BUREAU OF RECLAMATION

Winter 2022
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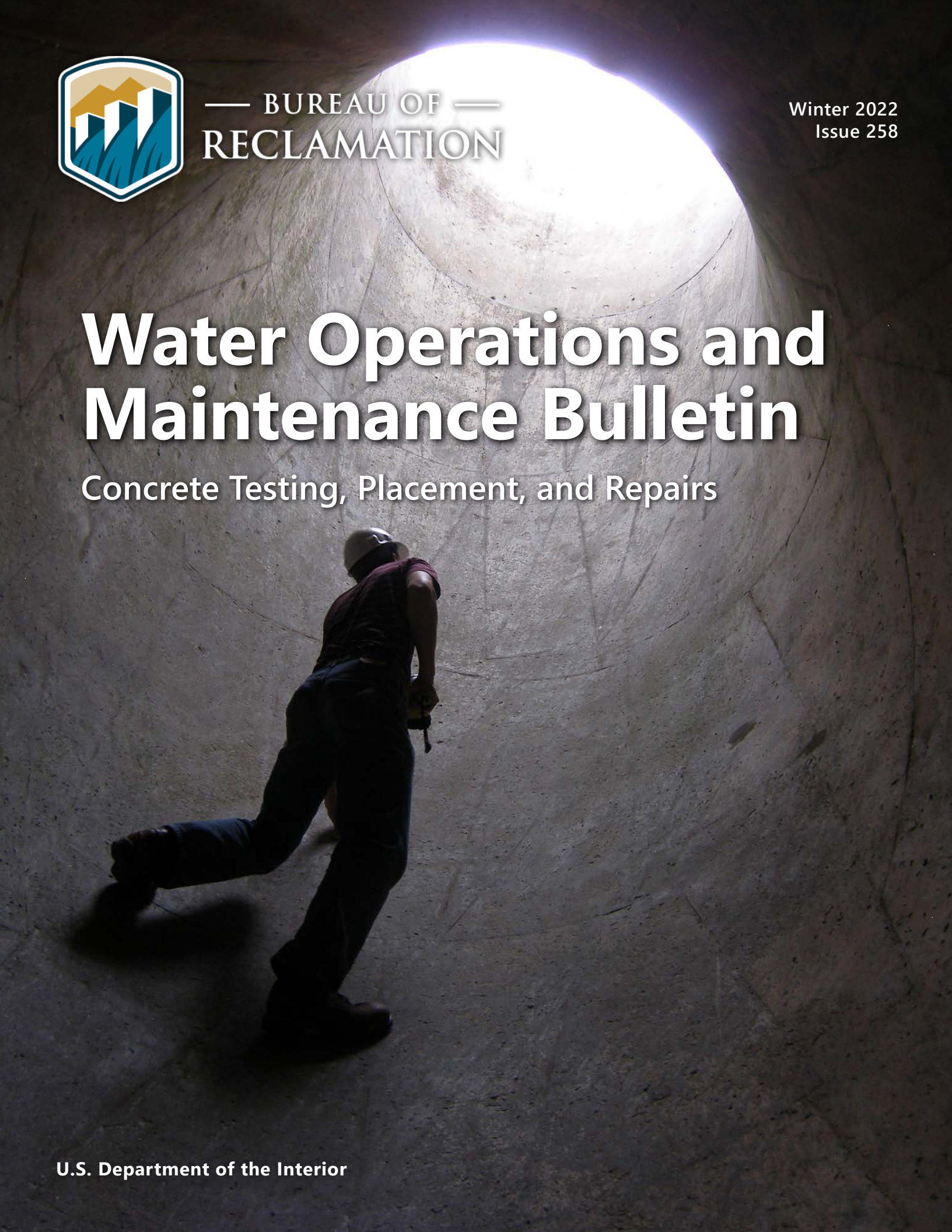
Water Operations and Maintenance Bulletin

Concrete Testing, Placement, and Repairs



U.S. Department of the Interior

Contents

Mission Statement

This *Water Operations and Maintenance Bulletin* is published quarterly through the Asset Management Division of the Dam Safety and Infrastructure Directorate. It serves as a medium to connect personnel who operate and maintain Bureau of Reclamation water supply systems.

History

The *Water Operations and Maintenance Bulletin* has been published quarterly since 1952. Past issues may be read and downloaded at Water Operations and Maintenance Bulletins, where you can also search the entire bulletin database by subject.

Contact

We welcome suggestions for future issue topics, contributing authors, and comments on the *Bulletin*. Please direct all inquiries to drowateroandm@usbr.gov.

Cover photo: Bureau of Reclamation employee inspecting the Inverted Bell Spillway at Cheney Dam, Kansas (Reclamation/Adam Milligan).

Editor's Note

Over the last several months, getting back into the field and to trainings has helped promote networking and collaboration. Several of this issue's articles originated in casual conversations outside of the day's business. Reclamation's people are constantly innovating, elevating, and implementing their craft, and this dedication comes across whether walking a spillway bridge or talking over a meal. It's an honor to work with such remarkable contributors to this *Bulletin*.

Our Winter 2022 issue highlights work being done through the Technical Service Center's Concrete and Structural Laboratory (CSL). Across three articles, CSL subject matter experts (SMEs) discuss high-capacity and complicated structural testing, cold weather concreting and tips for success, and crack mapping and concrete repair. These articles explore concrete testing and assessment capabilities in the CSL, best practices for placement under varying conditions, and the importance of proper monitoring and repairs. Outside of the CSL, "Water Operation Considerations Across Highly Variable Basins" examines how the Western Colorado Area Office manages a wide range of needs to fulfill its mission to deliver water. And finally, "Water Rights Information Management System" describes the creation of the first Reclamation-owned, centralized water rights database and the features it will provide users.

We owe a special thank you to Deputy Commissioner Michael Brain for participating in our Q&A. He spoke to us about his interdisciplinary education and past work for Congress, putting robust appropriations into action, and publicizing work that is often "out of sight and out of mind." Happy holidays!

