chairman Murkowski and Ranking Member Cantwell, Western Governors appreciate your interest in the impact drought is having on their states, and they applaud you for bringing attention to this significant and serious matter. Thank you for the opportunity to testify on behalf of WGA.

[13] Western Governors' Association. "Water Resource Management in the West." Governors' policy resolution passed in 2014. http://www.westgov.org/policies/301-water/597-water-resource-management-in-the-west-resolution-wga
[14] Western Governors' Association. "Wildland Fire Management." Governors' policy resolution passed in 2013. http://www.westgov.org/policies/304-wildfires/613-wildland-fire-management-wga-resolution-2

The CHAIRMAN. Thank you, Mr. Ogsbury.
Mr. Michael, welcome.

STATEMENT OF CANNON MICHAEL, PRESIDENT, BOWLES FARM, ON BEHALF OF THE FAMILY FARM ALLIANCE

Mr. MICHAEL. Well, good morning. I'd like to first of all thank the Committee for this opportunity to be able to present on this important issue of the Westwide drought and thank the Committee for taking the time for the attention on this matter.

I'd like to especially thank Chairwoman Murkowski for the leadership role she's taken in this effort and also for her recent visit to California to see the conditions for herself firsthand and greatly appreciate your comments that you started with. It means a great deal that you've taken it to heart and learned so much.

I would offer anyone in this room the opportunity to come to our farm for a visit to see conditions for yourself, firsthand.

I'm here today representing the Family Farm Alliance. We are a grass roots organization comprised of family farmers, ranchers, irrigation districts and allied industry groups that have representation through the 16 Western states. The main mission of the Alliance is to provide and ensure the availability of reliable, affordable irrigation water supplies for farmers and ranchers.

My name is Cannon Michael. I'm the sixth generation in my family to farm in the Central Valley. My great, great, great grandfather came over from Germany in the 1850's and through a lot of hard work became a successful cattle rancher. And we are still fortunate to farm some of the land that he originally settled on. I live on the farm with my wife and my three children.

As I sit here before you I've already fallowed 25 percent of my ground. I am now awaiting a decision which has just come up in the last few days which may take that number to 80 percent or higher.

We mentioned regulations for fish a little bit earlier. The sole decision that may change my allocation and the trajectory of my farm this year is based on temperature modeling for fish only. It's been discovered there's not enough cold water available in storage for fish, and that may completely eliminate all the collaborative work that's been done to provide some water supply for different water users this year. So obviously a very disturbing time for me and my family.

Throughout the last 15 months there's no denying, in the last four years there's no denying that hydrologic issues have been plaguing California. But in the last 15 month period there's also been significant rainfall events, very precious at the time of this critical drought. What we've seen over and over again is the uncaptured part of those rain events has flowed out, the majority of it has flowed out to the ocean and not been able to be captured by our water system.

California relies on an engineered water system that moves water through the Sacramento-San Joaquin Delta where two-thirds of the water falls in the north of the state to where two-thirds of the population is in the south part of the state. It's been a system that's worked for many years. Now with this layering of regulations

that we've seen since the 1990's, we've seen all flexibility be taken out of the system.

I would ask today, as the Federal Government you have the opportunity to ensure that regulations, when they are in place, are implemented with some balance and some accountability. It would be one thing to me if these last years of regulation and limitations, if we had seen some improvement in the fish species. But we're not seeing that. So, there needs to be a clear look at those regulations, and they need to have accountability. And they need to have balance.

Quickly on the impact of fallowing. I want to just make the point very quickly. One fallowed acre has an extreme impact over a very large area. It's not just the income to a farmer. It represents loss of work to my people on the ground. If I don't run a tractor on that ground it means I don't buy tires. I don't buy parts. I don't buy fuel. All those associated industries that bring me those products, they also suffer.

It then means that I don't produce an actual product off that ground. That product then doesn't go to a processing plant. It doesn't go to a supermarket. It doesn't stock those shelves. It doesn't come out to something else that may be transported across the nation or across the world.

I then may not take any financing. It affects the banks. It's a large ripple effect from one acre fallowed. We have over 800,000 acres being fallowed this year. The economic impact is huge.

We've also seen food prices rise. We're taking away sources of healthy fresh fruits and vegetables from people that we have been telling that they need to eat more of those types of products. Ten to 15 percent may not mean a lot if you have a disposable income, but it sure means a heck of a lot if you're on a low wage or you have a difficulty providing for your own family. We cannot take these products away from people.

California farmers produce food and fiber in the most environmentally and ethically-friendly ways in the entire world. We have enforceable penalties if we do not follow the regulations that we are underneath.

The LA Times recently did an excellent expose on Mexico where we're getting more and more food and relying on them to provide us this food. They do not pay living wages, they do not have environmental standards, and they do not have enforceable penalties.

I would just, I know I'm out of time, but everybody uses a lot of water every day. We all rely on water. So we need to decide where we want those products to come from. Every time you eat, you're consuming water. Every time you put on your clothes, you're consuming water.

We are ultimate water consumers, every single day. Do we want water to come from places like California, water products to come from there or do you want them to come from other countries?

We have to start figuring out solutions. We have to have some accountability for environmental regulations. We need leadership from the Federal Government. We need your help, and I'm asking for that today. Thank you.

[The prepared statement of Mr. Michael follows:]

Testimony of Cannon Michael
Representing
The Family Farm Alliance

Before the Committee on Energy and Natural Resources
United States Senate

Oversight Hearing
On
"The Status of Drought Conditions Throughout the Western United States and Actions States and Others are Taking to Address Them."

Washington, D.C.
June 2, 2015

Good morning Chairwoman Murkowski, Senator Cantwell and Members of the Committee.

My name is Cannon Michael, and on behalf of the Family Farm Alliance (Alliance), I thank you for this opportunity to present this testimony on a matter of critical importance to our membership: the Western drought. The Alliance is a grassroots organization of family farmers, ranchers, irrigation districts, and allied industries in 16 Western states. The Alliance is focused on one mission: To ensure the availability of reliable, affordable irrigation water supplies to Western farmers and ranchers. We are also committed to the fundamental proposition that Western irrigated agriculture must be preserved and protected for a host of economic, sociological, environmental, and national security reasons – many of which are often overlooked in the context of other national policy decisions.

The Family Farm Alliance has a long history of collaboration with constructive partners in all levels of government, conservation and energy organizations, and Native American tribal interests who seek real solutions to water resources challenges in the West. We seek to advocate for a proper role for the federal government on water matters, a vision that focuses on research and development; full integration, coordination and maximum sustainable use of resources; and planning that is driven from the "ground up." The Alliance also has a well-established relationship with Congress, with 45 invitations to testify before Congressional committees on Western agriculture, water and environmental matters in the past decade.

This testimony will illustrate the problems Western farmers and ranchers face in the current drought, outline what producers like me and other Westerners are doing to address these challenges, and provide policy recommendations that we believe lay the foundation for effectively addressing current and future droughts in the Western United States.

Personal Background

I manage the Bowles family farming operation, which is a long-time member of the Family Farm Alliance. I am the 6th generation of my family to be involved with California agriculture. My great-great-great grandfather came over from Germany as a young man and was able to start a cattle business on some of the same land that we now farm today. Starting at age 13, I began to work on the farm during the summer months. I learned about efficient irrigation practices, operation of farm equipment and gained experience with many aspects of managing an integrated farming operation in California's San Joaquin Valley. I met my wife in Los Banos in 1999 and we now have three sons. I live on the farm with my family and cannot imagine a better environment to raise my children. We farm in an area that has a very historic water right, but that has not spared us from the impacts of the ongoing drought.

I'm a farmer and I'm here to talk about what I know best: farming, and farmers and ranchers in California and elsewhere in the West have been hit hard by the drought. But farmers know that the impacts to our industry and to our communities are only part of the picture. Water shortages affect all sectors of the Western economy, creating problems for cities and towns, manufactures, builders, service providers, and individual citizens that are just as challenging as the difficulties faced by farmers and ranchers. The environment, too, is stressed by drought. In many areas of the West, species both plentiful and endangered are struggling to adapt and survive in extremely harsh conditions. The weeks and months ahead will bring wildfires, shortages of electric power and drinking water, business failures, unemployment, and other drought-related consequences, including harm to fish and wildlife, that will linger far into the future.

Water connects us all – farms, cities and the environment – and while drought presents unique problems for each sector, our solutions should be interconnected and mutually beneficial -- not divisive. That requires a willingness of all parties, including federal agencies, to be creative and flexible. That is happening in some places. In other places, it's not. The most helpful thing that Congress can do for drought-stricken states is to encourage, demand and mandate, where necessary, creativity and flexibility on the part of federal water management and regulatory agencies.

The Family Farm Alliance is an organization made up of farmers and ranchers in the West, but the drought problems we face vary by region, topography, climate, soil conditions, hydrology, and crop. These problems have some elements in common, including inadequate or deteriorating water storage infrastructure, inflexible or outdated operational requirements and regulatory conditions, and agencies that are not nimble enough, or not motivated, to seek out and embrace better ways of doing things to ensure the most benefit for the broadest suite of public interests. Solutions also vary by state and region, but they, too, are characterized by certain common elements, including creativity, flexibility and balance.

I will discuss drought conditions and problems in a few different areas of the West, as well as some examples of successful solutions and potential solutions. I'm a Californian so I'll begin there.

Coping with the California Drought

My home state of California is suffering the worst drought in recorded history. After four years of hot and dry weather, more than 44% of California is now experiencing "exceptional" drought conditions, which are characterized by widespread crop and pasture losses, and shortages of water in reservoirs, streams and wells. The record dry conditions of the past few years, coupled with water supply reductions related to regulatory actions, resulted in water supply reductions or constraints for most sectors even before California Governor Jerry Brown issued an executive order in April that imposed a 25% reduction on the state's 400 local water supply agencies over the coming year. The Governor's order focused on municipal, industrial and domestic water use, and he was criticized because the order did not apply to agriculture. But Governor Brown rightfully acknowledged that many farmers and ranchers were already experiencing severe water supply reductions. In 2014, vast areas of farm land in the San Joaquin and Sacramento Valleys received no surface water at all – a 100 % reduction. Those same areas were again zero-ed out in 2015. Overall, agricultural water supplies have been cut by 70% in the Central Valley.

Currently, 44% of California's 9.6 million acres of irrigated farmland are receiving zero surface water allocations from state, federal and local irrigation projects, according to the California Farm Water Coalition Agricultural Water Supplies Survey. Almost 75% of the state's irrigated farm land, nearly seven million acres, will receive 20% or less of its normal surface water supply. According to the California Department of Water Resources (DWR), 692,000 acres of farmland were fallowed in 2014 because of water shortages.

Individual farmers and irrigation districts with the oldest water rights in the State are experiencing severe reductions this year. On the Merced River in the San Joaquin Valley, irrigators in the Merced Irrigation District are receiving no water supplies for the first time in more than 150 years. Districts in the Kings River watershed, where runoff is only about 16% of average, will get so little water that some will not make irrigation deliveries for the first time in almost a century. Districts along the Feather River will see their water allocations decreased by 50% this year, the first cuts since 1992. Tuolumne River water rights holders in the Modesto and Turlock Irrigation Districts received minimal irrigation supplies this year, but there will be no water left for irrigation or municipal deliveries next year if current conditions don't improve - although water to meet fishery requirements will be released to the river.

For the second year in a row, many agricultural water users are receiving no allocations at all from the federal Central Valley Project (CVP), one of the largest water projects in the world. Table 1 shows the allocations for CVP for 2014 and the initial allocations for 2015. In both 2014

and 2015 no surface water supplies were allocated to water users on the Tehama-Colusa Canal, and in the San Luis Unit and Friant Division of the CVP. Settlement contractors, primarily agricultural water users, have water rights that pre-date the federal project, making them priority rights on the system, yet even allocations to those senior water rights holders are being reduced.

Table 1. Central Valley Project Water Allocations (2014 & 2015)

Contractors	***Percent Supply***	
	05/13/14	*02/27/15*
North of Delta		
Agricultural Contractors (Ag)	*0%*	*0%*
Urban Contractors (M&I)	*50%*	*25%*
Wildlife Refuges	*75%*	*75%***
Settlement Contractors / Senior Water Rights	*75%*	*75%***
American River M&I Contractors	*50%*	*25%*
In Delta-Contra Costa	*50%*	*25%*
South of Delta		
Agricultural Contractors (Ag)	*0%*	*0%*
Urban Contractors (M&I)	*50%*	*25%*
Wildlife Refuges	*65%*	*75%***
Settlement Contractors / Senior Water Rights	*65%*	*75%***
Eastside Division Contractors	*55%*	*0%*
Friant – Class 1	*0%*	*0%*
Friant – Class 2	*0%*	*0%*

***** - May be reduced if dry conditions persist***

Source: Bureau of Reclamation 2015

Almost as large as the federal CVP, California's State Water Project (SWP) will cut agricultural deliveries by 80 percent in 2015.

In most areas where surface water supplies have been severely reduced or eliminated, farmers have turned to groundwater to maintain their permanent crops – grapes, tree fruits, nuts, citrus – that represent a lifetimes' investment. But groundwater supplies are not infinite and were severely depleted in 2014 in areas that received no surface water. Groundwater also isn't cheap. Wells cost upwards of $200,000 each and they are expensive to run, so many farmers pump only enough water to keep their trees alive, but not producing. Often, farmers tear out mature, productive trees and vines and replace them with saplings that won't produce a crop for years, but require far less water to keep alive now. And in some places, mainly the citrus belt in the Friant Division of the CVP, there is no groundwater at all. The many small farms there, which

produce most of the nation's oranges, had their surface water cut off for the first time in 60 years last year. Most of those farms will receive no surface supplies again this year, and as a result decades-old orchards are being bulldozed out of existence.

In 2014 our family fallowed more than 15% of our farm. This year, we have a quarter of the farm abandoned or fallowed. When one hears that land is "fallowed" it might only seem that the impact is to the farmer, but that is definitely not the case. Every acre of farmed land generates jobs, economic activity and products. That is why the drought is so devastating to the rural agricultural communities of the Central Valley.

If I leave an acre fallow, my workers have less work and I use my tractors less. If I use my tractor less, I buy less fuel, lubricants and parts and tires, which means the local businesses that supply these things sell less and their companies suffer. When I don't purchase inputs for the land (fertilizer, seeds, amendments, etc.), the local companies that sell these items suffer reduced sales and the truck drivers who deliver these items have less work. With fewer trucks running fewer routes, fuel and parts purchases are reduced. If that one fallowed acre was intended to be a tomato field, those tomatoes would not be trucked to market or the processing plant.

As you can see, there is a huge interconnection between agriculture and many other industries. Recent press reports will acknowledge that California agriculture is a $46 billion-dollar industry, but then try to minimize this impact by suggesting that it is "only" 2% of the GDP of the state. The oft-reported $46 billion number is only the farm gate value of the products. It does not include all the other industries that benefit from the trucking and processing of the agricultural products (and all the fuel, parts, etc., from the activities). Clearly, agriculture is a huge economic driver for my state, particularly in rural communities. A recent report by the University of California shows that the food and beverage industry contributed $82 billion and 760,000 jobs that are directly and indirectly linked to agricultural products.[1]

Fallowing 25% of our land has had a very significant impact on those who have worked on those lands in the past. My family is doing everything it can to keep our employees working. Right now, we are trying to keep farmworkers on the payroll by putting them to work on two new solar projects that will be used to provide more affordable power to drive the extensive drip irrigation systems we have installed in recent years. This year, we are installing even more drip systems.

This is a very scary time for me and my family, since substantial investments are being made, primarily with the intent of converting more of our operation to drip irrigation, which we hope will stretch limited water supplies. Those investments will be for naught if the current drought / regulatory paradigm persists into the future and there is no water to conserve.

My fellow California farmers are doing their best to offset the devastating loss of water. For example, producers have been forced to buy water, when available, from other sources. In certain

[1] http://giannini.ucop.edu/media/are-update/files/articles/V18N4_3.pdf

instances, farmers had no choice but to buy water at a rate more than 25 times what they normally would pay. In the absence of once reliable surface water supplies, California farmers have looked to groundwater, where available, which is not sustainable. Central Valley producers have been trying to get ahead of a much feared, but anticipated, drought for years. Notably, they've spent about $3 billion to install more efficient irrigation systems on almost 2.5 million acres from 2003 to 2013, according to information compiled by the California Farm Water Coalition. These investments will continue as farmers strive to stretch their water supply.

California Drought: Myth vs Reality

Five years ago, reservoirs in California were brim full of water. Since then, much of that stored water – which had previously supplied Central Valley farms for decades – has been allowed to flow out the Golden Gate by federal fisheries agencies, with no apparent benefit for the fish species it is intended to protect.

"The reality is that farm water has already been rationed for more than two decades by the ascendant green politics, starting with the 1992 federal Central Valley Project Improvement Act", the *Wall Street Journal* recently reported. "Federal protections for the delta smelt, salmon, steelhead and sturgeon (2008-2009) further restricted water pumping at the Sacramento-San Joaquin River Delta, so 76% of inflows, mainly from the Sierra Nevada mountains, spill into San Francisco Bay."

Here are some other facts that are often overlooked in recent media coverage of the California drought:

- Crop production per acre-foot of water has risen 43% in California between 1967 and 2010.[2]
- California agriculture grows more than 50% of America's fresh fruits, nuts and vegetables across 78,000 farms, 400 crops and 450,000 jobs. California's value of agricultural output was $46.7 billion in 2013, with total U.S. output valued at $269.1 billion.[3]
- California is the country's largest agricultural producer and exporter. Agricultural products were one of California's top 5 exports in 2013, totaling $13.7 billion.[4]

Much of the initial media accounts since the Governor's announcement also advanced the decades-old myth that farmers consume 80% of water supplies in California and other parts of

[2] USDA National Agricultural Statistics Service, California Department of Water Resources
[3] California Department of Food and Agriculture, Gianinni Foundation of Agricultural Economics – University of California, USDA, Assembly Committee on Jobs, Economic Development and the Economy
[4] Assembly Committee on Jobs, Economic Development and the Economy

the West. But if we look at the "water footprint" in the same way as we have come to talk about the "carbon footprint," we get a different picture, particularly in California. Numbers from the California DWR provide perspective. According to the Department, statewide water use breaks down as follows: 10 percent urban use; 41 percent agricultural use and a majority of 49 percent use for environmental management: wetlands, Delta outflow, wild and scenic designations, and instream flow requirements.

Others in the media suggested that the shift in crops towards higher value crops like nuts and wine grapes have led to an increase in agricultural water use. For a few weeks, almonds were the preferred villainous target of these reports. But according to California DWR, the total amount of agricultural water use has held steady since 2000 and actually declined over a longer period.

I appreciate this opportunity to provide my first-hand observations of the drought challenges we are facing in my home state. However, the organization I am representing includes farmers and ranchers from across the West who are experiencing their own drought struggles, developing innovative solutions, and who are seeking assistance to create long-lasting fixes to allow them to better cope with future droughts.

The Western U.S. Drought Crisis

Unusually dry weather has dominated much of the West for the past three to four years, resulting in significant hydrological (low lake, reservoir, and stream levels) and agricultural impacts. Almost all of the West Coast continues to have record low snowpack this year, according to data from the fourth 2015 forecast by the United States Department of Agriculture's Natural Resources Conservation Service. Historically, April 1 is the peak snowpack in the West. This year, the peak came earlier. There was little snow accumulation in March, and much of the existing snow has already melted. In Western states where snowmelt accounts for the majority of seasonal water supply, information about snowpack serves as an indicator of future water availability. Streamflows in the West consist largely of accumulated mountain snow that melts and flows into streams as temperatures warm in spring and summer. A consequence of the early snowmelt is that Western states will have reduced streamflow later this spring and summer.

As noted previously, California's Sierra snowpack is at record low levels but is relied upon as the primary source of the summer water supply. With very little snow melt runoff, the current reservoir contents will essentially be the only amount of water available for use this summer. The major storage reservoirs for California are at roughly 50% of capacity and have very little opportunity to gain additional water.

The Colorado River Basin covers about 246,000 square miles, including parts of the seven "basin States" of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming and also flows into Mexico. The river supplies water to more than 30 million people, irrigates nearly four

million acres of cropland in the U.S. and Mexico, and supplies hydropower plants that generate more than 10 billion kilowatt-hours annually.[5] Much of the Colorado River Basin is facing multi-year drought conditions. In Arizona, the snowpack has melted out about a month earlier than normal, and streamflow forecasts have been further reduced. Colorado snowpack has prematurely transitioned to early spring-like conditions, with lower and some mid-elevation snowpack seeing significant melting. In Nevada, the April 1 snowpack was the lowest ever recorded at nearly every measuring site statewide (including three sites with over 100 years of data). Water year precipitation is also nearing record low amounts, which reinforces predictions of record low streamflow volumes this summer.[6] Predicted near-term Colorado River water supply scenarios are dire enough that drought contingency planning has been initiated in the Colorado River Basin. These efforts place a strong emphasis on demand reduction as one of the tools to stave off critical water shortages. If dry conditions continue, diminishing reservoir levels in Lakes Powell and Mead will have extremely negative consequences for water and power users throughout the watershed, especially urban areas outside of the Basin that rely on Colorado River trans-basin diversions for their water supplies.

In the State of Colorado, all river basins experienced peak snowpack in early March with the exception of the South Platte which, due to mid-April storms, was able to achieve a snowpack peak close to normal. Basin-wide snowpack follows the same storyline: while the South Platte snowpack is at 96 percent of normal on May 1, statewide snowpack is at 61 percent of normal. Snowpack in the Rio Grande River Basin is the lowest in the state, at 25 percent of normal on May 1. This means that mountain snowpack this year will only provide three quarters of the typical snowmelt to contribute to streamflow. However, snowmelt is not the only factor that determines spring and summer streamflow. Monthly precipitation has been well below normal in nearly every basin for the last two months, during which Colorado typically receives the most monthly precipitation amounts. Statewide April 2015 precipitation was only 71 percent of normal, while the South Platte April precipitation was the anomaly at 110 percent of normal. These factors, among others, currently paint a below normal streamflow forecast picture for much of the state heading into spring and summer of 2015.[7]

Snow packs in Utah are melting quickly and streamflow response has been poor. About 70% of all snow measurement sites in Utah had no snow as of May 1. Those that did – didn't have much and won't have that for very long. As an example, the Weber River has lost about 75% of its total snow pack to date and has produced a paltry 8.5% of its normal April-July streamflow. Low snow years typically melt out earlier (about 2 to 4 weeks), generate lower peak flows which also come earlier in the season and substantially lower accumulated flow. For most watersheds in low snow years, about half of the April-July flow is generated post snow melt out which will occur on most basins within the next two weeks. This means that – for most areas – April-July streamflow will likely be in the 20% to 40% of average range. Lower elevation watersheds are

[5] WaterSMART Colorado River Basin Focus Area Study, USGS 2012
[6] Nevada Water Supply Outlook Report, USDA NRCS, May 2015
[7] Colorado Water Supply Outlook Report, USDA NRCS, May 2015

already melted out and are in hydrograph recession. The year to date precipitation is below normal statewide at 64%. Current soil moisture saturation levels in runoff producing areas are near peak for the year and will quickly begin drying. Reservoir storage in 46 of Utah's key irrigation reservoirs is currently at 65% of capacity statewide. General runoff conditions are extremely poor in all areas of the state. May-July stream flow forecasts range from 6% for Salt Creek at Nephi to 54% of average for the East Fork of Smiths Fork near Robertson. [8]

It has been nearly five years since hydrologic conditions in New Mexico have been favorable, with extreme drought conditions now tolerable as some welcome moisture has fallen in northern New Mexico and across the western and eastern side to help fill streams and reservoirs. While most watersheds in the state show improvements in the April – July runoff forecast they are still only averaging between 25% and 68% of the 30-year average. The southern portion of the state remains vulnerable to drought conditions with the largest reservoir in the state, Elephant Butte, at only 13% of full capacity. Water from this reservoir feeds the Elephant Butte Irrigation District (EBID) and El Paso County Water Improvement District No. 1 in Texas. Currently, EBID farmers have been allotted only eight inches of water for the 2015 irrigation season, just over 20% of what a normal full allotment would be.

As of April 1, 76% of Oregon's long-term snow monitoring sites were at the lowest snowpack levels on record. In a typical year, most sites would be near their peak snowpack at this point in the season. This year, more than half of all snowpack measurements across the state recorded bare ground on April 1. Snowpack across Oregon peaked 40% to 90% below typical peak levels this winter, which will lead to reduced water supplies in the coming summer.[9] The Oregon Water Resources Department has a variety of tools it can use to exercise emergency water rights authority following a Governor's drought declaration, including issuance of emergency permits, temporary transfers (authorizing changes in type of use, place of use, or point of diversion of an existing water right, including "split season" transfers), and temporary instream leases to convert all or a portion of a water right to an instream lease. The state can also authorize temporary substitution of a supplemental ground water right for a primary surface water right and temporary exchanges of the source of water allowed under a water right, such as moving from a direct flow right to a stored water source. Under a drought declaration, the state can also grant preference of use to water rights for human consumption or livestock. All of these emergency actions involve a review process that includes an abbreviated public interest determination and a test for injury to existing water rights.

A dry April compounded with warmer-than-normal spring temperatures is deteriorating Idaho's water supplies. Snow water content levels peaked a month early and are now melting a month earlier than normal causing streams to peak in early to mid-May rather than mid-May to early June. Moderate snow melt rates and another dry month led to significant decreases in streamflow forecasts from last month. The highest forecast are for 80% of average for the rivers that flow

[8] Utah Water Supply Outlook Report, USDA NRCS, May 2015
[9] Oregon Basin Outlook Report, USDA NRCS, May 2015

into Idaho from Montana and the lowest are at only 1% to 30% across basins in northern, central and southern Idaho. With more of the snowmelt water percolating into the ground and not showing up in the rivers, most river systems are operating under reduced irrigation allotments resulting in surface irrigation shortages that are expected across southern Idaho this summer and fall. Current snowpacks are melted out or nearly melted out in the Owyhee, Weiser, Oakley, Little Wood, and lower elevations in eastern Idaho. Snowpacks are only 10% to 15% in the Little Lost and Mud Lake area and increase to 20% to 40% across parts of southern, central and northern Idaho. The Salmon and Boise basins snowpacks are 40% to 50% of median while the highest snowpacks are 50% to 65% in the Clearwater, Henrys Fork and Snake above Palisades Reservoir. Idaho reservoir storage varies across the state and the status of each reservoir filling is a function of which phase of the hydrologic cycle the watershed is in. The story remains the same; there are ones that won't fill, others that will fill but won't be full for long with limited inflows, and others that are already on decline because of the early and high irrigation demand. By summer's end or before, many water storage facilities will be at their minimal storage levels.[10]

Extremely low snowpack continues across the state of Washington. Combined with an early melt during a warm March, streamflows for the spring and summer are expected to be correspondingly low.[11] With snowpack at historic lows, rivers dwindling and irrigation districts cutting off water to farmers, Governor Jay Inslee last month declared a statewide drought for Washington. The Washington Department of Agriculture is projecting a $1.2 billion crop loss this year as a result of the drought. To protect permanent crops in the state's most productive agricultural region, the Yakima River Basin, pro-ratable irrigation districts (those with junior water rights) are scheduled to receive only 44% of normal water deliveries, and are turning off water for weeks at a time to try to extend water supplies longer into the summer. In the Walla Walla region, water is being shifted from creek to creek to keep water flowing for steelhead, Chinook and bull trout. Fish are even being hauled farther upstream to cooler water. As things continue to dry out, the Department of Natural Resources expects more early-season and higher-elevation wildfires. The Bureau of Reclamation, which manages water for the Yakima Basin, has tapped into reservoir storage two months earlier than normal, and with snowpack melted and gone those reservoirs will not produce enough water to meet all demands downstream. Farmers and communities facing hardships may qualify for drought relief funds. Money can be used to drill water wells, lease water rights and acquire pumps and pipes to move water from one location to another. The Department of Ecology has been leasing water rights to boost stream flows, partnering with other agencies to evaluate fish passage problems and monitoring groundwater wells.

In Wyoming, snowpack and streamflow forecasts are below normal throughout the state. Fortunately, a recent wet pattern has taken hold across the Great Basin and Central Rockies. The

[10] Idaho Water Supply Outlook Report, USDA NRCS, May 2015
[11] Washington Water Supply Outlook Report, USDA NRCS, May 2015

precipitation outlook calls for continued elevated changes of above normal precipitation across Wyoming through July may help to alleviate drought conditions in the southwest part of the state. Below normal snowmelt streamflow volumes (50% to 65%) are expected across almost all major basins across Wyoming.[12] The significant wildland fire potential outlook for July and August shows there will be a higher than usual likelihood that wildfires will occur and become significant events across the northern two-thirds of Wyoming.

Key Challenges

The key challenges Western irrigators face in times of drought include competition for scarce water supplies, insufficient water infrastructure, growing populations, endangered species, increasing weather variability/climate change, and energy development. Across the West, several key water policy challenges stand out:

1. **Water management in the West is becoming increasingly inflexible.**

We need a new way of looking at how we manage our limited water resources, one that includes a broader view of how water is used, along with consideration of population growth, food production and habitat needs. The goal should be to integrate food production and conservation practices into water management decision making and water use priorities, creating a more holistic view of water management for multiple uses. We must begin to plan now in order to hold intact current options. Planning must allow for flexibility and consider all needs, not just focus on meeting future needs from population growth.

In many parts of the West, litigation stemming from citizen suit provisions of environmental laws including the ESA and Clean Water Act (CWA) is producing federal court decisions (or court approved "settlements") that direct federal agency "management" of state water resources. Congress should recognize that this type of litigation and resulting settlements can actually harm the overall health and resilience of landscapes and watersheds by focusing on single species management under the federal Endangered Species Act (ESA). We should seek solutions that reflect a philosophy that the best decisions on water issues take place at the state and local level. Finding ways to incentivize landowners to make the ESA work is far more preferable than what we have been seeing in recent years, where the ESA has been used by special interest environmental groups and federal agencies in court as a means of "protecting" only a single species (such as the Sacramento-San Joaquin River Delta smelt in California) without regard for other impacts, including those on other non-listed species.

Litigation and the manner in which certain federal agencies administer the ESA are very much driving water management decisions these days, at least in the West. And adversarial, single-purpose approach is not helping the agencies recover very many species. Recent research into

[12] Wyoming Basin Outlook Report, USDA NRCS, May 2015

litigation associated with federal environmental laws is beginning to uncover some unsettling facts: the federal government appears to be spending about as much money funding plaintiffs' environmental lawyers as it does to directly protect endangered species. Certain tax exempt, non-profit organizations have been consistently awarded attorney fees from the federal government, for suing the federal government. These same environmental groups are receiving millions of tax dollars in attorney fees for settling or "winning" cases against the federal government.

Droughts occur routinely in the West; that is why the Bureau of Reclamation made such important investments in water supply infrastructure over the past century. However, this infrastructure was never designed to meet the burgeoning demands of growing communities and environmental needs, while continuing to help farmers, ranchers and rural communities make it through periodic droughts. Unfortunately, droughts in the West are predicted to be deeper and longer than we have historically experienced in the 20th century. We believe Congress should provide federal agencies with more flexibility under environmental laws and water management regulations to respond to drought condition. And where such flexibility currently exists, Congress should demand that agencies use it promptly and with a minimum of bureaucratic nonsense.

For example, during drought emergencies the Federal Energy Regulatory Commission (FERC) has the authority to adjust licensing conditions for hydropower projects that affect water storage and fishery requirement. FERC has been pro-active in exercising that authority, but the federal fishery agencies, which set the flow and fishery conditions on hydropower licenses, are reluctant or slow to cooperate, or they impose out-scaled demands for 'mitigation' of emergency actions.

In some cases, water project operators are forced to release water in 'pulse flows' that may benefit fish species during normal times, but are of no value whatsoever during droughts when the species intended to benefit from the flows is not present in the river. Nevertheless, federal fishery agencies insist that the flows be made, the result being no benefit to the species and a great loss of scarce water that could be used by towns and farms.

Despite record-breaking dry conditions in California in 2014, and the Governor's declaration of a state-wide drought emergency, the Bureau of Reclamation, the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service refused to invoke existing emergency authorities under the ESA that would have provided increased operational flexibility for the CVP and the State Water Project while still protecting listed species. When local water agencies pressed the federal agencies to use their existing emergency powers, they were told that it would likely result in the imposition of harsh "mitigation" measures.

The Corps of Engineers operates dozens of water projects throughout the West, and it regulates the operations of many non-federal dam and reservoir projects according to criteria that in many cases were established decades ago and have not been updated to reflect changed conditions or new technology. As a result, projects are sometimes forced to waste large amounts of water in

order to adhere to the letter of a flood-control plan that no longer has a basis in reality. The Corps has existing authority to make short-term adjustments to operation criteria during droughts, but the agency rarely does so on a proactive basis.

The Alliance also believes Congress should rein in the environmental litigation "industry" that so often is the cause of inflexible federal decision making in water resource management.

2. **Environmental water management needs to be held to a higher standard of accountability.**

We must manage water to meet all needs but in a manner that "shares the pain," not creates winners and losers, especially when the losers are the very beneficiaries the federal water projects were originally built to serve. The past federal management of water in California's Bay-Delta, which has redirected under the ESA millions of acre feet of water away from human uses and towards the perceived needs of the environment, with no documented benefit to the ESA listed fish intended for protection, is a prime example. Similar concerns relate to recent flow management decisions on the Klamath-Trinity River system in Northern California / Southern Oregon, driven by misperceptions of the much-publicized Klamath River salmon die-off that occurred in 2002. That die-off event proved to be the catalyst for many of the actions taken on the Klamath / Trinity system in the past decade, where a "flow-centric" philosophy of certain downstream entities and the U.S. government has been exercised over the past decade with little apparent benefit to the fish. After a decade of providing flow augmentation in the Klamath / Trinity River system, there has been no scientific evidence produced by any state, federal, tribal, regional, private, or non-governmental organization that flow augmentation has prevented a fish disease outbreak. Meanwhile, California and Oregon water and power customers have suffered enormous, unmitigated losses due to this "management by perception" approach.

To Central Valley Project agricultural water contractors, the loss of 123,000 acre-feet of Trinity River water that could have been diverted to the CVP for drought relief in today's water market equates to nearly a $250,000,000 replacement value. And this calculation doesn't account for the other known socio-economic impacts resulting from fallowed acreage, lost production, lost sales, lost employment, and increased need for social services throughout the San Joaquin Valley's communities, many of which are considered disadvantaged under federal and state laws.

Good water management requires flexibility, as well as adaptive management. More regulation usually reduces this flexibility. Federal agencies managing the competing demands for water in the West have in some cases failed in creating opportunities for more flexible water management during times of drought.

3. **The Endangered Species Act needs to be implemented in a new way to better benefit species and rural communities.**

The original intent of the ESA - stated in the Act itself - was to encourage "the states and other interested parties, through federal financial assistance and a system of incentives, to develop and maintain conservation programs which meet national and international standards." Of special importance to the Family Farm Alliance is that the ESA explicitly declared that it was the policy of Congress that "federal agencies shall cooperate with state and local agencies to resolve water resource issues in concert with conservation of endangered species."

The authors of the ESA clearly believed in applying the ESA in a way that would foster collaboration and efficiency of program delivery, in an incentive-driven manner. Unfortunately, implementation of the ESA has "progressed" in recent years toward an approach that is now driven by litigation and sometimes the inappropriate, inconsistent and incorrect interpretation of the law by federal agencies. As far as the Act itself is concerned, little to no progress has occurred to keep this 40-year-old law in step with the modern era. The ESA has not been substantially updated since 1988.

At the heart of the Family Farm Alliance's concerns with the ESA is the ever present potential of serious federal restrictions being placed on the West's irrigation water storage and delivery activities, often using federally developed water infrastructure in protecting listed species. Future endangered species listings are on the horizon, including the Western Yellow-billed Cuckoo and Western sage grouse. That prospect has the Alliance very concerned about potential new federal restrictions being placed on the water supplies that are crucial to the West's $172-billion per year irrigated agricultural economy.

The ESA is an outdated law that is clearly not working as it was originally intended. It needs to be more about incentives and collaboration and less about litigation and regulation. Fewer than 2% of the species ever listed under the Act have been recovered and removed from the list, and the failures under the law far outstrip the successes. Meanwhile, the economic and sociologic impacts of the ESA have been dramatic. From the Alliance's standpoint, the law has really only inflicted harm and generated litigation that uses the Act as a weapon against our members' ability to use our natural resources for farming and ranching, while doing little to help the environment or the very species it was designed to protect.

4. **Aging Water Infrastructure Must be Addressed to Protect Future Water Supply Reliability**

More surface and groundwater storage is still a critical piece of the solution to water shortfalls. Congress should streamline regulatory hurdles to assist in developing new environmentally-sensitive water storage projects and other necessary water infrastructure improvements. Congress

should work to facilitate the construction of new surface storage facilities, providing a more effective process to move water storage projects forward.

Also, new tools to assist in financing major improvements to aging water infrastructure will be needed in the coming years to ensure that farmers and ranchers charged for these upgrades can afford repayment. Water infrastructure is a long-term investment, as are farms and ranches, and long repayment and low interest terms will be crucial in reinvesting in aging facilities to meet the challenges of tomorrow. Such improvements could include investments in everything from new water storage reservoirs (both on- and off-stream), regulating reservoirs, canal lining, computerized water management and delivery systems, real-time monitoring of ecosystem functions and river flows for both fish and people, and watershed-based integrated regional water management. With the advent of the Water Infrastructure Finance and Innovation Act (WIFIA) in the WRRDA 2014, the Alliance believes a similar affordable loan program could be instituted at Reclamation to assist in providing capital for such investments. Also, more flexibility may be needed to allow for private investments at Reclamation facilities in order to attract additional capital to meet future water supply needs.

Western irrigators need flexible, streamlined policies and new affordable financing tools that provide balance and certainty to support collaborative efforts and manage future water infrastructure challenges. Solutions in all of these areas will be crucial to future enhanced agricultural production, conservation and community outcomes in the West.

Innovative Solutions

For family farmers and ranchers, finding solutions to constantly emerging challenges is just business as usual. Nature, the markets and the government are always finding new problems to throw at farmers, and farmers who are not determined, resourceful and innovative do not succeed -- at least not for long.

Irrigators and their local water agencies are responding to the drought with determination, resourcefulness and innovation. They also are bringing those attributes to bear in planning for a future where "drought" may be a long-term or even permanent condition. Throughout the West, farmers, ranchers and irrigation agencies have undertaken creative measures to efficiently manage increasingly scarce water resources. Some of these actions are intended to address the immediate crisis; others have been implemented as part of the broad portfolio of actions that successful farmers are employing to stay profitable in today's fierce economic and regulatory climate. If federal agencies are willing to take lessons from how farmers and ranchers are coping with the drought, the result would likely be better management of water for both economic purposes and environmental uses.

The following are real-world examples that Congress and the Administration should consider when developing legislation and polices to address the current drought and water management for the future.

Employing New Technology: *Elephant Butte Irrigation District (New Mexico)*

With less snow pack runoff and a more intense monsoon season, the Elephant Butte Irrigation District (New Mexico's largest irrigation district) has been instrumental in developing a storm weather tracking system that gives water managers time to react to monsoon events that can bring torrential rain events into the Rio Grande Valley. The new system can detect the storm event 20 miles away from the valley, calculate the rain event and determine the storm track before it hits the valley floor. The District then captures it in the Rio Grande River, diverts it into their canal system to irrigate farm land and into a system of drains that allow the storm water to recharge the underground aquifer.

Collaboration, Ecosystem Restoration, and New Storage: *Yakima Basin (Washington)*

The Yakima River Basin in Washington State does not have enough surface water storage facilities, with over 2.4 million acre feet of water needs annually dependent upon only 1 million acre feet of surface water storage capacity. The Yakima Basin is experiencing increased pressures and demands on our 1 million acre-feet of reservoir storage capacity, while we are now at above average carryover water storage, current water storage capacity cannot make up for shortages in the snow pack. We need more water storage carrying capacity to meet our dry-year demands like those we are experiencing this year, with proratable (junior) water rights estimated to receive only 44% of normal supplies.

To help plan for expanding our access to more irrigation and M&I water storage capacity and to help relieve tensions in the basin over water supply management for all needs, a large cross-section of the water stakeholder interests and the Yakama Nation have worked together over the past several years in developing the Yakima Basin Integrated Plan. The Integrated Plan is a well thought out, long-term comprehensive set of solutions to restore ecosystem functions and fish habitat and improve long-term reliability of water supplies for streamflows, agricultural irrigation and municipal supply. The Integrated Plan was developed in a public, collaborative process involving local, state, federal and tribal governments plus stakeholders representing environmental, irrigation and business interests. The consensus achieved by this diverse group represents a major and unprecedented accomplishment for the Yakima Basin and for water management in the western United States. The Integrated Plan offers a means to avoid a tangle of litigation and hardship for these users in future years. The Yakima Basin Integrated Plan is believed to be the first basin-wide integrated plan in the United States to reach the level of success that it has achieved.

Prior efforts to increase water storage in the Yakima Basin have failed, in part due to a lack of consensus among the key stakeholders. The Integrated Plan offers the best opportunity in decades to resolve long-standing problems afflicting the Basin's ecosystem and economy. In addition, improving water conservation and management, along with making available increased water storage for farms, fish and our communities are key components of the Plan. When implemented, the Plan will greatly improve operational flexibility to support stream flows while

meeting the basin's basic water supply needs under a wide range of seasonal and yearly snowpack and runoff conditions, both now and under possible future hydrologic conditions.

Empower Locals to Develop New Storage: *Sites Joint Power Authority (California)*

Growing concerns about the delays and costs associated with the proposed Sites off-stream reservoir project in the Sacramento Valley of California, 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 Sacramento Valley counties and water districts, 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 the Bureau of Reclamation and California Department of Water Resources, the JPA took a common-sense approach. The JPA worked with Reclamation and DWR to put together *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. Local project proponents envisioned a project that would be integrated with the system they already had, and one that would also operate effectively regardless of future operational changes to the larger system, such as construction of new conveyance to export water users located south of the Delta. The JPA wanted to maximize the benefits associated with existing infrastructure and provide as much benefit as possible to both the existing state and federal water projects at the lowest feasible cost.

The JPA approached the Sites project with the goal of making the best possible use of limited resources, and in the end, local irrigators believe they have identified a project that is both affordable and will provide significant benefits. The proposed project maximizes ecosystem benefits consistent with the State water bond, which states that at least 50 % of the public benefit objectives must be ecosystem improvements. Other benefits include water supply reliability, water quality improvements, flexible hydropower generation, more recreation benefits and increased flood damage reduction. In short, the JPA approached the Sites project with the goal of generating water for the environment while improving statewide water reliability and regional sustainability in Northern California. They believe they have achieved that goal.

Collaboration, Conservation, Energy and Water Reliability, and Regulatory Assurances: *Deschutes River Basin (Oregon)*

Irrigation districts that comprise the Deschutes Basin Board of Control are important members of the Family Farm Alliance. Since the 1960s, local irrigation districts, cities, counties, and others have undertaken an unprecedented array of voluntary measures to conserve water, return water in-stream for fish and wildlife purposes, and use irrigation water supplies to generate renewable carbon-free energy. District-led conservation projects have reduced diversions by more than 200,000 acre-feet annually, leading to higher in-stream flows in the Deschutes River and its tributaries. Recent projects by four districts alone have resulted in the piping or lining of 58 miles of canals, resulting in a return of 91.5 cubic feet per second of water in-stream. All of these measures are designed to sustain agricultural productivity, reduce diversions and increase in-stream flows in the Deschutes River and its tributaries.

One of the first applications of ESA section 10(j) in the United States by the National Marine Fisheries Service (NMFS) occurred in the Deschutes Basin because of the proactive water conservation and fisheries restoration work completed to date by local irrigation districts, along with cities, counties and others in Central Oregon. These water users have received assurances from NMFS that their lawful use of water supplies will not be at risk to the ESA while this designation is in effect. Many water users in other parts of the West have done much to conserve water, restore ecosystems, and take other actions to steward the environment, and have yet to receive the sort of regulatory "assurances" that the Deschutes Basin districts have. The relationship that exists between the local water users and federal regulatory agencies in the Deschutes Basin should serve as a model for other regions of the West.

Raising wool and beef, and growing alfalfa, grass hay, carrot seed, wheat, and other products requires a sustainable supply of water. Improving instream flows for salmon, steelhead and other fish and wildlife species also requires sustainable supplies of clean water. The efforts underway in Central Oregon are a terrific example of how to preserve our important agricultural economy in places like Deschutes County, while improving habitat in Oregon's iconic Deschutes River.

Fish Reintroduction and Regulatory Assurances: *Yuba Salmon Partnership Initiative (Marysville, California)*

The Yuba County Water Agency (YCWA) is leading a voluntary, science-based initiative with the California Department of Fish and Wildlife, NMFS, American Rivers, Trout Unlimited, and the California Sportfishing Protection Alliance to reintroduce Spring-run Chinook salmon (and possibly steelhead) into the North Yuba River upstream of YCWA's New Bullards Dam, and to enhance habitat for these species in the lower Yuba River. Recognizing the value of collaboration over controversial regulation, these parties are working to establish the sustainability of reintroducing these species into their historic habitat in the Sierra Nevada Mountain Range for the first time in 75 years. If the initiative is successful, it would help

contribute to the recovery of these species with benefits for California's Bay/Delta, and possibly serve as a model for fisheries reintroduction elsewhere. A foundation of this effort will be the use of Section 10(j) under the Endangered Species Act – a concept previously successfully employed in the Deschutes River Basin (above) - to ensure that the parties throughout this region do not incur any harm from the ESA.

Long-term Environmental Enhancement and Water Supply Reliability: *Klamath Settlement Agreements (California / Oregon)*

The three Klamath Agreements - the Klamath Basin Restoration Agreement, the Klamath Hydro-Electric Settlement Agreement and the Upper Klamath Basin Comprehensive Agreement - reflect an intensive, collaborative effort that has consumed much of the last decade. The Klamath irrigation community wants to move on to stability and has spent thousands of hours over the last decade at the negotiating table to reach this outcome. The Klamath settlement agreements are a critical means of keeping Basin family farmers and ranchers in the business of producing food and fiber for our country and the world. The settlement agreements are a unique solution that advances this critical need. What happens or does not happen for Klamath Basin irrigators could set an example, not only for all Western family farms and ranches, but other areas of the country where agricultural production is beset with environmental challenges.

Understandably, the idea of removing dams is a sticking point for some in the agricultural community, and the Alliance does not universally endorse the removal of dams. In fact, the Alliance is a leading proponent of creating more surface water storage in the West. We are advocates for enhancing the benefits of existing water-supply dam-reservoir projects and for building new ones to meet the needs Western irrigated agriculture. The potential impacts and precedents of removing any dam are concerns to us as advocates for irrigated agriculture.

The Klamath Settlement Agreements are unique to the Klamath Basin and its issues and their dam-removal components have no bearing on other agricultural region's decision-making. Moreover, no irrigation dams or flood control dams are removed as part of these settlements. Dams slated for removal are owned by a private company, PacifiCorp, which believes it is in the best interest of their Western states customers to remove them. Importantly, this is a private property rights issue. We believe that holders of private property rights in this country should have a say about what they do with their assets, and that is what PacifiCorp has exercised. In this instance, agricultural producers stand to gain increased water supply reliability in exchange for the expected fish passage benefits associated with removal of these dams.

To date, the local irrigators who have actually experienced a threat to their livelihood and way of life with water shut-offs, paying for litigation, and ESA pressures want these agreements in place. Proponents of these agreements believe they provide the most cost-effective, timely and politically viable solution.

Conservation and Drought Resilience: *Colorado River Basin*

In Wyoming, ranchers Pat and Sharon O'Toole have always managed their land with conservation in mind. Along the way, they've built strong partnerships with Trout Unlimited, Audubon Wyoming and The Nature Conservancy; organizations some ranchers once viewed as adversaries. Further south, in the fertile North Fork Valley outside of Paonia, Colorado, Harrison Topp took the leap from annual vegetable production to perennial fruit, growing food in a region with just 15 inches of annual average precipitation.

The newest Family Farm Alliance report, "*Innovations in Agricultural Stewardship: Stories of Conservation & Drought Resilience in the Arid West*," focuses on these two case studies and three others that profile producers across the Colorado River Basin and beyond who -- with curiosity, creativity and seasons of trial and error -- are conserving resources while enhancing productivity. The Alliance teamed up with the National Young Farmers Coalition on this report with the aim of elevating the voices of farmers and ranchers who are employing smart solutions to build drought resilience, steward water and grow good food.

Some of the farmers highlighted in the Alliance report are integrating efficient irrigation technology with soil health to increase both productivity and water savings. Others are navigating conservation within constraints outside of their control, such as the operations of the ditches which deliver water to farms. To paint a fuller picture of the complexities and nuances of agricultural water conservation in the West, the Alliance worked with the engineering firm Applegate Group to create a water balance for three of the case studies. These water balances utilize a technical, objective approach to assess the producers' water rights, current conservation efforts, and barriers or opportunities for future conservation. They underscore the reality that conservation practices are different on every operation and unique from farm to farm.

As the pressures of climate variability and drought increase, farmers and ranchers are at the forefront of our national adaptation strategy. Producers are coming together to help one another, but they also need support from consumers, policy makers, scientists, and service providers. The Alliance hopes that these case studies will provide policy makers and other stakeholders with a more nuanced understanding of the diversity and complexity of western agricultural water conservation and an appreciation of what continuing to take agricultural lands out of production might mean. A copy of the Alliance report is included as an attachment to this written testimony.

How the Federal Government Can Help

The Congress and the federal government certainly cannot change the hydrology of the West, but there is a role it can play to support family farmers and ranchers. Policy makers should understand the following observations and principles as they develop new solutions to the Western drought:

- State water laws, compacts and decrees must be the foundation for dealing with shortages.
- Water use and related beneficial use data must be accurately measured and portrayed.
- Benefits of water use must reflect all economic / societal / environmental impacts.
- Water conservation can help stretch water supplies, but has its limits in certain situations.
- Public sentiment supports water remaining with irrigated agriculture, and developing strategic water storage as insurance against shortages.
- Technologies for water reuse and recycling are proven effective in stretching existing supplies for urban, environmental and other uses.
- Urban growth expansion should be contingent upon sustainable water supplies; using irrigated agriculture as the "reservoir" of water for municipal growth is not sustainable in the long run.
- Planning for water shortage in the West must look to the long-term in meeting the goals of agriculture, energy, cities, and the environment.
- A successful water shortage strategy must include a "portfolio" of water supply enhancements and improvements, such as water reuse, recycling, conservation, water-sensitive land use planning, and water system improvements. New infrastructure and technologies can help stretch water for all uses.
- Temporary fallowing proposals should be approached in a thoughtful, thorough manner only after urban, energy and environmental users of water demonstrate a better management of their share of the finite supply.
- Unintended consequences associated with reducing productive agricultural land/groundwater recharge/riparian habitat benefits should be avoided and, if unavoidable, minimized and fully mitigated.

We offer the following specific actions that federal policy makers can address in new drought legislation:

Encourage accurate measurement and portrayal of water use and related beneficial use data.

As is often the case, what happens in California often has a ripple effect that extends to other Western states. For example, the common acceptance that "farmers use 80% of the water" is a mythical argument that is applied by critics of irrigation in areas throughout the West. We need to find clear and comparable ways to present these types of water use numbers as we struggle with finding the appropriate way to prioritize our water uses among competing demands. And, we need a solid understanding of how water used for environmental purposes is really benefitting the species or habitat it is intended to protect, and how to more efficiently manage such uses for maximum benefit using less water, the same standard to which irrigated agriculture is currently being held.

Find ways to streamlines regulatory hurdles assist in developing new environmentally-sensitive storage projects and other necessary infrastructure improvements.

There are several bills under consideration in the House of Representatives intended to facilitate the construction of new surface storage facilities. Congress should work to quickly pass all of these bills, given the brief window of opportunity the drought-related political attention has provided this year.

The President and Congress will prioritize whatever federal funds are available to meet existing and future needs. As for the rest of the capital, it must come either from state and local governments or from the private sector. If the federal government cannot fund the required investments, it should take meaningful steps to provide incentives for non-federal entities to fill the void, and remove barriers to the new ways of doing business that will be required.

The Alliance believes that the federal government needs to seriously consider adopting a policy of supporting new projects to enhance water supplies while encouraging state and local interests to take the lead in the planning and implementation of those projects. Local and state interests (see Sites JPA example, above) have shown enormous creativity in designing creative water development projects. Water agencies have at times obtained additional federal funding through the appropriations process; however, Reclamation could also supplement this effort by providing funding for local partnership agreements, especially where Reclamation and its water contractors are identified as potential beneficiaries.

Provide additional funding to support WaterSMART and/or other programs that provide incentive-driven cost share money for new water conservation projects.

Small federal investments in cost-shared, competitive grants help irrigation districts make larger investments in water conservation and management technologies that can help stretch water supplies to meet unmet needs. The Secure Water Act should be reauthorized to extend these grant programs into the future.

Sufficient funding should be provided to implement and expand the *"More Water, More Energy, Less Waste Act of 2007."*

This could lead to the treatment and beneficial use of excess produced water from oil and gas drilling and coal bed methane extraction. This law directs the Department of the Interior to evaluate the feasibility of recovering and cleaning produced water for further use in irrigation and for other purposes. The bill would also authorize a grant program to test produced water recovery technologies in Western states.

Improve ESA transparency and species recovery.

We know the ESA can play an important role in species protection, but it can only successfully do so with increased public input, stakeholder cooperation and new "outside-the-box" thinking on transparency and accountability. Unfortunately, the manner in which the ESA is being implemented in its current form discourages this sort of an approach. Private landowners should be viewed as potential partners in species recovery, not enemies. Incorporating the following four simple concepts into legislation or administrative directives would improve implementation of the ESA to recover and seek to remove species from the endangered list, and encourage public engagement and federal agency transparency and accountability:

- Require data used by federal agencies for ESA listing decisions to be made publicly available and accessible through the Internet. This would allow the American people to actually see what science and data are being used to make key listing decisions.
- Require the U.S. Fish and Wildlife Service and National Marine Fisheries Service to track, report to Congress, and make available online: 1) funds expended to respond to ESA lawsuits; 2) the number of employees dedicated to litigation; and 3) attorney's fees awarded in the course of ESA litigation and settlement agreements.
- Require the federal government to disclose to affected states all data used prior to any ESA listing decisions and require that the "best available scientific and commercial data" used by the federal government include data provided by affected states, tribes, and local governments.
- Prioritize resources toward species protection by placing reasonable caps on attorney's fees.

Surely constructive and thoughtful parties can all agree that a law addressing the needs of species in trouble is important. There is no reason why we should not be able to have an open and candid discussion about fixing the law to make it work as intended.

Require fish and wildlife agencies to inject some reality, set priorities and be accountable in their effort to manage the environmental share of the water pie.

In the Western U.S., environmental enhancement and mitigation programs are increasingly competing for existing sources of water. In some these instances, these actions have caused major conflicts, costly lawsuits and delayed benefits for endangered species and the environment. It's time that environmental interests, fish and wildlife agencies and water managers begin to inject some reality, set priorities and be accountable in their effort to manage the environmental share of this water pie. Legislative language that puts the burden of proof on the fisheries agency to conclusively demonstrate benefits to targeted imperiled fish species would be helpful. An institutional structure that ensures true peer review and impartial decision-making relative to this objective would also be useful.

Conclusion

Some California producers are starting to feel that their way of life is being written off by a segment of the public that appears to believe that the tragedy occurring in the Central Valley is a comeuppance that farmers somehow deserve. We still hold a sliver of hope that critical thinkers and leaders will easily distinguish this nonsense from reality.

California and the West need to manage water as if every year is a drought year. We need to invest in storage facilities to capture water in wet years, we need to look to innovative technology to enhance supplies and delivery and we need to get the very most benefit from the water we have available. The ability to measure, assess and show value for how that water is used is incumbent on every water manager -- environmental, urban and agricultural.

It will be hard work to reach an agreement and enact a legislation to wisely manage the West's water now and in the future, but that's the kind of work we elected you to do. Farmers work hard, and we expect Congress to do the same. We need you – all of you, urban and rural, Republican and Democrat – to come together and find a way to fix this broken system, now, before it breaks us all.

Only together can we in California and the West plan and prepare for our collective future. If we don't, we ensure only that the next drought will be worse than this one.

Thank you.



INNOVATIONS in AGRICULTURAL STEWARDSHIP

Stories of Conservation and Drought Resilience in the Arid West

A compilation of case studies from

NATIONAL YOUNG FARMERS COALITION

ALLIANCE

The **National Young Farmers Coalition (NYFC)** represents, mobilizes, and engages young farmers to ensure their success. We are a national network of farmers, ranchers, and consumers who support practices and policies that will sustain young, independent, and prosperous farmers now and in the future. Visit youngfarmers.org or contact kate@youngfarmers.org for more information.

The **Family Farm Alliance (FFA)** is a powerful advocate for family farmers, ranchers, irrigation districts, and allied industries in seventeen Western states. The Alliance is focused on one mission: to ensure the availability of reliable, affordable irrigation water supplies to Western farmers and ranchers. Visit familyfarmalliance.org or contact dankeppen@charter.net for more information.

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Photo courtesy Singing Frogs Farm

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LETTER TO THE READER

In the arid West we are entering a new normal. Drought and climate variability are colliding with population growth, spiking the demand for food and fresh water. Across the Colorado River Basin, a geography that supplies water to over 35 million people in seven U.S. states from Wyoming to California, and two states in Mexico, new efforts are underway to close the gap between supply and demand. While everyone is feeling the sting, farmers and ranchers are all too often caught in the middle.

The last 14 years have seen prolonged drought in the western U.S., but 2015 has set new historical records. California offers a prime example. Like most western states, California relies primarily on snowmelt for its drinking water, irrigation, and water for the environment. On April 1st of this year, the state's snowpack was a mere 5% of normal.[1]

The southern portion of the state relies on melt from the Colorado River system, which is experiencing far below average snowpack, as well. In an urgent response, Governor Jerry Brown ordered mandatory water cutbacks in towns and cities statewide. Meanwhile, many farmers are already receiving little to no surface water allocation due to the miniscule supply and regulatory constraints, even after many regions have invested billions of dollars in efficiency improvements.

This sense of urgency has spurred renewed efforts to find solutions across western states. However, too often agriculture is viewed as the default "reservoir" that other sectors can access to satisfy growing demands for water. A report released by the Bureau of Reclamation in 2012 identifies a 3.2 million acre-foot gap between water supply and demand in the Colorado River Basin by 2060.[2]

Suggestions to meet this gap indicate taking 6-15% of existing irrigated agriculture out of production. Such efforts are already underway: Thirsty cities continue to buy water from farmers at tough-to-beat prices while the almond unfairly bears the brunt of the latest round of negative PR targeting water-demanding crops. If we continue down this path we risk serious implications for our farmers, ranchers, and food supply.

Without a doubt, agriculture has a significant role to play in water conservation. But all too often discussions of what to do about water scarcity take place off the farm, without input from those who have a direct connection to our food supply and far away from the landscapes that will be most affected. In order to develop **smart policy, it is critical to understand the solutions farmers and ranchers—young and seasoned alike—are utilizing to build drought resilience, steward water, and grow good food for all of us.**

The National Young Farmers Coalition and the Family Farm Alliance have teamed up to elevate the voices of farmers and ranchers doing just this. Following are five case studies profiling producers across the Colorado River Basin and beyond who—with curiosity, creativity, and seasons of trial and error—are conserving resources while enhancing productivity. Some are integrating efficient irrigation technology with soil health to increase both productivity and water savings. Others are navigating conservation within constraints outside of their control, such as the operations of the ditches which deliver water to farms.

To paint a deeper picture of the complexities and nuances of agricultural water conservation in the West, we worked with the engineering firm Applegate Group to create a water balance for three of the case studies. These water balances utilize a technical, objective approach to assess the producers' water rights, current conservation efforts, and barriers or opportunities for future conservation. They underscore the reality that conservation practices are different on every operation and unique from farm to farm.

Of all the producers whose stories are told here, what binds them together is their ability to manage for the economic, ecological, and social health of their operations, communities, and environments. They represent a growing movement of agriculturalists who are stepping up to the plate—and have been for years, despite the lack of attention—to farm with "whole systems" in mind. These farmers see that healthy soil is integral to healthy crops; that efficiency is an investment in future food and water security; that ecological services contribute to the bottom line; and that farmers sharing knowledge with one another is critical to innovation and adaptation.

As the pressures of climate variability and drought increase, farmers and ranchers are at the forefront of our national adaptation strategy. Producers are coming together to help one another, but they also need support from consumers, policy makers, scientists, and service providers. Our hope is these case studies will provide policy makers and other stakeholders with a more nuanced understanding of the diversity and complexity of western agricultural water conservation and an appreciation of what continuing to take agricultural lands out of production might mean.

Now is the time to engage farmers and ranchers as allies in finding innovative solutions that support the health of our land, water, and Western communities.

Sincerely,

Kate Greenberg
National Young Farmers Coalition

Dan Keppen
Family Farm Alliance

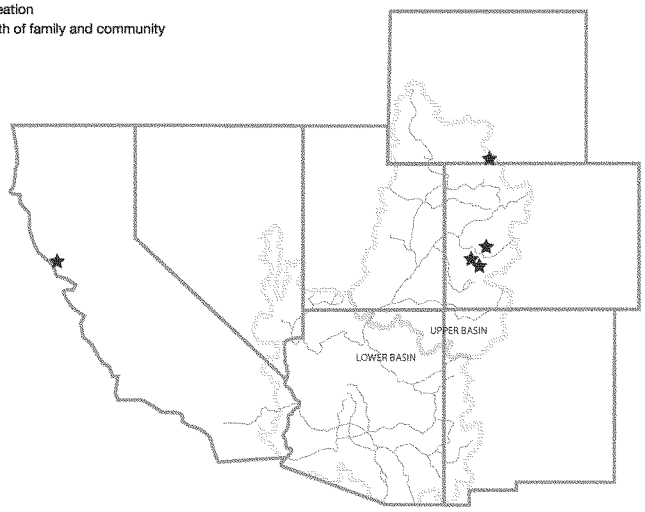
1 http://www.water.ca.gov/news/newsreleases/2015/040115enoswsurvey.pdf

2 http://www.usbr.gov/lc/region/programs/crbstudy/FactSheet_June2013.pdf

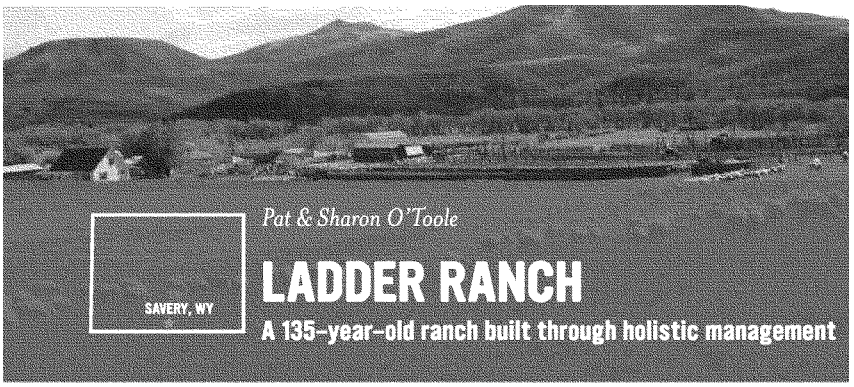
EXECUTIVE SUMMARY

Through the process of researching and compiling the following stories, a number of common themes emerged. These themes point toward more conservation-oriented, resilient agriculture evolving in the arid West. These ideas are not new but have not yet been implemented at a scale equivalent to their potential. The solutions illuminated here must be amplified across all sectors invested in western water.

- **Farmers are investing in irrigation efficiency and conservation**
- **Efficiency improvements may be cost-prohibitive for some producers**
- **Many farmers and ranchers manage their water for multiple values including:**
  - food production
  - ecosystem services
  - biodiversity and wildlife habitat
  - recreation
  - health of family and community
- **Soil health is critical to drought resilience, productivity, and water conservation. This includes such methods as:**
  - cover cropping
  - rotational grazing
  - no-till
  - mulching
- **Soil health is an investment with long-term benefits; it connects producers across operation types, regions, and philosophy; it enhances other forms of water-use efficiency**
- **Farmers and ranchers are our first line of innovation for climate change adaptation and drought resilience**



The Colorado River Basin is a seven-state geography governed by complex interstate and international water law. The river travels some 1,450 miles from the Rocky Mountains to the Gulf of California. It supports over 35 million people; 15% of U.S. produce; and recreation, industry, wildlife, and the environment.



SAVERY, WY

Pat & Sharon O'Toole

LADDER RANCH

A 135-year-old ranch built through holistic management

CONSERVATION AS FOUNDING PRINCIPLE

The Little Snake River Valley runs along the border between Colorado and Wyoming and helps form the headwaters of the Colorado River. This is a portion of the same water that eventually fills millions of taps in cities like Los Angeles and Phoenix. But first, it is stewarded on the Ladder Ranch, home to Pat and Sharon O'Toole, their children, and grandchildren.

The O'Tooles husband the same landscape that Sharon's great-grandparents settled on in 1881. Today, Ladder Ranch raises cattle, commercial sheep, horses, and working dogs. The O'Tooles have also created a ranch recreation business, which caters to fishermen, birders, hunters, and cyclers, as well as visitors interested in ranch life.

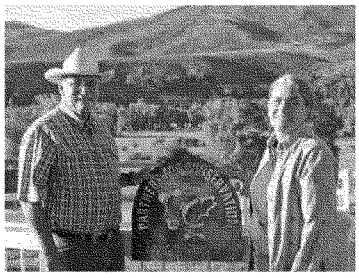
Sharon's family has long practiced what is known as holistic management—a way of integrating the whole farm or ranch, not just for economic health but for environmental and social benefits as well.[3] While Sharon grew up on the ranch, Pat is a first-generation rancher. From day one, he adopted the holistic management practices that for so long have been part of Sharon's family legacy. With their children taking on other elements of the business, the ethos of stewardship lives on.

To the O'Tooles, there is no inherent conflict between production and conservation. As Pat puts it, "We were always taught to keep one eye on the livestock and one eye on the landscape. One does not do well without the responsible management of the other. This is the resource ethic that we try to pass down through the generations."

WATER MANAGEMENT

Ladder Ranch, like many ranches in the interior West, relies on irrigation water derived from melting mountain snowpack. That water feeds a myriad of purposes. It grows hay and grass pasture, which supports the financial bottom line. It buffers soil against drought and fills creeks and streams. It supports trout fisheries and the anglers who seek them. It enhances biodiversity and provides water to wildlife that use Ladder Ranch as a migratory corridor. It draws in beneficial insects and pollinators and helps build a beautiful landscape. The O'Toole's holistic approach manages for all of these values simultaneously.

On 600 acres of irrigated land for hay and tens of thousands of additional acres of non-irrigated grazing land, the O'Tooles carefully monitor soil health. They plant



ABOVE: The O'Tooles have received many awards for conservation
TOP of PAGE: Ladder Ranch
Ladder Ranch photos courtesy Pat and Sharon O'Toole



Baling hay for the herd

cover crops on the farmland and utilize rotational grazing, which Sharon's father, George Salisbury, pioneered in the fifties. Rotational grazing imitates the movement of wild animals by rotating large herds of grazers—in this case sheep and cattle—on a carefully planned schedule. This allows the grasses ample time to regenerate while adding organic matter to the soil.

The irrigation practices the O'Tooles use vary depending on the nuances of the specific tract of land they are irrigating. Side-roll sprinklers irrigate about one-third of their pastures and flood irrigation waters the other two-thirds. While flood irrigation is considered less efficient, at the Ladder Ranch the "excess" water is essential to supporting waterfowl habitat. The water moves slowly across the land and eventually seeps back into rivers and streams to feed nine miles of trout fisheries and to provide irrigation for downstream users. In this specific case, increased irrigation efficiency could hinder other conservation values, a key example of the need for nuanced approaches to water management.

LEVERAGING PARTNERSHIPS

Another way the O'Tooles have conserved their lands' agricultural heritage is by partnering with land trusts to place a significant amount of acreage under conservation easement. Conservation easements are critical legal tools used to protect open space and working agricultural lands from development. The O'Toole's easement requires future owners to uphold the conservation values the family has agreed to, long into the future.

These decisions have made the O'Tooles leaders in collaborative conservation. Their partnerships include Trout Unlimited, Audubon Wyoming, and The Nature Conservancy—organizations some ranchers once viewed as adversaries. The O'Toole's recognize they share a common goal with many in the conservation community and have collaborated to protect threatened species, restore native habitat, and promote biodiversity.

A FAMILY ADAPTING TO A CHANGING CLIMATE

For the family, conservation is a pragmatic business choice that enhances their operation and ensures a productive landscape for future generations. With careful and specific management, the O'Tooles have watched their business and the landscape thrive together. In a changing climate—with a less reliable snowpack and thus a potentially less consistent water supply than in earlier years—they remain highly adaptable and responsive. Nothing is ever set in stone. As Pat puts it, "Our ranch is 135 years old, and we are still learning."

SNAPSHOT

Years owned by the same family: 135

Irrigated acres: 600

Commercial land use: cattle, sheep, working dogs, agritourism

Water management: Cover crops, rotational grazing, integrating ecosystem services

3 http://holisticmanagement.org/wp-content/uploads/2011/12/HolisticManagement-1-22.pdf



Cynthia and Ira Houseweart

★ HOTCHKISS, CO

PRINCESS BEEF

Raising grass-fed beef on the triple bottom line

RECORD OF RESILIENCE

Along the North Fork of the Gunnison River, a tributary of the Colorado River, orchards, ranches, and farm stands dot the landscape. This valley is home to rancher Cynthia Houseweart, who owns and operates Princess Beef, a grassfed beef operation she founded over 15 years ago with her husband, Ira. Like all farmers and ranchers in this arid region, Houseweart is constantly pushed to adapt her operation to an increasingly unpredictable water supply.

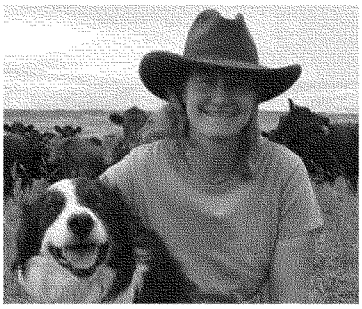
A historic drought in 2012 led many ranchers to cull their herds as they watched their pastures—and thus their winter feed—dry up. Yet Houseweart's pastures stayed alive, even after irrigation was turned off in August. Houseweart attributes this to how she manages her soil. As she recalls, "Down here on our place [...] it stayed green. You couldn't really tell it was a drought. [The soil] holds the moisture so much better when the ground can soak it up." The unique way Houseweart manages her herd, her soil, and her water kept her afloat through one of the worst drought years on record. She is an example of how many innovative ranchers today think about their operations.

ROTATE RATHER THAN TILL

Houseweart's first tool for resilience is to keep the soil covered. She does this through rotational grazing and no-till pasture management. Traditional ranching involves moving cattle infrequently, leaving them out in open pastures to graze for extended periods of time. This often leads to over-grazing, which, in turn, compacts soil or makes it prone to erosion, heightens rates of evaporation, and prevents the soil from soaking up precious moisture.

Rotational grazing, on the other hand, is the practice of moving the herd frequently to allow previously grazed pastures to regenerate. Houseweart rotates her cattle every two to three days. This brings some short-term disturbance to the soil, but by resting each pasture for much longer than it was grazed, Houseweart builds up organic matter and naturally fertilizes her land through the cattle's urine and manure. This also helps restore the carbon and water cycles on her ranch.

In addition, Houseweart has not tilled her pastures in the nearly two decades she has managed them. Underneath the soil surface a complex ecosystem of life delivers water and nutrients to the plants. Tillage would disrupt and damage that ecosystem and the soil structure.



ABOVE: Cynthia Houseweart and her herding companion
TOP of PAGE: Cattle graze on healthy forage
Princess Beef photos courtesy Cynthia Houseweart



The Houseweart family on their centennial ranch

Houseweart has found that by not tilling her pastures, her forage grows more vigorously throughout the year and is supported by this subsurface ecosystem. She has also reduced fuel costs by not running a tractor over her pasture. These practices build soil structure and sequester carbon, which allows the soil to work as a sponge to hold water in place for when it's most needed. This means that even in extremely dry years, or when surface water is tenuous, Houseweart has a buffer against drought.

Houseweart's ranch is also unique in the efficiency of its irrigation technology. Instead of flood irrigating her pastures, as is common, Houseweart has invested in a center pivot sprinkler, which is typically around 80% efficient versus 65% efficiency for flood.

But Houseweart has taken her efficiency to the next level by integrating this technology with stewardship practices. She rotates her cattle behind the sprinkler, which both increases the fertility of her pasture and reduces the amount of cutting and baling hay she needs to do.

THE TRIPLE BOTTOM LINE

From the get-go, Houseweart has managed for the whole health of her ranch and family. The decisions she makes for economic reasons must also be ecologically viable while supporting the well-being of each individual on the ranch, her family, and the community. This way of managing is possible on any operation at any scale.

But it is not Houseweart alone who drives this. She collaborates with a broad host of partners, from her local Natural Resources Conservation Service (NRCS) agent to a strong local growers' network. The Housewearts rely not only on a supportive community but on their willingness to adapt and try new things to meet modern challenges. As snowpack and irrigation supplies become more variable, and aridity continues to be a growing pressure, producers like the Housewearts point to a viable way ahead.



SNAPSHOT

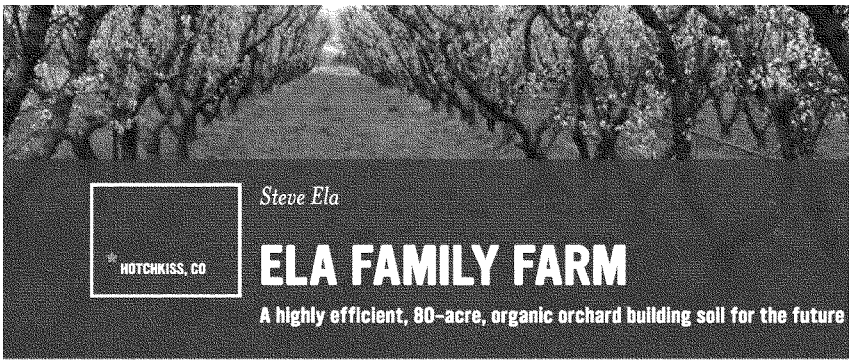
Years owned by the same family: 100

Irrigated acres: 100

Commercial land use: Grass-fed beef

Water management: Rotational grazing, no-till, center pivot irrigation

4 http://www.cpatt.ars.usda.gov/pdfs/Howell-Irrig%20Efficiency-Ency%20Water%20Sci.pdf P. 468



Steve Ela

HOTCHKISS, CO

ELA FAMILY FARM

A highly efficient, 80-acre, organic orchard building soil for the future

WATER ONLY WHERE IT'S NEEDED

High up on a south-facing hillside overlooking the North Fork Valley in north-central Colorado, orchardist Steve Ela grows 80 acres of organic tree fruits. In the peak of summer, Ela Family Farm is a locus of bounty: apples, peaches, pears, plums, and cherries hang heavy from the trees, tempting passersby with their undeniable sweetness. But the bounty doesn't grow itself: In as hot and dry a region as this, averaging less than 15 inches of precipitation a year, water is a top limiting factor to success. In his decades of farming, Ela has learned a thing or two about water.

When Ela's family bought the orchard in 1987 it was furrow irrigated. This form of irrigation, which remains a standard practice for many orchards to this day, lets water flow by gravity from a ditch or stream through furrows running through the crop. Based on the specific needs of his orchard, Ela felt he could improve the growing environment for his trees—and thus his productivity—by becoming more efficient.

Upgrading the orchards' irrigation system was Ela's first priority. He worked with his local Natural Resource Conservation Service (NRCS) agent to design and install a permanent drip irrigation system, an array of flexible plastic tubing with small emitters that release water directly where and when it's needed. The cost of this upgrade was significant, running nearly $2,500 per acre. The upgrade required care during installation to avoid damaging the tree roots as well as additional maintenance. But the increased efficiency has allowed for more effective watering, so the trees are irrigated consistently and with only the amount of water they need.

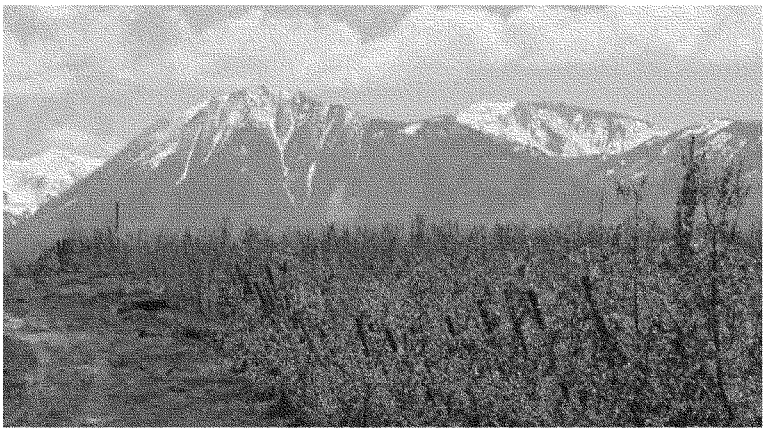
MANY SOURCES OF IRRIGATION

One of the primary challenges when it comes to irrigation water for farmers in the valley is late-season irrigation water. Surface water there is stored in a series of reservoirs and released into a network of ditches throughout the growing season. When the reservoirs are empty, the ditches are shut off. The amount of water in the reservoirs is primarily determined by that years' snowpack and subsequent spring melt.

Snowpack in recent years has been well below average. To mitigate this, Ela uses a few techniques. First, the farm owns and utilizes a broad array of water rights from multiple sources. These include Leroux Creek, the Highline Ditch, and numerous small reservoirs. Not only does this offer Ela options throughout the growing season, many of these rights are senior rights. That means that in the event of a "call," or when water supplies are too low for every user to get their full share, senior rights take priority. These rules are based on western water law that is over a century old. When Ela is unable to pull from the ditches, he can then tap the reservoir supply.



ABOVE: Ela admires his orchard
TOP of PAGE: Spring blossoms mark the start of the growing season
Ela Family Farm photos courtesy Steve Ela



A view of the North Fork Valley from Ela Family Farm

But relying on this system of water allocation isn't Ela's only approach. Nor is being as efficient as possible with his irrigation technology. Ela takes it yet a step further: into the soil.

HEALTHY SOIL GROWS HEALTHY FRUIT

Step into Ela's office and you will find binders full of farm records tracking the soil fertility of his orchard. Before becoming a full-time farmer, Ela received his Masters degree in soil science from the University of Minnesota. With the desire to someday return to his family's land, he knew that growing healthy soil would be essential to fostering a thriving business.

On his orchard, Ela curates what he calls a "soil smorgasbord," meaning he manages for overall soil health so the ecology of his orchard can provide the crops with what they need at a given time. A key part of this "smorgasbord" is a permanent cover crop mix, which holds water in the soil, provides nutrients, and produces a healthier fruit crop. The mix, which includes species such as alfalfa and white clover, provides the orchard with 50% of its nitrogen needs and the majority of its mineral needs. This greatly reduces the need to apply organic fertilizers and also reduces the associated cost. Ela mows the cover crop three to four times a year, which has built his soil organic matter (SOM) to 3-4%, an impressive percentage for a region where average SOM is 2% or less. These healthier soils wick up moisture and maintain cooler temperatures in the orchard throughout the hot summer months. The less water the trees expend under heat stress, the less water needs to be applied to keep them thriving. And the more water they can keep in the soil to grow larger, sweeter fruit.

DOLLARS AND "SENSE" OF CONSERVATION

Economics may best explain the value for these improvements. When the orchard was purchased in 1988, gross revenue was about $200,000. Now, 27 years later, the orchard's gross revenue is $1.1 million, a 450% increase using the same amount of water and acreage. By integrating modern irrigation technology, soil health practices and a tenacious marketing sense, Ela has watched his productivity climb and his operation withstand the tests of time. Water efficiency and conservation have proven smart business risks that turned into real returns. For Ela, managing his orchard for long-term ecological health and economic viability just makes sense.

SNAPSHOT

Years owned by the same family: 27

Irrigated acres: 80

Commercial land use: Organic apples, peaches, pears, plums, and cherries

Water management: Drip irrigation, microsprinklers, cover crops



PAONIA, CO

Harrison Topp

TOPP FRUIT

Beginning farmer brings an octogenarian orchard back to life

LEARNING TO FARM

In the fertile North Fork Valley outside of Paonia, Colorado, Harrison Topp prepares for his second season growing organic cherries and plums. The orchard, which Topp's parents purchased in 2007, has been in production for over eighty years. His family previously leased the orchard to a larger farm in the valley, but due to the age and condition of the trees, the operators decided to end the lease. In 2014, the responsibility of bringing the orchard back into working order fell to Topp.

At a spry 28 years old, Topp first began farming six years ago on small-scale vegetable operations, first as an apprentice and then as manager. It wasn't until last year that Topp took the leap from annual vegetable production to perennial fruit and became the primary operator of his new business, Topp Fruit. When asked what drew him to farming, Topp notes a desire for the lifestyle and a good dose of stubbornness. Now he is figuring out the day-to-day work of growing food in a region with just 15 inches of average annual precipitation.

WATER MANAGEMENT

As Topp experiments with the arts of pruning, cover cropping, harvesting, and caring for the daily needs of his orchard, he is also learning the intricacies of irrigation. Topp has a single source of irrigation water: surface water from the Fire Mountain Canal. The canal runs just upslope of the orchard and carries water to many producers throughout the valley. In Colorado, as in many western states, this is the original irrigation structure: Canals, also known as "ditches," supply users water that has often been captured and stored in reservoirs. Many ditches in Colorado are earthen—the same canals hand-carved through the landscape by homesteaders or, in some places, by native farmers millennia ago. The Fire Mountain canal is concrete lined, while others in the area have been piped to save water.

The way the Fire Mountain Canal is operated determines to a great extent the choices Topp can make with his irrigation practices. Some ditch systems deliver water to users throughout the season according to their rights and needs. The Fire Mountain Canal, however, runs on what is called a constant flow: when water flows through the canal, Topp and the other water users must use it before it flows downstream. However, neither Topp nor any individual producer alone can determine canal or ditch operations as the ditch is operated by the Fire Mountain Canal and Reservoir Company whose members include shareholders along the ditch. When water is released from Fire Mountain Canal, Topp receives the entire amount diverted at this point for four-and-a-half days straight on an ongoing cycle until the water is turned off. There



ABOVE: Topp takes a break for a photo shoot
TOP of PAGE: Gated pipe irrigates Topp's orchard
Topp Fruit photos by Kate Greenberg



Topp and fellow farmer Elizabeth Woods Darby mark irrigation furrows

is no benefit to him as a producer—and in fact some disincentives—to use less than his full allocation.

RESILIENCE IN HEALTHY SOIL

Topp uses furrow irrigation, or shallow channels that run alongside the trees. This type of flood irrigation is often considered less efficient than such technologies as sprinklers or drip irrigation. But for Topp, installing more efficient irrigation comes with a steep price tag, one he might be willing to consider if it did not also pose a risk to the health of his orchard.

Some years, particularly in drought years, the Fire Mountain Canal can be turned off as early as July. This is often due to scant snowpack producing below-average runoff. Summer rains can help but are not reliable. This means Topp risks losing late-season irrigation, which is critical to fruit ripening. Topp relies on furrow irrigation to store water in the soil. As water flows through the furrows, some of it is used by the trees, some returns to the river, and some is stored in the soil. Topp is essentially using his irrigation technology to do what the larger irrigation infrastructure prohibits him from doing: storing water on-farm for late-season irrigation. His management also supports multiple values, including building healthy soil, enhancing river flows, and growing delicious fruit. While water conservation and efficiency are critical to the future of the West, Topp offers an example of why their nuances must be sufficiently understood.

The limits on Topp's irrigation infrastructure have urged him to build the health of his soil. This year he is planting multiple mixes of cover crops—an amalgamation of crop types that bring nutrients and organic matter to the orchard. The healthier the soil, the more water it can store. And the more water Topp can store in his soil, the less he risks losing his crop in a drought year due to lack of surface water. (See the Appendix for an in-depth discussion on options for supplementing irrigation supplies).

YOUNG FARMERS OF THE FUTURE

Conservation means many things to farmers and ranchers. Soil conservation is critical to Topp's ability to conserve water, while his operation is also driven by the constraints of his irrigation infrastructure, the cost of efficiency improvements, and the particular operations of his ditch. Yet Topp is perpetually questioning how to do things better. He looks to his neighbors who, as one-time beginning farmers, have navigated decades of their own challenges. Topp says there have been few things more valuable than the mentorship of fellow farmers.

When asked where he sees himself in forty years, Topp replies, "I'd like to say I'm still farming [....] If I do continue, I'd like to expand to a scale that gives me more flexibility so I can grow fruit for a greater portion of the population." It will take a reliable water supply for Topp to realize that future. There is no easy answer. But one thing is clear: We need more young farmers like Topp on the land, learning from their predecessors, forging innovative routes to conservation, and adapting to the variables of a changing climate.

SNAPSHOT

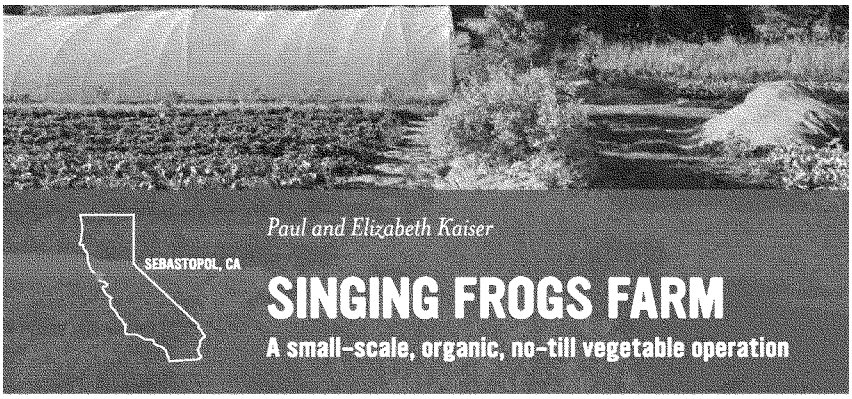
Years owned by the same family: 8

Years operated by Topp: 2

Irrigated acres: 4.4

Commercial land use: Organic cherries and plums

Water management: Cover cropping, soil moisture management, furrow irrigation



Paul and Elizabeth Kaiser

SINGING FROGS FARM

A small-scale, organic, no-till vegetable operation

GROWTH IN DROUGHT

Take a tour of Singing Frogs Farm and you will see crop rows packed with purple kale, butterhead lettuce, and heirloom tomatoes—over one hundred vegetable varieties in total. In this cool, low valley just outside of Sebastopol, California, farmers Paul and Elizabeth Kaiser are surprising their neighbors. In the midst of California's driest year on record, the Kaisers are increasing revenue on their two-and-a-half acres of cultivated bottomland while drastically reducing water consumption, an unlikely combination when the drought is driving farms elsewhere out of business.

Even in a historically unprecedented dry year, and in a region with an average of 30 inches of annual precipitation, the Kaisers are not daunted by the drought. Instead, they take it as a challenge to build drought resilience on their farm, where the precious groundwater they use to irrigate is just as tenuous as surface flows elsewhere. Whether through no-till, composting, or an intensive greenhouse schedule, the Kaiser's resilience always comes back to the health of their soil.

THE PATH TO NO-TILL

Like many young farmers today, the Kaisers did not grow up on a farm. In 2004, ready to raise a family and try out the ideas they experimented with while working on land restoration in The Gambia, West Africa, they purchased eight acres in Sonoma County. This land was not exceptional. The light, tan soil had only 2.4% soil organic matter (SOM) when the Kaisers bought the property, relatively low for the area. Only a couple of the acres were arable. Cold air funnels in from the surrounding vineyards, driving temperatures below freezing in the winter and bringing frost dates as early as September and as late as May.

The Kaisers started out tilling the soil, as is still the norm on most operations big and small. Soon they realized tillage, the process of breaking up the soil for cultivation, was disturbing critical life processes taking place underground. Now with no-till, Paul and Elizabeth are building their soil structure. This means they are able to capture more water—not to mention beneficial carbon and nitrogen—and store it in the soil where it supports the soil biome and the next crop.

The Kaisers also use an intensive greenhouse schedule to rotate crop successions and keep the soil covered at all times. The beds are not bare for more than a few



ABOVE: Farm employee Marty harvests a head of lettuce
TOP of PAGE: Singing Frogs Farm produces over 100 varieties of vegetables
Singing Frogs Farm photos courtesy Paul Kaiser



Most of the Singing Frogs Farm Crew: L to R (back row) Miguel, Elizabeth, Paul, John, Marty & Kim. L to R (front row) Anna, Lucas, Nina and Bryanna

hours at a time, which greatly reduces water loss to evaporation. Paul and Elizabeth are able to achieve this with transplants grown in their greenhouse and ready to plant-out immediately following harvest. They also apply a massive amount of compost, which they top-dress to the beds rather than tilling in. They plant directly into the compost, which retains moisture, builds organic matter, and delivers nutrients to the crop.

MORE ORGANIC MATTER, LESS IRRIGATION

Now, after eight years of no-till production, composting, and keeping the ground covered, the Kaisers have measured their soil organic matter at a twelve-inch depth at 6.5% and at a six-inch depth an astounding 9.5%. That's an increase of over four-fold from when the couple turned over their first row on this land. With every percent increase in SOM, the soil can hold upwards of twenty thousand gallons of water per acre, with some sources citing that number up to twenty seven thousand gallons[5]. So when the rains come, as they have been and are predicted to continue in more intense events, Kaiser's soil not only captures and retains that moisture, but also evades damaging erosion. After a recent eleven-inch downpour, the Kaiser's fields remained intact.

The Kaisers's soil water savings is showing up as savings in their irrigation, too. The Kaisers use precision drip irrigation across the farm. Two slender tubes run the length of each thirty-inch wide bed, dripping water precisely where it's needed. This system irrigates at around 90% efficiency, meaning that 90% of the water diverted to the farm is used by the crop, rather than lost to evaporation, runoff, or deep percolation, an extremely high level of efficiency for any farm.

The Kaiser's attribute the efficiency of their farm to a combination of healthy soil, efficient irrigation technology, and refined management practices. Paul explains, "When we started farming here [...] I was typically running the irrigation system two to three hours every-other day. And that was pretty standard. Now I am down to 45 minutes to an hour every five to seven days." The Kaisers grow the same crops now as they did then.

Not only are the Kaisers saving water, they're making more money doing it. Their high-intensity production pumps out over seven times the average volume of similar farms in California, pulling in around $100,000 an acre in sales and supporting four full-time staff.

A COMMITMENT TO INNOVATION

The improvements at Singing Frogs Farm didn't happen overnight. The Kaisers have put in seasons of trial and error integrating biology, ecology, and human stewardship to realize a profitable, productive, and conservation-oriented operation. They have invested in efficient irrigation and continue to refine their water management. Rather than finding productivity and drought resilience at the expense of healthy soil and an intact ecosystem, the farm is thriving precisely because they foster both.

SNAPSHOT

Years owned by the same family: 11

Acres owned/managed: 8

Irrigated acres: 2.5

Commercial land use: Diversified vegetable operation

Water management: No-till, composting, constant soil cover, drip irrigation

5 http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1082147.pdf

6 https://workpca.ucsd.edu/news/9156

GLOSSARY

WATER MANAGEMENT

Acre-foot: Amount of water that will cover an acre of land at a depth of one foot, or 325,851 gallons of water[1]
Center pivot: A type of automated sprinkler irrigation that rotates around a fixed point
Ditch: A channel constructed to deliver water for irrigation (see also "canal")[2]
Efficiency: Quantity of water consumed by crops versus the amount of water delivered[3]
Flood irrigation: Water diverted from ditches and spread across the field or pasture[4]
Furrow irrigation: A type of flood irrigation that applies water into shallow, evenly spaced channels that convey water through a field to the crops[5]
Irrigation canal: A channel constructed to deliver water for irrigation (see also "ditch")[6]
Micro sprinklers: Small sprinklers that deliver water just above the soil surface[7]
Reservoir: An artificial lake built to store water
Side roll: A type of automated sprinkler irrigation that moves in a line across a field
Sprinkler irrigation: A form of irrigation typically higher in efficiency than flood; includes such technology as side rolls and center pivots[8]
Surface drip irrigation: Pipes or hoses that deliver water directly to the soil surface through small emitters[9]
Subsurface drip irrigation: Pipes or hoses that deliver water below the soil surface through small emitters[10]

SOIL HEALTH

Conservation tillage: Any tillage system in which at least 30% of the previous crops' residue is left in the field to protect the soil
Cover crops: Non-cash crops that can provide multiple benefits including erosion prevention, nutrient availability, weed suppression, and water availability[11]
Holistic management: A whole farm planning system that helps farmers, ranchers and other land stewards better manage resources for environmental, economic, and social benefits[12]
No-till: Process of crop production that does not disturb the soil through tillage
Rotational grazing: Rotating livestock frequently throughout many small pastures to allow for pastures to regenerate[13]
Soil food web: Diverse soil community that includes bacteria, fungi, protozoa, nematodes, worms, insects, and more that work in tandem to create healthy soil
Soil health: The continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals and humans[14]
Soil organic matter (SOM): The part of the soil that contains anything that once lived. It aids in crop growth, reduces erosion, retains nutrients, stores water, and sequesters carbon, among other benefits[15]
SOM: Short for "soil organic matter"
Tillage: Preparation of the soil for cultivation

WATER LAW

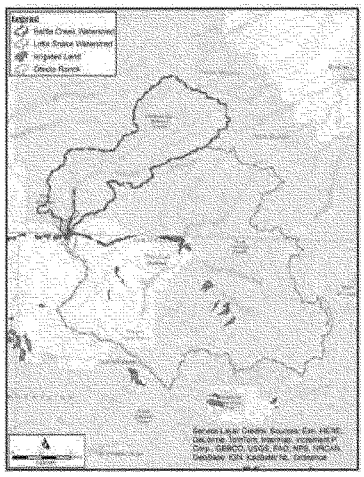
Beneficial use: The lawful use of water for a beneficial purpose which includes agricultural, industrial, and household use and may include environmental use
Call: In times of shortage senior water rights holders may "call" for water, thus curtailing deliveries to undecreed or junior water users in order to fulfill the beneficial use need of the decreed senior use right[16]
Consumptive use: Water use that permanently withdraws water from its source; water that is no longer available because it has evaporated, been transpired by plants, incorporated into products or crops, consumed by people or livestock, or otherwise removed from the immediate water environment[17]
Diversion: Removing water from its natural course or location, or controlling water in its natural course or location, by means of a water structure such as a ditch, pipeline, pump, reservoir, or well[18]
Return flow: Water that returns to streams, rivers or aquifers after it has been applied to a beneficial use[19]
Water right: Considered a property right; the right to use a portion of the public's surface or groundwater resource under applicable legal procedures[20]

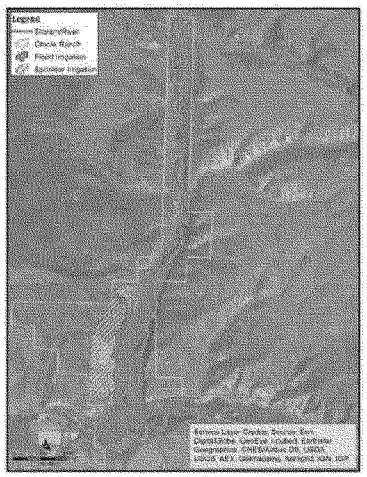
Definitions #1, 3, 4, 7-10, 16-20 courtesy of Colorado Foundation for Water Education (CFWE) from their publications *Citizen's Guide to Colorado Water Conservation* and *Citizen's Guide to Colorado Water Law*. Visit yourwatercolorado.org
Definitions #5, 11, 13-15 courtesy of the Natural Resources Conservation Service (NRCS), visit nrcs.usda.gov; #2 and #6 courtesy of the Bureau of Reclamation (BOR), visit usbr.gov; #12 courtesy of Holistic Management International, visit holisticmanagement.org

APPENDIX I: LADDER RANCH WATER BALANCE

Background

Ladder Ranch is located at the confluence of Battle Creek and the Little Snake River and straddles the Colorado-Wyoming border. The ranch draws water from Battle Creek and the Little Snake at multiple points for the irrigation of over 600 acres of hay pasture. Approximately 400 acres of flood irrigated pastures lie within a quarter mile of the two streams. Pressurized side roll sprinklers are used to irrigate approximately 175 acres on higher ground on the west side of Battle Creek.



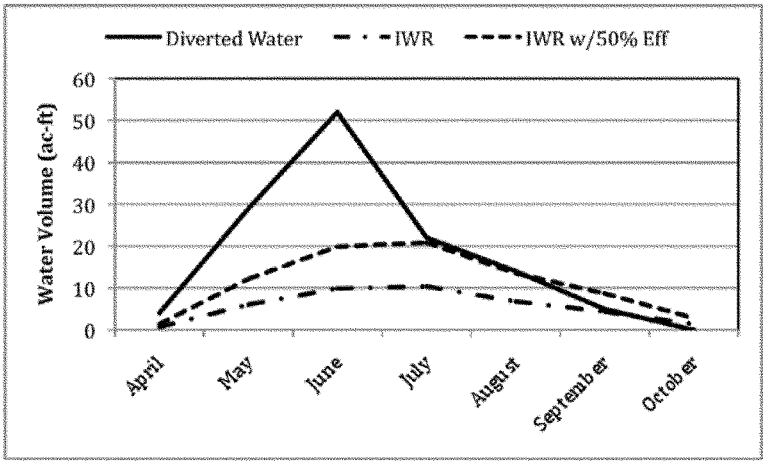


Water Rights

There is no irrigation and very little water use located above the ranch on Battle Creek, while there are approximately 2,200 acres of irrigated land above the ranch on the Little Snake. There is very little reservoir storage in the basin, which results in high peak flows that quickly taper off once the snowmelt is over. The ranch holds very senior water rights in Wyoming and Colorado, and these rights have never been called out or subject to administration during historical calls on the Little Snake in 2002 and 2004. Pat O'Toole stated that the ranch does reduce their irrigation diversions during low flow periods in order to leave sufficient water in both streams to maintain the fisheries there.

According to a recent study by CDM entitled "Agricultural Water Needs Study," hay pasture in this area requires approximately 2.28 acre-feet of supplemental irrigation water per acre to adequately meet the annual crop water demand. This means that crops on the ranch consume approximately 1,350 acre-feet of water annually (one acre-foot can cover a football field with one foot of water). Supplying a maximum crop demand of approximately 0.30 inches per day would require a total peak diversion flowrate of 15 cubic feet per second (cfs) assuming a system efficiency of 50 percent. Some diversion records are available from the Colorado Water Conservation Board for water rights filed with the state. One water right with fairly complete records is the Porter Salisbury Pump 1 & 2. The diversion records are compared to the irrigation water requirement (IWR) for this right in the figure on the next page.

LADDER RANCH WATER BALANCE, CONTINUED



This figure confirms comments by Pat O'Toole that when excess water is available, it is diverted, but once runoff tapers off, diversions are reduced to better match needs.

Irrigation Practices

The potential conversion of additional lands to sprinkler irrigation has helped many farmers and ranchers better manage their limited water supply. The impacts, however, of making such a change has both pros and cons that must be evaluated on a case by case basis. As mentioned previously, most of the irrigated lands on this ranch are located close to the creek. When excess water is applied in the spring, some of it would quickly return to the stream via surface return flows and be available by the next diverter downstream. In many cases, on this ranch the water is diverted from the stream and return flows accrue to the stream all within the ranch property, which implies that the only potential beneficiary of reduced diversions would be the stream in between. Some water would also penetrate below the root zone of the crops and travel through the soil back to the creek. This practice would tend to build up the amount of water stored in the soil and delay its release back to the stream system, thereby acting as an uncontrolled reservoir.

Future Water Conservation Measures

The "Agricultural Water Needs Study" mentioned earlier estimated that 72 percent of return flows in this area return to the stream within the same month that they are diverted, while most of the remainder returns over the following 4 months. This implies that most of the excess water diverted in May and June would return during those months; however, stream flows would continue to benefit from this return water through October. Based on our analysis of available data it appears that the current practices on the ranch are reasonable. While converting more areas to sprinklers would reduce the amount of flow diverted during the runoff season, it could negatively impact stream flows during the late summer and fall periods. Additional data would need to be collected to better predict the potential impacts of any large scale irrigation changes on the ranch.

Water balance researched and written by Applegate Group

APPENDIX II: ELA FAMILY FARM WATER BALANCE

Background

The Ela Family Farm is located on the upper portion of Rogers Mesa at an elevation of 5,850 feet near Hotchkiss, Colorado. The farm primarily grows a variety of fruits including apples, pears, cherries, peaches, and plums. The growing season extends from a blooming of the trees in mid-April to mid-May and concludes with harvest primarily in late August and September. The climate in this area is semi-arid with rainfall only contributing a small percentage of the annual crop water requirements. Crop production is heavily reliant on irrigation water. The soils consist of up to 20-24 inches of stony clay loam with an organic content of 3-4 percent.

Water Rights

The farm owns a wide variety of water rights that are used on the property, all of which are delivered through a combined ditch system off of Leroux Creek. Direct flow decrees include shares in the Allen Mesa, Highline, and Ellington Ditches, which have been physically combined into one ditch system. Their most senior decree includes 0.5 cubic feet per second out of Leroux Creek, which is typically in priority until August. After all the direct flow decrees are out of priority, the farm utilizes 250 shares it owns in the Leroux Creek Water Users Association, which operates numerous small reservoirs in the Leroux Creek Drainage.

The amount of water available from these shares varies depending on the snowpack. On average years, these shares will net about 190 acre-feet of water, but the volume can range from 100 acre-feet in dry years up to 225 acre-feet in wet years (one acre-foot can cover a football field in one foot of water). In order to have a firm water supply during dry years, Ela leases an adjoining parcel of land to the south and fallows the majority of that land in order to focus the water supply on the orchards. Ela also owns 200 shares in the Fire Mountain Canal, which equates to approximately 0.13 cubic feet per second (cfs). However, that water is leased to other users and is not used on Ela's property.

Irrigation Practices

Information regarding the property and associated irrigation practices were obtained from a meeting with Steve Ela on January 8, 2015. The property was originally purchased by the Ela family in 1987. At that time the entire orchard was irrigated with flood irrigation in furrows between the rows of trees. The family immediately started installing the backbone of infrastructure that would be required to convert over to micro-sprinklers in 1989. This included an NRCS Yak screen, main pipeline, and filtration system. Water would pass through the yak screen at the pipeline entrance and pressurize using the gravity fall from that point to the filter location. Pressures in the northeast corner of the property were not sufficient, so a 2 horsepower pump was added to increase the pressure there. Overflow from the Yak screen is conveyed to the alfalfa pastures for irrigation there. No flow measurement device is in place to determine the amount of overflow water, but according to Ela, during dry years there is very little overflow once spring runoff is over.

The first micro sprinklers were installed in 1990 and all orchards on the property were converted by 2000. Around 2002, the Ela family started to install buried drip lines in some orchards. After experimenting with multiple arrangements they determined that three drip lines per tree row is most effective. The drip lines contain pressure compensating drippers spaced 2 feet apart with flowrates of 0.25 gallons per hour. Once buried, the drip lines have assisted with controlling the ground cover near the tree trunks since that area is drier than between the rows where the cover crop can be managed easier. The drip system currently covers approximately 30 acres of the farm in 1-acre zones with the rest remaining on micro sprinklers. One distinct advantage to the drip system is that it is set up so that the user can adjust the application rate by simply entering the percentage of a full irrigation that is required. This makes seasonal adjustments much simpler than the micro sprinklers.

Installing the drip system necessitated increased water filtration in order to avoid plugging the drippers. After experimenting with numerous filtration options, the farm determined that sand media filters were the most effective. There are currently six of these filters in the system, and they are automatically backwashed as necessary. The frequency of backwash cycles depends greatly on the time of year.

Irrigation Demand vs. Supply

Aerial photography obtained from the National Aerial Imagery Program (NAIP) was used to determine the number of irrigated acres. The farm has 83.3 acres of orchards on the sprinkler and drip system and 6.4 acres of alfalfa/hay that are currently irrigated. Another 5.4 acres of potential orchard exists between older remaining rows of some crops. Evapotranspiration (ET) data was obtained from Colorado Agricultural Meteorological Network (CoAgMet) from their nearby station on Rogers Mesa. The

ELA FAMILY FARM WATER BALANCE, CONTINUED

station is located about 1 mile to the south and about 200 feet lower in elevation. The ET data is for a reference crop of alfalfa, which can be converted to other crops such as orchards by applying a crop coefficient to the data.

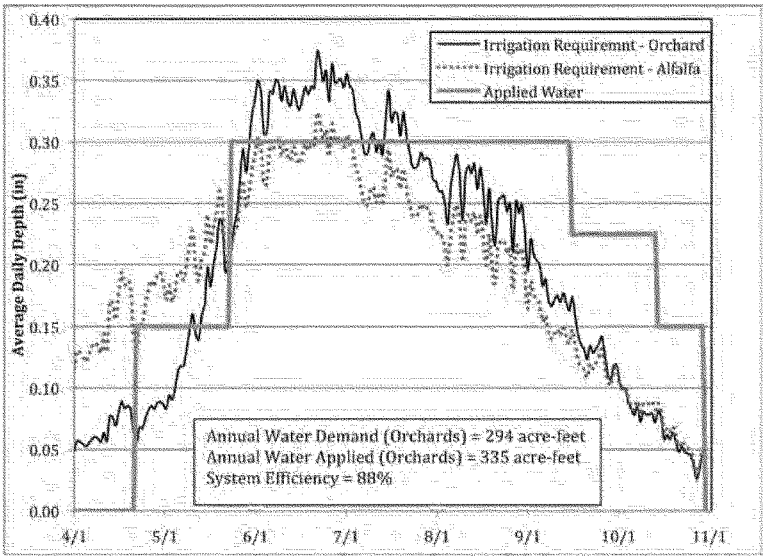
The Food and Agricultural Organization (FAO) published crop coefficients for a wide range of crops including orchards. These values were used to estimate the ET demand for the crops. Average precipitation data was also obtained from CoAgMet and to the ET demand at an 80% efficiency rate in order to calculate the Irrigation Requirement (IR) for the orchards. The amount of irrigation water supplied to the orchards was calculated by applying the dripper/micro sprinkler spacing and flowrate to the average irrigation schedule described by Ela. The figure below depicts a comparison between the irrigation supply and demand for an average year.

This analysis shows that the orchard irrigation system is achieving an efficiency of approximately 88%, which is very close to accepted values of 90% for drip systems and 80-90% for micro sprinklers.

Future Water Conservation Measures

There does not appear to be a significant amount of additional water that could be saved by increasing water conservation practices on the orchard portion of the farm. Converting more land to drip would allow the system to be managed so that the supply can even more closely follow the demand, but this will not likely result in a significant amount of conserved water. Rather it would allow the user to easily adjust the system to better match daily demand and maintain more consistent soil moisture. Backwash water could be used if a larger settling pond was provided to store backwash sediment and water, but another pump would be required to inject this water back into the system. This would also increase the complexity of operations while not resulting in a significant amount of water savings. Ela's willingness to experiment with various technologies and his efforts to continuously improve the system have resulted in a very efficient system overall.

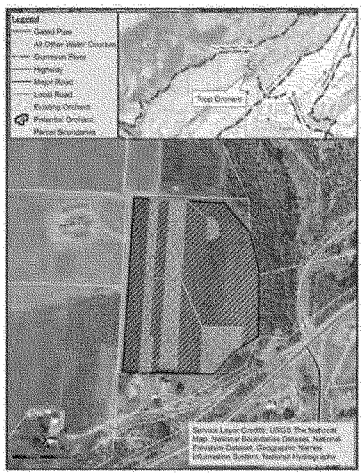
Water balance researched and written by Applegate Group



APPENDIX III: TOPP FRUIT WATER BALANCE

Background

The orchard owned by Harrison Topp is located on the upper portion of Rogers Mesa at an elevation of 5,850 feet near Paonia Colorado. The orchard has not been intensively managed in the past and only 14 acres of the site remains planted. The growing season extends from a blooming of the trees in mid-April to mid-May and concludes with harvest, primarily in late August and September. The climate in this area is semi-arid with rainfall only contributing a small percentage of the annual crop water requirements. Thus crop production is heavily reliant on irrigation water. The soils consist of up to 20-24 inches of stony clay loam.



Water Rights

The orchard owns 480 shares of water in the Fire Mountain canal, which is the only irrigation water supply on the property. These shares equate to 0.33 cubic feet per second (cfs) of water according to the Fire Mountain Ditch Company. Water is diverted from the Fire Mountain Canal in conjunction with the neighbors' shares on the north side of the property. The entire amount diverted at this point is routed to the Topp Orchard 4.5 days per week, while the northern neighbor takes the water the remaining 2.5 days a week.

The Fire Mountain Canal has a relatively junior water right on the North Fork of the Gunnison River, and it is called out every summer. When direct flows are not available, water is released from Paonia Reservoir in order to achieve a full decreed flow of approximately 175 cubic feet per second (cfs). The canal typically turns on around mid to late April and runs at a full canal flow until the reservoir is drained. After the reservoir is drained the canal typically has to shut down for the season. The average shutdown date is September 24th; however it varies greatly from late July to late October. The figure on the next page shows the frequency of start and stop dates for the canal.

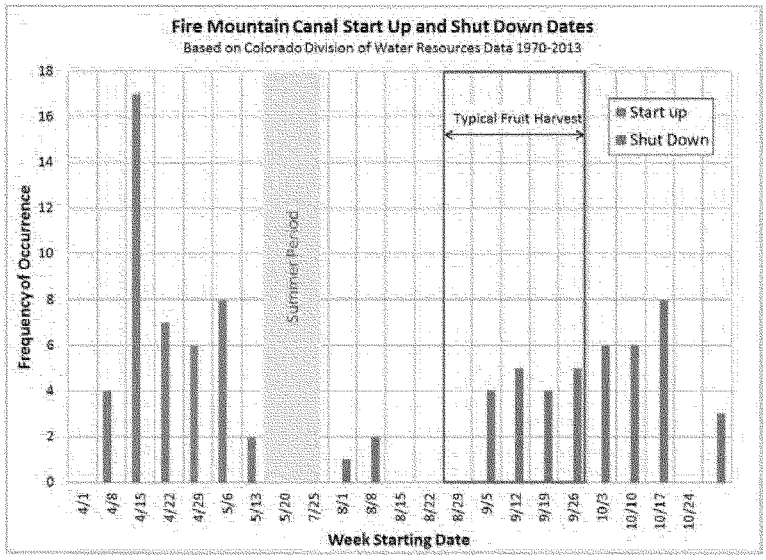
Irrigation Practices

Information regarding the property and associated irrigation practices were obtained from a meeting with Harrison Topp on January 8, 2015. The property was originally irrigated with flood irrigation in furrows between the rows of trees. The farm has 14.4 acres of potential orchard; however, many of the trees were recently removed and there is currently only 4.4 acres of orchard under irrigation. Gated pipe has been installed along the top and middle of the remaining orchard blocks as shown in the attached map. The remaining land is irrigated on a very limited basis.

Irrigation Demand vs Supply

Aerial photography obtained from the National Aerial Imagery Program (NAIP) was used to determine the number of irrigated acres. Evapotranspiration (ET) data was obtained from Colorado Agricultural Meteorological Network (CoAgMet) for their nearby station on Rogers Mesa. The station is located about 12 miles to the southwest and about 200 feet lower than the orchard. The ET data is for a reference crop of alfalfa, which can be converted to other crops such as orchards by applying a crop coefficient to the data. The Food and Agricultural Organization (FAO) published crop coefficients for a wide range of crops including orchards and these values were used to estimate the ET demand for the crops. Average precipitation data was also obtained from CoAgMet and to the ET demand at an 80% efficiency rate in order to calculate the Irrigation Requirement (IR) for the orchards. The amount of irrigation water available for the orchards was assumed to be constant since flows in the Fire Mountain Canal are typically constant when the canal is in operation. The figure on the next page depicts a comparison between the average demand, the average supply, and the supply in 1977.

TOPP FRUIT WATER BALANCE, CONTINUED



This analysis shows that on an average year the orchard irrigation system has surplus water when water is available. The largest potential hindrance to a productive orchard at this location is the uncertainty of late season water, which is critical as the fruit is ripening. Data from the Colorado Division of Water Resources shows that the canal is typically turned on in mid to late April but turns off as early as late July in extreme drought years. The driest year on record was 1977. During that season, approximately 47.7 acre-feet of water was available, which is nearly enough to meet the annual demand of the orchard. The timing of the water, however, would not have been sufficient to produce a crop and may have even resulted in tree mortality.

Harrison Topp indicated that he estimates he applied 18 acre-feet to the remaining orchards in 2014. Based on the irrigation requirement estimated from CoAgMet, the 4.4 acres would have required 15.5 acre-feet. This results in an estimated efficiency of 86 percent. This would be very high for gated pipe, which is typically around 60-70 percent efficient.

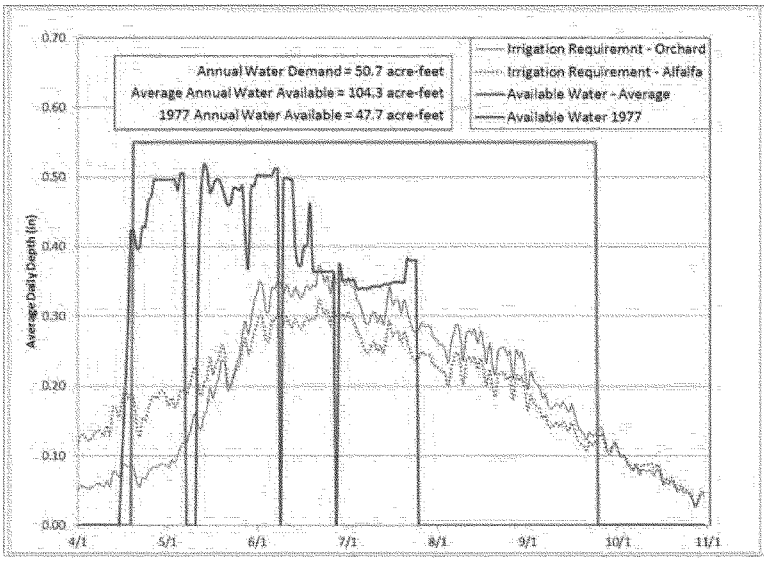
Future Water Conservation Measures

In order for this property to reach its full potential as an orchard, late season water would be required. In extreme drought years it would take approximately 18 acre-feet of storage to bank extra water in the spring for use in the fall. Constructing a reservoir of this size on the property would significantly reduce the amount of orchard acreage. Another option would be to seek out a supplemental water supply.

If a new supply was obtained through a well such diversions would require augmentation water to offset stream depletions when it was used. It is our understanding that augmentation water is difficult to find in the North Fork of the Gunnison due to the lack of storage available. A final option to address this shortage would involve operating the Fire Mountain canal at lower flowrates in late summer and fall when the canal is relying on storage water. This would require a major organizational change for the Ditch Company but the benefits to the users could be substantial.

Under the current method of canal operation, converting to micro sprinklers or a drip system would not help solve

TOPP FRUIT WATER BALANCE, CONTINUED



the potential water shortage late in the season and it could, in fact, negatively impact the orchard. Under flood irrigation, while the canal is on the entire soil profile could be irrigated to the field capacity. Then when the canal is shut down, there will be a sufficient amount of water stored in the soil column for use by the trees. If micro sprinkler or drip irrigation was installed it could limit the amount of soil moisture that could be built up and stored in the soil for later use. These systems would conserve water while the canal is on, but without the benefit of a local storage vessel the water supply for the property would remain unchanged.

If the orchard was completely replanted and irrigated with all 480 shares of water, on an average year about 53.6 acre-feet of water would return to the stream system through seepage or surface runoff. Some of this water might be intercepted by the North Fork Farmers Ditch and incorporated into their system for use by downstream users. The remaining water would enter the North Fork of the Gunnison upstream of a couple of very senior ditch diversions. This water would help fulfill their water decrees and be diverted into their system.

Another option would involve buying additional land that does not have a sufficient water supply and using some of the excess shares from this property to bolster irrigation there. Assuming the Fire Mountain Canal continues to operate the canal at a constant flow, we estimate that the 480 shares would be sufficient to irrigate approximately 6 additional acres. This estimate also assumes that drip or micro sprinkler irrigation systems were installed and managed to achieve 90% efficiency, similar to other local orchards. This option would actually increase the consumption of water since only 10% of diverted flows would then be returning to the stream system.

In summary, the best alternative for this property would involve changing the diversion patterns of the Fire Mountain Canal. However, that is beyond the control of a single shareholder. The lack of late season water likely explains why there are not as many orchards on in the North Fork Valley that rely strictly on Fire Mountain Canal water.

Water balance researched and written by Applegate Group



youngfarmers.org



familyfarmalliance.org

The CHAIRMAN. Thank you, Mr. Michael. I appreciate the personal touch that you have clearly given to the issue here this morning.

Finally let's go to Ms. Betsy Cody, welcome to the Committee.

STATEMENT OF BETSY CODY, NATURAL RESOURCES POLICY SPECIALIST, CONGRESSIONAL RESEARCH SERVICE

Ms. CODY. Thank you.

Chairman Murkowski, members of the Committee, thank you for the opportunity for CRS to testify today on Western drought conditions and challenges facing Western water managers.

While my testimony includes a discussion of potential options to address drought challenges, CRS does not take positions on legislative proposals or make recommendations to the Congress.

As you've heard from others today here, while more than 20 percent of the United States is experiencing moderate to the exceptional drought. Much of the drought is concentrated in the West.

Although there have been slight improvements in some areas, higher than average temperatures and lower than average precipitation have resulted in low record snow pack and early runoff in other areas. The short-term seasonal outlook is for these trends to continue in the far Western states, especially.

Long-term predictions, those more than three months, are more difficult to make, especially on a regional basis.

Chief among the challenges for Western states is managing scarce water supplies and ensuring public health and safety and industry and other effects, as you've heard from many of our panelists. States and local water entities typically lead efforts to prepare for a drought, and I think you've heard some very excellent examples of that today, due to their primary rule and water allocation.

Even without drought, though, 80 percent of state water managers surveyed by the GAO expect water shortages within the next decade. Key concerns range from population growth and lack of information on water availability and use to potential impacts of climate change and effects of extreme weather events such as floods and droughts.

The Bureau of Reclamation, as we've heard from Mr. Connor, faces similar challenges, especially for its large, multiple purpose projects that involve balancing multiple objectives across large areas. Challenges in the Colorado River Basin and for the Central Valley of California and to some degree the Columbia River Basin are prime examples. In these areas challenges include how to accommodate existing and new demands including growing populations and competing uses while also complying with Federal and state environmental and other laws.

As you have heard again from Chairman Murkowski and Mr. Connor, Reclamation has estimated that supply shortages for the Colorado could be in effect as early as 2016 and 2017.

Meanwhile Central Valley project water deliveries, we've also heard, have been significantly cut back affecting junior and senior water users, fish and wildlife resources, recreation and other industries.

Smaller Reclamation projects are also challenged by drought and are experiencing water delivery cutbacks. Again we've heard more

of that today. The Yakima Basin is an example and projects in New Mexico.

Although there are a wide range of options for addressing drought, the Federal rule in implementing options is not always clear cut. Options often discussed can be categorized as follows: they're supply-driven options, they can be demand-driven, those that involve new governance or institutional structures, and those that fund research, planning and monitoring activities that supports state and local efforts.

All of these options have their pros and cons and involve tradeoffs. For example, developing or augmenting supplies through construction of surface and groundwater storage projects may provide more water but opportunities for supply and conveyance systems are fewer than they once were and their costs are often significant. Likewise, developing water reuse and desalinization projects can also be costly. Project evaluations have also become more complex and lengthy.

Hence, some observers suggest streamlining or removing Federal regulations to facilitate project development and operations while others are more protective of the status quo. To address authorization and funding issues, some have called for an authorization process for Reclamation similar to that enacted for the Corps of Engineers in the Water Resources Reform and Development Act of 2014. They also call for public/private partnerships, authorization of non-Federal funding of some projects or coordinated funding and creation or reactivation of Federal loan programs.

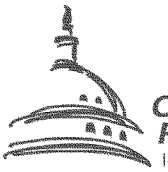
Some have also proposed new governance or institutional structures such as drought commissions, drought councils or water transfer mechanisms such as water banks or water markets. A difficulty in expanding water markets is this relationship between state water rights and the Federal Government's rule and having deferred primarily to states' primacy in water allocation.

Last, some commonly pursued options to support drought resilience and response at the local level include providing technical and financial assistance for drought planning, monitoring and mitigation, providing incentives for improved water efficiency or conservation and supporting technological research and development.

In summary, addressing drought in the West is a challenge for decisionmakers, as we've seen today, at all levels of government whether the Federal Government should continue or expand its existing policies supporting these efforts or pursue other legislative options is likely to be a matter of ongoing debate.

That concludes my testimony. I'm happy to answer questions. Thank you.

[The prepared statement of Ms. Cody follows:]



Testimony of Betsy A. Cody,[1]
Specialist in Natural Resources Policy
Congressional Research Service

Before the Senate Committee on Energy and Natural Resources

June 2, 2015

Madame Chairman, Members of the Committee, thank you for the opportunity for the Congressional Research Service to provide testimony on western drought conditions and challenges facing water managers throughout the West. Ongoing western drought conditions present challenges to federal water managers – particularly the U.S. Department of the Interior's Bureau of Reclamation (Reclamation) – as well as to states, Indian tribes, localities, public and private utilities, and the private sector.

Following is a summary of West-wide drought conditions, a brief description of challenges water managers face in meeting the demands of the West's economy, population, and ecosystems, and a discussion of potential options for addressing some of these challenges. This testimony will focus on federal issues and options related to water management during drought. CRS does not take positions on legislative proposals or make recommendations to the Congress on legislative options or other action.

[1] Many CRS analysts contributed to this testimony, including Charles V. Stern, Pervaze A. Sheikh, Peter Folger, and Nicole T. Carter.

West-wide Drought Conditions

Drought conditions vary greatly throughout the 17 Western states[2] – territory containing hundreds of Bureau of Reclamation (Reclamation) projects and millions of acres of federal land.[3] Drought conditions can persist for years or change rapidly with one large storm or high heat period.[4]

Current conditions:

As of May 26, 2015, roughly 51% of the contiguous 48-state land area of the United States of the country exhibited conditions ranging from abnormally dry to exceptional drought, and 26% of the area was experiencing levels of drought ranging from moderate to exceptional (see **Figure 1**).[5] However, much of the drought intensity is concentrated in the West. For example, nearly 75% percent of the land area in the 11 westernmost continental states is facing abnormally dry to exceptional drought conditions, and 57% of the area is facing moderate to exceptional drought.

Although the extent of drought has eased slightly from previous weeks, the number of people affected by drought has continued to grow. The U.S. Drought Monitor estimates that nearly 93 million people in the U.S. (nearly 30% of the population) are in areas affected by drought conditions; two weeks ago approximately 69 million (21%) were estimated to be in affected locations.[6]

[2] Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming.

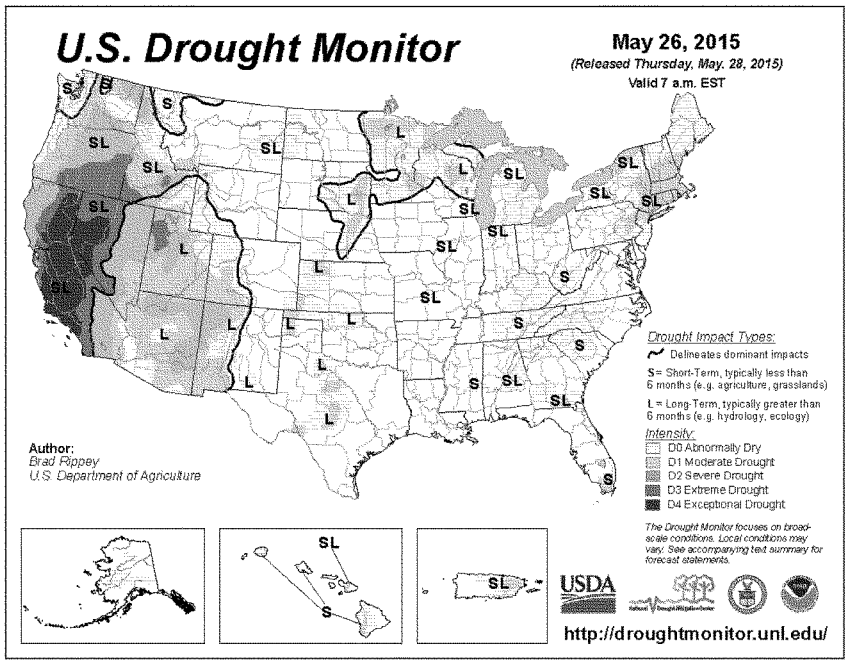
[3] Federal lands, especially in California and Nevada, have suffered multiple drought impacts including low water levels, growth in invasive species infestations, wildlife habitat damage, tree deaths, and a heightened risk of wildfire, among other effects. Tourist attractions such as Yosemite waterfalls and recreational boating at Lake Mead (NV) have also been affected, and water supply problems have temporarily closed some park facilities in recent years.

[4] U.S. Dept. of the Interior, Bureau of Reclamation, *Report on Western Water Conditions*, provided by e-mail to CRS on May 25, 2015.

[5] Approximately 46% of the land area including all 50 U.S. states and Puerto Rico were experiencing abnormally dry or worse conditions for the week of May 25, 2015, and 22.1% of all 50 U.S. states and Puerto Rico were experiencing moderate drought or worse.

[6] U.S. Drought Monitor and National Oceanic and Atmospheric Administration weekly congressional drought update, May 28, 2015 and May 21, 2015.

Figure 1. Drought in the United States

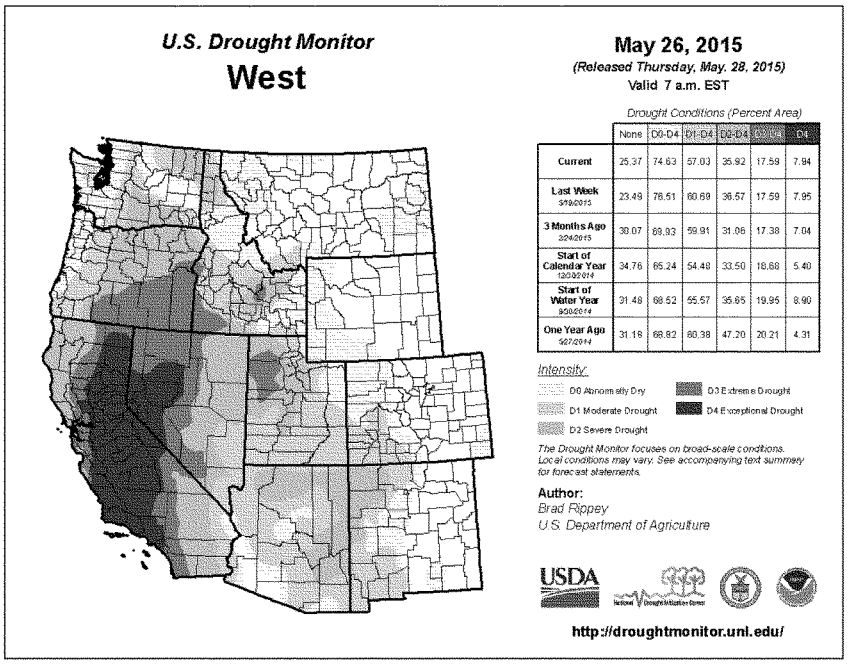


Source: The National Drought Mitigation Center, Univ. of Nebraska-Lincoln in partnership with the U.S. Dept. of Agriculture and the National Oceanic and Atmospheric Administration, Dept. of Commerce.

The most intense drought conditions are concentrated in California and western Nevada. Almost 47% of the land area in California is experiencing "exceptional" drought – the most intense category of drought described by the U.S. Drought Monitor (see **Figure 2**) – and nearly all of Nevada is experiencing at least moderate drought conditions, with 18% experiencing exceptional drought. Extreme drought conditions — the second-most intense category of drought — have extended to southern, central, and eastern Oregon, with pockets in Utah and Idaho as well. Moderate to severe drought conditions are affecting much of the remaining areas of the aforementioned states, as well as Arizona and Washington. The western edge of New Mexico is also experiencing moderate to severe drought, and the western edges of Colorado, Montana, and Wyoming are experiencing abnormally dry conditions with areas of moderate drought in

southwestern Colorado and southwestern Montana. By most metrics, however, California presently is the hardest hit by drought. Roughly 94% of the state is currently experiencing severe to exceptional drought conditions.

Figure 2. Drought in 11 Western States, May 26, 2015



Source: The National Drought Mitigation Center, Univ. of Nebraska-Lincoln in partnership with the U.S. Dept. of Agriculture and the National Oceanic and Atmospheric Administration, Dept. of Commerce.

While recent precipitation helped topsoil moisture conditions and reduced water demands in some areas, the relief provided by these storms to areas with entrenched long-term hydrologic drought, such as much

of California, is considered to be of negligible benefit.[7] In other areas, however, including parts of Colorado and Wyoming, some storms put a "meaningful dent" in drought conditions.[8]

Other recent observations put the nature of current western drought conditions in perspective. For example, the important overall set of conditions that has the longest-term impact is the combination of higher than average temperatures and lower than average precipitation. These two factors have contributed to record-low snowpack in some areas and early snowpack melting and runoff. For 7 western states (Arizona, California, Nevada, Oregon, Utah, Washington, and Wyoming), the 2015 statewide average temperature from January through March was the warmest on record in a 121 year period. In four others (Colorado, Idaho, Montana, and New Mexico), statewide average temperature was considerably above average.[9] At the same time, January through March precipitation was record driest or "much below average" in five western states and "below average" in six states (only two states were above average).[10] The combined effect of these conditions is exacerbating the effects of dry conditions from previous years, including low reservoir and groundwater levels and less water stored in snowpack, particularly for California, Nevada, Oregon and Washington.

Following are examples of how selected states are experiencing and coping with severe and extreme drought conditions:

- Following the record-low snow water content survey, the Governor of California on April 1, 2015, mandated a 25% reduction in water use for non-agricultural users. A statewide drought declaration made by the governor on January 17, 2014, also remains in effect and the U.S. Department of Agriculture (USDA) has announced disaster declarations for most California counties.

[7] U.S. Drought Monitor and National Oceanic and Atmospheric Administration weekly congressional drought update, May 28, 2015, p. 1.
[8] Ibid.
[9] http://www.ncdc.noaa.gov/sotc/service/national/statewidetavgrank/201501-201503.gif.
[10] http://www.ncdc.noaa.gov/sotc/service/national/statewidepcpnrank/201501-201503.gif.

- On May 15th, 2015, the Governor of Washington declared a statewide drought emergency. Within the state, 48 of 62 watersheds reported water supplies 75% of normal or below.[11] While the Puget Sound region (Seattle, Tacoma, and Everett) has sufficient water supplies and storage due to their reliance on rain rather than snowpack, agricultural areas in central and eastern areas will be strained by low water supplies, as will migrating fish in headwater streams. The state will be leasing water from some water rights holders to supplement in-stream flows for fish. A National Aeronautics and Space Administration (NASA) report states that Washington's snowpack is 16% of normal, and that will likely lead to the lowest yearly runoff in 64 years.[12]

- The Governor of Oregon has declared a drought emergency for 15 of Oregon's largest counties, covering approximately two-thirds of the state.[13] Oregon's snow surveys indicate that snowpack is 11% of normal, the lowest level since 1992.[14] Low snowpack raises concern for a water crisis that could lower crop yields, increase wildfire, and affect fisheries. According to the U.S. Drought Monitor, approximately 86% of the state is in some type of drought, with 34% in extreme drought.

- The Governor of Nevada has established a drought forum to coordinate drought information and response, and has called on state agencies to audit water usage and to conserve water. Local governments and private citizens are also encouraged to conserve water as the state endures its fourth year of drought.[15] All 17 counties of Nevada are under a USDA drought emergency declaration.

Drought Outlook:

Figure 3 shows the extended *seasonal* drought outlook for May 21, 2015, through August 31, 2015. The forecast is for drought conditions to persist or even intensify throughout the far West, and ease slightly or even ease completely in some areas as one moves east from western Idaho, Utah, and Arizona. Many areas of the far western states are entering their seasonally dry months – although this differs for central

[11] See: http://www.ecy.wa.gov/drought/.

[12] See: http://earthobservatory.nasa.gov/IOTD/view.php?id=85887&src=eorss-iotd.

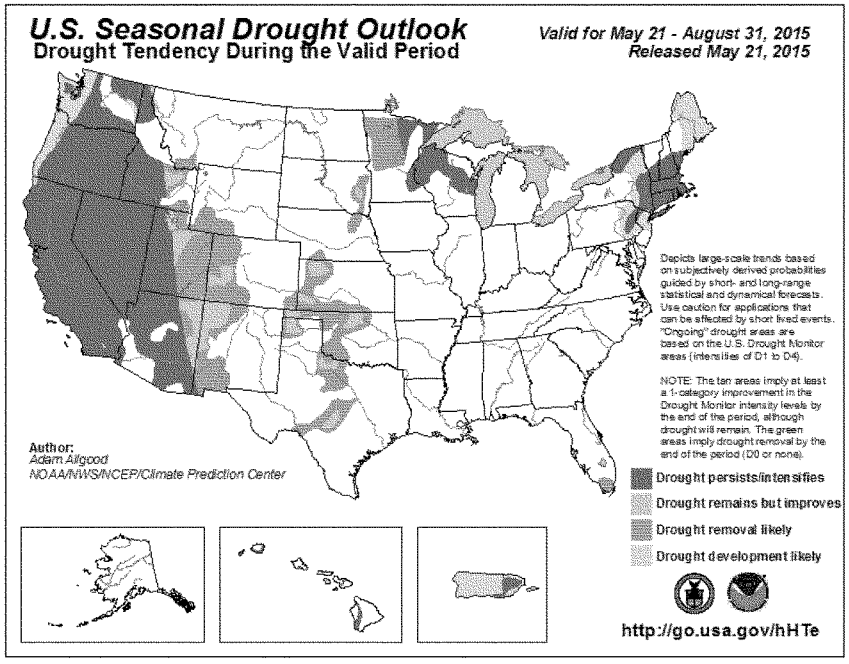
[13] See: http://www.oregon.gov/owrd/pages/wr/drought.aspx#Governor_Drought_Declarations.

[14] See: http://earthobservatory.nasa.gov/IOTD/view.php?id=85887&src=eorss-iotd.

[15] See: http://drought.nv.gov/uploadedFiles/droughtnvgov/Content/News/EO_2015-03_OrderEstablishingNevadaDroughtForum.pdf.

and northern plains states, where May is often one of the wettest months[16] and summer storms can also bring heavy precipitation.

Figure 3. U.S. Seasonal Drought Outlook



Source: U.S. Dept. of Commerce, National Weather Service, Climate Prediction Center, http://www.cpc.ncep.noaa.gov/products/expert_assessment/mdo_summary.html.

Long-term predictions (more than 3 months) are more difficult to make, due to the complexity in weather forecasting, including the large number of variables involved.

[16] U.S. Dept. of Commerce, National Weather Service, Climate Prediction Center, *Discussion for the Monthly Drought Outlook*, May, 2015: http://www.cpc.ncep.noaa.gov/products/expert_assessment/mdo_discussion.html. The June outlook will be available May 31st, 2015.

Additionally, the relationship between climate change and future drought trends is complex, and the scientific understanding of this dynamic appears to be evolving. While it is especially difficult to forecast droughts on a regional basis, many projections indicate that portions of the West are likely to get drier. Although parts of the United States have experienced severe and long-lasting droughts in the past, a combination of increased dryness and warmer temperatures with rising demand on supplies may magnify the effects of any particular drought.

Challenges for Western States

Western states, Indian Tribes, local governments, and the private sector face many challenges when addressing drought. In addition to challenges for municipal and industrial (M&I, or urban) water suppliers (including public health and safety) and agricultural water and irrigation districts, states and localities dependent on agricultural income, recreation (including boating, fishing, hiking, etc.), energy production, commercial fishing, and other industries that depend in part or heavily on water resources may suffer from reduced water supplies in times of drought. In addition, drought can alter natural systems such as wetlands, streams, lakes, and habitat for fish and wildlife, such as flyways used by migratory birds.[17] Additionally, there are often many indirect or unanticipated and long-lasting impacts of drought, such as soil compaction and subsidence, which can affect the capacity of groundwater aquifers, saline water intrusion at coasts and estuaries, changes to soil structure and health, wildfire potential, and expansion of invasive species.

Drought can take a fiscal toll on state budgets in terms of income and revenues, and also on expenditures to help workers, communities, and industries as they adjust to drought impacts. From a water

[17] Lack of open water concentrates migratory waterfowl into the remaining open water. The loss of migratory habitat in an important stopover area will affect waterfowl populations hundreds or thousands of miles away. The drought conditions in the West have resulted in fewer flooded rice fields, and less open water generally. Moreover, abnormally high concentrations of birds facilitate spread of disease such as avian influenza. According to USGS (see link below) the highest wildlife mortality from avian influenza in 2014 in the U.S. occurred at Tule Lake National Wildlife Refuge, where loss of over 6,000 waterfowl was documented. Survivors could spread the disease further; however, a cause was not cited in the press release. (http://www.nwhc.usgs.gov/publications/other/fwa/AFWA%202015%20Mar%20Report.pdf).

management standpoint, demands for state assistance in drought planning, mitigation, and response may greatly increase during times of drought, especially as drought intensifies. At the same time, public and private water utilities can see revenues decline at the local level since revenues are largely based on deliveries of water to consumers, which may be reduced during drought. States also are often called upon by local jurisdictions to issue county and state-wide drought declarations. U.S. Department of Agriculture (USDA) emergency drought declarations are made for counties based on conditions reported in the U.S. Drought Monitor.[18] Such federal declarations make available emergency loans designed to partially compensate for losses for producers who cannot obtain commercial credit.[19]

Because of the states' primary role in surface and groundwater allocation, states and local water entities typically lead efforts to prepare for drought. Such preparations usually fall primarily on state and local government planners, water managers, and public and private utilities.[20] Even without drought conditions, the Government Accountability Office (GAO) previously found that 80% of state water managers who were surveyed in an audit between 2012 and 2014 expected water shortages in some part of their respective states within 10 years.[21] According to these managers, their key concerns related to freshwater availability and use centered on:

- population growth;
- lack of information on water availability and use;
- energy sector water needs and effects on water quality;
- potential impacts of climate change; and,

[18] See: http://www.fsa.usda.gov/FSA/newsReleases?area=newsroom&subject=landing&topic=pfs&newstype=prfactsheet&type=detail&item=pf_20120720_insup_en_ed_desigp.html.

[19] For more on the topics of emergency drought declarations and agricultural and non-agricultural assistance, see CRS Report R40532, *Federal Crop Insurance: Background*, by Dennis A. Shields, and CRS Report R43408, *Emergency Water Assistance During Drought: Federal Non-Agricultural Programs*, by Nicole T. Carter, Tadlock Cowan, and Joanna Barrett. See also: http://www.usda.gov/wps/portal/usda/usdahome?navid=DISASTER_ASSISTANCE.

[20] The National Drought Mitigation Center provides and collects information on state drought plans. See, http://drought.unl.edu/Planning.aspx.

[21] U.S. Government Accountability Office, *Freshwater: Supply concerns Continue, and Uncertainties Complicate Planning*, GAO-14-430, May 2014, http://www.gao.gov/assets/670/663343.pdf.

- effects of extreme weather events (including droughts and floods).

With respect to drought, managing water supplies during scarcity, including groundwater resources, and ensuring public health and safety are perhaps the largest challenges for states and local water managers.

Challenges Facing the U.S. Bureau of Reclamation

Challenges facing the Bureau of Reclamation are similar to those facing state and local water resource managers – growing populations in its service areas, effects of extreme events, and uncertainties involving climate variations and climate change. However, what sets Reclamation apart is its widespread and diverse set of water projects and facilities, ranging from very large dams to smaller diversion dams and delivery facilities, throughout the 17 western states. Because of the diversity of these projects, Reclamation's challenges are likely to vary across regions. For example, large projects in many states (e.g., Arizona, California, and Washington) and water basins (e.g., Colorado, Columbia, Missouri, and Sacramento River Basins) may involve hundreds of stakeholders and multiple jurisdictions, while smaller projects – particularly single purpose projects – may involve fewer stakeholders and interests.

Drought challenges for Reclamation's large, multi-purpose projects are particularly notable because they may involve balancing multiple objectives across multiple states or parts of states, such as flood control (for acute rain events, even during drought), water supply for agriculture and urban use, energy production, recreation, and species needs.

For example, the size of the Colorado River Basin and number of people using its water and related resources present a management challenge even in times of no scarcity.[22] Current challenges facing

[22] The Colorado River Basin covers approximately 246,000 square miles in seven states. It provides water to approximately 40 million people and 4 million acres of farmland. Hydropower facilities on the river generate on average enough electricity to supply 5 million homes. Water from the river is shared among the seven upper and lower basin states, 23 Native American tribes, the federal government, and Mexico. Reclamation has multiple large dams and diversion facilities on the main stem of the Colorado River, as well as numerous projects throughout the Colorado Basin.

Reclamation with respect to the Colorado Basin are how to accommodate existing and new demands, including growing populations while complying with federal law, such as the Endangered Species Act (ESA) and Clean Water Act, all in the face of long-term water supply shortages.[23] Because of the successive drought years in the Colorado River Basin, Lake Mead as of May 26, 2015, was at 37% of historical capacity, just two feet above the elevation (175 feet above sea level) that would trigger shortages for some water users at the beginning of the calendar year. Lake Powell was at 46% of capacity.[24]

Recent projections by the Bureau of Reclamation indicate that by 2017, water levels in Lake Mead could be low enough to trigger a "level one" shortage on the river (a more definitive projection will be made in August 2015).[25] A level one shortage could result in significant reductions to Colorado River water diversions for Arizona and Nevada (11.4 % and 4.3 %, respectively) and would also affect California water users. Further, reductions in hydropower generation may occur if conditions worsened under some of the scenarios studied by Reclamation. Direct and secondary effects from these reductions would likely be significant. Previous studies by Reclamation have projected a long-term imbalance between Colorado River demand and the supplies available to meet them. A 2012 study by Reclamation projected long-term imbalances in supply and demand of approximately 3.2 million acre-feet per year.[26]

[23] Currently the Colorado Basin is in the midst of a long-term, 15-year drought. The combined water stored in system reservoirs has declined 50% since year 2000, and this trend has been observed to be persisting, if not worsening. Snowpack conditions in the Upper Basin this past winter were among the lowest on record, and average 2015 temperatures from January –March were the highest in the 121 year record for five of the seven basin states. As a result, record low runoff volume is expected in many areas through July.

[24] See: http://www.usbr.gov/lc/riverops.html, and http://www.usbr.gov/lc/region/g4000/weekly.pdf.

[25] See: http://www.eenews.net/greenwire/stories/1060018790/search?keyword=colorado+river.

[26] http://www.usbr.gov/lc/region/programs/crbstudy/finalreport/. define an acre-foot.

These scenarios represent huge challenges to Reclamation as it balances the competing uses and demands on water from its many facilities in the Colorado River Basin. Reclamation and the Secretary of the Interior, in coordination with Colorado River water users, have taken steps to address these challenges.[27]

Another example of challenges to large projects is the complexity of factors affecting management of the Central Valley Project (CVP) in California. Exceptional drought in much of the state has resulted in low reservoir levels, historically low snowpack, significant cutbacks to agricultural water users and municipal and industrial (M&I or urban) water users, and a lack of adequate in-stream flows and suitable water temperatures for migrating fish. For example, some water users – those with relatively junior state water rights – are projected to receive no water deliveries from the CVP this year. Senior water rights users have also had their water deliveries curtailed. Meanwhile, surveys show that Delta Smelt listed as threatened under the ESA are at record lows and 95% of one salmon runs' eggs are estimated to have been lost due to high water temperatures in California streams.[28]

Recent major reservoir levels in California are shown in **Figure 4**. In addition to hydrological conditions, major factors affecting CVP water deliveries include a complex combination of state and federal laws and regulations, many of which are related to protection of resources and water quality in the area known as the Bay-Delta (San Joaquin and Sacramento Rivers' confluence with San Francisco Bay). These laws and regulations include requirements for maintaining a salinity barrier and protecting fish and wildlife habitat, specific flow and reservoir release requirements of federal biological opinions on coordinated operations of CVP and the State Water Project (SWP), provisions of the federal Central Valley Project Improvement

[27] For example, recent efforts have been launched to reduce demand and increase supplies on the Colorado River, including a 2007 agreement among the seven basin states for improved coordination and balance of storage between Lakes Mead and Powell, that planned for shortage allocations among the lower basin states, and created a new category of surplus water (Intentionally Created Surplus, or ICS), which allows users to receive credit for conservation and fallowing. Reclamation and stakeholders have also started a new Colorado River System Conservation program, and recently released phase 2 of the "Moving Forward" report on the Colorado River, which documents opportunities and potential actions to address the future water supply and demand imbalances projected in the 2012 Colorado River Basin Water Supply and Demand Study.

[28] John McManus, Dick Pool, and Randy Repass, et al., *The Impact of the California Drought on Salmon*, Golden Gate Salmon Association, handout from presentation for congressional staff, April 15, 2015, p. 1. See also, infra 29.

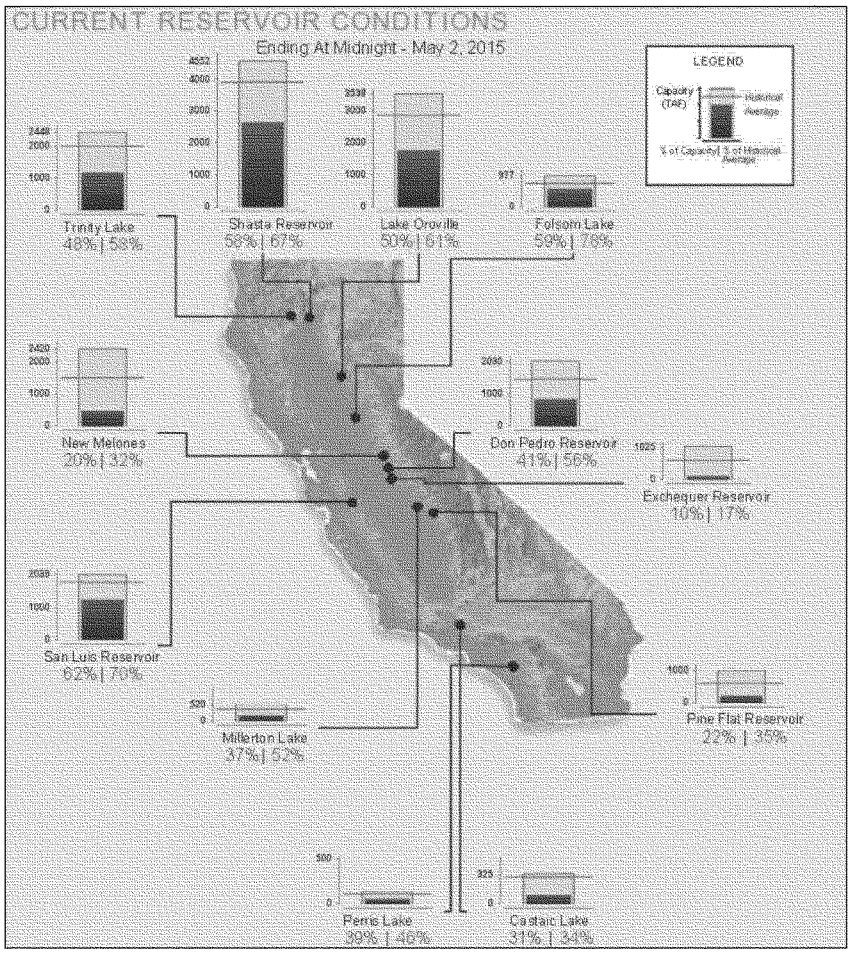
Act, and the state's system of water rights priorities, which in part underlie Reclamation contracts for water deliveries. The amount of influence that each of these factors has from year to year – and within the year – varies. For example, in some years, pumping regimes adopted for ESA compliance can significantly affect water diversions (exports) from the Bay-Delta to areas south; in other years, the percentage reduction due to ESA compliance is much smaller.[29] Relatedly, at many times during the year state water quality standards appear to be the controlling factor for Delta exports.[30] All of the combined factors above have contributed to some south-of-Delta water users consistently receiving less than full water deliveries from the CVP in recent years.[31]

[29] For example, see: response of Michael C. Connor, Deputy Secretary of the Dept. of the Interior at a House Interior, Environment, and Related Agencies Subcommittee budget hearing on February 25, 2015. (http://www.eenews.net/eedaily/2015/02/26/stories/1060014067.)

[30] See for example: California Water Boards, State Water Resources Control Board, Regional Water Quality Control Boards, *2015Drought Water Project Operations,* PowerPoint presentation, pp. 2-3.

[31] For example, regardless of the exact causes behind differences in annual export reductions, CVP agricultural water service contractors south-of-the-Delta have received less water than contracted for in most of the last 15 years, even with record high combined exports during this time. (See: U.S. Dept. of the Interior, Bureau of Reclamation, *Total annual Pumping at Banks, Jones, and Contra Costa Pumping Plants 1976-2014 (MAF).*)

Figure 3. Status of Surface Water Storage in Reservoirs in California as of May 2, 2015



Source: California Department of Water Resources, California Data Exchange Center, Current Conditions for Major Reservoirs, http://cdec.water.ca.gov/cgi-progs/products/rescond.pdf.

Smaller Reclamation projects also are facing drought-related challenges. For example water delivery cutbacks have been announced or are projected for the Yakima basin (WA), the Rio Grande Project (NM), the San Juan-Chama Project (NM), and the Newland's Project (NV).

Legislative Options for Addressing Drought

There is a wide range of options for addressing drought. Observed broadly, options for addressing drought can be categorized as those that are supply-driven; those that address demand management; those that provide for coordination of federal agency activities or address governance or institutional issues; and those that fund research, planning, and monitoring activities that support state and local efforts.

Supply Options

Supply-driven options include developing or facilitating new water supplies or augmenting existing supplies, such as constructing surface and groundwater storage projects, water reuse projects, and desalination projects, and facilitating water conservation and efficiency programs.

Historically, the federal approach to addressing the arid West's seasonal and multi-year variability in water availability was to improve the reliability of supplies through construction of large federal water storage and conveyance systems – a supply driven approach. For example, the Bureau of Reclamation – whose original mission was to "reclaim the Arid West" – was established following a series of droughts in the late 1800s.

Today, the opportunities for such supply and conveyance systems are fewer than they once were, and their costs are significant. Any option to expand supplies – whether through surface or groundwater storage, desalination, or reuse – is likely to be considerably more expensive than water developed through decades-old Reclamation projects.[32]

[32] See for example ongoing surface water storage studies for California: California Department of Water Resources, *North-of-the-*
(continued...)

Project evaluations have also become more complex and lengthy as a result of increased public awareness of the environmental costs of large water supply projects and enactment of laws such as the federal ESA, Clean Water Act, and others. This has led some observers to suggest streamlining or removing federal regulations that may inhibit new water supply projects or restrict operations of existing projects. Different perspectives on how to balance water resource development and natural resource protection is often at the heart of the debate surrounding new surface storage proposals, as well as debate on changing implementation of federal laws and regulations.

Also on the supply-side are proposals for expanding the federal role or financing water reuse and desalination projects. Water reuse/recycling project costs are also expensive, with costs in California estimated to range from $300-$1,300 per acre-foot,[33] while for seawater desalination projects in California, the reported range per acre-foot is $1,600-$3,000.[34] A question often raised is what should be the federal role in such projects.

Options for developing new federal water supply projects also face the twin hurdles of enacting new appropriations and complying with earmark policies for site-specific projects. Because of these challenges, some have called for an annual report and authorization process for Reclamation similar to the requirements enacted for the Corps of Engineers in last year's Water Resources Reform and Development Act (P.L. 113-121). To address funding issues, some call for the formation of private-public partnerships,

(...continued)

Delta Offstream Storage Preliminary Engineering Design and Cost Estimate, Dec 2013, p. 4-9. http://www.water.ca.gov/storage/northdelta/prelim_admin_draft_EngineeringDesign_index.cfm; and, Bureau of Reclamation, *Upper San Joaquin River Storage Investigation Draft Feasibility Report*, Jan 2014, http://www.usbr.gov/mp/sccao/storage/docs/Draft_Feasibility_Report_2014/USJRBSI_Draft_FR_2014_Full_Report.pdf. For current CVP water rates see: Bureau of Reclamation, *Schedule of Irrigation Contract, Cost of Service, and Full Cost Water Rates per Acre-Foot by Contractor, 2015 Irrigation Water Rates*, Schedule A-1, 2015, http://www.usbr.gov/mp/cvpwaterrates/ratebooks/irrigation/2015/IRR_2015_Sch_A-1_F.Z17.pdf. These costs do not include certain "special" rates, which are explained in detail at http://www.usbr.gov/mp/cvpwaterrates/ratebooks/special/2015/index.html.

[33] California Natural Resources Agency, Department of Water Resources, *California Water Plan, 2013 Update*, Bulletin 160-13, p 12-25. http://www.waterplan.water.ca.gov/cwpu2013/final/index.cfm#Volume1. Hereafter *California Water Plan*.

[34] *California Water Plan*, Vol. 3, Ch. 10, p 10-37. Earlier estimates by the WateReuse Foundation estimate costs as low as $1,000 per acre-foot. Desalination costs are very location specific for a variety of reasons, including dependence on electricity or other and land costs. For more on this topic, see: CRS Report R40477, *Desalination and Membrane Technologies: Federal Research and Adoption Issues*, by Nicole T. Carter.

authorization of non-federal funding or private development of projects, and creation or reactivation of federal loan programs.

Demand Management Options

Options for demand management include providing incentives and technical and financial assistance for conservation programs (e.g., for irrigation and urban water use efficiency), water pricing reform (e.g., through tiered or increased block rate pricing, full-cost pricing, etc.), and restrictions or limits on water use. Often these options are pursued at the local level; however, they may be supported by federal programs.

Governance or Institutional Options

Other options include those that involve governance or institutional structures at various levels, such as drought task forces, commissions,[35] councils,[36] or water transfer mechanisms, such as water banks or water markets. Many observers have called on federal and state governments to facilitate water transfers or water markets and banking as a way of augmenting water supplies for those who are willing and able to pay more for their water. These mechanisms aim to match available water supplies with changing demands.

While several states (e.g., California, Colorado, Idaho, and Texas) support transfers and have active water markets, others do not. A difficulty when considering legislation involving the federal government in this issue area is that historically, although the federal government itself may hold water rights, it has largely deferred to states primacy in water allocation, and state water rights systems and water codes typically

[35] Congress established a National Drought Commission in 1998. The commission reported its findings in 2000 and was then disbanded.

[36] Congress considered, but did not enact, legislation in the 108th and 109th Congresses (The National Drought Preparedness Act, S. 1454 and S. 802, respectively), which would have established a National Drought Council to develop a national drought policy and fund development of drought preparedness plans for states, tribes, and local entities, as well as other recommendations of the 2000 National Drought Commission report. Some of the commission recommendations were enacted in separate legislation, which created the National Integrated Drought Information System (P.L. 109-430).

govern whether water can be leased or transferred and under what terms and conditions (although federal laws may also apply). Where the federal government may have a larger role to play is in policies or legislation affecting access to, transfer, or marketing of water from federal facilities (e.g., Bureau of Reclamation or U.S. Army Corps of Engineer reservoirs). For example, under the CVPIA, Congress authorized transfer of water outside the CVP service area and specified conditions and reporting requirements for such transfers, some of which water users have proposed streamlining or eliminating. A related option is to pay voluntary water users to forego water use (e.g., land fallowing or purchase of tainted lands) for use as in-stream flows or for use by other water users willing to pay such costs.[37]

Other Options for Supporting Local Efforts

Lastly, options that support research, planning, and monitoring activities that support state and local efforts might include financial support or incentives for improved water related technologies (e.g., improved desalination and water reuse technologies, efficient irrigation technologies, etc.), providing regulatory relief or streamlining of laws and regulations, and coordinating federal agency activities.

Conclusion

The challenges of cost, the differences in state and federal roles in water allocation decisions, and congressional budget and procedural issues in part highlight challenges in federal response to drought. In recent decades this federal response has been predominantly limited to providing financial assistance to farmers and ranchers through U.S. Department of Agriculture (USDA) programs; providing research, planning and technical assistance through various federal agencies; improving federal drought science and information collection and dissemination; and coordinating federal activities with states and local

[37] For example, the State of Washington is leasing back water rights from farmers in order to keep some water in streams for fish passage. Additionally, Reclamation has studied the option of voluntary buy-out of drainage lands impaired by selenium in the San Joaquin Valley. Such actions can free up water for other uses, depending on policy goals.

governments and entities. Whether the federal government should continue and/or expand these policies, or pursue other legislative options, is likely to be a matter of ongoing debate.

This concludes my testimony. I am happy to take questions.

The CHAIRMAN. Thank you, Ms. Cody. I was hoping that you were going to have the silver bullet for us. [Laughter.]

The CHAIRMAN. We can wrap this up, and say we have done this analysis.

Ms. CODY. I wish I did.

The CHAIRMAN. Yes, we all wish that you did.

Each and every one of you has mentioned collaboration, cooperation, and flexibility, but it seems that collaboration amongst our agencies whether on state side, Federal side, working with our tribes, this is all key.

We clearly hear that, yet we are still faced with a situation where the drought is extreme in places, the forecast is not looking very good and the uncertainty makes it even more difficult, more complicated.

I would be interested in hearing your perspective, Mr. Buschatzke, in what Arizona is doing. Are there ways we can provide for greater collaboration with our Federal agencies? What are the barriers we have right now that are limiting our opportunities to do more, clearly, with less?

I am going to throw this out to all of you, and then I am going to have to go vote but I will be back for a followup with this.

Mr. Buschatzke, if you want to lead off? I would really ask all of you to weigh in on this.

Mr. BUSCHATZKE. So Chairman Murkowski, first I'll say that the collaboration with the Federal Government, with the Department of the Interior has, kind of, been exemplary so far.

I think the biggest road block for further collaboration in dealing with drought contingency and sustainability planning on the Colorado River in the Lower Basin is really number one, the drought in California has reduced their flexibility to participate in potential ways to save water in Lake Mead.

I think, second, the environmental issues revolving around the Salton Sea. Drain water goes into the Salton Sea from the Imperial Irrigation District. We could save a lot of that water by creating efficiencies in that irrigation district and save that water in Lake Mead, but for the environmental issues related to the Salton Sea.

And last, honestly the fact that California under the 1968 Basin Project Act does not take shortages, only Nevada and Arizona do, has created a bit of an unlevel playing field. And so I think we can use the help of the Department of the Interior, specifically on that issue, finding a way to create some more equity at that negotiating table.

The CHAIRMAN. Mr. Connor, would you like to comment?

Mr. CONNOR. Well, I do agree that the issues that Tom has raised are the next wave of areas of collaboration that we have to deal with, and some of those issues are fairly tough which is why they haven't been resolved up to this point. And the Salton Sea is certainly one of those areas.

Nonetheless I can point to the Colorado River Basin where, over the last 15 years, we've had six or seven major agreements that have reduced water use, that have increased storage in Lake Mead, created institutional mechanisms to incentivize the saving of water. And yet, here we are facing significant percentage possibilities that

we're going to face a shortage in the Lower Basin in 2016 and 2017.

Yet the states are still at the table. We've got a system pilot conservation agreement that we've all put together, Upper Basin and Lower Basin and the Federal Government, to create more water, to look for new ways to conserve and place more water in Lake Mead. There's an MOU that's just been agreed to where I think the states are looking at mechanisms to create another million acre feet by 2018. And these are the mechanisms that we are going to have to finalize through our agreements.

But the idea, also, is that we've got to create new relationships between the parties. And that's what we've been doing.

I would just note real quickly that the success of the Arizona Water Bank, which has been tremendously successful and as I found out, even more so, this morning, was facilitated in great part by the 2004 Arizona Water Settlement Act that the Congress passed. It facilitated Arizona taking its full Colorado River entitlement every year, a good portion of that which has been stored to alleviate any drought situations. And oh, by the way, it also resolved two major Indian water right settlements and provided opportunities for them to create increased water supply reliability.

It's a combination of the investments that we make for conservation, for looking at new storage opportunities. One of the more recent storage facilities we do have is in the Colorado River Basin, a regulating reservoir that's saving 60,000 to 70,000 acre feet per year, once again, keeping that water in Lake Mead.

Investments, new agreements, new relationships and certainly, I think for the Salton Sea, we're going to have to look at new authorities, probably.

The CHAIRMAN. Thank you.

Senator Cantwell?

Senator CANTWELL. Thank you, Madam Chair.

Mr. Connor, I think I'll continue with you on this issue.

First of all, thanks for visiting the Northwest. I think you were out at a Yakima Basin meeting years ago with myself, then Secretary Salazar, and Congressman Hastings, along with others. So I know you have great familiarity there.

As we've seen these drought conditions persist in the West over years, and we've tried to make plans for changes. You mentioned increasing storage capacity.

What are the major barriers for the Department if we continue to do authorization project-by-project, and it takes years of planning and studying? Again, I'm not talking about changing environmental laws, but what do we need to do to have more flexibility? What are the major barriers that exist to a more rapid response to some of these conditions?

Mr. CONNOR. Well I think, you know, obviously the larger the project, the more complicated, the more likely to impact other water users as well as the environment. And I think there's a fundamental question related to the economic feasibility of some of those larger projects. So I think, sometimes, we have been focused on larger is better, but it bogs down our ability to move through permitting processes, etcetera.

And I will give, you know, the Yakima Basin is the perfect example with the Black Rock Reservoir proposal which took a lot of time, which proved to be probably one of the more expensive ways to yield water supply. And when the numbers came out, I think it called into question whether it could be afforded and caused the parties to go back to the table to a much more robust and comprehensive approach to dealing with water supply issues from the environment, to new water supply, to facilitating conservation efforts.

I think, at the end of the day, those smaller projects, those—and we've been doing this in the Yakima Basin consistently for ten to 15 years, the Yakima River Basin Water Enhancement Project. I think through from about a 10-year period to 2003 to 2013 we created somewhere about 30,000 to 35,000 acre feet of reduced diversion demand. That water has been allocated to in stream flows to improve the conditions of the fishery while also being retained by the irrigation community to help weather times of drought.

So I think we're making great advances through a series of smaller projects that I think are less controversial, that are more affordable and prove to be yielding, adding to the bottom line and bringing in more broad support.

So it's not always smaller is better, but I do think at times we get bogged down with the very larger projects.

Senator CANTWELL. Well, you are reminding me that a process does solve most problems because of that step of going through that larger exercise. I think it is a catalyst to bring all the parties together at the table.

At a hearing that I once chaired for this Committee on the San Joaquin, there was a similar process: after 18 years of legal battles people decided to come to the table.

So what about this issue of what do we need to do to provide more flexibility to the agency to support those kinds of collaborative efforts?

Mr. CONNOR. I think we have good authorities right now that allow us to participate as a cost share partner in a number of these projects.

And so what's happening in a lot of cases and I think we should look at more opportunities to facilitate this is the Federal Government is a participant in a lot of projects. I would concede that when the Federal Government leads a project development activity there's a lot of hoops to leap through, with respect to the regulatory permitting process. Certainly even there's some of that when we participate. But in a lot of cases the states and local entities have developed project concepts. They are looking for Federal permits as well as some Federal assistance with respect to cost share, and that's appropriate in a lot of cases because there are Federal interests at stake in the Yakima Basin. We have our trust responsibility to the Yakima Nation. We have the environmental laws. We have the goals with, we all have, with respect to the fisheries. And we have a Federal project that we want to maintain its viability to serve agricultural interests for the long term.

So in a lot of cases I think facilitating the Federal Government to continue to be a partner in these efforts whether they're conservation projects, small storage projects, environmental restora-

tion projects, as a partner providing flexibility from a financing standpoint for non-Federal entities will help facilitate results.

Senator Cantwell [presiding]: Thank you.

Senator Flake?

Senator FLAKE. Thank you, Madam Chair, and thank you all for being here. It is great to see Tom here, and the first question is for you.

You talk about Lake Mead looks like we are going to, you know, we are in our 16th year of below average runoff of the Colorado River. Lake Mead is likely going to hit or fall below the 1,075 feet mark over the next two years and will trigger the shortage declaration.

You talk about structural deficits. You touched on it in your comments. Can you explain that further? Evaporation, delivery, losses and how that affects allocation?

Mr. BUSCHATZKE. Yes, Senator Flake.

So the structural deficit is a function of the fact that those losses in evaporation, losses, the reservoir evaporation. Those volumes of water in the Lower Basin, Nevada, Arizona, California and what goes to Mexico, are not accounted for. So in the decree in Arizona verses California each state's allocation which was certified in that decree, was for the total consumptive use, 2.8 million for Arizona, 4.4 for California, 300,000 for Nevada and under the Mexican Treaty 1.5 million acre feet.

So more water has to really be in the system to get those volumes of water to those entities for actual use. And so that impacts the Lower Basin by driving Lake Mead toward shortage, even in normal years. The brunt of, again, those impacts fall on those who take shortage. Basically, California does not take shortage. Arizona, Nevada and Mexico do.

But there are also impacts to the Upper Basin states, Colorado, Wyoming, New Mexico and Utah, potentially. And so, their system, under prior appropriation and under their Upper Colorado River Compact, they do incorporate the losses into the actual use by their farms, customers, cities, etcetera.