Darion Mayhorn, P.E.
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Writer-Editor
Dam Safety and Infrastructure

Photo (right): Ice forming inside the Heart Butte Dam conduit 15 miles south of Glen Ullin, North Dakota (Reclamation/David Herr).

Around O&M

- **The Inflation Reduction Act of 2022 –** Public Law 117-169 includes $4 billion in funding for water management and conservation efforts in the Colorado River Basin and other areas experiencing similar drought. The Lower Colorado River Basin System Conservation and Efficiency Program, funded with an initial allocation through the Inflation Reduction Act and managed through Reclamation, will help increase water conservation, improve water efficiency, and prevent System reservoirs from falling to critically low elevations that threaten water deliveries and power production. The Department of the Interior is also working to invest in long-term system efficiency improvements, including at least $500 million in the Upper Basin states of Colorado, Utah, Wyoming, and New Mexico.
- **Enterprise Asset Registry –** The Recreation and Boat Ramp Asset Classes are undergoing regional review (December-February) for over 200 managements areas, 1,000 recreation sites, and 400 boat ramps. The Pumping Plants Asset Class is also undergoing regional review of over 800 pumping plants. Training sessions were held in November and December for SMEs for each asset class. In addition, the Bridge Asset Class was finalized and moved to active management in November.
- **Reclamation Bridge Training –** Reclamation's Asset Management Division is hosting a training in Boulder City, Nevada, January 11-13, 2023, for Reclamation staff involved with the operations and maintenance of Reclamation-owned bridges and those that otherwise cross Reclamation facilities. The training will cover a variety of topics including the Reclamation Bridge Inventory, inspections, load ratings, replacement projects, funding opportunities, railings, and others.

Not Just Concrete: High-capacity and Complicated Structural Testing

Katie Bartojay, P.E., FACI
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Westin Joy, P.E.
Civil Engineer, Concrete and Structural Laboratory, Technical Service Center

Reclamation's iconic 5,000,000-Pound Testing Machine.

Although better known for its concrete excellence, the Bureau of Reclamation's (Reclamation) Concrete and Structural Laboratory (CSL) is accomplished in the field of high-capacity and complicated structural testing. Located at Reclamation's Technical Service Center (TSC) in Denver, the CSL performs custom fabrication for scaled or full-scale testing of materials, structural members, and building components. CSL has multiple universal testing machines that apply loads in compression and tension. The three main workhorses in the laboratory weigh in with a capacity of 120,000 pounds, 674,000 pounds, and 5,000,000 pounds. The 5,000,000-pound machine, the icon of the TSC laboratory, has stood its ground at the CSL since 1948 and can test samples up to 30 feet tall. In addition, CSL also houses a vibration lab that is highly customizable and six environmental chambers that can vary sample temperatures from –40°F to 180°F.

The CSL's main focus is to support the TSC and our regions and to help Reclamation make decisions about the materials and building components used for both new and aging mission critical infrastructure.

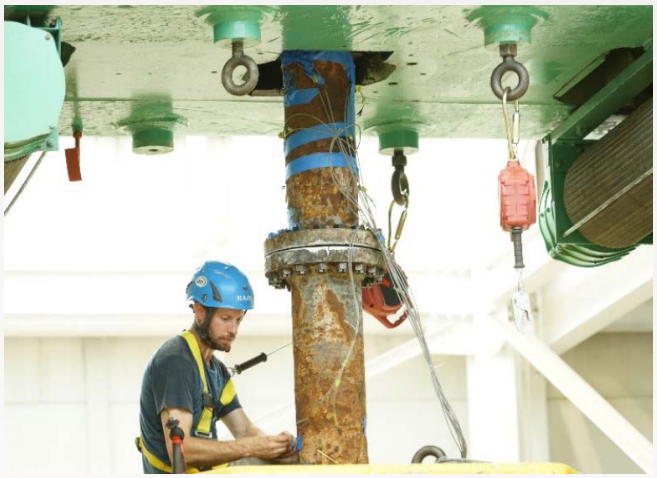
Tensile testing of rebar taken from our existing structures to determine capacity is as standard as breaking concrete cylinders for our engineers. However, CSL recently successfully tested in tension an 8-foot-long by 9.5-inch-diameter steel pipe from the Hoover Dam Intake tower gate stems to determine the capacity of the current gate stems. It was a challenge to attach the strain gages 30 feet in the air, but it's all in a day's work for Caleb Nickel, P.E.!

This testing will help the area office make informed decisions on when replacement may be needed. Research also paves the way for better decision-making. Two important ongoing projects include Bulkhead Optimization Research and Shear Capacity of Cantilevered Concrete Retaining Walls. CSL is assisting the TSC Mechanical Structures group with Bulkhead Optimization Research funded by Reclamation's Science and Technology Program. The Gate Optimization project will support Finite Element Analysis for gate design to verify manual calculations with lab testing. This will help to reduce development costs by improving design efficiency and reducing fabrication costs with lighter-weight designs. We are evaluating bulkhead gates in both steel and fiberglass materials, as these are the more common materials used for construction. CSL is testing one bulkhead in each material for ultimate design capacities.

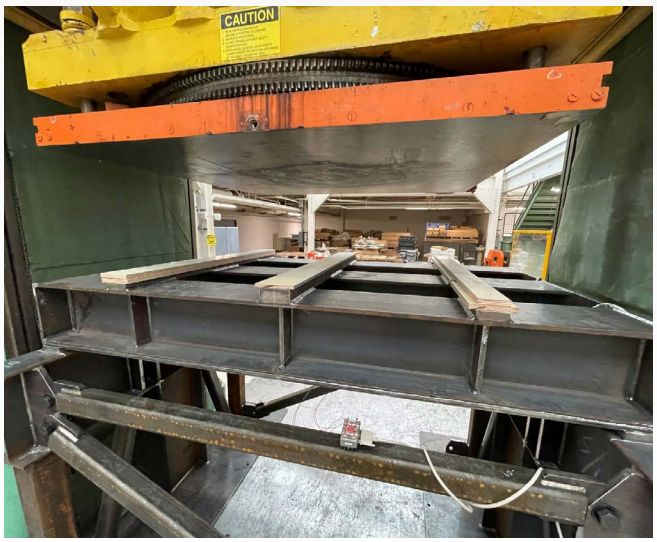
Shear capacity determination testing of Cantilevered Concrete Retaining Walls is a joint effort between CSL, the University of Notre Dame, and Texas A&M University. CSL's effort is funded by the Dam Safety Office's Technical Development Program and will include building and testing a large-scale cantilevered concrete wall section in the lab. Testing will consist of applying a horizontal shear load to assist in the development of more informed building code equations for shear strength.