So what happens there is because Lake Powell and Lake Mead are conjunctively managed and the contents are balanced. Lake Mead falling more rapidly from the losses not being accounted for forces more water from Lake Powell to go to Lake Mead. The potential impacts there are on loss of power revenues that come out of Lake Powell, Glen Canyon Dam. Those power revenues are used to fund environmental programs and other things in the Upper Basin.

And also if Lake Mead and Powell continue to drop, potentially, those Upper Basin states are subject to curtailment under the 1922 Compact if they can't deliver 75 million acre feet over a 10-year period to the Lower Basin. So the impacts fall on both the Upper and Lower Basin because of the structural deficit.

Senator FLAKE. Alright. During times of water storage in the West we often see these conflicts portrayed as irrigated agriculture pitted against the cities. Will you explain how these tensions will be dealt with in Arizona? Are we trying to allow growing urban economy but still maintain healthy agricultural economy?

Mr. BUSCHATZKE. Yes, Senator Flake.

So there are some tensions in Arizona between our senior priority users for Colorado River in the Yuma, Arizona area and the cities in Central Arizona, who take Central Arizona Project water. We've been working with the Central Arizona Project and the Yuma area agricultural interests in trying to help come up with a way to do things like intentionally create surplus that Deputy Secretary Connor referred to, to try to prop up the levels of Lake Mead. I think those things have been going fairly well. We don't have a deal on the table yet.

In Central Arizona our agricultural users who take Central Arizona Project water will suffer the brunt of the shortage if there's a Tier One shortage in 2016 or 2017. They'll lose about half of their renewable Colorado River supplies. They have options to pump groundwater under state law. But under our Underground Storage and Recovery Program they also have options to partner with Arizona tribes and Arizona municipal users who have higher priority Central Arizona Project water. Those folks, the agricultural users, can partner with those entities, take their Colorado River water. And in return those entities will get a future credit to pump groundwater from under the agricultural land.

The Department of Water Resources has looked at the permitting that goes along with that program, and we've tried to create as much flexibility as possible to make those partnerships most probable as we approach this shortage is 2016 or 2017.

Senator FLAKE. Thank you.

Just very quickly in my remaining time. You talk about augmentation to our areas. What are the most promising areas to augment the resources that we have?

Mr. BUSCHATZKE. I think the Lower Basin states, including Arizona, help funding weather modification, cloud seeding in the Upper Basin to try to increase the flows there.

We also are looking at potential desalination of brackish groundwater within our state. Of course are participating through the auspices of the Minute 3–19 process, Minute 3–19 Treaty implementation with Mexico to look at potential bi-national desalination with Mexico and also potentially partnering with California for desalination with California and Arizona.

Senator FLAKE. Okay.

Mr. BUSCHATZKE. Those are probably the main sources.

Senator FLAKE. Thank you.

Thank you, Madam Chair.

Senator CANTWELL. Senator Heinrich?

Senator HEINRICH. Deputy Secretary Connor, in its Colorado River Basin Study the Bureau of Reclamation identified efficiency in conservation projects as some of the most cost effective approaches to increasing available water supplies for users, in other words, actual wet, delivered water. In New Mexico the state has elected to pursue a new diversion project on the Helit River under the Arizona Water Settlements Act instead of focusing on efficiency projects that would help stretch existing water supplies further.

As Reclamation begins its review process with a value planning study this summer, I am wondering how will the lessons learned from the Basin Study factor into consideration into the costs and

benefits of the various projects that could be pursued under the Settlement Act?

Mr. CONNOR. Senator, I think in looking at, you know, obviously when we do our studies one of the areas that we look at are alternatives, approaches. And as you've pointed out I think that will be something that does get scrutiny as to what are the water supply demands that are trying to be met by this project, first of all. And then what are the options available to meet that demand.

I think overall, through our history and in my prior capacity I had the opportunity to spend a lot of time up here testifying on water resources issues. One of the things I went back and looked at was what are the relative, you know, back of the envelope calculations for the relative different types of projects that we have?

There were a couple of large scale storage projects that I mentioned—one was the Black Rock Reservoir proposal, another one in California, the Auburn Dam. The cost per acre foot, just overall project costs versus yield were somewhere in the neighborhood of, you know, $17,000 to $46,000 per acre foot.

You look at the Water Smart conservation proposals that we've gotten, and water conservation is not going to create a new supply for a new demand. But it certainly can lead to saving water, be able to putting that in storage, maintaining flexibility in the situation. Those are down from $500 to $800 per acre foot.

The Title 16 Water Reuse Projects that we have which have great drought resistance aspects to them, they provide water in times of plenty as well as times of shortage. They're about $8,400, $8,500 per acre foot. So it gives you the kind of range.

And we've made investments. I think the water conservation projects in the Yakima River Basin are something around $2,500 per acre foot. And we did a major infrastructure improvement project in California, an intertie between two canals which resulted in about 40,000 acre foot per year on average. And that was $850 per acre foot, cheapest water in the West.

So we're making improvements that, I think, are adding to the bottom line of water availability. Every project needs to be evaluated on its own merits, but it shows you the range and the differences.

And quite frankly, what we found, is we've got a lot of demand for these conservation and reuse programs because, I think, water managers, this is not a Federal driven program. We've got the availability where we can participate. But we're getting applications on a yearly basis that greatly exceed the available resources because water managers view that as the best investment opportunity to yield water supply, in a lot of cases much better than large storage.

Senator HEINRICH. Great, thank you. I appreciate your focus on looking quite transparently at the cost per acre foot and the yield of these individual projects. I think that is incredibly important given the stress we are at West wide now.

Ms. Cody, I want to move to you real quickly.

For a number of years now the Bureau of Reclamation has actually leased water from the local water utility in Bernalillo County to maintain flows in the Rio Grande necessary to support local

wildlife populations, and many have suggested expanding that program to lease water from local irrigators on a voluntary basis.

Can you tell us a little bit about how water leasing has been used in other states around the West to meet water needs and what New Mexico should keep in mind as we consider expanding the tool box in the middle Rio Grande Valley?

Ms. CODY. Thank you for the question.

The other areas that this has been done, I think we heard from testimony here today in Washington State where the Department of Ecology has worked with having water left in streams by having people voluntarily agree to use that water. I don't know, honestly, if the state is paying for that. That would be a question for my colleague over here.

California is another place where people with senior water rights have entered into long-term contracts with municipal areas to move water on a voluntary basis. Usually those are structured as a contract. Reclamation has done some work on providing guidelines for long-term transfer of water and short-term transfer of water in those situations.

So those options are out there. Others have proposed to do similar things in other areas of the West and that could include New Mexico.

Senator HEINRICH. Thank you.

The Chairman [presiding]: Senator Barrasso?

Senator BARRASSO. Thank you, Madam Chairman.

Mr. Connor, it is nice to see you again. Thank you so much for being here. You are aware of my efforts to pass legislation, S. 593, which would compile the Bureau's maintenance backlog into a report that would be available to the public and updated every two years. Your staff has been very helpful, and I just want to say that.

You have been very helpful in working with my office to move this legislation. It unanimously passed the Senate the last Congress. Will you commit once again to continue to work with me to move this legislation so we can understand what the total backlog is and eventually the way to address it?

Mr. CONNOR. Yes, Senator. Full commitment. That's a very valuable bill, and my staff says the same thing, that your staff has been wonderful to work with.

Senator BARRASSO. Well, good. Thank you.

You know, folks across the West, we are in serious need of more water. Ranchers in my state, like Big Horn Basin, they need water to grow alfalfa, to raise cattle. Many have junior water rights, and they worry about getting the water they need to keep their livelihood.

So the sentiment in the West and certainly in Wyoming has always been summed up by the old saying, "Whiskey is for drinking, water is for fighting over." The best solution, I think, to solve the water crisis is to increase water storage in the West.

The State of Wyoming, through our Governor's office, has developed a strategy to increase water storage, and I support them on this. So I have introduced legislation, S. 1305, to expand the storage capacity of Fontenelle Reservoir, to provide more water for Southwest Wyoming. Together we are looking at other options to expand our reservoirs.

So my question is, will you continue to work with me, with Governor Mead, to help move water storage projects forward such as Fontenelle and others and what steps are you taking to address this need across the West for more water storage?

Mr. CONNOR. To the Wyoming specific examples that you referenced, Senator, of course, we will be happy to keep working, particularly I know we've had some activity on the Fontenelle Reservoir issue, I think. We want to work through the technical aspects, in particular. But it's, I think it's demonstrating where we see there is value and economic viability, in particular, is looking at existing storage facilities and seeing how we might increase. So yes, we are absolutely committed to continue to working with your office.

Overall, we have a number of storage proposals that we are continuing to do work on, particularly in California. 2004 legislation, CALFED, required us to look at four major new storage opportunities in California. One of those, the Las Calaveras Dam, raises a facility that's in the Bay delta itself. Did go through a phase one dam raise, increased water storage by 60,000 acre feet, now they're looking at a second raise, potentially another 100,000 acre feet.

So but we've completed some. We're in the process of completing others. We are looking at increasing storage in the St. Louis Reservoir which is south of the delta in California. I think that might have a great opportunity to provide additional water supply.

And as I mentioned earlier, we've looked at some smaller regulating reservoirs. One of the most successful aspects of that is Brock Reservoir on the Lower Colorado River. You know, obviously we've got 60 million acre feet of storage on the Colorado River, quite frankly. And we're trying to get more water into those existing facilities.

But there's great value in a regulating reservoir, 8,000 acre feet that's yielding about 60,000 to 70,000 acre feet of yield.

$172 million, the major municipalities in Arizona, California and Nevada paid for that. We provided technical system assistance. And once again, that proved to be great value as to the dollars per acre foot added.

So it's not a comprehensive look across the West. It's more where there have been projects identified that we think that there are sponsors for that want to look at storage. And we are certainly believe that that's one of the tools that we need to address our water resource challenges.

Senator BARRASSO. Well, I appreciate it.

You know, with increasing water storage in terms of Wyoming, I know the Wyoming Water Development Commission is working on producing a viable feasibility study on enlarging the Bull Lake Reservoir. I know you are familiar with that.

If we look at Congress enacting language broadening authorities under the Safety of Dams Act, will your Bureau then have the authority, you think, to integrate a dam safety fix at Bull Lake with the Wyoming Water Development Commission with their proposal to enlarge the facility?

Mr. CONNOR. I think we need to look at that authority issue, quite frankly, under our existing Safety of Dams legislation. But I do think it warrants what we need to be looking, as we're doing

major corrective actions to existing dams, that we should look at the opportunities to increase storage. I do think there's an authority issue there, and we'll need to work through cost share issues on that point.

Senator BARRASSO. Finally, Mr. Ogsbury, in your written testimony you mentioned and other witnesses today have testified the drought is not just in California, but in many Western states as well. I believe any drought relief bill should not just address California's drought crisis. There should be a west wide drought relief.

I am just wondering what you are hearing from Western Governors' that you represent.

Mr. OGSBURY. Chairwoman Murkowski, Ranking Member Cantwell, Senator Barrasso, members of the Committee, the Governors have been phenomenally engaged in the Western Governors' Drought Forum, the invention of our current chairman, Brian Sandoval of Nevada.

As we've gone across the West, Senator, Governor Martinez of New Mexico hosted a workshop on drought's impacts on tourism and recreation. Governor Brown of California hosted a workshop on drought's impacts on agriculture. Mr. Connor participated with us in Las Vegas when we did a workshop that Governor Sandoval hosted on drought's impacts on water supply. They fully recognize that this is a regional issue and it demands regional collaborative solutions.

Senator BARRASSO. Thank you, Madam CHAIRMAN.

The CHAIRMAN. Thank you, Senator Barrasso.

Senator Franken?

Senator FRANKEN. Thank you, Madam Chair, for holding this hearing.

We have been hearing from the testimony of the Western United States experiencing record low snow pack, unusually dry weather, the warmest temperatures on record and these drought conditions are having tremendous impacts on our communities and our economy. We have also heard the cooperation between states and Western states and Federal Government and different entities to address these impacts.

To make matters worse many climate models are projecting that portions of the West are just likely to get drier and hotter. So now more than ever I believe that the Federal Government should take the lead in supporting research on how climate change will exacerbate drought conditions like the ones we have been talking about today.

Mr. Connor, what is the Department of the Interior doing to better understand the impacts of these climate-related events and how is that informing our understanding of what we are going to do going forward?

Mr. CONNOR. Thank you, Senator Franken.

We have a number of different areas by which we are participating, particularly in the area of better understanding the impact of climate change on water resources and then systematically trying to assess what are the right strategies to deal with those implications. And we participate, our US Geological Survey premier science organization participates, with the Global Change Program that helped put together the National Climate Assessment.

Certainly within the Department itself we have had a focus on putting together more transparent use of our water-related data because not only can we use that, but there's a lot of smart people outside the Department. And we have an open water data initiative to try and standardize data enough so that we can put it out and make it accessible because we think others, particularly in academia, can help us use that data to better understand the changes that have occurred to date and how to move forward.

From a more practical standpoint we have a Basin Studies program within the Bureau of Reclamation, and we are looking at opportunities to assess on a basin-wide scale supply/demand imbalances over a 50-year period using the best climate data and downscaled models to assess how supply is changing in individual basins.

Senator FRANKEN. Since we are projecting drier, hotter weather going forward because of climate change, is that going to make certain technologies suddenly economic where they were not before?

Anyone is free to comment on this. I heard about desalinization of brackish waters in Arizona. I think San Diego has a billion dollar desalinization project that will deliver seven percent of the county's needs.

Going forward, things like, I know you mentioned the US Geological Survey. I know that the aqueducts in California, for example, go through some very arid areas and there is a lot of evaporation. And I know the U.S. Geological Survey study covering certain, in very low precipitation areas, covering the aqueducts so you don't lose the evaporation. Going forward are we going to see certain approaches become economical, start to make sense, like desalinization or like that, like covering the aqueducts? Are we going to start seeing those things become economical? Anybody can weigh in.

Mr. LORANGER. I will, thank you.

We are, for example, leasing water, one season leases. Ten years ago in Yakima Basin we paid $137 an acre foot. This year it's about $275, and this is just a reverse auction where we solicit bids from water rights holders. So costs have doubled.

And with more frequent droughts what does that mean for the cost of water? What does that mean for the cost of leasing?

For example, the Yakima Integrated Strategy, there's some controversy around the benefit cost analysis. One of the proposals is to have a pumping system set up on Lake Kachese because there's 200,000 acre feet of dead storage. Well, if you could pump that water down the Yakima, then 200,000 acre feet is an enormous amount of water for both fish and agriculture. So I think it could be that as water is more scarce projects like that make more economic sense.

Thank you.

Senator FRANKEN. Any other comment?

Mr. BUSCHATZKE. Yes, Senator Franken.

So looking at some statistics for desalinization of water, for example, in Texas to desalinate brackish groundwater, the cost is about $1,000 per acre foot. For Pacific Ocean desalinization it's about $1,500 to $2,100 an acre foot. You compare that with Central Arizona project cities who treat new and reportable water at a cost

of about $1,200 to $1,600 per acre foot. So it's becoming more economical, coming more into range of what we're seeing now for the costs of water.

Senator FRANKEN. Thank you, Madam Chair.

I know that someone mentioned Israel before. They are a very arid area and a great agricultural sector, and they are exploring desalinization.

So as we go in the future I think there are certain technologies that are going to become economic.

Thank you.

The CHAIRMAN. Senator Gardner?

Senator GARDNER. I am happy to allow Senator King to go and just flip flop if we could.

The CHAIRMAN. So you will go after him, fine. Thank you.

Senator King?

Senator KING. I appreciate it.

Just really one major question, and I am not sure who wants to tackle this. This might be something that we take for the record.

I am interested in the historic data of water in the West. In other words are we facing a new crisis or are we seeing a return to a normal situation over the 1,000 years or 10,000 years? I think that is an important question because that will inform our response.

Does anybody have any response to that question now or is this something that we have to look at?

Mr. Connor, do you have any background on that?

Mr. CONNOR. I do have a quick thought. But yes, I think it deserves a little bit more elaboration for the written record.

Mr. CONNOR. But as an example, we've got about 100 years of stream flow data in most of the river basins. So that's the history——

Senator KING. That's a blink of the eye.

Mr. CONNOR. That's a blink of the eye, but the example I wanted to give is in the last 15 year drought in the Colorado River Basin, the in steam flows, the runoff within that system, is the lowest on record over that period of drought.

But through tree ring data there's been some research that is highlighted that it's in the lowest first percentile of the last 1,200 years. So there are new mechanisms to look at the estimates of what the runoff within that basin has been, and we are at the very lowest levels through that tree ring data.

And we may have similar reconstructions of data in other basins that we can now start to compare to, to really find out where we're at and how significant is this drought because drought, of course, is cyclic.

Senator KING. Good, I appreciate that.

Any further information, I think that is important to have to inform how we respond to this.

I was in California in April, and I was up in the mountains and was shocked to see that the reservoirs at what looked like August levels in April when they should have been full. I was told that the snow pack in the Sierras was at six percent of normal, and I thought they said 60 percent. It was 94 percent down which is just stunning.

It seems to me that we are going to—one of the things and you all have mentioned this at various points in your testimony. We really need to talk about conservation and efficiency measures, not necessarily conservation of don't use, but use more efficiently, low flow toilets, drip irrigation. All of those kinds of techniques which are probably the lowest cost, I think you testified to this, Mr. Connor, that of all the alternatives those tend to be the lowest cost per acre foot as opposed to reservoirs, desalinization and other technologies. Is that accurate?

Mr. CONNOR. Absolutely. It is one of the most efficient ways. It's the low hanging fruit, particularly for any municipalities, the appliances, the plumbing that they use.

One area and our Water Smart program that we've been investing in since 2009, we've invested something like $460 million of Federal money, and we've yielded about 860,000 acre feet of water that we view as conserved or contributed as new supply that we've help facilitate through that program.

One of the ongoing—I just looked at the 50 plus projects that we just announced a couple weeks ago, turf removal programs for a lot of municipalities are very highly leveraged in their water savings amongst municipalities across the West. And so we're still giving out some grants along those lines.

Senator KING. I have one question on energy efficiency. I am thinking energy, but it is a similar issue of water efficiency is price signals.

What would be the incentive for the efficiency if somebody is going to put in a low flow toilet, is there a price signal on the water that will make that a justifiable expense? In other words, are they doing it just to be good citizens or are they saving themselves money?

I think this can be something we can discuss further, but that is important. Are we talking about incremental price increases if you use above a certain amount or a regulatory requirements that new installations have to be more water efficient? It seems to me that is an important discussion because if water is the same price whether we are in a terrible drought or in a surplus situation then there is no incentive for people to do that kind of efficiency.

Mr. Michael, talk to me about your farm and the incentives for water efficiency.

Mr. MICHAEL. Well California, because of the regulatory climate, we use every resource as carefully as we absolutely can. So we have an incentive just based on our cost of production to always use things as carefully as possible.

We've installed drip irrigation on over 60 percent of our farm. We have very successful collaborative partnerships with the Bureau on modernization of the entire water district which benefits all the water users. So we've had a long history working with the Bureau. I think it's important, as you mentioned, not only to look at the very large projects, but also find ways to incentivize local efforts and work in collaboration with the Bureau and the Federal agencies to help that along.

So and then streamlining some of the environmental requirements if you were going to have some participation by the private sector in some storage projects and things like that, I think, you

know, there's ways to encourage other participation. But we are very proactive in terms of using our water resources.

Senator KING. Thank you.

The CHAIRMAN. Thank you, Senator King.

As we talk about infrastructure and updating things around this country, I think one of those areas that we forget, we want to talk about efficiency or conservation, is old water systems that just leak, how much water we lose just because of aging infrastructure.

Senator Gardner?

Senator GARDNER. Thank you, Madam Chair, and thank you for holding this hearing today. I think it is very timely.

While we in the West are talking about drought issues that may have of spurred this hearing, all of us in the West could talk about water all day, every day of the year, regardless of a drought or not. In fact parts of Colorado today are flooding. We see flooding today, and two years ago in 2013, we saw massive and catastrophic flooding in Colorado intersparced with drought in parts of the state as well.

If you just look at the needs of Colorado over the next several years, by 2050 according to the state's Department of Natural Resources, the statewide Water Supply Initiative, it is estimated that just on municipal and industry, industrial needs alone for water by the year 2050, Colorado will have to have an additional 600,000 to 1,000,000 acre feet of water. That is not even taking into account drought. That is just talking about future projected needs of MNI on our water supplies. If you look at what happens in Colorado without that water over the next several decades we lose between 500,000 and 700,000 acres of farmland through urbanization, urban water transfers, if we do not have the water that we need.

We have done a good job of conservation in Colorado. Can we do better? Obviously we all can, and we should look at ways to develop the critical conservation approaches in Colorado.

We have basically resulted, through the hard work of many people, in 18 percent water savings per capita in Colorado since the year 2000. And per capita energy—water efficiency has resulted in an 18 percent per capita water conservation rate.

If we hit the median level, though, of every water storage project that we need to get to that 600,000 to 1,000,000 acre feet of water, we are looking at a $15 billion infrastructure cost in Colorado alone simply to develop 800,000 acre feet of water, additional water that we need by 2050. That is a significant cost.

If we build every water project in Colorado that is under construction, I guess the acronym is IPP, if we build all the plans that we have, we still are somewhere between 180,000 and 500,000 acre feet short of the water that we need by 2050. So regardless of the issue of drought, which is severe and catastrophic in parts of this nation and indeed parts of Colorado, the conversation that we have to have on water in this country is real. Without drought, we need $15 billion in Colorado alone to meet our needs by 2050.

So I have a couple of questions for both of you, Reclamation and to Mr. Ogsbury.

One of the concerns that we hear is giving more flexibility or power to the Department of the Interior's Bureau of Reclamation to manage water projects. I am concerned about that and believe

perhaps we need more flexibility and management ability at the local and state levels.

Mr. Ogsbury, do you think additional flexibility at the local level, water management levels, would be preferable to more control at the Federal level over water projects?

Mr. OGSBURY. Chairwoman Murkowski, Senator Gardner, members of the Committee, the Western Governors have adopted a policy resolution 2014–03 Water Resource Management in the West. With the Chairman's permission I'd like to submit that for the record.

[The information referred to follows:]



WESTERN GOVERNORS' ASSOCIATION

Western Governors' Association
Policy Resolution 2014 - 03

Water Resource Management in the West

A. BACKGROUND

1. The scarce nature of water in the West makes it a crucial resource for the communities, industries, habitats, and farms it supports. Clean, reliable water supplies are essential to maintain and improve quality of life.

2. States are the primary authority for allocating, administering, protecting, and developing water resources, and they are primarily responsible for water supply planning within their boundaries. States have the ultimate say in the management of their water resources and are best suited to speak to the unique nature of Western water law and hydrology.

3. Many communities in the West anticipate challenges in meeting future water demands. Supplies are nearly fully allocated in many basins across the West, and increased demand from population growth, economic development, and extreme weather and fire events places added stress on those limited water resources. Sustainability of our natural resources, specifically water, is imperative to the foundations upon which the West was developed. Growth and development can only continue upon our recognition of continued state stewardship of our unique resources and corresponding responsibilities.

4. Strong state, regional and national economies require reliable deliveries of good-quality water, which in turn depend on adequate infrastructure for water and wastewater. Investments in water infrastructure also provide jobs and a foundation for long-term economic growth in communities throughout the West. Repairs to aging infrastructure are costly and often subject to postponement.

5. Western Governors recognize the essential role of partnership with federal agencies in Western water management and hope to continue the tradition of collaboration between the states and federal agencies.

6. Tribal governments and Western states also share common water resource management challenges. The Western Governors Association and Western States Water Council have had a long and productive partnership with tribes, working to resolve water rights claims.

B. GOVERNORS' POLICY STATEMENT

1. **State Primacy in Water Management:** As the preeminent authority on water management within their boundaries, states have the right to develop, use, control and distribute the surface water and groundwater located within their boundaries, subject to international treaties and interstate agreements and judicial decrees.

   a. **Federal Recognition of State Authority:** The federal government has long recognized the right to use water as determined under the laws of the various states; Western Governors value their partnerships with federal agencies as they operate under this established legal framework.

      Nothing in any act of Congress or Executive Branch regulatory action should be construed as affecting or intending to affect states' primacy over the allocation and administration of their water resources.

      Reauthorization of the Water Resources Development Act, proposed federal surplus water rulemakings, and/or storage reallocation studies should recognize and defer to the states' legal right to allocate, develop, use, control, and distribute their waters, including but not limited to state storage and use requirements.

   b. **Managing State Waters for Environmental Purposes:** States and federal agencies should coordinate efforts to avoid, to the extent possible, the listing of water-dependent species under the Endangered Species Act (ESA). When ESA listings cannot be avoided, parties should promote the use of existing state tools, such as state conservation plans and in-stream flow protections, to conserve and recover species.

2. **Infrastructure Needs:** Aging infrastructure cannot be ignored; infrastructure investments are essential to our nation's continued economic prosperity and environmental protection, and they assist states in meeting federally-mandated standards.

   a. **Federal Support for Infrastructure Investment:** Congress should provide adequate support for the Clean Water Act (CWA) and Safe Drinking Water Act (SDWA) State Revolving Funds. Further, Congress should fully utilize the receipts accruing to the Reclamation Fund for their intended purpose in the continuing conservation, development and wise use of western resources to meet Western water-related needs, including the construction of Congressionally-authorized Bureau of Reclamation rural water projects and facilities that are part of a Congressionally-authorized Indian water rights settlement.

Congress should reauthorize Water Resource Development Act (WRDA) legislation on a regular schedule and include adequate funding so all projects and studies authorized in WRDA can be completed in a timely manner.

Congress also should consider facilitating greater investment in water infrastructure, utilizing such tools as loan guarantees, revolving funds, infrastructure banks and water trust funds.

Capital budgeting and asset management principles should be used to determine funding priorities based on long-term sustainability and not annual incremental spending choices. It should be accompanied by dedicated sources of funding with appropriate financing, cost-sharing, pricing and cost recovery policies.

b. **Alternatives to Direct Federal Investment:** Federal and state policymakers should also consider other tools to promote investment in water infrastructure and reduce financing costs, including: public-private partnerships; bond insurance; risk pooling; and credit enhancements.

Congress should remove the state volume caps for private activity bonds used for water and wastewater projects, provide guaranteed tax-exempt status for bonds issued by state or local agencies to finance water infrastructure, provide loan guarantees, and otherwise support and encourage alternatives to direct federal investment of limited general funds.

c. **Hydropower:** Congress and the Administration should authorize and implement hydropower projects and programs that enhance renewable electric generation capacity and promote economic development through streamlined permitting processes, while appropriately protecting environmental resources.

d. **Infrastructure Planning and Permitting:** Infrastructure planning and permitting guidelines, rules and regulations should be coordinated, streamlined and sufficiently flexible to: 1) allow for timely decision-making in the design, financing and construction of needed infrastructure; 2) account for regional differences; 3) balance economic and environmental considerations; and 4) minimize the cost of compliance.

3. **Western States Require Innovative and Integrated Water Management.** Western Governors believe solutions to water resource challenges require an integrated approach within states and with federal, tribal and local partners. Water resource planning should occur within a framework that preserves states' authority to manage water through policies which recognize state law and the financial, environmental and social values of the water resource to citizens of the western states today and in the future.

a. **Water Transfers:** Western Governors recognize the potential benefits of market-based water transfers, meaning voluntary sales or leases of water rights. The Governors support water transfers that avoid or mitigate damages to agricultural economies and communities while preventing injury to other water rights.

b. **Energy Development:** Western Governors recognize that energy development and electricity generation may create new water demands. Western Governors recommend increased coordination across the energy and water management communities, and support ongoing work to assess the interconnection of energy and water through the Regional Transmission Expansion Planning Project for the Western interconnection and similar efforts.

c. **Conservation and Efficiency:** Western Governors encourage adoption of strategies to sustain water resources and make existing water supplies go further in light of diminished water resources and declining and inconsistent snowpack, including the use of water conservation, water reuse and recycling, desalination and reclamation of brackish waters, and reductions in *per capita* water use. The Governors encourage the use of and research into promising water-saving strategies.

d. **Local Watershed Planning:** Western Governors encourage federal agencies and Congress to provide resources such as technical support to states and local watershed groups. States can choose to empower these watershed groups to deal with local water issues associated with water quality, growth and land management as best complements state water needs.

e. **Intergovernmental Collaboration and Conflict Resolution:** Western Governors support the negotiated settlement of interstate water disputes, Indian water rights claims, and other federal water needs and claims, the settlement of which are in the best interest of Western states.

f. **State-Federal Coordination:** Western Governors recognize the important role of federal agencies in advancing sound water resource management in the Western states. Governors appreciate the efforts of federal agencies to coordinate water-related activities, particularly through the Western States Water Council, and support the continuation of these key state-federal partnerships.

4. **Western States Need Reliable Water Resource Information:** Basic information on the status, trends and projections of water resource availability is essential to sound water management.

a. **Basic Water Data:** Western Governors support the U.S. Geological Survey's Cooperative Water Program and National Streamflow Information Program (NSIP), the Natural Resources Conservation Service's Snow Survey and Water Supply

Forecasting Program, the National Oceanic and Atmospheric Administration's weather and hydrology-related data collection, monitoring, and drought information programs, and the National Aeronautics and Space Administration's National Land Imaging (Landsat) Program with its thermal infrared sensor. Western Governors support federal efforts to coordinate water data gathering and information programs across multiple agencies.

b. **Drought Information and Planning**: Western Governors encourage federal agencies to partner with states in the gathering, coordination and effective dissemination of drought-related data between the federal government and states. The National Integrated Drought Information System (NIDIS) is a successful model of state-federal collaboration in the development of information services.

   i. Governors recommend Congressional reauthorization of the NIDIS program, particularly with respect to implementation of regional drought early warning systems.
   ii. Governors support a comprehensive national policy that promotes a coordinated and integrated approach to future drought, including improved forecasting and monitoring, drought preparedness and planning, and efficient delivery of drought programs.
   iii. Governors believe that drought preparedness and contingency plans – created through partnerships of states, federal agencies and local communities – provide a proactive approach to addressing drought.

c. **Extreme Weather Events Planning**: Western Governors recognize the significant potential impacts of extreme weather variability and change on water supplies. Western Governors urge Congress and the Administration to work closely with states and other resource managers to improve predictive and adaptive capabilities for extreme weather variability and related impacts.

d. **Water Data Exchange:** The Western Governors' Association and the Western States Water Council have worked together to create the Water Data Exchange, an online portal that will enable states to share their water data with each other, federal agencies, and the public via a common platform. The Governors encourage the use of state water data in planning for both the public and private sectors.

C. GOVERNORS' MANAGEMENT DIRECTIVE

1. The Governors direct the WGA staff, where appropriate, to work with Congressional committees of jurisdiction and the Executive Branch to achieve the objectives of this resolution including funding, subject to the appropriation process, based on a prioritization of needs.

2. Furthermore, the Governors direct WGA staff to develop, as appropriate and timely, detailed annual work plans to advance the policy positions and goals contained in this resolution. Those work plans shall be presented to, and approved by, Western Governors prior to implementation. WGA staff shall keep the Governors informed, on a regular basis, of their progress in implementing approved annual work plans.

Mr. OGSBURY. And it is very emphatic about the Governor's, about the state primacy over water management authority.

Senator GARDNER. Thank you.

I think one of the challenges we also see is it has taken almost a dozen years for the Chatfield Reservoir in Colorado, which was an Army Corps of Engineers' project, to receive the approvals it needed to move forward in Colorado.

In Northern Colorado where the flooding is occurring, we have another water storage project that started in 2004, the NIST project, which could store tens of thousands of acre feet of water. Yet we still do not have the necessary permits for that project.

Is there something that we can do from a permit point of view to increase our ability to store more water as we work on the needed conservation efforts?

Mr. OGSBURY. Chairwoman Murkowski, members of the Committee, Senator Gardner, quoting from that still same policy resolution 2014–03: "Infrastructure planning and permitting guidelines, rules and regulations should be coordinated, streamlined and sufficiently flexible to allow for timely decisionmaking in the design, financing and construction of needed infrastructure, account for regional differences, balance economic and environmental considerations and minimize the cost of compliance."

Senator GARDNER. Thank you.

I think there are three legs of a stool to a sound water policy. Number one is increased water storage as we see that we need. Number two is critical conservation, what we can do to conserve more water, become more water efficient. Number three is indeed what you just said, that Federal, State, and local partnership. Whether that is funding or planning to make sure that we are taking advantage of every opportunity we can to conserve, to store additional water. And I mentioned those other projects.

There is one other project, Mr. Conner, that I wanted to ask you about. I had a great conversation with Jennifer Gimble who spent, obviously, a significant time at the Colorado Water Conservation Board and is now with the Department of the Interior. We spoke about the Arkansas Valley Conduit. It is something that was authorized under President Kennedy and has received some funding over the past several years which we are grateful for. But now we have hit the point where we need to move forward or figure out a different way to move forward, but I think the funding issues need to be resolved. We need to figure out a way to ramp up this project so we can build this desperately needed, 100-mile plus long pipeline to provide clean, abundant water to the people of the Arkansas Valley.

What specific actions would the Bureau of Reclamation, Department of the Interior like to see at the local level or state level in order for the Arkansas Valley Conduit to move forward?

Mr. CONNOR. Thank you, Senator, for that question.

I think overall it is a time of transition with respect to Arkansas Valley Conduit, and I do think we need to look at a different and better funding model.

Our goal, up until this point, at the Bureau of Reclamation has been to look at the permitting actions that needed to be done. Figure out the best alternatives in moving forward in laying out that

project and then get it to a full design phase. And that's what we've been working over the last couple years is to invest the money necessary to get to the design phase. Fully understand the cost.

Now we're close to that transition point. And what we've talked about over the last year is there a way to use state money. And I know they've got a significant low interest loan from the state. Is that enough to get the project started, to start phasing in construction, serving some of that demand? I agree with you, absolutely, it's a critical, important project.

And give us some time to look at other Federal programs that might be used to contribute to the cost of the construction. And I say that just because in as much as I think the Administration has supported a robust budget for Bureau of Reclamation, and Congress has added to it knowing the importance of water resource issues.

We're just in a bind overall, particularly with respect to these rural water supply projects. We are $1.5 billion behind with our rural water program, and I think we're looking at $300 to $400 million more for the Arkansas Valley Conduit. We need to look at cobbling together a bunch of sources.

Senator GARDNER. If there are particular actions you would like to see at the local or state level when it comes to the Arkansas Valley Conduit, I hope that you will contact my office with those so that we can share them with the local operators and water managers.

Mr. CONNOR. We will do that, absolutely, Senator.

Senator GARDNER. Thank you, Madam Chair.

Thank you.

The CHAIRMAN. Senator Daines?

Senator DAINES. Thank you, Madam Chair.

We have heard a lot from Western Senators today as well how critical water is.

I know last night when I was chatting with my wife, my wife and kids live back in Montana, I checked on how the four kids were doing. Then it was how are the three dogs doing? Then it was what does the rain gauge say? [Laughter.]

Because we just had a bunch of storms come through Montana and May has been a pretty good month. We made up for some lost time, but the West is having drought. It is a serious issue.

Though the drought conditions that we are seeing in Montana are not as severe as those in California, we still face below average snow packs. We have seen some welcome rain storms over the last few weeks, but they are not going to replace the summer snow pack runoff which normally occurs.

I want to note that the headwaters, literally the three forks of the Missouri that form it, are 30 miles away from where I grew up. In fact, recent news reports, including ones about the Flathead River Basin, show that we are at 55 percent of normal snow levels. The Kootenai River Basin, again these are up in Northwest Montana, is reporting 16 percent of normal levels.

So the concern now is that we are looking at June 2nd is what does this mean for fire season coming up around the corner?

Montana has over 7,000,000 Federal acres that are at high or very high risk of wildfire, most of which are managed by the Forest

Service. That is approximately one in four Federally-controlled acres in my home state of Montana, and nearly 2,000,000 of these forested acres are most in need of some kind of treatment because they are near populated communities or critical watersheds.

Unfortunately I was just informed by the Forest Service that the hazardous fuels treatments were only conducted on about 52,000 acres in the last fiscal year, so this current pace of treatment is unacceptable. Now we are staring at a significant fire season coming just around the corner. Our communities, our watersheds, our habitat, our access to recreation, all of these critical Montana treasures are at real risk because of wildfire.

Mr. Buschatzke, your testimony mentions how a number of national forests in Arizona were created primarily for the purpose of watershed protection. In fact, I understand the city of Phoenix set aside $200,000 for active forest management, the National Forest Foundation Project on Arizona National Forests and the purpose, as I understand it, is to protect the watersheds supplying water to our communities. Could you expand on the risk to watersheds that unhealthy forests pose?

Mr. BUSCHATZKE. Senator Daines, certainly.

So in Arizona we've looked at the condition of the forests in presettlement times, and they were less than 50 trees per acre. Today there are over 1,000 trees per acre in our forests. So they are choked. Fire risk gets high.

In the 1980's we burned about 85,000 acres in those forests. In the 1990's, about 230,000 acres. And in the 2000's, over 2,000,000 acres have burned in the forest.

So we are seeking ways to thin the forest, and honestly it's going more slowly than we would like it to go. Some of that is some of the environmental restrictions under NEPA and the Endangered Species Act. And we will look, maybe, again as we've talked potentially about streamlining some of those issues for California for transferring that same streamlining to Arizona to help with our forest issues and our forest health.

Senator DAINES. So connecting the dots there, what impact on the watershed does a wildfire pose?

Mr. BUSCHATZKE. So after the wildfire, the erosion and runoff you get from soil going into the streams creates huge water quality problems. It greatly increases the turbidity in the streams and raises the treatment costs for those cities who take that water out of those streams further downstream. That's one of the issues.

It also chokes our reservoirs with silt, and those reservoirs will rapidly fill up and lose more of their capacity over the long term. So we'll lose storage long term as well. So that's one of the other big issues that the forest fires create.

Senator DAINES. Mr. Ogsbury, in your testimony you mentioned a resolution which the Western Governors' Association had adopted in a wildland fire management. This resolution draws attention to the use of active forest and rangeland management as a means to prevent wildfire and promote healthy landscapes.

How are healthy forests linked to helping to maintain clean, reliable water for our communities?

Mr. OGSBURY. Chairwoman Murkowski, Senator Daines, Western Governors understand the interrelatedness of these various re-

sources issues on which we work, and they certainly recognize that wildfires and water supply and forest management all impact one another. I think we would certainly subscribe to the comments of the previous witness and beyond that I would ask for the ability to, or permission to answer more fully for the record.

The CHAIRMAN. We would welcome additional comments.

Mr. OGSBURY. Thank you.

Senator DAINES. Alright, thank you.

Last for Deputy Connor. Your testimony talks about how increased wildland fire risk threatens public health and a variety of resources including habitat for threatened and endangered species. What is the Department of the Interior doing to mitigate that risk?

Mr. CONNOR. A couple of areas.

To get to the point that you were talking about, you know, there is not sufficient funding that we would like to see across all the agencies with respect to hazardous fuels reduction. So what we've tried to do is expand the interest and the partnerships available to deal with that. And the Bureau of Reclamation, a couple of years ago, we started the Western Watershed Enhancement Partnership for the very reason that you identified here.

We had a couple of situations in Colorado where Denver Water and Colorado Springs Utility have faced massive maintenance costs in cleaning up post fire because of siltation and other impacts on the reservoirs. And so we've formed partnerships.

One in Montana above Hungry Horse with local entities to try and the Forest Service would add money and we would do fuels reduction right above critical water infrastructure.

So it's starting to take off. We're getting good. The city of Payson, I was out for an event last year in Arizona. We're starting to get a lot of traction with interested entities. So we're expanding upon the resources to bring to this issue.

Also we have a fire funding proposal in the President's budget. For the last two years we've gotten great support, very much appreciated. We need to get over the finish line where we can increase the cap and make available emergency funds for fire suppression so we don't have to take it out of other accounts like our hazardous fuels reduction.

Through that we would like to have more stable budgeting or fuels reduction resilient landscape activities where we can marry up fuels reduction with landscape improvements that address species issues, the health of the overall forest. And that's our goal with that budget proposal.

Senator DAINES. Well, I appreciate that, and that point that we want to be filling our reservoirs full of good, clean water and not silt as we look at one way here to mitigate the impacts of drought.

Thanks.

The CHAIRMAN. Thank you, Senator Daines.

I want to continue with Mr. Connor, the relationship between water and some of our endangered species.

When Reclamation makes decisions on supply and delivery, is the legal contract between the Bureau and water users equal to the Federal Government's statutory responsibility to protect threatened or endangered species? Is this viewed equally? And whatever your answer is, I am curious to know why? If you can just speak to that?

Mr. CONNOR. It's not necessarily viewed equally, Chairman Murkowski. It depends on the contractual language.

The vast majority of Reclamation's contracts contain what is called a shortage clause. And that clause, depending on its language, but the majority have been interpreted to say shortages to contracted amounts due to drought and even regulatory requirements result in Reclamation not delivering, not having to deliver, that quantity of water.

There are some contracts, though, where it's been found the language is different. And that has not been held to be the case.

The CHAIRMAN. Let's just use a specific example.

As I mentioned, I was in the Central Valley in California and all the discussion there is about release to provide for the Delta Smelt. So in that situation is that one where the statutory requirement to protect the smelt overrides the legal contract, again with the Bureau, for water for users?

Mr. CONNOR. It is the statutory, regulatory requirements as manifested in biological opinions are legal requirements.

The CHAIRMAN. Right.

Mr. CONNOR. That the Bureau of Reclamation has to comply with as part of making its water allocation decisions.

The CHAIRMAN. How then, as we are trying to gather the data to better understand whether or not we are making any head way, whether it is with the Delta Smelt or with others, with these environmental releases? How are we doing with our data collection?

I mentioned in my initial questioning the collaboration that is, obviously, key throughout all of our agencies. Are we also collaborating when it comes then to the data collection that is necessary for making these decisions as we are talking about these environmental releases?

Mr. CONNOR. Chairman Murkowski, I recognize that there are differing views, having read all the testimony presented today, but I think we are doing a much better job of collaborating and applying the biological opinions and I can give you several examples.

These biological opinions from NOAA fisheries and the U.S. Fish and Wildlife Service, having to do with Delta Smelt and several surmounted species, are very significant in how they affect water supply over time. But they've received a great amount of independent, scientific review which isn't always the case in all biological opinions.

The two biological opinions, I think between them, they were subject to four independent reviews prior and two reviews subsequent. The National Academy upheld them as being fundamentally and conceptually sound in their application. Having said that, they also raised issues about several of the reasonable, prudent alternatives saying that they weren't as well grounded in science and needed to be looked at closer.

We have engaged in a collaborative science program with water users, and we have gradually made incremental changes in how we apply those biological opinions. We've done a better job with resources, particularly provided by the Congress, to install monitoring stations, monitoring turbidity, where the fish are. It's given us more flexibility to operate the pumps at higher levels. We have just recently, this past year, made a change to the incidental state-

ment that applies for the Delta Smelt which was critical because we were taking smelt at the pumps in a manner that would get close to that incidental take limitation which would have caused us to re-consult.

What we did is we took new data presented by the water users. We were convinced of the scientific soundness of that data to increase the incidental take statement.

Overall I would just say we're getting better. We're making changes. You could certainly argue those changes should have been made several years ago, but we are moving in the right direction with respect to flexibility. And I do think there is data out there that does demonstrate the benefit to the fishery from the application of these biological opinions. I don't believe that there's——

The CHAIRMAN. Let me ask Mr. Ogsbury then, from the Western Governors' perspective, are we getting better? Are we doing enough? Do we have this collaboration? Are we gaining the data that is going to be helpful?

Mr. OGSBURY. Chairwoman Murkowski, Ranking Member Cantwell, as it turns out data needs emerges as one of the key themes of the Drought Forum Workshop discussions over our initiative's first year. And as we move into years two and three of the Western Governors' Drought Forum I think that focus on data and data gaps will sharpen.

One of the things we heard is yes, there's a lot of data out there, but it's poorly coordinated, disseminated, synthesized, analyzed and interpreted. So as we look forward to the coming years of the Drought Forum, we're going to explore ways to ensure that the collection and sharing of crucial drought, flooding and extreme weather related data impacts statistics and information are improved and sustained.

The CHAIRMAN. I am going to ask one more question and then turn to my colleague, and we will wrap up here.

A lot of headway, I think, with the technologies that allow us to conserve more water whether it is, as was mentioned by my colleague, Senator King, low flow toilets or what we are seeing with low drip irrigation. It is incredibly impressive. It is also very expensive, but it just goes to the point that these investments will be made for the long term recognizing that we are going to be dealing with these water and drought issues for some time, but considerable technologies that are there.

I mentioned the Energy Water Nexus in my comments. It is my understanding that in the energy producer's world there has been some pretty considerable technology that allows our energy producers, particularly in Oklahoma, to be managing water more efficiently in ways that, I think, catch a lot of people by surprise that they are actually putting more water back into the system than they are using.

Is this something that your group, the Drought Forum, Mr. Ogsbury, has been looking to in terms of best practices that are out there?

Mr. OGSBURY. Chairwoman Murkowski and Ranking Member Cantwell, absolutely. In fact, our Drought Forum Workshop series began in Norman, Oklahoma where Governor Fallin hosted our

first workshop that focus went very deep on drought's impacts on energy production.

We've learned a great deal about opportunities that energy producers have to source marginal quality water near energy operations to return cooling water to reservoirs for reuse and to adjust cooling water consumption to advance computer controls.

We've learned a great deal about the opportunities that utilities have to use reused brackish water and effluent so by all means.

The CHAIRMAN. Thank you.

Senator Cantwell?

Senator CANTWELL. Thank you, Madam Chair.

I generally think this hearing is about the new normal that we are seeing in drought conditions; we need new solutions. I thank Mr. Connor and Mr. Loranger for talking about some of those solutions.

My colleague asked you to be specific on some legislation. I wanted to get more specific on the next parts of the Yakima Basin project—things like the Kachess Reservoir and building fish ladders and things of that nature—do you see those as the logical next step?

Mr. CONNOR. I do, Senator Cantwell. I do see those as logical next steps for moving forward the comprehensive plan that exists as it addresses water supply and environmental issues and trust issues. I think it represents a very good strategy that seems to have been moving forward with broad, you know, I wouldn't say consensus because you can't get consensus on anything in the water world, but as broad a support as you can get from a number of different constituencies.

I think, you know, to be blunt there's always going to be a question of what's the appropriate Federal role in this strategy verses state and local entities. And I know the state has really stepped up to fund significant amounts of the program as soon as it got the plan was finalized.

And we are making incremental investments as strategic——

Senator CANTWELL. I know you are not an expert on agricultural issues, but isn't the Federal Government going to see this one way or another?

I mean, when you have drought, emergency drought issues related to agriculture, then people are going to come here and talk about crop loss and cost damage and they are going to ask the Federal Government to help.

So isn't this about measuring the level of investment we can make now that, I can't remember if it's you or Mr. Loranger that talked about the improvements that saved 35,000 acre feet of water that could then be used for something else? That was just like the beginning of this process, right? So isn't this about investing now so that we don't come back to the Federal Government later with all these disasters and ask for help?

Mr. CONNOR. Senator Cantwell, I think that's a very good point. I think we have made that point in other basins. And we've advocated for significant resources for funding conflict-ridden basins like the Klamath Basin. There are assistance programs, drought relief programs that have continually gone and expanded resources to address those issues. And there's an argument to be made that

these up front investments do help to head off those kind of shortages, conflicts and the relief measures that are needed.

Senator CANTWELL. So I think the thing I like best about cooperation is that farmers and ranchers and tribes and everybody come together, including fishermen, and agree on what they think is the best way to increase capacity at this point in time or the best way to relieve some of the key issues in drought. I think then their coming to the Federal Government asking for us to move faster and to support these efforts will give us more capabilities.

It is not the Department of the Interior's job to look over your shoulder and say this other agency is going to be coming and asking for billions of dollars of relief, but I guarantee you that is what is going to happen in our agricultural communities. So a little bit of prevention up front to help with this, I think, would go a long way.

Mr. Loranger, you talked about Seattle and Everett not having as serious a problem because of storage of rain water. Could you elaborate on that?

Mr. LORANGER. Yes, it was pretty clear early on that snow pack was not accumulating, and typically their reservoir management curves, they would let a lot of the winter rain go because they need capacity for the winter snow pack as it's released. And they also have responsibilities for maintaining minimal stream flows for fish downstream from the projects.

So the nature of their management is such that the rain water was adequate to get them through this season. I'm not sure about their reservoir rule curves for this next year. It seems like in the State of Washington, even on the agricultural side, there's concern and it's a very tough situation. But what they really talk about is next year because we're looking at California. And we don't have the year to year series of droughts yet and what that means for carryover in the reservoirs.

Thank you.

Senator CANTWELL. But we are likely to see that.

Ms. Cody, did you have something you wanted to add about how we look at the cost investment issues now as it relates to helping the situation?

Ms. CODY. I think you raise an interesting point, and as some people have proposed in the past, such storage would be a way to offset some of the costs in, say, crop insurance loss. I'm not either an agriculture expert on that, but we do have people at CRS that are experts in that that could help with that question and followup.

Senator CANTWELL. Okay.

Senator CANTWELL. What about some of these other innovative ideas that have been proposed through cooperation with local communities? Do you think we should support more of those at the Federal level?

Ms. CODY. I do know CRS cannot make recommendations or propose solutions. We can outline the options.

I'd say there are a lot of innovative options out there and that we've heard several of them today. I think it was John Keys who sat at this table many years ago and said water reuse is the last untapped river in the West.

I think Mike points out that a lot of these questions on what's the best option comes down to the fundamental question of what is the Federal role in these, in the water supply. Does Congress want to take that on? Is it a Federal taxpayer responsibility for these projects or is it the collaboration approaches we see with local governments? That's a policy question for Congress.

Senator CANTWELL. But why wouldn't we follow that? I mean, we are not saying that the Department of the Interior isn't involved either way?

Ms. CODY. Right, No, certainly they are.

Senator CANTWELL. I guess in this world of information and change where everything is becoming flatter, this is just one more example of where collaboration on the ground by people who do not usually agree about water.

Ms. CODY. Right.

Senator CANTWELL. Agreeing about what the best next steps are.

Ms. CODY. Right.

Senator CANTWELL. Then the Department aiding those projects to move forward whether it is in moving, their authority or in finance. This is a better way to go than saying, okay, we are going to come back to the Department of the Interior and look for a lot of top down solutions that might take another 10 years. I think this is the new normal that we are going to have for at least several years.

Ms. CODY. I see the point you're making and——

Senator CANTWELL. And so——

Ms. CODY. There is a lot of collaboration going on, yes.

Senator CANTWELL. Well, if those are the results that we can get, like the 35,000 acre square——

Ms. CODY. Right.

Senator CANTWELL. Feet saving just by doing some small things, let's figure out what we need to help the Department of the Interior to move more quickly on those kinds of projects so that they can help these communities who are making decisions together, which, again, I would think probably alleviate some of the legal battles that we have had in the past when people do not agree.

Mr. Connor?

Mr. CONNOR. Senator Cantwell, if I could just add.

As I mentioned before there are specific Federal interests, particularly in the Yakima Basin, that we are involved in and the reason for ongoing investments. But I think the President's Climate Action Plan makes it clear there is an ongoing Federal role that needs to be played with respect to these challenges that are upcoming. And so the question is recognizing the limitation of resources. We just need to be as creative as possible and figure out how we're going to address that role because it is critical, and this is the new norm.

Senator CANTWELL. Well, I definitely think, so when you talk about that, the resources. I am saying we are going to see this one way or another.

This is going to come back on to if it is in the form of, again, the agricultural losses which have a huge economic impact in Washington State. I am sure California is seeing the same thing.

I thank the witnesses. I think this has been a good discussion, Madam Chair. I do think that we should continue to get some information from our national laboratories on what they are doing work on what is the long-term impact or at least the next 10 year projection. I think that might give us some indication of what we ought to be looking at as far as helping to alleviate some of the problems, at least in the next time period.

But again, thank you for this hearing.

The CHAIRMAN. Thank you, Senator Cantwell, and thank you to each of our witnesses here today. I think that this has been a good discussion. I think that this clearly highlights why it is important that we do a broader water bill.

Initially the focus has been on California and the very dire situation there, but I think it is clear that the focus with legislation moving forward needs to be western-wide. So some of the discussion that we have heard today, I think, will help us as we formulate that.

We have had a good discussion about the collaboration, the need for flexibility, the need for some streamlining. We have got some permitting issues. Obviously storage is a key consideration. The technologies that will allow us to have greater efficiencies, greater conservation, these are all going to be critical. But I clearly agree with you, Senator Cantwell, that as we are dealing with the here and the now when it comes to water and water access, we need to be looking long-term.

Senator King was trying to give some historical context here—is this cyclical? Is this a thousand year event?

Whether or not we have defined that, I think going forward we need to be trying to be as long-term in our view and our vision on this as possible because if this is the new normal going forward, then we have got a lot of work to be doing. We are willing to take up that work here in the Committee, again, working with many of you.

We appreciate the perspectives that you have lent. Thank you, again, for your time this morning.

With that, we stand adjourned.

[Whereupon, at 12:06 p.m. the hearing was adjourned.]

APPENDIX MATERIAL SUBMITTED

U.S. Senate Committee on Energy and Natural Resources
June 2, 2015 Hearing: Drought Conditions in the Western United States
Questions for the Record Submitted to The Honorable Michael Connor

Questions from Chairman Lisa Murkowski

Question 1: Which federal and state agencies does the Bureau of Reclamation work most closely with in coordinating on policy and impacts in terms of water delivery in California and in the Lower Colorado Region? How does that compare with other states in the West? Could you give an example of how often Reclamation officials meet with representatives other agencies in terms of days in an average week or month they meet in California? What level are agency representatives? How often have meetings been held in California in the last six months? The lower Colorado River Basin? Primary purpose for the meetings? Can you give a brief summary of actions stemming from the California meetings in the first quarter of 2015?

Response: In every state where the Bureau of Reclamation (Reclamation) owns and operates water infrastructure, there are regular channels of communication with state and federal wildlife agencies, water management agencies, water rights offices, and other entities involved in natural resources management at the state and federal levels. Reclamation operates in conformity with state water law across the west (though there is a unique legal framework in the Lower Colorado River Basin), and delivers water pursuant to contracts with water users, many of which are constituted under state law. These working relationships are well established, and this situation is not unique to the Lower Colorado or the Mid-Pacific Regions of Reclamation.

In the case of the Mid-Pacific Region, the ongoing drought has necessitated an extremely rapid tempo of coordination with state and other parties to adapt the operation of existing water infrastructure in real-time as conditions dictate. As referenced in our testimony, Reclamation has worked constructively with the California Department of Water Resources (DWR), California Department of Fish and Wildlife (CDFW), State Water Resources Control Board (Board), U.S. Fish & Wildlife Service (FWS), and National Marine Fisheries Service (NMFS) to adjust project operations and export pumping, fine-tune reservoir releases, manage in-river temperatures, and control salinity in the Sacramento-San Joaquin Delta for the benefit of fish species and water users. The specific personnel and frequency of these meetings varies widely depending on the projects' needs on a given day. In summary, several multi-agency work teams are very active and post their weekly and monthly activities online such as the Smelt Working Group[1], Delta Operations for Salmon and Sturgeon Technical Work Group,[2] Water Operations Management Team[3], Delta Conditions Team, Sacramento River Temperature Task Group[4], Clear Creek Technical Team, American River Group, Stanislaus Operations Group[5], and the Real Time Drought Operations Management Team (RTDOT). The RTDOT has been

[1] http://www.fws.gov/sfbaydelta/cvp-swp/smelt_working_group.cfm
[2] http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/doss.html
[3] http://www.water.ca.gov/swp/operationscontrol/calfed/calfedwomt.cfm
[4] http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/srttg.html
[5] http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/sog.html

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meeting at least weekly during the WY2014 and WY2015 drought to discuss the real time constraints and opportunities related to water operations.

In the first quarter of 2015, Reclamation, with the participation of the teams listed above and others, has been focused on preserving system storage in the face of very challenging hydrology, maintaining compliance with salinity requirements in the Delta, complying with biological opinions governing operation of the Central Valley Project and capturing runoff from what few storms have occurred over California. To date, the operations informed by these groups have prevented any unauthorized take of listed species, enabled water deliveries to continue on an albeit limited basis, maintained compliance with water quality objectives including Delta salinity, and enabled the conservation of nearly 300,000 acre-feet of water that would otherwise not have been saved.

The Lower Colorado (LC) Region works closely with the seven Colorado River Basin States (Arizona, California, and Nevada in the Lower Basin, and Colorado, New Mexico, Utah, and Wyoming in the Upper Basin), Mexico, Native American Tribes, the International Boundary and Water Commission (IBWC), the Western Area Power Administration (WAPA), the National Park Service (NPS), other Federal Agencies, environmental organizations, and interested stakeholders on communicating the impacts of the on-going drought, possible impacts to operations and water deliveries (pursuant to applicable law and operational agreements), and drought response planning efforts. These meetings are primarily informational in nature.

Reclamation management actions related to water delivery for the lower Colorado River Basin are informed by routine, ongoing meetings with the affected tribes, states, and water users throughout each year. In addition information regarding the status of Colorado River reservoirs is shared as part of the process of stakeholder consultation and input during preparation of each year's Annual Operating Plan. The Colorado River Annual Operating Plan memorializes operational decisions that are made pursuant to individual federal actions and serves as a single, integrated reference document required by federal law regarding past and anticipated operations in the upcoming year.

- Lake Mead's operational condition is based on criteria set forth in the Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead adopted in 2007, found here: http://www.usbr.gov/lc/region/programs/strategies.html.
- In calendar year 2015, pursuant to the 2007 Interim Guidelines, the Lower Basin is operating in a Normal/ICS Surplus Condition, which means full water deliveries for U.S. water users and Mexico, and the potential for U.S. water users to create or take delivery of Intentionally Created Surplus (ICS) in 2015.
- The determination for the 2015 operating condition was made in August 2014 and documented in the 2015 Annual Operating Plan for Colorado River Reservoirs, found here: http://www.usbr.gov/lc/region/g4000/aop/AOP15.pdf.

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- This operating condition for 2015 will be implemented as determined in August 2014 and California will continue to receive its full Colorado River allocation in 2015.

The LC Region conducts additional meetings with California water agencies in the lower Colorado River Basin, including:

- Discussions on current conditions and projected operations at least weekly, or several times per week, on an operational level.
- Discussions on current conditions, projected operations, potential drought impacts, and technical modeling questions at least monthly, or several times per month, as needed.
- Discussions on California issues, the drought, and drought response planning efforts on both executive and technical levels severally times annually, as needed.
- Representatives from California participate in binational discussions to implement Minute 319.

Question 2: Given your close coordination with the federal and state fish agencies, can you give me a sense of what kind of information to they provide to Bureau officials in their recommendations to Reclamation regarding water releases of water across the West?

Response: Federal and state wildlife agencies assist Reclamation with a variety of environmental objectives, including compliance with biological opinions, conducting river restoration and habitat restoration activities, providing in stream flows, managing water quality and temperatures, addressing impacts from invasive species, and many other activities. Key to this assistance is wildlife agencies' expertise in documenting the needs of species and the effects of water infrastructure on the natural environment.

Question 3: Has Reclamation provided funding to FWS to collect data on the status of the smelt in the California Bay Delta. If so, what level of funding has it been? Is this a common elsewhere in the West between the Bureau and FWS? Is that a sustainable practice to ensure Reclamation can meet its mission effectively?

Response: Reclamation and FWS have actively coordinated to develop early warning surveys to provide information on Delta smelt distribution that will inform water operations in WY2015. The overall intent for early warning surveys is to inform FWS and others whether, during weather events, substantial numbers of Delta Smelt are moving, or being moved, into areas potentially subject to entrainment. This information will allow exports to continue as long as Delta smelt are not in the area of influence of the pumps. The early warning surveys were initiated in December 2014 and continued into 2015. A FWS proposal dated September 26, 2014, identified resource needs totaling $830,000. Reclamation, FWS, CDFW and DWR collaborated to leverage available funds from all agencies and integrate Delta smelt and salmonid trawl efforts to improve efficiency. This

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arrangement is a valuable example of interagency coordination toward a shared objective, and is sustainable where warranted.

Questions from Senator Jeff Flake

Question 1: In your written testimony you refer to 20 pre-proposals received for short-term projects under the Pilot System Conservation Program.

a. How many of the pre-proposals are in the lower basin and how many are in the upper basin?

Response: All of the pre-proposals received to date are from entities in the Lower Basin. The Upper Basin is in the process of seeking pre-proposals.

b. What is the anticipated timeline for project implementation?

Response: Most projects are anticipated to be implemented in fiscal years 2015 and 2016. Some projects may have a longer implementation period.

c. What is the status of selecting a contracting agent for the Upper Basin projects?

Response: The Upper Colorado River Commission (UCRC) accepted the role as the contracting entity for the Pilot System Conservation Program (Program) in the Upper Basin in December 2014, and on May 8, 2015, memorialized its commitment in an agreement.

d. What are the project types and the projected water conservation estimates for the projects which have been selected?

Response: To date, one Program project has been selected. The project is a forbearance project that will create system conservation through a reduction of agricultural water consumptive use (fallowing) on fields in the Muddy and Virgin River Basins upstream of Lake Mead. The conserved water will flow to Lake Mead and increase overall Lake Mead storage. The amount of system conservation will total 15,000 acre-feet for 2015 and 2016. Currently Reclamation and the Program funding partners are considering 7 other projects for funding. These projects encompass a wide range of concepts from a diverse group of entities.

e. How many of the pre-proposals and selected projects involve Native American tribes?

Response: Reclamation has two projects under consideration from Native American tribes. In addition, one Native American Tribe which initially submitted

a pre-proposal recently elected to not participate in the program. Another tribe submitted a pre-proposal for a project that did not qualify under the Program .

f. What if any legal barriers are there to tribal participation in the Program?

Response: There are no legal barriers to tribal participation in the Program. The Program's eligibility requirements apply to Native Americans and non-Native Americans equally. Any Native American entity that has a Colorado River water entitlement and can demonstrate a history of use for the water that would be conserved pursuant to the Program is eligible to participate in the Program.

g. Please provide a copy of the guidelines or criteria for considering which projects will be funded.

Response: Criteria for determining which projects will be selected may be found in Enclosure 2 to Reclamation's October 2014 solicitation letter to Lower Basin Colorado River water entitlement holders (attached) under the section entitled "Selection".

Question 2: How are planned or potential Intentionally Created Surplus withdrawals factored into the models that are used to produce the Bureau of Reclamation's 24-month study for operation of Hoover Dam and Lake Mead?

Response: Each month, Reclamation uses the best available information to develop the 24-Month Study for the operation of Lake Mead and other Colorado River System reservoirs. This process includes discussions with water users in the Lower Basin for additional operational information to improve water use projections in the 24-Month Study model.

Question 3: In your response to a question from Senator Murkowski, you referred to a MOU that has just been signed between the states to create another 1,000,000 acre-feet by 2018.

a. What is status and timeline for implementing the MOU including the necessary approval for conservation and storage programs included or contemplated in the MOU, such as CAP's Intentionally Created Surplus program referenced in Section 3(b)(iii) of the MOU?

Response: The MOU became effective December 10, 2014 for a 5-year period. Central Arizona Water Conservancy District (CAWCD) is currently in the process of acquiring necessary signatures from the eleven parties as part of the approval process for its Intentionally Created Surplus (ICS) plan. CAWCD may designate the ICS created under this plan to help meet Protection Volume goals contained in the MOU.

b. How much protection volume will be created by each participant and what is the estimated contribution by each participant for 2014 and 2015?

Response: Under the MOU, Reclamation, CAWCD, SNWA, and MWD will make best efforts to generate 740,000 acre-feet of Protection Volume during the 2014 to 2017 timeframe.

- 50,000 acre-feet by Reclamation
- 345,000 acre-feet by CAWCD
- 45,000 acre-feet by SNWA
- 300,000 acre-feet by MWD

Reclamation has begun moving forward with activities to generate 50,000 acre-feet of Protection Volume in the 2014-2017 timeframe to help meet Reclamation's commitments in the MOU. The Lower Colorado (LC) Region received $8.6 million of the Drought Funding in 2016 for three projects to help meet this goal.

In 2014, CAWCD left 18,290 acre-feet of unused apportionment in Lake Mead. This water may be applied toward CAP's Protection Volume goal of 345,000acre-feet in the 2014-2017 timeframe.

In 2014, SNWA left 10,384 acre-feet of unused apportionment in Lake Mead. This volume may be applied toward SNWA's Protection Volume goal of 45,000 acre-feet in the 2014-2017 timeframe.

It is anticipated that CAWCD and SNWA will leave additional unused water in Lake Mead and/or create ICS that may be applied toward Protection Volume goals in 2015.

MWD will use best efforts to create 300,000 acre-feet of Protection Volume in the 2014-2017 timeframe.

Question 4: In preparation for times of possible Colorado River shortages, Arizona has stored over 9 million acre-feet of water underground, of which about 4 million acre-feet has been stored by the Arizona Water Banking Authority to be used to firm Central Arizona Project ("CAP") supplies during the shortage and to support interstate water banking agreements. The ability to recover this water and deliver it to water users during times of shortage is critical to Arizona's long-term water strategy. I understand that the Bureau of Reclamation ("USBR") and CAP have been working for several years to develop and implement agreements that would allow the flexibility to recover and deliver

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this water using CAP infrastructure. With a shortage declaration likely in the near future, there is heightened interest in these agreements. Can you please provide:

a. An update on the status of discussions between the USBR's Phoenix Area and Lower Colorado Region offices, and the CAP staff regarding the development and implementation of a Standard Form Wheeling Agreement as contemplated in the Master Repayment Contract between the CAWCD and the USBR.

Response: The concept of wheeling non-project water through the Central Arizona Project was originally envisioned in Article 8.18 of the Contract between the United States and CAWCD for the Delivery of Water and Repayment of Costs of the CAP, dated December 1, 1988 (Master Repayment Contract). The Master Repayment Contract states that non-project water may be wheeled through project facilities pursuant to wheeling agreements between CAWCD and a third party, approved by Reclamation.

CAWCD developed a Staff Proposal for Wheeling Non-Project Water Supplies and was directed by their Board to forward that proposal to Reclamation for discussion and comment in October 2014. The proposal outlines a set of agreements between Reclamation and CAWCD that establish the foundation for a wheeling program.

Reclamation and CAWCD have been meeting and communicating regularly and have developed a cooperative vision and schedule on how to move the process forward. Reclamation is currently engaging in formal tribal consultation. Following formal consultation and comment from the Tribes, Reclamation intends to finalize negotiations of a Standard Form of Wheeling Agreement with CAWCD.

b. The status of related discussions between CAP and the USBR to prepare agreements to recover and deliver Arizona Water Banking Underground Storage Credits during Colorado River shortages.

Response: When necessary, recovery activities will be implemented to meet both the State of Arizona and the United States firming obligations. While CAWCD will act as the recovery agent for the Arizona Water Bank to recover water for both Indian and municipal firming commitments, Reclamation is responsible for the United States' firming obligations to the Tribes. There are many similarities between the program being developed to wheel non-project water and the use of the CAP canal to deliver recovered water for firming purposes and, therefore, it makes sense to develop criteria for both programs simultaneously. Reclamation is committed to working with CAWCD to finalize both the wheeling and recovery programs.

c. The anticipated schedule to complete and implement these agreements.

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Response: Reclamation met with the Arizona Tribes on June 25, 2015 to discuss the wheeling program. After that meeting, Tribes, at their request, will be offered individual formal consultations. Reclamation anticipates final comments from the Tribes by the middle of July and will then engage in final negotiations with CAWCD and final public comment.

Question 5: Thirteen of the twenty-two federally recognized Indian tribes in Arizona have either partially or fully resolved outstanding water rights claims through settlement with Indian and non-Indian parties. Many of those settlements are premised on the delivery of Central Arizona Project ("CAP") water. Likewise, yet-to-be resolved Indian water rights claims in Arizona are likely to include some component of CAP water deliveries – the Arizona Water Settlements Act of 2004, specifically reserved 67,300 acre-feet for that purpose. With a high probability of a shortage declaration on the Colorado River and the corresponding reduction of CAP supplies, can you explain:

a. What the Department of the Interior (the "Department") has done to consider the potential impact those reductions might have on United States trust obligations to Native American communities in Arizona that rely on CAP supplies?
b. How those reductions could impact settlement opportunities for those tribes in Arizona that have not settled their water rights claims?
c. The level of consultation the Department has undertaken or intends to take with those tribes that could potentially be affected by a shortage declaration.

Response:

a. Arizona Indian tribes have been allocated 348,079 acre-feet (AF) of Indian priority CAP water either through settlement or as a part of original tribal CAP allocations. Indian priority water is the highest priority within the CAP system. Based upon current water use data, it is not expected that Indian priority CAP water will be impacted until shortage declarations reach below a level 3 shortage (Lake Mead elevation at or below 1025 ft.). This means that non-Indian agricultural uses would be cut before there are any cuts to Indian priority water.

In addition to Indian priority CAP water, the Arizona Water Settlements Act of 2004 (AWSA) reallocated 197,500 AF of Non-Indian agricultural (NIA) priority CAP water for use by Arizona Indian tribes. 102,000 AF of this water was allocated to the Gila River Indian Community, 28,200 AF was allocated to the Tohono O'odham Nation, and 67,300 AF was reserved for future Indian water rights settlements. In times of shortage, NIA priority water that is not firmed is eliminated entirely before any deliveries of Indian Priority, firmed NIA priority, or Municipal & Industrial (M&I) priority are cut.

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Pursuant to AWSA, the United States and the State of Arizona (State) are required to "firm" 60,648 AF of the reallocated 197,500 AF of NIA priority CAP water for tribes. Of the total 60,648 AF of firmed water, 15,000 AF is being firmed for the Gila River Indian Community by the State and 28,200 AF is being firmed by the United States for the Tohono O'odham Nation. The White Mountain Apache Tribe Water Rights Quantification Act allocated 23,782 AF of the NIA priority CAP water to the White Mountain Apache Tribe, 7,500 AF of which is to be firmed by the both the State and the U.S. During times of shortage, "firmed" NIA water is to be delivered in the same manner as water with a M&I delivery priority.

b. Arizona has been very successful in settling Indian water rights claims. Claims totaling approximately 1.1 million AF have been settled. However, over one million AF of Indian water rights claims remain pending in current adjudications. The amount of available CAP water, the priorities of that water, and the real threat of reductions of water from the Colorado River are all significant hurdles to settle remaining water rights in Arizona. There is no more Indian priority water, with its relatively protected status, to allocate. There is 43,518 AF of NIA priority CAP water remaining for use in future settlements. The priority of this water and its susceptibility to shortage makes it generally unattractive to tribes for settlement purposes. Even "firmed" NIA priority water, of which only 17,448 remains available, is considered by many tribes not to be an appropriate equivalent to federal reserved water with very senior priority dates. Tribes are understandably reluctant to waive claims to federal reserved water rights in exchange for promises of increasingly less reliable CAP water. The historic reliance on CAP water to settle Indian water right claims is drawing to a close. New water supplies and more creative settlement mechanisms must be developed in order to avoid the "winners and losers" scenario that litigation may ultimately produce.

c. The United States has taken significant steps to be transparent with respect to potential Colorado River shortages with all Arizona citizens including the tribes. An intensive series of consultations with all affected water users in the Basin States, including tribes, was held from 2005 through 2007, prior to issuance by the Secretary of the Interim Shortage Guidelines. Tribal impacts were specifically addressed in a tribal Listening Session convened in December of 2011, hosted by the Counselor to the Secretary and the Deputy Assistant Secretary for Indian Affairs. During that session, the Department presented information about the CAP supplies available for existing and future Indian water rights settlements and heard tribal concerns. Another tribal listening session was convened in December of 2014, at the Inter-Tribal Council of Arizona which included discussion of anticipated shortages and the Pilot System Conservation Program being implemented by the United States and the Basin States. Finally, by letters dated June 1, 2015, tribes with CAP allocations were advised of potential shortages to the 2016 CAP supply pursuant to their CAP water delivery contracts. The Department intends to continue a dialogue with the tribes as shortages develop. The subject of CAP water availability and its consequences are a central topic in all on-going settlement negotiations in Arizona.

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Question 6: Please explain the difference in how evaporative losses are accounted for in the lower basin of the Colorado River as compared to the upper basin.

Response: The Colorado River Basin Project Act of 1968, Public Law 90-537, directs the Secretary of the Interior to "make reports as to the annual consumptive uses and losses of water from the Colorado River System after each successive five-year period . . . ." These reports reflect the Department of the Interior's best estimate of actual consumptive uses and losses (including evaporative losses) for each year within the Colorado River Basin (available at: http://www.usbr.gov/uc/library/envdocs/reports/crs/crsul.html).

In accordance with the Upper Colorado River Basin Compact (63 Stat. 31) of 1948, evaporative losses in the Upper Basin reduce water supply available to the Upper Division States.

The Consolidated Decree entered by the Supreme Court of the United States in Arizona v. California (547 U.S. 150 (2006)) requires the Secretary of the Interior to annually publish a report on the diversions from the mainstream, returns of such water and consumptive uses within the Lower Basin. The Colorado River Accounting and Water Use Report: Arizona, California, and Nevada (available at www.usbr.gov/lc/region/g4000/wtraccttypes.html#decree) serves as the official record of water use for the purposes of administering water entitlements, State apportionments and other facets of the "Law of the River." Per the Consolidated Decree, diversions, return flows and consumptive uses of Colorado River water are measured and accounted for at the point where the water leaves or returns to the Colorado River. Evaporative losses that occur once the water has been diverted from the river (point where water leaves Colorado River) are considered to be a part of the consumptive use of individual water users and the state within which such losses occur.

Question 7: In response to a question from Senator Heinrich regarding cost-effective approaches to increasing water supplies, you noted that the Bureau of Reclamation must consider the demands that a project is trying to meet and the cost of the array of options available to meet those demands. Referring to "back-of-the-envelope" calculations, you estimated that large-scale projects such as the Black Rock Reservoir and Auburn Dam might cost between $17,000 to $46,000 per acre-foot, while WaterSMART conservation projects cost between $500 to $800 per acre-foot. Please provide a table with the cost per-acre foot of:

a. All WaterSMART grants issued in FY15;
b. All Title XVI grants issued in FY15;
c. The twenty-six congressionally authorized Indian water rights settlements enacted since 1978, excluding operations, maintenance and replacement costs (adjusted for inflation);
d. The sixteen congressionally authorized Indian irrigation projects, excluding operations, maintenance and replacement costs (adjusted for inflation); and

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e. The eleven congressionally authorized rural water projects enacted between 1980 and 2007, excluding operations, maintenance, and replacement costs (adjusted for inflation).

Response: While it is possible to develop informal estimates of the cost per acre foot for any number of federal and non-federal water resources development projects, Reclamation does not have readily available tables that show the cost of water per acre foot for the individual projects funded through the programs cited. Reclamation's Web site provides descriptions of each project funded under WaterSMART Grants and the Title XVI Water Reclamation and Reuse Program in FY 2015[6] and prior years, which include the number of acre-feet of water savings or additional water deliveries expected to result from each project once completed, along with brief reference to the other benefits of each project that are expected to increase water management flexibility.

From 2010-2015, Federal appropriations for WaterSMART Grants totaled over $127 million. That funding is being leveraged with over $390 million in non-Federal funding to complete over $500 million in improvements, which are expected to result in annual water savings of over 570,000 acre-feet once completed. One could perform a basic calculation to achieve a cost per acre-foot based on the federal investment alone, or a cost per acre-foot based on all funding, federal and non-federal, but because of the variety of project benefits and their varying degrees of completion as discussed below, Reclamation does not prepare or publish such a figure.

Note that in addition to water savings, WaterSMART Grant projects accomplish a variety of benefits, including installation of advanced measurement components, renewable energy components, and habitat restoration, as well as some planning activities that do not themselves result in quantifiable water savings but are intended to set the stage for future water management improvements. Projects are selected based on the extent to which they are expected to save water, increase energy efficiency and the use of renewable energy in water management, support environmental benefits, facilitate and support water markets, and mitigate conflict risk in areas at a high risk of future water conflict.

For example, as part of one WaterSMART Grant project funded in FY 2013, the Avra Valley Irrigation and Drainage District near Tucson, Arizona, is using $300,000 in federal funding to line 3.2 miles of canal to address seepage losses, which is expected to result in water savings of 525 acre-feet annually. The district's project includes other significant elements that do not add water savings but increase flexibility in other ways, including installation of flow meters and two new, more-efficient electric motors on irrigation pumps. In addition to the water savings that will enable the District to reduce groundwater pumping and therefore contribute to sustainable management of the aquifer in the Tucson

[6] www.usbr.gov/WaterSMART/docs/2015/fy2015WEEGprojects.pdf
www.usbr.gov/WaterSMART/docs/2015/fy2015TitleXVIprojects.pdf
www.usbr.gov/WaterSMART/docs/2015/fy2015TitleXVIfeasibilitystudies.pdf

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Active Management Area, the district also expects to reduce energy consumption by approximately 2,635,918 kilowatt-hours each year through avoided pumping and installation of more efficient motors. Viewing this project solely in terms of cost per acre-foot of water savings would not fully capture the multiple benefits that result from the work being completed.

Similarly, congressionally authorized water recycling projects are selected for funding each year based on not only the amount of water expected to be made available, but the specific concerns being addressed by the project, costs of the proposed project compared to other alternatives available to that project sponsor, any renewable energy components, and the extent to which the project is part of a watershed-based planning effort, among other criteria. Costs of individual water recycling projects vary considerably depending on a number of factors, depending on the extent of treatment facilities necessary, the delivery infrastructure involved, and energy costs, among other significant variables. Water recycling typically provides water managers with flexibility, helps to diversify the water supply, and reduces pressure to transfer water from agricultural to urban uses. This is especially true in urban areas where water recycling and reuse is a critical tool to create local, drought proof water supplies and reduce the reliance on imported water.

Since 1992, Reclamation has provided approximately $626 million in federal funding to congressionally authorized Title XVI water recycling and reuse projects. This funding has been leveraged with more than $2.4 billion in non-Federal cost share. Based on information provided by project sponsors, it is estimated that in fiscal year 2014 Title XVI projects delivered approximately 378,000 acre-feet of recycled water. It is important to note that significant funding has been dedicated to project phases that are still under construction and that will result in additional water deliveries once complete. As a result, recycled water deliveries from Title XVI projects are projected to increase to more than 416,000 acre-feet in fiscal year 2015, and will continue to increase as more project phases come on-line.

It is also important to note that because water conserved through WaterSMART Grants and delivered by Title XVI projects repeats each year that the improvement or facility is operational, in order to arrive at an accurate cost per acre-foot, the cost of the project must be spread out over the entire life of the project and not simply divided by the water saved or produced in one year.

Questions from Senator Debbie Stabenow

Question 1: What is the Department doing to coordinate its drought-related cost-share programs, such as the WaterSMART Program, with similar efforts at the Department of Agriculture, such as the Environmental Quality Incentives Program or the Regional Conservation Partnership Program (RCPP), which had a focus on combatting drought in the recently announced second round of RCPP projects?

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Response: In 2011, Reclamation and the Department of Agriculture's Natural Resources Conservation Service (NRCS) began a partnership to leverage funding for water delivery agencies and agricultural producers in California: through a competitive process, Reclamation makes funding available to irrigation districts and other entities so that improvements that save water or improve water management can be made in the systems that deliver water to farmers. NRCS, in turn, makes funding available to farmers who receive water from those districts so that on-farm conservation improvements could also be made throughout those five districts.

In 2012, Reclamation began to work with NRCS to expand this collaborative effort throughout the West. Reclamation's WaterSMART Grants funding criteria now encourage applicants to describe in detail how their projects would directly expedite future on-farm irrigation improvements, including future on-farm improvements that may be eligible for NRCS funding. Once new WaterSMART Grants have been selected, Reclamation and NRCS coordinate so that on-farm water conservation improvements that complement the water delivery improvement projects selected through WaterSMART Grants may be considered for NRCS funding and technical assistance, to the extent such assistance is available.

Over the last year, Reclamation and NRCS have continued to work together to identify additional ways to ensure that WaterSMART Grants funding opportunity announcements fit together with NRCS's new Regional Conservation Partnership Program. This year, for example, Reclamation made additional revisions to WaterSMART Grants funding criteria to make clear that applications that are related to a proposed RCPP project may receive additional consideration during Reclamation's selection process.

Question 2: Does the Department have the authorities and resources it needs to coordinate its drought response efforts with other federal programs such as the Department of Agriculture's conservation programs? What additional authorities or resources would improve the Department's drought response efforts?

Response: The Department is not seeking additional programmatic authorities to coordinate its drought response efforts.

Question 3: When will the Department reach the authorized spending limit set forth in Sec. 9504 of PL 111-11, as amended by the omnibus appropriations act of FY15? What Department programs will be impacted if this spending limit is not raised by Congress, and how will they be impacted?

Response: Reclamation estimates that approximately $66 million of the authorized appropriations ceiling remains after FY 2015 appropriations. The President's 2016 budget includes a total of $32 million for programs that rely upon the authority of Sec. 9504(e). WaterSMART Grants, the Water Conservation Field Services Program, California-Bay

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Delta Water Conservation, and some activities that are part of the Drought Response Program rely upon the authority of Section 9504(e) of the SECURE Water Act, which now authorizes $300 million to carry out financial assistance agreements for water management improvements. These programs make competitive, cost-shared funding available to non-federal entities and provide an important tool for water managers to increase flexibility in their operations. If the authorized spending limit were reached, Reclamation would be forced to suspend funding opportunities until additional authorization was provided. Language is included as part of the 2016 Budget to increase the authorized appropriations ceiling by $100 million to a total of $400 million.

Question from Senator Mazie K. Hirono

Question: According to the third U.S. National Climate Assessment, "In Hawaii, average precipitation, average stream discharge, and stream baseflow have been trending downward for nearly a century, especially in recent decades, but with high variability due to cyclical climate patterns as the El Niño-Southern Oscillation and the Pacific Decadal Oscillation. On most islands, increased temperatures coupled with decreased rainfall and increased drought will reduce the amount of freshwater available for drinking and crop irrigation."

While Hawaii is not currently experiencing a drought emergency, based on history as well as future predictions as outlined in the aforementioned assessment, Hawaii will experience drought in the future. Being an island state introduces unique challenges with regards to water storage and an inability to rely on other states to provide us water-challenges that, coupled with our sensitivity to climate change, give our state a heightened sense of urgency to proactively plan for drought emergency scenarios. Can you talk a little bit about how the Department of Interior partners with other government agencies to provide states and communities tools to make long-term preparations to proactively deal with drought situations? Can you identify specific programs or resources that are available to folks in Hawaii?

Response: Reclamation has recently reformulated our drought program to improve our ability to work proactively with States, tribes and local governments to *prepare for* and respond to drought. Reclamation has been providing emergency drought assistance to States and tribes under the Reclamation States Emergency Drought Relief Act of 1991 (Drought Act) since 1991. Going forward, Reclamation believes that program funding can be used more effectively by focusing on mitigation actions and planning to increase resiliency to drought in advance of a crisis. Through the new Drought Response Program, Reclamation will provide financial assistance on a 50/50 cost-share basis to fund the preparation of drought contingency plans and to implement water management projects that will build long-term resiliency to drought (drought resiliency projects).

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Reclamation has authority under the Drought Act to provide both emergency assistance, and financial or technical assistance with drought contingency planning to State, tribal and local government entities in Hawaii. In 2005, Reclamation worked with the State of Hawaii to develop a drought contingency plan under the original drought program. However, Reclamation is relying on Section 9504(a) of the SECURE Water Act (Subtitle F of Title IX of Public Law (P.L.) 111-11) to fund drought resiliency projects under the new program, since the Drought Act includes limited construction authority. The SECURE Water Act authority does not authorize drought resiliency projects in Hawaii. In extreme situations, Reclamation can still conduct emergency response actions in Hawaii. This would include for example, installation of temporary pipes and pumps, water hauling, water purchases and nonfinancial assistance to willing buyers and sellers of water.

Reclamation's authorities in Hawaii also include the Title XVI Water Reclamation and Reuse Program (authorized under P.L. 102-575, as amended). There are currently three congressionally authorized Title XVI projects located in Hawaii: (1) Kalaeloa Seawater Desalination Project; (2) Lahaina Water Recycling Project #3; and (3) Kealakehe Water Recycling Project. The sponsors of these three projects are eligible to apply for Title XVI funding each year under the annual Title XVI funding opportunity announcement for authorized projects. To date, none of the sponsors of these three projects have submitted applications for funding.

As noted above, applicants located in Hawaii are currently not eligible under the SECURE Water Act, which provides authority for Reclamation's WaterSMART Grants and other programs. However, during the 113th Congress, Reclamation testified in support of S. 2019 (Schatz), legislation to raise the authorization ceiling for WaterSMART Grants under the Secure Water Act of 2009 (PL 111-11), clarify that activities related to drought are authorized under the program, and revise the program's eligibility to include the State of Hawaii.

Beyond Reclamation's drought related activities in Hawaii, the U.S. Geologic Survey (USGS) works cooperatively with Federal, State, and local agencies to provide information and tools needed to proactively address periodic drought in Hawaii. To assess the status and trends of water resources, the USGS currently monitors about 20 rainfall stations, 45 groundwater wells and 70 streamflow and reservoir sites in Hawaii. Through its Groundwater and Streamflow Information Program, the USGS contributes about $640K annually in matching funds to the Federal-State cooperative water-resource monitoring program in Hawaii. To assist with decision-making, a summary of recent hydrologic conditions in Hawaii is provided on a quarterly basis to water-resource managers, scientists, and the public through a series of web pages.

In addition, the USGS WaterWatch web page, which provides streamflow information on past, current, and drought conditions in Hawaii, can be accessed through the Hawaii Drought Monitor web page maintained by the Hawaii Commission on Water Resource Management. To assess the impact of water (including drought) and land-use changes on

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water availability, the USGS periodically updates water-budget and groundwater models for the five major Hawaiian Islands. For example, the impact of historical drought conditions on groundwater recharge was recently assessed for the islands of Oahu and Maui. In fiscal year 2015, the USGS supported more than $1.1M in Water Availability and Use Science in Hawaii. As part of this program, the USGS recently provided grants through the Water Resources Research Act to the University of Hawaii for their scientists to collaborate with the USGS on the development of monthly rainfall maps and groundwater flow models that can be used to assess impacts of droughts on water availability. To better understand water use in Hawaii, the USGS Water Availability and Use Science Program is providing a grant ($80,000) to the Hawaii Commission on Water Resource Management in fiscal year 2015. The USGS Pacific Islands Water Science Center remains committed to providing useful and timely information for management of our limited water resources during periods of drought.

Enclosure 2

Pilot System Conservation Program (Pilot Program)
Requirements for the Lower Division States
Pursuant to Agreement No. 14-XX-30-W0574, Dated July 30, 2014

Purpose:

To achieve a voluntary, measurable reduction of consumptive use of Colorado River System water to increase storage in Lake Mead to benefit the Colorado River System. The conserved Colorado River System water will not accrue to the benefit or use of any individual Colorado River water user.

Selection:

For this solicitation, the Parties including the Metropolitan Water District of Southern California, the Southern Nevada Water Authority, the Central Arizona Water Conservation District, Denver Water, and the Bureau of Reclamation will jointly select proposals for inclusion in the Pilot Program based on factors provided in subarticle 5.5 of the Funding Agreement. Please submit a pre-proposal of up to two pages that includes the following information:

- Project description;
- Amount of Colorado River System water to be conserved either per year or over the life of the proposed project;
    - Provide supporting information or methodology for the estimated reduction in consumptive use;
    - Describe how Reclamation would verify the reduction in consumptive use;
- Amount of time required to implement the conservation project and the project duration;
- Estimated cost per acre-foot of conserved water;
- Description of how your organization will ensure that the conserved water will reduce your approved water order and through third party consents or forbearance agreements will remain in Lake Mead; and
- Any additional information that would be helpful in understanding your organization's pre-proposal.

Other Information:

Reclamation's annual Colorado River accounting and water use report will serve as the basis for documenting a participant's achieved water conservation yield.

A participant will be required to execute a System Conservation Implementation Agreement (Implementation Agreement) with Reclamation which will provide the terms and conditions for design, implementation, monitoring, and evaluation of the Pilot Program project and compensation to the participant.

A participant must be in compliance with applicable Federal, State, and local environmental, cultural, and paleontological resource protection laws and regulations throughout the term of the Implementation Agreement.

By entering into an Implementation Agreement, the participant grants access to Reclamation to perform periodic on-site inspections of the Pilot Program project(s) to verify compliance with the Implementation Agreement.

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Questions from Chairman Lisa Murkowski

Question 1: Can you give a sense of how often and in what form your state coordinates with other Basin states? And what you discuss?

Arizona regularly meets with the other Colorado River Basin States. The meetings address operations of the River, hydrology and hydrologic projections that include historic data, tree-ring reconstructions and climate change projections, risks to the short-term and long-term health of the system and ways to minimize and mitigate those risks. The discussions often involve looking at how the Law of the River evolved, its current form and identifying flexibility that exists within the Law of the River today. The meetings are collegial and collaborative but long-standing entrenched positions within each State are part of the dynamic and color the ability to find innovative solutions.

The following is a list of some of the larger processes that Arizona participates in. There are many more technical, planning and policy meetings in support of the items listed.

a. Drought Contingency and Sustainability planning for the Colorado River. The process was described early on as the "outside the box" process because any and all options were laid out regardless of past operational constraints, legal interpretations or disagreements over the Law of the River. We have been meeting since May 2013 to discuss collaborative voluntary measures to lessen the risk that the Lower Basin will have a declared shortage, to address the structural deficit and long-term sustainability of the Colorado River system and to protect power generation at Lake Powell. Lower Basin states and water users entered into a Memorandum of Understanding For Pilot Drought Response Actions in December 2014. Discussions are continuing to explore additional drought protection actions and to address the structural deficit in the lower basin ("sustainability actions"). There have been 80 meetings either for the lower basin states or with the entire basin.
b. The States and Reclamation partnered to create the Colorado River Basin Water Supply and Demand Study published in December 2012 and the Moving Forward Phase I Report in May 2015. Together the reports identified supply and demand imbalances in the Colorado River Basin through 2060, potential solutions and action items to reduce the imbalance. The States provided 50% of the funding along with the 50% provided by Reclamation. Many man-hours were contributed by State and Reclamation staff in addition to the cash contributions. There were 20 meetings among the States and Reclamation associated with this project.
c. The Colorado River Salinity Control Forum and Advisory Council meet twice a year to implement programs that reduce salinity in the River. Work groups for both entities meet several times a year. The programs that reduce salinity are

funded 50/50 by the federal government and by the States. The Lower Basin states fund 85% of the 50% total states cost share, while the upper basin states fund the remaining 15% of the costs. Federal funding comes from Reclamation and the Department of Agriculture. The work groups meet six times per year.

d. Binational negotiations related to the 1944 Mexican Water Treaty are another key area where the states regularly meet among themselves, with the United States and with Mexico. Minutes to the treaty have resulted in more flexibility for management of the Colorado River system and have allowed Mexico to become a true partner on the River. The benefits and risks of the system are being shared more equitably as a result. The latest addition, Minute 319, was signed in November 2012 and is a pilot program running through 2017. There were multiple work groups created to implement terms of the Minute. There have been about 27 meetings to date. Since January 2015 there have been 3 meetings to discuss the successor to Minute 319. Meetings among the States, the States and the US and the States, the US and Mexico will continue over the next year or more to attempt to reach agreement on a successor minute.
e. The Glen Canyon Adaptive Management Work Group meets two times per year to advise the Secretary of the Interior on the operations of Glen Canyon Dam consistent with the Grand Canyon Protection Act. A Technical Work Group meets 12 times per year to support the larger Work Group. The goal is to take management or experimental actions at Glen Canyon dam that balance all of the resources values associated with the Dam and downstream in the Grand Canyon consistent with the Grand Canyon Protection Act. Power production, aquatic species management, vegetation management, sedimentation and transport, endangered species protection, cultural resources and water supple are some of the main considerations discussed.
f. The States are participants in the NEPA process to create a new record of decision for the Long Term Environment Management Plan for the operation of Glen Canyon Dam. The States have proposed an alternative for evaluation in the Environmental Impact Statement. The States have also been working with the Department of Interior on a potential hybrid alternative that may become a stakeholder consensus alternative. There have been about 30 meetings over the last 3 years.

Question 2: Do the basin states share information and ideas regarding best practices regarding conservation and water delivery?

Yes, the States discuss their conservation targets and how they achieve them. Conservation programs and methodologies implemented by municipal, agricultural and industrial water users within states are also shared. We regularly share information and presentations that we use in various conferences, workshops and public meetings. Our programs and best management practices are generally posted on each state's websites or on the websites of individual providers within each state.
The Moving Forward Phase I study of the Colorado River Basin Water Supply and Demand Study was particularly focused on evaluating conservation potential and practices across the Basin.

Question 3: Are there greater opportunities to coordinate activities?

Our efforts to coordinate our activities are robust. Arizona, and I believe other states as well, struggle to find the resources and staff to deal with the myriad of meetings and processes that are taking place simultaneously. Arizona believes that Colorado River drought contingency and sustainability planning should be the number one priority for the States and the Department of the Interior. Negotiating a successor to Minute 319 is not far behind in importance since that new minute will likely contain elements that can support the goals of drought contingency and sustainability planning. Coordination of federal/state activities that address those two priorities can be helpful to Arizona.

Question 4: Are there additional ways that federal agencies can foster collaboration?

As stated in the answer to Question 3 above federal agencies can be sensitive to the resource and staffing constraints in each Basin state. Interior has provided invaluable resources to the States in the drought contingency and sustainability planning process from both a technical and facilitation standpoint.

Collaboration will be improved to the extent that federal agencies with often competing interests establish a "United States" position as part of any discussions with the States. Successful collaborative solutions sometimes take longer to achieve or are not achievable due to competing federal interests.

Question 5: What are the barriers to increased collaboration in the region?

The Law of the River in the lower basin which assigns a senior priority to California's Colorado River allocation over the allocations to Nevada and Arizona creates an unequal playing field that makes it difficult to negotiate solutions that result in all three states sharing the benefits and risks of the system.

The drought in California has reduced their flexibility to participate in conservation that can benefit the Colorado River system instead of one individual state or water user.

The environmental and potential health impacts from a shrinking Salton Sea in California have greatly reduced to ability for increases agriculture efficiencies in the Imperial Valley to be put into place for the benefit of the Colorado River system.

While the need for augmentation of the Colorado River system has been identified and memorialized in federal legislation and studies for decades it does not seem to be getting any real traction, especially at the federal level. The myth that the system can become sustainable through conservation and water transfers still prevails

Question 6: What forms does coordination with federal agencies, other than Reclamation, take place as it relates to actions water delivery?

The Fish and Wildlife Service, the Parks Service and the Bureau of Indian Affairs are key players in the Glen Canyon Adaptive Management Work Group and the Environmental Impact Statement for the Long Term Experimental and Management of Glen Canyon Dam.

The US State Department and the International Boundary and Water Commission are lead agencies in dealing with the Mexican Water Treaty, the implantation of existing minutes to the treaty and the negotiation of future minutes.

Occasionally the US Army Corps of Engineers is called upon to coordinate water deliveries from Painted Rock Dam, a flood control structure on the Gila River in Arizona, to help meet treaty deliveries to Mexico. That opportunity is rare because it is unusual for that reservoir to have any water in it.

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Questions from Chairman Lisa Murkowski

Question 1: Can you please discuss in detail the importance of data collection and drought science as it relates to various aspects of drought?

Water managers measure drought through multiple factors, including mountain snowpack, soil moisture, streamflow, temperature and precipitation, reservoir levels and reported impacts. These measurements and reports enable water managers and users to piece together a picture of drought conditions.

Drought scientists pull this information together in a user-friendly map called the U.S. Drought Monitor that shows drought severity across the nation. Each week, collaborators affiliated with the National Oceanic and Atmospheric Administration (NOAA), the U.S. Department of Agriculture, and the National Drought Mitigation Center at the University of Nebraska-Lincoln analyze the latest information on water and other variables described above to generate this map, depicting four levels of drought severity. The easy-to-understand graphics of the Drought Monitor make it ideal for policymakers and the public to get a quick grasp of on-the-ground conditions.

Detailed data on water use—including residential, agricultural and industrial uses—help states and water providers manage their resources. The common refrain, "if you can't measure it, you can't manage it" was used by Western Governors' Drought Forum participants to describe the need for water use data for both surface water diversions and groundwater pumping. Water managers require this data to confidently develop water demand projections, whether or not drought conditions prevail. For water utilities, this information can inform strategies to implement conservation programs and adjust rate structures. For states, water use data provides a better sense of diversions, consumption and return flow of water, which is used by some states to facilitate water transfers and deliveries.

WGA will explore the topic of drought data and analysis in-depth with the release of its report on the first year of the Drought Forum on June 24.

Question 2: Please discuss the federal partnerships WGA has now?

WGA signed a Memorandum of Understanding with the National Oceanic and Atmospheric Administration (NOAA) in June 2014. In that document, WGA and NOAA agreed to collaborate on drought, flooding and wildfire preparedness by sharing information and identifying management strategies that states can use to respond to

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extreme events. Collaboration between WGA and NOAA dates to 2003, when Western Governors worked with the agency to create a vision for improved drought monitoring and forecasting – what would become the National Integrated Drought Information System (NIDIS).

WGA has strong relationships with other federal agencies and reached out to multiple federal partners during the first year of the Drought Forum. Federal representatives from the Environmental Protection Agency, the Natural Resources Conservation Service, the Farm Service Administration, the U.S. Forest Service, the U.S. Bureau of Reclamation, the U.S. Geological Survey, NOAA-Fisheries, and NOAA-NIDIS participated in at least one Drought Forum workshop or webinar. In addition, NOAA is a sponsor of the Drought Forum.

Question 3: Are there partnership opportunities with federal agencies beyond the current ones?

Yes. WGA is particularly interested in the collection, analysis and sharing of water and soil moisture data that helps state water managers prepare for and respond to drought. Additionally, WGA plans to investigate how existing data sources can elucidate the connections between drought and other major issues that governors must deal with in the West: wildfire, impacts to wildlife, and the spread of invasive species, among other topics. The association's goal in this endeavor is to better integrate data streams as means to provide governors with more robust tools to react to current droughts and plan for future ones. WGA is exploring opportunities to partner with federal agencies on this topic.

Question 4: I am very concerned about the water-energy nexus, particularly in areas hit by drought. So, can you talk in more detail about what you found in Oklahoma in terms of how energy producers are managing the water in the face of drought? Are there states where it's happening?

Energy producers' responses to drought are influenced by local geology and regulations. That said, many are finding innovative ways to reuse water in the energy production process, particularly in hydraulic fracturing. During the October 2014 Drought Forum workshop titled "Managing Drought in the Energy Sector," energy producers briefed WGA on the various ways the oil and gas industry is managing produced and flow back water at the well head, including recycling it for reuse. A complete summary of that workshop follows.

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WGA decided to further explore the topic of water reuse in energy production in a webinar (described below) and as one of the key themes of the Drought Forum report which will be released on June 24.

Ken Knox, Senior Advisor & Water Resources Manager for Noble Energy, spoke about water reuse in energy production on a Drought Forum webinar titled, *Once Marginal, Now Crucial: The Growing Demand for Re-used, Produced, and Brackish Water*. Knox said that more than 95 percent of total water demand for his company's energy production is from hydraulic fracturing; drilling and dust control are among the additional water uses. He explained that the produced and flow back water from energy extraction were once considered to be waste products. Increased regulatory constraints and environmental impacts have led energy producers to consider treatment and reuse of these former "waste streams."

Treated water is blended with freshwater supplies to reduce total water demand at well sites. This treated water can also be sold to farmers for dust control and livestock watering, depending on the needs and interest of the agricultural community near the well site.

Energy producers also said that a diverse water rights portfolio also helps to maintain operations. The states' ability to provide flexibility in transferring water rights assists energy producers—and other water users—in continuing their work.

Energy producers across the West are engaging in water reuse and recycling as well as diversifying their collections of water rights.



WESTERN GOVERNORS' ASSOCIATION

MEETING SUMMARY

Western Governors' Drought Forum

Managing Drought in the Energy Sector

September 18-19, 2014

National Weather Center – Norman, Oklahoma

As Chairman of the Western Governors' Association, Governor Brian Sandoval of Nevada has convened industry leaders, state experts, and stakeholders to share best practices for drought management through the Western Governors' Drought Forum. Using the framework of the Drought Forum, WGA is holding sector-specific workshops to identify drought impacts, solutions, success stories and case studies.

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The first workshop of the Drought Forum meeting series, ***Managing Drought in the Energy Sector***, was held on September 18-19, 2014 at the National Weather Center in Norman, Oklahoma. Governor Mary Fallin and the Oklahoma Secretary of Energy and Environment hosted the event.
Governor Fallin opened the workshop with remarks on the value of partnership and collaboration among states, industry, federal partners and stakeholders in the drought decision-making process. "The best solutions on drought are those developed in partnerships, with everyone together at the table – all levels of government with all private sectors," the Governor said.

A summary of key findings from the workshop follows. For more information, visit westgov.org/drought-forum or email WGA Policy Advisor Carlee Brown at cbrown@westgov.org.

Drought Impacts in the Southern Great Plains

Findings and Observations

- "The tendency is for decision makers and the general public to sit back on drought issues until a drought occurs. For drought planning to advance, scientists must focus on conveying relevant information and establishing credibility before drought conditions exist." – *Kevin Kloesel, Director, Oklahoma Climate Survey*
- "Accurate soil moisture data is critical to the effectiveness of drought prediction and monitoring." – *Mark Shafer, Director, Southern Climate Impacts Planning Program*
- "As drought conditions persist, sub-soil water storage issues accumulate and linger. This means that even though rain may be falling at the soil surface, not much of it is able to seep down into the soil and restore moisture." – *Mark Shafer, Director, Southern Climate Impacts Planning Program*

Drought Impacts in the Energy Sector

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Findings and Observations

- "California used to generate 14% of its power from hydroelectric sources prior to the current drought. Now, that figure is now just 6 percent." – *Sylvia Bender, Deputy Director, Energy Assessments Division, California Energy Commission*
- "New gas-fired combined-cycle power plant units use 20-40% less water than conventional steam-based infrastructure, so as fleets turn over there will be a continuing increase in efficiency." – *Usha Turner, Corporate Environmental, Oklahoma Gas & Electric*

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- "Fleet turnover over time, in combination with the practical use of renewables that use much less water, maintains reliable generation supply while reducing water consumption over time. "– *Usha Turner, Corporate Environmental, Oklahoma Gas & Electric*
- "During drought, pumping for irrigation increases, thus increasing energy demand in turn." – *Mike Sorenson, Senior Manager of Fuels and Water Resources, Tri-State Generation & Transmission Association*
- "The key to providing reliable energy production is diversity in power plant technology and water supply sources. The power sector uses a great deal of water but does not consume much, as 97% of water withdrawn is returned to a fresh water source." – *Usha Turner, Director, Corporate Environmental, Oklahoma Gas & Electric*
- "The challenge for oil and gas providers lies in implementing water conservation strategies that are operationally feasible, cost-effective, and protective of other environmental uses of water." – *Mike Mathis, Regulatory Affairs, Continental Resources*
- "Having diverse storage options, water rights and diversion rights helps maintain resilience during drought periods." – *Mike Sorenson, Senior Manager of Fuels and Water Resources, Tri-State Generation & Transmission Association*
- "Research and development of new technologies allowing for use of poor quality water in hydraulic fracturing operations is imperative to reducing the amount of fresh water consumed." – *Darren Smith, Environmental Manager, Devon Energy*

Possible Solutions

- "Reservoir storage of cooling water can serve multiple uses: providing fishing and other recreational opportunities, wildlife habitat, and municipal water benefits." – *Usha Turner, Director, Corporate Environmental, Oklahoma Gas & Electric*
- "Industry leaders operating in the same region can work together through industry trade groups to develop cost sharing arrangements to identify new alternatives for water resource management." – *Darren Smith, Environmental Manager, Devon Energy*
- "Encourage cooperation with various local water users to sustain water availability during constrained (water) resource periods." – *Mike Sorenson, Senior Manager of Fuels and Water Resources, Tri-State Generation & Transmission Association*
- "The California Governor's Drought Task Force is in the process of integrating a planning dashboard to monitor hydroelectric and thermal generation. The dashboard requires power producers to have an alternative supply source during future water constrained periods." – *Sylvia Bender, Deputy Director, Energy Assessments Division, California Energy Commission*
- "Energy producers are working to find opportunities for sourcing marginal-quality waters near their operations, keeping in mind the environmental benefits of minimizing pipeline disturbance and truck traffic. Marginal-quality water opportunities can include such options as: recycling or reuse of produced water; marginal-quality ground- and surface water; and municipal/industrial wastewater effluent. Ultimately, any

opportunity must prove to be operationally feasible, cost-effective and environmentally protective." – *Mike Mathis, Regulatory Affairs, Continental Resources*

- "Proactive infrastructure assessments help to detect leaks or issues with water transmission." – *Mike Sorenson, Senior Manager of Fuels and Water Resources, Tri-State Generation & Transmission Association*
- "The risk of grid reliability helps to drive cooperation between agencies and with utilities. Environmental, water, and energy agencies have regulatory and policy responsibilities that require data about utility operations. Cooperative relationships between agencies and utilities help identify earlier rather than later potential risks to power plant operations from water shortages that could endanger grid reliability. Cooperative data sharing enables agencies and utilities to identify where risks may occur and find appropriate means to mitigate them." – *Sylvia Bender, Deputy Director, Energy Assessments Division, California Energy Commission*
- "Small producers often do not always have the wherewithal to recycle their produced water, but larger companies may be able to take on process water from smaller producers and recycle it in their operations." – *Mike Mathis, Regulatory Affairs, Continental Resources*

Drought Data and Analysis

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Findings

- "There are a variety of data networks (including the Oklahoma MESONET) that are currently collecting data. Bringing together this vast amount of data has appeal, but also presents challenges for creating a consistent and robust dataset. Without a standardized set of equipment, maintenance scheduling, and metadata associated with individual networks, there is a high possibility of error during integration of various data sources. Educating users, especially in the non-science community, would be vital to implementing a broad integrated data set, particularly with soil moisture and precipitation monitoring." – *Brian Fuchs, Assistant Geoscientist/Climatologist, National Drought Mitigation Center*
- "In the past, there have been attempts by the federal government to integrate data nationally that resulted in negative impacts. In order to ensure that data integration and national datasets are actually representative and useful, it's vital that states be involved in the process if not leading the charge (for example, the Western States Water Council's Water Data Exchange, or 'WaDE')." – *J.D. Strong, Executive Director, Oklahoma Water Resources Board*

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- "Better data networks must be created to inform long-term management and decision making." – *Mike Hightower, Distinguished member of the Technical Staff, Sandia National Laboratories*

Solutions

- "There is a need to better incorporate other methods of observing environmental variables. Enhancing satellite-monitoring technology could help with that. Realistically, we can't have 50 weather stations in each county, and that is why data gaps exist." – *Gary McManus, Oklahoma State Climatologist*
- "Make data more accessible to the public. There is a great deal of data out there; it's just a matter of finding it." – *Gary McManus, Oklahoma State Climatologist*
- "A bill before the U.S. House of Representatives, H.R.2413, a weather forecasting improvement act aimed at enhancing the predictability of mid- to long-term forecasts, could help scientists forecast drought conditions in the future." – *Kevin Kloesel, Director, Oklahoma Climate Survey*

Technologies and Innovative Approaches

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Findings

- "Brackish water sources are a new frontier in terms of water supply. There is a vast amount of information and expertise on desalination of seawater, but brackish and produced water provide new challenges and technology needs." – *Dr. Jeri Sullivan Graham, New Mexico Energy, Minerals and Natural Resources Department and Los Alamos National Laboratory*

Solutions

- "Hybrid technology that utilizes membrane and thermal distillation allows high-salinity water to be treated cost-effectively." – *Ed Steele, Water Technical Manager, GE Global Research Center*
- "On-site wellhead water treatment options reduce the environmental impact of trucking (water to the wellhead). Treated water can theoretically then be injected directly back into underlying aquifers. Recharging aquifers with treated water would eliminate inefficiencies resulting from evaporative losses. However, this concept faces considerable regulatory and legal liability challenges." – *Ed Steele, Water Technical Manager, GE Global Research Center*
- "In a desert environment, trade-offs in efficiency and cost must be sacrificed in the name of water conservation. For example, air-cooled condensers recently employed in Nevada energy plants slightly increase cost and decrease efficiency, but the benefits seen in

water conservation outweigh the drawbacks." – *Kevin Geraghty, Vice President, Generation, NV Energy*

- "Reuse of flow back and produced water (in hydraulic fracturing), in addition to expanding the use of brackish and gray water, can yield significant water use reductions (for energy producers)." – *Roy D. Hartstein, Vice President, Strategic Solutions, Southwestern Energy Corp.*

Policy Obstacles and Opportunities

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Obstacles

- New technologies created by industry leaders outpace state and federal regulatory authorities' capacity to adequately address the implications of these technologies, leading to a lag in the energy industry's ability to implement new solutions.
- Aquifer injection of treated wastewater is often limited by liability concerns, as well as state and federal regulatory hurdles.
- Existing regulatory schemes rarely facilitate emerging opportunities for brackish water reuse.

Initiatives and Opportunities

- *Oklahoma's Water for 2060 initiative* – The goal of this initiative is to consume no more fresh water in 2060 than is already being consumed currently. The plan focuses on innovative solutions to forecast water shortages and an emphasis on water conservation, reuse, and recycling. The act sets goals, not mandates, by providing voluntary programs, financial incentives and education.
- *Utah's 2014 Energy Efficiency and Conservation Plan (EECP)* – The plan encourages increased collaboration between energy and water departments within the state, calls for work to mitigate the water quality impacts of oil shale development, and establishes a goal for Utah's energy providers to reduce water usage by 25 percent by 2050. The impetus for the plan was a combination of diminishing water resources, increasing energy consumption, and a rapidly growing population. Development of the EECP included assessing the water use of numerous industries and identifying areas for improvement. In addition to the EECP, a summit occurring in January 2015 will bring diverse stakeholders together to share water conservation technologies and encourage future innovation.
- *Nevada Public Utilities Commission* – The PUC has supported water efficiency advances through new technology and regulatory measures. Through the PUC's Integrated Resource Planning process, all new thermal generation in Southern Nevada built since the year 2000 uses a dry cooling process. The switch to dry cooling saves 17,400 acre feet of water per year, or the equivalent water use of approximately 70,000 southern

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Nevadans. In addition to more water efficient cooling technology, Nevada has also committed to increased use of renewable energy sources and the retirement of coal generation in Southern Nevada. Nevada plans to generate 25% of its energy needs from renewable sources by 2025. The retirement of 850 MW of coal generation by 2019 will save 10,000 acre feet per year. To supplement water savings on the generation side, the Nevada Public Utilities Commission has supported tiered rate structures for the water utilities it regulates, which encourages water conservation. Additionally, the PUC requires enforcement of water conservation plans.

Resources

- Oklahoma's MESONET, a statewide weather monitoring network of 120 environmental monitoring stations.
- MESONET SIP program – Homeowners can input the type of grass they have and connect their lawn irrigation system to the nearest MESONET station. This allows for smarter irrigation based on real-time weather measurements.
- National Drought Mitigation Center (NDMC) at the University of Nebraska-Lincoln.
- NDMC Drought Risk Atlas, a mapping tool that references historical drought conditions.
- Devon Energy's Water Sustainability Principles.
- California Governor's Drought Task Force's integrated planning dashboard
- Southwestern Energy's program ECH2O, Energy Conserving Water establishes a Commitment to water neutrality by 2016.

Question 5: I understand the Drought Forum is a multi-year effort. What is planned for years two and three?

WGA intends to maintain and expand the Drought Forum online resource library located at www.westgov.org/drought-forum. WGA will continue to develop content for the site—including policy briefs and case studies— and will ensure existing information remains up-to-date.

WGA also plans to work with NOAA to help identify informational needs and management strategies regarding drought and wildfire. WGA and NOAA will host meetings for state drought coordinators and state foresters this summer and fall. After considering the findings of those sessions, WGA will determine what additional products would be of greatest use to the Western Governors and will develop a work plan that meets those needs.

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WGA is very interested in drought data and analysis, as well. Currently, the association is exploring potential partnerships that will help break down informational silos and present data on water, soil moisture, wildfire, wildlife, invasive species and other drought- and natural resources-related data streams in ways that will useful to governors, their state water managers and their citizens.

Similarly, WGA is exploring potential partnerships regarding water infrastructure for drought management. As WGA weighs the opportunities for the second year of the Drought Forum, it will develop a work plan that incorporates infrastructure, the elements described above and other topics as the Governors deem fit.

Sen. Daines' question (2:07:45 in hearing video): In your testimony, you mentioned a resolution that the Western Governors' Association had adopted on wildland fire management. This resolution draws attention to the use of active forest and rangeland management as a means to prevent wildfire and promote healthy landscapes. How are healthy forests linked to helping to maintain clean, reliable water for our communities?

WGA submits for the record the Western Governors' policy resolutions on wildland fire management and water resource management in the West.

Healthy forests are better able to withstand the risk of wildfire. Some research indicates that thinned forests also require less water, in general, which can mean more water supplies for human consumption. This research is still in its infancy but the benefits of decreased wildfire risk make forest management a sound practice, whether to achieve increased water availability or not.

WGA concurs with the statements of another hearing witness, Mr. Thomas Buschatzke of the Arizona Department of Natural Resources, regarding the impacts of fire on western water resources. Mr. Buschatze spoke to the impacts of increased erosion caused by wildfire, which can lead to water quality problems. Additionally, runoff following fires tends to increase sediment in reservoirs, which results in decreased reservoir storage.

For more information, WGA submits to Sen. Daines and other Committee members its Drought Forum webinar titled *Managing Forest Health for Water Resources*. Additionally, WGA will explore this topic more fully in its report on the first year of the Drought Forum to be released on June 24.



WESTERN GOVERNORS' ASSOCIATION

Western Governors' Association
Policy Resolution 13-03

Wildland Fire Management and Resilient Landscapes

A. BACKGROUND

1. The health of the nation's federal forests and range lands has deteriorated due to a reduction in active management, past federal fire suppression policies, and changing climate conditions. Overgrowth and crowding in forests has allowed damaging insects and diseases to flourish. Many of our range lands are infested with "cheat grass" or other invasive species. The result has been a significant increase in the average acreage burned, higher fire suppression costs, increased impacts on public health, catastrophic damage to the environment and more communities threatened by wildfires every year.

2. Active management, such as range habitat restoration projects, improved livestock grazing practices, thinning, prescribed fire, and road maintenance, has been used successfully to improve the health of forest and range ecosystems. This type of active management can provide significant benefits to ecosystem function, while protecting and promoting development of healthy, resilient landscapes. However, complex analysis processes and legal challenges on federal lands have hampered efforts to increase active forest and range management sufficient to make a measureable difference on a landscape scale.

3. State aviation resources (both fixed and rotary-wing) are an integral part of wildfire suppression programs nationwide. Large fixed-wing air tankers play an important role in firefighting, as well. However, availability of federal air tankers has been significantly reduced due to the age and airworthiness of the existing air tanker fleet. The shortage of federal air tankers has put an increasing stress on state air tanker resources. An overarching problem is inaction on approving and funding a national wildfire aviation strategy. This strategy developed by federal and state wildfire management agencies identifies nationally-shared aerial resource needs. It is overdue to be updated and implemented.

4. In severe wildfire seasons, the U.S. Forest Service has "borrowed" from other program areas, such as community assistance and hazardous fuels reduction, to pay the costs of wildland fire suppression. In 2009, Congress passed the Federal Land Assistance and Management Enhancement Act (FLAME Act) which established a split fund to cover U.S. Forest Service and DOI wildland fire suppression costs.

5. The FLAME Act also directed the Secretary of the Interior and the Secretary of Agriculture, acting jointly, to develop a new National Cohesive Wildland Fire Management Strategy (CS). Phase I of the CS established three goals: Creating resilient

landscapes, fire adapted communities, and more effective response to wildfire. Under Phase 3 of the CS, regional science-based risk analysis reports and regional action plans have been completed. These documents and work in other regions will inform the new national strategy, which is expected to be completed early 2014.

6. When developing the CS, policy barriers and process complexities were identified which affect the ability to effectively and efficiently share resources, not only for wildfire, but for work on hazardous fuels and prescribed fire activities. The U.S. Forest Service role in state-state billing procedures is one of these complex processes and the federal authority to continue to perform this role is unclear. The USDA Forest Service provides initial payment for state resources responding to another state's wildfire incident and provides assistance for out of state resource mobilization tracking. By initially compensating states for mobilized resources and seeking subsequent reimbursement from states receiving outside assistance, the USDA Forest Service plays an essential role in facilitating rapid and efficient response to wildland fires.

7. The use of "Good Neighbor Authority" was approved by Congress in 2009 for projects in Colorado and Utah. The Authority enables state agencies to act as an agent for the federal agency to complete similar or complementary forest and land management activities across state, federal and private landowner boundaries. The Authority has not been widely used due to problematic contracting requirements. The Authority expires in September 2013.

8. The use of "Stewardship Contracting Authority" (SCA) was approved by Congress in 2003 to allow forest products to be exchanged for services rendered to restore forest function and health, improve wildlife habitat, or make improvements to recreational or other federal facilities. Where it has been used, SCA has been a valuable tool to restore forest health and wildlife habitat across the west. Stewardship Contracting Authority expires in September 2013, and reauthorization of SCA was proposed in the 2012 Farm Bill.

B. GOVERNORS' POLICY STATEMENT

1. Western Governors call on Congress and the Administration to fully implement the FLAME Act, to accomplish the goals of the National Cohesive Wildland Fire Management Strategy, and to implement the regional action plans, accepted by the Wildland Fire Executive Council, for each of the Cohesive Strategy regions.

2. Western Governors call on Congress to authorize active management and forest health improvement on federal forest lands. Western Governors call on Congress to enact legislation designed to reinforce the role and effectiveness of collaboration in implementing projects on federal forest lands, and to reduce administrative and preparation processes, costs, and legal challenges to science-based collaborative projects.

3. Western Governors support increased capacity and coordination of state, federal and private aerial resources to respond to wildland fire. The Governors support an immediate revision and implementation of the National Interagency Aviation Management Strategy.

4. Western Governors encourage expedited and coordinated consultation of requirements by federal and state agencies to address Endangered Species Act, Clean Water Act, Clean Air Act, and other environmental laws to ensure timely review and approval of needed forest restoration and active management on affected forest landscapes.

5. Western Governors support identification and correction of policy barriers that prevent the effective sharing of resources for wildland fire and land management activities.

6. Western Governors support reauthorization of the Good Neighbor Authority; improving the Authority based upon the experience on using it on the ground in Colorado and Utah; and broadening the use of the Authority's provisions to other states where local interest and support exists.

7. Western Governors support reauthorization of Stewardship Contracting Authority to enable federal agencies to more effectively implement forest health improvement projects on a landscape scale.

C. GOVERNORS' MANAGEMENT DIRECTIVE

1. The Governors direct the WGA staff, where appropriate, to work with Congressional committees of jurisdiction and the Executive Branch to achieve the objectives of this resolution including funding, subject to the appropriation process, based on a prioritization of needs.

2. Furthermore, the Governors direct WGA staff to develop, as appropriate and timely, detailed annual work plans to advance the policy positions and goals contained in this resolution. Those work plans shall be presented to, and approved by, Western Governors prior to implementation. WGA staff shall keep the Governors informed, on a regular basis, of their progress in implementing approved annual work plans.



WESTERN GOVERNORS' ASSOCIATION

Western Governors' Association
Policy Resolution 2014 - 03

Water Resource Management in the West

A. BACKGROUND

1. The scarce nature of water in the West makes it a crucial resource for the communities, industries, habitats, and farms it supports. Clean, reliable water supplies are essential to maintain and improve quality of life.

2. States are the primary authority for allocating, administering, protecting, and developing water resources, and they are primarily responsible for water supply planning within their boundaries. States have the ultimate say in the management of their water resources and are best suited to speak to the unique nature of Western water law and hydrology.

3. Many communities in the West anticipate challenges in meeting future water demands. Supplies are nearly fully allocated in many basins across the West, and increased demand from population growth, economic development, and extreme weather and fire events places added stress on those limited water resources. Sustainability of our natural resources, specifically water, is imperative to the foundations upon which the West was developed. Growth and development can only continue upon our recognition of continued state stewardship of our unique resources and corresponding responsibilities.

4. Strong state, regional and national economies require reliable deliveries of good-quality water, which in turn depend on adequate infrastructure for water and wastewater. Investments in water infrastructure also provide jobs and a foundation for long-term economic growth in communities throughout the West. Repairs to aging infrastructure are costly and often subject to postponement.

5. Western Governors recognize the essential role of partnership with federal agencies in Western water management and hope to continue the tradition of collaboration between the states and federal agencies.

6. Tribal governments and Western states also share common water resource management challenges. The Western Governors Association and Western States Water Council have had a long and productive partnership with tribes, working to resolve water rights claims.

B. GOVERNORS' POLICY STATEMENT

1. **State Primacy in Water Management:** As the preeminent authority on water management within their boundaries, states have the right to develop, use, control and distribute the surface water and groundwater located within their boundaries, subject to international treaties and interstate agreements and judicial decrees.

   a. **Federal Recognition of State Authority:** The federal government has long recognized the right to use water as determined under the laws of the various states; Western Governors value their partnerships with federal agencies as they operate under this established legal framework.

      Nothing in any act of Congress or Executive Branch regulatory action should be construed as affecting or intending to affect states' primacy over the allocation and administration of their water resources.

      Reauthorization of the Water Resources Development Act, proposed federal surplus water rulemakings, and/or storage reallocation studies should recognize and defer to the states' legal right to allocate, develop, use, control, and distribute their waters, including but not limited to state storage and use requirements.

   b. **Managing State Waters for Environmental Purposes:** States and federal agencies should coordinate efforts to avoid, to the extent possible, the listing of water-dependent species under the Endangered Species Act (ESA). When ESA listings cannot be avoided, parties should promote the use of existing state tools, such as state conservation plans and in-stream flow protections, to conserve and recover species.

2. **Infrastructure Needs:** Aging infrastructure cannot be ignored; infrastructure investments are essential to our nation's continued economic prosperity and environmental protection, and they assist states in meeting federally-mandated standards.

   a. **Federal Support for Infrastructure Investment:** Congress should provide adequate support for the Clean Water Act (CWA) and Safe Drinking Water Act (SDWA) State Revolving Funds. Further, Congress should fully utilize the receipts accruing to the Reclamation Fund for their intended purpose in the continuing conservation, development and wise use of western resources to meet Western water-related needs, including the construction of Congressionally-authorized Bureau of Reclamation rural water projects and facilities that are part of a Congressionally-authorized Indian water rights settlement.

Congress should reauthorize Water Resource Development Act (WRDA) legislation on a regular schedule and include adequate funding so all projects and studies authorized in WRDA can be completed in a timely manner.

Congress also should consider facilitating greater investment in water infrastructure, utilizing such tools as loan guarantees, revolving funds, infrastructure banks and water trust funds.

Capital budgeting and asset management principles should be used to determine funding priorities based on long-term sustainability and not annual incremental spending choices. It should be accompanied by dedicated sources of funding with appropriate financing, cost-sharing, pricing and cost recovery policies.

b. **Alternatives to Direct Federal Investment:** Federal and state policymakers should also consider other tools to promote investment in water infrastructure and reduce financing costs, including: public-private partnerships; bond insurance; risk pooling; and credit enhancements.

Congress should remove the state volume caps for private activity bonds used for water and wastewater projects, provide guaranteed tax-exempt status for bonds issued by state or local agencies to finance water infrastructure, provide loan guarantees, and otherwise support and encourage alternatives to direct federal investment of limited general funds.

c. **Hydropower:** Congress and the Administration should authorize and implement hydropower projects and programs that enhance renewable electric generation capacity and promote economic development through streamlined permitting processes, while appropriately protecting environmental resources.

d. **Infrastructure Planning and Permitting:** Infrastructure planning and permitting guidelines, rules and regulations should be coordinated, streamlined and sufficiently flexible to: 1) allow for timely decision-making in the design, financing and construction of needed infrastructure; 2) account for regional differences; 3) balance economic and environmental considerations; and 4) minimize the cost of compliance.

3. **Western States Require Innovative and Integrated Water Management.** Western Governors believe solutions to water resource challenges require an integrated approach within states and with federal, tribal and local partners. Water resource planning should occur within a framework that preserves states' authority to manage water through policies which recognize state law and the financial, environmental and social values of the water resource to citizens of the western states today and in the future.

a. **Water Transfers:** Western Governors recognize the potential benefits of market-based water transfers, meaning voluntary sales or leases of water rights. The Governors support water transfers that avoid or mitigate damages to agricultural economies and communities while preventing injury to other water rights.

b. **Energy Development:** Western Governors recognize that energy development and electricity generation may create new water demands. Western Governors recommend increased coordination across the energy and water management communities, and support ongoing work to assess the interconnection of energy and water through the Regional Transmission Expansion Planning Project for the Western interconnection and similar efforts.

c. **Conservation and Efficiency:** Western Governors encourage adoption of strategies to sustain water resources and make existing water supplies go further in light of diminished water resources and declining and inconsistent snowpack, including the use of water conservation, water reuse and recycling, desalination and reclamation of brackish waters, and reductions in *per capita* water use. The Governors encourage the use of and research into promising water-saving strategies.

d. **Local Watershed Planning:** Western Governors encourage federal agencies and Congress to provide resources such as technical support to states and local watershed groups. States can choose to empower these watershed groups to deal with local water issues associated with water quality, growth and land management as best complements state water needs.

e. **Intergovernmental Collaboration and Conflict Resolution:** Western Governors support the negotiated settlement of interstate water disputes, Indian water rights claims, and other federal water needs and claims, the settlement of which are in the best interest of Western states.

f. **State-Federal Coordination:** Western Governors recognize the important role of federal agencies in advancing sound water resource management in the Western states. Governors appreciate the efforts of federal agencies to coordinate water-related activities, particularly through the Western States Water Council, and support the continuation of these key state-federal partnerships.

4. **Western States Need Reliable Water Resource Information:** Basic information on the status, trends and projections of water resource availability is essential to sound water management.

a. **Basic Water Data:** Western Governors support the U.S. Geological Survey's Cooperative Water Program and National Streamflow Information Program (NSIP), the Natural Resources Conservation Service's Snow Survey and Water Supply

Forecasting Program, the National Oceanic and Atmospheric Administration's weather and hydrology-related data collection, monitoring, and drought information programs, and the National Aeronautics and Space Administration's National Land Imaging (Landsat) Program with its thermal infrared sensor. Western Governors support federal efforts to coordinate water data gathering and information programs across multiple agencies.

b. **Drought Information and Planning**: Western Governors encourage federal agencies to partner with states in the gathering, coordination and effective dissemination of drought-related data between the federal government and states. The National Integrated Drought Information System (NIDIS) is a successful model of state-federal collaboration in the development of information services.

   i. Governors recommend Congressional reauthorization of the NIDIS program, particularly with respect to implementation of regional drought early warning systems.
   ii. Governors support a comprehensive national policy that promotes a coordinated and integrated approach to future drought, including improved forecasting and monitoring, drought preparedness and planning, and efficient delivery of drought programs.
   iii. Governors believe that drought preparedness and contingency plans – created through partnerships of states, federal agencies and local communities – provide a proactive approach to addressing drought.

c. **Extreme Weather Events Planning**: Western Governors recognize the significant potential impacts of extreme weather variability and change on water supplies. Western Governors urge Congress and the Administration to work closely with states and other resource managers to improve predictive and adaptive capabilities for extreme weather variability and related impacts.

d. **Water Data Exchange:** The Western Governors' Association and the Western States Water Council have worked together to create the Water Data Exchange, an online portal that will enable states to share their water data with each other, federal agencies, and the public via a common platform. The Governors encourage the use of state water data in planning for both the public and private sectors.

C. GOVERNORS' MANAGEMENT DIRECTIVE

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Questions from Chairman Lisa Murkowski

Question 1: In your testimony you say, "The most helpful thing that Congress can do for drought-stricken states is to encourage, demand and mandate, where necessary, creativity and flexibility on the part of federal water management and regulatory agencies."

Could you expand on that, and be more specific as to what you mean?

Response: We must start managing water in California and across the Western U.S. to meet the future needs of humans and their communities, and not just narrowly focus on protecting the environment. That includes better managing our current water supplies for multiple needs (including agriculture), and by developing new water storage projects that will allow the greater flexibility we will need to meet the challenges of future drought years like this one. It also means applying the agency discretion allowed under the federal Endangered Species Act (ESA) and other federal laws in a way that maximizes water supply for human uses without imperiling species. The ESA was never intended to avert environmental disaster by creating other disasters. The ESA is a reality, but the manner in which it is being applied has not utilized any of the flexibilities inherent to the Act, or in consideration of the collateral human disasters that are being caused through such rigid federal decision-making.

Especially during times of crisis, operational entities need to be able to weigh the needs of the environment as well as the needs of the economy and communities. There should be ways for agencies to exercise some discretion when making decisions regarding resource management. We have seen that the application of rigid regulatory standards have a very detrimental effect at a time when every gallon of water is important.

Lawmakers and policy makers must provide agency implementers with the tools to understand that it is not all just about mathematics and science, that there are truly human costs associated with their decisions. We believe there is already flexibility built into the ESA that must employed in situations like California's Central Valley that do the least harm to affected communities.

As noted in our written testimony, the original intent of the ESA - stated in the Act itself - was to encourage "the States and other interested parties, through Federal financial assistance and a system of incentives, to develop and maintain conservation programs which meet national and international standards". Of special importance to the Family Farm Alliance is that the ESA explicitly declared that it was the policy of Congress that

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"Federal agencies shall cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species."

Members of the Family Farm Alliance were pleased to see the leadership of House Natural Resources Committee establish the ESA Working Group in 2013. With the February 2014 release of the Working Group's final report, and with ESA implementation exacerbating the drought in California and other parts of the West the past several years, the timing is critical for a forum that will invite discussion and input on ways in which the ESA (last reauthorized in 1988) can be updated to boost its effectiveness for both people and species.

Finding ways to incentivize landowners to make the ESA work is far more preferable than what we have experienced in recent years, where the ESA has been used by special interest environmental groups and federal agencies in court as a means of "protecting" only a single species (such as the Delta smelt, in California) without regard to any other impacts, including those to other non-listed species.

It is clear that the collaborative, incentive-driven approach envisioned by the authors of the ESA has taken a back seat to litigation and the top-down approach employed by some federal agencies charged with ESA implementation. It just doesn't have to be this way, and opportunities exist for a fundamental paradigm shift that can make the ESA really work. As the Congressional Working Group pointed out in their 2014 Report, the ESA can be modernized to more successfully assist species that are truly in danger. It can be updated so species conservation does not create conflicts with people. Surely constructive and thoughtful parties can all agree that a law addressing the needs of species in trouble is worthwhile. We are not arguing for an outright repeal of the ESA; we want to make it work better on the ground, and especially in the West where water and land uses are the backbone of people's lives and livelihoods. There is no reason why we should not be able to have an open and candid discussion about fixing the law to make it work as intended.

Question 2: You note in your testimony that Central Valley producers have spent billions over the last decade or so to install more efficient irrigation systems. Can you give me examples of similar activities elsewhere in the West?

Response: It is possible to meet the needs of cities and the environment in a changing climate without sacrificing Western irrigated agriculture. To achieve that goal, the West needs to implement a full array of forward-thinking and innovative water management actions. Each contributes in different ways to the overall reliability of the water management system. Water conservation, water recycling, watershed management,

improved conveyance, desalination, water transfers, groundwater storage, and surface storage are all needed in a diversified management portfolio. Water conservation, one of the most cost effective actions, needs to continue to be aggressively pursued in conjunction with new surface storage and other actions. The following examples demonstrate that aggressive efforts are underway throughout the West to increase efficiency of irrigation delivery systems:

- **Water for Irrigation, Streams, and Economy Project** (WISE - Oregon), a collaborative effort in Oregon to improve the health of the Little Butte Creek and Bear Creek systems and increase the effectiveness and efficiency of local irrigation districts. The WISE Project utilizes a combination of strategies including: piping and lining canals, increasing the storage capacity of selected reservoirs, and installing a pumping system that will provide access to water that has been allocated for agricultural purposes. Collectively through implementation of WISE, more water will be made available for management for irrigation and environmental instream purposes.

- **Strawberry Valley Rehabilitation and Betterment Projects** (Utah) are proposed to decrease the water seepage and losses in the Strawberry Valley Project, as well as provide system-wide gravity pressure for the continued migration toward sprinkler irrigation systems, which would then provide additional water savings. These projects could save approximately 15,000 to 20,000 acre-feet of water per year in an agricultural area that is rapidly urbanizing.

- **Irrigation Management in Yuma County** (Arizona) features infrastructure improvements largely driven by increased winter vegetable production. Most of the many miles of canals, laterals and farm ditches within the Yuma irrigation districts are lined with concrete. Laser and GPS land leveling is practiced within Yuma County. Irrigation water diverted to farms has decreased 15 percent since 1990 and nearly 18 percent since 1975. Factors contributing to this reduction in water use include significant improvements in crop and irrigation management and infrastructure (source: *A Case Study in Efficiency – Agriculture and Water Use in the Yuma, Arizona Area*, February, 2015).

- **Klamath Basin Watershed** (California / Oregon) – As noted by the USDA Natural Resources Conservation Service in 2007, "Farmers and ranchers recognize the importance of conserving the area's natural resources. They contribute to a healthy watershed by implementing sound agricultural practices that create fish and wildlife habitat and improve water quality and quantity. NRCS and Klamath Basin partners help local landowners achieve their conservation goals". Between 2002 and 2006, the

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Klamath conservation partnership had conserved irrigation water on 54,503 acres. The 2002 Farm Bill included an appropriation under the Environmental Quality Incentives Program (EQIP) of $50 million for assistance to implement practices that result in on-farm/ranch net water savings in the Klamath Basin through Fiscal Year 2007. In addition to these funding totals, NRCS Conservation projects require a 25% - 50% cost share from project (landowner) recipients. In other words an additional $13 -$20 million was invested locally in conservation during this time period.

- **Yakima River Basin Integrated Plan** (Washington State) – After decades of fighting resulting in inaction, water users throughout the region put aside their differences to craft a water plan that meets everyone's needs. The Yakima River Basin Integrated Water Resource Management Plan provides water for agriculture, fish, and communities by modifying water system operation and infrastructure, building fish passage at existing dams, implementing enhanced water conservation projects, creating additional groundwater and surface storage capacity, enhancing and protecting habitat and increasing in-stream flows, and employing water marketing and banking. In addition, over the past several decades, the Yakima River Basin Water Enhancement Program (YRBWEP), a partnership between the Bureau of Reclamation, the State of Washington and local irrigation districts has provided many measurable results and benefits for farmers and fish due to the many past investments in water conservation and management infrastructure and water supply enhancements, preventing the conflict over endangered species and water supplies in the Yakima Basin that have been experienced in other river basins across the West. YRBWEP is now part of the foundation for implementation of the broader basin-wide Integrated Plan.

We also described in our written testimony other areas of the West where innovative water management practices are taking place. The Colorado River Basin case study report we included as an attachment to our testimony describes the efforts of several individual farmers and ranchers to find ways to tighten up water use efficiency. Another section of our testimony highlights the efforts of irrigation districts in Oregon's Deschutes River Basin who have undertaken an unprecedented array of voluntary measures to conserve water, return water in-stream for fish and wildlife purposes, and use irrigation water supplies to generate renewable carbon-free energy. District-led conservation projects have reduced diversions by more than 200,000 acre-feet annually, leading to higher in-stream flows in the Deschutes River and its tributaries. Recent projects by four districts alone have resulted in the piping or lining of 58 miles of canals, resulting in a return of 91.5 cubic feet per second of water in-stream. All of these measures are designed to sustain agricultural productivity, reduce diversions and increase in-stream flows in the Deschutes River and its tributaries.

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Question 3: In your testimony, you talk about the need to find ways to incentive landowners to make the ESA work. Do you have ideas or suggestions as to what such incentives might be?

Response: The role of state and local governments (including political subdivisions such as irrigation districts) can be improved through ESA Section 6 cooperative agreements and other mechanisms under the ESA. State and local government management of species recovery efforts should be encouraged to ensure local control and participation. The federal government must recognize and promote state and local government efforts that can act as umbrella programs for small landowners.

Landowners are also willing to partner on habitat restoration projects, as is happening on our farm today. There are many examples of successful partnerships between landowners and governmental agencies. There are also examples of partnerships between landowners, governmental agencies and nongovernmental organizations (NGO's). These partnerships can be the most successful when a variety of stakeholders come together. The difficulty becomes when some NGO's will not engage in the solutions. Fear of compromise on ESA related issues can cause paralysis when it comes to collaboration in some circles.

The Alliance supports the efforts of a group within the USFWS called "Partners for Fish and Wildlife", which helps to fund habitat work on private lands. This program already has the infrastructure and relationships with landowners to implement effective habitat work for endangered species. They have projects on the ground all over the country and are doing yeoman's work to preserve habitat for toads in Nevada, sage grouse in Wyoming, and the mountain plover in Colorado, to name just a few success stories. The Partners for Fish and Wildlife is uniquely positioned to fulfill the direction of the ESA for the USFWS to manage threatened and endangered species.

The Partners program is successful because it employs experts who are on the ground, working with landowners, instead of crafting mandates in far-removed government offices. These federal officials recognize that if a species exists and thrives on a property—public or private—the practices that currently occur on that property will not harm and could possibly protect that species. These officials have learned to recognize, for example, that sage grouse are vulnerable to predators, and that areas where ranchers run sheep tend to have heavy predator control. They take the time to respect the observations of local landowners, who every day see thriving sage grouse populations on their lambing areas. Working with landowners, they gain an understanding and shared belief that the predator control that takes place on private lambing grounds has helped to keep the sage grouse in those areas healthy and thriving.

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There are other good examples in the West of how collaboration and cooperation can work to reach solutions that benefit species and human communities:

- The **Lower Colorado River Multi-Species Conservation Program** was created to balance the use of the Colorado River water resources with the conservation of native species and their habitats. The program works toward the recovery of species currently listed under the ESA. It also reduces the likelihood of additional species listings. Implemented over a 50-year period, the program accommodates current water diversions and power production, and will optimize opportunities for future water and power development by providing ESA compliance through the implementation of a Habitat Conservation Plan.

- Partners of the **Upper Colorado River Endangered Fish Recovery Program** are recovering four species of endangered fish in the Colorado River and its tributaries in Colorado, Utah, and Wyoming while water use and development continues to meet human needs in compliance with interstate compacts and applicable federal and state laws.

- The new, more collaborative (negotiated) approach that is occurring in the **Klamath Basin**, which is being driven by the region's diverse stakeholders, also gives us a glimpse of what might be possible if fear-mongering and litigious approaches are set aside in favor of collaboration and partnerships.

When landowners, water agencies and local governments are engaged and do not have their very existence threatened, they can and most of the time will, become willing and quite able partners in species recovery.

Question 4: You also indicate that you believe Congress should provide federal agencies with more flexibility under water management regulations to respond to drought conditions. Can you be more specific?

Response: Existing implementation of environmental laws by federal agencies has in many cases restricted water management flexibility. For example, during drought emergencies, the Federal Energy Regulatory Commission (FERC) has the authority to adjust licensing conditions for hydropower projects that affect water storage and fishery requirements. FERC has been pro-active in exercising that authority, but in some instances state and federal fishery agencies, which set the flows and fishery conditions on hydropower licenses, are reluctant or slow to cooperate, or they impose out-scaled demands for 'mitigation' of emergency actions. A February 6, 2014 letter was sent from

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FERC to all hydropower license holders in California saying "staff of the Federal Energy Regulatory Commission is prepared to act swiftly to review requests to amend licenses on a temporary or longer-term basis, as appropriate, in order to conserve water resources at FERC-licensed hydroelectric projects." Since sending out its letter, FERC has received and acted upon several requests to adjust hydropower license conditions because of the drought. Fishery agencies, and California's State Water Resources Control Board, have in many cases cooperated promptly on such requests. In others, final decisions are pending or are being contested by environmental organizations.

For Corps of Engineers projects, or non-federal projects regulated for flood control by the Corps, existing regulations already require the Corps to periodically update operations and flood-control criteria to reflect changes in long-term watershed conditions. The regulations also encourage the Corps to make temporary adjustments to operations and flood-control criteria to respond to immediate drought conditions. But the Corps is slow to follow its own regulations, mainly because of a lack of funding. As a result, project operators must abide by outdated instructions that sometimes do not reflect conditions on the ground and so lead to a waste of water.

Federal irrigation projects like the Central Valley Project cannot solely bear the burden for species recovery in their basins, which is driven in part by certain litigious environmental groups and implementation of federal laws by the U.S. Fish and Wildlife Service and National Marine Fisheries Service. A watershed-wide approach to species recovery – one that addresses all the stressors to the ESA-listed fish species – is essential to improving the environment and saving the local agricultural economy. Increased knowledge, improved management, and cohesive community action would promote recovery of the listed fish species. Focused regulation of federal water projects cannot remain the dominant or sole aspect of ESA biological opinions. 'More water is better for fish' – while perhaps an intuitively logical argument - may sometimes be the wrong approach. Federal ESA requirements to reallocate water to listed fish that cannot clearly show demonstrable benefits to the species should be reviewed or reconsidered during times when that water has a direct economic, social and environmental benefit to agriculture, communities and refuges. There must be accountability for measured results when water is dedicated to environmental purposes, just as irrigated agriculture and other water users are held accountable for their water use.

We advocate for a watershed approach that employs peer review, greater stakeholder involvement, oversight of agency actions, a focus on all factors impacting listed species (and not just federal water project operations), reduction of resource conflicts, and incorporation of the principles of adaptive management toward species recovery. The need for this approach is especially critical in California, where there is insufficient

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scientific justification for moving water away from agriculture and towards the perceived needs of ESA-protected salmon and smelt.

The California legislature has established their Co-Equal Goals of enhancing water supplies and reliability while also enhancing and restoring the ecosystems which rely on the waters of the state. This is a simple and common sense statewide policy that would have applicability in all of the 17 Western states. But there is nothing "co-equal" about managing our water resources or even taking action to improve our ecosystems when the federal ESA is in play. Any federal agency decision which may, now or in the future, have any implication or impact on a listed species must find agreement from those in government who are charged with implementing the ESA. The Act that guides them requires no balancing of interests, no concern for our food supply or food safety, and no consideration of the human impacts of their regulatory decisions. The agencies' powers are near boundless and the judicial system gives their decisions great deference.

We all know of the difficulty in amending the ESA. However, there is considerable discretion in how the ESA is implemented. Given the significant scientific uncertainty that exists with many of these species and the ecosystems in which they reside, and the failure of the ESA regulators to look at the broader set of stressors affecting them, the Alliance believes these agencies must step back and rethink the consequences of their actions. Even though the ESA does not require the human consequences of their decisions to be considered, it does not prohibit such consideration. Understanding the impacts on people that come with ESA decisions is simply good public policy. To ignore how people are affected is simply bad public policy and an overreach of federal regulatory power.

Question 5: How would computerized water management and delivery systems work? Is it being used now? What are the barriers and opportunities to greater use?

Response: The use of computerized Supervisory Control and Data Acquisition (SCADA) systems is fast becoming common among Western irrigation water delivery organizations. Such systems measure and control the management and delivery of irrigation water to farms and ranches through the use of automated control gates, remotely telemetered water measurement devices, and computer software that captures and reacts to data changes in the system in order to vastly improve water management over older, manually operated systems. And by coupling a SCADA system with regulating reservoirs (where possible), water managers can conserve incredible amounts of water that typically would be lost to the system using the original equipment installed decades, if not a century ago. Such technologies can be easily added to existing irrigation

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water delivery systems providing almost immediate water savings and helping to stretch existing water supplies to meet current or future needs.

Western water users have spent millions of dollars on the computerization of water delivery system, with outstanding results. These modernized tools allow water managers to control deliveries and minimize losses in the system. The technology, however, is very expensive and often covers large geographical areas, adding complexity and cost to implementing the technology. My own irrigation district has become much more efficient through our modernization program that includes computerization and remote sensing.

One of the barriers to the widespread adoption of such systems includes a fear of system failure due to computer/hardware malfunction, and a lack of understanding on the part of water managers of the safeguards built into SCADA systems to alleviate such events. The Bureau of Reclamation has been helpful in educating water managers in the use of new technologies that can safely and successfully better manage irrigation water systems and save water in the process, but more could be done.

Another barrier is the cost of purchasing, installing and maintaining such technological improvements to water delivery systems. But, federal cost share grants through Reclamation grant programs like WaterSMART and the Water Conservation Field Services Program have greatly increased investments in technology in water delivery systems over the past decade or more. These programs assist with up to 50% of the costs of such systems and require that system performance and added benefits from such retrofits be measured and accounted for.

Finally, another barrier (and an opportunity) to maximize the successful use of SCADA systems to conserve and manage water supplies in the West has to do with a lack of coordination between Reclamation and WaterSMART with other federal programs, such as NRCS EQIP on-farm conservation grants. EQIP helps cost-share on-farm irrigation technologies that can conserve irrigation water; however, if these improvements are not coupled with irrigation delivery system improvements that can actually capture the saved water supplies for other users on the system, then the on-farm water conservation investments will not result in actual usable "wet" water benefits. We are hopeful that the NRCS and Reclamation can and will work together to coordinate these programs through the Regional Conservation Partnership Program (RCPP) that could allow for USDA NRCS and WaterSMART grant funding to apply to both on-farm and water delivery system improvements to maximize the benefits of such federal investments in water conservation. The two agencies have tried working together in California to identify irrigation improvement projects that could benefit from a coordinated

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WaterSMART/EQIP grant award, and should continue such efforts across the water short Western U.S.

Question 6: Similarly, you mention the use of real time monitoring of ecosystems functions and river flows for both fish and people? How might that work?

Response: We know that in critical West Coast rivers and estuaries like the Sacramento – San Joaquin River Delta (Bay-Delta) and the Klamath / Trinity River system there is a need for improved general water quality monitoring and data collection. For example, in the Bay-Delta, California Department of Fish and Wildlife and Bay-Delta science programs are dedicating additional dollars to address real-time monitoring needs, focusing primarily on Delta smelt. We are already learning new things. Smelt monitoring conducted last year using "different gear" resulted in new and different results when Delta smelt were observed where previous techniques suggested they would not be found. In California, there appears to be consensus among fisheries interests that better life cycle modeling would provide more insight into smelt distribution, movement, etc.

I'll conclude this response with a more compelling example. Among the "stressors" in the Bay-Delta environment are non-native fish species that prey on endangered species such as Delta smelt and Chinook salmon. It is also estimated that there are nearly one million striped bass in the Bay-Delta and the watershed, and the catch of large-mouth bass has quadrupled since the 1980s. Both are non-native fish that prey on young salmon and delta smelt. Government agencies and independent experts have estimated that at least 90 percent of juvenile salmon die due to predation before making it to the Bay-Delta. Non-native bass could be consuming more than 40 percent of the salmon population. And yet, there is not even a pilot program in place to begin trying to further understand this critical stressor.

California State legislators have introduced AB 1201, a bill that would direct the state's Department of Fish and Wildlife to develop a science-based approach that helps address predation of listed species by non-native species in the Bay-Delta. The Bay-Delta ecosystem is in severe distress and there is no major stressor facing the Bay-Delta ecosystem that can be ignored. The concept embedded in this bill could provide one example of the type of ecosystem monitoring that would help lead to better fisheries and water management decisions.

Question 7: Would there be opportunities for public private partnerships for these and other ideas you suggested, real time monitoring for example? Do you think farmers and communities would be willing to provide funds to match federal and state investments to make these ideas work?

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Response: Yes, but our farmers will want assurances that these ideas will "work" for them, too.

I point to the Bay-Delta Conservation Plan (BDCP), which was intended to help achieve the coequal goals by improving the Bay-Delta ecosystem and water supply reliability. Specifically, BDCP was a Natural Community Conservation Plan (NCCP) that would provide state and federal wildlife agencies with the necessary information to issue new endangered species act permits for the operation of the State Water Project and Central Valley Project for the next 50 years. Since 2006-07, a total of $176 million has been spent on planning activities related to BDCP (as of June 2013). Funding for these activities have come from water contractors south of the Delta (paid by rate-paying farmers within those contracting districts) under a series of funding agreements with California DWR and the United States Bureau of Reclamation. Further, these same contractors pledged to cover the costs of future improved Delta conveyance systems, while the state and federal governments would primarily fund the ecosystem restoration actions.

The producers and water managers in my neighborhood have already demonstrated their commitment to provide funding for meaningful solutions, but are understandably wary of future related endeavors because of the situation we are now facing.

Question 8: In the important area of water storage, what kind of flexibility specifically do you think Reclamation needs to provide to attract and make possible greater private investment for water storage?

Response: The often slow and cumbersome federal planning and regulatory process is a major obstacle to realization of projects and actions that could enhance Western water supplies. In addition, there exists with some agency officials a preconceived attitude that no new dams or water supply projects will ever be built. So, there is little apparent commitment to earnestly begin and engage in the difficult problems described above, especially using the status quo processes that kill most water supply projects with mounds of paperwork and bureaucratic doublespeak.

By the time project applicants approach federal agencies for authorization to construct multi-million dollar projects, they have already invested extensive resources toward analyzing project alternatives to determine which project is best suited to their budgetary constraints. However, current federal procedure dictates that the agencies formulate another list of project alternatives which the applicant must assess, comparing potential impacts with the preferred alternative. Sometimes these alternatives even conflict with

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state law. The federal government should adopt a policy of supporting new efforts to enhance water supplies and encouraging state and local interests to take the lead in the formulation of those efforts. The existing regulatory procedures for developing additional supplies should also be revised to make project approval less burdensome. Opportunities should be explored to expedite this process and reduce the costs to the project applicant. And, it should be easier for non-federal entities to finance and construct, operate and maintain new water supply infrastructure on their own, even if the non-federal project is to be integrated into a federally owned and operated project.

There are several bills under consideration in the House of Representatives intended to facilitate the construction of new surface storage facilities. Congress should work to quickly pass all of these bills, given the brief window of opportunity the drought-related political attention has provided this year. One of these bills would make it easier to construct additional storage by streamlining the current multi-agency permitting process for new storage projects and creating a "one-stop-shop" permitting process through the Bureau of Reclamation. The Secretary of the Interior would coordinate federal permitting processes related to the construction of new surface water storage projects on Department of Interior and Department of Agriculture lands and to designate the Bureau of Reclamation as the lead agency for permit processing. This "one-stop shop" bill is a concept many Western water users have long advocated for. This bill includes provisions that ensure the "cooperating" federal agencies, some with very different mission statements from the Bureau of Reclamation, must actually buy into the process and work with the lead agency to accomplish the goals and purpose of the legislation by directing strict adherence to the project schedule established by the lead agency (Reclamation), including the coordination of all federal agency reviews. The bill also provides broad authority and responsibility to the lead federal agency to coordinate all federal reviews related to a project.

Creative ways to finance new water storage projects are also needed. Irrigation districts should be allowed to voluntarily prepay on their Project repayment contracts with the federal government. The funding that is generated by these payments could be placed in an account to fund either the construction of new water storage projects or the expansion of current water storage reservoirs.

Title II of the Rural Water Supply Act of 2006 (PL 109-451) authorized a loan guarantee program for rebuilding and replacement costs of aging water infrastructure within Reclamation's ownership that would leverage a small amount of appropriated dollars into a large amount of private lender financing available to qualified Reclamation-contractor water districts with good credit. In other words, the Congress

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has given the authority to Reclamation to co-sign a loan to help their water contractors meet their contract-required, mandatory share of rebuilding and replacement costs of federally-owned facilities. Given this scenario, it is incredible that Reclamation loan guarantees, a long-awaited critical financing tool for water users across the West, are now being held up because of incorrect interpretations of federal policy by the Office of Management and Budget (OMB). Efforts must continue to compel Reclamation and OMB to implement this program and to investigate opportunities to develop similar loan guarantee programs that can help fund new water infrastructure projects. And, we must continue to find ways to leverage funding to meet even more needs for both aging and new water infrastructure projects.

Finally, many new water supply projects can be built by non-federal entities, such as irrigation districts, states, and joint power authorities. But in many cases, these facilities would need to be integrated into the operation of a federal water project and may have to be built on federal lands. We need to develop innovative ways to allow for non-federal investments in constructing new water supply facilities to be made without requiring that the federal government actually build that infrastructure. We believe such investments would allow for more cost-effective construction, operation and maintenance of much needed new water supply infrastructure and not impact federal budgets.

Question 9: Can you explain what "tail water" is and how farmers are capturing and reusing it?

Response: Tailwater refers to water running off the lower end of a field as part of normal irrigation practices and is most often associated with surface irrigation (furrow and border-strip irrigation). Tailwater is necessary, especially in furrow irrigation, to adequately irrigate the lower end of a field since a sufficient infiltration time is required to allow the desired amount of water to infiltrate through the plant root zone in the soils. In many areas, tailwater can be recycled on a farmer's property to save water and money. It is often cheaper to pump water from a tailwater collection pond than from a well or the river. Often times, tailwater can only be addressed by neighboring farmers working cooperatively, as many times that tailwater is another farmer's supply.

As irrigation water leaves a farm field it still can be available for re-use. Our irrigation district has a complex system of reuse – as do many in California and across the West – so that we maximize the use of every gallon of water. The water we use on our farm has been used by farmers upstream of us several times. Our system can blend water that has been used with other sources to alleviate quality concerns. Quality degrades after multiple uses, so we are hopeful that one day there can be desalinization technology that can improve quality for agricultural uses. While restoring water to drinking quality is

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very expensive, we only need relatively modest improvements in the quality for irrigation uses, which hopefully will not be as expensive.

Many Western irrigation projects and irrigation districts work cooperatively with farmers and ranchers to make the best use of all tailwater without damaging crop production or relationships. There are many examples of tailwater capture and reuse projects in the West. In the northern part of my state, the Shasta Valley Resource Conservation District (SVRCD) was awarded a grant from the State Water Resources Control Board to implement a local Tailwater Reduction Project. Even further north, on the Oregon-California border, one drop of water can be used and reused half a dozen times by neighboring growers. Because of the federal Klamath Irrigation Project's design and the interrelated nature of water use within it, including the use of return flows by farmers and the refuge, Project efficiency is very high. An engineering assessment of Klamath Project water use efficiency[1] implies that a sophisticated seasonal pattern of water use has evolved in the Klamath Project. One must understand that the Klamath Project has developed into a highly effective, highly interconnected form of water management, in large part to tailwater management implemented by local farmers and irrigation districts. According to the 1998 Davids study (see footnote), effective efficiency for the overall Project is 93 percent, making the Klamath Project one of the most efficient in the country[2].

However, there are sometimes limitations associated with tailwater management. In the Yuma, Arizona area, the concept of tailwater return flows must be included in any discussion regarding infrastructure improvements and water efficiency. There is an extensive amount of canal and ditch lining in the Yuma region which has a bearing in how one factors return flows in water budget analyses. In the Yuma area, the majority of contracts with the Bureau of Reclamation are consumptive use contracts, meaning that Reclamation measures both deliveries and return flows to the system. The consumptive use is then determined by subtracting return flows from diversions. When a district's delivery system is less efficient, there is a greater amount of return flows entering the system. This allows the district to divert additional water and still stay within the district's contract entitlement. This system is unique to the Yuma area, where return

[1] "Klamath Project Historical Water Use Analysis", Davids Engineering for U.S. Bureau of Reclamation, October 1998.

[2] For example, Tulelake Irrigation District irrigates 62,000 acres of farmland. In the 1990s, the district diverted an average of 131,000 acre-feet of water. Each year, an average of 80,000 acre-feet was pumped out of the district. Consumptive use within the district is considerably less than the amount of water diverted. The reason is the difference from the return flow from other districts and the reuse of water within the Project.

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flows are available for consumptive use in the U.S. or in satisfaction of a treaty obligation with Mexico. By lining a canal, lateral, or ditch, the district actually decreases its return flows to the river. In this case, canal lining enhances system operations, but does not necessarily result in increased water in the Colorado River Basin.

Question 10: In your suggestions for Congress you indicate that we should take meaningful steps to provide incentives for non-federal entities to fill the financial void if Congress cannot provide funding for various water management tools. You also indicate that Congress should remove barriers to the new ways of doing business that will be required.

Could you be more specific in what you mean by financial incentives and removal barriers? How might we do both?

Response: See response to Question 8, above.

Question 12: Recognizing funds are limited, how could we better promote public partnerships where Reclamation would be a beneficiary?

Response: First of all, the Reclamation program is already a great example of a public private partnership. Most Reclamation-built water delivery systems are currently being operated, maintained and rebuilt for the future (OM&R) by state-sanctioned local irrigation and water districts under the direction of local citizens elected to their boards of directors. These districts pay the entire bill for this OM&R as well as their portion of any federally managed infrastructure from which they derive benefits. The federal government has built a large footprint on Western water infrastructure over the past 100+ years, but the water infrastructure of the future will largely be built and paid for by the project beneficiaries at the local level. Much of this new infrastructure will need to be integrated into the operation of federal projects in order to fully develop and maximize its public benefits. This is easier said than done, in that Reclamation in the past has been protective of its infrastructure and has not allowed for much involvement by irrigation and water districts, other than reimbursing the high costs of federally building such infrastructure back to Reclamation.

We fully understand that the federal funding mechanisms used in the past to build Reclamation water infrastructure many be long gone, as Congress grapples with the enormous fiscal challenges of the Nation. We view the future of water infrastructure as one where local districts work to plan, design, finance, construct, operate and maintain new water facilities, sometimes on federally-owned lands, to be integrated into federal project operations. Innovative ideas currently being explored (and potentially in need of

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federal legislative authorities) include long-term leases of federally owned property, full or partial title transfers of federal property to project beneficiaries, and privately constructed facilities using sale and leaseback or finance and repayment mechanisms to ultimately transfer the facility into local district operation and ownership.

Questions from Senator Debbie Stabenow

Question 1: The 2014 Farm Bill authorized major investments in agricultural conservation programs, including the new Regional Conservation Partnership Program (RCPP), which is designed to address resource issues at a watershed scale through innovative public-private partnerships, and maintaining support for the Environmental Quality Incentives Program (EQIP), which can help farmers install better water management practices on their farm. I believe these programs should be a key resource for producers who are looking to conserve and better utilize water on their farms, whether it's installation of more efficient irrigation systems to planting cover crops to help maintain soil moisture and health. Your testimony mentions that on your farm in California, you are looking to expand the drip irrigation systems that are installed on your farm. While I understand that on-farm water and soil conservation measures are just one component of the many water issues in the West, I think this is an area that needs to be discussed further. According to the California Irrigation Methods Survey, only 38.4% of all California growers use a Low-Volume irrigation system, such as drip irrigation. While I applaud your efforts to expand drip irrigation on your own farm, it's concerning that this number hasn't increased despite entering the fourth year of drought in California. Instead, we understand that the percentage of California growers using sprinkler irrigation has remained constant. We see this as an area of tremendous opportunity for growers.

Are you utilizing any of the programs authorized by the Farm Bill to expand the drip irrigation on your farm? If so, which programs and do you find them useful? How can more producers be encouraged to take advantage of funding opportunities from the USDA conservation programs authorized by the Farm Bill to transition to more efficient irrigation systems? What are the barriers that prevent farmers from using more efficient irrigation techniques and what are your suggestions for how to increase the number of farmers that use these systems?

Response: We have participated in programs offered by the NRCS, but due to payment limitation changes, we often reach the maximum capped funding level and can no longer participate. Penalizing larger growers with payment limitations stifles the amount of water conservation possible. Payment limitations are an issue. The cost per acre of installing and using highly efficient irrigation systems is many times prohibitive, and

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government assistance is very helpful if we have access to it. Conservation plans should be made on a farm by farm basis – regardless of acreage – and then funding should be made available based on the plan – regardless of payment limitations. Offering farms assistance with consulting costs could also help growers who are not familiar with the technology become more comfortable adopting it.

But converting all crops to drip irrigation is not practicable and could be potentially harmful to the environment. Critics of irrigated agriculture, including the Pacific Institute, are constantly harping about how roughly half of the state's farms still use "inefficient flood irrigation." We can refer you to work completed by David Zoldoske at Fresno State or Stuart Styles at Cal Poly San Luis Obispo, which provide an enlightened view about the efficiency, and low energy use, of "flood" irrigation. Flood irrigation provides groundwater recharge, along with ancillary but direct benefits to wildlife. In the Sacramento valley, thousands of acres of rice ground is flooded annually and provides crucial migration corridor habitat to migrating waterfowl. In our area, alfalfa fields provide important habitat to many bird and snake species. Keep in mind that farmers spend a great deal of money to make sure their flooded fields are properly leveled using the latest in technology. We use a sophisticated GPS system to level our fields to ensure that water properly flows evenly and efficiently across our crops. An uneven field results in poor water distribution and will lead to poor crop quality and yields. Flood irrigation in California is very efficient due to our extensive use of this field leveling technology.

The commercial irrigation industry numbers indicate that drip irrigation investments in agriculture are increasing in recent years. The information in the Irrigation Methods Survey, published by California DWR, ended in 2010 and is essentially the same data that appears in DWR Bulletin 160. There are no published data after 2010, which as you noted the Irrigation Survey reports as roughly 39 percent. So, to say that farmers are not investing in more drip irrigation during the drought may not be correct.

Fortunately, we work with organizations like the California Farm Water Coalition, an organization that itself works closely with industry professionals who provide confidential sales information on an annual basis. The last three years for which we have data show that the acreage of newly installed drip systems is increasing every year.

Drip irrigation acreage annual increases
2011 - 182,000 acres
2012 - 269,000 acres
2013 - 316,000 acres

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This three year total – which includes the drought years – shows that 767,000 acres have been converted to drip irrigation. This does not count 2014, for which we do not yet have data.

Bulletin 160 shows this dramatic change in the installation of drip and decreasing flood acreage that are also outlined in the irrigation methods survey. While the figures shown on page 19 of this response (California Water Plan Update 2013. Volume 3, Chapter 2, pages 2-21 and 2-23) are based on information that ends in 2010, we contend, based on the information above, that they continue on their documented trajectory.

We hope this helps tell the rest of the story. Again suggesting that farmers are not investing in more drip irrigation during the current drought is not an accurate characterization, because the survey cited in the question does not extend past 2010.

Question 2: The USDA Natural Resources Conservation Service provides technical assistance to farmers and ranchers in developing comprehensive conservation plans to help farmers better understand and manage natural resources on their farm or ranch. Do you, or your fellow producers, utilize this service from NRCS to help manage the farm for drought in the long term, including looking at new irrigation systems and guidance on cover crops and tilling methods? If not, why not?

Response: We work closely with the NRCS on conservation planning and have received valuable assistance with installing efficient irrigation systems and adopting reduced tillage practices. We are often limited by the restrictive payment limitations that only allow a certain level of participation. The limits are not based on acreage so a larger grower is often quickly excluded from greater participation. This stifles collaboration and results in less acres being able to participate in these valuable programs.

Many Family Farm Alliance members in the 17 Western states work directly with NRCS and local soil and water conservation districts on a regular basis, looking for better ways to improve water and soil management. For example, NRCS acknowledged this in 2007 in reference to Klamath Basin Conservation Partnership accomplishments: "Farmers and ranchers recognize the importance of conserving the area's natural resources. They contribute to a healthy watershed by implementing sound agricultural practices that create fish and wildlife habitat and improve water quality and quantity. NRCS and Klamath Basin partners help local landowners achieve their conservation goals."

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Figure 2-3 **Change in Irrigation Methods in California (1977-2010)**

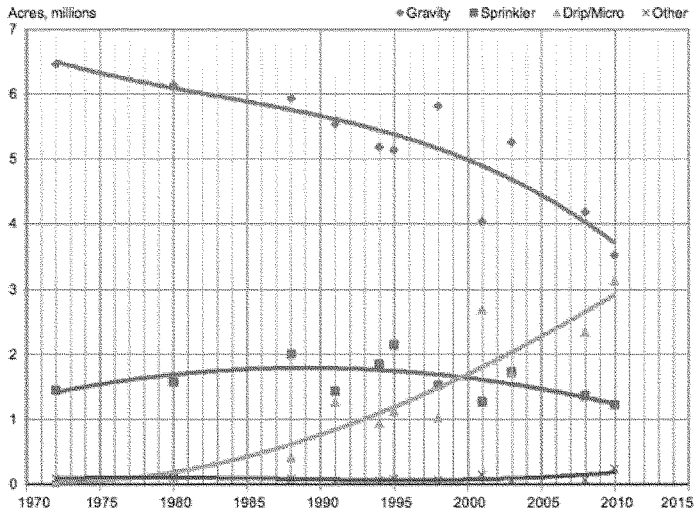

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Table 2-1 **Trends in Irrigation Method Area (in million acres)**

Irrigation Method	1991 Area (MA)	1991 % of Total	2001 Area (MA)	2001 % of Total	2010 Area (MA)	2010 % of Total	Change from 1991 to 2010 Percent Change in Acreage and Reduction/Increase of Area	
Gravity (furrow, flood)	5.54	67	4.04	50	3.53	43	-36%	-2.01 MA
Sprinkler	1.43	17	1.28	16	1.24	15	-13%	-0.19 MA
Drip/micro	1.26	15	2.69	33	3.12	39	+150%	+1.86 MA
Subsurface	0.05	1	0.15	2	0.24	3	+380%	+0.19 MA
Total	**8.28**	**100**	**8.16**	**100**	**8.13**	**100**	**2.01 MA reduction in gravity systems 1.86 MA increase in pressurized systems**	

Note: MA = million acres.