CSL also makes unique and specialized equipment, along with our structural testing expertise, available to other government agencies and private entities. Recent examples include assisting the Engineer Research and Development Center (ERDC), part of the U.S. Army Corps of Engineers, in testing confined high-strength concrete samples up to a load of 5,000,000 pounds (approximately 65,000 psi applied to the confined sample), and the testing of 30-foot-tall shoring towers for Titan Formwork to help them verify design capacities for construction.

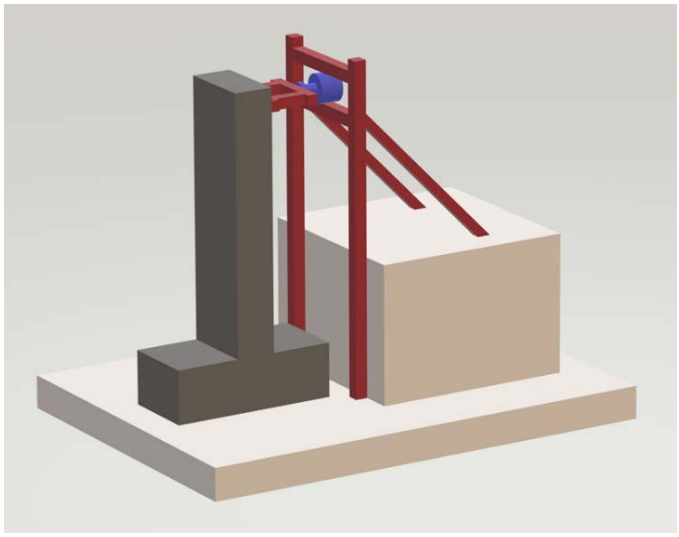
The creativity and talent of the engineers in Reclamation's Concrete and Structural Laboratory provide an endless combination of possibilities for materials and building component testing.



Nickel adding strain gages to gate stems in the testing machine.



Steel bulkhead awaiting testing.



Rendition of 12-foot concrete wall section planned for testing at CSL this winter.

Cold Weather Concreting – Five Tips for Success

Catherine Lucero, P.E., John Archibald, P.E., and Veronica Madera, P.E.
Civil Engineers, Concrete and Structural Laboratory, Technical Service Center

Portions of each Bureau of Reclamation (Reclamation) region experience cold temperatures, and construction schedules commonly require concrete placements when temperatures are low enough to implement cold weather concreting practices. Reclamation's Cast-in-Place Guide Specifications require following cold weather concreting practices described in American Concrete Institute (ACI) 306 Guide to Cold Weather Concreting when the air temperature has fallen, or is expected to fall, below 40°F. Cold weather increases risks and liability for concrete placement, but these concerns can be mitigated by following best practices.

There are five objectives of proper cold weather concreting that can help facilitate quality concrete in cold temperatures.

Objective 1: Prevent Damage Due to Early Age Freezing

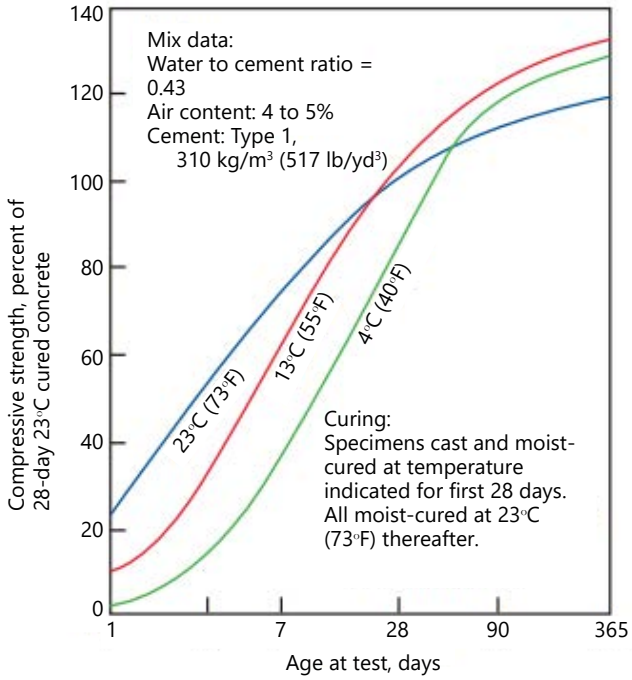
The first objective is to prevent damage due to early age freezing. Water expands as it freezes, and expansive forces are created in the pores of concrete. Concrete is very weak in tension, particularly at early ages after placement, so one freezing cycle could cause cracking due to the internal stress caused by ice formation. To mitigate this, Reclamation's Cast-in-Place Concrete Specifications require the surface temperature to be at least 50°F during the protection period. This can be achieved by using insulated blankets or by tenting the placement and heating. If using a heater, the carbon dioxide from the exhaust must be vented outside of the enclosure so as not to carbonate the concrete surface. It is also important to not let the hot air blow directly across the concrete and dry out the surface. Except within heated

Frozen concrete being removed by excavator after improper early age protection.

protective enclosures, little or no external supply of moisture is recommended during cold weather curing. External moisture can freeze and damage freshly placed concrete. Concrete that is protected from freezing until it attains a compressive strength of at least 500 psi likely will not be damaged by exposure to a single freezing-and-thawing cycle.