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The Family Farm Alliance played an active role in the development of the last two Farm Bills. In particular, working with a diverse coalition of commodity groups, conservation organizations, and urban water users, we helped develop the framework that ultimately became the Agricultural Water Enhancement Program (AWEP). In 2010, we released a report (*Western Water Management Case Studies*) - that describes a dozen real-world examples of water conservation, water transfers and markets, aging water management infrastructure problems, and watershed restoration and enhancement projects. An important objective of this report was to demonstrate that water managers, ranchers and farmers are resourceful and creative individuals who should play an active role in resolving the water conflicts of the West.

Ranchers in the West depend on the availability of both public and private land for economically viable operations. The single most important factor leading to the loss of wildlife and ecologically degraded landscapes is fragmentation from development, not from farming and ranching. Ranchers want a stable business climate for their operations; conservation groups want healthy and productive landscapes. We will continue to work with conservation groups who share a common interest in supporting working ranches and healthy landscapes and to ensure that continued emphasis is placed in the Farm Bill to support incentive-driven conservation programs. Thousands of water and land conservation projects have been completed across the Western United States, and these efforts should continue. We have long urged federal policy makers to give Farm Bill conservation programs a priority and fund those programs accordingly.

We strongly believe that local, regional and state land managers should be encouraged and provided the tools to lead watershed enhancement efforts. The best decisions on natural resources issues happen at the state and local level. The 2010 Family Farm Alliance report includes a case study that focuses on one such example in the Little Snake River watershed of Wyoming. Since 1991 numerous agencies, organization, and NGO's have recognized landowners and the local governmental natural resource agency, the Little Snake River Conservation District (LSRCD), as leaders in natural resource conservation. These successful efforts have all been locally-led. Conservation of natural resources in the Little Snake River Basin integrated with agrarian life style and perpetuation of this culture is the highest priority for the local community in the Little Snake Basin. In Wyoming, the local residents have passed a conservation property tax to carry on this work. Since 1990 this tax has generated approximately $8 million dollars in local revenues. These funds have leveraged over $40 million dollars in project money to implement conservation and development projects in the Little Snake River Basin.

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Today, the Little Snake River Basin hosts a myriad of wildlife and robust natural resources while sustaining compatible agricultural uses and natural resource-based recreation businesses. This was accomplished through local leadership and commitment of the Little Snake River Conservation District working collaboratively with over 30 different partner organizations and agencies that have assisted in the conservation of the Little Snake Basin, in a collaborative locally-led process.

Properly managing federally-owned watersheds and encouraging federal agencies to work with the agricultural community to solve local water problems are imperative. Through thoughtful planning, Congress can direct NRCS to improve on its truly important role in finding the solutions that have proved so elusive to date.

We need federal policies and water decisions that are based on sound science and that reward producers who care about the environment in providing inexpensive food and fiber and rural economic health. We need to encourage young producers, rather than litigious, anti-agricultural activist groups.

We stand ready to assist you in your efforts, and to share real examples of the effective utilization of Farm Bill programs to the benefit of both agricultural production and conservation results.

Question 3: USDA is currently accepting applications for the second round of RCPP projects. The Department has said they are looking for applications that focus on helping farmers and ranchers manage drought. Is the Family Farm Alliance looking to submit an application for RCPP with other partners in the region to focus on drought assistance for farmers and ranchers?

Response: The Family Farm Alliance as an organization rarely engages in grant application processes. However, we definitely encourage our members to do so, and have been active on the policy front to make it easier for them to do so. As you know, the RCPP folds in the previous Agricultural Watershed Enhancement Program (AWEP) as a part of the Environmental Quality Incentives Program (EQIP), which is administered by the NRCS. The main difference between typical EQIP projects and AWEP projects is that applications for project funding are made directly to the U.S. Secretary of Agriculture from an organization on behalf of a group of agricultural producers who intend to make water conservation improvements in a geographic area.

The Family Farm Alliance was part of a diverse coalition formed during the crafting of the last Farm Bill that focused exclusively on the development of the AWEP concept. Our primary motive for engaging in this process was to provide additional funding

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opportunities –outside of the Interior Department and the Bureau of Reclamation – for irrigation districts and other agricultural water delivery and management organizations to tackle aging infrastructure and water conservation challenges in a more coordinated and effective manner. The original concept behind AWEP was to focus on cooperative approaches to enhancing water quantity and/or quality on a regional scale. This new program - in tandem with multiple conservation tools (including farmland management practices, easement purchases, and ecosystem restoration assistance) - was intended to provide flexibility to cooperative conservation partners to achieve improved water quantity and quality goals.

Some of our members have witnessed firsthand the types of challenges that AWEP advocates were trying to address. For example, the 2002 Farm Bill contained $50 million of EQIP funding to implement water conservation measures in the Klamath Basin of northern California and southern Oregon. These federal funds were matched by $12.5 million of local money from individual landowners. While the water conservation measures undertaken undoubtedly contributed to improved water use efficiency on individual farms, the EQIP program was not designed to coordinate conservation benefits to meet specific regional goals, such as conserving water for storage and future use. Irrigation districts and other, larger conservation entities, which many times coordinate conservation projects to maximize benefits, were not eligible to compete for these funds in the last Farm Bill. We believe this was an opportunity lost, one that could have provided regional water supply solutions to some of the complex problems experienced in Klamath.

Our push on AWEP, in part, was intended to address these types of challenges. There is a need to fund projects that provide water quality and/or water quantity benefits at a scale that benefits more than just one or two producers. In many instances, coordinated regional water conservation efforts can lead to improved water quantities and quality that can only be physically captured and managed by these water delivery organizations to meet overall goals and objectives. We had hoped that AWEP would provide substantial matching grant funding to irrigation districts or other water agencies, which are already in a position to work with multiple producers to achieve locally-generated, measurable objectives and results. If consensus at a regional level can be reached on a common approach to conserving water to meet unmet needs, there will be a better chance of positive community participation and ultimately, a better bang for the federal buck.

The original AWEP proposal was solid from a conceptual standpoint, but by the time it made it through the legislative and administrative process, the program that is now in place is not being implemented in a manner consistent with the original vision. In Arizona, for example, state NRCS local working groups came up with a list of priorities and resource concerns at the request of NRCS headquarters in Washington, D.C. While irrigation

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efficiency was one of the highest priorities listed, local working groups noted that AWEP simply was not being applied in a way that could maximize its potential benefits. Rather than providing funds directly to irrigation districts, the districts instead have been put in situation where they essentially pass the phone number of the local NRCS office on to the individual landowner, and NRCS takes over from there. In essence, the AWEP had simply become an expansion of the existing EQIP program, which was definitely not the intent when this concept was originally crafted.

In the last Farm Bill, Congress included irrigation districts as entities eligible to participate in the RCPP as partners. However, as administered by NRCS, irrigation and water districts are largely disqualified from participation. This is particularly unfortunate because irrigation districts carry out their water distribution activities on behalf of a large number of farmers. They would seem to be the ideal kind of partner that NRCS would want to get involved in the program.

Our understanding is that NRCS correctly reads the RCPP statute to require conformance with the mandatory requirements in the underlying program statutes. One of the requirements of EQIP is that eligible participants must be actually engaged in the production of agriculture. Irrigation districts are comprised of producers who pay for the districts to deliver water for agriculture production. Nevertheless, the district itself does not actually produce the food. For this reason, NRCS bars irrigation districts from participation in RCPP as partners.

There is no reason to read a conflict with the underlying EQIP requirements. And remember, simply conserving water on-farm does not create new water or stretch water supplies. The irrigation districts must be a full partner in on-farm and corresponding on-ditch investments in order to maximize the conservation and use of water under the RCPP or other water conservation partnership programs.

Regardless of our arguments, right now it appears that irrigation districts are prohibited from entering into an EQIP contract since they are viewed as a division of local government. Exempting irrigation districts from the prohibition on contracting with divisions of state or local government is a statutory change we would like to work towards in the next Farm Bill.

The Family Farm Alliance looks forward to working with you further to help improve this vital program.



MEMORANDUM June 19, 2015

To: Senator Lisa Murkowski, Chairman
Senate Energy and Natural Resources Committee
Attention: Darla Ripchensky

From: Betsy A. Cody, Specialist in Natural Resources Policy

Subject: **CRS Response to Questions for the Record for June 2, 2015 Hearing on Drought**

This memorandum responds to your request for CRS to provide answers to several different questions from yourself and Senator Mazie K. Hirono following the Senate Energy and Natural Resources Committee June 2, 2015 hearing, "Drought Conditions in the Western United States." Several CRS analysts contributed to this memorandum. Their contact information has been included with each response. Please feel free to contact me (bcody@crs.loc.gov) or others listed below if you have further questions.

Questions from Chairman Lisa Murkowski

Question 1: In your testimony, you discuss potential legislative options for the Congress to consider. Can you discuss them in a bit more detail?

Response:[1] In my testimony I summarized most legislative options as falling in one or more of the following broad categories: supply augmentation, demand management, governance and institutional mechanisms, and other options to support local efforts. Below are selected examples of options in each category. Because several options could be considered in one or more categories, the options presented are ordered as a continuum, beginning with supply options and moving toward federal support for local efforts. Although each option has benefits and costs, the pros and cons of each option are not discussed herein. CRS would be happy to meet with the Committee to discuss these and other options in more detail.

Selected Legislative Options for Addressing Drought

Legislative options include authorizing and funding – or otherwise supporting – development of new or expanded water supplies, such as surface and groundwater storage projects; augmentation of existing supplies through construction or support of water reuse or recycling projects and desalination projects;

[1] Multiple CRS analysts worked on the topics discussed below. Please feel free to contact Betsy A. Cody (bcody@crs.loc.gov), Nicole T. Carter (ncarter@crs.loc.gov), or Charlie V. Stern (cstern@crs.loc.gov) to coordinate requests for more information on these options.

improvement of project operations and conveyance; and, facilitation of water conservation and efficiency programs.[2] Other options include supporting water pricing reforms associated with federal projects, including elimination of subsidies for water use; establishing water banks, and facilitating water transfers and the use of water markets; authorizing water commissions, task forces, or councils to coordinate federal activities or make recommendations to Congress for further action; and, providing planning and technical assistance to states, tribes, and local governments or entities.

New Storage Projects

The Bureau of Reclamation (Reclamation) is evaluating the feasibility of several new water storage projects, including raising the height of existing federal dams to expand storage capacity. These projects include five in California (Los Vaqueros dam raise; San Luis low-point/expansion; Shasta dam raise; Sites Reservoir (North-of-Delta off-stream storage); and Temperance Flat dam and reservoir (Upper San Joaquin River Storage)), Scoggins Dam in Oregon, and the Yakima River Basin Water Enhancement Project in Washington State. A key component of several these projects is managing water for environmental purposes as well as for delivery to off-stream water users. Traditionally, Reclamation project construction costs are divided into "reimbursable" and "non-reimbursable" costs. Reimbursable costs are those that can be allocated to different water and power users, or "beneficiaries," and are repaid over multiple decades; non-reimbursable costs generally include portions of a project attributed to flood control and other public benefits, and are generally borne by U.S. taxpayers.[3] However, with increasing construction costs and a different mix of project benefits, the question of who should pay for construction (and how much) is becoming more and more complex. Once Reclamation completes these feasibility studies,[4] Congress may be asked to formally authorize these projects and provide funding for them. On the other hand, some project sponsors may seek only limited federal support.

Several bills have been introduced in the 113th and 114th Congresses that include provisions that would authorize water storage projects, address financing of such projects, or require reporting on their status. These include: H.R. 3964 and H.R. 5781 (113th Congress); and, H.R. 291, S. 176, H.R. 2028, and H.R. 2749 (114th Congress).

Improved Conveyance

Improved or new conveyance facilities may help move more water to where it is desired by certain users or to conserve water for instream flows. The State of California Department of Water Resources (DWR), Reclamation, and their respective water contractors are studying options to construct tunnels that would divert water from the Sacramento River and move it underneath the Sacramento and San Joaquin Rivers Delta (Delta) to federal and state pumping facilities in the South-Delta area. Additionally, Congress has

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[2] Water conservation and efficiency programs may also be viewed as demand management, particularly if the programs contain mandatory requirements, such as the Governor of California's executive order mandating a 25% cutback in water use for non-agricultural water users.

[3] In general, irrigators pay no interest on those costs and power users pay irrigation costs beyond irrigators' "ability-to-pay," as defined by Reclamation law. Non-reimbursable costs associated with public benefits may include some costs attributable to fish and wildlife enhancement or general recreation.

[4] These studies are in various stages of completion. For more information on the California studies, see: http://www.usbr.gov/budget/2016/FY16_Budget_Justifications.pdf, pp 10-11.

in the past considered and authorized covering, or converting distribution facilities to pipelines in order to conserve water and stretch available supplies.[5]

Federal Reservoir Operations

Increasing attention is being paid to how federal reservoirs are managed and operated. Of particular interest are facilities that are used for both flood control and water supply storage. Federal agencies may manage these facilities for flood control first and foremost, and develop rule curves that inform operators about when to "spill" water to make room for incoming storms and expected run-off. If expected run-off does not materialize, water spilled represents the loss of water that may have otherwise been stored for future use. With concerns about changes in potential and observed precipitation and runoff patterns, many are questioning whether decades old operating rule curves could be improved upon, for instance by taking into account real time weather forecasts (instead of operating strictly on measured or projected inflows). This might in turn allow reservoirs to store more water for dry times while continuing to manage floodwaters for downstream communities, lives, and property.[6]

Water Reuse and Desalination

Many communities, particularly in California, Florida, and Texas, are seeking to reclaim, reuse, or recycle water as a way to conserve water and use it more efficiently. In the midst of a six-year drought in California and in anticipation of Colorado River water supply shortages, then-Secretary of the Interior, Manuel Lujan, proposed a demonstration program of water reuse for the Bureau of Reclamation. Congress authorized the program in 1992 (Title XVI of P.L. 102-575), including authorization of multiple water reuse projects and desalination pilot projects. More than 50 Title XVI water reclamation and reuse projects have since been authorized by Congress to receive federal support; [7] however, many have not received federal funding. Some have proposed that federal support of water reuse projects be extended to other federal agencies and programs. Most recently, Congress authorized a five-year pilot program for the Army Corps of Engineers and the EPA to provide loan and loan guarantees for a range of water projects, including municipal water recycling (and desalination) as part of the Water Resources Reform and Development Act (WRRDA 2014; P.L. 113-121, Title V, Subtitle C, Water Infrastructure and Finance Innovation Act (WIFIA)).[8] Additionally, states can use money from the federally supported Clean Water State Revolving Fund (CWSRF) and Drinking Water State Revolving Fund (DWSRF) for projects involving water reclamation, reuse, and aquifer recharge and for various water conservation and efficiency measures.

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[5] See for example, the All-American Canal lining project. Additionally, the Idaho Water Resources Board provides loans for such improvement projects in the public interest and 50% grants for engineering and design. See also the Friant Water Users Authority report on recirculation and recapture programs and projects; H.R. 3768 (110th Congress), and the Oregon State Water Resources Department website: http://www.oregon.gov/OWEB/Pages/BiennialReport1315/OWRD.aspx.

[6] For example, see H.R. 813 (114th Congress); and, U.S. Army Corps of Engineers, Folsom Water Control Manual Update, authorized by WRDA 1999 (P.L. 106-53), Section 10, http://www.spk.usace.army.mil/Missions/CivilWorks/FolsomWaterControlManualUpdate.aspx.

[7] Reclamation estimates that for southern California alone, approximately 400,000 acre-feet of water will be made available for local uses when the 17 Title XVI projects in that region are completed. For more background on the Title XVI program, see: CRS Report R41487, *Water Reuse and the Title XVI Program: Legislative Issues*, by Betsy A. Cody and Nicole T. Carter.

[8] For more information on WIFIA, see: CRS Report R43315, *Water Infrastructure Financing: The Water Infrastructure Finance and Innovation Act (WIFIA) Program*, by Claudia Copeland. WIFIA generally funds projects with costs of $20 million or more. See also, H.R. 5534 (113th Congress), and S. 1005 (111th Congress).

Some communities are also pursuing desalination projects. Wider adoption of desalination is constrained by financial, environmental, and regulatory issues. Although desalination costs have dropped in recent decades, significant further decline may not happen with existing technologies. The federal government generally has been involved primarily in desalination research and development (including for military applications), some demonstration projects, and select full-scale facilities.[9] For the most part, local governments, sometimes with state-level involvement, are responsible for planning, testing, building, and operating desalination facilities. Consequently, public and private water providers are interested in the loan and loan guarantee program mentioned above and other alternative financing approaches for reducing the funding barriers to broader desalination adoption.[10] During recent Congresses, legislative proposals have identified a range of different potential federal roles in desalination. Desalination questions before the 114th Congress include how to focus federal research to produce results that provide public benefits, at what level to support desalination research and projects, and how to provide a regulatory context that protects the environment and public health without unnecessarily disadvantaging these technologies.

Conservation and Efficiency

Many observers have promoted water conservation and improved efficiency efforts to stretch existing water supplies.[11] Several federal programs support such efforts, including the U.S. Department of Agriculture's Environmental Quality Incentives Program (EQIP), Agricultural Conservation Easement Program, Conservation Reserve Program, and Regional Conservation Partnership Program.[12] Increased financial support of these programs could assist with agricultural water efficiency or other resource concerns (i.e., fish and wildlife protection). The Department of the Interior also has several water conservation programs, including its WaterSMART program, which provide grants to local entities.[13] Eligible activities are those that promote water resources management preparedness, sustainability, and water and climate variability resilience through actions such as water and energy efficiency, conservation, and planning (including for drought). As noted above, the CWSRF and DWSRF also may be used to support water efficiency and conservation projects.[14] Many conservation efforts are implemented at the local level where public and private utilities may adjust pricing or other policies to promote conservation (see also, tiered/scarcity pricing below). Increased funding or streamlining of any of these programs could assist with improved water conservation and efficiency to support various policy goals.

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[9] For more information on the federal government's role in desalination, see: CRS Report R40477, *Desalination and Membrane Technologies: Federal Research and Adoption Issues*, by Nicole T. Carter.

[10] For example, WIFIA-type programs or private public partnerships (see answers to questions 5 and 6 below).

[11] For legislative examples, see: H.R. 123 (113th Congress); H.R. 291 (114th Congress); S. 176 (114th Congress); S. 720 (114th Congress); S. 1462 (111th Congress); S. 886 (114th Congress); H.R. 291 (114th Congress); H.R. 1278 (114th Congress); S. 176 (114th Congress); H.R. 201 (114th Congress); H.R. 5534 (113th Congress); S. 1005 (111th Congress); S. 2470 (113th Congress); also see CRS Reports R40763 and R43504 (linked above); H.R. 873 (114th Congress); S. 128 (114th Congress); S. 535 (114th Congress).

[12] EQIP is the largest source of federal assistance for agricultural conservation projects on private agricultural land; it is a voluntary conservation program administered by the Natural Resources Conservation Service (NRCS). The program provides direct financial and technical assistance for approved conservation practices based on a current conservation plan. For more information on agricultural conservation programs, see CRS Report R40763, *Agricultural Conservation: A Guide to Programs*, by Megan Stubbs. See also, CRS Report R43504, *Conservation Provisions in the 2014 Farm Bill (P.L. 113-79)*, by Megan Stubbs.

[13] Much of the program was authorized under the SECURE Water Act (Subtitle F, Title IX of the Omnibus Public Land Management Act of 2009, P.L. 111-11, 42 U.S.C. 10364).

[14] See, CRS Report RS22037, *Drinking Water State Revolving Fund (DWSRF): Program Overview and Issues*, by Mary Tiemann.

Tiered/Scarcity or "Conservation" Pricing

Some economists and others have long advocated for tiered or block pricing to manage demand for scarce water resources. The idea behind tiered pricing is to charge a higher fee for larger increments of water used or delivered in order to prompt water conservation and efficiency. Congress directed tiered pricing for the Central Valley Project (CVP) as part of the Central Valley Project Improvement Act (CVPIA, P.L. 102-575; Section 3405(d)). Many public and private water supply purveyors implement some level of tiered or block pricing to manage demand and stretch available supplies.[15] Others have proposed using scarcity pricing to charge more for water when supplies are lower in order to decrease demand at critical times.

Elimination of Water "Subsidies"

Some economists and others for decades have recommended full-cost pricing for water service and elimination of government and public utility subsidies in order for payment of water deliveries to more accurately reflect long-run costs – including developmental and environmental costs. The theory behind the proposals is that the higher the cost of water, the more efficient water users will become. Thus, economists have often recommended developing mechanisms to signal to water users the full economic cost of delivering water supplies, and elimination of existing water subsidies (e.g., the elimination of the interest subsidy on agricultural water deliveries from Reclamation projects) or creation of strategies to market such water (see below) to benefit more water users.[16]

Water Banking

Some states allow and encourage water storage in aquifers in wet years for use in dry years through aquifer storage and recovery programs – also known as groundwater banking. Water may also be traded and stored in surface water reservoirs.[17] Many states, including Arizona, California, Idaho, and Texas have active water banking activities. Reclamation is authorized to "wheel" non-project water (carry water in its facilities) for such purposes and is authorized to participate in groundwater banking under the CVPIA.[18] Congress may wish to review Reclamation policies regarding water banking and wheeling non-project water. Some have advocated strengthening and fostering groundwater banking mechanisms through a variety of means.[19]

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[15] See: Australian Government, National Water Commission, *Urban Water Reform; Efficient Water Resource Pricing: An Assessment of Administered Scarcity Pricing in Urban Areas*, Water Report Series No. 44, Canberra, April 2011, http://archive.nwc.gov.au/__data/assets/pdf_file/0007/22849/Efficient-water-resource-pricing-an-assessment-of-administered-scarcity-pricing-in-urban-areas.pdf; and, Metropolitan Water District of Southern California (MWD) summary of tiered rates: http://www.mwdh2o.com/mwdh2o/pages/finance/finance_03.html#Anchor-Tier-10903.

[16] The "interest subsidy" generally refers to the fact that irrigation contractors do not pay interest on the federal investment for capital construction costs. For more on this topic generally, see: Wahl, Richard, *Markets for Federal Water: Subsidies, Property Rights, and Bureau of Reclamation* (Washington DC: Resources for the Future, 1989); Terry L. Anderson and Pamela S. Snyder, *Priming the Invisible Pump*, PERC, PERC Policy Series, Issue Number PS-9, Bozeman, MT, February 15, 1997, pp. 8-12; and, Beard, Daniel P., *Deadbeat Dams* (Boulder, CO: Johnson Books, 2015).

[17] For example, see the credit system developed for "Intentionally Created Surplus" activities in the Colorado River Basin: http://www.snwa.com/ws/river_surplus_ics.html.

[18] Draft criteria for water banking is available from Reclamation's website: http://www.usbr.gov/mp/waterbanking/.

[19] Ellen Hanak and Elizabeth Stryjewski, *California's Water Market, By the Numbers: Update 2012*, Public Policy Institute of California, November 2012, http://www.ppic.org/content/pubs/report/R_1112EHR.pdf.

Water Transfers and Markets

Economists and others have advocated for decades the use of water transfers and markets as a means of increasing water use efficiency and bolstering water supplies for those who are willing to pay more for water in times of scarcity.[20] While most water markets and transfers are implemented at the local level and generally governed by state law and policy (although certain federal laws may also apply),[21] there are some specific options that might be considered at the federal level, such as:

- Allowing transfer of Reclamation water supplies to purchasers/lessors outside of Reclamation project service areas (The authority currently exists for the CVP but is not widely used.);
- Establishing for each state a coordinating committee from relevant agencies with the authority to facilitate discussions and transactions for water banking and transfers;
- Directing Reclamation to provide incentives for, or otherwise facilitate, "options and futures" contracts for fallowed land and water transfers;
- Waiving cost reimbursement to federal agencies for National Environmental Policy Act (NEPA) and Endangered Species Act (ESA) compliance for water transfers of federal contract water during declared drought conditions;
- Requiring measurement or metering of Reclamation water as part of contract renewal processes; or
- Directing that a percentage of water transfer profits (or flat fee) on the sale/transfer of Reclamation-supplied water (sale price minus cost of water to seller) be deposited in an infrastructure improvement, conservation, or habitat restoration account (e.g., trust or bank). Funds could be used by the transferring entity for specified authorized purposes (e.g., on-farm or municipal and industrial efficiency improvements, water storage, reuse projects, fish screens, or habitat or restoration projects).

Governance/National Policy

Several factors make comprehensive drought policy at the national level a challenge, including:

- the gradual nature of drought;
- the split federal and nonfederal drought response and management responsibilities;

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[20] In general, see: Wahl, Richard, *Markets for Federal Water: Subsidies, Property Rights, and Bureau of Reclamation* (Washington DC: Resources for the Future, 1989); National Research Council, *Water Transfers in the West: Efficiency, Equity, and the Environment*, Committee on Western Water Management, Water Science and Technology Board, Commission on Engineering and Technical Systems, Washington DC, 1992, http://www.nap.edu/catalog/1803/water-transfers-in-the-west-efficiency-equity-and-the-environment; Todd Doherty and Rod Smith, *Water Transfers in the West: Projects, Trends, and Leading Practices in Voluntary Water Trading*, Western Governors' Association, Western States Water Council, Denver, CO, December 2012; Peter W. Culp, Robert Glennon, and Gary Libecap, *Shopping for Water: How the Market Can Mitigate Water Shortages in the American West* (Washington DC: Stanford Woods Institute for the Environment/Brookings Institution "The Hamilton Project"), discussion paper 2014-05, http://waterinthewest.stanford.edu/sites/default/files/market_mitigate_water_shortage_in_west_paper_glennon_final.pdf; and California DWR information on water transfers, available at: http://www.water.ca.gov/watertransfers/.

[21] For example, some have challenged whether Clean Water Act standards apply to transferred water (see: http://www.crs.gov/LegalSidebar/details.aspx?ProdId=1180).

- a patchwork of federal programs and oversight with little coordination; and
- the differences in regional conditions and drought risk in terms of the drought hazard, vulnerability, and potential consequences.

Congress has long recognized the lack of coordinated drought planning and mitigation activities among federal agencies and the predominance of a crisis management approach to dealing with drought. For example, in 1998 Congress passed the National Drought Policy Act (P.L. 105-199), which created the National Drought Policy Commission. In 2000, the commission submitted to Congress a comprehensive report that included policy recommendations.[22] Congress has considered recommendations from the commission's 2000 report; to date, it has enacted one part of the recommendations (the National Integrated Drought Information System, discussed below).[23] In the past, Congress has considered, but has not enacted legislation to create a National Drought Council.[24]

Other options include establishing a commission to assess federal coordination on water resources more broadly, such a national water commission, or reinstituting the Water Resources Council to coordinate federal water activities.[25] In November 2013, the Obama Administration established the multi-agency National Drought Resilience Partnership to coordinate efforts to deliver federal expertise and resources to facilitate community drought preparedness.[26] To date, this partnership has not received direct appropriations, but its activities are supported through the participating federal entities and their budgets, which provide another avenue for congressional action.

Drought Data/Science/Research/Planning

In addition to federal efforts associated with specific technologies (e.g., reuse, desalination), the federal government also provides other research and science significant to drought preparedness and response. For example, the U.S. Drought Monitor relies on data collection from remote observations (e.g., satellites) and surface observations (e.g., U.S. Geological Survey stream gauges, and soil moisture and precipitation measurements); it also relies on complex models and on dissemination and research through the National Integrated Drought Information System (NIDIS). This information is used by communities and states to plan water withdrawals and diversions, assess needs for water-use restrictions, and anticipate or respond to drought-related environmental stresses (e.g., fish kills, saltwater intrusion into aquifers, and habitat degradation from high water temperatures). Improved monitoring and other technologies have resulted in a better understanding of drought frequency, intensity, and duration due to climate and weather conditions. Support for improved forecasting and efforts to incorporate improved drought information into decision-making may reduce public and private losses resulting from drought.

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[22] National Drought Commission, *Preparing for Drought in the 21st Century*, Washington DC, May 2000, http://govinfo.library.unt.edu/drought/finalreport/fullreport/pdf/reportfull.pdf.

[23] See: CRS Report RL34580, *Drought in the United States: Causes and Issues for Congress*, by Peter Folger, Betsy A. Cody, and Nicole T. Carter.

[24] Congress considered, but did not enact, legislation in the 108th and 109th Congresses (The National Drought Preparedness Act, S. 1454 and S. 802, respectively), which would have established a National Drought Council to develop a national drought policy and fund development of drought preparedness plans for states, tribes, and local entities, as well as other recommendations of the 2000 National Drought Commission report. Some of the commission recommendations were enacted in separate legislation that created the National Integrated Drought Information System (P.L. 109-430).

[25] For more on this topic, see: CRS Report R40573, *Thirty-Five Years of Water Policy: The 1973 National Water Commission and Present Challenges*, coordinated by Betsy A. Cody and Nicole T. Carter.

[26] See https://www.whitehouse.gov/blog/2013/11/15/introducing-national-drought-resilience-partnership for more information.

States, along with local governments and water providers, generally are responsible for preparing and planning for drought conditions. Often states take actions guided by state-level drought plans. Federal programs and options exist to support state, local, and tribal efforts to prepare for or mitigate drought impacts. Additional federal support and technical assistance for local and state water resources planning and action plans (e.g., state drought plans, water utility drought plans) may foster improved drought preparedness.

Regulatory Relief (i.e., ESA/NEPA)

Some observers have also proposed altering or waiving regulatory compliance mechanisms such as project and program reviews under the National Environmental Policy Act or consultation and listing activities under the federal Endangered Species Act. Specific legislative examples include: S. 2016 in the 113th Congress); H.R. 1668 and S. 280 in the 114th Congress. See also, CRS Report RL33267, *The National Environmental Policy Act: Streamlining NEPA*, by Linda Luther, and CRS Report RL34641, *Changes to the Consultation Regulations of the Endangered Species Act (ESA)*, by Kristina Alexander and M. Lynne Corn.

Tax Incentives

Some have proposed that Congress approve tax incentives for activities that might alleviate drought conditions (e.g., to increase municipal and industrial and agricultural water use efficiency, build water reuse projects, and increase surface and groundwater storage). See, for example, S. 2227 and S. 2189 in the 113th Congress; and, S. 1711 in the 111th Congress.

WIFIA/Infrastructure Banks/Loans/Trust Funds

The combination of federal budget constraints and increased construction costs for new projects has resulted in proposals for different financing mechanisms for federal water resources projects, including private-public partnerships, infrastructure banks, federal loan programs, and special trust funds to support project construction. For more on these options, see answers to questions 5 and 6 below and CRS Report CRS Report R43315, *Water Infrastructure Financing: The Water Infrastructure Finance and Innovation Act (WIFIA) Program*, by Claudia Copeland and CRS Report IF10042, *The Reclamation Fund*, by Charles V. Stern. See also: H.R. 1710 and S. 1365 (114th Congress); and H.R. 3582 and H.R. 1877 (113th Congress).

Question 2: In your testimony, you indicate that current and expected population growth is among the challenges facing water state and federal water managers. Could you be a bit more specific? For example, what are the project[ions]s for the region? What are the projections for major cities, such Phoenix, Las Vegas, and Denver?

Response:[27] Reclamation in 2012 completed a comprehensive supply and demand study for the Colorado River Basin, which encompasses 7 western states and includes the metropolitan areas of Phoenix and Las Vegas. While dense population areas such as Denver, CO, and southern California (including Los Angeles and San Diego) are not in the Colorado River hydrologic basin, they were included in the study because these areas receive and use Colorado River water.[28] In conducting the study, Reclamation

[27] For more on this topic contact Betsy A. Cody (bcody@crs.loc.gov).

[28] Because these areas have supplies other than Colorado River water, demand projections are more complicated. For an (continued...)

outlined six supply and demand scenarios. The demand scenarios included a range of population projections from "slow growth" to "rapid growth." The slow growth estimate projected a growth in population from 40 million people in 2015 to 49.3 million in 2060. The rapid growth estimate projected that population would reach 79 million by 2060.[29] The study confirmed that demand in the Lower Basin (AZ, CA, NV) is or is likely to be, greater than supply for all scenarios.

Question 3: You reference the Lake Mead levels getting potentially low enough to trigger a level one shortage resulting in state allocations in Arizona and Nevada. What is a level one shortage? How many people would be affected?

Response:[30] The term "level one" or "tier one" shortage refers to the first level of water supply shortages that could be triggered under the "Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead," an agreement among the seven Colorado River Basin states for addressing Colorado River water supply shortages. Under the agreement, Arizona and Nevada would see a reduction in water deliveries (320,000 acre feet for Arizona and 13,000 acre feet for Nevada) if water levels in Lake Mead fall below 1075 feet above sea level; however, California would not be affected by tier one shortages under the agreement. For Arizona, the reductions would come primarily from agricultural reductions to the Central Arizona Project (CAP). Supplies for Arizona Municipal and Industrial (M&I) water users and Indian water supplies are not projected to be reduced, but may need to be supplemented with stored groundwater. Consequently, it is unknown exactly how many people would be affected under this scenario.[31] Deliveries to Mexico would also be reduced under a level one/tier one declaration.

Question 4: In your testimony, you mentioned that junior water rights holders in California are expected to get no water this year from the Central Valley Project. That will be the second year in a row correct? And in fact many senior water rights holders are also facing significant reductions this year as they did last year, correct?

Response:[32] Central Valley Project (CVP) agricultural water service contractors are projected to get no water from the CVP this year. Senior water contractors such as the "Sacramento River Settlement Contractors" and the "Exchange Contractors" are projected to receive 75% of their contract supplies – a

(...continued)

explanation of the methodology used by Reclamation, see: http://www.usbr.gov/lc/region/programs/crbstudy/finalreport/Technical%20Report%20C%20-%20Water%20Demand%20Assessment/TR-C-Water_Demand_Assessmemt_FINAL.pdf.

[29] U.S. Dept. of the Interior, *Colorado River Basin Supply and Demand Study*, Bureau of Reclamation, Washington DC, December 2012, http://www.usbr.gov/lc/region/programs/crbstudy/finalreport/Study%20Report/CRBS_Study_Report_FINAL.pdf.

[30] For more on this topic contact Betsy A. Cody (bcody@crs.loc.gov).

[31] One acre-foot is equivalent to 325,851 gallons and is estimated to be enough water to supply a family of 4 people for one year (http://www.usbr.gov/main/about/fact.html). However, water reductions in agricultural use may affect landowners, farm operators, farm workers, agricultural producers, suppliers, and potentially consumers. Thus, estimating how many people might be affected by such reductions is very difficult. For more information on the shortage sharing guidelines, see: http://www.usbr.gov/lc/region/programs/strategies.html. For information on how guidelines might affect Arizona, see: http://www.cap-az.com/documents/meetings/05-01-2014/9.%20Colorado%20River%20Report%20May%201%20Board.pdf.

[32] For more on this topic, please contact Betsy A. Cody (bcody@crs.loc.gov).

25% reduction (see **Table 1** below). It is correct that CVP agricultural water service contractors also received a zero allocation in 2014, as did contractors of the CVP Friant Division.[33]

Table 1. CVP Contractors and 2015 Water Allocations
(allocations as percentages of maximum contract quantities)

CVP Contractors	February	March	April	May
Senior Water Rights				
San Joaquin Exchange Contractors	75%	75%	75%	75%
Sacramento River Settlement Contractors	75%	75%	75%	75%
Wildlife Refuges				
NOD Refuges (level 2)*	75%	75%	75%	75%
SOD Refuges (level 2)*	75%	75%	75%	75%
Friant Division				
Class I Contractors	0%	0%	0%	0%
Class II Contractors	0%	0%	0%	0%
Other CVP Water Service Contractors				
NOD Ag. Service	0%	0%	0%	0%
NOD M&I	25%	25%	25%	25%
SOD Ag. Service	0%	0%	0%	0%
SOD M&I	25%	25%	25%	25%

Source: U.S. Department of the Interior, Bureau of Reclamation, *Summary of Water Supply Allocations*, p 4. See, "Water Allocations Historical" at bottom of webpage: http://www.usbr.gov/mp/cvo/.

Notes: According to Reclamation's website, no changes in allocations have been made since February, 2015. * Level 2 supplies are less than full level 4 supplies, which are specified under CVPIA. (NOD=North of the Sacramento and San Joaquin Rivers Delta confluence with San Francisco Bay (Bay-Delta, or Delta); SOD=South of Delta; M&I=Municipal and Industrial contractors.)

Question 5: Regarding legislative options, in your testimony you indicate some folks have called for an annual report and authorization process for Reclamation similar to the requirements enacted for the Corps of Engineers in last year's Water Resources Reform and Development Act. Can you explain what the Corps language in the Water Resources bill did? Would it work at Reclamation?

Response:[34] The Water Resources Reform and Development Act of 2014 (WRRDA 2014, P.L. 113-121) included provisions that created new administration and congressional processes associated with authorizing U.S. Army Corps of Engineers civil works studies and construction projects. WRRDA 2014 requires that the Secretary of the Army annually transmit to the House Transportation and Infrastructure Committee and the Senate Environment and Public Works Committee a report identifying new studies, completed feasibility reports, and project modification reports for potential authorization by Congress. The first step in producing the report is to solicit proposals from nonfederal entities. The Secretary is then required to transmit qualifying proposals to the authorizing committees in the annual report. The first

[33] For a summary of historical CVP water allocations see:
http://www.usbr.gov/mp/cvo/vungvari/water_allocations_historical.pdf.

[34] For more information on the WRRDA language and how it applies to the U.S. Army Corps of Engineers, please contact Nicole T. Carter (ncarter@crs.loc.gov) or Charles V. Stern (cstern@crs.loc.gov. For more information on how such language might apply to the Bureau of Reclamation, contact Charles V. Stern or Betsy A. Cody (bcody@crs.loc.gov).

annual report was delivered in February 2015; a May 26, 2015, Federal Register notice opened the period for proposal submission for consideration in the second annual report. The authorizing committees have not acted on any "annual report" transmissions at this point in time. WRRDA 2014 also established expedited House and Senate procedures for bills authorizing construction projects meeting specified criteria.

While these process changes may shape how Congress authorizes Corps study and project authorizations, these specific provisions did not alter how the agency delivers projects. For example, most Corps projects still need to be authorized by Congress and funded through annual appropriations bills.

Other portions of WRRDA 2014 were focused on altering project delivery; for example, other provisions authorized increased roles for nonfederal entities and nonfederal financing in the delivery of projects. (See response to Question #6, below.) Given the early stages of implementation of WRRDA 2014, there is insufficient experience to determine how the changes enacted in WRRDA 2014 for the Corps may be affecting Corps project delivery.

Similar study and project authorization and funding approaches could be used for Reclamation Projects. Currently, Reclamation is authorized to undertake general investigations and project appraisal studies (i.e., pre-feasibility studies) but must get congressional approval for feasibility level studies. Congress could direct Reclamation to summarize all studies and seek proposals for projects as has been done for the Corps. If authorizing process changes similar to the WRRDA 2014 changes were adopted for Reclamation without other changes to project delivery, such as funding mechanisms, it is unclear whether they would significantly improve Reclamation's project delivery. An option for Congress would be to also authorize a WIFIA-type pilot project for Reclamation as done for the Corps in WRRDA 2014; however, it is not yet clear how such will work in practice (see response to Question 6, below). Or, instead, authorize a central water resources infrastructure financing program, to avoid duplication among agencies.

Question 6: You also highlight that to address funding issues, some call for the formation of private-public partnerships, and authorization of non-federal funding or private development of projects. What might nonfederal funding or private development projects look like? Can you expand on that?

Response:[35] To date, private financing of or investment in public water projects has been limited. The Water Resources Reform and Development Act of 2014 (WRRDA 2014, P.L. 113-121) made several changes aimed at expanding the options for water project delivery and financing, including expanding the opportunities for public-private partnerships. Prominent among these were the authorization of the Water Infrastructure Finance and Innovation Act (WIFIA) and a pilot public-private partnership construction program.[36] Each of the newly authorized programs and their potential application to Reclamation projects is discussed below.

WIFIA

WRRDA 2014 (Title V, Subtitle C) authorized a five-year pilot program for the Army Corps of Engineers and the EPA to provide loan and loan guarantees for a range of water projects. Notably, desalination, municipal water recycling, and aquifer recharge projects are specifically identified as eligible under the

[35] For more information on this topic, please contact Claudia Copeland (EPA implementation) and Charles V. Stern (Corps of Engineers implementation).

[36] See P.L. 113-121, Title V.

EPA-administered WIFIA. Proponents of the WIFIA concept believe that it can be a mechanism to encourage more public-private partnerships for water infrastructure projects.

Conceptually, under WIFIA, a low-interest federal loan or loan guarantee will be able to leverage private investment by attracting substantial private and other non-federal co-investment in projects. In the case of the Transportation Innovation and Finance Act (TIFIA), the federal transportation program on which WIFIA was modeled, what attracts private investors is TIFIA's ability to provide very long-term loans at below market interest rates. Whether WIFIA will facilitate such investments in water projects is largely unknown for now, because implementation of WIFIA will not occur until Congress appropriates funds to cover the subsidy cost of the program, which has not yet happened. For the Corps of Engineers (the agency most similar to Reclamation), the Administration has yet to request funds under the new authority, and is reportedly researching the feasibility of the concept for federal water resources projects. For more about the WIFIA program, see CRS Report R43315, *Water Infrastructure Financing: The Water Infrastructure Finance and Innovation Act (WIFIA) Program*, by Claudia Copeland.

Hypothetically, some of the WIFIA program concepts could potentially be applied to Reclamation; however, a number of issues would need to be resolved. For instance, would a WIFIA-funded Reclamation project be subject to Reclamation Law?[37] Would the loan subsidy cost (i.e., the valuation of the federal risk) for a Reclamation WIFIA project be different than for that of other water infrastructure projects financed by WIFIA? And finally, what kind of charges/revenues could be collected to provide for the repayment of these projects, in what amount, and by whom?[38]

Pilot for Nonfederal Construction of Corps Projects

WWRDA 2014 (Section 5014) also authorized a 5-year public-private partnership pilot for managing construction of 15 authorized Corps navigation or flood control projects; at present, the agency has not published implementation guidance for this section and no projects have been proposed.

While it is difficult to see exactly how this authority might be applied to Reclamation, a similar authority for nonfederal management of the construction of Reclamation projects could hypothetically be provided to Reclamation. Such an authority could potentially expedite certain construction activities if they are not subject to the same federal processes and guidelines that some complain are slowing construction. However, unless the nonfederal entity managing construction is funding these activities itself, with no expectation of reimbursement, they may still depend (either totally or partially) on federal appropriations, which are one of the chief obstacles to construction of new federal water resource projects.

Question from Senator Mazie K. Hirono

Question: In your testimony you note that recent federal response to drought has largely been limited to the USDA providing financial assistance to farmers and ranchers. A lot of these programs appear to be

[37] The body of law that applies to the U.S. Dept. of the Interior Bureau of Reclamation is known as "Reclamation Law." It consists of the Reclamation Act of 1902, as amended, and numerous other laws. Some provisions of Reclamation law restrict use of water supplied by Reclamation projects to specific lands and also limit the number of acres that can be owned and irrigated by one user (known as the "960 acre limit"). Other provisions provide for repayment of assigned construction costs, and specify operations and maintenance requirements.

[38] It is unclear whether Reclamation projects that would otherwise have been built with federal appropriations would be able to generate sufficient revenue streams to pay back construction/loan costs without authority to charge more than is currently authorized.

reactive to ongoing drought situations, such as emergency response. As you may know, Hawaii has experienced drought in our past. Between 2005 and 2013 drought impacted our Hawaii Cattle Industry, causing them to lose 15% of their herd. Based on climate predictions Hawaii will experience drought again in the future-so we would like to position ourselves in a proactive posture when preparing for drought scenarios.

Can you identify any USDA programs or funding opportunities that support long-term drought mitigation projects? For example, funding to maintain existing agricultural water infrastructure or develop new systems for agricultural use. Also, Hawaii has a grass that grows wild across the state and is currently listed as invasive by the USDA Natural Resources Conservation Service. This grass has potential to serve as cattle forage and replace native grasses that are severely impacted by drought conditions. Has there been an instance in the past where USDA-NRCS has made exemptions for farmers to utilize an invasive species for their operations in times of drought emergencies?

Response:[39] **Programs and Funding Opportunities** – USDA utilizes a number of conservation program authorities to provide voluntary, on-farm, water conservation assistance to agricultural producers. These programs provide technical and financial assistance directly to producers to create conservation plans and implement structural, vegetative, and management practices that reduce on-farm/ranch water consumption both in the short- and long-term. It should be noted that the purpose of these programs is to address multiple resource concerns and are not limited to water quantity improvement. Select examples of USDA conservation programs that provide assistance for implementing water conserving practices include:

- Environmental Quality Incentives Program (EQIP) – provides financial and technical assistance for conservation practice implementation addressing resource concerns;
- Agricultural Management Assistance (AMA) program - provides financial and technical assistance to improve water management and irrigation structures among other activities;
- Conservation Technical Assistance – provides technical assistance for site-specific conservation planning and conservation system application tailored to local conditions;
- Conservation Stewardship Program (CSP) – provides financial and technical assistance to expand and enhance existing conservation practices while addressing multiple resource concerns;
- Emergency Conservation Program (ECP) – provides emergency financial and technical assistance to rehabilitate farmland damaged by natural disasters and implement emergency water conservation measures in response to severe droughts; and
- Emergency Watershed Protection (EWP) program - provides technical and financial assistance to help communities address hazardous watershed impairments (e.g., re-seed drought stricken areas that would be prone to erosion and could potentially pose a threat to life or property).

Other USDA easement and land retirement conservation programs may reduce water consumption as a secondary benefit to its primary objective of removing land from production for the purposes of wetland restoration or wildlife habitat. These programs include, but are not limited to:

- Agricultural Conservation Easement Program (ACEP) – wetland reserve easements remove land from production for wetland protection and restoration; and

[39] For more information on this topic, please contact Megan Stubbs (mstubbs@crs.loc.gov).

- Conservation Reserve Program (CRP) – removes land from production for soil, water, and wildlife habitat benefits. Also allows for limited haying and grazing during times of drought.

Additional information about these and other USDA conservation programs may be found in CRS Report R40763, *Agricultural Conservation: A Guide to Programs.*

Response: Invasive Grasses – Generally, invasive species are not encouraged under federal programs as defined by Executive Order 13112.[40] Several USDA programs provide assistance for research, eradication and control of invasive species, but not for expanded use.[41] NRCS operates Plant Materials Centers (PMCs) in many areas of the country that seek out and test plants and plant technologies for conservation traits. In Hawaii, the Hoolehua Plant Materials Center selects plant materials and develops conservation technology for the unique volcanic soils of Hawaii, Guam and other Pacific Basin islands and could assist constituents in your state with forage alternatives during times of drought.[42] Examples of exemptions, if any, for planting invasive species under NRCS programs would have to be requested from NRCS.[43]

[40] Executive Order 13112, "Invasive Species," 64 *Federal Register* 6183, February 3, 1999.

[41] For additional information, see CRS Report R43258, *Invasive Species: Major Laws and the Role of Selected Federal Agencies.*

[42] For additional information on the Hoolehua PMC, see http://www.nrcs.usda.gov/wps/portal/nrcs/detail/pia/plantsanimals/?cid=nrcs142p2_037728.

[43] Please contact Megan Stubbs (mstubbs@crs.loc.gov) if you would like additional information on this process.

Testimony for the Record

The 21st Century Pipe Coalition

Submitted to the Committee on Energy and Natural Resources United States Senate
Oversight Hearing On
"The Status of Drought Conditions Throughout the Western United States and Actions States and Others are Taking to Address Them."

Washington, D.C.
June 2, 2015

Chair Murkowski, Ranking Member Cantwell, Members of the Committee, on behalf of the Uni-Bell PVC Pipe Association, the American Concrete Pressure Pipe Association, the Northwest Pipe Company, and Diamond Plastics Corporation, together known as the "21st Century Pipe Coalition", we thank you for holding this hearing to examine drought impacts and solutions in the West and giving the Coalition the opportunity to discuss the role that pipe companies play in drought mitigation.

The Coalition represents plastic, steel, and concrete pipe manufacturers with operations in 34 states where we employ a total of 8,700 individuals. We supply pipe for municipal and agricultural water infrastructure projects of all sizes. We believe that one of the keys to ensuring stable, long-term water supplies is a reliable, efficient, and effective water delivery system.

During the June 2nd hearing Chair Murkowski wisely noted that, "As we talk about infrastructure and updating things around this country one of those areas that we forget, when we talk about efficiency and conservation is old water systems that leak and how much water we loose just because of aging infrastructure."

Chair Murkowski's comments are extremely accurate. Leaky pipes and water main breaks lead to a significant loss of potable water, cost cities millions each year and increase costs for ratepayers. According to a report by the U.S. Conference of Mayors, municipal water systems lose 2.6 trillion gallons each year (17 percent of all pumped water) to leaky pipes.[1]

As the Committee considers how to best address the problems posed by our nation's aging water infrastructure we feel it is important to consider that the corrosion of buried metallic pipe is often the culprit of water main breaks. A 2012 Utah State University study found that one in four water main breaks is caused by corrosion and that 75 percent of all utilities have corrosive soil conditions.[2]

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[1] U.S. Conference of Mayors, MUNICIPAL PROCUREMENT: PROCUREMENT PROCESS IMPROVEMENTS YIELD COST-EFFECTIVE PUBLIC BENEFITS (March 2013), *available at* http://www.usmayors.org/publications/media/2013/0422-waterprocurementWP.pdf.

[2] Steven Folkman, Utah State University Buried Structures Laboratory, WATER MAIN BREAK RATES IN THE USA AND CANADA: A COMPREHENSIVE STUDY (April 2012), *available at* http://www.watermainbreakclock.com/docs/UtahStateWaterBreakRates_FINAL_TH_Ver5lowrez.pdf.

In its landmark 2012 report, *Buried No Longer: Confronting America's Water Infrastructure Challenge*, the American Water Works Association estimated America's investment needs for buried drinking water infrastructure to be $1 trillion over the next 25 years.[3] That infrastructure investment, which includes pipe repair and replacement, will be crucial for water conservation and savings. We believe that it is essential for public dollars to be spent wisely on long-lasting pipe that keeps water in the system and provides a positive return on public investment.

To that end, water providers and their partners at federal agencies, must consider the life cycle of buried pipe by looking not only at the cost of initial installation, but also the likelihood that a water main will corrode or break, the cost of potential repairs, and the water lost due to main failure. This requires, amongst a variety of factors, a comprehensive analysis of soil composition (this is especially important where corrosive soils are present), pipe material, and water pressure. In addition, water providers must weigh the need for special practices or materials to mitigate corrosive factors in soils, including potential application of cathodic protection or special coatings. These considerations must all be based on sound engineering.

We call ourselves the 21st Century Pipe Coalition because, despite our members' status as competitors, we embrace and employ the latest technological advances that mitigate the effects of corrosion and consistently work to improve water systems that are often more than a century old. The Coalition firmly believes that pipe manufacturers have a vital role to play, using tried and true engineering practices and principles in corrosive soils, in assisting western water providers to repair and replace aging water transmission systems in a manner that conserves precious water supplies and ensures long-lasting water infrastructure.

We appreciate the Committee's efforts to assess current drought conditions, find effective solutions, and foster sustainable water supplies throughout this great nation.

Respectfully submitted,

Richard I. Mueller, P.E.
President and CEO
American Concrete Pressure Pipe Association

Bruce Hollands
Executive Director
Uni-Bell PVC Pipe Association

Martin Dana
Executive Vice President - Sales
Northwest Pipe Company

Dennis Bauer
Vice President – Sales & Marketing
Diamond Plastics Corporation

[3] American Water Works Association, BURIED NO LONGER: Confronting America's Water Infrastructure Challenge (February 2012) available at *http://www.awwa.org/Portals/0/files/legreg/documents/BuriedNoLonger.pdf*

OFFICE OF THE
CITY COUNCIL

JAY SCHENIRER

COUNCILMEMBER
DISTRICT FIVE

CITY OF SACRAMENTO
CALIFORNIA

June 2, 2015

Honorable Lisa Murkowski
Chairwoman
Committee on Energy and Natural Resources
U. S. Senate
Washington, D.C. 20510

Honorable Maria Cantwell
Ranking Democrat
Committee on Energy and Natural Resources
U.S. Senate
Washington, D.C. 20510

SUBJECT: DROUGHT LEGISLATION

Dear Chairwoman Murkowski and Ranking Democrat Cantwell:

The City of Sacramento (Sacramento) requests that this letter be made part of the June 2, 2015 hearing record into the hearing held to review the western drought and actions taken to address the impacts of the drought. We appreciate that the hearing was held to consider west-wide drought conditions and impacts. However, our comments, understandably, focus on the four year California drought and proposals that have been offered during the past Congress.

The City of Sacramento supports legislation that would enhance collaboration among all stakeholders and focuses any policymaking in a manner that equitably balances the needs of municipal and agriculture and northern and southern Californians. California is experiencing its fourth consecutive year of an extraordinary and serious drought. Any policy response must consider that we are in a period of prolonged hydrological changes that will impose predictable and unpredictable challenges to the State of California as well as the western United States.

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With these challenges in mind, we encourage your committee to adopt the following set of principles in crafting legislation as it pertains to California:

- Legislation must avoid the redirection of impacts to existing water users. Alteration of how the Central Valley Project (CVP) operates to benefit one set of CVP customers will have ripple effects on others who are provided with water via the CVP. These need to be understood and adverse effects avoided.
- Legislation should be constructed in a way that ensures that Federal water supply projects such as the CVP are operated in a manner consistent with existing settlement and operating contracts (settlement contracts). We are concerned that past proposals could result in Folsom Reservoir being operated in a manner inconsistent with the City's settlement contract with the United States Bureau of Reclamation. This contract and the underlying water rights are essential to the City's water supply. Reclamation must retain the authority and ability to operate Folsom and other CVP facilities in a manner that enables it to comply with its settlement contract obligations.
- Legislation should provide funding for water recycling and water use efficiency programs and projects that can be quickly implemented that would make strained water supplies stretch further.

Sacramento is committed to work with you in developing a legislative solution that addresses the serious need for water supply reliability for all users of water. We stand ready to provide comments on specific legislative language.

If you have any questions, please contact Randi Knott, Director of Government Affairs at (916) 808-5771 or Jim Peifer, Department of Utilities at (916) 808-1416.

Sincerely,

Jay Schenirer
Councilmember, Chair of Law and Legislation Committee

CC: Senator Dianne Feinstein
Senator Barbara Boxer
Representative Doris Matsui
Representative Ami Bera
City of Sacramento Mayor and Council Members

Tanya Trujillo
Executive Director
Colorado River Board of California

Statement for the Record
Committee on Energy and Natural Resources
United States Senate
Oversight Hearing on
Drought Conditions throughout the Western United States
June 2, 2015

The Colorado River Board of California appreciates the opportunity to submit testimony in connection with the Committee's oversight hearing regarding the status of drought conditions in the Western United States and the actions states and others are taking to address them. Drought conditions within California and the Colorado River Basin are of great concern to the Colorado River Board of California. The Board was established in 1937 to protect the interests and rights of the State of California, its agencies, and citizens, in the water and power resources of the Colorado River System. The Board's member agencies are Palo Verde Irrigation District, Imperial Irrigation District, Coachella Valley Water District, the Metropolitan Water District of Southern California, the Department of Water and Power of the City of Los Angeles, and the San Diego County Water Authority. Water from the Colorado River is used to irrigate over 700,000 acres of some of the most productive farmland in the country, and is an essential supply for the municipalities in Southern California especially during the current drought within California.

In response to the exceptional drought conditions in the State of California that have existed since 2013, on April 1, 2015, California's Governor issued an Executive Order mandating a statewide 25% reduction in potable urban water usage through February 2016. The April 1 Executive Order extended prior orders issued in January and April of 2014 establishing a State of Emergency throughout the State due to the severe drought conditions. Since 2013, the State of California's water supplies have been severely depleted as a result of record low snowpack in the Sierra Nevada, decreased water levels in most of California's reservoirs, reduced flows in the State's rivers and diminished supplies from the State's underground aquifers and aqueduct systems. In addition to the Governor's Executive Orders and State Water Resources Control Board's efforts to implement the Executive Orders, there have been numerous responses to the drought conditions at the local level. Agencies continue to enhance their water conservation programs and a significant public awareness campaign continues to provide information to residents and assistance in complying with the mandated water use reductions. On May 29, the board of directors of Metropolitan approved the nation's largest turf removal and water conservation program that over the next decade is expected to generate enough water savings to nearly fill the region's largest reservoir—Diamond Valley Lake. The significant expansion of the turf removal component is expected to remove about 175 million square feet of lawn, more than triple Gov. Jerry Brown's goal for the entire state. The total conservation program is projected to save more than 70 million gallons of water a day for Southern California, or enough water for 160,000 households. Metropolitan's board added $350 million to the district's conservation budget to a new total of $450 million over two years. With local rebate programs of more than $50 million, the total regional investment will be more than half a billion

dollars. California agencies are also investing in technologies such as seawater desalination and the Carlsbad Desalination Project is expected to begin producing water this fall.

Within the Colorado River Basin, existing agreements and the "Law of the River" have successfully enabled 90 years of water development in each of the Basin States while at the same time protecting existing rights within each state. The Colorado River Basin has been experiencing a drought for the past 15 years that has resulted in an average of approximately 2.5 million acre-feet less water coming into the system per year than over the past 109 years. This reduced amount of water has led to decreased levels of surface water storage in the basin. Lake Mead in particular, is experiencing the lowest storage elevation levels since Hoover Dam was constructed in the 1930s. The water managers in the Colorado River Basin States have planned ahead for these types of drought conditions through the development of rules, guidelines and specific agreements that were designed to increase water management flexibilities in the face of uncertain hydrology and to prepare for reduced Colorado River water supply allocations.

Since at least 1968, the Basin States have recognized that coordinated operation of the system makes sense for both basins. In 1968, Congress authorized the construction of the Central Arizona Project and required the Secretary of the Interior to develop operating criteria to ensure compliance with the Colorado River Compact and to balance the water supply between the Upper and Lower Basins. In 1970, the Secretary of the Interior issued the Criteria for Coordinated Long-range Operation of Colorado River Reservoirs. The 2007 Interim Guidelines for Lower Basin Shortages and Coordinated Operation of Lake Powell and Lake Mead follow that same strategy and are an excellent example of collaboration among the Basin States and the Department of the Interior to plan for the operation of the Colorado River System during drought and to develop guidelines to help administer the existing water allocations among the States of Arizona, California and Nevada in accordance with existing federal law. Since 2007, the Basin States have continued to plan for short-term water shortages and longer-term imbalances, and have expanded the cooperative agreements to include partnering with Mexico on International Boundary and Water Commission Minute No. 319.

Innovative agreements and investments within the Colorado River Basin have resulted in the storage of over 1 million acre-feet of water in Lake Mead over the past 10 years. This has included continued implementation of the Imperial Water Conservation Program funded by Metropolitan, implementation of the Palo Verde Valley Land Fallowing Program funded by Metropolitan, groundwater desalting projects with financial contributions from Metropolitan, Yuma Desalting Plant pilot operation and Warren H. Brock Reservoir construction and operation partially funded by Metropolitan. The ability to access stored water and utilize it during times like this has been essential to meeting water supply needs within California during the current drought in California. The current Colorado River Basin drought has led to lower than average inflow into Lake Powell, and has also led to lower annual releases from Lake Powell by an average of approximately 1 million acre-feet per year since the adoption of coordinated operation criteria for the system. In the event conditions are met for the Secretary of the Interior to trigger reduced allocations in the Lower Basin as required by the 2007 Interim Guidelines and Minute No. 319, the Lower Basin States have indicated they are prepared to make necessary adjustments to their water management practices in order to comply with the provisions of the 2007 Interim Guidelines.

California has contributed to the successful management of the Colorado River System during the current Colorado River Basin drought by, for example, significantly reducing its average annual consumptive uses from the Colorado River over the past 12 years (2003-2014) as compared to the previous 12 years (1991-2002). California's municipal water providers serve close to 20 million of the more than 30 million people who receive at least part of their water supply from the Colorado River and their conservation efforts have enabled them to reduce water use while still enabling communities to grow and prosper. California's conservation efforts include conservation, stormwater capture, water recycling and reuse and recovery of local groundwater resources. California has implemented the largest agricultural to urban water transfers within the country through agreements that will remain in place for several more decades. These types of voluntary agreements provide mutual benefits to the participating agencies, are important tools to help manage finite supplies of water, and can serve as examples for other areas around the West that are striving to balance various demands for limited supplies of water. Agricultural conservation within California last year resulted in storage of more than 18,000 acre-feet of water in Lake Mead.

The successful ongoing water conservation and reuse efforts within the Colorado River Basin provide a foundation for water managers and other stakeholders to continue to work together. The collective management efforts among the Basin States, water agencies and the Federal Government have kept the water levels higher in Lake Mead than they otherwise would have been, despite having endured over 15 years of drought. In light of the possibility of continued drought, efforts will continue to work toward creative, implementable solutions. Although future hydrology is not certain, long-term water management efforts within the Colorado River Basin are underway, including the recent completion of the Colorado River Basin Stakeholders *Moving Forward* to Address Challenges Identified in the Colorado River Basin Water Supply and Demand Study, Phase 1 Report, that begins to address challenges identified in the 2012 Study.

Ongoing Congressional support for funding for the Bureau of Reclamation's Drought Response Program and the WaterSMART and Title XVI Water Reclamation and Reuse Programs helps continue the current drought management efforts underway within the Colorado River Basin. Those programs are cost-shared by the non-federal participants and provide assistance to local water management entities that are attempting to mitigate the effects of drought, conserve water and maximize water use efficiency. Helpful tools that should continue include investments in existing water supply infrastructure to ensure that the operation of existing facilities can be as efficient and secure as possible, and continued funding for water efficiency and conservation programs that are matched by or enhance the ongoing efforts at the state and local level.

The Colorado River Board supports continued collaboration to develop additional tools and strategies to enable us to address ongoing challenges and meet the evolving Colorado River demands.

Testimony of Dennis Patch
Chairman, Colorado River Indian Tribes

To the Senate Committee On Indian Affairs
Hearing on Addressing the Needs of Native Communities Through Indian Water Settlements

Chairwoman Murkowski, Ranking Member Cantwell, Members of the Committee, I am Dennis Patch, Chairman of the Colorado River Indian Tribes (CRIT). Thank you for holding this important hearing and for the opportunity to offer a statement.

The Colorado River Indian Tribes' reservation includes land on both sides of the Colorado River, roughly between Blythe, California and Parker, Arizona. Although our reservation was initially created by President Abraham Lincoln in 1865, our ancestors have lived in the desert for countless generations.

We understand how to live with, and struggle through, drought. At our Tribal headquarters, in Parker, Arizona, the average annual rainfall is only 5 inches per year. So historically, we had to learn the value of conservation.

Fortunately the Colorado River Indian Tribes are weathering the drought well. In fact, we are even in a position to help our neighbors mitigate some of the most devastating water shortages in the 21st century.

As a part of *Arizona v California*, the Supreme Court recognized CRIT's reserved right to 719,248 acre/feet of Colorado River water. More specifically, CRIT maintains the right to divert 56,846 acre/feet per year for use in California, and 662,402 acre/feet per year for use in Arizona. In both states we are the first priority water user on the river.

But unlike water rights holders in California or Arizona, CRIT cannot lease our rights to other water users. This policy is severely limiting and forces the tribe to either use our water on tribal lands or forfeit any economic benefit from this valuable right.

This creates a perverse incentive. If the CRIT use all our water, we can create value for our members. But if we conserve, as we are developing plans to do and as everyone should be doing during this drought, others will receive the benefit of our conservation and generate income from our conservation expense.

The fact that CRIT cannot monetize its water rights puts the tribe in an unfortunate Catch 22:

We can either:

1) Utilize the water by replacing some of our native riparian habitat with water intensive in irrigated agriculture in the middle of the worst drought in a millennia; or

2) Stand by as others to receive the economic benefit of our water rights.

For obvious reasons, neither option is desirable. That's why CRIT is actively working to devise a more appropriate third option.

Our first attempt was to apply to participate in the Bureau of Reclamation's pilot program to create Colorado River system water. We submitted an application to the program that would have contributed 10-30,000 acre/feet of our California water per year to Lake Mead, a volume of water that could have significantly raised the lake's critically low water levels. And we offered this water at the bargain price of $150 an acre/foot—far below market rate.

With Lake Mead water levels falling to alarming levels, our proposal could have delayed the need for mandatory water cutbacks. But unfortunately, our application was rejected. The Department of Interior determined that the tribe was ineligible to make water available for system storage unless the water was actually being used on the reservation. In other words, we were told to go put land into agriculture production, just to take that land out of production, in order to make the water available for storage in Lake Mead under the programs for either the system conservation or intentionally created surplus.

On the Arizona side of our reservation we are planning extensive conservation measures. We have the right to irrigate additional land on the reservation with our full water right, but prefer to make the conserved water available for use by others. However, we cannot give the economic benefit of this valuable resource away for free to the lower priority water users.

Such a position is untenable, and this Committee should see that better options must be available.

One such option would be to have Congress enact legislation that authorizes CRIT to lease water. Doing so would allow CRIT to provide water to communities in need and incentivize the Tribe to make significant investments to conserve the water resources that are available to us.

While we understand that this issue may fall just outside of the scope of today's hearing, we hope to work with you in the weeks and months ahead to explore ways that Congress can help CRIT and other tribes that have fully adjudicated rights but lack sufficient legal authorities to benefit from them. If this authority is granted, CRIT stands ready to work collaboratively with you and your staffs to make sure that our water resources are used efficiently and benefit the basin community as a whole.

I want to thank you once again for holding this hearing today, and I look forward to working with you to ensure that all tribes are able to receive the full benefits of their water rights.

DIANNE FEINSTEIN
CALIFORNIA

SELECT COMMITTEE ON INTELLIGENCE - VICE CHAIRMAN
COMMITTEE ON APPROPRIATIONS
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COMMITTEE ON RULES AND ADMINISTRATION

United States Senate
WASHINGTON, DC 20510-0504
http://feinstein.senate.gov

June 16, 2015

Chairman Murkowski
709 Hart Senate Office Building
Washington, D.C. 20510

Ranking Member Cantwell
511 Hart Senate Office Building
Washington, D.C. 20510

Dear Chairman Murkowski and Ranking Member Cantwell,

I write this letter today to thank you for convening the June 2, 2015, hearing of the Senate Energy and Natural Resources Committee, which examined drought conditions affecting the West. The testimony at that hearing highlighted that this historic drought is not unique to California—it's a problem for the entire country, whether now or at some point in the future.

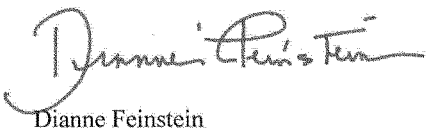
Nevertheless, the effects of the drought in California are well-documented: Snowpack is at a record low. The State's largest reservoirs are at or below half their capacity far earlier in the year than usual. And the State recently issued curtailment orders to senior water rights holders, something that last occurred in 1977. The effects of this drought will only become more severe during the summer and fall.

An analysis from the University of California-Davis—attached for this Committee's consideration—revealed that the drought is responsible for the greatest absolute reduction in water availability for California agriculture ever documented. The situation is dire. Gross crop farm revenue will be reduced by about $856 million as a result of 564,000 now-fallowed acres. Combined economic losses will potentially add up to $2.6 billion. Job losses are also mounting, with expected reductions of 18,600 full-time and part-time positions.

Yet the emergency goes beyond just dollars and cents—it's also a social and environmental emergency. Small and rural communities continue to lose access to adequate drinking water supplies every day. And refuges and endangered species are further imperiled by the inadequacy of current water supplies.

I, too, believe that Congress can play a significant role in addressing the tremendous challenge of upgrading our water infrastructure while providing short-term relief. I look forward to working with you to address this historic drought, the effects of which do not always abide by state borders.

Sincerely,



Dianne Feinstein
United States Senator

DF/jp/kdr

Date:	May 31, 2015
To:	California Department of Food and Agriculture
From:	Richard Howitt (UC Davis), Duncan MacEwan (ERA Economics), Josue Medellin-Azuara (UC Davis), Jay Lund (UC Davis), Daniel A. Sumner (UC Davis)
Subject:	**Preliminary Analysis: 2015 Drought Economic Impact Study**

Introduction

California is facing another year of severe drought in 2015. Following three critically dry years, many irrigation districts have exhausted their surface water reserves, and the groundwater table has been drawn-down in many parts of the Central Valley. This memorandum summarizes a preliminary assessment of the economic impacts of the 2015 drought conducted by the UC Davis and ERA Economics research team1.

The results summarized here are preliminary and will be revised as we get new information and a clearer picture of irrigation water availability, major water transfers for the 2015 season and acreage of major crops. We know how much water will be delivered from the state and federal projects, and have surveyed districts to assess local surface water supplies and groundwater substitution. But some factors remain uncertain. Many irrigation districts have not made final water allocation decisions and other districts are working to secure transfers from areas with more senior water rights. Drought impacts on livestock and dairies derive from forage and pasture estimates. Decisions of many participants in the system will change water deliveries and economic impacts; therefore our analysis will be updated in July.

Summary

As in 2014, agricultural water districts and farmers will show more resilience to the 2015 drought than many anticipated earlier this year. Groundwater substitution has again substantially buffered crop fallowing and will reduce employment losses. This study does not address long-term costs of groundwater overdraft, such as higher pumping costs and greater water scarcity. The socioeconomic impacts of an extended drought, in 2016 and beyond, could be much more severe.

In estimating the drought's economic impact, we control for confounding factors. That is, we calculate the known changes in irrigation water deliveries and groundwater substitution and then estimate the corresponding planting decisions, market prices and fallowing. By using changes in water availability to estimate economic impacts, we avoid the problems from ascribing all changes in aggregate measures of economic production and employment to the drought. Changes in business conditions, commodity prices and other factors also affect agricultural revenues and employment, regardless of hydrologic conditions, and it is important to net out these influences.

[1] We want to acknowledge Jennifer Scheer and Kabir Tumber of ERA Economics for leading the irrigation district survey and compiling the surface and groundwater data used in the analysis.

We estimate about 564,000 acres will be fallowed because of the drought, resulting in a statewide reduction in gross crop farm revenue of about $856 million. Livestock and dairies may add another $350 million in direct revenue losses for 2015. Regional economic impacts of these cuts were estimated using the IMPLAN model for the Central Valley, and show approximately 18,600 full-time, part-time and seasonal jobs lost once multiplier effects are included. The total economic loss to agriculture is estimated to be $2.7 billion.

The 2015 drought is not as severe as initially anticipated, but worse than 2014 in terms of reduced water availability and economic impact to agriculture. Groundwater substitution, water market transfers and grower use of limited water for the most profitable crops are key factors buffering the economic and employment effects of drought. Regions with reliable access to groundwater are able to irrigate most of their land. Regions with groundwater access also benefit from small (less than a few percent) increases in some crop commodity prices because of greater fallowing in more water-stressed regions. Water market transfers allow water to move from lower value to higher value uses, which also dampen some of overall economic impacts.

Table 1. Statewide 2015 Drought Impacts Summary

Drought Impact	Loss Quantity
Water Supply	
Surface water reduction	8.7 million acre-feet
Groundwater pumping increase	6.2 million acre-feet
Net water shortage	2.5 million acre-feet
Statewide Costs	
Crop revenue loss	$856 million
Additional groundwater pumping cost	$595 million
Livestock revenue loss	$100 million
Dairy revenue loss	$250 million
Total direct agricultural costs	**$1.8 billion**
Total statewide economic cost	**$2.7 billion**
Total job losses	**18,600**

Comparing 2015 with 2014

Our analysis compares the impacts of the 2015 drought with an average water supply year. This shows that the 2015 drought will be worse than the 2014 drought. Surface water shortage to agriculture will be greater in 2015 than in 2014. Net water shortage to agriculture, after additional groundwater pumping will be nearly 67%, or 1 million acre-feet, greater than in 2014. Cropland fallowing because of water shortage is expected to increase by 33% over 2014. The drought is expected to decrease direct farm-gate revenues by 6%. Groundwater pumping costs are expected to increase by 31%.

The ability of California's agriculture to adjust to drought conditions is driven by several factors. The primary adjustment – increased groundwater pumping – is expected to reduce the surface water shortage by more than 70%. Regional crop shifting in 2014 was significant. For example, contracts for growing processing tomatoes shifted to the Sacramento Valley, resulting in strong yields and a small net

increase in the statewide tomato harvest. Water market transfers, another important adjustment to drought, eased the impact on perennial crops throughout the Central Valley last year. Early reports this year show some transfers from senior water-right holders to perennial crop producers in the eastern San Joaquin Valley. In addition, our survey of water districts suggests there will be more transfers of groundwater within districts than in 2014. Taken together, these adjustments blunt much of the economic costs of drought to crop growers and consumers.

Methods

This preliminary assessment of the socioeconomic impacts from reduced availability of water for California's agriculture during the 2015 drought uses the same approach as our estimation of losses in the 2014 drought.

Our analysis of economic impacts relies on the amount of water available, as estimated by operators of irrigation districts and water projects. Water availability drives the acreage and type of crops planted and corresponding economic losses. For this preliminary analysis, we:

1. Surveyed irrigation districts
2. Determined CVP and SWP deliveries
3. Estimated changes in groundwater levels using DWR CASGEM and C2VSim data
4. Estimated water market transfers between and within districts

We integrated this information into the SWAP model. Using an "average" water year as the baseline of comparison, we estimated economic impacts of the 2015 drought. Changes in direct farm-gate value, livestock and dairy costs and additional groundwater pumping costs were then run through the IMPLAN input-output model to estimate the multiplier effects in ancillary industries and overall economic and employment impacts to agriculture.

Expected impacts on California crop prices are determined with the analysis. That is, we model the statewide supply and demand for each crop commodity and estimate the market-clearing price. Price changes will be discussed in more detail in our final analysis, but most crop price increases are quite small — generally less than 2%. However, when the price of a crop increases, even by less than 1%, this benefits producers in regions less affected by the drought. For example, the Central Coast and Southern California, which generally have access to irrigation water, will benefit from any statewide price increase.

Irrigation District Survey

We surveyed more than 72 irrigation districts from late April to mid-May to estimate irrigation water availability. Our preliminary survey included:

1. Estimated fallowing in 2014
2. Expected fallowing in 2015
3. Increases in irrigation water charges (fixed and volumetric)

4. Dry wells and whether these were domestic, agricultural or municipal/industrial (M&I)
5. Groundwater substitution, on-farm and within the irrigation district
6. Transfers in and out of the district: volume, price and import/export region

Many irrigation districts reported that water transfers ameliorated some of the 2014 drought impacts. In addition, surface storage, banking and within-district transfers were extensively used. Most districts reported that some domestic and M&I wells went dry, but few agricultural wells went dry because they are typically drilled deeper than domestic wells. Most districts confirmed new, deeper wells were being drilled in 2014 and currently.

Most districts reported being uncertain about 2015 fallowing. Many are delivering smaller allotments of water to growers, with deliveries ranging from a few inches to 36 inches per acre, which is less than normal. Other districts were delivering no water to growers, but allowing them to ship groundwater through their system at a yet unspecified cost. Growers with private wells can transfer water to other growers within these districts.

Many growers have standby wells for irrigating early and late in the season and to increase irrigation scheduling flexibility. Growers with standby wells can use them to move water through the system (if the district permits it), supplement reduced district deliveries or, depending on the size of these wells, run them to fully irrigate their crops. In most areas groundwater is significantly more expensive than district surface water. This groundwater substitution allows growers to avoid fallowing land, but the higher pumping cost reduces profits and is an important economic cost.

Water market transfers in 2015 are still uncertain. Feather River contractors with senior water rights initially planned to transfer water south of the Delta; however, an allocation of 75% caused the district board to delay this transfer. It is not clear if and when this transfer and others might be completed. San Joaquin River Exchange Contractors recently agreed to transfer water to Friant Canal users, effectively increasing Friant surface water deliveries from 0% to about 5%. Other similar transfers are pending across the state and will be included in our final analysis.

The amounts of water transferred so far this year varied by district. The average price to agricultural users was reported to be $750 per acre-foot, across all districts surveyed. Many districts are still negotiating transfers. We expect water values to increases as the drought progresses.

Agricultural Economic Impact Results

We linked the changes in water availability to the SWAP model and, in turn, linked the SWAP model output to the IMPLAN model. We include a preliminary review of losses to the California dairy and the cattle and calf industries because they derive primarily from higher costs and lower availability of California-grown hay, silage and pasture. Lastly, increased pumping costs reduced farm returns that were entered into the IMPLAN model. We use this integrated framework to estimate regional and statewide agricultural economic impacts of the 2015 drought. Economic impacts are estimated in terms of direct revenue losses to agriculture, changes in agricultural income, value added and employment. We also report spillover effects of these four impact measures on the California economy as a whole.

Total Water Availability

Our preliminary drought-impact analysis is based on expected Central Valley Project and State Water Project deliveries announced by the U.S. Bureau of Reclamation and California Department of Water Resources (DWR). In addition, as described above, we surveyed major water districts in the Central Valley to determine expected shortages in local surface water supplies and the availability of carry-over storage. The ability to increase groundwater pumping in the short term is based on DWR's maximum groundwater-pumping estimates for 2006 - 2010 and the C2VSim model data.

The preliminary drought scenario shows a reduction in surface water of 8.7 million acre-feet and groundwater replacement of 6.2 million acre-feet, for an approximate net shortage of 2.5 million acre-feet. Table 2 summarizes the estimated 2015 surface water shortage by region and the estimated ability to replace lost surface water with groundwater.

Table 2. Estimated Change in Water Use in 2015 Drought Relative to Average Conditions [millions of acre-feet (maf)]

Region	Surface Water (maf)	Groundwater (maf)	Net Delivery Shortage (maf)
Sacramento	-2.17	1.28	0.89
San Joaquin	-1.86	1.40	0.46
Tulare	-4.75	3.45	1.30
Central Coast and Southern CA	-0.01	0.02	-0.01
Total	**-8.7**	**6.2**	**2.5**

Irrigated Crop Acreage

Changes in the crop mix estimated by the SWAP model show the drought resulted in the fallowing of nearly 565,000 acres, almost all within the Central Valley. Table 3 summarizes the estimated impact of the drought on irrigated agricultural land use by region and crop group. These estimates will be updated when planted area data for major field crops becomes available.

As noted, the decrease in water supply in the Central Valley slightly increases the estimated statewide price for some crops. This causes a small increase in plantings in some Central Coast and Southern California regions with better access to irrigation water supplies, and the slightly higher groundwater use.

Table 3. Estimated Change in Irrigated Crop Acreage Due to 2015 Drought, Relative to an Average Year (acres in thousands)

Region	Feed Crops	Vegetables	Orchard & Vines	Grain	Other Field	Total
Sacramento	-84.9	-3.4	-7.9	-77.9	-3.4	**-177.6**
San Joaquin	-42	-0.2	-6.6	-18.7	-12.9	**-80.5**
Tulare	-59.4	-23	-31.6	-97.6	-91.6	**-303.2**
Central Coast and Southern CA	2.8	-1.4	0.2	-1.8	-2.3	**-2.5**
Total	**-183.6**	**-28**	**-45.9**	**-196**	**-110.2**	**-563.8**

Dairy and Other Livestock Impacts

The dairy industry generates more revenue than any other farm commodity in California. The most important economic changes are that milk prices are lower and dairy price-to-cost margins are lower than normal—especially compared with 2014, a profitable dairy year. California milk production already is down by more than 3%, while milk production has risen elsewhere in the United States. Not all of this loss is due to the drought. But abnormally high forage prices are causing ranchers to cull more cows than they would because of lower milk prices alone. Alfalfa hay shipments to the dairy region are down relative to 2013 and 2014, even though the lower ability to pay has lowered prices from 2014 peaks. We estimate milk revenue will decrease by about 3%, or $250 million, because of the drought.

The cattle and calf industry depends on pasture (both rain-fed range and irrigated pasture). Lack of rain in early 2015 caused cow and calf numbers to be lower than normal, and the shift away from irrigated pasture will decrease forage for feeder cattle. The California feedlot industry relies primarily on grain from the Midwest. But California feedlots fatten beef calves from California and dairy steers, so will again have a lower supply of cattle. Overall, we expect the cattle and calf industry will lose about $100 million, comparable to 2014. Other livestock industries, primarily poultry and eggs, will be minimally affected because most of their feed is imported.

Gross Farm-Gate Crop Revenues

Financial impacts can be decomposed into crop revenue losses, livestock losses, additional pumping costs, and multiplier effects in ancillary industries. Total gross crop revenue losses are estimated to be $856 million. Table 4 summarizes the change in gross crop revenues by region and crop group.

The Central Coast and Southern California farm regions benefit from slightly higher commodity prices because of decreased production elsewhere in the state. For example, lower hay production in the Central Valley will increase hay revenues for Southern California. Likewise, lower berry and wine grape production in the Central Valley will increase berry and wine grape revenue in the Central Coast.

Table 4. Estimated Change in Irrigated Crop Revenues Due to Drought, 2015 (dollars in millions)

Region	Feed Crops	Vegetables	Orchard & Vines	Grain	Other Field	Total
Sacramento	-52.4	-4.1	-2	-170.6	-2.7	**-231.6**
San Joaquin	-21.4	3	15.7	-35.7	-13.5	**-51.9**
Tulare	-87.6	-102.3	-115.5	-141.4	-173.6	**-620.3**
Central Coast and Southern CA	29.4	-4.4	18.9	-2.2	5.8	**47.5**
Total	**-131.9**	**-107.7**	**-82.8**	**-349.9**	**-184**	**-856.3**

Statewide Economic Impacts

We estimate direct drought impacts of $856 million in gross crop revenue losses, $250 million for dairies and $100 million for other livestock industries. When we recognize farm income losses due to increased pumping costs ($595 million) and multiplier effects, the statewide impact to agriculture and related industries is $2.7 billion. Estimated direct job losses in agriculture are estimated to be nearly 8,560 full- and part-time jobs. However, when increased pumping costs and spillover effects are factored in, total job losses are close to 18,600 statewide. These job loss figures do not include estimates of adaptation in labor intensity (hours of work per job) or other non-agricultural impacts of the drought. Losses in value added, a measure of the California's gross domestic product, are estimated to be about $1.3 billion for the 2015 drought. Labor income, which includes salaries and proprietor income, is expected to fall by about $716 million.

Table 5. Estimated Regional Agriculture Economic Impacts Due to Drought, 2015

Impact	Jobs	Labor Income	Value Added	Sector Output
Direct	-8,546	-287	-421	-1,206
Indirect	-5,286	-191	-372	-744
Induced	-4,764	-238	-460	-716
Total	**-18,597**	**-716**	**-1,253**	**-2,667**

Analyzing 2014 Drought Employment Loss Estimates

Our 2014 analysis estimated that the drought would result in a loss of 17,100 California farm-related jobs (full- and part-time) – about 7,500 of them directly related to farms. Aggregate agricultural employment statistics nonetheless show an overall increase of about 2% in 2014, according to the state Employment Development Department (EDD).

It important to understand that there is no conflict between these numbers.

A detailed analysis of the EDD base data shows that contract field work employment in the San Joaquin Valley decreased substantially during the irrigation growing season of 2014 (Figure 1). The aggregate increase in agricultural employment was due to two components. First, there is a growth in summer agricultural employment in areas with better water availability--the Sacramento Valley and Coastal regions with increases in high value vegetable and field crops in these regions. Second, the winter season (January through March and October through December) employment grew in several regions, which were largely not drought related.

In addition, agricultural employment in California has been on a long-term increase driven mostly by long-term shifts to higher revenue per acre (and acre-foot) crops. The small, 2% increase in 2014 farm employment should be viewed as a slowing of this long-term growth trend and is consistent with a loss of agricultural jobs because of drought. Figure 1 shows the difference in average monthly employment in agriculture from 2013 to 2014 across time and regions. The irrigation season runs from April to September. The first and last three months of the year define the off- season.

The drought in 2014 and 2015 is causing substantial land fallowing and significant job losses. Global and national market forces and farm adjustments are important for mitigating drought impacts to agriculture and California's economy. Regions with greater surface water shortages and less access to groundwater will suffer larger employment losses due to drought.

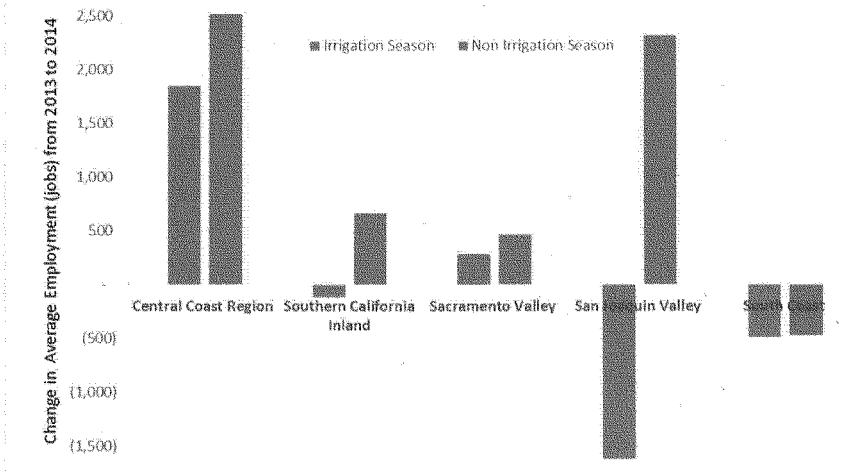


Figure 1. Changes in average monthly agricultural employment between 2013 and 2014. Source: Authors calculations using California Employment and Development Department.

Preliminary Impact Summary and Ongoing Work

We estimate the 2015 drought will cause direct farm revenue losses of about $1.2 billion, relative to an average water year, with a net water shortage of about 2.5 million acre-feet. The total surface water shortage is estimated to be 8.7 million acre-feet, of which 6.2 million acre-feet will likely be replaced through increased groundwater pumping. The additional pumping will cost $595 million.

When the spillover effects of water shortage on agriculture are considered, total losses of $1.25 billion in value added and $2.7 billion in total value of sector output can be expected.

These preliminary drought impact estimates depend critically on water transfers and the regional capacity to substitute groundwater for surface water. We are working with DWR to link the SWAP model to the DWR's C2VSim groundwater-surface water model to better estimate the capacity to pump groundwater and the short- and long-run effects on water levels. This will provide a basis for estimating groundwater availability and cost impacts should the drought continue for several more years. We anticipate using USDA crop acreage data in calibrating and refining our analysis of livestock industry losses. Lastly, we anticipate using remotely sensed estimates of fallowed acres from NASA and DWR studies to crosscheck the SWAP model results.

Further Reading

Howitt RE, Medellín-Azuara J, MacEwan D, Lund JR and Sumner DA. 2014.
"Economic Analysis of the 2014 Drought for California Agriculture."
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"Why California's agriculture needs groundwater groundwater management."
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April 14, 2015

Sumner DA. "Food prices and the California drought." *California WaterBlog*. April 22, 2015

Economic Analysis of the 2014 Drought for California Agriculture

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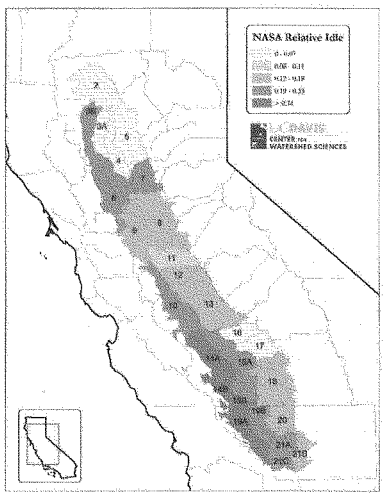

July 23, 2014*

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Executive Summary

California is enduring its third driest year on record as agricultural, urban and environmental demands for water are at an all-time high. This report presents an assessment of the economic impacts of the 2014 drought on crop production, livestock and dairies using a suite of models.

This analysis extends the preliminary estimates of the Central Valley drought impacts released May 19, 2014 (Howitt *et al.* 2014) to include:

- Broadened coverage of the Statewide Agricultural Production Model (SWAP) to include major agricultural areas on California's central and south coasts and inland farms of the Imperial, Coachella and Palo Verde valleys,
- Updated SWAP agricultural production and economic impact estimates for the Central Valley using the most current data available,
- Estimated Central Valley impacts if the drought persists through 2015 and 2016, including economic effects and the impact of increasing groundwater depletion and pumping depths using the California Department of Water Resources' (DWR) C2VSim model,
- Estimated fallowing of cropland due to drought using the SWAP model,
- Estimated losses to dairies and livestock using a supply elasticity approach based on pasture losses and feed crop prices, and
- Comments on the preliminary draft from various state agencies.

The study finds that the 2014 drought will result in a 6.6 million acre-foot reduction in surface water available to agriculture. This loss of surface water will be partially replaced by increasing groundwater pumping by 5.1 million acre-feet.

The resulting net water shortage of 1.5 million acre-feet will cause losses of $810 million in crop revenue and $203 million in dairy and other livestock value, plus additional groundwater pumping costs of $454 million. These direct costs to agriculture total $1.5 billion. The total statewide economic cost of the 2014 drought is $2.2 billion, with a total loss of 17,100 seasonal and part-time jobs. Table ES-1 summarizes the key findings of the study.

Table ES-1. 2014 Drought and California Agriculture Summary

Drought impact	**Loss quantity**
Water supply	
Surface water reduction	6.6 million acre-feet
Groundwater pumping increase	5.1 million acre-feet
Net water shortage	1.5 million acre-feet
Statewide costs	
Crop revenue loss	$810 million
Additional pumping cost	$454 million
Livestock and dairy revenue loss	$203 million
Total direct losses	**1.5 billion**
Total economic cost	**$2.2 billion**
Total job losses	**17,100**

Approximately 60% of the fallowed cropland, 70% of the statewide crop revenue losses and most of the dairy losses are likely to occur in the San Joaquin Valley. Most crop fallowing is expected for lower-value irrigated pasture and annual crops such as corn and dry beans.

Farms along the coast have access to groundwater and Southern California agriculture largely relies on Colorado River water supplies, which are less affected by this drought. Consequently, these areas are not expected to be significantly affected by the 2014 drought, with estimated direct crop revenue losses and increased groundwater pumping costs of $10 million and $6.3 million, respectively.

Statistically, 2015 is likely to be another dry year in California – regardless of El Niño conditions. Continued drought in 2015 and 2016 would lead to additional overdraft of aquifers and lower groundwater levels, thereby escalating pumping costs, land subsidence and drying up of wells. Additional dry years in 2015 and 2016 would cost Central Valley crop farming an estimated total of $1 billion a year.

These results highlight California agriculture's economic resilience and vulnerabilities to drought. They also underscore California's heavy reliance on groundwater to cope with droughts. Without replenishing groundwater in wet years, water tables fall and both reduce regional pumping capacity and increase pumping energy costs – ultimately threatening the viability of higher value permanent crops in some areas.

The 2014 drought has magnified our need to better understand two major mechanisms used to respond to drought in California: groundwater management and water markets. While our aggregate measures of groundwater depth over time and space are often good, our estimates of regional groundwater use are poor.

This lack of groundwater pumping information precludes most forms of regional groundwater management. Water markets are operating in a largely informal manner with reports of extremely high prices being paid throughout the Central Valley – prices at least three times those seen in the 2009 drought. However, the absence of a central clearinghouse for water trade information prevents normal market information on current prices and quantities from being available to buyers and sellers, which complicates coordination of water movement.

The following conclusions arise from this analysis:

- The 2014 drought is responsible for the greatest absolute reduction in water availability for California agriculture ever seen, given the high agricultural demands and the low streamflows and reservoir levels. Surface water availability is expected to be reduced by about one-third.
- Groundwater availability and use is the key to agricultural prosperity in the 2014 drought and future droughts. This year, groundwater may replace as much as 75% or 5.1 million acre-feet of the roughly 6.6 million acre-foot loss of available surface water. This would raise groundwater's share of agricultural water supply in California from 31% to 53%. Failure to replenish groundwater in wet years will continue to reduce groundwater availability to sustain agriculture – particularly more profitable permanent crops – during California's frequent droughts.
- Statistically, the drought is likely to continue through 2015 – regardless of El Niño conditions. If the drought continues for two additional years, groundwater substitution will remain the primary response to surface water shortage, with decreases in groundwater pumping capabilities and increasing costs due to declining water levels. A continued drought also increases the vulnerability of agriculture, as urban users with largely adequate supplies in 2014 will likely buy water from agricultural areas.
- Net water shortages for agriculture in this year's drought most severely affect the Central Valley with at least 410,000 acres lost to fallowing, $800 million in lost farm revenues and $447 million in additional pumping costs. These effects are most severe in the Tulare Lake Basin. Dairy and

livestock losses from reduced pasture availability and higher costs of hay and silage add $203 million in agricultural revenue losses.

- Coastal and Southern California farm regions are less affected by the 2014 drought, with approximately 19,000 acres fallowed, $10.1 million in lost revenue and $6.3 million in additional pumping costs.
- State and regional policymakers concerned with drought should pay special attention to (1) groundwater reliability, (2) the ability of state and county governments to provide technical and organizational assistance to rural communities and (3) facilitating voluntary water trades between willing parties, including the defining of a standard environmental impact report for water transfers that can be assessed and approved prior to droughts. These policies would give local governments the ability to reduce the impacts of droughts to rural and agricultural areas and economies susceptible to water scarcity.

Introduction

The California Department of Food and Agriculture and the University of California, Davis, jointly funded the UC Davis Center for Watershed Sciences to estimate economic impacts of the current drought on California agriculture.

The Center for Watershed Sciences collaborated with ERA Economics in updating and using the SWAP model of agricultural production in California; the California Department of Water Resources (DWR) to account for groundwater table depth interactions with the SWAP model; NASA for remote sensing estimates of fallowing; and the University of California's Agricultural Issues Center to estimate effects of the drought on dairies and livestock.

Drought water shortage conditions were developed in consultation with the Drought Task Force, DWR and local water providers.

This analysis builds on the Preliminary Estimates of Central Valley Agricultural Drought Impacts Report of May 19, 2014 (Howitt *et al.* 2014). New features include:

- Broadened coverage of the Statewide Agricultural Production Model (SWAP) to include selected major agricultural areas in California's central and south coasts and inland farms of the Imperial, Coachella and Palo Verde valleys,
- Updated SWAP agricultural production and economic impact estimates for the Central Valley using the most current data available,
- Estimated Central Valley impacts if the drought persists through 2015 and 2016, including economic effects and the impact of increasing groundwater depletion and pumping depths using DWR's C2VSim model,
- Estimated fallowing of cropland using two remote-sensing methods and SWAP modeling,
- Estimated losses to dairies and livestock using a supply elasticity approach based on pasture availability and feed crop prices, and
- Comments on the preliminary draft from various state agencies.

Results are presented by crop group and region, with estimated impacts to crop acreage, employment, revenues and regional income. These results are from the integrated modeling framework developed for this project. The framework includes the widely used SWAP model linked with the IMPLAN model of regional economic and employment impacts, and the C2VSim groundwater-surface water simulation model.

Given the heavy reliance on groundwater to mitigate the 2014 drought, and the statistical likelihood that 2015 and 2016 will be dry years (Lund and Mount 2014), we evaluate the economic impacts of an extended drought (using less severe 2009 water delivery conditions). We summarize the drought-impact estimates for 2014 and for an extended, but less severe drought though 2015 and 2016.

The report is structured as follows:

- Water availability estimates
- Estimates of crop production and agricultural economic impacts for the Central and Salinas valleys and farm regions of Southern California
- Economic and production estimates for dairies and livestock
- Comparison of three estimates of 2014 fallowing because of the drought
- Study limitations and extensions
- Conclusions and policy recommendations
- Erratum and appendix detailing study methods, data and assumptions

Water Supply Availability

California is enduring its third driest year in 106 years of recordkeeping as agricultural, urban and environmental demands for water are at an all-time high.

Drought Curtailments from Water Agencies and Water Board Emergency Regulations

On Jan.17, 2014, Governor Brown declared a statewide drought emergency, triggering emergency regulations to protect habitat in the Sacramento-San Joaquin Delta and allowing a range of additional state actions. Since then, the State Water Resources Control Board has curtailed diversions for various water-right holders and some environmental flow requirements. Major state, federal and local water projects have also reduced water allocations, mostly to record lows.

Even today, the effects of water-right curtailments and reduced project releases for agriculture are not entirely clear. Many of them were anticipated in this year's irrigation district allocations to farmers. Here, we use the results of a survey of allocation reductions from irrigation districts to represent all water allocation and right curtailments.

Water Supply Availability and Groundwater Pumping

Table 1 summarizes the estimated reductions in water availability by year and region. The 2014 drought has decreased surface water availability by 6.6 million acre-feet relative to an average water year. Less severe drought conditions in 2015 and 2016 could be expected to reduce surface water availability by approximately 6 million acre-feet a year.

Table 1. Change in Surface Water by Region Relative to an Average Year (in millions of acre-feet per year)

Region	**Surface Water Use Change**		
	2014	2015	2016
Sacramento Valley, Delta and East of Delta	-1.8	-2.3	-2.3
San Joaquin Valley	-1.8	-1.4	-1.4
Tulare Lake Basin	-3.0	-2.3	-2.3
Central Valley subtotal	**-6.5**	**-6.0**	**-6.0**
Central Coast	0.0		
South Coast	0.1		
South Inland	0.0		
Statewide	**-6.6**		

Note: 2015 and 2016 analysis was limited to the Central Valley.
Any differences in totals are due to rounding error.

In normal years, agricultural water use in the areas modeled by the SWAP model is about 26 million acre-feet (maf), with 18 maf from surface water and 8 maf from groundwater. For 2014, this water use is estimated to be reduced by about 1.5 maf. A 6.6 maf drought-related reduction in surface water availability amounts to a 36% reduction in surface water availability for agriculture, or a 25% reduction compared with total normal agricultural water use.

The proportion of irrigation water from wells is expected to jump from 31% to 53% this year. (The figures account for an estimated 1.5 maf reduction in total agricultural water use.) This amounts to a 62% increase in groundwater pumping.

The ability to increase groundwater pumping as a substitute for decreased surface water supplies is critically important to California's ability to cope with drought. Increased groundwater extraction, beyond diminished recharge during droughts, decreases groundwater levels, reduces groundwater quality and increases land subsidence (sinking). As groundwater levels drop, the costs to extract groundwater

increase. In some areas, water levels can drop below the installed capacity of existing wells, causing wells to go dry and reducing groundwater pumping capacity for subsequent drought years.

This study estimates the increase in pumping cost and loss of well capacity due to declining water levels. The percentage of wells likely to go dry was estimated using statistical regression analysis of the distribution of existing well depth, which was estimated from well logs for each SWAP model region.

In areas with no alternative water supply, groundwater levels begin to drop below installed well depths, which increasingly forces growers to fallow fields. In areas with deeper wells, growers still have access to groundwater but must pay more in energy costs to extract it. In some areas it may not be profitable to irrigate standard crops and growers would adjust crop rotations or fallow fields.

Table 2 summarizes the estimated groundwater replacement and additional groundwater pumping cost in each year. Growers are expected to pump an additional 5 million acre-feet to partially offset surface water reductions, at a direct cost of $454 million. Drought in 2015 in 2016 would likely prompt additional pumping of 5 million acre-feet and 4.9 million acre-feet, respectively, at a cost of $438 million and $459 million.

The additional pumping in 2014 will drop water levels from a few feet to tens of feet, causing some grower to lose their wells and others paying more to pump from them. Come 2016, pumping costs increase by an additional 5%, primarily because of falling water tables. Our statistical analysis of the well depth finds a small percentage of wells going dry in each subsequent drought year.

Table 2. Additional Groundwater Use and Cost by Region Relative to an Average Year

Region	**Additional use (maf/yr)**			**Additional cost ($million/yr)**		
	2014	2015	2016	2014	2015	2016
Sacramento Valley, Delta and East of Delta	0.9	1.6	1.6	35.4	63.2	65.5
San Joaquin Valley	1.5	1.2	1.2	71.9	63.2	68.7
Tulare Lake Basin	2.6	2.2	2.2	340.3	312.5	324.8
Central Valley subtotal	**5.0**	**5.0**	**5.0**	**447.6**	**438.9***	**459.1**
Central Coast	0.0	NA	NA	0.3		
South Coast	0.1	NA	NA	0.0		
Colorado River region	0.0	NA	NA	6.0		
Statewide	**5.1**	**5.0**	**5.0**	**453.9**		

Notes: 2015 and 2016 analyses were restricted to the Central Valley, where groundwater information is more available.

* Reduction in pumping cost for 2015 comes from a shift in pumping to areas of the Central Valley with higher groundwater tables.

Regional Crop Production and Economic Impacts of the Drought

The economic impacts of drought have been aggregated into six areas: (1) Sacramento Valley, Delta and East of the Delta, (2) San Joaquin Valley South of the Delta, (3) Tulare Lake Basin, (4) Salinas and Santa Maria valleys on the Central Coast, (5) South Coast and (6) inland agriculture in the Imperial, Coachella and Palo Verde valleys.

Crop types were aggregated from the standard 20 crop groups in the SWAP model to four groups compatible with the IMPLAN macroeconomic model: (1) cotton, grain and oilseed, (2) vegetables and non-tree fruit, (3) tree fruit and nut and (4) feed and other crops.

Table 3 and Figure 1 summarize changes in irrigated acreage by region for 2014 - 2016. The SWAP model estimates the response of growers to drought, including the decision to fallow land.

In the Central Valley, high-value crops including vegetables, non-tree fruits and permanent crops represent less than 13% of total fallowing as growers direct scarce water to the highest value use. Most of the crop fallowing is estimated to be feed and other annual crops. This pattern is repeated across years; fallowing in the valley declines from 408,000 acres in 2014 to 243,000 acres by 2016. The coastal areas and Southern California have access to surface and groundwater and are not expected to fallow significant acreage.

Table 3. Changes in Irrigated Crop Areas by Region and Crop Group (in thousands of acres)

2014 Statewide					
Region	Cotton, grain and oilseed	Feed and other crops	Fruit and nut trees	Vegetables and non-tree fruit	Total
Sacramento Valley, Delta and East of Delta	-54	-83	-9	-4	-151
San Joaquin Valley	-76	-39	-8	-3	-125
Tulare Lake Basin	-81	-24	-24	-4	-133
Central Valley subtotal	*-211*	*-147*	*-41*	*-10*	*-409*
Central Coast	0	-3	0	0	-3
South Coast	-5	-8	0	0	-13
Colorado River region	-0.16	-3	0	-0.1	-4
Total	**-216**	**-160**	**-41**	**-10**	**-428**
2015 Central Valley					
Sacramento Valley, Delta and East of Delta	-52	-97	-7	-3	-159
San Joaquin Valley	-17	-32	-4	-0.5	-54
Tulare Lake Basin	-7	-5	-15	-0.5	-27
Total	**-77**	**-133**	**-26**	**-4**	**-240**
2016 Central Valley					
Sacramento Valley, Delta and East of Delta	-52	-97	-5	-3	-157
San Joaquin Valley	-17	-32	-4	-0.4	-54
Tulare Lake Basin	-13	-8	-10	-1	-32
Total	**-82**	**-137**	**-20**	**-4**	**-243**

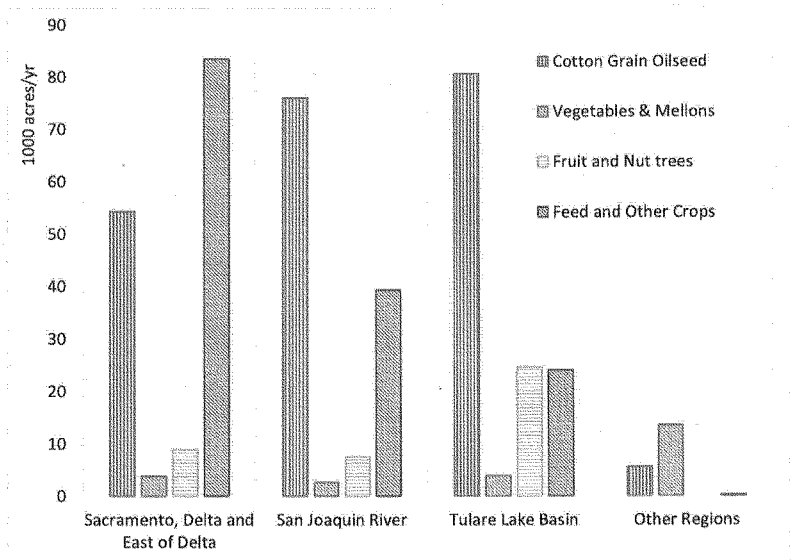

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Figure 1. Crop acreage reductions in 2014 drought, Central Valley regions

Drought Effects on Gross Crop Revenues

Table 4 and Figure 2 summarize the estimated change in gross crop revenues because of drought. For the Central Valley, the 2014 drought costs approximately $800 million to gross crop revenues. Approximately 70% of these losses occur south of the Delta largely because of the severe cutbacks in Delta exports, which provide much of the region's water supply. A similar pattern can be seen if the drought persists through 2015 and 2016, with somewhat increased surface water deliveries. An additional $10 million in gross crop revenue losses is expected in the coastal areas and inland Southern California.

Table 4. Changes in Crop Revenues by Area and Crop Group (in millions of dollars, 2014 values)

2014 Drought					
Region	Cotton, grain and oilseed	Feed and other crops	Fruit and nut trees	Vegetables and non-tree fruit	Total
Sacramento Valley, Delta and East of Delta	-76.8	-76.8	-52.7	-13.2	-219.4
San Joaquin Valley	-105.7	-42.6	-46.3	-12.7	-207.3
Tulare Lake Basin	-123.8	-51.2	-179.0	-19.5	-373.4
Central Valley subtotal	-306.3	-170.5	-277.9	-45.4	-800.1
Central Coast	0.0	-0.7	0.0	0.0	-0.7
South Coast	-2.7	-5.9	0.0	0.0	-8.5
Colorado River region	-0.1	0.8	0.1	-1.7	-0.9
Statewide	-309.2	-176.3	-277.8	-47.1	-810.3
2015 Drought					
Region	Cotton, Grain and oilseed	Feed and other crops	Fruit and nut trees	Vegetables and non-tree fruit	Total
Sacramento Valley, Delta and East of Delta	-76	-80	-43	-10	-209
San Joaquin Valley	-25	-25	-27	-2	-79
Tulare Lake Basin	-11	-9	-100	-3	-123
Central Valley	-112	-114	-170	-15	-411
2016 Drought					
Region	Cotton, grain and oilseed	Feed and other crops	Fruit and Nut trees	Vegetables and non-tree fruit	Total
Sacramento Valley, Delta and East of Delta	-76	-80	-31	-10	-197
San Joaquin Valley	-24	-25	-27	-2	-78
Tulare Lake Basin	-19	-13	-70	-5	-108
Central Valley	-120	-118	-128	-17	-383

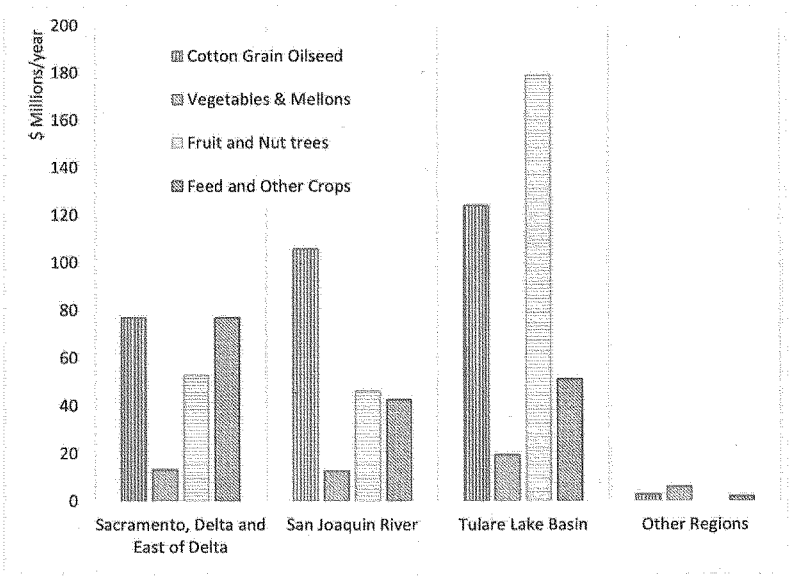

Figure 2. Crop revenue reductions for 2014 drought, Central Valley regions

Drought Effects on Commodity Prices

The SWAP model includes crop demand functions for world market crops and crops in which California has a large enough share of the relevant market to significantly affect global and national prices. These commodities include almonds and pistachios, some subtropical and citrus crops, vegetables and non-tree fruits. Model runs indicate some price increases for forage and field crops in response to the decreased production during the drought. However, these price changes do little to compensate for losses from fallowing, lower yields (from hay crops) and increased pumping costs. The exception may be the total market for alfalfa where higher California prices may offset some of the higher costs of irrigation and lower alfalfa yields.

Drought Effects on Dairies

Dairies and other livestock comprised 30% or $12.4 billion of California's total agricultural commodity value in 2012. Dairy industry revenue totaled $6.9 billion while revenue from cattle and calves totaled $3.3 billion (CDFA 2014).

More than 65% of dairy production cost is for feed. Alfalfa hay alone is about 20% of feed costs and silage adds another 10% to the bill. Alfalfa hay prices have increased 40% since January 2014. Most feed concentrates are made of corn, soymeal and other grains from the Midwest. Corn and other grain and oilseed prices have declined in the past year. Higher local feed costs have increased the total production cost for dairy by about 12%. Dairy production can adjust monthly, but supply response to temporary disruptions tends to be small. Yu and Sumner (2014) suggest a short-run supply elasticity with respect to feed prices of about -0.1 for milk production. All else equal, we would expect dairy production to be

reduced by 1.2%. However, the price of milk and cattle has increased substantially since 2012 and are currently at historic highs. With higher than normal milk revenue to feed cost margins in 2014, we expect somewhat less short-term supply response to higher forage costs for dairies.

Our middle range estimate for the reduction in dairy output is 1.5% relative to an average year, leading to a $104 million in statewide direct impacts.

Drought Effects on Livestock

The beef cattle industry in California includes cow-calf, feeder cattle and stocker and feedlot operations. Cow-calf and feedlots account for the largest proportion of sales in this sector with $3.1 billion in gross sales. Cattle are often marketed several times over their life so gross sales includes those intermediate transactions. The poultry industry, including eggs, broilers and turkeys, is significant but less likely to be affected by drought because poultry eat mostly concentrate feeds from out of state. Sheep and hogs account for a very small share of California's agricultural value.

Impacts of the drought on cattle are moderated by three factors. First, California has a small share of the national beef herd. The state's 2 million calves and its cattle on feed (steers and heifers) amount to only 6% and 4% of the national totals, respectively. California faces national prices for cattle and conditions here have little impact on the national supply situation. Second, feed concentrates for cattle are largely from out of state. (Prices rose after the 2012 Midwest drought, but have since declined to 2009 levels.) Dry roughage (alfalfa hay) prices are high, but hay is a small proportion of the total costs for the beef industry. Third, the economic cycle for the sector is at a stage of low cattle numbers and high prices, so producers have seen larger profits in the past two years and 2014 prices are at historic highs.

The impact of the drought has been mainly through effects on pasture, the most important feed source for the pre-feedlot segment of the industry. The lack of rain in the winter of 2013-2014 substantially reduced the quality of non-irrigated pasture and the number of cattle per acre during the crucial periods of calving and raising of feeder cattle on pasture. This lack of feed caused ranchers to sell sales of calves and some cows out of the state. Ranchers will likely further reduce herds to save irrigation water for higher value non-forage crops. The drought also has increased alfalfa hay prices, making feedlot operations more expensive. We expect 3% or more in revenue losses for the sector in 2014 due to lack of pasture, and $100 million reduction in statewide gross revenues.

Drought Effects on Groundwater Use and Cost

Increased costs of groundwater will be significant. For 2014, replacing about 5 million acre-feet of surface water with groundwater will cost $447 million dollars in the Central Valley and about $6.3 million elsewhere in the state. By 2016, the additional cost could increase to nearly $460 million for the Central Valley.

Since we do not see a significant change in commodity prices, we define this cost as a loss in net revenues for the farmer. From a statewide perspective, the cost of increased electricity can be viewed as a transfer from the farming sector to the power generation sector. About 89% of increased pumping costs occur south of the Delta, where only 40% of the power generation capacity occurs. Some of the additional expenditures on energy may return to the Central Valley economy. Some additional direct jobs in the power generation sector will depend on the structure of the power industry.

Statewide Total Economic Impacts

Gross revenue losses from the SWAP model and from the drought's effects on dairy and livestock are linked to the IMPLAN input-output model. The model takes direct changes in sector output (gross sales or revenues) and details the direct, indirect and induced effects from the economic event (drought) by tracing expense on other economic sectors and households as employment, labor income, value added and sector output.

Employment has been adjusted to account for both part-time and full-time employment. Labor income represents both wages from employees and proprietor income. Value added is the difference between total sector output (gross revenues) and the non-labor business expenses. Changes in value added can be used as measures of the agricultural sector's gross domestic product and a region's economic activity (Medellin-Azuara *et al.* 2012).

Direct effects show the first-round effects of an economic change. Indirect effects are the estimated losses from all other sectors associated with crop production. The induced effects trace expenses from households employed in crop farming and households receiving income from related sectors of the economy. The sum of the direct, indirect and induced effects is called the total or multiplier effect.

Economic Impacts by Year and Region

Tables 5 and 6 summarize the drought's economic impacts on crop farming, livestock and dairies for the entire study area – the Central Valley, central and south coast and inland Southern California. Table 5 and Table 6 summarize the drought effects in 2014 and in 2015-2016, respectively.

The estimated 1.5% loss in the dairy industry and 3% loss for the cattle industry represent direct revenue losses of about $203 million statewide. When the multiplier effects are included, the overall losses total impact is nue is $442 million and approximately 1,615 seasonal and full-time jobs statewide.

Statewide economic impacts for the 2014 drought total $2.2 billion in lost revenue and 17,100 jobs lost.

Table 5. Economic Impacts of the 2014 Drought

Impact type	Employment (jobs)	Labor income (dollars in millions)	Value added (dollars in millions)	Output (dollars in millions)
Central Valley crops				
Direct Effect	-6,722	-274.5	-310.5	-800.1
Total Effect	-15,183	-581.2	-894.6	-1,728.9
Crops in Salinas Valley, inland and coastal Southern California				
Direct Effect	-200	-5	-5	-10
Total Effect	-297	-13	-10	-23
Statewide livestock and dairies				
Direct Effect	-582	-19.8	-67.4	-202.5
Total Effect	-1,615	-71.7	-164.1	-441.9
Statewide economic impacts				
Direct Effect	-7,504	-299	-383	-1,013
Total Effect	-17,095	-666	-1,069	-2,194

Table 6. Economic impacts of a 2015 and 2016 drought in the Central Valley

Impact type	Employment (jobs)	Labor income (dollars in millions)	Value added (dollars in millions)	Output (dollars in millions)
2015 drought				
Direct Effect	-3,158	-146.9	-167.3	-408.7
Total Effect	-8,495	-349.0	-551.1	-1,016.8
2016 drought				
Direct Effect	-2,965	-129.2	-147.1	-378.4
Total Effect	-8,047	-323.8	-519.8	-969.6

Summary of Total Economic Impacts

Table 7 summarizes the total economic impact of the drought and compares the estimated losses with the magnitude in an average water year.

Table 7. 2014 Drought and California Agriculture Summary

Drought impact	Loss quantity	Average year	Percent loss
Crop production			
Water Use	6.6 maf	26 maf	25%
Net shortage after increased groundwater pumping	1.5 maf	26 maf	6%
Fallowed irrigated land	428,000 acres	8.5 million acres	5%
Crop revenue loss	$810 million	$35 billion	2.3%
Revenue lost plus additional pumping cost ($454 million)	$1.26 billion	n/a	
Economic loss	$1.75 billion	n/a	
Direct crop production job losses (seasonal and full time)	6,920	170,000	4.0%
Direct, indirect and induced job losses	15,480	n/a	
Dairy and livestock production			
Direct revenue losses	$203 million	$12.4 billion	1.6%
Total revenue losses	$442 million	n/a	
Direct crop production job losses (seasonal and full time)	580	29,000	2%
Direct, indirect and induced job losses	1,615	n/a.	
State agriculture totals, 2014			
Revenue loss	$1.0 billion	$45 billion	2.2%
Revenue lost plus additional costs ($454 million)	$1.5 billion	n/a	
State agricultural economic loss	$2.2 billion		
Direct crop production and livestock job losses (seasonal and full time)	7,500	200,000	3.8%
Direct, indirect and induced job losses (seasonal and full time)	17,100	n/a	

Comparison with the 2009 Drought

Our analysis of the socioeconomic impacts of the 2014 drought finds that impacts are likely to be significantly higher than those in 2009 (Howitt *et al.* 2011). The 2009 drought resulted in estimated total losses of 7,500 jobs and 270,000 acres fallowed. In contrast, the 2014 drought is estimated to cause 17,100 jobs lost and 428,000 acres fallowed. The most significant difference between the 2009 and 2014 drought is that CVP and SWP contracted water is significantly lower. In addition, Friant Division contractors are projected to receive no deliveries and many local surface water supplies on the east side of the valley are reduced because of decreased Sierra snowpack. The combined socioeconomic effects of the 2014 drought are up to 50 percent more severe than in 2009.

Estimates of Agricultural Fallowing

We estimated fallowing attributable to the 2014 drought using the SWAP model. The model results can be compared with inferences from USDA crop acreage surveys and estimates based on remote-sensing data from satellites. The USDA surveys and remote-sensing methods can identify the total change in irrigated acreage. But they cannot estimate the proportion of that change attributable to the 2014 drought without more detailed statistical analysis to control for other factors that affect fallowing. As such, these surveys and remote-sensing data should be viewed as an estimate of the total idle agricultural land, not fallowing attributable to the drought.

On June 30, USDA published its estimates of crop acres for selected crops in California. We do not use this information for our projected losses for California irrigated crops for two reasons. First, the USDA collects information only for "principal" crops (based on national acreage), which account for only half of the state's irrigated acreage. Second, the USDA measurement of the winter wheat crop in California includes dryland wheat and partially irrigated winter wheat. These caveats aside, the USDA data are consistent with our estimates for the crops covered.

A NASA-USDA-USGS team working with DWR generated the remotely sensed estimates of idle cropland. They used the time series of Normalized Difference Vegetative Index (NDVI) data – collected by four NASA and USGS satellites and composited every eight days – to generate separate estimates of idle cropland for the winter and summer growing seasons.

Their preliminary 2014 idle-acreage estimates for summer (compared with 2011) are thought to be high, perhaps by as much as 50%, mainly because of delays in planting. Those delays resulted in a much higher percentage of acreage appearing to be bare or having scant vegetative cover in June. But, in fact, field validation surveys show those fields had just been planted or were being prepared for planting.

NASA expects that estimates for summer (using satellite data through July 31) will have much lower uncertainty. In addition, new remote-sensing based estimates of idle acreage from the USDA National Agricultural Statistics Service will be incorporated into the analysis.

Independently, the Center for Watershed Sciences used a similar approach, using both NDVI and the near-infrared reflectance on surface for three Landsat 7 and 8 Row Paths in the Central Valley (excluding some portion of Shasta County, the Delta and southern Kern County in late May and early June 2012-2014). We also find high uncertainties associated with a late start in the growing season. Preliminary estimates indicate at least 295,000 acres of idle agricultural land for the San Joaquin Valley and the Tulare Lake Basin in late May.

Table 8 shows the range of idle cropland estimates from SWAP and NASA.

Table 8. Estimates of Idle Irrigated Cropland for 2014 in the Central Valley (in thousands of acres)

Region	**SWAP 2014-2012**	**NASA 2014-2011**	**Range**
Sacramento Valley	151	130-260	151-260
San Joaquin Valley	125	115-230	125-230
Tulare Lake	133	380-760	133-760
Central Valley total	409	645-1,290	409-1,290

Notes: The SWAP model estimated fallowed acreage due to 2014 drought.
NASA's estimated idle acreage is the total idle land due to all factors including drought.

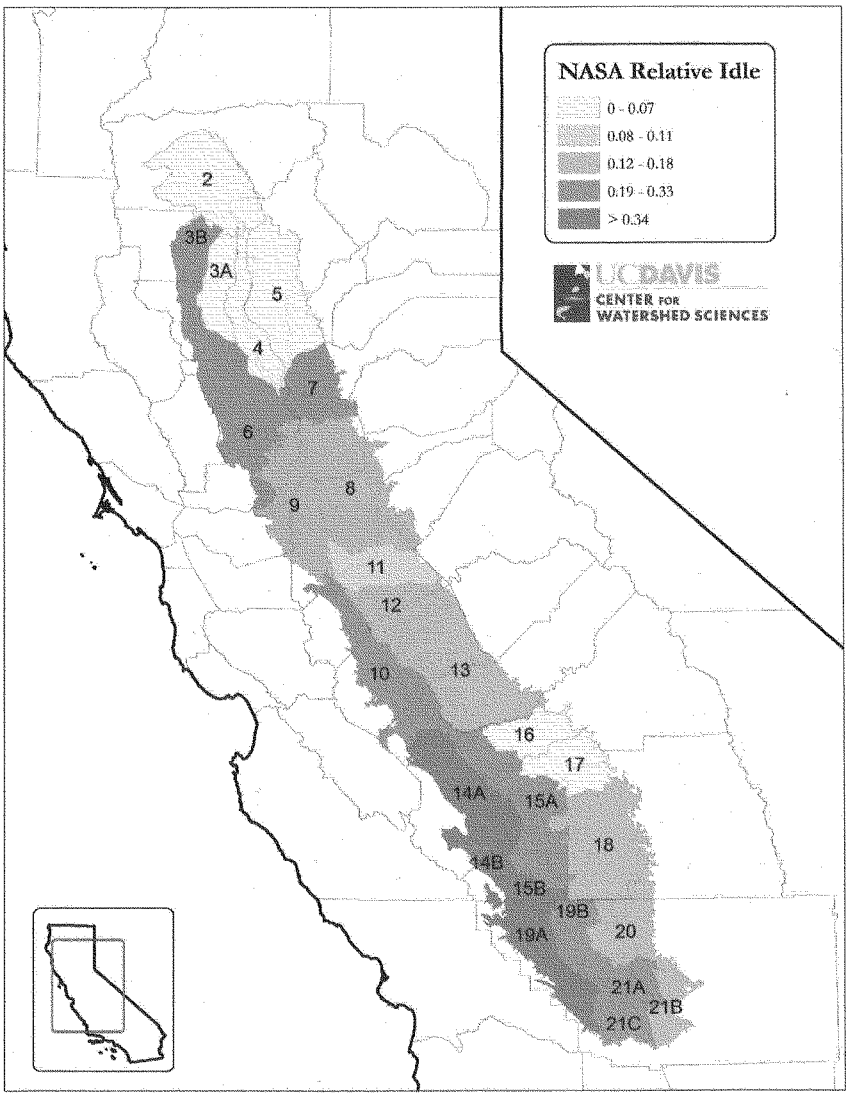

Figure 3. Difference in idle Central Valley cropland between 2014 and 2011, relative to the total agricultural land in each region. Prepared by authors using information from the Satellite Mapping consortium project of DWR, NASA Ames Research, CSU-Monterrey Bay, USGS and the USDA.

Some Public Policy Implications

The effects of such a severe drought on California's large agricultural economy would be much greater without two resources: 1) extensive groundwater availability and 2) the availability of water markets to re-distribute water to crops with the highest economic value while compensating selling farmers. The safeguarding and development of these two resources are essential for mitigating economic effects of drought today and in the future. We suggest six areas of public and technical policy improvements that could enhance California's ability to deal with future droughts.

1. **Groundwater management**. California is the only western state without groundwater rights, regulations or measurements on major use. A first step to local groundwater management – as opposed to groundwater regulation – is to measure pumping. Two groundwater policy bills currently under consideration in California would provide incentives for more management of groundwater, helping assure support for crops during a drought.

2. **Water trade Environmental Impact Reports (EIRs).** Water trading is another key to successful drought management. Some water trades can cause adverse environmental impacts, so EIRs are needed. However, environmental concerns should not be used as a ruse to block trades. This happened to several proposed water trades during the 2009 drought. A policy solution is to define a programmatic EIR for water transfers that can be assessed prior to a drought. If the pre-drought EIR is approved, then the transfer can proceed, with any subsequent damages adjudicated after the fact. This policy change would lower the costs of water transfers and provide greater predictability and flexibility during a drought.

3. **A water trade clearinghouse (or ISO).** The surface water distribution system in California is an interdependent network of individually run canals, reservoirs and rivers. Coordinated operating agreements and contracts exist among some agencies, but moving water efficiently under drought conditions could be improved. California's water system has parallels to the state's electricity grid system before its reorganization. Today, California's electric power is routed and dispatched with a market and prices managed by an Independent System Operator (ISO). A similar water ISO might operate to improve adaptability and responsiveness (Hanak et al 2011). It would take significant federal and state political will to implement a similar system for water, but it remains a promising policy innovation.

4. **Linking groundwater and economic models**. The motivation for groundwater use is economic, while the costs are determined by hydrogeology. Modeling outcomes for different groundwater (and larger water system) management actions requires close coupling of groundwater and larger water supply system models with economic models of water use. Alternative approaches for such modeling need to be tested and evaluated.

5. **Remote-sensing of water use.** This study demonstrates the promise and limitations of remote-sensing estimates of land fallowing. Remotely sensed land and water use data should be able to provide a real-time crosscheck of the water supply-based estimates of land fallowing and economic outcomes. Definitive estimates of fallowed acreage in the 2009 drought were not available until years later. Remotely sensed estimates potentially offer an information system that can be used for management during the drought period. An impartial inter-agency consortium should be established to develop and evaluate remotely sensed water-use measures.

6. **Water data management**. The spatial and temporal resolution of remotely sensed water information promises to generate a tsunami of data. Alternative systems of structuring, managing and accessing this data should be researched and tested before the wave arrives. Several emerging protocols exist for water data management. Hydro-platform, for example, can form the basis of data management tests.

Limitations and Extensions

Results from the SWAP model are fundamentally driven by the estimates of water availability detailed above. Of necessity, these estimates were made from surveys of irrigation districts, announced CVP and SWP contract deliveries and DWR estimates of groundwater pumping. All of these sources have associated errors, but they should diminish as more information becomes available.

Our estimates of the drought's impacts on California agriculture did not include spinoff effects on industries outside of agriculture. For example, the additional groundwater pumping will increase energy use and revenues for power companies. Power companies may hire additional workers with some of these additional revenues. This effect, however, would likely be small – on the order of 320 direct jobs – and depends on the transactions within the power grid and the structure of the power generation and transmission sector in the Central Valley. These factors, and their effect on state or national GDP, could be estimated in a broader general equilibrium analysis.

Crop values were based on 2013 prices, which have been influenced by factors unrelated to the drought. To identify the effect of drought on crop prices we have held other factors constant, and thus show relatively small drought-related price changes.

The aggregate regional impacts mask significant variability. Several agricultural areas on the east side of the Central Valley are at high risk of losing access to even minimum water supplies. Some communities will be affected by the loss of agricultural production and others will suffer from a heavy loss of farm jobs.

We have tried to be clear about the data, methods and assumptions underlying this analysis, but are mindful that we are dealing with a complex economic system that is driven by an evolving water shortage and market forces.

Over the course of this project we have identified several broad and important areas for future research:

- The need for better integration of economic models such as SWAP with groundwater models such as C2VSim. We believe that an integrated hydrologic and economic modeling framework would be a valuable tool for a long-term agricultural economy that relies on groundwater.
- We are aware that the two main avenues for drought response – groundwater and water markets – require timely data and information. We see measurement of water use and transparency in transactions as essential prerequisites to an efficient market allocation of water resources.
- We see a strong potential in remotely sensed estimates of land and water use as a cost-effective and timely source of information.
- The water use and remote-sensing data available as of July 2014 was limited. Estimates of the drought's impacts will likely improve as more of this cropping and field-idling data becomes available later in this irrigation season.

Conclusions and Policy Recommendations

The following conclusions arise from this analysis:

- The 2014 drought is responsible for the greatest absolute reduction to water availability for agriculture ever seen, given the high agricultural demands and low streamflows and reservoir levels. Surface water availability is expected to be reduced by about one-third.
- Groundwater availability and use is the key to agricultural prosperity in the 2014 drought and future droughts. This year, groundwater may replace as much as 75 percent or 5.1 million acre-feet of the roughly 6.6 million acre-foot loss of available surface water. This would raise groundwater's share of agricultural water supply in California from 31% to 53%. Failure to replenish groundwater in wet years will continue to reduce groundwater availability to sustain agriculture – particularly more profitable permanent crops – during California's frequent droughts.
- Statistically, the drought is likely to continue through 2015 – regardless of El Niño conditions. If the drought continues for two additional years, groundwater substitution will remain the primary response to surface water shortage, with decreases in groundwater pumping capabilities and increasing costs due to declining water levels. A continued drought also increases the vulnerability of agriculture, as urban users (who generally have adequate supplies in 2014) would likely buy water from agricultural areas.
- Net water shortages for agriculture in this year's drought most severely affect the Central Valley with at least 410,000 acres lost to fallowing, $800 million in lost farm revenues and $447 million in additional pumping costs. These effects are most severe in the Tulare Lake Basin. Dairy and livestock losses from reduced pasture and higher costs of hay and silage add about $203 million in agricultural revenue losses.
- Coastal and Southern California regions are less affected by the 2014 drought, with approximately 19,150 acres fallowed, $10.1 million dollars in lost revenues and $6.3 million in additional pumping costs.
- State and regional policymakers concerned with drought should pay special attention to (1) groundwater reliability, (2) the ability of state and county governments to provide technical and organization assistance to rural communities and (3) facilitating voluntary water trades between willing parties, including defining a standard environmental impact report for water transfers that can be assessed and approved prior to droughts. These policies would give local governments the ability to mitigate the impacts of droughts on rural and agricultural areas and economies susceptible to water scarcity.

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Erratum

This July 23, 2014 release of the report, Economic Analysis of the 2014 Drought for California Agriculture, corrects or clarifies the following items in the original July 15, 2014 release:

- Additional groundwater pumping attributable to the 2014 drought totals 5.1 million acre-feet for the entire study area (Central Valley and portions of the Central Coast and Southern California)
- The drought's direct impacts on the livestock and dairy industries totals $203 million
- Scope of study is clarified in Limitations and Extensions section

Appendix on Methods

This section summarizes the methods used to estimate the economic impacts of the 2014 drought and extended drought in 2015 and 2016. We provide a summary of the drought water shortage conditions and a brief description of the SWAP model. We discuss how we linked the SWAP model to other hydrologic models and the IMPLAN model.

Agricultural Areas Covered

This study examined major California agricultural areas in the Central Valley; in the central and south coast regions of the Salinas Valley, Santa Maria, Ventura and San Diego; and inland Southern California farming in the Imperial, Palo Verde and Coachella valleys. These areas together cover more than 90% of all irrigated cropland in California (9.4 million acres statewide in 2010). Figure A-1 locates these areas, represented in the SWAP model. Table A-1 has a more detailed definition of all SWAP regions.

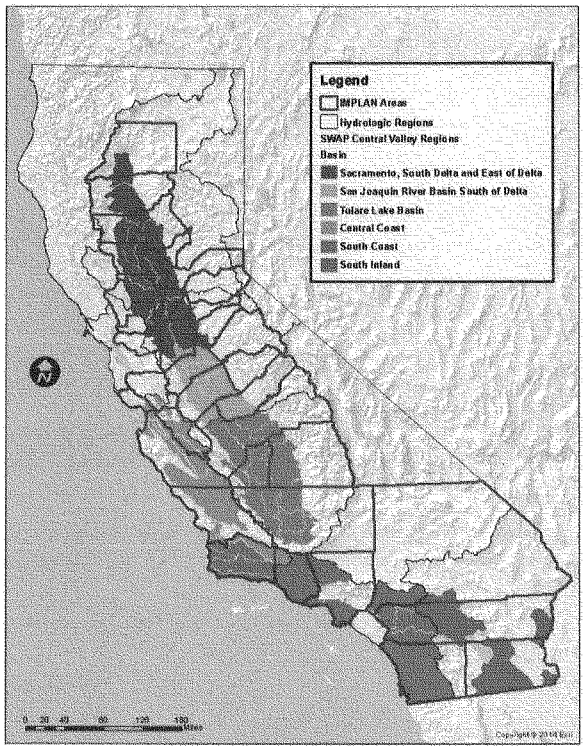

Figure A-1. Coverage SWAP Model for the drought study.

Table A-1. SWAP and drought study regions and example districts or agricultural areas.

SWAP region	**Example districts** (WD = Water District; ID = Irrigation District)	**Drought study region**
1	Bella Vista WD, and miscellaneous Sacramento River water users	Sacramento, Delta and East of Delta
2	Tehama, and miscellaneous Sacramento River water users	
3a	Glenn Colusa ID	
3b	Tehama Colusa Canal Service Area	
4	Princeton-Codora-Glenn ID, and miscellaneous Sacramento River water users	
5	Feather River region	
6	Yolo and Solano counties.	
7	Sacramento County north of American River	
8	Sacramento County south of American River and San Joaquin County	
9	Delta Regions	
10	Delta Mendota Canal	San Joaquin River
11	Stanislaus River area	
12	Turlock ID	
13	Merced ID, Madera ID, Chowchilla WD and Gravely Ford	
14a	Westlands WD	Tulare Lake Basin
14b	Local and groundwater	
15a	Tulare Lake Bed	
15b	Dudley Ridge WD and Devils Den (Castaic Lake)	
16	Eastern Fresno County	
17	Friant-Kern Canal, Hills Valley ID, Tri-Valley WD and Orange Cove	
18	Fresno County area	
19a	Kern County SWP service area	
19b	Semitropic Water Service District, SWP service area	
20	Friant-Kern Canal, Shafter-Wasco and South San Joaquin ID	
21a	Cross Valley and Friant-Kern canals	
21b	Arvin Edison WD	
21c	Wheeler Ridge-Maricopa	
22	Santa Clara and San Benito County	Central Coast
23	Salinas Valley	
24	San Luis Obispo and Santa Maria	
25	Santa Barbara area	South Coast
26	Ventura County	
27	Metropolitan Water District service area, excluding San Diego and Ventura County areas	
28	Coachella Valley	South Inland
29	Blythe/Desert areas	
30	San Diego	
31	Imperial Valley	
32	Yuma	

Statewide Agricultural Production Model (SWAP)

The SWAP was the central modeling framework used to estimate drought impacts on crop production, costs, and revenues. A comprehensive description of the model can be found in Howitt *et al.* (2012). The SWAP model is a statewide economic model of agricultural production, calibrated to a recent base year of land and water use conditions. It includes 27 areas in the Central Valley and 10 regions of the coast and Southern California.

Twenty crop groups are included in the base dataset. Crop production cost information, agricultural prices and yields, and estimates of applied water are compiled from the USDA NASS County Agricultural Commissioner's Annual Crop Reports, UC Cooperative Extension Cost and Return Studies, DWR water budget data and other sources. The model has a portfolio of water sources including groundwater, contract water and local diversions that are used depending on the relative cost of the sources and local water availability levels. Constraints on crop stress (under irrigation), permanent crops and water transfers also have been imposed in the model. The model is also able to estimate yield changes, intensive margin adjustment, agricultural land use conversion and changes in crop prices.

In a base model run, input use and cropping decisions calibrate within 1% to a base dataset. In policy analysis with SWAP, various parameters can be changed, such as water availability by sources, reductions in the available agricultural land, input factor use prices and crop yields. We typically estimate a "no action" or "existing conditions" alternative and then compare the "policy" drought alternative with the estimated baseline. In this way the SWAP model results can be interpreted as changes from an average year.

The base data in the model was updated to 2010 using the latest available information on irrigated crop acreage and applied water from DWR. Table A-2 summarizes irrigated crop area in the base SWAP model dataset.

Table A-2. Base irrigated crop areas in the SWAP model. (1000 acres).

Region	Cotton, Grain and oilseed	Feed and other Crops	Fruit and Nut Trees	Vegetables and non-tree fruit	Total
Sacramento	1,027	364	672	180	2,243
San Joaquin	579	251	608	181	1,620
Tulare Lake	1,106	352	1,289	327	3,073
Central Coast	23	3	114	459	598
South Coast	40	8	146	106	300
South Inland	194	261	45	140	641
Statewide	2,968	1,240	2,874	1,393	8,474

Hydrologic and Groundwater Replacement Conditions

The SWAP model uses 2010 as the base for water use in agriculture across the state. According to the Water Year Hydrologic Classification Indices published by DWR[1], 2010 was a below normal year for the Sacramento Valley and an above normal year for the San Joaquin Valley. 2010 is the most recent data available for applied water data from DWR.

Drought in 2015 and 2016

Drought conditions in 2015 and 2016 were based on the 2009 drought. According to DWR's statistics on water year types, there is a 29% chance that a critically dry year will be followed by another critically dry

[1] See: http://cdec.water.ca.gov/cgi-progs/iodir/WSIHIST.

year (doubling the normal change of a critically dry year). The chance of a critically dry year does not seem to be affected substantially by El Niño conditions.

Water Availability for 2014

The drought impact analysis was based on expected Central Valley Project and State Water Project deliveries announced by the Bureau of Reclamation and California Department of Water Resources (DWR) on April 18, 2014. The project team surveyed major water districts in the Central Valley to determine expected shortages in local surface water supplies and the availability of carry-over storage. The short run ability to increase groundwater pumping was based on DWR's maximum groundwater pumping estimates for the years 2006-2010. We surveyed water districts along the coast and in Southern California. Most districts will continue to primarily use groundwater for agricultural irrigation. Surface water represents a small share of total water used along the coast and Southern California so the zero allocation from CVP and SWP in some areas will not substantially impact current irrigation practices. Colorado River surface water is expected to remain stable. Presently, Lake Powell, the largest Colorado River reservoir is at 44% of full capacity. Diamond Valley Lake in Hemet is at 70% of full capacity.

Groundwater Replacement

Groundwater has historically been the swing resource for droughts in California, particularly in most agricultural areas. Groundwater use during the 2014 drought will supplement for most surface water shortages in the Central Valley and elsewhere. The additional cost of groundwater itself reduces some crop production, typically for the least profitable crops.

Central Valley

To assess groundwater availability for 2015 and 2016 in the extended drought years, we conducted a set of sequential runs using C2VSim, the California Department of Water Resources groundwater model (Brush *et al.* 2013). In this sequence, initial levels in the SWAP model provided surface water deliveries and pumping quantities for 2014 to C2VSim. Then C2VSIim estimated changes in the water table depths for 2015. SWAP used changes in the groundwater table elevations from C2VSim to estimate loss in pumping capacity by region and pumping costs for year 2015. Surface water deliveries for the 2015 drought were used in the SWAP model. The resulting cropping patterns for 2015 then provided C2VSim information on applied water and pumping during the year so C2VSim could estimate the new groundwater table levels for 2016. The percent change in groundwater levels for 2016 from C2VSim were then used to estimate the last year of the synthetic drought's cropping patterns with SWAP.

We believe that substantial new well drilling is unlikely to have a widespread effect for an extended drought. Although this lack of new pumping capacity is less realistic if the drought continues, we are analyzing a worst case in which pumping capacity depends on the resulting water table depths and local well pump screen depth distributions.

Central Coast and Southern California

Coastal and Southern California agriculture are less likely to experience severe surface water curtailments due to the relative decoupling of these regions from the 2014 drought. However, if the drought continues in 2015 and 2016, the depletion of water stored for urban uses in Southern California might impose some pressure over other uses, increasing opportunity costs of water in the region and resulting in greater water shortages for agricultural users (in some cases compensated for by water sales to urban areas).

Region-wide Economic Impacts Using IMPLAN

Input-Output models allow tracing expenses in a region's economy after an economic event has occurred. One of the most widely used input-output models is Impact Analysis for Planning Model (IMPLAN) developed by the Minnesota IMPLAN Group (MIG) Inc. The model was originally used by the US Forest Service to conduct economic impact analyses on forestry but more recently has been adopted by

academics, agencies and consultants to estimate region-wide economic effects of exogenous changes in a region of interest.

We used job estimates from the California Employment and Development Department (EDD) to adjust farm employment and convert to full time equivalents in an intermediate step. Results presented in the report for employment are seasonal and full time jobs. Personal communication with agricultural labor (Phillip Martin) and estimates form literature Martin and Taylor (2013) indicate that for every full time equivalent job there are about two full time and part-time jobs per year in California. IMPLAN's built in sector output (gross revenues) for various agricultural commodity groups were also compared to SWAP's gross revenues by large crop group. We characterized the six SWAP aggregate regions (Figure A-1) in IMPLAN by aggregating the corresponding county groups as shown in Table A-3. Interaction between SWAP and IMPLAN is shown in Figure A-2.

Table A-3. Drought regions and corresponding IMPLAN county group models.

IMPLAN Regions	Counties
Sacramento River	Amador ,Butte , Calaveras, Colusa ,Contra Costa,El Dorado, Glenn , Placer ,Sacramento, Shasta, Solano,Tehama, Sutter, Yolo and Yuba
San Joaquin River	Madera, Mariposa, Merced, San Joaquin, Stanislaus, Tuolumne
Tulare Lake Basin	Fresno, Kings, Tulare, and Kern Counties
Central Coast	Monterrey, Santa Clara, San Benito, San Luis Obispo
South Coast	Ventura, Los Angeles, San Diego, Santa Barbara
Inland Southern California	Imperial and Riverside

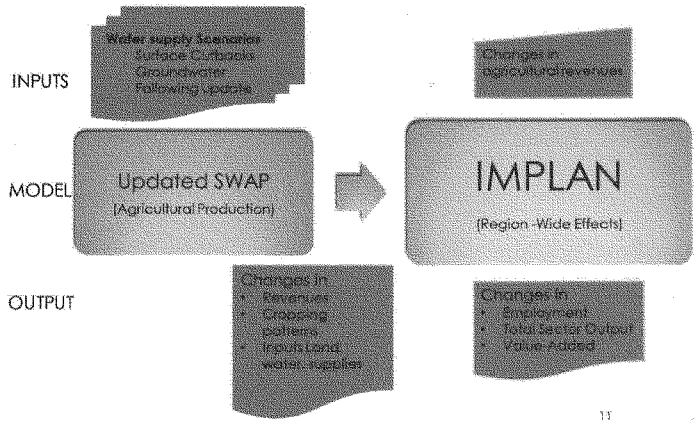

Figure A-2. Interaction of SWAP and IMPLAN modeling with inputs and results

Use of Satellite Information

A preliminary analysis of fallowing using the Normalized Difference Vegetation Index (NDVI) available reflectance on surface spectral bands was conducted for three satellite images in the Central Valley including the Sacramento Valley, the San Joaquin Valley and the Tulare Lake Basins (Figure A-3). Landsat 8 and Landsat 7 images from May 2012 to May 2014, and for early June for the case of the Sacramento Valley were used, it was found that for the San Joaquin Valley and the Tulare Lake basin at least 295,000 acres are idle in 2014 with respect to 2012. Idle agricultural land estimates for the Sacramento Valley are still under development as images later in the season would improve estimates.



Figure A-3. Analyzed Landsat rows and paths for idle land from 2012 to 2014

Statement for the Record
A Water Plan
For
All of California

Senate Energy and Natural Resources Committee

John Garamendi
Member of Congress

Introduction

Upon introduction of the Senate drought legislation and pending the introduction of House legislation by California Republicans, we'll begin the fifth year of fighting over how to deal with the California drought. This conflict has resulted in no progress and no viable federal policy to deal with the blistering drought. Below are two documents that would provide both short- and long-term drought solutions for all of California.

The first is a proposal that would establish a federal policy for administrative agencies to address the California drought. This legislation would direct the administration and relevant agencies to conform their policy and activities in California to the voter-approved Proposition 1 water bond. While this may seem to be a minor policy change, it would create significant administrative action to reduce the disastrous effect of the drought on communities large and small, agriculture, and the environment. Furthermore, it could advance the implementation of the $7 billion California water bond by as much as 18 months by providing advanced federal funding ahead of the decisions that will be made by the California legislature and the governor.

The second is my comprehensive water plan, which is a cost-effective, comprehensive water solution for the state that does not present an existential threat to the Delta. Rather than stealing water and pitting north against south, this plan would actually create new water for the state and make it more capable of adapting to future drought and flood conditions.

A BILL

To ensure that Federal water policy and activities in the State of California conform to Division 26.7 of the California Water Code (the Water Quality, Supply, and Infrastructure Improvement Act of 2014), as approved by the voters of California in California Proposition 1(2014).

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Section 1. Federal water policy and activities in the State of California in support of California water bond funding for water quality, supply, treatment and storage projects.

(a) In General.—The Secretary of the Interior, the Secretary of Agriculture, the Secretary of Commerce, and the Administrator of the Environmental Protection Agency shall ensure that Federal water policy and activities undertaken by such Secretary or Administrator in the State of California prioritize, facilitate, supplement, and support the implementation of Division 26.7 of the California Water Code, also known as the Water Quality, Supply and Infrastructure Improvement Act of 2014, as approved by the voters of California in California Proposition 1 (2014).
(b) Termination.—Subsection (a) shall be in effect until the date that is three years after the date of the enactment of this Act.

A WATER PLAN FOR ALL OF CALIFORNIA

We need to think in a comprehensive way about water in California. The controversial California Water Fix, formerly known as the Bay Delta Conservation Plan (BDCP),[1] is an outdated and destructive plumbing system. It does not create any new water nor does it provide the water and the ecological protection that the Golden State must have. California and the federal government must set aside this big, expensive, destructive plumbing plan and immediately move forward with a comprehensive approach that includes:

1) Conservation,
2) Recycling,
3) The creation of new storage systems,
4) Fix the Delta - right sized conveyance, levee improvements, and habitat restoration,
5) Science driven process,
6) Protection of existing water rights.

This combination of projects constitutes a comprehensive water plan for the state.

Through a comprehensive plan that brings all stakeholders to the table, California can solve its water needs, and it can avoid the continuous water wars that have long divided our state. Unfortunately, California is once again embroiled in a bitter water war brought about by the California Water Fix (BDCP), the most recent attempt to fix California's water supply. After more than five years of study and over $200,000,000 spent on consultants, the process has become bogged down and turned into another

battle pitting north vs. south, water exporters vs. environmentalists, and senior water right holders vs. new comers. A classic California water brawl is in full bloom.

The governor's water plan for California is to take water out of the Sacramento River just south of Sacramento and put it into two tunnels each 40 miles long, 40 feet in diameter and with a potential capacity of moving 15,000 cubic feet per second (cfs). While the current proposal is set up to move 9000 cfs, the twin tunnels have a much larger capacity therefore setting the system up for future expansion. Pumping would also continue directly from the southern Delta at the Tracy pumps. The system will be able to deliver up to 5.3 million acre feet of water to the pumps in Tracy and then on to the San Joaquin Valley farmers and Los Angeles.

So what is wrong with the Water Fix (BDCP)? It is not a water plan for California. It does not create one gallon of new water. It does not solve the long term needs of the state. With a minimum estimated construction and operating cost over 50 years of $24.5 billion, it is an extraordinarily expensive plumbing system dressed up with a coating of habitat restoration. The plan simply takes water from one region and delivers it to another while tearing up acres of prime agricultural farm land in the process. All of this while stoking the fire of divisiveness over water that has plagued our state for years.

A quick look at the water flow in the Sacramento River over the last two decades shows that approximately six months out of the year there is somewhere between 15 and 20 thousand cubic feet per second (cfs) of water flowing in the Sacramento River. This proposal has the potential to suck the river dry and destroy the largest delta estuary on the west coast of the Western Hemisphere. Critical habitat for dozens of fish species like salmon, striped bass, and sturgeon would be threatened. These fish and the water they live in are crucial for jobs, agriculture and fishing businesses, and the region's economy.

We should never build a water system that has such destructive potential. It is never safe to assume that ecological concerns will trump greed and thirst. We should keep in mind that in 2012 the U.S. House of Representatives voted on H.R. 1837, the euphemistically titled Sacramento-San Joaquin Valley Reliability Act. The bill passed by a vote of 246 to 175 and swept away all environmental protections for the Delta while stealing 800,000 acre feet of water from the aquatic environment. Luckily, the legislation was derailed in the U.S. Senate, but H.R. 1837 in one form or another is likely to return in future legislative battles.

California must move beyond a patched plumbing system. We need to think about what California really needs, and what it needs is a comprehensive water plan. Big changes are coming that threaten our water supply and our economy. A short list of these challenges include: climate change and related weather events, population growth, world food supplies, and earthquakes.

Climate change is real and its effect on California will be significant. The Colorado River Basin is in a prolonged drought, and likely to be much drier in the future. Based on today's water flows, the water in the Colorado River is oversubscribed by a third and projections indicate less water in the future. This is a big, big problem for the seven states that rely on the river, and especially for Southern California.

The Sierra Nevada Mountains, the Central Valley, and the coastal ranges will also be drastically impacted by climate change. We know that the timing of the precipitation is going to change and the snow is already melting earlier. As a result, the snowpack is moving up the mountains and while it may be deeper at the higher altitudes, the amount of land it covers is greatly reduced. It's the lower snowpack that has the greatest volumes of water and if that continues to recede, we will have less and less water. The 2009 "California Water Plan," published by the California Department of Water Resources, estimates that the snowpack will decrease 25-40 percent by 2050.[2] We must also anticipate more severe storms and flooding. All of this means the natural and man-made storage systems will hold less water. Putting the denial of scientific facts aside, California has to deal with the reality of climate change and its water policy implications.

We know California's population will continue to grow and therefore, the demand for water will increase. We know the world will be very hungry in the future, and we know that the role of agriculture in California is going to be exceedingly important. California agriculture not only fills our own desire for diverse and nutritious foods, but it will also continue to meet basic food needs for people around the world and will continue to serve as an essential component of our nation's economy.

We know the Delta is in serious trouble. The fish species are threatened with extinction and a total collapse of the estuary ecosystem is possible if the current water pumping program continues. Rising sea levels and deferred maintenance threaten the Delta levees which protect nearly 500,000 people, thousands of acres of valuable farm land, and miles of critical highways, gas and water transmission lines, and water delivery channels. Major upgrades are needed.

For these reasons, California must take off its blinders and expand its scope when thinking about ways to manage its water supply. It must be a holistic approach that is applied to every project that will impact the water needs of all Californians.

SIX BUILDING BLOCKS FOR CALIFORNIA'S WATER FUTURE

To achieve this comprehensive approach, here are six specific actions to provide a foundation for California's water future. If California does all of these, we will create new water supplies and better use the resources we already have:

1) Conservation,
2) Recycling,
3) The creation of new storage systems,
4) Fix the Delta - right sized conveyance, levee improvements, and habitat restoration,
5) Science driven process,
6) Protection of existing water rights

CONSERVATION

The quickest and cheapest source of new water is to stretch our current supplies by conserving what we have. Californians have been at this for years in our cities, in our industries, on the farm, and in our homes. We have engaged in serious water conservation, yet more can and should be done everywhere.

There are many conservation strategies. One conservation strategy is to use devices that measure the moisture in the soil to provide real time monitoring of the exact amount of water needed for ideal growing conditions. These devices are connected to a computer that automatically turns on just the right amount of water. These systems are in use and conserve at least ten percent with a financial payback in less than one year. If they were deployed widely perhaps at least 1 percent of the 30 million acre feet of water consumed by agriculture could be saved each year (300,000 acre feet).[3]

All of us are going to do a lot more water conservation, not just the agriculture community. The water conservation mandate set by the state is a 20 percent reduction per capita by 2020 which equals 1,600,000 acre feet.[4] In a very real way conservation can create new water that was not previously available for use. To be on the conservative side, let us assume that just one quarter of the State's goal could be obtained in the next decade, thereby adding 400,000 acre feet of new water to our supplies each year.

RECYCLING

Can you name the fifth biggest river on the west coast of the Western Hemisphere? It's the water that flows out of the sanitation plants in Southern California and is dumped into the Pacific Ocean.

Why would any sane government take water from the Sacramento River, pump it 500 miles south, lift it 5,000 feet in the air, clean it, use it once, clean it to a higher standard than the day it arrives in Southern California, then dump it in the ocean? California does just this as it discharges over 3.5 million acre feet of water to the ocean each year, much of which could be reused.

We need to think seriously about recycling, not just in Southern California, but everywhere. The State of California currently recycles approximately 650,000 acre feet of water each year and has set a water recycling goal of 1.5 million acre feet of new water in California by 2020, and 2.5 million acre feet by 2030.[5] While achievable, WateReuse California estimates this goal cannot be achieved without State regulatory changes to expand the types of recycling available that rely on existing technologies.[6]

Another option is desalination of the ocean. This is feasible and used extensively throughout the world, however it is not a viable option for all communities. It costs about 40 percent more to desalinate sea water than to recycle water using current technology. However, technological advances are being pursued for both recycling and desalination that could lower the costs of both.

In the next ten years, conservation and recycling in California can create approximately 2.2 million acre feet of new water to use each year, and that can increase to 3.2 million acre feet in twenty years. This is new water that is not available today because it is wasted or pumped out to sea. It can be developed at a reasonable cost when compared to all other alternatives that might be out there. Conservation and recycling are steps one and two in a comprehensive water program for California.

CREATE NEW STORAGE

Water storage south of the Delta is possible and necessary. The capacity of the great Delta pumps near Tracy is 15,000 cubic feet per second. They are designed to meet maximum demand south of the Delta. They do not operate year round, only when there is sufficient water in the Delta, when threatened fish are not near the pumps, and when there is agricultural and urban demand south of the Tracy pumps. There is very limited water storage capacity south of the Delta. We must build more. San Luis and Los Vaqueros reservoirs could be expanded. New dams could be built at Los Banos Grandes, Temperance Flats, and numerous smaller off stream sites throughout the San Joaquin Valley. There are extensive and numerous aquifers throughout the San Joaquin Valley that may prove suitable to store additional water that would be used in a conjunctive water management system. With these water storage facilities in place and a smaller cross Delta facility operating year round, the need for havoc causing, excessive pumping in the Delta could be avoided.

When coupled with recycling, the underground aquifers in Southern California are another key to our water future. The underground aquifers of the Santa Ana River in Orange County, the San Fernando Basin, Chino Basin, San Bernardino, San Gabriel Basin, and others have a combined capacity larger than Shasta Reservoir, the largest man made reservoir in the state. Today, some recycled water is put into the underground water basins to be stored for those inevitably dry years. When needed, it

is pumped out, used, cleaned and returned to storage. On a larger scale this recycling system could create as much as 2.5 million acre feet of new water, and thereby reduce the need for shifting Colorado River supplies and imports from the Sacramento River.

Surface and underground storage should be used in a conjunctive water management program. Use the rivers when there is lots of water and use the reservoirs when there is little. Another way to describe this strategy is "big gulp" and "little sips." When there are low flows in the Delta the system would take a little sip. When there is excessive water in the Delta, the system would take a big gulp, but there must be some place to put that water when the big gulp is taken. Therefore, the surface and sub-surface reservoirs south of the Delta become an essential element in a California water plan.

Water storage north of the Delta is also important, and three proposals are on the books today. An off stream reservoir at Sites, located west of Williams, has great promise for storage and for creating greater flexibility in managing the Sacramento River for salmon runs, water demand, and Delta outflow. This reservoir can deliver 500,000 acre feet of annual yield and the additional flexibility that it offers can under some scenarios save another 500,000 acre feet of water that would otherwise be released into the river systems.[7] Raising Shasta Dam is also possible, as is better conjunctive management of the many aquifers in the Sacramento Valley. State and federal agencies have already commenced studies for these projects. A quick completion of these studies is essential.

FIX THE SACRAMENTO – SAN JOAQUIN DELTA

The current plan for the California Water Fix (BDCP) is a dual use facility with the main focus on the twin tunnels with a capacity of 15,000 cubic feet per second, and the continued use of the Delta channels for moving water from the Sacramento and San Joaquin rivers to the Tracy pumps. This dual use system adds another layer of risk to the eco-system and agricultural economy of the Delta with the potential for the massive tunnels to suck the Delta dry from the north and from the south with the thirsty pumps. In scale, the cost and destructive potential of this project will rival the Three Gorges Dam on the Yangtze River in China. The twin tunnel proposal is a large scale, destructive project that does not create one gallon of new water for a thirsty California.

The location of the intakes for the twin tunnels is in the heart of the rich farm lands of the northern Delta, near the small community of Courtland. Thousands of acres of valuable farmland essential to California agriculture production will be destroyed during construction of the project, and, following completion, a vast industrial zone of pumping stations, fish screens, reservoirs, and electrical stations will impede on one of California's great agricultural regions. Along the forty mile route of the twin tunnels the construction process will produce a total of 22 million cubic yards of tunnel muck. This combination of soil and conditioning agents will have to be stored and managed and

the latest draft of the plan calls for storage areas along the tunnel ranging in size from 100 to 570 acres. The amount of muck extracted would be enough to cover 100 football fields to a height of roughly 100 feet, and in the end will destroy close to 1600 acres of farm land while disrupting domestic and agricultural water wells.

A SOLUTION FOR THE DELTA

Go forward carefully; start small; use science to evaluate each step; then proceed to the next step. Remember the Delta is a unique and precious environmental asset. We must take care of it. A narrowly focused plumbing system like the California Water Fix/BDCP will not achieve progress in creating a water supply sufficient for California's future. We must pursue a holistic, comprehensive approach that will achieve a bigger bang for our buck.

First, reduce demand on the Delta with steps one, two and three: water conservation, recycling, and strategic use of storage facilities. Use the "Big Gulp, Little Sip" pumping strategy. Move forward with the flood plain and fresh and saltwater marsh habitat improvements. Repair and improve the key Delta levees. Evaluate the effect on the Delta as these projects come on line.
Then, and only if necessary, proceed with a conveyance system that is much smaller and with a reduced capacity to destroy.

A much smaller facility with a capacity of no more than 3,000 cubic feet per second could be built to deliver water from the Sacramento River to the Tracy pumps. With the normal minimum flows in the Sacramento River above 15,000 cfs, a small 3,000 cfs facility could operate at least 300 days in most years, delivering approximately two million acre feet of water south to the pumps at Tracy where it would be pumped south to the new and expanded storage facilities.

There are several alternative ways to build this smaller system. One alternative is found with a careful look at the Delta map which reveals that two thirds of this Delta friendly system is already built. Two miles from the State Capital is the Port of Sacramento and the shipping channel that ends 25 miles south near Rio Vista. From there it is thirteen miles to existing channels and the Tracy pumps. The Federal Government already owns the land along the river where an intake and fish screen could be built, allowing 3000 cfs of Sacramento River water to enter the channel and flow south to a shipping lock at the southern end of the channel. Then, pumps could deliver the water into a short 12-mile pipe beneath the Sacramento and San Joaquin Rivers and into the existing Delta channels that lead to the Tracy Pumps. The threatened Delta fish could be protected by sealing the channel from the Delta. Such a smaller facility is less costly than two 40-foot diameter, 40-mile long tunnels that devastate large swaths of the Delta and put the entire Delta at risk.

It is correct that this smaller facility like the twin tunnels is insufficient to quench the thirst of the Southern water contractors. This is where the southern reservoirs and the "Little Sip, Big Gulp" strategy comes into play. In normal water years there is sufficient water in the Delta to allow the pumps to take a big gulp of two million acre feet of water. This amount together with the two million acre feet delivered through the 3,000 cfs facility and the new water developed from conservation and recycling efforts could add up to six million acre feet. This plan would create far more new water than will ever be available with the current California Water Fix (BDCP) plan, which in its current state creates nothing new, except new destruction.

IMPROVE DELTA LEVEES

This small 3,000 cfs proposal and the current twin tunnel proposal envision the continued use of the existing Delta levee system as water conveyance channels for the delivery of water to the big pumps at Tracy. However, the California Water Fix (BDCP) has neither a plan nor funding for the maintenance of the levees that are crucial for their proposed water conveyance system. The Delta levees must be upgraded and maintained if water is to be transported through the Delta and if the Delta agriculture, infrastructure, ecology and people are to be protected.

No sane homeowner would go fifty years without maintaining their plumbing system. For more than fifty years, the Bureau of Reclamation and the California Department of Water Resources have used the Delta levees as a plumbing system to deliver water from the Sacramento River to the Tracy pumps. Yet, they have spent virtually no money maintaining these critical levees, the failure of which could shut down water deliveries for an extended period of time. The Federal and State agencies have relied upon the local reclamation agencies to do the repairs, literally giving the exporters a free ride. When a levee does give way and an island is flooded, it is the local agency and federal and state governments that foot the bill to repair the levees, often at a much greater cost than would have been necessary with basic maintenance.

Legislation is necessary to require that the Federal and State water contractors, who have for years and will continue for even more years depended upon the Delta levees for the delivery of water to their fields and cities, pay a part of the levee maintenance cost.

HABITAT RESTORATION

The California Water Fix (BDCP) envisions restoring flood plains and the salt and freshwater marsh habitat of the Delta in an effort to restore the fisheries. However, a series of questions are raised: where to do it, how much to do, what type, at what cost and who is to pay for the restoration? Those who have created the ecological problem should pay for the restoration of the problem. All this will require careful attention to science, and a careful balance between competing goals. Current science indicates that no amount of habitat restoration can compensate for the damage done to fish from excessive water exports.

LET SCIENCE DRIVE THE PROCESS

The California Water Fix (BDCP) and any other proposal must be based and driven by quality science that measures and informs decisions. California and federal law require that the Delta aquatic and terrestrial ecosystems be protected. We must do so, not just because the laws demand it, but because our status as human beings on this planet demands that we pay attention and protect precious and rare ecosystems. Also, healthy ecosystems provide a valuable asset to our communities because healthy ecosystems help to ensure we have healthy water. If we let the ecosystems fall by the wayside, our water will get dirtier making it increasingly difficult and costly to clean it up enough to use. For all of these reasons, we must let science govern.

The California Water Fix (BDCP) anticipates 50-year permits from state and federal agencies to allow incidental takes of endangered fish species. Once granted, the water exporters will have assurances that the project can take covered species and pump Delta water despite changes in the environment. To date, the California Water Fix (BDCP) has not built in flexibility to address the inevitable changes that will occur and the damage that could be done if the plan does not account for climate change.

We must also use science to understand our river basins in the age of climate change. Dams on California Rivers serve multiple purposes of water storage, flood protection, electric power generation, recreation, and environmental river flows. Current dam operations on California Rivers place flood protection as the first priority followed by water storage. The decisions to release water to create greater flood storage are based on the average river flows compiled from the last 60 years. Climate change and resulting river flow change is certain and one can only imagine how rare it will be for the historic average to actually occur.

We have the technology today to better understand what is happening, in real time, in every river basin in this state. Satellites and unmanned aircraft using infrared and ground sensing radar, together with terrestrial stations collecting soil conditions, snow temperature and moisture content coupled with telemetry will soon be deployed in the American River basin. Collecting this data and using it in real time to predict river flows allows for better operation of the dams so that additional flood storage capacity

could be available by lowering the reservoir ahead of the storm or keeping water in the reservoir if a major storm is heading for a different river basin or if it is a cold snow storm. Using the best science can simultaneously deliver increased flood protection and greater water storage.

PROTECT WATER RIGHTS

Soon after gold was discovered in California, the miners discovered that water could be used to separate gold from gravel and soon after, the right to the water flowing in the rivers became as valuable as the gold. Today, water is California's gold. The classic water war in California is usually about one group attempting to take another group's water. It is reasonable to view the current twin tunnels conflict in this way: southern exporters taking water belonging to northern water right holders and water necessary for the aquatic river environment. Any water plan that ignores the prior and existing water rights is destined to be embroiled in a vicious and contracted water war. If a project is to be built, then existing rights must be honored.

CONCLUSION

California must develop a comprehensive water program. The current California Water Fix (BDCP) is an outdated and destructive plumbing system. It does not create any new water. It does not provide the water and the ecological protection the Golden State must have. California and the federal government must set aside the big, expensive, destructive plumbing plan and immediately move forward with a comprehensive program that includes:

1) Conservation,
2) Recycling,
3) The creation of new storage systems,
4) Fix the Delta - right sized conveyance, levee improvements, and habitat restoration,
5) Science driven process,
6) Protection of existing water rights

California is once again embroiled in a water war. The California Water Fix/BDCP is not a comprehensive plan; it is a plumbing system that seeks to extract water from one part of the state and deliver it to another part. If history is any indication, water wars are expensive and fruitless. Only by embracing a comprehensive plan that creates new water for the entire state can we avoid gridlock and a water war. This paper presents a

plan that emphasizes using the best available science and a portfolio of water projects to create a positive solution to the water challenge facing California. It's time to move forward and ensure a reliable water supply for the entire state.

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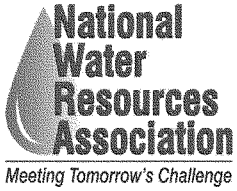

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Senate Committee on Energy and Natural Resources

Hearing to receive testimony on the status of drought conditions throughout the Western United States

Submitted Testimony of
Robert W. Johnson
Executive Vice President
National Water Resources Association

June 2, 2015

Introduction

Chair Murkowski, Ranking Member Cantwell and members of the Committee. I respectfully offer this testimony on behalf of the National Water Resources Association; more commonly known as NWRA. NWRA represents state associations, irrigation districts, other water providers, and their collective interests in the management of irrigation and municipal water supplies throughout the Western United States and portions of the South. NWRA members provide clean water to millions of individuals, as well as families, agricultural producers and other businesses throughout the United States. For more than eighty years our members have worked to provide water in a manner that provides both economic and ecosystem benefits to communities. NWRA's members are on the front line dealing with drought and water supply challenges and appreciate the opportunity to provide our perspective on this massive challenge.

Importance of Water

Water covers about 71 percent of the Earth's surface. But less than 0.3 percent of that water is available for human consumption. Access to a reliable source of water is a cornerstone of society and a building block for life. The importance of water supply and associated infrastructure in the West has been recognized for centuries.