Objective 2: Ensure Concrete Develops Required Strength

Concrete strength development is dependent on time, temperature, and moisture. Concrete develops strength through an exothermic (heat generating) chemical reaction between cement and water. When the temperature of freshly mixed concrete is lowered, the reaction rate slows down. As the reaction progresses, the concrete sets and begins to develop strength. If the concrete is placed and cured below about 50°F, cement may not hydrate properly, and the rate of strength development can be significantly delayed. Reclamation's Cast-in-Place Concrete Specifications instruct the contractor to "prepare ingredients and mix in accordance with ACI 306.1." Specifically, "do not use frozen materials or materials containing ice or snow" and "uniformly heat water and aggregates before mixing to obtain concrete mixture temperature of not less than 50°F."



Effect of temperature conditions on concrete strength development (Kosmatka, S.H., & Wilson, M.L. (2011). *Design and Control of Concrete Mixtures* (15th ed.). Skokie, IL: Portland Cement Association).

The time it takes for concrete to harden (setting time) doubles for every 20°F drop in temperature. For example, concrete that has an initial setting time of 5 hours at 70°F would have an initial setting time of about 10 hours at 50°F. This extended setting time leaves the concrete vulnerable to freezing for longer. Using a heated enclosure or adding chemical accelerators can offset delayed setting. Reclamation specifications allow for the use of admixtures that conform to ASTM C494 Type C (accelerating) or E (water reducing and accelerating), provided the admixture does not contain added chlorides. Sufficient strength must be obtained within a few days to remove formwork.

Objective 3: Maintain Curing Conditions that Promote Strength Development

Strength gain stops when moisture required for hydration is no longer available. Concrete curing helps retain its internal moisture so it can achieve a higher ultimate strength and greater durability. There are several curing methods that promote proper hydration. In general, concrete retained in forms and covered with insulation does not lose enough moisture to impair curing. Liquid membrane forming compounds reduce moisture loss and can also be used on concrete surfaces within heated enclosures.

In cold and potentially freezing temperatures, wet curing is often suspended to prevent ice formation on the concrete surface. The hydration process can be stalled if the proper curing methods to retain moisture are not followed.

The protection section of the cast-in-place concrete specifications includes requirements for maintaining temperatures in cold weather. The specification instructs the contractor to "protect concrete when freezing temperatures are imminent," which includes maintaining concrete at a temperature of 50°F or greater for a minimum of 72 hours after placement. It is good practice to monitor the surface temperature of concrete to determine the effectiveness of protection during the protection period. "The protection period is defined as the amount of time recommended to prevent concrete from being adversely affected by exposure to cold weather during construction" (ACI 306). Edges and corners are especially vulnerable to freezing, and it is typically more difficult to maintain required temperatures at these locations. Monitoring these

Damage due to early age freezing. Top surface was tented and heated. Freezing is localized to form panel seams and exterior upper edges of block.

areas could prevent damage like that shown in this article's included images. Ideally, temperature measuring devices are embedded two inches below the surface, but placing thermometers against the concrete provides satisfactory accuracy.

Two field-cured test cylinders are required during cold weather placements. These cylinders are in addition to the standard-cure set of cylinders required for all placements. The field-cured cylinders are to be cured on the jobsite under the same conditions as the cast-in-place concrete for a minimum of seven days before transferring to a laboratory until testing at the design strength age.

Objective 4: Limit Rapid Temperature Changes

Rapid temperature changes can induce stresses large enough to cause thermal cracking, especially at early ages when concrete tensile strain capacity is low. This is called "thermal shock." After the protection period is over, it is important not to shock the concrete by subjecting the heated surface to low ambient temperatures. ACI 306.1 suggests a gradual drop in surface temperature after the protection period. Reclamation specifications are more specific and require a temperature drop of less than 5°F per hour.

Section size, min. dimension	Reclamation		ACI 306.1/306R	
	Protection Period	Gradual Drop in Temp (°F)	Protection Period	Gradual Drop in Temp (°F) in 24-hour period
< 12 in	3 days (min.)	≤ 5°F/hour & ≤ 40°F in 24 hours	3 days (min.)	50
12 to 36 in.				40
36 to 72 in.		≤ 5°F/hour & ≤ 20°F in 24 hours		30
> 72 in.				20

Protection Period and Gradual Drop in Surface Temperature after Protection Period.

Objective 5: Provide Protection Consistent with the Durability of the Structure During its Design Life

Durable concrete can be obtained even during cold weather. According to ACI 306R, "short-term gains in construction economy on concrete protection should not be obtained at the expense of long-term durability." To implement the practices described previously, a concrete preplacement meeting can be held with, but is not limited to, the general contractor, concrete contractor, concrete supplier, and Reclamation personnel including inspectors and resident engineers. The preplacement meeting should cover all aspects of concrete placement, including procedures for cold weather concreting. This is an opportunity to discuss specific procedures and record responsibilities assigned to the appropriate parties. Plans to protect fresh concrete from freezing and maintain temperatures above recommended minimum values should be made well before freezing temperatures are expected to occur. Equipment and materials should be at the worksite before anticipated cold weather. A sample agenda for use during the pre-placement meeting can be obtained on the Reclamation intranet or by emailing cllucero@usbr.gov for those outside of Reclamation.

Heaters are commonly used to elevate the ambient temperature of an enclosure. Exhaust from the heater must be vented out of the enclosure during the protection period. If not properly vented, the surface of the concrete will react with carbon dioxide and form a weak layer of calcium carbonate that will eventually slough off the surface. Additionally, care must also be taken to ensure hot air does not blow directly on the concrete, as this will dry it out and cause premature deterioration.

Cast-in-place concrete for Reclamation projects must come from a National Ready Mixed Concrete Association (NRMCA) certified batch plant. NRMCA inspectors ensure the production facility is capable of producing concrete in cold weather. Cold weather certified plants have hot water heaters or boilers with sufficient heat capacity and adequate storage of admixtures.

Slaking and scaling on formed concrete surface due to hot air blowing directly on the forms, which dried out the concrete underneath.

Crack Mapping and Concrete Repair

Matthew Klein, P.E., Ph.D.
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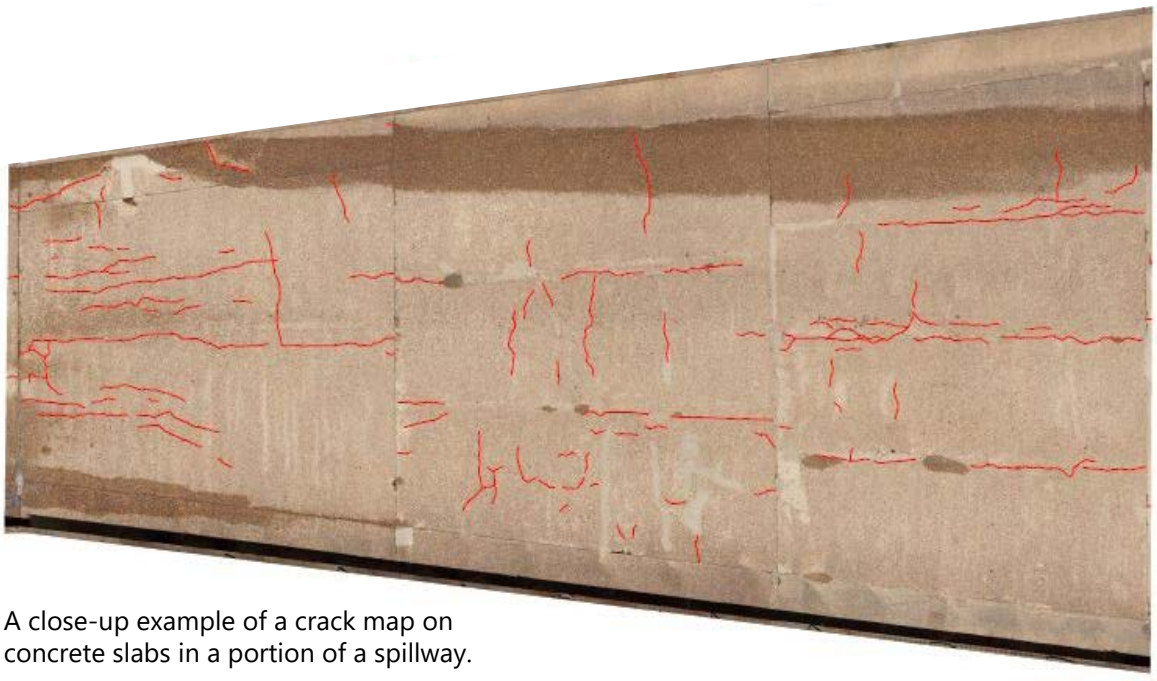
"All concrete cracks." You may have heard such an explanation when you've pointed out a concerning jagged edge running through an otherwise sound stretch of concrete. Contrary to this popular myth, when concrete is properly designed, mixed, and placed, it should only crack where intended – at joints but not at random locations. Even though concrete, like most other civil engineering materials, is subject to length changes due to temperature differentials, concrete is typically designed to limit or withstand cracking due to autogenous shrinkage and drying shrinkage, which occur during the hydration and curing processes of a concrete placement. Other cracks are often the result of foreign or external forces such as freezing and thawing cycles, alkali-aggregate reaction, reinforcement corrosion, sulfate attack, structural overloading, and improper design. So, when cracking is observed, it is appropriate to question the cause of the cracking and attempt to address it.

The Bureau of Reclamation's (Reclamation) Concrete Repair and Maintenance system – outlined in Reclamation's Guide to Concrete Repair – consists of seven basic steps. The first and second steps are to evaluate the 1) cause(s) and 2) extent of cracking. Sometimes the cause and extent of cracking can be determined simply by observing the crack characteristics and taking measurements of the cracks. However, in many cases, the extent of the cracking is better studied by developing "crack maps" of the study area or of the entire structure.

Crack maps are typically created by drawing cracks on scaled drawings of the structure using either measured field observations or photographs. The accuracy of these crack maps is usually low due to assumptions made regarding the shape of the crack, as most cracks are not a straight line. Crack maps can also be generated from a series of high-resolution images that are combined in a mosaic to form a much larger image of an entire surface of a structure, such as the downstream face of a dam or the entire spillway.



A close-up example of a crack map on concrete slabs in a portion of a spillway.

Chemical grout injection in a spillway contraction joint at Vallecito Dam to prevent water inflow leading to uplift pressure.

These crack maps provide a spatial reference to the crack patterns and can be used to help determine the cause of the cracking.

Once the cause of the cracking is determined, the cracks may require repair. Some civil infrastructure can still maintain structural integrity even after cracks form. However, if the crack is wide enough, loss of structural integrity can occur. Such cracks should be repaired using structural epoxy injection and/or by adding additional reinforcement. If the cracking does not affect the structural integrity but allows water to leak through the structure, chemical grouts can be used for stopping water leaks and seepage.

Adding steel reinforcement to strengthen structural members can be accomplished by cutting grooves in the concrete perpendicular to the crack and embedding reinforcement to stabilize the crack. Strengthening also can be done by adding steel on the exterior of the concrete member and increasing the size of the structural concrete to encapsulate and pacify the added steel. The reinforcing steel repair is usually designed by an engineer and installed perpendicular to the crack(s). It is also possible to provide additional reinforcement by overlaying the cracked member with a bonded fiber-reinforced polymer (such as carbon fiber).

The addition of supplementary reinforcement is usually accompanied by one of the two methods of crack injection mentioned above. If maintaining structural load paths across the crack is desired, epoxy injection is preferred. However, epoxies are usually unforgiving to movement; if the structure is not stabilized prior to injection, the epoxy may fail, causing cracks to reform. It is also possible for reflective cracking to form in the concrete parallel to an epoxy-injected crack.

If cracks do not compromise structural integrity, they may still lead to other issues, such as leaking and reinforcement corrosion. These cracks may be sealed using chemical grouts, like polyurethane or methacrylic acrylate (though some solid polyurethanes can be used for structural applications). These chemical grouts are often highly elastic and can resist failure even if there is residual movement across the cracked plane. It should be noted that chemical grout injection can also be successfully used to repair failed expansion joints due to the flexibility of the injected material.