Historical data indicates that the Anasazi people were constructing facilities to divert runoff for agricultural purposes as early as the tenth or eleventh century. When Spanish settlers came to the West in the late 1500's and early 1600's one of the first efforts they undertook was to establish gravity flow irrigation systems called "acequias". Acequias were constructed in California, Arizona, Texas, Colorado and, most extensively, in New Mexico. Hundreds of these acequias, many built more than four centuries ago, are still in use today. In addition, some of the

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"Wild West's" most storied historical western figures, including William F. "Buffalo Bill" Cody and Sherriff Pat Garrett, attempted large scale efforts to develop water supply resources in Wyoming and New Mexico respectively. President Theodore "Teddy" Roosevelt, who is often regarded as America's "Father of Conservation", also saw the importance of water in the West. In 1901, in his first State of the Union Address, President Roosevelt stated: "In the arid region (the West) it is water not the land, which measures production."

President Roosevelt's statement is as true today as it was more than a century ago. We use water every day in ways that most individuals don't realize. According to the USGS the average American uses between 80 and 100 gallons of water a day. Much of this water is used for sanitary needs. This 80 to 100 gallon figure is only part of the picture of water use in the United States. Producing food, and almost any other product, requires significant use of water. As an example, production of a cotton T-shirt can utilize 600 to700 gallons of water, a 32-megabyte computer chip – which weighs about 2 grams – has a water footprint of about 8 gallons, a piece of paper has a water footprint of around 2.6 gallons, and a single cup of coffee 37 gallons.

The ultimate user of this water is not the farmer, the manufacturer, or your local coffee shop but the consumer. This means that we all have a shared responsibility to work to address western droughts. This fact was highlighted by a recent New York Times feature titled: "Your Contribution to the California Drought", it noted that the average American consumes more than 300 gallons of California water each week by eating food that was produced there.

The connection between water supply and food affordability is on the minds of many Americans. A Reuters/Ipsos poll conducted between May 18th and May 22nd found that 84 percent of those polled said that they strongly agree or somewhat agree that the drought is going to cause a significant increase in food prices. The need for an affordable food supply is not only an issue domestically, it is also extremely important globally. According to the USDA, the United States is responsible for approximately 20 percent of the world's food exports by volume. Input costs for U.S. agricultural production affect costs both domestically and abroad. Keeping food affordable is extremely important because price spikes can have disproportionate adverse affects on vulnerable populations. According to U.N. and World Bank figures, food price spikes in 2008 drove 110 million people into poverty and added 44 million to the undernourished globally. As the world's population continues to grow in coming decades the need to produce food will also grow. It is estimated that by 2050 the demand for food will increase by 70 percent.

Food production in the United States must play a role in meeting this demand. This is a daunting challenge but one that NWRA members are ready to help our nation's agricultural producers meet. Our nations farmers and ranchers have successfully doubled U.S. food production over the last half century. Much of this improvement has come during a time when agriculture is working to become more efficient in its water use. According to the USGS, since peaking in 1980 water used for irrigation has dropped from almost 150 billion gallons per day to about 115 billion gallons a day in 2010. Since 2005 alone, 950 thousand more acres of land have been put into irrigated agricultural production while water use has been reduced nine percent.

Increased production with less water is made possible because agricultural water users are making significant investments in water use technologies. As an example, NWRA members in

New Mexico have invested in subsurface drip irrigation systems that help reduce water lost to evaporation. Producers in Arizona are laser leveling their fields to help reduce water lost to runoff. Irrigation districts in Washington State are using geomembranes to line canals to stop seepage in canals and SCADA technology to help measure and respond to water demands in real time, which yields water savings.

Efforts to improve water use efficiency are not limited to the agriculture sector. Throughout the U.S. water suppliers are looking for ways to improve efficiency and reduce water demand. The most recent data available indicates that today we are withdrawing 20 billion gallons of water less each day than we were in 1980. Over this same period the U.S. population increased by about 70 million people. NWRA members in California are maximizing water recycling and reuse technologies to meet almost a third of their water supply needs. Water managers in Las Vegas undertook an aggressive water conservation program and reduced overall water use between 2002 and 2012. They accomplished this despite the fact that the area added some 400,000 new residents during the same period. In Texas, NWRA members are examining the possibility of developing the State's first seawater desalination plant.

Despite these improvements in water management the world remains a thirsty place.

Opportunities for Addressing Drought and Water Supply Needs

Meeting the challenge posed by drought, climate variability and a growing population will require an "all of the above" approach for meeting water supply needs. This will require substantial investments in new or expanded storage reservoirs; reuse facilities; desalinization plants; water collection, delivery and distribution pipelines; pump-back projects; groundwater recharge facilities; reverse osmosis water treatment plants and conservation.

1. Encourage Regulatory Efficiency

A common thread with an "all of the above" water supply solution, especially where federal partners are involved, is a regulatory process that can be time consuming and costly. NWRA members are responsible members of the regulated community and believe that appropriate regulation is an important part of water management. However, regulations must be developed and implemented in a way that meets the needs of the agencies, the regulated community and the environment.

We recognize that the Clean Water Act is not within the Committee's jurisdiction. However, it perhaps more than any other federal regulation has the possibility to impact water supply operations. It can provide a telling example of regulatory costs. As often cited from the *Rapanos* decision, a 2002 study reported the average applicant for an individual permit under the Clean Water Act spent 788 days and $271,596 in completing the process, and the average applicant for a nationwide permit spends 313 days and $28,915—not counting costs of mitigation or design changes. Close to $2 billion is spent each year by the private and public sectors obtaining wetlands permits.

NWRA is still reviewing the final rule that was posted last week. Based upon its preliminary review of the final rule language, NWRA believes that the agencies have taken positive steps in efforts to address a number of our concerns, including those associated with the future treatment of ditches, stormwater control facilities, and "erosional" or "ephemeral features". It appears, however, that issues may remain in other areas. For example, there is: (i) an apparent failure to include specific exemption language for canals and raw water treatment and delivery systems; (ii) the inclusion of overly broad concepts in an attempt to define those "functions" which are relevant to a significant nexus determination; and (iii) a failure to resolve ambiguity surrounding the treatment of arroyos and ordinarily dry washes which may nevertheless possess a bed and bank and have an ordinary high water mark. That said, NWRA will be carefully reviewing the more detailed supporting documentation and will provide additional information to congress as we come to better grasp the implications of the final rule.

The National Environmental Policy Act (NEPA) also has the potential to create significant costs and delays for water management. This is especially true when a water manager needs to interact with multiple federal agencies during the NEPA process. Given the vital importance of water infrastructure we believe that the NEPA process could be improved by designating Reclamation as the lead agency for NEPA permitting associated with water storage development on lands managed by the Department of the Interior and the Department of Agriculture. Within the land management agencies, Reclamation has the most experience constructing and managing water infrastructure. Placing it in the role of lead agency is a common sense decision that is backed up by more than a century of engineering and water management experience.

NWRA is committed to working with the Congress and the agencies to provide a clearly defined, efficient process for federal permitting requirements.

2. Invest in Water Infrastructure

An investment in water infrastructure is an investment in our nation's economy.

The federal government has in interest in maintaining existing - and developing new - water infrastructure. This interest lies in the numerous benefits associated with water supply. This infrastructure provides our nation with essential and beneficial services beyond clean drinking water and water for agriculture. It is also essential for economic development; provides a multitude of recreational opportunities; flood control; and power generation. These additional benefits are significant.

Water supply infrastructure is a key component of our nation's flood mitigation system. Many of the facilities built by NWRA's members and our federal partners at Reclamation and the Army Corps of Engineers (Army Corps) have flood control benefits. As flood management issues become more prevalent the infrastructure developed and managed by NWRA members and our federal partners will become ever more important.

The storage and conveyance of water also provide opportunities to develop clean, carbon free energy in the form of hydropower. Infrastructure on Reclamation facilities alone provide approximately 40 billion kilowatt hours of electricity each year (enough to power 3.5 million

homes), produce a billion dollars in power revenues annually, and offset approximately 27 million tons of carbon dioxide.

Much of our nation's water infrastructure is in need of repair or replacement to meet increasing urban, agricultural, recreational, and environmental demands. In the West, much of the water infrastructure is between 50 and 100 years old. Fifty percent of Reclamation's dams were built between 1900 and 1950.

The replacement value of Reclamation's infrastructure assets is nearly $100 billion. The replacement value of the entire federal government's water supply infrastructure is more than $350 billion. However, these dollar figures fail to capture the fact that much of this infrastructure is actually irreplaceable; and its true value is much greater.

a. Federal Funding

NWRA recognizes that federal funding is limited and we know that the federal government must allocate funds in a fiscally responsible manner. We believe that an investment in our nation's water infrastructure is a responsible investment in the nation's economy. Commerce and economic development depend on access to a clean, reliable, and affordable supply of water. Multi-purpose water supply and delivery infrastructure provides millions of citizens with essential and beneficial services, including clean drinking water, water for agriculture, economic development, recreational opportunities on rivers, lakes, and streams, instream flows for fish and wildlife, and power generation and transmission.

We encourage the Committee to consider targeting funding increases to projects that increase water supply, address current and future drought concerns, meet aging infrastructure needs, address rural water concerns, and increase project operational efficiency. Specifically we encourage the reauthorization of Reclamation's Safety of Dams Program and the SECURE Water Act.

i. Safety of Dams Program

Approximately ninety percent of Reclamation dams were constructed before the currently used state-of-the-art design and construction practices were available. This makes ongoing risk analysis measures extremely important. To date Reclamation has preformed dam modifications at nearly 90 facilities throughout the west. In it's FY2016 budget request Reclamation noted that it could hit the authorization ceiling for the Safety of Dams program at the end of FY2016. We strongly encourage the extension of this valuable program.

ii. SECURE Water Act

The SECURE Water Act authorized cost share programs that effectively leverage money by combining non-federal funds with federal grant money. In recent years grants have helped fund projects in: Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, New Mexico, Nevada, Oklahoma, Oregon, Texas, Utah and Washington State. These projects in the afore mentioned states have benefited both tribal and non-tribal lands, they have helped conserve

water, expand ground water storage opportunities, and conduct important infrastructure work such as canal lining and headgate improvements.

When discussing funding for water supply projects it is important to note that, unlike a great deal of federal spending, Reclamation project authorizations usually require 100% repayment. Project beneficiaries have repaid much of the federal investment in the Reclamation water infrastructure that our nation enjoys.

b. Do not Limit Access to Private Capitol

Water managers greatly appreciate federal investments in infrastructure. However, they have also long sought funding solutions that do not rely on federal dollars. In recent years a great deal of work has been done to construct and maintain water supply systems in partnership with private sector funding. Access to this private capitol is becoming increasingly important. As Congress seeks ways to mitigate drought we think it is vital that they do not hinder water users ability to utilize market accessible capitol. A loan Guarantee program similar to what was authorized in the Secure Water Act for improvements to federally owned facilities would go a long way to open access to private capital for water suppliers.

i. Municipal Bonds

State and local government entities like water providers have used municipal bonds for decades to help develop infrastructure. Municipal bonds play an important role in the financing of many local water projects. Congress is currently discussing proposals to modify our nation's tax infrastructure. This is an important debate that water users welcome. As this discussion is undertaken it is important to note the vital importance of tax-exempt municipal bonds. Federal taxation of municipal bonds, in whole or in part, will hamper a valuable financing tool that water providers have successfully used for years and will make it more difficult to construct the infrastructure necessary to deal with drought.

ii. Use of tax-exempt funding for WIFIA Projects

We greatly appreciate Congresses' efforts in passing the Water Resources Reform and Development Act of 2014 (WRRDA), this legislation provided a number of valuable tools for water managers including the Water Infrastructure Financing and Innovation Act or WIFIA. This program provides low interest federal loans of up to 49 percent for drinking water, wastewater, and water reuse projects. As the law is currently written it prohibits water suppliers from using tax-exempt bonds to finance the remaining 51 percent of project costs. This limitation makes the program less effective and prevents water suppliers from utilizing a very important source of private sector financing. In order to make WIFIA as effective as possible we encourage congress to allow the use of tax-exempt municipal financing.

iii. Respect State Allocated Water Rights

In many western states a water right is a property right and as such has significant value. A water right can be a valuable part of an entity's balance sheet and considered when that entity

attempts to secure private sector financing. In recent years the United States Forest Service (Forest Service) has attempted to tie the approval of a special use permit to the relinquishment or modification of a state allocated water right. We find this concerning for numerous reasons but, in this case, feel it is important to highlight the fact that this type of federal action threatens a valuable asset. Federal attempts to restrict or modify a state allocated water right would impair an entity's ability to utilize private sector funding and could make the development of water infrastructure more difficult.

3. Maximize Facility Operations

As previously noted, Reclamation has a vital Safety of Dams Program. Congress should give Reclamation the authority to consider opportunities to increase project benefits for water supply when conducting a dam safety assessment.

Section 1046 of WRRDA also directed the Army Corps of Engineers (Corps) to examine operations at existing facilities to determine how these practices effect water supply during drought. This examination could lead to improved operations practices that provide additional water supply opportunities. We believe that the Corps should work with local water users when completing this examination.

4. Authorize Accelerated Repayment

Under existing authorities, the prepayment of a water service contract between the Bureau of Reclamation and a water user often requires a project specific authorization. We believe that requiring project specific authorization for repayment is an unnecessary step and recommend that Reclamation be given the authority to, at the request of the water user, convert water service contracts to allow for prepayment. Contract prepayment will allow a return funds to the federal government sooner and can help increase the federal governments return on water infrastructure investment. We believe that providing Reclamation with this authority is a common sense measure that could benefit water users as well as have a net positive impact on the U.S. Treasury.

Conclusion

We thank the Committee for holding this important hearing and for giving NWRA an opportunity to share our perspective. This testimony represents an overview of our thoughts on what steps congress can take to help meet water supply needs. We will be providing additional information to the Committee for their consideration prior to the hearing record closing.

Thank you again.

Robert Johnson

Robert W. Johnson
Executive Vice President
National Water Resources Association

Written Testimony from The Nature Conservancy

United States Senate, Energy and Natural Resources Committee

Oversight Hearing on the

"Status of Drought Conditions Throughout the Western United States and Actions States and Others are Taking to Address Them."

June 16, 2015

The Nature Conservancy appreciates the opportunity to provide testimony to the Senate Energy and Natural Resources Committee on the status of drought conditions throughout the western United States and solutions we recommend to address them. The Nature Conservancy (the Conservancy) is an international, non-profit conservation organization working around the world to protect important lands and waters for people and nature. The Conservancy puts great emphasis on solutions and partnerships, and we rely heavily on science to inform our direction, focus and priorities. We work in communities across the United States and around the world and partner with local leaders in conservation, business, agriculture and ranching.

California is experiencing the worst drought in recorded history and responding to this drought in ways that benefit both people and nature will require balanced, science-based approaches. Statewide, the snowpack is at nine percent of average—only a small fraction of where it was at this time last year. The state is also experiencing record low river flows, with 37 rivers at record lows in May and with many more record lows expected as the drought persists over the summer. Three-quarters of the rivers monitored by active gages are recording below-normal or much-below-normal flows.

Water availability has declined across the board, including reduced availability for agricultural and municipal use, as well as substantially reduced flows for nature in streams and wetlands. The agricultural industry will be adversely impacted this year, as it was last year. Fields fallowed last year will again be dry this year, plus thousands of additional acres. Agriculture uses roughly 80% of the water diverted for human use in the state, so drought inherently has a very significant impact on the agricultural sector. Reduced agricultural water availability can also have a significant adverse impact on migratory birds, if the fields that are fallowed also happen to be those that provide important seasonal habitat for migratory birds.

Low flows also reduce habitat for fish and other species, and result in increased water temperatures in many streams. Warm waters are putting anadromous fish, like salmon, at risk for disease and death prior to spawning, which could have disastrous and lasting impacts. As the drought persists California could see a massive fish kill from the gill rot disease that spreads as fish crowd into low and warm pools while waiting for higher water to move upstream to spawn. As some stream reaches dry entirely, connectivity is lost along the length of the stream, and fish can become trapped in areas with lethal conditions.

For almost 15 years, the Colorado River Basin has also been in the grip of a severe drought — possibly the worst in the last 1,200 years. Even a remarkably wet May in the Upper Basin will probably not forestall the cut-back of releases from Lake Powell for the second time in three years—an outcome that is

without precedent—or the steadily increasing chances that shortages will be declared for Arizona, Nevada and Mexico for the first time ever in 2017. Lakes Powell and Mead, the two largest reservoirs in the United States, are the region's principal water banks and are being drawn down towards critical levels. As the drought persists, these bank accounts are depleted, available water supplies are reduced, and the Colorado River Basin faces the loss of critical hydropower production. Those power production revenues help fund the basin-wide salinity control program, large-scale programs that facilitate river ecosystem restoration and endangered species recovery, and repayment for federal water projects.

We must act urgently but also thoughtfully to meet the needs of people and nature. The Conservancy's focus is on long term solutions that will help us be far better prepared to respond effectively the next time we have a drought. First and foremost, this means restoring balance between supply and demand, thereby making it possible for enough water to be stored in wet years and carried over to sustain both people and nature in dry years. Second, it means making the most efficient use of the water we have to meet vital needs while maintaining the health of the natural system.

The Conservancy supports a proactive approach that includes administrative and congressional action to improve the health of freshwater ecosystems while increasing the drought-resilience of cities and agriculture. This approach includes both no-cost collaborative agreements and strategic investments in environmentally sound and cost-effective surface and below-ground storage, modernized irrigation water conveyance and other water infrastructure, more efficient on-farm water use, improved management of groundwater, water sharing, and restoring and protecting river flows. Our aim is healthy ecosystems and related economies in the face of drought.

The Nature Conservancy's Collaborative Approach

The Conservancy endeavors to better understand and minimize the impacts of drought on nature while finding solutions that meet the needs of people. Providing enough fresh water for cities, farms and wildlife when and where we need it is one of the biggest challenges we face. We are finding new ways to be more efficient and effective with the water we have and ensure that we will have the water we need for years to come. With climate change contributing to the severity of the current drought and frequency and duration of future droughts, we cannot rely on more precipitation to solve our water challenges.

The on-going drought threatens every societal sector: industry, agriculture, recreation, and the environment. Unless we take steps now to change course, drought will cause even more damage. The Conservancy works closely with partners to find common ground where municipal, agricultural, and conservation communities can develop practical solutions to the water supply and demand challenge. The Conservancy works with farmers to keep water on their fields for migrating birds, and we work with vintners and ranchers to figure out how to run their businesses while keeping water in the streams for endangered species like salmon. We understand that we are all in this together.

California

The Nature Conservancy is demonstrating collaborative approaches to responding to drought by working with farmers and ranchers in California. The Conservancy believes that more efficient, optimized use and delivery of water where and when farms, cities and wildlife need it most, along with thoughtful cutbacks,

will bring California's system back into balance. We advance projects, such as through our BirdReturns Program and the California Salmon Initiative, which demonstrate how this is possible. We are also working to expedite groundwater reform (assessing and regulating) to ensure we have enough water for people and nature in dry and wet years.

BirdReturns – California's Central Valley

The Conservancy, through BirdReturns, is partnering with farmers in California's Central Valley to make their farms more hospitable for migratory birds while keeping their crops in production. BirdReturns allows farmers to better manage their water to create habitat on their land during critical periods for shorebirds.

Habitat created under BirdReturns largely relies on precisely timing the delivery of water that was already going to be applied to fields to help decompose rice straw left after harvest. Pulling from the most comprehensive dataset eBird, developed by the Cornell Lab of Ornithology, we are able to create habitat exactly when and where birds need it to maximize the conservation benefit of every drop.

Current drought conditions impact people and wildlife – so the fields participating in BirdReturns will help reduce the threats to birds associated with dry conditions, which include massive die offs due to disease, while also continuing to meet farmers' agronomic needs – all with the same water supply. Our voluntary program allows for willing buyers and willing sellers to participate when it makes sense for them, an adaptive approach that could be part of a long term strategy to better prepare the state for future droughts.

California Salmon Initiative

California's drought also poses a significant threat to salmon, especially Coho, which could disappear from California within our lifetime. Some populations in California rivers may disappear as soon as this year. Swift and urgent measures taken by the California Department of Fish and Wildlife in response to this historic drought have improved the situation for salmon, including closing rivers to fishing, conducting fish rescues and expediting habitat restoration. The Nature Conservancy is working to augment these measures by providing additional deep, cool habitat instream for salmon by installing large woody debris in streams in the North Coast.

Our work on the Shasta River and Mill Creek also provides essential flows for salmon and other fish during times of drought through management of our own water rights with voluntary agreements with landowners. The Conservancy has been working to increase streamflows for fish by working with willing landowners to leave water in the Shasta River through short-term forbearance agreements. In these agreements, landowners leave water in the Shasta during spawning migration and smolt outmigration when water levels are typically dangerously low. In exchange for not diverting the water for irrigation, landowners are compensated at fair market value for the water not used. This tool supports the water needs of fish while also giving small ranching operations in the Shasta Valley an economic boost. In addition, The Conservancy has officially added "fish and wildlife protection" to Section 1707 of the California Water Code as a beneficial use of the Shasta Big Springs Ranch's water rights. When we aren't using our water right for irrigation purposes, we leave this water instream and protect it from use downstream to improve conditions for salmon.

In Mill Creek, one of the last strongholds for wild fall and spring run chinook salmon in the Sacramento River watershed, the Conservancy is working with a water district to maximize flows for fish and people. The Conservancy exchanges the use of our water rights during the summer irrigation season for an equal amount of water for salmon and steelhead passage in the spring and fall from our partner, the Los Molinos Mutual Water Company (LMMWC). The water exchange is a "win / win" deal. LMMWC shareholders will have the use of the Conservancy's water rights during the summer months when irrigation demand is greatest, an increase of approximately 13% more water. Instream flows will, in exchange, be increased in the spring and fall when additional water is needed for salmon and steelhead passage in the valley reach of Mill Creek. Monitoring of the exchanged flows will be integrated into an accounting system that will include supplemental flows provided by the two conjunctive use wells on the Conservancy's Dye Creek Preserve that are funded through the "Four Pumps" Agreement. The additional passage flows provided through the Mill Creek Water Exchange Agreement, when combined with the Conservancy's water rights, will substantially increase the assured passage flows. By working with landowners and agencies to lease water from willing farmers and ranchers, we are improving flows during summer months and providing for nature at times of greatest need.

Groundwater

Groundwater provides a vital source of drinking and irrigation water and creates critical habitat conditions for a broad range of species in many areas of California. The Conservancy is working to better understand the link between groundwater and biodiversity by identifying where and how species are dependent on groundwater conditions. We are also studying the inextricable linkage between groundwater and surface water use in the Central Valley to understand how stream flows important to our water supplies and nature are affected by unsustainable reliance on groundwater during droughts. On the ground, we are testing strategies and developing approaches that protect and restore groundwater-dependent ecosystems and species by managing surface and groundwater supplies collectively and sustainably.

Colorado River Basin

Three interrelated efforts have been recently initiated in response to the Colorado's deepening drought: the Upper Colorado River Commission's **Contingency Planning**, the **System Conservation Pilot** Program, and the **Water Bank Work Group** in Colorado.

Contingency Planning: Both the Upper and Lower Colorado River Division states are working together to develop contingency plans to ensure that the region is prepared for record drought. The Upper Division states are in the process of developing a multi-faceted contingency plan that would respond to declining water levels in Lake Powell. It is crucial that all water use sectors be engaged and play a constructive role in the development and implementation of the contingency plan; all sectors have a critical stake in the operational integrity of Lake Powell. The plan includes weather modification, reservoir reoperation to keep reservoir levels above critical power production levels, and demand management. The plan will be a multi-faceted, long term plan that ensures a reliable water supply for the many communities that rely on the Colorado River, provides certainty for agricultural users, and enhances environmental values in the Basin. The Conservancy is working alongside Upper Basin states, water users, hydropower interests and

federal agencies to ensure that re-operations and demand management are done in a manner that meets the primary objective of reliability but also environmental enhancement where possible.

System Conservation Pilot Program: The system conservation pilot program, which is a form of demand management, is another effort that would also be based on voluntary, market-based, compensated agreements and would seek reductions in consumptive water use in agriculture as well as other sectors. Such pilots would be coordinated with the drought contingency planning and the WBWG when efforts would contribute to our understanding of what ideas will work. It is a two year pilot to test whether water use can be reduced relatively quickly. The pilot program aims to generate a small amount of water in 2015-16, some of which is expected to end up in Lake Powell. The Lower Basin is doing a more comprehensive program in 2015 and 2016. There is $11M for pilots in both Upper and Lower basins, with the majority being allocated to the Lower Basin.

Water Bank Work Group (WBWG): The WBWG envisions an insurance-like program in the event of extreme shortages that significantly affect Lake Powell's operations or our ability to meet the Colorado River Compact obligations. Currently, we are working on the many technical, social and economic questions that must be answered before we can design an approach that works for all sectors. This effort may help provide important answers to how to develop a long-term approach to ensure water security for all water sectors while providing environmental benefits.

San Pedro River: Smaller scale projects in the Colorado River Basin demonstrate that the needs of people and nature do not have to be mutually exclusive. For example, finding a solution for the San Pedro started with good science and a better understanding of the river. Every June, the Conservancy works with more than 100 community members in the U.S. and Mexico to map the extent of surface water along 270 miles of the river and its tributaries – specifically where the river continues to flow during the hottest and driest time of the year. We then developed a computer simulation model with our local, state and federal partners to better understand underground groundwater flows in the aquifer that help sustain the river. Using this information, we were able to identify the best locations for groundwater recharge projects that enhance stream flows in the San Pedro by improving the aquifer where it is needed the most. In partnership with the Department of Defense, the Conservancy has acquired key lands from willing sellers and is now designing aquifer recharge projects in conjunction with our partners, including Cochise County, local developers, private foundations and Natural Resource Conservation Districts. The project has helped raise groundwater levels, which helps both the community and the river.

Colorado River Delta: Another example is the recent agreement between the United States and Mexico that restores water to the Colorado River Delta while increasing water supply reliability for communities in both countries. In the past, the international boundary stood in the way of traditional approaches to restoring healthy river flows. When the Colorado River no longer reached the sea and habitat was lost in the delta, many decried Colorado River management as a failure. But water managers from both countries were able to overcome the challenge of the border by creating benefits for water users on both sides of the border. Flows for the environment were created through cooperation between the United States and Mexico, as well as through private sector contributions. Water is being used to restore healthy habitat in the Delta, water conservation will shore up supplies, and both countries will benefit during wet periods and share the pain of cutbacks during drought. While these negotiations were arduous, and the

agreement is a pilot project that expires in 2017, the benefits are clear for water users and nature in both nations.

Drought Resilience Policy for People and Nature

The Nature Conservancy believes there are common-sense solutions that can meet the recurring challenge of drought in California and other areas of the West. These solutions can help reduce the impacts of drought this year, while others can help us prepare for future droughts that are increasingly likely due to climate change. Our drought resilience policy recommendations include:

- Federal drought funding should be directed to watersheds that have critically low flows and high conservation values.

- Congress should increase funding and increase the authorized spending levels for the WaterSMART programs (Sections 9503 and 9504 of the SECURE Water Act and other authorities) that can help restore system supply and demand balance in California, the Colorado River Basin and the other more drought stricken areas across the West, including:
    - Basin Studies and climate change assessments
    - Cost share grants
    - Title XVI Water Reclamation and Reuse Projects
    - Water Conservation Field Services Program
    - Cooperative Watershed Management
    - Drought Response and Comprehensive Drought Plans
    - Resilient Infrastructure Investments

- The scale up and prioritization of U.S. Bureau of Reclamation (USBR) funding for drought management should not be limited to programs authorized under the SECURE Water Act. The Bureau of Reclamation's authority to fund temporary water transfers, water banking and other structural and non-structural measures to stabilize river flows and improve the efficiency and reliability of water supplies across all sectors under Title I of the Emergency Drought Relief Act was recently extended through 2017. This authority should be utilized more extensively with appropriations for Fiscals Years 2016 and 2017 to strengthen and expand the USBR's Drought Response and Resilient Infrastructure programs and other targeted, emergency drought relief. The authorized spending levels under the Emergency Drought Relief Act should be increased as needed through 2017.

- The full and innovative implementation of the USBR drought management programs will be essential for the West, but the Federal response should extend well beyond these programs and be well coordinated through the National Drought Resilient Partnership and the Western States Federal Agency Support Team.

- A fundament component of the broader federal response is the rapid deployment of additional stream flow gages by the US Geological Survey (USGS) throughout the West to gain a more direct and real time understanding of drought impacts on stream flow and water supplies. Priority should be given to

streams with established minimum instream flow requirements or water rights but that do not have functional gages and to those locations in high conservation value areas that have historic flow records but do not currently have active gages.

- There are approximately 400 active USGS gages in California and 1500 that are inactive. Over half of the 170 areas that have been identified by The Nature Conservancy as high value conservation areas for freshwater species have no active gages at all. We ask that funding be provided to install or reactivate gages in critical watersheds, including 775 gages that are found in high value conservation areas and areas that have been identified has high priority watersheds for salmon and steelhead.

- More broadly, the USGS and the National Oceanic and Atmospheric Administration (including the Colorado River Basin Forecast Center) are forecasting low flow conditions that are critical for storage operations, water apportionment and ecosystem protection. The USGS is also integrating remotely sensed data on vegetation with other information on climate, land cover and use, ecological setting and soil characteristics to quantify and evaluate the extent of drought impacts, alongside the coarser drought monitoring by the US Department of Agriculture (USDA). The funding for such drought science is essential and must be kept in place. Increased funding that enables a suite of other federal agencies with flow science capabilities to assess the less visible and less direct impacts of drought on river dependent ecosystems and huge recreational economies is just as essential.

- Just over one year ago, in the Agricultural Act of 2014 (2014 Farm Bill), Congress consolidated or eliminated nearly a dozen conservation programs and reduced mandatory spending by $6 billion. By enabling agricultural producers to implement practices that conserve water and maintain habitat, these programs are critical drought management tools for the USDA and western irrigators. The cuts in the 2014 Farm Bill mean that new enrollments in these conservation programs will decline by millions of acres in Fiscal Year 2016. Despite these cuts, the USDA is proposing to cut more than $800 million from these programs in Fiscal Year 2016 relative to the Congressionally-mandated amounts, including:
  - $300 million from the Environmental Quality Incentives Program (EQIP)
  - $54 million from the Conservation Stewardship Program
  - $60 million over five years from the Regional Conservation Partnership Program

  We urge Congress to restore these funds, which are fundamental to modernizing western irrigation systems, restoring western rivers, and building water security for western cities and towns. In turn this will provide crucial benefits to the economies of cities that are imperiled by drought

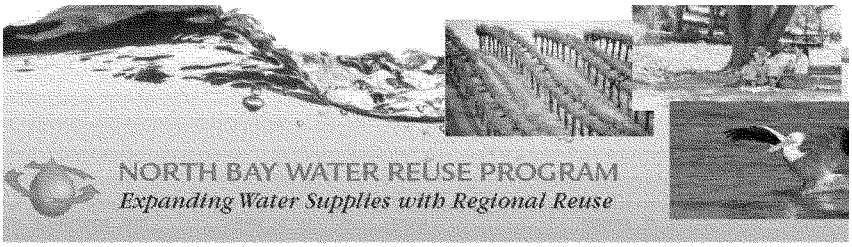
- In the Colorado River Basin, we need to maintain current funding levels for the Upper Colorado River Endangered Fish Recovery program, San Juan River Basin Recovery Implementation Program, the Adaptive Management Program for the Grand Canyon, the Lower Colorado Multi-Species Conservation Program, and Salinity Control Program for the whole Basin, including improved salinity management of the water deliveries under the latest Minutes to the Treaty with Mexico. Maintaining the appropriations to the USBR for the salinity control program in the Upper Basin is especially important, because these appropriations are more than matched by the allocation of hydropower revenues from the larger federal dams in both the Upper and Lower Basins and by the

allocation of EQIP spending in the Upper Basin. Much of this salinity control is achieved by modernizing irrigation systems throughout the Basin.

- In California, we need to protect and provide baseline water-bird and water fowl habitat requirements on refuges and post-harvest flooded lands. The USBR should ensure that all refuges north and south of the Sacramento-San Joaquin Delta receive baseline (75% of Level 2) water deliveries, with bolstered summer water deliveries to improve the forage value of these lands.

- More generally, all agencies in the U.S. Department of the Interior should support both pilot and longer term projects, within or outside the WaterSMART program, to help manage the water demands in the agricultural, municipal and industrial sectors. These projects should reduce consumptive water use voluntarily and lower transaction costs for buyers and sellers in alternative agricultural transfer methods and other voluntary water sharing agreements. (Common water sharing agreements include interruptible supply agreements, water banks, rotational and split season fallowing, water purchase and leaseback, and agriculture conservation methods like deficit irrigation.)

- Across the West, stream, forest, meadow and floodplain restoration projects should be encouraged to provide water supply, improve water quality and recharge depleted ground water basins. Congressional funding for such projects should be increased:
    - Congress should invest in projects that restore and better manage forests and meadows in California's Sierra Nevada and in other important watersheds throughout the West to reduce wildfire intensity, improve water quality, and increase water yield. New funding for such forest and meadow restoration should be appropriated to the US Forest Service and the Natural Resources Conservation Service.
    - Congress should also invest in projects that restore floodplain function and capacity to provide multiple public benefits—including both public safety and enhanced water supply. With increased floodplain capacity, space behind existing dams can be reallocated from flood water capture to water supply storage. This is important in a state where most of the precipitation in a given year can occur in a few large storms. Floodwaters can be retained in floodplains and redirected, if necessary, to areas with high recharge potential. New funding should be appropriated to the US Army Corps of Engineers and the USBR for such floodplain restoration.



Testimony of Sonoma County Supervisor David Rabbitt

Representing

The North Bay Water Reuse Authority

Before the Committee on Energy and Natural Resources

United States Senate

Oversight Hearing

On

"The Status of Drought Conditions Throughout the Western United States and

Actions States and Others are Taking to Address Them."

Washington, D.C.

June 2, 2015

Good morning Chairwoman Murkowski, Ranking Member Cantwell and Members of the Committee.

My name is David Rabbitt. I am a Supervisor in Sonoma County and chair of the North Bay Water Reuse Authority, 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 how the federal government can assist local agencies in meeting the water supply needs of urban centers, agriculture, and the environment in the face of what are likely to be recurring, severe drought conditions in California and much of the West.

Our North Bay communities face just such a challenge. In response, the North Bay Water Reuse Authority, through 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 water and 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. As Deputy Secretary Connor suggested in his testimony before the Committee, water reuse and smaller scale storage projects are often the best opportunity to yield additional water supply, and acting on a regional-scale, integrating our systems and greatly expanding the storage associated with our water reuse facilities allows us to greatly expand the benefits of our water reuse facilities and the end-users they serve.

For the last several years, the North Bay Water Reuse Authority has been advocating for the creation of a new, innovative, federally-backed, low-interest, long-term loan program through the Bureau of Reclamation. We think a loan program through Reclamation, modeled after the highly successful Transportation Infrastructure Financing and Innovation Act (TIFIA), is the best way, and represents the most realistic opportunity, given the budget rules, of securing meaningful assistance for water infrastructure investments of all kinds; water recycling, distribution systems and/or surface and groundwater storage. We need assistance, but we need assistance that is affordable to the federal government and achievable in Congress. We need authorities that can be funded.

Three key "tools"

The North Bay Water Reuse Authority believes we need three new tools to help accelerate local efforts to build a more drought resilient water supply infrastructure in the West: federally backed loans, a title transfer provision to accelerate the transfer of certain Reclamation facilities, and cost-shared competitive grants for small-scale storage, conveyance and integrated regional water management and recycling projects.

Those same proposals have been included in the two companion Water 21 bills (S. 176 and H.R. 291), introduced by Senator Barbara Boxer and Representative Grace Napolitano. Both proposals would provide funds to support low-cost, long-term federally-backed financing for a wide-array of water infrastructure investments, as well as authorize new grants and the title transfer provisions mentioned earlier.

The Authority would certainly support Congress acting on these measures. But we have also suggested slight adjustments to those measures that might help build broader support for the concepts included in these measures. Specifically, we have recommended that Congress consider a proposal like the RE-Act proposal that I have attached to my testimony. RE-Act differs from these earlier efforts in several ways. First, it includes a potential budget offset by authorizing Reclamation to work with Congress and stakeholders to deauthorize Reclamation projects and programs that are no longer viable. Second, it caps loans at 49 percent of total project costs to match up with the cap on federally-backed financing in last year's WRRDA bill and the level of assistance that is available under the TIFIA program. Congress has backed those financing initiatives with overwhelming, bipartisan support. And, the only difference between RE-Act and the WIFIA proposal in the WRRDA bill is that under RE-Act, like under TIFIA, borrowers would be able to use tax free municipal bonds to match up with the 49 percent federally-backed financing available under RE-Act.

Under the RE-Act proposal, we also suggest that the competitive grant proposal be increased from $15 million to $20 million or 25 percent of project costs, whichever is less. This brings the level of grant assistance up to the level generally available under Title XVI, but it opens up grant assistance for more than just currently authorized water reuse projects. Unauthorized water reuse projects and small scale surface water storage projects, conveyance, conjunctive use, groundwater recharge projects, for example, would all be eligible under the RE-Act competitive grant proposal.

And, we have added one additional important provision to the competitive grant proposal: under RE-Act we have suggested that Reclamation be required to submit all recommended grant awards to key congressional committees for review and consent, before final grant awards are made, before any funds are released. That is intended to institutionalize a closer working partnership between the Congress and Reclamation on the allocation of funds, and, hopefully, build stronger support for WaterSMART and competitive grants of this kind.

Deauthorization Process

RE-Act, as I said earlier, sets up a deauthorization process nearly identical to the one that Congress adopted overwhelmingly as part of last year's WRRDA bill. As was done in the WRRDA bill for the Corps, RE-Act would set up an expedited and definitive process to deauthorize Reclamation projects and programs that are no longer viable in order to create an opportunity (an "offset" under current budget score-keeping rules) to authorize Reclamation support for projects and programs to address current water infrastructure and related resource needs. The bill would require Reclamation to identify water and related resources projects and programs that are no longer viable and that could be deauthorized. Reclamation would be required to develop a report identifying any inactive projects and programs and project backlogs. Upon completion of the report, and providing an opportunity for public review and comment, Reclamation would be required to submit a final deauthorization list to Congress for review and approval.

Projects and programs would be deemed no longer viable based upon criteria similar to those adopted as part of the WRRDA bill, such as the following: a lack of non-federal support; an authorized purpose that is no longer relevant or feasible; or a lack of federal or non-federal resources.

Such a deauthorization process should generate savings that can be used pay for new authorizations to jump-start the kind of programs we all need and want, additional grant opportunities and access to federally-backed, low-cost, long-term financing.

Federally-Backed Loans Through Reclamation; RE-Act Loans

If a federal-backed loan program were in place today, like the one envisioned under RE-Act or the W-21 RIFIA proposals, the interest rate for such loans would be approximately 3.22 percent. Based on current municipal bond rates even for a local government that could secure AA-rated municipal bond financing, RE-Act would generate approximately 14.74 percent in annual savings over a 30 year repayment period, and just under 22 percent in annual savings over the

longer repayment period allowed under RE-Act (35-year repayment period). Compared to an A-rated municipal bond, annual savings would be approximately 19 percent if financed over 30 years, and 25.8 percent if financed over 35 years.

RE-Act and other RIFIA proposals offer the opportunity to greatly leverage limited federal funds. A $100 million a year program investment would support $1 billion in water infrastructure financing and would likely result in a two to three million dollar charge against federal outlays, making it a very cost-effective way for the federal government to provide much needed water infrastructure financing assistance in advance of extraordinary drought and chronic water shortages. As currently drafted, the bill would require the collection of charges from the borrowers, eliminating all charges against outlays when the funds are appropriated to implement the program.

The "scoring" of budget authority and outlays represents an estimation of the potential risk to the Federal Treasury. The calculation will be determined by the Congressional Budget Office (CB O). Even without the collection of fees sufficient to cover the CBO determined outlay rate for implementation of the program, it is not unreasonable to assume that there will be no outlays. The historical default rate on bonds associated with municipal water and sewer projects is a very low, almost non-existent, .04 percent. Therefore, the risk of default on federal credit assistance is minimal.

Fiscal conservatives give high marks to the transportation version of the RE-Act and RIFIA concepts. TIFIA has been endorsed, for example, by the Taxpayers for Common Sense. The taxpayers groups like it because even when there has been a default in the TIFIA program, the taxpayers have not lost a dime. In those few instances where there has been a default, the TIFIA debt has been restructured and repayment resumed. And, as noted above, the risk of default would be even less in water infrastructure.

Debt Service Savings Based on Various Interest Rates

Debt Service Savings on $100 Million RE-Act/RIFIA Loan
AA-Rated Municipal Bond (30-Year Repayment Period)

- 30-Year AA- Municipal Bond @ 4.55% $6,106,627
- 30-Year RIFIA Guaranteed Loan @ 3.22% $5,206,497
- Annual Savings $900,129
- 30-Year Savings $27,003,883
- Debt Service Savings if Repaid Over 30 Years 14.74%

Debt Service Savings on $100 Million RE-Act/RIFIA Loan
AA-Rated Municipal Bond (35-Year Repayment Period)

- 30-Year AA- Municipal Bond @ 4.55% $6,106,627
- 35-Year RIFIA Guaranteed Loan @ 3.22% $4,766,547
- Annual Savings $1,340,079
- Annual Debt Service Savings if RE-Act/RIFIA Loan Repaid Over 35 Years 21.94%

Debt Service Savings on $100 Million RE-Act/RIFIA Loan
A-Rated Municipal Bond (30-Year Repayment Period)

- 30-Year A- Municipal Bond @ 5.00% $6,425,8000
- 30-Year RE-Act/RIFIA Guaranteed Loan @ 3.22% $5,206,497
- Annual Savings $1,219,303
- 30-Year Savings $36,579,091
- Debt Service Savings if Repaid Over 30 Years 18.98%

Debt Service Savings on $100 Million RE-Act/RIFIA Loan
A-Rated Municipal Bond (35-Year Repayment Period)

- 30-Year A- Municipal Bond @ 5.00% $6,425,800
- 35-Year RIFIA Guaranteed Loan @ 3.22% $4,766,547
- Annual Savings $1,659,252
- Annual Debt Service Savings if RE-Act/RIFIA Loan Repaid Over 35 Years 25.82%

Figures assume amortization of principal over the life of the loan/bond and a fixed annual payment.

RE-Act Loan Benefits: More Money for Water Infrastructure at a Lower Cost and with Greater Flexibility

- No requirement to borrow for a debt service reserve fund - approximately a $6 million savings on every $100 million in municipal financing needed for water infrastructure improvements.

- Ability to defer initiation of repayment - repayment could be deferred for up to five years following substantial completion of the project.

- Amortized over 35-years rather than 30-year maximum for municipal bonds - significant annual debt service savings and even greater real dollar savings when the net present value of money used to repay the debt is considered.

- Ability to refinance existing water infrastructure debt - RIFIA allows borrowers to refinance existing debt, if doing so will enable greater water infrastructure improvements.

Difference between RE-Act Loans and WIFIA Loans

Some have suggested that we shouldn't be pushing for a new loan program until we see if WIFIA will work as intended. There are some important differences between RE-Act loans and WIFIA loans that make it clear why we need both.

- WIFIA loans cannot be matched with municipal financing; RE-Act loans don't carry that prohibition.

- WIFIA loans cannot be used to support surface water storage, other than storage projects eligible under the drinking water SRF, which is largely above ground, contained storage.

- RE-Act loans can be used to refinance existing debt when doing so will create the opportunity to make significant new investments in water infrastructure.

- RE-Act loans will not compete against available funds for the SRFs. The drinking water and clean water SRFs are under enormous budget pressure. They are funded out of the Environmental Protection Agency's budget. RE-Act loans, funded by Reclamation, will not add to those budget pressures.

Transfer of Title Authority

RE-Act, like the W-21 bills, authorizes Reclamation to transfer title of certain Reclamation facilities or separable elements of such facilities.

This is an attempt to provide a pathway where federal assistance can be provided to federal projects or components of federal projects that are paid off and where there is a need for additional investment in order for the project to continue to provide or enhance project purposes to project beneficiaries. This is not something that will benefit the North Bay member agencies, but we think it will help broaden access to the water infrastructure tools that we have discussed and broaden congressional support for the overall proposal.

Grants for Storage, Integrated Regional Water Management and Recycling

The North Bay Water Reuse Authority strongly believes WaterSMART should be expanded to create a new category of grants to support small-scale storage and integrated regional water management activities. Our proposal deviates a bit from those in Water 21 in that we believe Reclamation should have the capacity to allocate up to $20 million or 25 percent of a project's cost, whichever is less, to support new water supply infrastructure investments, particularly new storage projects. The Water 21 bills cap these grants at $15 million over five years.

And surface water storage is not just of importance to the larger CalFed projects currently under review, water storage represents approximately half of Phase 2 of the North Bay water reuse program, which will increase the yield of our systems by about 25,000 acre feet annually.

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.

Title: To establish a water innovative financing program, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

(a) Short Title.—This Act may be cited as the "Reclamation Efficiency Act of 2015" or "RE-ACT".

(b) Table of Contents.—The table of contents of this Act is as follows:

Sec.1.Short title; table of contents.

TITLE I—DEAUTHORIZATION OF INACTIVE PROJECTS AND PROGRAMS

Sec.101 Deauthorization of Inactive Projects

TITLE II—STORAGE, INTEGRATED WATER MANAGEMENT AND RECYCLING

Sec.201.Definitions.

Subtitle A—Innovative Financing

Sec.211.Purposes.

Sec.212.Authority to provide assistance.

Sec.213.Applications.

Sec.214.Eligibility for assistance.

Sec.215.Determination of eligibility and project selection.

Sec.216.Secured loans.

Sec.217.Program administration.

Sec.218.State and local permits.

Sec.219.Regulations.

Sec.220.Limitation on use of authority.

Sec.221.Funding.

Sec.222.Report to Congress.

Subtitle B— Storage; Water Reuse and Integrated Regional Water Management

Sec.231.Water storage projects.

Sec.232.Authorization of appropriations.

Subtitle C—Title Transfers

Sec.241.Authorization to transfer title.

TITLE I—DEAUTHORIZATION OF INACTIVE PROJECTS AND PROGRAMS.

SEC. 101. DEAUTHORIZATION OF INACTIVE PROJECTS.

(a) Purposes.--The purposes of this section are--

(1) to identify water resources development programs and projects authorized by Congress that are no longer viable for construction due to--

(A) a lack of local support;

(B) a lack of available Federal or non-Federal resources; or

(C) an authorizing purpose that is no longer relevant or feasible;

(2) to create an expedited and definitive process to deauthorize water resources development programs and projects that are no longer viable for construction; and

(3) to allow the continued authorization of water resources development programs and projects that are viable for construction.

(b) Comprehensive Status Reports.--

(1) Minimum funding list.--At the end of each fiscal year, the Secretary shall submit to the Committee on Energy and Natural Resources of the Senate and the Committee on Committee on Natural Resources of the House of Representatives, and make available on a publicly accessible Internet site in a manner that is downloadable, searchable, and sortable, a list of—

(A) Programs, projects, or separable elements of programs and projects authorized for construction for which funding has been obligated during the current fiscal year or any of the 6 preceding fiscal years;

(B) the amount of funding obligated for each such program, project, or separable element per fiscal year

(C) the current phase of each such program, project, and separable element; and

(D) the amount required to complete the current phase of each such program, project, or separable element.

(2) Comprehensive backlog report.—

(A) In general.--The Secretary shall compile and publish a complete list of all programs, projects, and separable elements of programs and projects of the Bureau of Reclamation that are authorized for construction but have not been completed.

(B) Required information.--The Secretary shall include on the list developed under subparagraph (A) for each program, project, and separable element on that list--

(i) the date of authorization of the program, project, or separable element, including any subsequent modifications to the original authorization;
(ii) the original budget authority for the program, project, or separable element;
(iii) a brief description of the program, project, or separable element;
(iv) the estimated date of completion of the program, project, or separable element;
(v) the estimated cost of completion of the program, project, or separable element; and
(vi) any amounts appropriated for the program, project, or separable element that remain unobligated.

(C) Publication.--

(i) In general.--Not later than 1 year after the date of enactment of this paragraph, the Secretary shall submit a copy of the list developed under subparagraph (A) to--
(I) the Committee on Energy and Natural Resources of the Senate and the Committee on Natural Resources of the House of Representatives; and
(II) the Director of the Office of Management and Budget.

(ii) Public availability.--Beginning on the date the Secretary submits the report to Congress under clause (i), the Secretary shall make a copy of the list available on a publicly accessible Internet site in a manner that is downloadable, searchable, and sortable."

(c) Interim Deauthorization List.--

(1) In general.--The Secretary shall develop an interim deauthorization list that identifies each water resources development program or project, or separable element of a program or project, authorized for construction before March 30, 2009, for which--
(A) construction was not initiated before the date of enactment of this Act; or
(B) construction was initiated before the date of enactment of this Act, but for which no funds, Federal or non-Federal, were obligated for construction of the program,

project, or separable element of the program or project during the current fiscal year or any of the 6 preceding fiscal years.

(2) Special rule for projects receiving funds for post-authorization study.--A program, project, or separable element of a program or project may not be identified on the interim deauthorization list, or the final deauthorization list developed under subsection (d), if the program, project, or separable element received funding for a post-authorization study during the current fiscal year or any of the 6 preceding fiscal years.

(3) Public comment and consultation.--

(A) In general.--The Secretary shall solicit comments from the public and the Governors of each applicable State on the interim deauthorization list developed under paragraph (1).

(B) Comment period.--The public comment period shall be 90 days.

(4) Submission to congress; publication.--Not later than 90 days after the date of submission of the list required by subsection (b), the Secretary shall—

(A) submit the interim deauthorization list to the Committee on Energy and Natural Resources of the Senate and the Committee on Natural Resources of the House of Representatives; and

(B) publish the interim deauthorization list in the Federal Register.

(d) Final Deauthorization List.--

(1) In general.--The Secretary shall develop a final deauthorization list of each water resources development program or project, or separable element of a program or project, described in subsection (c)(1) that is identified pursuant to this subsection.

(2) Identification of projects.--

(A) Criteria for inclusion.--

(i) In general.--The Secretary shall identify programs, projects, and separable elements of programs and projects for inclusion on the final deauthorization list that are no longer viable for construction due to--

(I) a lack of local support;

(II) a lack of available Federal or non-Federal resources; or

(III) an authorizing purpose that is no longer relevant or feasible;

(ii) Factors to consider.--The Secretary may identify programs, projects, and separable elements of programs and projects for exclusion from the final deauthorization list if the Secretary determines, on a case-by-case basis, that a project or separable element of a project is critical for interests of the

United States, based on the possible impact of the project or separable element of the project on public health and safety, the national economy, or the environment.

(iii) Consideration of public comments.--In making determinations under clause (i) and clause (ii), the Secretary shall consider any comments received under subsection (c)(3).

(B) Appendix.--The Secretary shall include as part of the final deauthorization list an appendix that--

(i) identifies each program, project, and separable element of a program or project on the interim deauthorization list developed under subsection (c) that is not included on the final deauthorization list; and

(ii) describes the reasons why the program, project, or separable element is not included.

(3) Submission to congress; publication.--Not later than 120 days after the date on which the public comment period under subsection (c)(3) expires, the Secretary shall—

(A) submit the final deauthorization list and the appendix to the final deauthorization list to the Committee on Energy and Natural Resources of the Senate and the Committee on Natural Resources of the House of Representatives; and

(B) publish the final deauthorization list and the appendix to the final deauthorization list in the Federal Register.

(e) Deauthorization; Congressional Review.--

(1) In general.--After the expiration of the 180-day period beginning on the date of submission of the final deauthorization report under subsection (d), a program, project, or separable element of a program or project identified in the report is hereby deauthorized, unless Congress passes a joint resolution disapproving the final deauthorization report prior to the end of such period.

(2) Non-federal contributions.--

(A) In general.--A program, project, or separable element of a program or project identified in the final deauthorization report under subsection (d) shall not be deauthorized under this subsection if, before the expiration of the 180-day period referred to in paragraph (1), the non-Federal interest for the program, project, or separable element of the project provides sufficient funds to complete the program, project, or separable element of the project.

(f) General Provisions.--

(1) Definitions.--In this section:

(A) Secretary.—The term "Secretary" means the Secretary of the Interior

(B) Post-authorization study.--The term "post-authorization study" means--

(i) a review conducted by the Bureau of Reclamation including an initial appraisal that--

(I) demonstrates a Federal interest; and

(II) requires additional analysis for the project or separable element.

(C) Water resources development program or project.--The term "water resources development program or project" includes any water and related resource project or program of the Bureau of Reclamation.

(2) Treatment of project modifications.--For purposes of this section, if an authorized water resources development program, project, or separable element of the program or project has been modified by an Act of Congress, the date of the authorization of the program, project, or separable element shall be deemed to be the date of the most recent such modification.

TITLE II—STORAGE, INTEGRATED WATER MANAGEMENT AND RECYCLING

SEC. 201. DEFINITIONS.

In this title:

(1) ELIGIBLE ENTITY.—The term "eligible entity" means—

(A) a corporation;

(B) a partnership;

(C) a joint venture;

(D) a trust;

(E) a Federal, State, or local governmental entity, agency, or instrumentality; and

(F) a conservancy district, irrigation district, canal company, mutual water company, water users' association, Indian tribe, agency created by interstate compact, or any other entity that has the capacity to contract with the United States under Federal reclamation law.

(2) FEDERAL CREDIT INSTRUMENT.—The term "Federal credit instrument" means a secured loan or loan guarantee authorized to be made available under this title with respect to a project.

(3) INVESTMENT-GRADE RATING.—The term "investment-grade rating" means a rating of BBB minus, Baa3, bbb minus, BBB (low), or higher as assigned by a rating agency to project obligations.

(4) LENDER.—

(A) IN GENERAL.—The term "lender" means any non-Federal qualified institutional buyer (as defined in section 230.144A(a) of title 17, Code of Federal Regulations (or a successor regulation) (commonly known as "Rule 144A(a) of the Securities and Exchange Commission" and issued under the Securities Act of 1933 (15 U.S.C. 77a et seq.))).

(B) INCLUSIONS.—The term "lender" includes—

(i) a qualified retirement plan (as defined in section 4974 of the Internal Revenue Code of 1986) that is a qualified institutional buyer; and

(ii) a governmental plan (as defined in section 414 of the Internal Revenue Code of 1986) that is a qualified institutional buyer.

(5) LOAN GUARANTEE.—The term "loan guarantee" means any guarantee or other pledge by the Secretary to pay all or part of the principal of, and interest on, a loan or other debt obligation issued by an obligor and funded by a lender.

(6) OBLIGOR.—The term "obligor" means an eligible entity that is primarily liable for payment of the principal of, or interest on, a Federal credit instrument.

(7) PROJECT OBLIGATION.—

(A) IN GENERAL.—The term "project obligation" means any note, bond, debenture, or other debt obligation issued by an obligor in connection with the financing of a project.

(B) EXCLUSION.—The term "project obligation" does not include a Federal credit instrument.

(8) RATING AGENCY.—The term "rating agency" means a credit rating agency registered with the Securities and Exchange Commission as a nationally recognized statistical rating organization (as defined in section 3(a) of the Securities Exchange Act of 1934 (15 U.S.C. 78c(a)).

(9) RECLAMATION STATE.—The term "Reclamation State" means any of the States of—

(A) Arizona;

(B) California;

(C) Colorado;

(D) Idaho;

(E) Kansas;

(F) Montana;

(G) Nebraska;

(H) Nevada;

(I) New Mexico;

(J) North Dakota;

(K) Oklahoma;

(L) Oregon;

(M) South Dakota;

(N) Texas;

(O) Utah;

(P) Washington; and

(Q) Wyoming.

(10) SECRETARY.—The term "Secretary" means the Secretary of the Interior.

(11) SECURED LOAN.—The term "secured loan" means a direct loan or other debt obligation issued by an obligor and funded by the Secretary in connection with the financing of a project under subtitle A.

(12) SUBSIDY AMOUNT.—The term "subsidy amount" means the amount of budget authority sufficient to cover the estimated long-term cost to the Federal Government of a Federal credit instrument, as calculated on a net present value basis, excluding administrative costs and any incidental effects on Governmental receipts or outlays in accordance with the Federal Credit Reform Act of 1990 (2 U.S.C. 661 et seq.).

(13) SUBSTANTIAL COMPLETION.—The term "substantial completion", with respect to a project, means the earliest date on which a project is considered to perform the functions for which the project is designed.

Subtitle A—Innovative Financing

SEC. 211. PURPOSES.

The purposes of this subtitle are—

(1) to promote increased development of critical water resources infrastructure by establishing additional opportunities for financing water resources projects;

(2) to attract new investment capital to infrastructure projects that are capable of generating revenue streams through user fees or other dedicated funding sources;

(3) to complement existing Federal funding sources and address budgetary constraints on Bureau of Reclamation programs; and

(4) to leverage private investment in water resources infrastructure.

SEC. 212. AUTHORITY TO PROVIDE ASSISTANCE.

(a) In General.—The Secretary may provide financial assistance under this subtitle to carry out projects within—

(1) any Reclamation State;

(2) any other State in which the Bureau of Reclamation is authorized to provide project assistance; and

(3) the States of Alaska and Hawaii.

(b) Selection.—In selecting projects to receive financial assistance under subsection (a), the Secretary shall ensure diversity with respect to—

(1) project types; and

(2) geographical locations.

SEC. 213. APPLICATIONS.

To be eligible to receive assistance under this subtitle, an eligible entity shall submit to the Secretary an application at such time, in such manner, and containing such information as the Secretary may require.

SEC. 214. ELIGIBILITY FOR ASSISTANCE.

(a) Eligible Projects.—The following projects may be carried out using assistance made available under this subtitle:

(1) A project for the reclamation and reuse of municipal, industrial, domestic, and agricultural wastewater, and naturally impaired ground and surface waters, which the Secretary, acting through the Commissioner of Reclamation, is authorized to undertake.

(2) Any water infrastructure project not specifically authorized by law that—

(A) the Secretary determines, through the completion of an appraisal investigation and feasibility study, would contribute to a safe, adequate water supply for domestic, agricultural, environmental, or municipal and industrial use; and

(B) is otherwise eligible for assistance under this title.

(3) A project for enhanced energy efficiency in the operation of a water system.

(4) A project for accelerated repair and replacement of an aging water distribution facility.

(5) A brackish or sea water desalination project.

(6) Acquisition of real property or an interest in real property for water storage, reclaimed or recycled water, or wastewater, if the acquisition is integral to a project described in paragraphs (1) through (5).

(7) A combination of projects, each of which is eligible under paragraphs (1) through (6), for which an eligible entity or group of eligible entities submits a single application.

(b) Activities Eligible for Assistance.—For purposes of this subtitle, an eligible activity with respect to an eligible project under subsection (a) includes the cost of—

(1) development-phase activities, including planning, feasibility analysis, revenue forecasting, environmental review, permitting, preliminary engineering and design work, and other preconstruction activities;

(2) construction, reconstruction, rehabilitation, and replacement activities;

(3) the acquisition of real property (including water rights, land relating to the project, and improvements to land), environmental mitigation, construction contingencies, and acquisition of equipment;

(4) capitalized interest necessary to meet market requirements, reasonably required reserve funds, capital issuance expenses, and other carrying costs during construction; and

(5) refinancing interim construction funding, existing long-term project obligations, or a secured loan or loan guarantee made under this subtitle.

SEC. 215. DETERMINATION OF ELIGIBILITY AND PROJECT SELECTION.

(a) Eligibility Requirements.—To be eligible to receive financial assistance under this subtitle, a project shall meet the following criteria, as determined by the Secretary:

(1) CREDITWORTHINESS.—

(A) IN GENERAL.—Subject to subparagraph (B), the project shall be creditworthy, as determined by the Secretary, who shall ensure that any financing for the project has appropriate security features, such as a rate covenant, to ensure repayment.

(B) PRELIMINARY RATING OPINION LETTER.—The Secretary shall require each applicant to provide a preliminary rating opinion letter from at least 1 rating agency indicating that the senior obligations of the project (which may be the Federal credit instrument) have the potential to achieve an investment-grade rating.

(2) ELIGIBLE PROJECT COSTS.—The eligible project costs of a project shall be reasonably anticipated to be not less than $20,000,000.

(3) DEDICATED REVENUE SOURCES.—The Federal credit instrument for the project shall be repayable, in whole or in part, from dedicated revenue sources that also secure the project obligations.

(4) PUBLIC SPONSORSHIP OF PRIVATE ENTITIES.—In the case of a project carried out by an entity that is not a State or local government or an agency or instrumentality of a State or local government, the project shall be publicly sponsored.

(b) Selection Criteria.—

(1) ESTABLISHMENT.—The Secretary shall establish criteria for the selection of projects that meet the eligibility requirements of subsection (a), in accordance with paragraph (2).

(2) CRITERIA.—The selection criteria shall include the following:

(A) The extent to which the project is nationally or regionally significant.

(B) The extent to which assistance under this section would foster innovative public-private partnerships and attract private debt or equity investment.

(C) The likelihood that assistance under this section would enable the project to proceed at an earlier date than the project would otherwise be able to proceed.

(D) The extent to which the project uses new or innovative approaches.

(E) The amount of budget authority required to fund the Federal credit instrument made available under this subtitle.

(F) The extent to which the project helps maintain or protect the environment.

(c) Receipt of Other Federal Funding.—Receipt of a Federal grant or contract or other Federal funding to support an eligible project shall not preclude the project from being eligible for assistance under this subtitle.

(d) Federal Requirements.—

(1) EFFECT OF SECTION.—Nothing in this section supersedes the applicability of other requirements of Federal law (including regulations).

(2) NEPA.—A Federal action carried out regarding a loan or loan guarantee provided under this subtitle shall not be considered to be a Federal action for purposes of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.).

SEC. 216. SECURED LOANS.

(a) Agreements.—

(1) IN GENERAL.—Subject to paragraphs (2) through (4), the Secretary may enter into agreements with 1 or more obligors to make secured loans, the proceeds of which shall be used—

(A) to finance eligible project costs of any project selected under section 215;

(B) to refinance interim construction financing of eligible project costs of any project selected under section 215; or

(C) to refinance long-term project obligations or Federal credit instruments, if that refinancing provides additional funding capacity for the completion, enhancement, or expansion of any project that—

(i) is selected under section 215; or

(ii) otherwise meets the requirements of section 215.

(2) LIMITATION ON REFINANCING OF INTERIM CONSTRUCTION FINANCING.—A secured loan under paragraph (1) shall not be used to refinance interim construction financing under paragraph (1)(B) later than 1 year after the date of substantial completion of the applicable project.

(3) RISK ASSESSMENT.—Before entering into an agreement under this subsection for a secured loan, the Secretary, in consultation with the Director of the Office of Management and Budget and each rating agency providing a preliminary rating opinion letter under section 215(a)(1)(B), shall determine an appropriate capital reserve subsidy amount for the secured loan, taking into account each such preliminary rating opinion letter.

(4) INVESTMENT-GRADE RATING REQUIREMENT.—The execution of a secured loan under this section shall be contingent on receipt by the senior obligations of the project of an investment-grade rating.

(b) Terms and Limitations.—

(1) IN GENERAL.—A secured loan provided for a project under this section shall be subject to such terms and conditions, and contain such covenants, representations, warranties, and requirements (including requirements for audits), as the Secretary determines to be appropriate.

(2) MAXIMUM AMOUNT.—The amount of a secured loan under this section shall not exceed the lesser of—

(A) an amount equal to 49 percent of the reasonably anticipated eligible project costs; and

(B) if the secured loan does not receive an investment-grade rating, the amount of the senior project obligations of the project.

(3) PAYMENT.—A secured loan under this section—

(A) shall be payable, in whole or in part, from State or local taxes, user fees, or other dedicated revenue sources that also secure the senior project obligations of the relevant project;

(B) shall include a rate covenant, coverage requirement, or similar security feature supporting the project obligations; and

(C) may have a lien on revenues described in subparagraph (A), subject to any lien securing project obligations.

(4) INTEREST RATE.—The interest rate on a secured loan under this section shall be not less than the yield on United States Treasury securities of a similar maturity to the maturity of the secured loan on the date of execution of the loan agreement.

(5) MATURITY DATE.—The final maturity date of a secured loan under this section shall be not later than 35 years after the date of substantial completion of the relevant project.

(6) NONSUBORDINATION.—A secured loan under this section shall not be subordinated to the claims of any holder of project obligations in the event of bankruptcy, insolvency, or liquidation of the obligor of the project.

(7) FEES.—The Secretary may establish fees, as provided for in section 217(b) of this subtitle, at a level sufficient to cover all or a portion of the costs to the Federal Government of making a secured loan under this section.

(8) NON-FEDERAL SHARE.—The proceeds of a secured loan under this section may be used to pay any non-Federal share of project costs required if the loan is repayable from non-Federal funds.

(9) MAXIMUM FEDERAL INVOLVEMENT.—For each project for which assistance is provided under this subtitle, the total amount of Federal assistance from all sources, including the assistance provided under this subtitle, shall not exceed 80 percent of the total project cost.

(c) Repayment.—

(1) SCHEDULE.—The Secretary shall establish a repayment schedule for each secured loan provided under this section, based on the projected cash flow from project revenues

and other repayment sources.

(2) COMMENCEMENT.—Scheduled loan repayment of principal or interest on a secured loan under this section shall commence not later than 5 years after the date of substantial completion of the project.

(3) DEFERRED PAYMENTS.—

(A) AUTHORIZATION.—If, at any time after the date of substantial completion of a project for which a secured loan is provided under this section, the project is unable to generate sufficient revenues to pay the scheduled loan repayments of principal and interest on the secured loan, the Secretary may allow the obligor, subject to subparagraph (C), to add unpaid principal and interest to the outstanding balance of the secured loan.

(B) INTEREST.—Any payment deferred under subparagraph (A) shall—

(i) continue to accrue interest in accordance with subsection (b)(4) until fully repaid; and

(ii) be scheduled to be amortized over the remaining term of the secured loan.

(C) CRITERIA.—

(i) IN GENERAL.—Any payment deferral under subparagraph (A) shall be contingent on the project meeting such criteria as the Secretary may establish.

(ii) REPAYMENT STANDARDS.—The criteria established under clause (i) shall include standards for reasonable assurance of repayment.

(4) PREPAYMENT.—

(A) USE OF EXCESS REVENUES.—Any excess revenues that remain after satisfying scheduled debt service requirements on the project obligations and secured loan and all deposit requirements under the terms of any trust agreement, bond resolution, or similar agreement securing project obligations may be applied annually to prepay a secured loan under this section without penalty.

(B) USE OF PROCEEDS OF REFINANCING.—A secured loan under this section may be prepaid at any time without penalty from the proceeds of refinancing from non-Federal funding sources.

(d) Sale of Secured Loans.—

(1) IN GENERAL.—Subject to paragraph (2), as soon as practicable after the date of substantial completion of a project and after providing a notice to the obligor, the Secretary may sell to another entity or reoffer into the capital markets a secured loan for a project under this section, if the Secretary determines that the sale or reoffering can be made on favorable terms.

(2) CONSENT OF OBLIGOR.—In making a sale or reoffering under paragraph (1), the Secretary may not change the original terms and conditions of the secured loan without the written consent of the obligor.

(e) Loan Guarantees.—

(1) IN GENERAL.—The Secretary may provide a loan guarantee to a lender in lieu of making a secured loan under this section, if the Secretary determines that the budgetary cost of the loan guarantee is substantially the same as that of a secured loan.

(2) TERMS.—The terms of a loan guarantee provided under this subsection shall be consistent with the terms established in this section for a secured loan, except that the rate on the guaranteed loan and any prepayment features shall be negotiated between the obligor and the lender, with the consent of the Secretary.

SEC. 217. PROGRAM ADMINISTRATION.

(a) Requirement.—The Secretary shall establish a uniform system to service the Federal credit instruments made available under this subtitle.

(b) Capital Reserve Fund.—

(1) IN GENERAL.—There is hereby established in the Treasury of the United States the Reclamation Loan Finance Capital Reserve Fund, which shall be available for deposit of capital reserve fees provided for under this subsection. Amounts deposited shall be credited as offsetting collections.

(2) CAPITAL RESERVE FEES.—To the extent required by appropriations Acts, the Secretary may assess, collect and spend capital reserve fees at a level that is sufficient to cover—

(A) the costs of services of expert firms retained pursuant to subsection (d); and

(B) all or a portion of the costs to the Federal Government of servicing the Federal credit instruments provided under this subtitle, including all or a portion of the outlays associated with the provision of the Federal credit instruments under this subtitle. The capital reserve fees shall be established at amounts that will result in the collection, during each fiscal year, of an amount that can be reasonably expected to equal the outlays associated the provision of the Federal credit instruments under this subtitle.

(c) Servicer.—

(1) IN GENERAL.—The Secretary may appoint a financial entity to assist the Secretary in servicing the Federal credit instruments provided under this subtitle.

(2) DUTIES.—A servicer appointed under paragraph (1) shall act as the agent for the Secretary.

(3) FEE.—A servicer appointed under paragraph (1) shall receive a servicing fee, subject to approval by the Secretary.

(d) Assistance From Experts.—The Secretary may retain the services, including counsel, of any organization or entity with expertise in the field of municipal and project finance to assist in the underwriting and servicing of Federal credit instruments provided under this subtitle.

SEC. 118. STATE AND LOCAL PERMITS.

The provision of financial assistance for a project under this subtitle shall not—

(1) relieve any recipient of the assistance of any obligation to obtain any required State or

local permit or approval with respect to the project;

(2) limit the right of any unit of State or local government to approve or regulate any rate of return on private equity invested in the project; or

(3) otherwise supersede any State or local law (including any regulation) applicable to the construction or operation of the project.

SEC. 219. REGULATIONS.

The Secretary may promulgate such regulations as the Secretary determines to be appropriate to carry out this subtitle.

SEC. 220. LIMITATION ON USE OF AUTHORITY.

Notwithstanding any other provision of law, nothing in this subtitle applies to any Sacramento-San Joaquin Delta conveyance facility included within an approved Bay Delta Conservation Plan.

SEC. 221. FUNDING.

(a) In General.—There is authorized to be appropriated to the Secretary to carry out this subtitle $150,000,000 for each of fiscal years 2016 through 2020, to remain available until expended.

(b) Administrative Costs.—Of the funds made available to carry out this subtitle, the Secretary may use for the administration of this subtitle not more than $2,200,000 for each of fiscal years 2016 through 2020.

SEC. 222. REPORT TO CONGRESS.

Not later than 2 years after the date of enactment of this Act, and every 2 years thereafter, the Secretary shall submit to the Committee on Energy and Natural Resources of the Senate and the Committee on Natural Resources of the House of Representatives a report summarizing the financial performance of the projects that are receiving, or have received, assistance under this subtitle, including an assessment of whether the objectives of this subtitle are being met.

Subtitle B—Storage; Water Reuse and Integrated Regional Water Management

SEC. 131. WATER STORAGE PROJECTS.

(a) Agreements.—The Secretary may enter into a cost-shared financial assistance agreement with any non-Federal entity in a Reclamation State or the States of Alaska and Hawaii to carry out the planning, design, and construction of any permanent water storage and conveyance facility used to regulate and maximize the water supply arising from a project that is eligible for assistance under this title or any other provision of law—

(1) to recycle impaired surface water and ground water; or

(2) to use integrated and coordinated water management on a watershed or regional scale.

(b) Financial Assistance.—In providing financial assistance under this section, the Secretary

shall give priority to storage and conveyance components that—

(1) ensure the efficient and beneficial use of water or reuse of recycled water;

(2) consistent with Secretarial Order No. 3297, dated February 22, 2010, support sustainable water management practices and the water sustainability objectives of 1 or more offices of the Department of the Interior or any other Federal agency;

(3)(A) increase the availability of usable water supplies in a watershed or region to benefit people, the economy, and the environment; and

(B) include adaptive measures needed to address climate change, drought and future demands;

(4) where practicable—

(A) provide flood control or recreation benefits; and

(B) include the development of incremental hydroelectric power generation;

(5) include partnerships that go beyond political and institutional jurisdictions to support the efficient use of the limited water resources of the United States and the applicable region; and

(6) generate environmental benefits, such as benefits to fisheries, wildlife and habitat, and water quality and water-dependent ecological systems, as well as water supply benefits to agricultural and urban water users.

(c) Federal Share.—The Federal share of the cost of a project carried out under subsection (a) shall be—

(1) equal to the lesser of—

(A) 25 percent of total cost of the project; or

(B) $20,000,000, adjusted for inflation; and

(2) nonreimbursable.

(d) Non-Federal Share.—The non-Federal share of the cost of a project carried out under subsection (a) may include in-kind contributions to the planning, design, and construction of a project.

(e) Title and Costs.—A non-Federal entity entering into a financial assistance agreement under this section shall—

(1) hold title to all facilities constructed under this section; and

(2) be solely responsible for the costs of operating and maintaining those facilities.

(f) Approval.—The Secretary may enter into financial assistance agreements under this section, if—

(1) annually or at such frequency as the Secretary deems appropriate, the Secretary notifies the Committee on Energy and Natural Resources of the Senate, the Committee on Natural Resources of the House of Representatives, the Committee on Appropriations of the Senate, and the Committee on Appropriations of the House of Representatives of the intent to enter into such agreements;

(2) No objection is raised by any such committee within 45 days of notification.

SEC. 232. AUTHORIZATION OF APPROPRIATIONS.

There is authorized to be appropriated $300,000,000 to carry out this subtitle.

Subtitle C—Title Transfers

SEC. 241. SHORT TITLE.

This Subtitle may be cited as the `Reclamation Title Transfer Act of 2008'.

SEC. 242. DEFINITIONS.

In this Subtitle:

(1) ELIGIBLE FACILITY.—The term `eligible facility' means a reclamation project or facility, or a portion of such a project or facility (which may include dams and appurtenant works, water rights, infrastructure, recreational facilities, buildings, distribution and drainage works, and associated lands or interests in lands or water) that meets the criteria for potential transfer established pursuant to section 245.

(2) QUALIFYING ENTITY.—The term `qualifying entity' means an agency of a State or local government or an Indian tribe, a municipal corporation, public agency, or other entity such as a water district, that--

(A) held or holds a water service contract, repayment contract, water rights settlement contract or exchange contract providing for water service from the eligible facility to be transferred; and

(B) as determined by the Secretary has the capacity to continue to manage the conveyed property for the same purposes that the property has been managed under reclamation law.

(3) SECRETARY.—The term `Secretary' means the Secretary of the Interior.

(4) CONVEYED PROPERTY.—The term `conveyed property' means an eligible facility that has been transferred out of Federal ownership under this Subtitle.

SEC. 243. AUTHORIZATION OF TITLE TRANSFER PROGRAM.

(a) TITLE TRANSFER PROGRAM.—Not later than one year after the date of the enactment of this Subtitle, the Secretary shall establish a program to--

(1) identify and analyze the potential for public benefits from the transfer out of Federal ownership of eligible facilities, which may include an analysis of the financial, operational, water supply, and environmental characteristics of the properties proposed for transfer; and

(2) facilitate transfer of title of eligible facilities out of Federal ownership to promote more efficient management of water and water-related facilities.

(b) AUTHORIZATION TO TRANSFER TITLE TO ELIGIBLE FACILITIES.—The Secretary, without further authorization from Congress, is authorized to convey all right, title, and interest in any eligible facility to a qualifying entity, provided that—

(1) the Secretary shall retain any mineral interests associated with the conveyed property, but all mineral interests retained by the United States under this Subtitle shall be managed consistent with Federal law in a manner so as not to interfere with the purposes for which the eligible facility was authorized;

(2) interests in water shall be conveyed under this Subtitle by a written Agreement between the Secretary and the qualifying entity; and

(3) interests in eligible facilities shall be conveyed under this Subtitle by a written Agreement between the Secretary and the qualifying entity, developed in consultation with the existing power customers of the eligible facility.

SEC. 244. COMPLIANCE WITH ENVIRONMENTAL AND HISTORIC PRESERVATION LAWS.

Before conveying land and facilities under this Subtitle, the Secretary shall complete all actions required under all applicable laws, including—

(1) the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.);

(2) the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.); and

(3) the National Historic Preservation Act of 1966 (16 U.S.C. 470a et seq.).

SEC. 245. ELIGIBILITY CRITERIA FOR TITLE TRANSFER UNDER THIS SUBTITLE.

Not later than one year after the date of the enactment of this Subtitle, the Secretary shall establish criteria for determining whether facilities are eligible for title transfer under this Subtitle. The criteria shall include the following minimum requirements:

(1) A qualifying entity agrees to accept title to the property proposed for transfer.

(2) The proposed title transfer will not have an unmitigated significant effect on the environment.

(3) The qualifying entity intends to use the property for substantially the same purposes the property is being used for at the time the Secretary evaluates the potential transfer.

(4) The transfer is consistent with the Secretary's responsibility to protect land and water resources held in trust for federally recognized Indian tribes.

(5) The transfer is consistent with the Secretary's responsibility to ensure compliance with international treaties and interstate compacts.

(6) The qualifying entity agrees to provide, as consideration for the assets to be conveyed, compensation to the United States worth the equivalent of the net present value of any repayment obligation to the United States or other income stream the United States derives from the assets to be transferred at the time of the transfer.

(7) Interests in water shall only be eligible for conveyance under this Subtitle—

(A) in connection with a conveyance of title to associated land or infrastructure; and
(B) when the qualifying entity already has a contractual right to delivery or other interest or use right in the water being considered for conveyance.

(8) No conveyance under this Subtitle may—
(A) adversely impact power rates or repayment obligations; or
(B) include a Federal facility that produces power that is sold to or eligible to be sold to power customers pursuant to section 9(c) of the Reclamation Project Act of 1939 (43 U.S.C. 485h(c)).

SEC. 246. LIABILITY.

Effective upon the date of conveyance of any eligible facility pursuant to this Subtitle, the United States shall not be liable under any law for damages of any kind arising out of any act, omission, or occurrence based on its prior ownership or operation of the conveyed property.

SEC. 247. BENEFITS.

After a conveyance of title under this Subtitle—
(1) the conveyed property shall not be considered to be a part of a Federal reclamation project; and
(2) the entity to which the property is conveyed shall not be eligible to receive any benefits, including project power, with respect to the conveyed property, except benefits that would be available to a similarly situated entity with respect to property that is not part of a Federal reclamation project.

SEC. 248. COMPLIANCE WITH OTHER LAWS.

(a) IN GENERAL.—After a conveyance of title under this Subtitle, the entity to which the property is conveyed shall comply with all applicable Federal, State, and local laws and regulations in its operation of the conveyed property.

(b) APPLICABLE AUTHORITY.—In accordance with section 213(a) and (b) of the Reclamation Reform Act of 1982 (96 Stat. 1269), the ownership and full-cost pricing limitations of Federal reclamation law (the Act of June 17, 1902 (43 U.S.C. 371 et seq.), and Acts supplementary thereto and amendatory thereof) shall not apply to water in which an interest is conveyed to a qualifying entity under this Subtitle, except that all provisions of Federal reclamation law shall be applicable to project water provided to the entity from facilities that are part of a Federal reclamation project.

SEC. 249. AUTHORIZATION OF APPROPRIATIONS.

There are authorized to be appropriated such sums as may be necessary to carry out this Subtitle. These funds may be used to carry out the investigations authorized under this Subtitle, and for other costs associated with title transfer under this Subtitle, including an appropriate Federal share of the costs of compliance with the National Environmental Policy Act of 1969 (42 U.S.C.

4321 et seq.) and other applicable Federal law. Expenditures made by the Secretary under this Subtitle shall not be a project cost assignable to any Federal reclamation project and shall be nonreimbursable.

SEC. 250. REPORT.

Not later than two years after the date that funds are made available for this Subtitle, the Secretary shall submit a report to the Natural Resources Committee of the House of Representatives and the Energy and Natural Resources Committee of the Senate. The report shall—

(1) describe actions taken to implement this Subtitle;
(2) list conveyances made under this Subtitle;
(3) state the amount of Federal funds obligated or expended to carry out this Subtitle; and
(4) describe factors that limit conveyances under in this Subtitle.

SEC. 251. RECLAMATION LAW.

This Subtitle shall amend and supplement the Act of June 17, 1902 (32 Stat. 388, chapter 1093), and Acts supplementary thereto and amendatory thereof (43 U.S.C. 371 et seq.).

Testimony of
REED WATSON
EXECUTIVE DIRECTOR
PROPERTY AND ENVIRONMENT RESEARCH CENTER (PERC)

Before the
COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

"Hearing to Receive Testimony on the Status of Drought Conditions throughout the Western United States"

June 2, 2015

Introduction

Madame Chair Murkowski, Ranking Member Cantwell, and Members of the Committee, thank you for the opportunity to provide testimony on the important topic of water scarcity in the West.

As the Senate Committee on Energy and Natural Resources considers the current drought, its members should explore ways to encourage water marketing as a means of mitigating the economic and environmental impacts of water scarcity today and in the future. Water markets mitigate the economic and environmental impacts of acute water scarcity, i.e., drought, by allowing water users to cooperate in a mutually beneficial way, namely, by voluntarily trading water rights rather than fighting over them. Not only do water markets promote cooperation and efficient resource allocation during times of scarcity, they also encourage water conservation by providing water rights a financial incentive to eliminate waste.

Scholars at the Property and Environment Research Center (PERC) have for decades conducted research, published articles, and written books on water markets and the institutions that allow them to flourish. This testimony will outline several reforms Congress could take to encourage water marketing in the West.

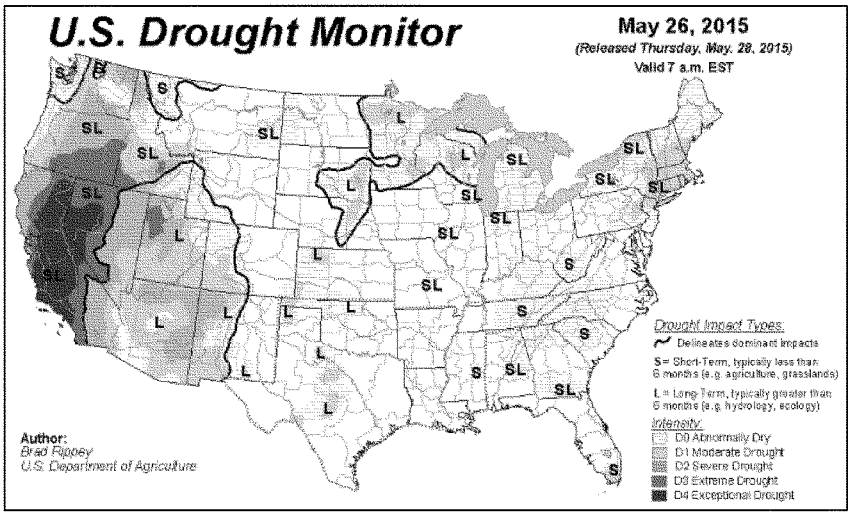
The Current Drought

Water scarcity in the West is nothing new. Indeed, the prior appropriation doctrine, which dominates western water law, is premised on there not being sufficient supplies to satisfy all

demands all of the time.[1] The current drought, however, is exceptional for its severity, longevity, and the economic and environmental risks it poses.