Reclamation's Concrete and Structural Laboratory (CSL) at the Technical Service Center can collect and process crack mapping data using unmanned aircraft systems (UAS) and other methods. The CSL is also experienced in specifying, designing, and, in some smaller projects, executing concrete crack repairs through the use of specialized equipment and chemical grout injection equipment. If you have questions regarding cracks on your structure, don't be satisfied with the misleading assumption that "all concrete cracks." Listen to your engineering judgment: investigate the cause of the crack and repair it! This will not only give you peace of mind but can also extend the overall life of the structure and reduce future maintenance issues.

Water Operation Considerations Across Highly Variable Basins

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Western Colorado Area Office Basin

The Western Colorado Area Office (WCAO) is responsible for Bureau of Reclamation (Reclamation) projects and program activities in western Colorado, northwestern New Mexico, and northeastern Arizona (WCAO Area). Projects are in the Upper Colorado, Gunnison, Yampa, White, Dolores, Uncompahgre, Animas, and San Juan River Basins.

Silver Jack Reservoir (Colorado) on Cimarron Creek about 20 miles above the junction with the Gunnison River.

On the mainstem of the Upper Colorado River and its upper basin tributaries (including the Gunnison, Uncompahgre, and Dolores Rivers), the WCAO provides or oversees the operation, management, and maintenance of several projects: Bostwick Park, Collbran, Dallas Creek, Dolores, Fruitgrowers, Grand Valley, Paonia, Silt, Smith Fork, Uncompahgre, and the Paradox Valley Unit of the Colorado River Basin Salinity Control Project. The Area Office sets operations and coordinates with the Colorado River Storage Project (CRSP) Power Office for water operations decisions regarding releases from the Aspinall Unit (Crystal, Morrow Point, and Blue Mesa Dams).

The WCAO is also responsible for providing or overseeing the operation, management, and maintenance of seven projects in the San Juan River Basin: Animas-La Plata, Florida, Mancos, Pine River, Hammond, the Navajo-Gallup Water Supply Project, and the Navajo Unit of the Colorado River Storage Project. WCAO's 18 Reclamation projects provide over 3 million acre-feet of water storage and serve approximately 453,382 acres of land with irrigation water in western Colorado and northwestern New Mexico. This invaluable water also provides recreation opportunities, hydropower, flood control, and benefits for endangered fish.

Projects cover a wide variety of purposes and are in ecologically differing terrain and watersheds. For example, the northern half of the WCAO Area covers operations at Silver Jack Reservoir, as well as the Aspinall Unit. These reservoirs are primarily snowmelt-driven high elevation storage projects. Within the southern portion of the WCAO Area are the Navajo and McPhee projects, as well as some high elevation smaller projects. While also primarily filling through snowmelt runoff, these more southern projects are experiencing overall decreasing hydrology and increasing drought-related effects. Although some WCAO reservoirs are independent hydrologically, many work together in systems to meet the goals and objectives of the project or projects.

WCAO Hydrology

As climate change-driven aridification takes hold on the areas served by the WCAO, there is a noticeable north-to-south gradient on hydrology and temperatures. The green and lush alpine snowpack accumulation areas give way to drier, high desert conditions as water moves west towards lower elevations in Colorado and into New Mexico and Utah.

Hydrology to the south can experience greater extremes of wet or dry years, relative to the northern areas. Southern watersheds may also experience greater extremes of wet or dry conditions within the summer months, mainly due to the presence or absence of the summer monsoon rains.

Higher elevation reservoirs, and those in the northern part of the WCAO Area, have more concerns with snowpack forecast accuracy and the effects on filling or spilling at the reservoir. Southern and western reservoirs in the WCAO Area, lower in elevation and in the drier desert climate, have more concerns with irrigation, silt and sediment, heat, evaporation, and transpiration. Projects throughout the WCAO Area support Endangered Species Act operations to various degrees.

Northern WCAO Operation Factors

Watersheds of the northern half of the WCAO Area, including the Colorado River and its tributaries, receive most of their water supply during the spring runoff season, with reservoir operations dependent on snowpack conditions and the timing of snowmelt. Summer river flows have been primarily dependent on the magnitude of the spring runoff, although recent drought years have shown the cumulative effect of dry winter and summer seasons on river flows during the irrigation season.

Extreme daily rainfall events are relatively rare compared with what may occur in the southern watersheds, and river flows in the northern watersheds generally do not show sharp rises and drops from these types of rain events. As a result, reservoir operations may be more consistent as there are less downstream river flow fluctuations that would require adjusting releases.

Reservoir operations satisfy multiple objectives, including ensuring adequate flood control, filling reservoirs for water supply, and meeting instream flow targets for downstream endangered fish. The ability to meet these objectives is dependent on knowledge of snowpack-generated runoff timing and volume. Most WCAO reservoirs located in northern watersheds are sized appropriately to capture snowmelt runoff and achieve a full water supply for users within those basins. Filling is not guaranteed but is typical in most years, and reservoirs are actively operated and monitored to avoid the risk of spilling.

Southern WCAO Operation Factors

The southern half of the WCAO Area has similar snowpack-driven spring runoff from the high elevation San Juan Mountains. Snowpack in the San Juan River Basin has been impacted by the effects of climate change through dwindling annual snowpack, increasingly dry soil moisture, and other factors at a faster rate than the northern half of the Area. Even if snowpack is good, filling is not guaranteed and is increasingly rare. The basin drains south to New Mexico and Utah; to high elevation desert farmland, power plants, and municipalities. The San Juan River Basin contends with historical mining impacts, silt and sediment, high evaporation and transpiration rates, and heavy water use through irrigation.

Increasing aridification has brought additional impacts besides lower snowpack. Dust from the southwest blows north into the mountains and has increasing effects on runoff timing and intensity, with similar impacts to that of an increase in average spring temperature.

McPhee Dam in Colorado. Part of the Dolores Project within the southern portion of the WCAO Area.

Another important component to the hydrology in the southern part of the WCAO Area is the annual monsoon season. The rainy season has significant impacts on project releases, soil moisture, and operations in most years, depending on its presence and intensity. Extreme rain events, flash floods, sediment influx, debris from forest fires, and mine waste affect operations at Federal projects.

Irrigation, high evaporation rates, and depletions are a major component of operations. Reservoirs to the south also serve Tribal Nations with large water rights allocations from Indian Water Rights

Settlements. Irrigation and real time on-farm use drive releases on a frequent basis throughout the summer months.

Operations at reservoirs in the arid part of the WCAO Area must consider downstream channel migration, sediment, silt, and other factors. The river channels are no longer high clear rocky streams and rivers as they are in the northern part of the basin; they now contain significant volumes of sediment. The sediment is a critical component of the natural system, and the clear water discharge from the dam can have a significant effect on the downstream channel that is used to receiving sediment.

WCAO Management Actions

Decision-making at a multitude of projects with a wide array of hydrologic conditions and systems requires assimilation and interpretation of substantial amounts of information, as well as the ability to adapt as hydrology forecasts and demands change frequently over time. Water managers in WCAO work closely with irrigation districts operating some of the projects (transferred works), the U.S. Army Corps of Engineers who oversee flood control operations, Tribal Nations whose interests are administered by Reclamation, Recovery Programs for Endangered Species Act compliance, and other stakeholders to determine the most safe, economical, ecologically sound, and efficient operations for each project.

WCAO staff consider monthly forecasts and runoff estimates in modeling future operations. Often this can mean using experience to focus operations on more likely forecasts. For example, in the southern half of the basin where drought impacts have been most severe, operations may be more focused on the lower end of the inflow forecast. This would mean that operations would prioritize conservation. In the northern half of the basin, or in higher elevation reservoirs where filling is common, it makes sense to target operations to meet the expected median inflow forecast. This may mean that operations prioritize passing inflow to minimize risk of spilling.

Predicting and planning operations is a complex and challenging task. The WCAO is committed to working with partners and using the best science, technology, and data available to make informed decisions to manage an increasingly limited water supply to meet a wide range of differing needs.

Navajo Dam and Reservoir on the San Juan River in northern New Mexico.

Water Rights Information Management System

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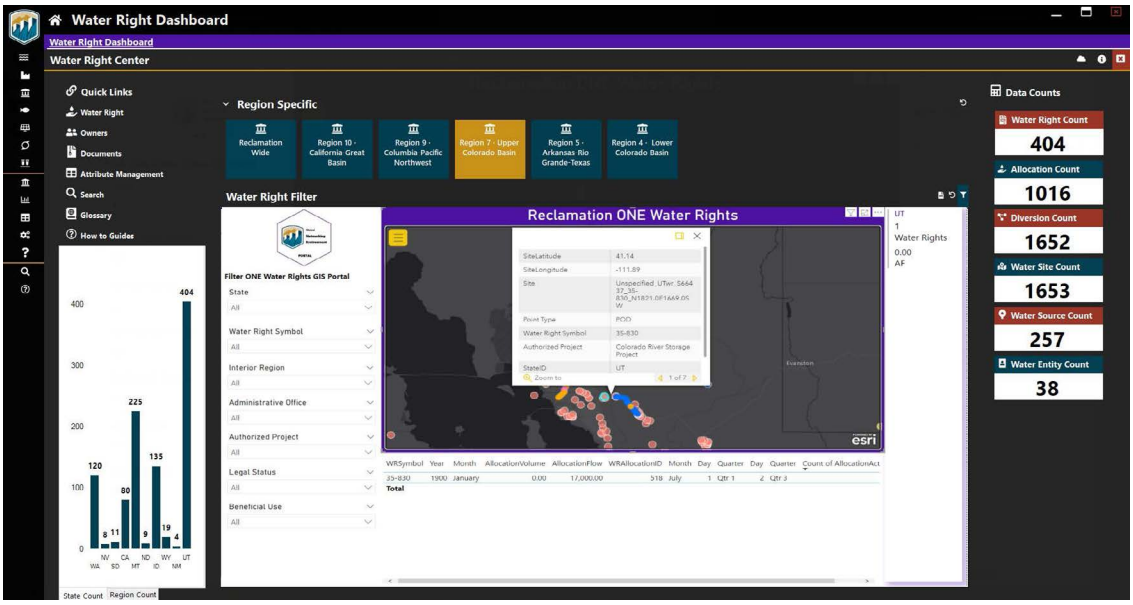
Background

The Bureau of Reclamation's (Reclamation) water rights inform the management of water throughout the West and support Reclamation's mission to deliver water to the nation. However, Reclamation does not own a centralized database system that tracks Reclamation water rights. The creation and implementation of the Water Rights Information Management System (WRIMS) stems from a fiscal year 2020 Science and Technology (S&T) Program project. Based on extensive S&T Research, a need was identified for a centralized, streamlined, and comprehensive water rights inventory database. The Dam Safety and Infrastructure Directorate's Asset Management Division (AMD) collaborated with the Upper Colorado Basin Region to create the Reclamation-wide WRIMS database.

Previous efforts to develop a centralized database system did not come to full fruition. The Office of Policy and Administration (now Policy and Programs) uploaded regional information to a mainframe database system in Microsoft Access with a recurring cycle on reporting water rights. The last compiled water rights report was completed on December 23, 2009. The report was based on feedback received from the regional offices.

Outcome

With the completion of the WRIMS database, Dam Safety and Infrastructure is now asking all regions for their support in consolidating all of Reclamation's water rights information to WRIMS. Training, outreach, and coordination of the initial data verification process will be managed by the regional offices and AMD. WRIMS will serve many long-term efforts, including implementing Geographic Information System features, improving data granularity, and continuing to support Reclamation's overall mission to deliver water.



Water Rights Information Management System PowerBI Dashboard.

Q&A
Michael Brain, J.D.

Deputy Commissioner, Bureau of Reclamation

Michael Brain was named Deputy Commissioner on March 15, 2022. He oversees the Bureau of Reclamation's (Reclamation) internal and external communication strategy, and congressional relations, to increase public awareness and understanding of Reclamation's priorities, policies, and programs. He spoke to us about how his interdisciplinary education and work for Congress prepared him to serve as Deputy Commissioner, the challenges of putting robust appropriations into action and publicizing work that is often "out of sight and out of mind," and listening with the intent of understanding.