According to the U.S. Drought Monitor, most western states are experiencing at least "Abnormally Dry" conditions.[2] Additionally, nine states are classified under "Severe Drought" and five states are currently experiencing "Extreme Drought." Hardest hit are California and Nevada, with large portions of their states classified under "Exceptional Drought," the most severe classification.

Figure 1: Drought Conditions



Other droughts in recorded history, such as the drought of 1934, covered a larger geographic area.[3] However, the severity of the current drought and its epicenter in California's Central

[1] Anderson, Terry Lee, Brandon Scarborough, and Lawrence R. Watson. *Tapping Water Markets*. Routledge, 2012.
[2] National Drought Mitigation Center, United States Department of Agriculture, National Oceanic and Atmospheric Administration. May 26, 2015. U.S. Drought Monitor. http://droughtmonitor.unl.edu/
[3] National Integrated Drought Information System. "Current Conditions in Historical Perspective." https://www.drought.gov/drought/content/resources-weekly-drought-update/current-conditions-historical-perspective

Valley, which grows roughly one third of the nation's vegetables and two-thirds of its fruits and nuts, poses unique economic threats.

Western agriculture is heavily dependent on irrigation. Without reliable supplies, farmers have been forced to switch to less water-intensive crops and, in the hardest hit areas, to fallow fields. Additionally, surface water reductions have led to increased groundwater use and higher pumping costs. These factors translate into lost crop revenues and increased costs that have devastated agricultural communities throughout the West. For example, the 2014 drought was estimated to cost $2.2 billion in lost agricultural productivity and 17,000 jobs in California alone.[4]

Aside from the economic impacts, the drought is exacting a significant environmental toll. Reduced stream flows, dewatered reaches, and high water temperatures all threaten fish habitat.[5] Due to the extremity of the current drought, NOAA Fisheries in California is working with the California Department of Fish and Wildlife to transport anadromous fish trapped upstream of th ocean. In a stark example of the dire conditions, volunteers recently transported "landlocked" coho salmon—one by one—from Scott Creek near Monterey Bay to a nearby hatchery.

The lack of precipitation also significantly increases the risk of catastrophic wildfires.[6] Although drought conditions might not increase the rate of wildfire ignition, the lack of moisture lengthens the fire season and hastens the spread of wildfires once started.[7] Across the West, residential development has accelerated in the wildland-urban interface. Protecting these properties from drought-fueled wildfire is expensive and risks the lives of fire fighters.[8]

In short, the current drought poses a major threat to western economies and ecosystems. Fortunately, there are actions Congress can take to minimize the economic and environmental impacts of the current and future droughts. Chief among these is to enact policy reforms that foster water marketing.

Water Markets

The traditional regulatory response to water scarcity is to restrict withdrawals and consumption. Low-flow technology mandates, water rationing, and use restrictions can alleviate short-term and small-scale water shortages through forced reductions in demand. However, such regulatory

[4] Howitt, et al. "Economic Analysis of the 2014 Drought for California Agriculture." University of California, Davis, 2014. https://watershed.ucdavis.edu/files/biblio/DroughtReport_23July2014_0.pdf.
[5] U.S. Fish and Wildlife Service. http://www.fws.gov/refuge/Sacramento/Drought.html.
[6] U.S. Drought Portal. https://www.drought.gov/drought/content/products-current-drought-and-monitoring/wildfire.
[7] National Geographic. "Record Drought Hastens Dramatic Spread of California Wildfires." http://news.nationalgeographic.com/news/2014/09/1409019-california-wildfires-king-fire-drought-climate-change/
[8] Headwaters Economics. "Wildfire Costs, New Developments, and Rising Temperatures." http://headwaterseconomics.org/wildfire/fire-research-summary#Costs.

approaches ignore the economic forces that promote water waste and perpetuate water scarcity. As such, these strategies offer little hope of addressing the large-scale and long-running drought currently gripping the West.

Water markets offer a different approach, one that relies on the price of water to encourage conservation and efficiency. In the most fundamental sense, water markets are a voluntary exchange between willing buyers and willing sellers of legal rights in water. Water markets can be informal trading arrangements between ranching families or inter-basin transfers of enormous volumes across hundreds of miles. The important and distinguishing features of all competitive water markets are (1) the voluntariness of the trade and (2) the legality of the right traded.

Rarely does one hear of a crisis in condominiums, pick-up trucks or laptop computers, and with good reason. Markets for these goods quickly eliminate shortages by balancing supply and demand. Unfortunately, markets for water have been hampered by a number of state and federal laws that distort the price of water and restrict when and how it can be traded. Although water is predominantly a state issue, the federal government can take several important steps to promote water trading and harness water markets.

Eliminate Water Subsidies

Currently, the Bureau of Reclamation is the largest wholesaler of water in the country, delivering water to more than 31 million people and providing one in five Western farmers with irrigation water. The 10 million acres of farmland served by the Bureau produce approximately 60 percent of the nation's vegetables and 25 percent of the country's fruits and nuts.[9]

Unfortunately, Bureau policies often exacerbate water shortage by pricing water far below its opportunity cost and, in so doing, encouraging waste. The history of water subsidies is long, complex, and irrefutable. Either by lengthening the pay-back period for project contractors, allocating disproportionate costs to non-agricultural users, or reducing the cost to irrigators on the basis of "ability to pay," the Bureau has made cheap—often scarce—water available to agriculture at below-market rates for decades. It has been estimated that as little as 15 percent of total project costs are, on average, repaid when interest costs are included.[10]

During times of drought, the Bureau does reduce deliveries. Indeed, at present, most western reservoirs have only a small fraction of capacity available, so full deliveries are impossible. However, the decades-long history of subsidizing water combined with transfer restrictions that make it difficult—if not impossible—to transfer water outside the Bureau service area, have largely decoupled consumption rates from water availability.

[9] Bureau of Reclamation – About Us. http://www.usbr.gov/main/about/ retrieved May 29, 2015.
[10] Wahl, Richard. "Market for Federal Water: Subsidies, Property Rights, and the Bureau of Reclamation. Resources for the Future, 1989.

To be sure, water subsidies are politically sacred. The longevity of the Bureau's irrigation subsidies affects have long been incorporated into agricultural land prices such that the price of land served by a Bureau project reflects the expectation of future, subsidized water deliveries. Reducing or eliminating water subsidies will unsettle those expectations and have a commensurately negative effect on the value of those agricultural demands.[11] But, until these subsides are reduced or altogether eliminated, Congress cannot expect subsidized agricultural water users will align their consumption with relative scarcity of water. Bureau of Reclamation subsidies effectively prevent them from doing so.

Although the Bureau's Drought Response Program provides funding for (1) drought contingency planning, (2) drought resiliency projects, and (3) emergency response actions, none of these programs address the fundamental issue of price. When the price of water is artificially lowered through subsidies, Reclamation contractors have a reduced incentive to conserve—even during times of drought when water scarcity is most acute.

Eliminate Water-Intensive Crop Subsidies

The federal government plays a large role in influencing water demand, directly by subsidizing water consumption, as described above, and indirectly by subsidizing water-intensive agricultural outputs. This year alone, the Farm Bill will subsidize more than $18 billion in agricultural crops.[12] Such subsidies tend to exacerbate water shortage by encouraging water consumption.

Market prices contain valuable information regarding the relative scarcity and opportunity cost of water. A free market based on trade creates accurate information about water scarcity, to which water users can quickly and efficiently respond. In the context of drought, acute water scarcity forces competing users to make decisions with regard to resource constraints: conserve and trade when possible, and pay the market price when not.

Much like subsidies for water as described above, subsidies for agricultural crops that require significant volumes of water distort price information and encourage the unsustainable use of water, even during times of drought. Federal subsidies direct water to farmers at a price below its opportunity cost, often encouraging wasteful uses. Lustgarten and Sadasivam describe this dynamic in the context of crop subsidies in the Colorado River Basin:

> "[He] could plant any number of crops that use far less water than cotton and fill grocery store shelves from Maine to Minnesota. But along with hundreds of farmers across

[11] Tullock, Gordon. "The Transitional Gains Trap." *The Beli Journal of Economics and Management Science*, Autumn 1975, pp. 671-678.
[12] Smith, Vincent. May 11, 2015. "Cash Crop." American Enterprise Institute. http://www.aei.org/publication/cash-crop/

> Arizona, he has kept planting his fields with cotton instead. He says he has done it out of habit, pride, practicality, and even a self-deprecating sense that he wouldn't be good at anything else. But in truth, one reason outweighs all the others: The federal government has long offered him so many financial incentives to do it that he can't afford not to."[13]

It is important, especially during drought, to let prices coordinate allocation. Water intensive crops are the beneficiaries of federal subsidies, and generally soak up tax funds rather than playing a sustainable role in the water market. Almond production, for example, is an 800,000 acre production in California, requiring 2,100 gallons of water to produce one pound of shelled almonds.[14] Moreover, about 5 gallons of water are needed to produce a *single* shelled almond. Other notable thirsty crops include rice, soybeans, cotton, and wheat. Finding the appropriate demand for each of these crops will encourage the sustainable allocation of water rather than intensifying drought issues.

The current federal model, which relies on central control and political allocation by administering agricultural subsidies, presents risks to the population of the West during a time of water scarcity. Information problems are inherent under this structure, and distort the price system in dangerous ways.

For this reason, Congress should examine the effect of subsidizing water-intensive agricultural outputs and and consider repealing those subsidies in order to minimize the effects of the current drought. Specific opportunities for reform include decreasing funds directed to water intensive crops such as almonds, cotton, rice, sugar, and soybeans, particularly during times of drought. For the federal government to positively impact the drought situation in the West, the appeal to water markets is the most effective strategy.

Clarify Tribal Water Rights

Another pertinent drought issue and opportunity for Congress to encourage water marketing is the water rights associated with Indian reservations. Reservation lands represent sizable areas throughout the West. Large quantities of water are associated with these lands but they are not clearly denominated or adjudicated. Federally reserved water rights were established as a result of westward expansion in the early 20th century. Specifically, the *Winters* doctrine of 1908 declared that when Congress set aside lands for a reservation, it also implicitly reserved sufficient water to "fulfill the purposes of the reservation."[15]

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[13] Lustgarten, Sadasivam. May 27, 2015. "Holy Crop: How Federal dollars are financing the water crisis in the West." ProPublica. https://projects.propublica.org/killing-the-colorado/story/arizona-cotton-drought-crisis

[14] Creelman. August 29, 2014. "How Water Intensive Food Choices Impact California's Drought." Ecology Global Network. http://www.ecology.com/2014/08/29/water-intensive-food-impact-california-drought/

[15] Winters v. United States. 207 U.S. 564. 1908

It is important to note that these federal rights are administered separately from the water rights systems of the respective western states, and yet their administration directly affects the rights of other western water users. The prior appropriation doctrine, which characterizes the vast majority of western water law, seeks to establish property rights to water that are clearly defined, enforced, and transferable. Federal rights granted to tribes are senior to these state rights, and are not subject to "use it or lose it" provision of the prior appropriation doctrine. Hence, the uncertainty surrounding exactly how much water was implicitly reserved for tribal lands creates uncertainty as to how much water tribes can claim, conserve, and transfer during drought.

Historically, federally reserved rights have not been marketable. First, rights created under the *Winters Doctrine* were not explicitly quantified, an ambiguity which has led to numerous disputes and protracted disputes over how much water tribes currently hold. Secondly, some rights have not been fully utilized since their inception, creating doubt as to the general validity of tribal claims.

Settling these disputes is preferred over costly litigation because settlements not only clarify rights to water, but can also establish tribe-specific provisions as to transferability. Past settlement agreements have included tribal development plans, establishing minimum instream flows and lease-based diversion rights. As of 2014, 29 tribes have resolved rights issues through the settlement process.[16]

Although settlements are preferred over litigation, they are still cost-intensive and often take years to finalize. Even when rights are successfully established, the transferability of those rights is overlooked. Federal law has not allowed tribes to convey water off-reservation.[17] This prevents tribes from trading water rights in situations when trades are economically or environmentally advantageous.

Congress can take several steps to encourage trading among resource users. To ensure water held by the tribes is transferable, quantified rights must first be established. Congress should enact legislation to define tribal water tights supported by the *Winters* doctrine, and uphold those rights on a consistent basis. Otherwise, property rights unenforced are nonexistent. Secondly, Congress should enact legislation to allow the transfer of water rights between Indian and non-Indian users and across state lines. Federally reserved rights that are clearly defined, enforced, and transferable will favor water markets and tap their potential to address drought and prolonged water scarcity.

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[16] Cordalis, Cordalis. April 17, 2015. "Indian Water Rights: How Arizona v. California left an Unwanted Cloud over the Colorado River Basin." The University of Arizona. http://www.ajelp.com/articles/indian-water-rights-how-arizona-v-california-left-an-unwanted-cloud-over-the-colorado-river-basin/

[17] Congressional Budget Office. August 2006. "How Federal Policies Affect the Allocation of Water." http://www.cbo.gov/publication/18035

WATEREUSE
1199 North Fairfax St, Suite 410 • Alexandria, VA 22314

June 2, 2015

The Honorable Lisa Murkowski, Chairwoman
Committee on Energy and Natural Resources
United States Senate
304 Dirksen Senate Building
Washington, DC 20510

The Honorable Maria Cantwell, Ranking Member
Committee on Energy and Natural Resources
United States Senate
304 Dirksen Senate Building
Washington, DC 20510

Dear Chairwoman Murkowski, Senator Cantwell and Members of the Committee:

Thank you for holding this oversight hearing on *"The Status of Drought Conditions Throughout the Western United States and Actions States and Others are Taking to Address Them"*, and for the opportunity to provide the views of the WateReuse Association (WateReuse) concerning potential solutions to the current and future drought conditions that plague the West. Our association represents nearly 400 organizational members, including water utilities and corporations throughout the United States who actively practice and support water reuse and recycling to provide sustainable water supplies to water short communities. WateReuse is the premier nonprofit organization in the country that is dedicated solely to creating sustainable sources of freshwater through water reuse and recycling.

Water is our nation's most precious resource, especially in the western U.S. where water scarcity is the norm. In many watersheds in the West and across the nation, fresh water supplies are quickly coming under increasing stress as climate change and drought, growing competition for limited supplies, and conflict between uses continue to inject uncertainty into water resource development and management.

The severity and likely impacts of the epic California drought of the past few years are fast becoming potential indicators of future chronic conditions throughout the West. The need for reliable water supplies that are resilient to the impacts of predicted future changes in our climate, including more extreme periods of drought, diminished snowpack levels, more sporadic and locally intense precipitation events, and extreme heat waves, will continue to increase in many areas of the arid West. And, the worst time to prepare for drought conditions is during the drought itself.

Our ability to meet municipal and industrial water demands, grow enough food for our nation and to protect our environment will be challenged by these persistent water supply extremes. Therefore, the nation cannot afford to overlook any opportunities to reuse, recycle and desalinate water to create drought and shortage resilient supplies of fresh water for urban, rural, and agricultural needs.

Approximately 97.2% of all the water on the globe is saline and another 2.1% is trapped in the polar ice caps. The current global population of 7 billion people is surviving and sustaining itself on the 0.6% of the world's water which is in non-saline surface waters and groundwater. This suggests strongly that brackish and saline waters will need to become more widely utilized, and treated wastewater effluent is even more readily available and more inexpensive to treat and reclaim than ocean or brackish waters.

WateReuse believes that now is the time to plan and develop reliable water supplies for the future through the use of water reuse, recycling and desalination technologies in the West and in other water-short regions of the country. And we believe the federal government should be our partner through policies and budgets that recognize the importance of incentivizing and accelerating this effort.

WateReuse has identified the following actions that will, if implemented, create new, resilient water supplies in critical areas of the West (and the Nation) to combat the effects of drought and chronic water shortages.

Additional investment in water reuse and recycling infrastructure for the future

In order to provide the federal leadership and the tools to help meet these water resource challenges, the Secretary of the Interior issued Secretarial Order 3297 in February 2010 establishing the WaterSMART (Sustain and Manage America's Resources for Tomorrow) Program within the Bureau of Reclamation (Reclamation).

Reclamation's WaterSMART Program allows all bureaus of the Department of the Interior to work with States, Tribes, local governments, and non-governmental organizations to pursue a sustainable, drought and climate resilient water supply for the West and the Nation. WaterSMART establishes a framework to provide federal leadership and assistance on the efficient use of water, integrating water and energy policies to support the sustainable use of all natural resources, and coordinating the water conservation activities of the various Interior offices.

Over the past 20-years, water treatment technologies have been developed that allow for the cost effective reuse, recycling and desalination of water that, in the past, was not fit for human consumption or use. These technologies and projects did not just spring up overnight. Past investments in research and development of water treatment applications have provided important technologies that are currently being used to reduce the stressors on our valuable fresh water supplies, helping to stretch water supplies to meet unmet needs and protect other users reliant on existing water development projects.



With ever growing water demands and increasing weather uncertainty facing the country, we believe that now, more than ever, is the time to invest in water recycling infrastructure. Events like the droughts in the Western states and other climate change impacts across the country make it imperative that we invest in new sources of fresh water. Water reuse is exactly that, a new source of fresh water.

In 1992, Congress passed Title XVI of P.L. 102-575, which provides authority for Reclamation's water recycling and reuse program (Title XVI). Through the Title XVI program, Reclamation identifies and investigates opportunities to reclaim and reuse wastewaters and naturally impaired ground and surface water in the 17 Western States and Hawaii. Funding is budgeted for through WaterSMART Title XVI Program competitive grants and includes funding for planning studies (50% federal) and the construction of water recycling projects (25% federal), on a congressionally authorized project-specific basis, in partnership with local governmental entities. Since 1992, over $556 million in federal cost-share has been leveraged with more than $1.7 billion in non-federal (local taxpayer and private) funding to design and construct water recycling projects. In 2011, an estimated 260,000 acre-feet of water was recycled through Title XVI projects.[1]

Yet a recent nationwide recycled water project survey undertaken by WateReuse in conjunction with the Association of California Water Agencies (ACWA), California Association of Sanitation Agencies (CASA), National Association of Clean Water Agencies (NACWA) and the Western Recycled Water Coalition, documented that 92 agencies in 14 states across the country are developing recycled water projects that will provide over 900,000 acre-feet of additional water supply. These public agencies are currently planning and investing in recycled water projects totaling over $6 billion. While this work is underway, the survey also indicated that almost half of these projects will require some level of federal financial support in order to proceed to construction and deliver their benefits.

While we understand the current fiscal constraints Congress is dealing with today, in our view we must incentivize investments in water reuse and recycling infrastructure through a measure of financial support from the federal government, as we have in the past. Without those initial past federal investments and incentives, the impact of the current drought we are facing today would be much, much worse, especially in California. **Reclamation and Congress should substantially increase funding for the WaterSMART Title XVI Program to better meet the many water reuse and recycling projects that are currently awaiting funding assistance.**

WateReuse also supports reforming the WaterSMART Title XVI Program through legislation that would drop the requirement that an eligible water reuse and recycling project first be congressionally authorized before it can compete for Title XVI Program grant funds. While the select few projects that are already authorized by statute are worthy projects, there are many projects being planned and designed today that could help meet even more unmet demands for water during future droughts, but have not been congressionally authorized The Title XVI Program should be authorized as a program, and modified to move away from a project specific authorization requirement to a programmatic commitment to drought relief where worthy projects are able to compete for budgeted grant funding

[1] Bureau of Reclamation WaterSMART Title XVI Program



within WaterSMART without additional congressional authorization. Of course, Congress should provide oversight and guidance of such a program to ensure that federal grants are being invested in the best possible projects that produce valuable water supplies for their water-short communities.

We also believe that fully funding the state revolving fund (SRF) capitalization grants from the Environmental Protection Agency (EPA) can assist in providing low cost, long-term financing to communities in need of water reuse and recycling projects nationwide. And, WateReuse has long supported other innovative financing tools, such as the new Water Infrastructure Finance and Innovation Act (WIFIA) authorized in the Water Resource Reform and Development Act (WRRDA) passed in the last Congress. Finally, protecting the existing tax exemptions on interest from municipal bond financing will be imperative in maintaining this important and widely used public infrastructure financing tool.

Research partnerships to find the next generation of water technologies.

Today, as water stressors, such as drought and climate change, continue to pressure our limited supplies, we must find the next generation of water treatment technologies that can provide even more relief. Only through the development of sustainable, "drought-proof" and climate resilient supplies of fresh water can we begin to meet our future water demands amidst drought conditions such as those we are experiencing today. And, applied research partnerships with federal, state, local, and private entities can help achieve this goal.

In a new study entitled "*The Opportunities and Economics of Direct Potable Reuse*" (WRRF-14-08), Dr. Robert S. Raucher of Stratus Consulting and Dr. George Tchobanoglous of the University of California – Davis have found that potable water reuse is one of the most economically feasible potential sources of new water supply available in places such as California. We must continue to pursue this new potable water source and will need additional applied research to ensure that we do it properly and safely.

For example, the California legislature has adopted a number of goals with respect to greater integration of recycled water into municipal, industrial and agricultural applications. The state has established goals of recycling 1.5 million acre-feet of water by the year 2020, and 2.5 million acre-feet by the year 2030, amounts that would be impossible to attain through current supply methods, including increased water conservation. By setting these goals, California is leading the nation in expanding water reuse, as well as ensuring the long-term preservation of its economic, social and environmental assets.

In order for California and the other water-short regions of the Nation to increase usable water supplies through reuse, recycling and desalination projects, more high-quality and independent research will be necessary in order to find the "next generation" of water reuse, recycling and desalination technologies. The State of California will not be able to meet its goal of 2.5 million acre feet of water reuse by 2030 without implementation of direct potable reuse (DPR), and the research to develop the technologies that will allow the safe and publicly accepted direct potable reuse of wastewater is fast becoming a top priority in the water-short state.



WateReuse, in partnership with WateReuse California, launched the Direct Potable Reuse (DPR) Initiative in June, 2012 to advance DPR as a water supply option in California. The drivers for establishing this program included statewide goals for increasing recycled water use and a mandate from the California legislature to report on the feasibility of DPR by December 31, 2016. The DPR Initiative was built upon existing DPR research that started in 2011 when WRRF began funding research identified in the Foundation's groundbreaking report, *Direct Potable Reuse: A Path Forward,* as well as research identified in the 2012 National Research Council report on potable reuse and at a DPR Workshop held in December, 2012 in which a panel of experts identified 22 high-priority research projects. The first six DPR projects, initiated in 2011 and 2012, represented a $3.8 million investment in cutting-edge/leading-edge research.

WateReuse and WateReuse California have partnered with many agencies and firms that are committed to advancing DPR to protect the water supply of California, the nation, and the world. By the end of 2012, $2.6 million had been pledged to the initiative and by the end of 2013, the total amount pledged increased to $5.4 million. To date, more than 50 public water agencies, consulting engineering firms, and suppliers have pledged funds to advance DPR as a water supply option in California. Their contributions directly funded four DPR projects initiated in 2013, totaling $1 million. Altogether, WateReuse' DPR Research Program since 2011 totals more than $6 million, and continues to grow with every new partnership.

Leveraging research funding from many partners, such as the DPR Initiative, should be the model for future federal drought and climate resilient water reuse and recycling research partnerships at Reclamation. Reclamation could (and should) participate in these partnerships through competitive cost-shared applied water reuse and recycling research grants. Making a commitment through leveraged partnerships to research the next generation of water reuse and recycling technologies in the near term will provide benefits for several generations to come. It will ease the pressure on the limited water available from natural systems, and ensure the sustainable drought-proof water supply provided through reuse is available for current and future generations.

Conclusion

Water reuse and recycling creates a drought proof, sustainable supply of water for the long-term – water supplies that are not created at the expense of irrigated agriculture or the environment. Water reuse technology is well-established, currently readily available and used effectively in water distribution systems around the world. Drought stricken states would undoubtedly receive the greatest benefits from water reuse technologies and we believe that support for water reuse and recycling projects should be part of any future legislative effort to address the effects of the drought. Additionally, water reuse systems enable our communities to be prepared for future drought impacts and uncertainties in advance of a crisis situation like this drought. **No other source of new water can be brought on line this quickly to provide such significant usable volumes of water.**

On behalf of our membership, many of whom are located in the State of California, the WateReuse Association thanks you for taking a leadership role in holding this oversight hearing to address the



ongoing drought in the State of California and the West. This year's drought is of epic proportions and will deprive many Westerners of their basic water needs. We must work together with the Congress to find creative solutions to the ongoing water crises in California and other western states. And we believe, as you do, that water reuse is an important tool available at our disposal to increase the availability of fresh water and thus should be included as part of a comprehensive plan to manage the impacts of drought in both the short- and the long-term. The country needs innovative options to address limited water availability and we would like to work with you and your staff in ensuring that Western communities have the water they so desperately need every single year, including through water reuse and recycling projects that could be brought online quickly and effectively.

Respectfully submitted,



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June 15, 2015

The Honorable Lisa Murkowski
Chairwoman
Senate Energy & Natural Resources Committee
304 Dirksen Senate Office Building
Washington, DC 20510

The Honorable Maria Cantwell
Ranking Member
Senate Energy & Natural Resources Committee
304 Dirksen Senate Office Building
Washington, DC 20510

Re: *Hearing to receive testimony on the status of drought conditions throughout the western United States and actions states and others are taking to address them*

Dear Chairwoman Murkowski and Ranking Member Cantwell:

Chairwoman Murkowski, Ranking Member Cantwell and Members of the Committee, thank you for the opportunity to provide written testimony to the Senate Energy and Natural Resources Committee regarding the status of drought conditions throughout the western United States and actions states and others are taking to address them. Western Growers members are small, medium and large-sized businesses that produce, pack and ship fresh fruits, nuts and vegetables grown in the United States from our home farming operations in California, Arizona and Colorado. Western Growers members produce in – and directly contribute to the economies of – over 25 states. In total, Western Growers members account for nearly half of the annual fresh produce grown in the United States, providing American consumers with healthy, nutritious food. Indeed, Western Growers' has long had the slogan: "We grow the best medicine".

I. Drought's Impact

Drought has captured public attention across the United States this year as California is gripped in its fourth year of drought which has led to dramatic water use reductions mandated by Governor Brown. Indeed, according to research evaluating tree rings the ongoing drought in California is the worst to hit the region since the 13th century.[1] The University of Davis recently completed an analysis of the potential harm that the drought will have on California's agricultural sector. The study estimates that farmers will suffer a 33% loss in their water supply,

[1] Evidence Suggests California's Drought is the Worst in 1,200 Year, Woods Hole Oceanographic Institution, News Release, Dec. 14, 2014 found at http://www.whoi.edu/news-release/California-drought.

with impacts concentrated in the San Joaquin Valley. The estimates, prepared on behalf of the California Department of Food and Agriculture, also show that farmers will fallow roughly 560,000 acres or 6 to 7 percent of California's average annual irrigated cropland.[2] While it may capture headlines, California is not alone in experiencing drought.

The Colorado River Basin has experienced the driest 15- year period since the 1960s with above-average flows in only 3 of the last 15 years.[3] Today, between 35 and 40 million people rely on the Colorado River and its tributaries for some, if not all, of their municipal water needs. These same water sources irrigate over 4 million acres of land in the Basin and the adjacent areas that receive Colorado River water, generating many billions of dollars a year in agricultural and economic benefits. There are over 20 federally recognized tribes in the Basin who depend on the river. The Colorado River and its tributaries provide habitat for a wide range of species and flows through seven national wildlife refuges and 11 National Parks. Drought conditions have led to steep declines at Lake Mead and Lake Powell, the two largest reservoirs in the system. Lake Mead at roughly 1,076 feet of water is at a point that it has not been seen at Hoover Dam since April and May of 1937.[4] Indeed water levels at Lake Mead are so low that it is possible that mandatory water cuts to Arizona and Nevada will soon kick in (cuts start at 1075 feet). In order to prepare for cuts Arizona is already indicated that farmers operating in the interior of the state will lose access to Colorado River water.[5]

Drought conditions are so severe and persistent that Colorado's 2014 Draft state water plan already notes that "[i]rrigated agriculture is being lost by the purchase and permanent transfer of agricultural water rights. At the current rate of transfer, there will be a major reduction in Colorado's agricultural lands in the future. This could impact Colorado's economy and food security. In addition, rural communities could dry-up along with agriculture if enough agricultural business goes away."[6]

In Nevada the State Water Engineer earlier this year ordered a 50% reduction in the amount of groundwater that can be pumped for crops in the Smith and Mason valleys north and east of Yerington, home to Nevada's biggest agricultural producers. "The water table is dropping like a rock. We're seeing unprecedented pumping and we have to curtail some of that pumping so that the water table will hopefully start to recover," said Jason King, Nevada's state water

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[2] Howitt RE, Medellín-Azuara J, MacEwan D, Lund JR and Sumner DA. 2015. "Preliminary Analysis: 2015 Drought Economic Impact Study," UC Davis Center for Watershed Sciences.

[3] US Bureau of Reclamation, "US Bureau of Reclamation Upper Colorado Region," 11 July 2014. [Online]. Available: http://www.usbr.gov/uc/water/crsp/cs/gcd.html.

[4] Average Monthly water levels of Lake Mead since construction found at http://www.usbr.gov/lc/region/g4000/hourly/mead-elv.html, compared with Lake Mead current level reports found at http://www.usbr.gov/lc/region/g4000/hourly/hourly.html

[5] Chris McGreal, Disappearing Lake Powell underlines drought crisis facing Colorado river, The Guardian, May 18, 2015

[6] 2014 Draft Colorado's Water Plan, p3 found at http://coloradowaterplan.com/

engineer." Western Growers Member Peri & Sons Farms in Yerington, one of the nation's largest onion growers, is among those who've been hit hardest by the drought now entering its fourth year. "It's the blood in the farmers' veins; if you do not have water, you cannot grow crops," company president David Peri told KOLO-TV. "It's as serious as serious gets. It is actually scary."[7] That curtailment has been challenged in court, and an injunction has been issued, but if it stands farmers in the area will need to reduce their acreage by roughly half.[8]

Finally, New Mexico's Rio Grande River basin has been in drought since 2003. This spring federal forecasters pegged the runoff from mountain snowpack feeding the Upper and Middle Rio Grande (Colorado to just below El Paso) at roughly half the average logged in the final two decades of the 20th century. "The last four or five years running, we've had a weak snowpack, early melting and really dry spring weather," said Mr. Fleck, a journalist and scholar. "The spring runoff usually peaks in early May. I think it may have peaked in March this year."[9] This decade long drought has taken its toll on New Mexico agriculture. Irrigation authorities below Elephant Butte Dam, one of the states' two most important reservoirs, have not been able to release much water to producers which means that they in turn struggle to stay in business. As an example, the Elephant Butte Irrigation District, was only able to give farmers seven inches of their full, three-foot allotments for each acre throughout 2014. "We're definitely struggling," said Gary Esslinger, manager of the district.[10] Indeed, water shortages combined with a lack of labor have been critical contributors to the decline in the state on New Mexico's iconic Chile pepper industry; over the last two decades pepper acreage has declined by nearly 70 percent.[11]

The Department of the Interior has recognized the dire situation across the Western United States. Deputy Secretary Connor has said with respect to drought: "[t]he challenge is systemic and persistent across the West. We need better infrastructure, better operation arrangements, better ways to share water and move water."[12]

II. Agriculture's Response to Drought

a. Agriculture's Increasing Use of Water More Efficiently

Contrary to some media reporting, given the persistence of drought throughout the West, not only over the last decade but on other occasions throughout the last quarter century, agriculture in the West has made adjusts to an increasingly low-water environment. The truth of

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[7] Drought Prompts Disaster Declaration for Most of Nevada, Associated Press, Feb 5, 2015.
[8] http://nvfb.org/2015/03/09/water-curtailment-limits-farmers-in-mason-and-smith-valley/
[9] Michael Wines, "Mighty Rio Grande Now a Trickle Under Siege" New York Times, April 12, 2015
[10] Marty Schladen, "Quenching Our Future, Part 5: In drought, Rio Grande Valley irrigators feel the crunch", El Paso Times, Dec. 14, 2014
[11] *Id.*, Logan Hawkes, New Mexico Chile crop struggles for comeback in a modern world, SouthWest Farm Press, March 9, 2012
[12] Michael Wines, "Mighty Rio Grande Now a Trickle Under Siege" New York Times, April 12, 2015

the matter is that Western agriculture has been switching to more efficient technologies that improve water management, resulting in water use declining and far from wasting water agricultural water has been saved from historic use levels. While the historical record of achievement is impressive, drought is a slow-moving crisis and likewise changes in practices and investment in costly technology are likewise incremental. As drought conditions intensify now is an appropriate moment for the federal government, working with agricultural producers, local and state governments to accelerate the many positive water use trends within the agricultural sector.

1. Increased Water Use Efficiency within California's Agriculture

In examining agriculture's water use, the Public Policy Institute of California has noted: "[f]armers have steadily improved productivity and shifted to crops like fruits, nuts, and vegetables that generate more revenue and profit per unit of water. Adjusted for inflation, the value of farm output has more than doubled since the late 1960s despite little change in acreage or irrigation water used." Indeed, the Institute has noted that "[i]n the water-limited San Joaquin Valley, orchards grew from 34 percent to 40 percent of irrigated cropland between 2000 and 2010."[13] Beyond shifting to high value crops which provide better return on every unit of water used, water delivery and field irrigation efficiencies are also rising. Rural irrigation districts that are the primary service providers for farmers have been upgrading delivery systems in California to provide more flexible service and minimize canal spills and seepage. In addition, California farmers under water pressure have been switching from flood irrigation to more efficient drip and sprinkler systems.[14]

As one detailed example of some of the technology that has been deployed, state-of-the-art farming and production developments over the past two decades have helped almond growers reduce the amount of water they use per pound of almonds grown by 33 percent. How has the almond industry, which is focused in California, accomplished this? First, the overwhelming majority of producers in the industry use micro-irrigation systems, which conserve water by decreasing water runoff, applying water directly to the root zone to avoid waste. Beyond that producers have combined micro-irrigation systems with precise timing and rate of irrigation techniques that ensure water is only delivered when the trees need moisture. This is done by

[13] Ellen Hanak, Jay Lund, Charles Burt, Richard Howitt, Josué Medellín-Azuara, Doug Parker, Daniel Sumner, and David Zoldoske, California's Water: Water for Farms, Public Policy Institute of California, April 2015, page 1-2 found at http://www.ppic.org/content/pubs/report/R_415WFFR.pdf

[14] Ellen Hanak, Jay Lund, Charles Burt, Richard Howitt, Josué Medellín-Azuara, Doug Parker, Daniel Sumner, and David Zoldoske, California's Water: Water for Farms, Public Policy Institute of California, April 2015, page 1-2 found at http://www.ppic.org/content/pubs/report/R_415WFFR.pdf. Note however that these water management upgrades, including canal lining and on-field sprinkler efficiency, have the unintended consequence of lowering groundwater levels. Why? Because irrigation water not consumed by crops has historically been a major source of groundwater recharge.

using monitoring systems that have been put in place that look at weather conditions and soil moisture as it relates to detailed soil maps that show soil characteristics in individual orchards in order to determine the design of the irrigation systems in order to enhance water infiltration and distribution based on precise measurements.[15]

2. Agriculture in the Colorado River and Rio Grande Basins Tell a Similar Story

These developments in farming are not limited to California as the Department of Interior discovered in looking at agriculture throughout the Colorado River Basin. In a recently released report the Department finds that: "[a]lthough water use and acreage, and therefore water use per acre, have remained relatively constant historically, productivity has increased in areas receiving Colorado River water by about 25 percent since 1980. More crops are being grown using the same amount of water, on the same amount of land. The increase in productivity is generally consistent with estimates of increased productivity due to improvements in crop varieties. A portion of the increased productivity is likely also due to better water management (for example, laser-leveled fields) and more efficient cropping patterns (such as switching to "double-cropping" or planting more than one crop on an acre in a given year), increasing productivity per acre per unit of water consumed."[16]

A few examples of how this is playing out within the Colorado Basin are included in the Interior Department's report. For example, in the Central Arizona Project service area significant investments totaling more than three quarters of a billion dollars have been made on water-efficient practices and infrastructure. "In particular, more than 150,000 acres have been converted to high-efficiency, laser-level basins with efficiencies estimated near 85 percent."[17] In another example, Yuma County Arizona irrigation water use has declined over 15 percent over the last couple of decades. This is as a result of "expanded use of multi-crop production systems that require less water and significant improvements in crop and irrigation management and infrastructure."[18] Indeed, an analysis performed for the Wellton-Mohawk Irrigation and Drainage District (WMIDD) indicates district-wide irrigation efficiencies (using annual laser-leveling,

[15] California Almond Board, "Sustainability", found at http://www.almonds.com/consumers/about-almonds/sustainability

[16] Department of the Interior, "Moving Forward: Phase I Report, Chapter 4 Agricultural Water Conservation, Productivity and Transfers", May 2015 Page 4-14, found at http://www.usbr.gov/lc/region/programs/crbstudy/MovingForward/Phase1Report/Chpt4.pdf

[17] *Id.* at page 4-22.

[18] Yuma County Agricultural Water Coalition, A Case Study in Efficiency – Agriculture and Water Use in the Yuma, Arizona, Feb 2015, at Exec Summary page II-III, found at http://ycwua.org/wp-content/uploads/2015/03/ACaseStudyInEfficiency.pdf

press wheels to better manage water flow and highly efficient irrigation systems) have increased in recent years and approach 75 percent.[19]

Agriculture's more efficient use of water similarly is occurring in New Mexico and changes in technology enable producers to use less water than in previous decades. "For example, high plains farmers rely on groundwater pumping. Many who previously used overhead sprinklers now deploy systems that are positioned a few feet or less above the crop, significantly reducing evaporative losses. Farmers who rely on surface irrigation turn to different solutions, such as lining ditches with concrete, covering canals, and converting to alternative irrigation methods instead of flooding fields."[20] Indeed, switching to drip systems, microjet spray, or border flood systems are highly effective conservation strategies for surface and groundwater irrigators, versus traditional flood irrigation.

As evidenced by these facts, throughout the West agriculture has been and is adapting to use less water to grow our nation's food. While it is true that agriculture is the dominate water use across the Western states mentioned above production systems are using that water more efficiently than ever before. Producers are producing more while using less water per acre, and water management systems and improved technologies are creating water savings that in some cases are returned to irrigation districts for other uses. Producers acting on their own are adapting or are working with irrigation districts to innovate. In some cases, federal or state programs provide assistance to producers but given the crisis point we face today more needs to be done. Transitioning to new technology and implementing new irrigation systems and practices can be costly for individual producers and more federal government resources can assist in this process. In addition, federal resources and technical assistance could be crucial in stimulating innovative water transfer protocols and systems. Many water transfer systems depend on technology both to save water on a farm and then accurately record the amount of the savings. Once that has been accomplished sophisticated legal expertise maybe necessary to navigate local and state water law so saved water can be transferred. While many states and localities are examining such

[19] *Id*; *See also*, Department of the Interior, "Moving Forward: Phase I Report, Chapter 4 Agricultural Water Conservation, Productivity and Transfers", May 2015 at 4-16 and 4-23.

[20] New Mexico First, "A Town Hall Meeting on Water Planning, Development and Use: Background Report", April 2015, page 23-24 found at nmfirst.org. "Note not all these changes are universally favored. When canals are lined in concrete, less water seeps into the ground to support nearby vegetation or aquifer recharge. If the goal of the ditches is to deliver water to farms, concrete linings are good public policy. But if the goal is also to support the surrounding cottonwood trees and vegetation near the ditch-banks, concrete lining poses a problem. Research conducted in northern New Mexico found that 16 percent of the canal flow seeped out of the ditch bed and supported vegetation habitat along the ditch as well as groundwater recharge. Additionally, some researchers and farmers do not favor drip irrigation systems because of concerns about increased salinity in the soils. They favor flood irrigation because it flushes more of the salts from the soil and enables more water to seep into shallow aquifers." *Id*.

techniques, and some have been developed, federal resources and/or technical expertise could help accelerate local developments.[21]

b. Agriculture's Use of Research and Innovation

Another response agriculture is making to drought is investing in itself. During the last few years Western Growers members and the Association itself have invested heavily in propelling forward cutting edge agricultural research. During 2013-14, led by and partially funded by Western Growers members, the University of Arizona opened an innovation center in Yuma, Arizona. The Yuma Center of Excellence for Desert Agriculture will provide rapid, direct value-adding responses to any issues important for desert crop production systems, including of course the challenge of using water.[22]

During 2015, Western Growers built upon this step. During the spring of this year, Western Growers announced several new partnerships around agricultural research and technology. First, Western Growers and Silicon Valley Global Partners (SVG Partners) entered into a strategic alliance agreement to find, accelerate, advance and invest in innovative solutions intended to solve critical challenges to production agriculture through technology and produce more with less water, labor and inputs. Pursuant to the agreement the two entities will collaborate on innovation centers in Salinas and San Jose and both are involved as sponsors of Forbes' Reinventing America: The AgTech Summit in Salinas July 8-9, 2015. In addition, other mutual efforts will include participation and collaboration in the SVG Thrive Accelerator program and the SVG Technology Growth Fund which are designed to help identify and then provide operating capital to agriculture technology companies.[23]

These many millions of dollars of investment are a concrete commitment by the produce industry to conquer the many challenges we face, including the challenge of less abundant water. What we hope to accomplish with these efforts is identify promising new technology or techniques and once identified help propel them to the marketplace. In some cases, the newly identified technology can be propelled forward with joint venture capital, in other cases we will seek out traditional research and development partnerships with universities and federal or state governments. In that regard, given the enormity of the drought problem and its persistence

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[21] Department of the Interior, "Moving Forward: Phase I Report, Chapter 4 Agricultural Water Conservation, Productivity and Transfers", May 2015 at 4-36-38. *See*, Colorado Alternative Agricultural Water Transfer Methods as example: http://cwcb.state.co.us/loansgrants/alternative-agricultural-water-transfer-methods-grants/Pages/main.aspx; *See also*, Policy Options from the New Mexico Water Resources Research Institute's 57th Annual
New Mexico Water Conference, Hard Choices: Adapting Policy and Management to Water Scarcity, at page 14-17, 24 found at http://www.tomudall.senate.gov/files/documents/SenUdallWaterConferenceReport.pdf

[22] *See*, Yuma Center for Excellence in Desert Agriculture found at https://yceda.cals.arizona.edu/

[23] "WG Announces Major Investment in Future", May 1, 2015 found at https://www.wga.com/magazine/2015/05/01/ag-technology-wg-announces-major-investment-future

Western Growers asks that the federal government reexamine how it is responding to this crisis. Clearly, additional resources are necessary to address this issue over the short, medium and long-term. While new resources are identified, Western Growers asks that the federal government convene relevant agencies together in order to utilize existing resources more efficiently and effectively. It is our contention that the Departments of Agriculture, Interior and Commerce as well as the Army Corps of Engineers must be brought together to focus on this issue. Specifically, how can the federal government in a coordinated focused manner work together to foster new technology? For example, can Defense Department technologies be commercialized to help? Can various agency budgets, across multiple Departments, be coordinated to leverage private dollars with federal dollars more effectively? Can the federal government convene universities, philanthropic foundations and stakeholders together to discuss ways to cooperate on research and development efforts across a spectrum of innovations?

While clearly more resources should be allocated to these research priorities across the federal budget within all relevant Departments, the federal government also has, at minimum, a role in helping to facilitate better and wiser use of funds that are already available both from private and public sector sources. The produce industry is stepping up to address this challenge in the long-term through technology and innovation- the federal government must do the same.

III. Legislative Ideas to Increase Water Availability and Better Manage Drought

Provided below for the Committee's consideration are legislative ideas that can help increase available water as well as better manage water resources:

a. Directives to Increase Available Water through Efficiency and Storage.

1. Amend existing authorizations of all Corp or Reclamation water storage or delivery projects to "maximize quantity of water supplies possible" during a state declared drought. Currently agency administrators have much flexibility with their missions and the associated biological opinions to adjust flows. Mandating "maximum delivery" during a drought emergency will give Corp or Reclamation staff legal cover during drought declarations to ensure that they are legally obliged to deliver "maximum water" when they also have other obligations on our water resources. Conflicting obligations confuse and freeze the agencies from acting prudently during a drought thus they act conservatively and our municipalities and economies suffer. (i.e. federal projects on San Joaquin, Sacramento, Missouri, Colorado, Klamath and Rio Grande)

2. Amend existing authorizations of Interior restoration plans or water control and water storage projects to only account for native species when calculating needed environmental flows. (i.e. federal projects on San Joaquin, Sacramento, Missouri, Colorado, Klamath and Rio Grande). Nonnative species can demand additional allocation of water during different times of the year therefore constricting the water

delivery options agencies or water districts may have on their finite resources. Currently restoration and operational plans administered by Interior and Commerce use inconsistent parameters; in some cases plans target nonnative species and seek to manage flows in such a way to control or eliminate them, while in other cases it appears water flow calculations assume water being delivered to help nonnative species survive. Environmental constraints should focus on native species only and thus not confuse the missions of water delivery and storage agencies and thus also maximizing deliveries.[24]

3. Reauthorize the Water Desalination Act of 1996 through FY 2020 [25] in order to continue to develop approaches to lower the financial costs of desalination so that it is an attractive option relative to other alternatives in locations where traditional sources of water are inadequate. Some western state action plans have identified desalinization as a critical part to their water supply & economic future. [26] The Water Desalination Act of 1996 has three principal parts: (1) perform research on desalination technologies and related issues to advance the state of the art forward (research and studies), (2) conduct development and demonstration activities to test technological advancements, confirm economics, and gain public acceptance (development projects), and (3) support operation and maintenance at the Brackish Groundwater National Desalination Research Facility (BGNDRF). Currently grants range from $100,000 to $2 million but H.R.5363 - Water in the 21st Century Act 113th suggests that Congress fund this program at $5,000,000 for the first year and an additional $5,000,000 for the following years until the maximum of $20,000,000 is spent.

4. Increase funding for The Bureau of Reclamation's WaterSmart program. There is significant promise in technologies that will reduce leakage from municipal water delivery systems. EPA estimates leakage rates average around 14%, with some utilities experiencing significantly higher rates. Leak detection and system management can reduce the water consumption needed by utilities and these technologies may have promising applications in rural or agricultural settings. WaterSmart allows all bureaus of the Department to work with States, Tribes, local governments, and non-governmental organizations to pursue a sustainable water supply. Most western state water plans have

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[24] Some biological opinions or restoration plans that can control environmental flows assess how to minimize non-native species survival. Example: *Final Biological Opinion on the Operation of Glen Canyon Dam including High Flow Experiments and Non-Native Fish Control. December 23, 2011.* However some agency actions like the Bay Delta Conservation Plan discusses and looks to minimize stressors and provide optimal conditions for non-native species like the striped bass in the California Bay Delta. http://baydeltaconservationplan.com/Libraries/Dynamic_Document_Library/Public_Draft_BDCP_EIR-EIS_Appendix_11B_-_Noncovered_Fish_and_Aquatic_Species_Descriptions.sflb.ashx (page 11B-1-11B-3)

[25] Policy Options from the New Mexico Water Resources Research Institute's 57th Annual New Mexico Water Conference at page 25 found at found at http://www.tomudall.senate.gov/files/documents/SenUdallWaterConferenceReport.pdf; H.R. 291 - Water in the 21st Century Act 114th Congress (2015) Section 303.

[26] Developing water resources to expand the available supply. New Mexico State Water Plan, Office of State Engineer. Interstate Stream Commission. December 23, 2003 page 7; Resource Management Strategies. Desalinization (Brackish and Sea water) Chapter 10. California Water Plan. 2014 Update; Supply Importation-Desalination. Arizona's Next Century: A Strategic Vision for Water Supply Sustainability. page 16

identified the need to replace or repair aging infrastructure as critical step to achieving their water supply future.[27] In order to accomplish the ultimate objective:

i. It may be prudent to allow individual water districts to match federal grants of a project in another district in order to receive water saved from that investment. (Ex. one rural water district pays for the conservation grant match and thus receives the water saved)

ii. Encourage states with prior appropriation water law to clearly allow for conservation water to be owned and sold without forfeiture or abandonment. In order to achieve this, Congress could tie WaterSmart funds to adoption of state law that allows conserved water to be owned not lost and thus marketable.[28]

iii. Encourage states to define lawns as not a "beneficial use" under state law- doing so would drastically reduce water use on lawns- in order to receive funds.

5. Direct AMA and AWEP programs within the USDA EQIP program to be focused on western drought states. The Agricultural Management Assistance Program (AMA), which is only available in 16 states, helps agricultural producers use conservation to manage risk and address natural resource issues, such as improving water management, irrigation system improvements, or improving soil health to increase retained moisture through natural resources conservation. The Agricultural Water Enhancement Program (AWEP) is a voluntary conservation initiative that provided financial and technical assistance to agricultural producers to implement agricultural water enhancement activities on agricultural land to conserve surface and ground water and improve water quality.

   i. It may be prudent to direct these funds to states that have addressed agricultural resources as an essential part of their economy and the need to conserve water through more efficient agricultural systems.[29]

6. Establish within the Environmental Protection Agency (EPA) a WaterSense program to identify and promote water efficient products, buildings, landscapes, facilities, processes, and services in western states.[30] Some estimate that urban water efficiency and conservation could save millions of acre feet power year in California alone. [31] Within the

[27]Imperative to address Invest in Innovation and Infrastructure. Chapter 2 California Water Plan- 2013 Update; Arizona Water Atlas Volume I. Water Supply. Water Supply Management. Colorado's Water Plan Chapter 6.

[28] Currently some Western states have abandonment and forfeiture rules that reduce the incentive to conserve water. As noted the California water code used to have this impediment but it now clearly defines "Using less due to conservation efforts" and a beneficial use immune to forfeiture. Cal Water Code §1011. Having such clear definitions can expedite short-term water transfers when water is conserved, while also overcoming the "use it or lose it" mentality that historic Western water laws have had. Providing legal clarity, and then educating agricultural producers about these changes are critical given that agriculture holds many senior water rights across Western states. *See*, Adam Schapp, "Western Water in the 21st Century Policies and Programs that Stretch Supplies in a Prior Appropriation World", Environmental Law Institute, June 2009, page 51 found at http://www.eli.org/sites/default/files/eli-pubs/d19_02.pdf.

[29] Promoting Conservation and the efficient use of Water. New Mexico State Water Plan, Office of State Engineer. Interstate Stream Commission. December 23, 2003 page 8; Resource Management Strategies. Agricultural Water Use Efficiency. Chapter 2. California Water Plan. 2014 Update; Cultural Water Demand. Arizona Water Atlas Volume I. page 60; Managing Our Water. Executive Summary. Water Supply Management. Colorado's Water Plan Chapter 6.

[30] H.R. 291/ S 176- Water in the 21st Century Act 113th Congress (2015-2016) (Section 101).

[31] Urban Water Conservation ab Efficiency Potential of California. Pacific Institute. June 2014.

WaterSense program the EPA should establish a State Residential Water Efficiency and Conservation Incentives Program to provide financial incentives for consumers to purchase and install products, buildings, landscapes, facilities, processes, and services labeled under the WaterSense program.[32] Currently HR 291 Authorize $100M in FY15, escalating to $200M and back down to $100M in FY19.

7. Amend the Drinking Water State Water Revolving Fund within the Safe Drinking Water Act so that the formula used to distribute federal grants to States for drinking water programs prioritizes western states experiencing repetitive droughts and amend the statute so these funds can be distributed to owners or operators of water systems to address any ongoing or forecasted impact of long-term drought on a region's water quality or quantity. All grant applications under the revolving fund are competitively awarded and must be supported by the best available research or data (as determined by the EPA). This proposed change merely would give priority in judging competitive projects for those projects who also focus on long-term drought impacts.[33] Currently the EPA is requesting $1.19 billion for the Drinking Water State Revolving Funds (SRFs) for FY 2016, which an increase of approximately $279 million (23%) from the FY 2015 operating level. An increase in mission of this sort would certainly require an additional increase in funding to the FY 2016 funding request.

8. Authorize the Department of the Interior to provide innovative financial assistance for water recycling and water infrastructure and water storage for that recycled water in specified western states.[34] Modeled after the successful and popular Transportation Infrastructure Finance and Innovation Act (TIFIA) program, this title would offer long-term, low-cost financing for eligible water infrastructure projects directly and indirectly associated with a Bureau of Reclamation (Reclamation) project. Many state water plans recognize that there is a "growing gap between supply and future demand".

9. Create a streamlining process for water storage projects (whether above ground or below).[35] Expedite the permitting process by streamlining it for all expanded or new water storage construction projects on Department of Interior and Department of Agriculture lands. "Most storage projects were developed in the middle of last century. Both construction and infrastructure have remained relative static over the last 30 years. In fact construction of storage has declined so much that our current rate of building storage capacity resembles that of the Great Depression." [36] Make the Bureau of Reclamation within the Department of Interior the lead coordinator for all federal approvals, permits and decisions required in regards to those projects. Permits for ESA

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[32] H.R. 291/ S 176- Water in the 21st Century Act 113th Congress (2015-2016) (Section 101).

[33] H.R. 291/ S 176- Water in the 21st Century Act 113th Congress (2015-2016) (Section 101) creates a stand-alone program with a similar purpose but rather than create a new program we believe this purpose can be accomplished within the existing safe drinking water act not a new program.

[34] H.R. 291/ S 176 - Water in the 21st Century Act 113th Congress (2015-2016) (Section 211).

[35] "Over the next 25 to 100 years, Arizona will need to identify and develop an additional 900,000 to 3.2 MAF of water supplies to meet the projected water demands." Arizona's Next Century: A Strategic Vision for Water Supply Sustainability. Page 16. "Colorado will need a variety of projects and methods to meet its current and futures needs, ranging from storage projects to riparian restoration." Multiple storage projects listed in many sections of Colorado's plan. Colorado's Water Plan Chapter 6 Water Supply Management, at page 86.

[36] Water Supply Management. Colorado's Water Plan Chapter 6 at page 63.

compliance, Clean Water Act, NEPA, among many others would all be included.[37] In addition to improving the permitting process going forward, the bill should expedite or finish feasibility and environmental studies for languishing list of current projects.[38] Lastly it may be prudent in creating this new streamlining process that priority be given to increasing storage within existing projects.[39] Expanding existing reservoirs or groundwater recharge facilities is a quicker pathway to delivering new water in the West- while new storage projects are working their way through the newly streamlined process.[40]

10. Authorize, under certain conditions, the transfer of title to nonfederal entities of reclamation projects in need of rehabilitation that have already been authorized.[41] This will allow for the non-federal operating entity to obtain a loan guarantee that would not constitute a "third-party" financed obligation and would be favorably "scored" under congressional budget rules.

11. Require USDA/ NRCS Watershed Rehabilitation Program to prioritize dam rehabilitation projects where storage can be increased & authorize additional off farm irrigation water storage facilities in western alpine areas where environmental effects would be minimal. Create prioritization in the mission of the NRCS Watershed Rehabilitation Program to increase water supply for agriculture uses. Funding will need to be increased and match requirements will need to be set. For context, NRCS spent 23 million in FY 2014 and is slated to spend 13 million in FY 2014 on this program- funding under this proposal may need to be increased beyond that.

12. Require Secretary of Corp and Director of Bureau to study and set a road map on how to increase water supply in the arid West over the next ten years. Road map should establish funding requirements, potential private partnerships, regularly reporting to EPW, and water supply goals. First report on road map to be delivered to EPW within 18 months of bill passage.

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[37] H.R. 3980 and companion bill S.2427. The Water Supply Permitting Coordination Act. "In Wyoming, we spent more than 14 years securing permits for the High Savery Project, a small dam project that was built in less than two years. On the High Savery Project, the lead federal agency wasted a great deal of time making decisions on the project and at times seemed unable to make decisions. These delays not only postponed the project, they incurred unnecessary costs. Senator Barrasso's bill will help address these types of problems by providing equal footing for state agencies with all federal agencies, resulting in unified environmental documentation and a streamlined permitting process." A similar streamlining concept was undertaken for water infrastructure within the Water Resources Reform and Development Act of 2014, Pub.L. 113-121 at sections 1001-1007.

[38] Rep. Doug LaMalfa (R-CA-01) and Rep. John Garamendi (D-CA-03) announced the introduction of HR 1060, which will accelerate the completion of a feasibility study of Sites Reservoir and authorize the project should it be found feasible. Located in Colusa and Glenn counties, Sites Reservoir is a proposed off-stream reservoir that would store as much as 1.8 million acre feet of water for cities, agriculture and the environment.

[39] Many states like California and Colorado have already identified dam expansion or dam height increases that could supply large water volumes. "In many cases, it may be more particular and efficient to reallocate or enlarge an existing dam and reservoir than to build a new structure." Water Supply Management. Colorado's Water Plan Chapter 6. Resource Management Strategies; Surface Water Storage (Regional/ Local) Surface Water Storage (CALFED/State. Chapter 13 & 14. California Water Plan. 2014 Update; Developing water resources to expand available supply. New Mexico State Water Plan, Office of State Engineer. Interstate Stream Commission. December 23, 2003 (page 7).

[40] Developing water resources to expand available supply. New Mexico State Water Plan, Office of State Engineer. Interstate Stream Commission. December 23, 2003 (page 7); California Water Plan, Resource Management Strategies. Groundwater/Aquifer Remediation. Chapter 17. 2014 Update; Arizona Water Atlas Volume I, Hydrology. Ground Water Hydrology at page 10; Colorado's Water Plan, Managing Our Water: Executive Summary, Water Supply Management at Chapter 6.

[41] H.R. 291/ S 176- Water in the 21st Century Act 113th Congress (2015-2016) (Section 241).

13. Return the Bureau of Reclamations mission to prioritize irrigation of arid lands as its main purpose. Reclamation's original mission under the 1902 Reclamation Act has expanded from just watering arid lands to multifaceted endeavors. Today, Reclamation's responsibilities extend to generating hydroelectric power, delivering reliable and clean water supplies to municipalities and industries, regulating river flows for navigation, protecting lives and property from floods, and exploring ways to improve water quality and preserve wetlands and habitation for fish and wildlife. The Bureau has evolved into a contemporary water management agency with a conflicting mission not only "to manage, develop, and protect water and related resources" in the West, but to do it "in an environmentally and economically sound manner in the interest of the American public." It may be prudent to return the Bureau to its original mission or at least require that allocation to consumptive uses (municipal, industrial, agricultural) have priority over environmental or power uses during drought declarations (i.e. federal projects on San Joaquin , Missouri, Colorado, Klamath and Rio Grande).

14. Explore the establishment of a "Western Water Trust Fund" for low-interest loans for specifically targeted water conservation and efficiency programs/projects. Section 73-10-1(7) of the Utah Code provides revolving funds to give technical and financial assistance to water users to achieve the highest beneficial use of water resources in the state. This financial assistance is provided by the Utah Board of Water Resources through three revolving loan funds: the Revolving Construction Fund, the Cities Water Loan Fund, and the Conservation and Development Fund. Funding is available for projects that conserve, protect, or more efficiently use current water supplies, develop new water, or provide flood control. The Utah Board requires that the revolving loans be repaid, making funds available for subsequent loans. The federal government could develop a similar program modeled upon this approach.

b. Directives to Increase Water Availability by Focusing Agencies on Drought Management.

1. Require the U.S. Geological Survey (USGS) to establish an open water data system. Direct the Secretary of the Interior, through the U.S. Geological Survey (USGS), to establish an open water data system that improves water data availability, enhances data use, and ensures timely distribution of water data and information. This data system would support water management, research, education, assessment, and monitoring. Require the Secretary to integrate water data into a national data framework; identify water data and information needs; support water data sharing, research, and educational programs; and encourage cooperation among State, local, and tribal governments, communities, education institutions, and the private sector related to water data and information. [42]

2. Conduct analysis of how forestry and forest management practices will increase water supply in watersheds, including modeling research on relationships between fire, forest

[42] H.R. 291/ S 176- Water in the 21st Century Act 113th Congress (2015-2016) (Section 301).

thinning, and the resultant impacts on water supply. Forest thinning and clearing increases surface and ground water yield by reducing evapotranspiration from tree canopies thus increasing available water.[43] Department of the Interior and its bureaus such as the USGS, Department of Energy, and National Science Foundation should be tasked with this report and the report should include a plan of action that would implement any forest management practices that are found to benefit water supply. This plan of action should include deadlines and potential water supply gains. Secondary impacts of these practices will include fire suppression, fragile ecosystem, and endangered species survival.

3. Direct the Army Corp, Bureau of Reclamation, & USFWS to conduct to develop and implement a plan on invasive species that may be impeding water delivery or supply. These efforts should balance invasive removal efforts with an emphasis on restoration of native plants and the river processes that sustain them. These two agencies should increase and coordinate the removal of invasive plants that negatively impact the natural water cycle and native plant and animal endangered species (examples are tamarisk/salt cedar, Russian Olive, Golden Algae, and other phreatophytes). In order to be effective, removal efforts and native species restoration will require action not only on federally controlled lands but also require coordination and efforts with state, local and tribal governments and private landowners. Moreover the Dept. of Interior should 1.) expand research into water consumption by non-native and native phreatophytes to improve the understanding of effects of vegetation management on river basin hydrologic budgets[44] and 2.) support the efforts of the Sevilleta Long-Term Ecological Research (LTER) Program that is currently measuring long-term patterns of tamarisk water use under varying climates and hydrology.[45]

4. Reauthorize and Amend the Water Resources Research Act of 1984 to provide grants for applied water supply research at the water resources research and technology institutes established under that Act at each state. Authorize $9 million for each of fiscal years 2015 through 2020.[46]

5. "Advances in metrology, hydrology, and dam engineering make it possible to reassess reservoirs and potentially capture excess flood storage for use as active storage."[47] Require Sec. of Army and Director of the Bureau at the request of any non- Federal sponsor of a reservoir or storage project to study and revisit water control manuals, rule curves, weather forecasting in order to maximize water deliveries.[48]

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[43] James Shanley & Beverly Wemple, Water Quantity and Quality in Mountain Streams, 26 VTL Rev. 717 (2011)
[44] Policy Options from the New Mexico Water Resources Research Institute's 57th Annual
New Mexico Water Conference Hard Choices: Adapting Policy and Management to Water Scarcity, page19-20 found at http://www.tomudall.senate.gov/files/documents/SenUdallWaterConferenceReport.pdf
[45] *Id.*
[46] H.R. 291/ S 176- Water in the 21st Century Act 113th Congress (2015-2016) (Section 302); Policy Statements. Section C.14: Promote collaboration with and strategic focusing on the research and development national laboratories and research institutions to address state's water challenges and t bring states demonstration projects in ...technological approaches to enhancing water supply. New Mexico State Water Plan, Office of State Engineer. Interstate Stream Commission. December 23, 2003 page 56.
[47] Water Supply. Water Supply Management. Colorado's Water Plan Chapter 4, at page 64.
[48] HR 4239 To provide drought assistance to the State of California and other western states, 113th congress Section 9; H.R. 291/ S 176- Water in the 21st Century Act 113th Congress (2015-2016) (Section 304).

6. Streamline NEPA requirements for all transfers in all states. Water transfers of water deliveries within the Reclamation system can take up to 3 years to approve because of the environmental reviews. During a drought, 3 years is too long. [49]

7. Give Warren Act authority to all water districts looking to store water during surplus years. [50]

8. Direct the USFWS or NOAA to address all high AND medium threats listed in Recovery Plans of Endangered Species and referenced by the Biological Opinions of water control, delivery, or storage structures. The goals of this directive would be to 1.) increase species populations effected by water infrastructure and 2.) by so doing increase take limits thus increasing delivery rates and allocations. Many states have identified that federal environmental mandates have curtailed their ability to provide water to their users.[51] Currently federal agencies typically ONLY address the highest "threat" of water supply or delivery to aquatic species. The status quo of only addressing one threat to an endangered aquatic species is not helping aquatic species recover and while those species are in limbo it is costing billions in economic activity.

9. Require the USFWS and/or NOAA to design a conservation banking and/or Recovery Credit Program to offset western pumping or water delivery projects that have been listed as a "threat" to endangered species in Endangered Species Recovery Plans and referenced by their respective Biological Opinion. These programs should be required to be included into any future Biological Opinions of water delivery projects and should be retroactively be required to be added to past Biological Opinions restricting western water delivery. Conservation Banking and Recovery Credit Programs are proven concepts and are allowable under Section 7 and a net benefit under Section 10 of the ESA. These restoration tools have been around since 2003 and 2007 respectively.[52] Each of these programs allow private or public entities "to receive credit for recovery measures (or mitigation) being carried out in an effort to offset adverse effects that may result from activities".[53] Currently private or public entities must apply for these types of programs through a burdensome process, but if predesigned in the Biological Opinion it

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[49] *"Effective water management will require...streamlining the administration process for transfer of water rights to ensure timeliness and responsiveness to filed application".* Clear Vision and Policy Direction for Active Management of States Waters. New Mexico State Water Plan, Office of State Engineer. Interstate Stream Commission. December 23, 2003 page 16; HR 1837 Sacramento San Joaquin Valley Water Reliability Act Rep Nunes; Bureau of Reclamation. Managing Water in the west. Water Transfers Brochure Guidance and Information for Water Transfers
http://www.usbr.gov/mp/watertransfer/docs/Action10_WaterTransfers_BROCHURE.pdf

[50] HR 3964 Sacramento San Joaquin Valley Emergency Water Delivery Act 113th congress Section 112.

[51] "New Mexico must take control of this vital resources when nature is pinching supplies through drought and man-made issues- from endangered species matters to interstate water conflicts- are further threatening or squeezing those already dwindling supplies." Introduction. New Mexico State Water Plan, Office of State Engineer. Interstate Stream Commission. December 23, 2003 page 1; Water Supply Availability may similarly trend "lower" or "higher" depending on climate change, watershed hydrology, and legal constraints associated with Colorado's interstate compacts, water law, and environmental regulations." Water Supply Management. Colorado's Water Plan Chapter 6 (page 94); "The pumping restrictions resulting from biological opinions have significantly affected the opportunities for cropland idling and cropland shifting water transfers." Water Transfers. Resource Management Strategies. Chapter 8. California Water Plan. 2014 Update (page 8-7)

[52] Guidance for the Establishment, Use, and Operation of Conservation Banks https://www.fws.gov/endangered/esa-library/pdf/Conservation_Banking_Guidance.pdfMAy 2 2003

[53] Third Party Evaluation of the Recovery Credit System Proof of Concept Robertson Consulting Group, Inc. March 2010.

may be a catalyst to the voluntary involvement for the public and private sector to implement these tools. [54]

10. Encourage better coordination with agricultural water releases among the U.S. states as part of river compacts with IBWC, which handles water releases for Mexico. In 2012, early releases of water for Mexico, due to drought conditions, led to greater losses of water through bed seepage, than when the releases for Mexico, Texas, and EBID are combined. A lack of communication and coordination resulted in controversy that should not be repeated.[55]

11. Allow for temporary water transfers as a solution under the ESA and for Tribal water settlements, to avoid the need for more onerous "command and control" regulation to protect threatened and endangered species or to resolve other longstanding conflicts. Such transfers from irrigation districts to address the needs of listed or candidate species should include "safe harbor" type assurances, similar to voluntary Candidate Conservation Agreements with the Fish and Wildlife Service (FWS). These transfers should, however, focus on ecosystem benefits (such as river and riparian health), rather than on a single species.[56]

IV. Conclusion

On behalf of Western Growers and our members operating in California, Arizona, Colorado, Nevada and New Mexico, I thank the Committee for the opportunity to provide comments on current drought conditions impact on agriculture, as well as providing an opportunity to inform the Committee about steps agriculture is taking to use both less water and use what water we have more efficiently. Western states face a crisis point and while producers are adapting as best they can, the federal government can and must do more.

We look forward to working with the Committee on this issue.

Sincerely,



Tom Nassif

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[54] "This system will make it easier for other federal agencies to reach out to the American people and work with landowners to do what we can't do alone." Fish and Wildlife Service Director H. Dale Hall; Endangered and Threatened Wildlife and Plants; Recovery Crediting Guidance Notices Vol. 70, No. 148:

[55] Policy Options from the New Mexico Water Resources Research Institute's 57th Annual New Mexico Water Conference Hard Choices: Adapting Policy and Management to Water Scarcity at page 12-14 found at http://www.tomudall.senate.gov/files/documents/SenUdallWaterConferenceReport.pdf.

[56] *Id*. at page 16.

United States Senate Committee on Energy and Natural Resources
Testimony of Gary W. Darling, General Manager of Delta Diablo and
Lead Agency of the Western Recycled Water Coalition
June 2, 2015

Chairman Murkowski and Members of the Committee, my name is Gary Darling and I am the General Manager of Delta Diablo in Antioch, California, lead agency for the Western Recycled Water Coalition. I appreciate the opportunity to submit this testimony on behalf of the Western Recycled Water Coalition (WRWC), which includes 22 cities, water and wastewater districts, and an investor-owned water utility representing over 3.8 million people across California's San Francisco Bay Area, Delta, Central Valley, and Central Coast, and which is currently developing recycled water projects that will provide over 100,000 acre-feet annually.

California is currently facing one of the worst droughts on record, characterized by widespread and substantial shortages of well and reservoir water, significant cutbacks and water use restrictions. Last month, the State Water Resources Control Board, for the first time ever, adopted an emergency regulation requiring an immediate 25% reduction in overall potable urban water use statewide.[1] Also for the first time, water and drought are seen as the most important state issue for surveyed Californian's (39%), followed by jobs and the economy (20%).[2]

The financial impact of drought has been in the billions[3]. The agricultural industry has been one of the hardest hit since droughts have a substantial impact on livestock and crops, which in turn have affected job loss and increased food costs. Manufacturing, energy, and water utilities have also felt the pain of water shortages[4]; but, California is not alone. Most of the Western United States is in some form of drought[5]. These prolonged, dry conditions severely strain water supplies for all users, and threaten increased risk of damaging and deadly wildfires[6].

What differentiates the current water crisis from droughts of decades past is that many of the easiest steps have already been taken. The water efficiency of fixtures such as showerheads, toilets and washing machines has improved significantly over the years. Community education programs that began as early as elementary school have helped increase awareness of water conservation. Unfortunately, these steps, while important, are not enough. It will take more than remembering to turn off the faucet while brushing your teeth, for example, to solve the current and predicted water shortages. Even with these efforts, the California Department of Water Resources predicts that by 2020, California will experience water shortages of 2.4 million acre-feet (MAF) in an average water year and 6.2 MAF in drought years[7]. Short-term solutions, such as temporary restrictions and rationing, are no longer sufficient. Now is the time for a serious commitment to one of the most reliable and drought-resistant water sources that can be made available in a relatively short time – recycled water.

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[1] http://www.waterboards.ca.gov/press_room/press_releases/2015/pr050515_water_conservation.pdf
[2] http://www.ppic.org/main/pressrelease.asp?i=1784
[3] http://www.recordnet.com/article/20150602/NEWS/150609904
[4] http://fortune.com/2015/04/09/6-industries-hurt-the-most-by-the-california-drought/
[5] http://droughtmonitor.unl.edu/
[6] http://thinkprogress.org/climate/2015/06/03/3665076/2015-wildfire-preview/
[7] http://www.waterplan.water.ca.gov/previous/b160-98/TOC.cfm

In addition to efficiently reusing and developing new water supplies, recycled water provides considerable benefits. These include reducing diversions from natural waterways and aquifers; providing drought-tolerant, sustainable water supplies for industry, agriculture, landscape, and wetlands enhancement; improving surface water quality; saving energy; attracting green projects and increasing economic development; and, supporting much needed jobs. The drought has increased the popularity and need for recycled or reclaimed water projects. What was once considered mere waste is now a valuable resource as communities scramble to meet the challenges of the drought and maximize the efficiency of their water use.

Agencies across the United States are developing recycled water projects and supplies to help meet water needs for urban, agricultural, environmental, and industrial uses and for groundwater recharge. A recent nationwide recycled water project survey undertaken by the WRWC, National Association of Clean Water Agencies, WateReuse Association, California Association of Sanitation Agencies, and Association of California Water Agencies showed that 92 agencies located in fourteen states across the country are currently developing recycled water projects that will provide approximately 900,000 acre-feet of new water annually[8]. This volume of water is equivalent to meeting the water needs for approximately 2.7 million people – equivalent to the populations of San Jose, California; San Antonio, Texas; and, Jacksonville, Florida combined. However, with estimated costs of $6.4 billion, the survey identified that the projects are in need of $2.8 billion in financial assistance to construct these projects. Many of these projects have been planned and have completed feasibility studies through the U.S. Bureau of Reclamation (USBR), but they are not eligible for Federal construction funds because the current USBR process requires that projects be authorized first by Congress. This has created a catch 22 situation – projects need authorization to secure funding but can't get authorization because of the earmark ban. We don't understand why prior individual project authorization is a necessary prerequisite to funding, especially during a near crisis drought situation.

Accordingly, as the Committee considers drought legislation, we would respectfully request that it provide as much programmatic flexibility as possible, including funding eligibility for recycled water projects whether authorized or not (see subject letter attached). In addition, we would encourage the Committee to give serious consideration to reforming the current Title XVI program. By all accounts, it is broken: the annual appropriation to the program is abysmal; the backlog is growing; new ready-to-go projects are barred by the prior authorization requirement; and, the program is limited to only part of the country. We need a new approach. We need a fresh approach. We need a bold approach. That's why our Coalition has proposed a new national recycled water grant program administered by the EPA, modeled after the TIGER program, and financed by offsets (see draft bill attached).

Members of the Committee, our Coalition is actively working to implement critical water recycling projects and to promote viable water recycling programs. To date, projects have been undertaken by Coalition members resulting in over 35,000 acre-feet of much-needed recycled water being supplied annually to communities and businesses[9], and Coalition members are currently planning new projects to provide over 100,000 acre-feet annually[10]. WRWC projects

[8] http://www.westernrwc.org/
[9] http://www.westernrwc.org/projects.html
[10] http://www.westernrwc.org/files/WRWC%20Brochure.pdf

are ready to deliver – having feasibility studies and CEQA/NEPA completed or well underway. The projects will use the latest in water resource recovery and recycling technology, treating wastewater to high standards that allow it to be reused for many purposes. WRWC projects will supply clean water for irrigation of parks, school grounds, and government facilities; for cooling processes for power plants, data centers in Silicon Valley, and other manufacturing facilities; for growing crops in the fertile Central Valley and Monterey, and grapes in the Napa Valley; for environmental restoration; and, supplementing potable supplies. And, there are many more opportunities for us to be active leaders in addressing the growing importance of water reuse, but we can't do it alone. Federal funding and support are of a paramount importance to developing these reliable, recycled water supplies to the benefit of citizens in a far broader geography than simply the communities our agencies serve.

Thank you.



June 11, 2014

The Honorable Dianne Feinstein
United States Senate
331 Hart Senate Office Building
Washington, D.C. 20510

The Honorable David Valadao
1004 Longworth House Office Building
Washington, D.C. 20515

SUBJECT: REQUEST TO ALLOW SHOVEL READY RECYCLED WATER PROJECTS NOT PREVIOUSLY AUTHORIZED TO BE ELIGIBLE FOR DROUGHT RELIEF FUNDING

Dear Members of Congress:

We write to request that when a conference agreement is reached on the Sacramento-San Joaquin Valley Emergency Water Delivery Act (H.R. 3964) and the Emergency Drought Relief Act of 2014 (S. 2198), that it provide for federal grants assistance to develop recycled water projects that are ready to proceed to construction regardless of whether or not they have been previously authorized by Congress under the Bureau of Reclamation's Title XVI Program. Many "ready-to-go" recycled water projects throughout California and the nation can provide critical water supplies very quickly, but are hampered by prior federal project authorization requirements and limited funding assistance through Title XVI. A decision to address this issue and leverage local resources would provide the vital funding path needed to construct these projects during this drought emergency.

A recent nationwide recycled water project survey undertaken by the Western Recycled Water Coalition in conjunction with the Association of California Water Agencies (ACWA), California Association of Sanitation Agencies (CASA), National Association of Clean Water Agencies (NACWA) and WateReuse Association documented that 92 agencies in 14 states across the country are developing recycled water projects that will provide over 900,000 acre-feet of additional water supply. These public agencies are investing in recycled water projects totaling over $6 billion. They are seeking $2.8 billion in financial support. In California, the survey results revealed that 64 agencies are planning and designing recycled water projects that would produce over 528 TAF at a cost of $5.6 billion. While this work is underway, the survey also indicated that almost half of these projects require federal financial support to proceed to construction and deliver benefits.

The challenge that our communities confront is many of these projects have completed feasibility studies, but are stalled because Congress has not authorized any new projects under

the Title XVI program in over four years. For example, only ten of the 92 survey projects are authorized to participate in the program. Again, this constraint is attributable to the lack of specific authorization for the Secretary of the Interior to allow for funding of a project to proceed to construction, even if it is demonstrated it would help to ameliorate drought impacts such as public health and economic stability.

It is important to note, we are asking - only for the duration of the drought - that the Secretary of the Interior be provided authority (similar to that provided to USACE under the recently passed Water Resources Reform and Development Act) to approve and financially support construction of water recycling facilities without regard to project authorization.

Constructing these recycled water projects will deliver multiple benefits ranging from improved and increased water supply reliability to improved ecosystems to enhanced economic stability and growth.

Again, we urgently request that you and your colleagues ensure that any final drought legislation contain provisions to allow recycled water projects not previously authorized to be eligible for drought relief funding.

Sincerely,

Gary W. Darling, General Manager, Delta Diablo, and
Lead Agency for the Western Recycled Water Coalition

Roberta L. Larson, Executive Director,
California Association of Sanitation Agencies

Melissa L. Meeker, Executive Director
WateReuse Association

Ken Kirk, Executive Director,
National Association of Clean Water Agencies

Timothy H. Quinn, Executive Director
Association of California Water Agencies

GWD/dcj

cc: Senator Barbara Boxer
Senator Ron Wyden
Senator Brian Schatz
Speaker John Boehner
Majority Whip Kevin McCarthy
Representative Ken Calvert
Representative Tom McClintock
Congressman Jeff Denham
Representative Devin G. Nunes
Minority Leader Nancy Pelosi
Representative Jim Costa
Representative Doris O. Matsui
Representative Eric Swalwell
Representative Doug LaMalfa
Representative Grace Napolitano
Representative Jim Costa
Representative John Garamendi
Representative Jared Huffman
Western Recycled Water Coalition Members
File P.90024.03.04
Chron File

NATIONAL WATER RECYCLING AND RECLAMATION ACT

SEC. 1. Short title - This Act may be cited as the "National Water Recycling and Reclamation Act."

SEC. 2. Program Establishment

There is established within the United Stated Environmental Protection Agency (EPA) the National Water Recycling and Reclamation Program to distribute funds appropriated pursuant to this Act as discretionary grants to be awarded to eligible entities on a competitive basis for water recycling and reclamation projects.

SEC. 3. Definitions

1. ELIGIBLE PROJECT COSTS. - The term "eligible project costs" means amounts substantially all of which are paid by, or for the account of, an eligible entity in connection with a project, including the cost of -
    A. development phase activities, including planning, feasibility analysis, revenue forecasting, environmental review, permitting, preliminary engineering and design work, and other preconstruction activities;
    B. construction, reconstruction, rehabilitation, replacement, and acquisition of real property (including land related to the project and improvements to land), environmental mitigation, construction contingencies, and acquisition of equipment;
    C. capitalized interest necessary to meet market requirements, reasonably required reserve funds, capital issuance expenses, and other carrying costs during construction; and,
    D. reimbursement for eligible project costs incurred prior to the enactment of this Act.
2. ELIGIBLE ENTITIES. -The term "eligible entities" means a corporation, partnership, joint venture, trust, public or investor-owned utility, private entity, governmental entity, agency, or instrumentality, or any other reclamation and reuse entity.
3. PROJECT. - The term "project" means a project carried out by the EPA and an eligible entity for water recycling or water.
4. EPA - The term "EPA" means the Environmental Protection Agency of the United States.

SEC. 4. Determination of eligibility and project selection

a. ELIGIBILITY. - To be eligible to receive financial assistance under this Act, a project shall meet the following criteria:
   1. APPLICATION. - An eligible water reclamation and reuse entity undertaking the project shall submit a project application to the EPA.
   2. MINIMUM ELIGIBLE PROJECT COSTS. - To be eligible for assistance under this Act, a project shall have eligible total project costs that are reasonably anticipated to exceed $1,000,000.
   3. DEDICATED REVENUE SOURCES. - To be eligible for assistance under this Act, a project shall have a demonstrated source of non-Federal revenues to satisfy the non-Federal share.

b. SELECTION AMONG ELIGIBLE PROJECTS. -
   1. ESTABLISHMENT. - The EPA shall establish criteria for selecting among projects that meet the eligibility requirements specified in subsection (a).
   2. SELECTION CRITERIA. -
      A. IN GENERAL. - The selection criteria shall include the following:
         i. The extent to which the project addresses near and long term water demand and supplies, protects the environment, increases water supply, or otherwise enhances the overall water reclamation and reuse system
         ii. The extent to which the project enhances the return on the Federal investment through the production of new, highly renewable water supplies.
         iii. The likelihood that assistance under this Act would enable the project to proceed at an earlier date than the project would otherwise be able to proceed.
         iv. The extent to which the project uses measures and that enhance the efficiency of the project.
         v. The amount of budget authority required to fund the Federal credit instrument made available under this Act.

      B. TIMING. –The EPA shall (1) publish criteria on which to base the competition for any grants awarded under this Act not later than 90 days after enactment of this Act; (2) require applications for funding to be submitted not later than 180 days after publication of such criteria; and, (3) announce all projects selected to be funded

from such funds not later than one year after enactment of this Act.

SEC. 5. Federal Share

In recognition of the return on investment of a project through the production of new, highly renewable water supplies, the Federal share shall be 80 percent of the reasonable anticipated eligible project costs.

SEC. 6. Regulations

The EPA may issue such regulations as the EPA determines appropriate to carry out this Act.

SEC. 7. Funding

a. FUNDING. -
    1. IN GENERAL. - There is authorized to be appropriated $500 million for each of FY16-20 to carry out this Act.
    2. AVAILABILITY. - Amounts made available to carry out this Act shall remain available until expended.
    3. ADMINISTRATIVE COSTS. - From funds made available to carry out this Act, the EPA may use, for the administration of this Act, not more than 2 percent for each year.

SEC. 8. Funding Offset

a. SUBMISSION OF PROJECT LIST.- On or before October 1, 2015, the EPA shall submit to Congress a list of recycled water projects or separable elements of such projects that have been authorized but that have received no obligations during the 5 full fiscal years preceding the submission of that list.
b. ADDITIONAL NOTIFICATION. - On submission of the list under subparagraph (A) to Congress, the EPA shall notify -
    1. Each Senator in whose State and each Member of the House of Representatives in whose district a project (including any part of a project) on that list would be located; and,
    2. Each applicable non-Federal interest associated with a project (including any part of a project) on that list.
c. DEAUTHORIZATION. - A project or separable element included in the list under subparagraph (A) is not authorized after the last date of the fiscal year following

the fiscal year in which the list is submitted to Congress, if funding has not been obligated for the planning design, or construction of the project or element of the project during that period.

SEC. 9. Reports to Congress

On October 1, 2016, and every 2 years thereafter, the EPA shall submit to Congress a report summarizing the financial performance of the projects that are receiving, or have received, assistance under this Act.

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