What initially inspired you to pursue a career in water and the environment?

I had two teachers who inspired me to pursue a career in the policy and management of water and power. In my junior year of high school, I took an AP Environmental Studies course with Professor John Heetderks, who taught about the interplay between policy and the environment and focused a good deal on urban environments. Then at Boston College, I was an Environmental Studies minor, which was an interdisciplinary program focused on urban environmental science headed up by Professor Eric Strauss. One class put students from every school at Boston College into one classroom. We met weekly and tackled some significant and compelling issues with respect to the environment. We talked about policy, environmental health, environmental justice, and how those issues intersect. Those two teachers were very passionate and gave me that initial, "Yeah, I think I could do this."

A few years after graduating from Boston College ('06), you went back to school to earn your J.D. from Saint Louis University in Urban Planning, Land Use and Environmental Law ('13). How did that education prepare you to work in the House of Representatives and now as Reclamation's Deputy Commissioner?

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In my second and third year of law school, I got out of the ordinary track that most lawyers go through and took a few non-traditional law courses that combined students from Saint Louis University's other schools. A lot of these courses focused on developing relationships, talking to clients, and how to work with those clients to understand their needs and best provide for those needs. I also took an administrative law class that gave me keen insights into the ways our laws are drafted and interpreted. When I then got to Capitol Hill in a more senior role and was drafting legislation, I was grateful that my education provided me with an understanding of how that legislation would likely be interpreted and that certainly influenced how I drafted it.

Many of us recognize the terms "staffer" and "counsel" but don't know what these positions entail. Can you share what it means to perform these roles for House Subcommittees?

It is probably easiest to talk about two separate facets of those jobs. First, a staffer's job is to prepare your boss, the elected official that you work for, for various meetings and official business. For example, there will be meetings with stakeholders and constituents to talk about local issues dealing in water infrastructure. The issues are unique because they are local so they require a lot of preparation. Also, a staffer prepares their boss for hearings or markups on issues that may come up. If you are getting them ready for a markup where legislation is going to be considered, a good staffer will get in on the front end to make sure their boss has what they need. Second, a staffer is sometimes called upon to draft legislation that may be considered at some of those official meetings. That work is typically carried out by committee staff, like the Committee on Transportation and Infrastructure and the Committee on Appropriations where I worked.

Deputy Commissioner Brain staffing a meeting of the Subcommittee on Water Resources and Environment at the U.S. House of Representatives with Chairwoman Grace Napolitano and Committee on Transportation and Infrastructure Chairman Peter DeFazio.

I had the good fortune of working on water infrastructure issues on Capitol Hill for pretty much my entire career there. The best part was how these were issues that folks would come together on. We worked hand in hand with our colleagues, and it was a very collaborative environment.

How did your previous work in the House of Representatives intersect with Reclamation's operations and mission to deliver water to the Nation?

I cut my teeth on Capitol Hill working on the Transportation and Infrastructure Committee, doing authorizing for the U.S. Army Corps of Engineers and EPA's [Environmental Protection Agency] Clean Water Act programs. I didn't start to get into Reclamation issues until 2019 when I joined the staff of the Committee on Appropriations, Energy and Water Subcommittee. That Subcommittee drafted funding legislation for both the Corps and Reclamation, as well as the Department of Energy. I focused on the Corps and Reclamation. That was where I started engaging on Reclamation funding and policies. It was fascinating working for the Appropriations Committee. It's the committee where the funding originates for government agencies.

The first year of getting my legs under me was 2019. Then, in 2020, the pandemic hit, and we had to look into how the pandemic impacted funding needs across the government, including at Reclamation. I worked with the appropriate staff and Reclamation to talk through those things. And ultimately, Reclamation did receive money in the CARES Act to deal with response to the pandemic.

How would you describe the Deputy Commissioner's responsibilities, both big picture and day-to-day?

The Bureau of Reclamation serves as the water and power infrastructure of the American West. We are the largest water purveyor in the nation, and the second largest producer of hydroelectric power in the United States. We deliver water to nearly 31 million Americans across the West, and to 1 out of 5 farmers who grow 60 percent of our nation's vegetables and 25 percent of our fruits and nuts.

As the Deputy Commissioner, I oversee Reclamation's internal and external communication, as well as Congressional and Intergovernmental

Affairs. Those are the two biggest responsibilities. These organizations serve as the first line of communications (the public face) for the Bureau, not only for our external stakeholders and Tribal partners, but also Capitol Hill too. Overseeing those communications and how they mutually support each other to support Reclamation's credibility with the American public is the biggest responsibility – and directly supports our non-negotiable obligation to be accurate and transparent with our partners, Tribes, stakeholders, and the American public.

I like to say that my role here, first and foremost, is to support my Reclamation colleagues. I'm here to make sure that with the things Reclamation employees are trying to do, if they run into roadblocks, I will try to help if I can. My role as someone who supports the Reclamation team is critical to me.

What has been the greatest challenge in your first year serving as Deputy Commissioner?

There are two big challenges. Reclamation has been the beneficiary of robust appropriations of late. Our annual appropriations are at historic highs. We received about $210 million in supplemental disaster appropriations in 2020. We received $8.6 billion in the Bipartisan Infrastructure Law and then a little over $4.6 billion in the Inflation Reduction Act. When your appropriations have increased by that magnitude, implementation could be a challenge. Reclamation is up to that challenge, and I'm grateful to be a part of it. The other challenge for me is that I had been part of another organization for 12 years, so I knew who to call first when I had a question or an issue. I'm learning now who to call about specific issues. Fortunately, there are great folks in the Commissioner's hallway who have been able to help me navigate things.

Now that the Bipartisan Infrastructure Law and Inflation Reduction Act have been enacted and work has begun to improve the Nation's infrastructure, how does your office communicate this legislation's ongoing impact and results?

That's something we grapple with on a daily to weekly basis. It's twofold. First, we've prioritized outreach and strategy for implementing the Bipartisan Infrastructure Law and the Inflation Reduction Act, which started with stakeholder and Tribal partner engagement. For example, we held listening sessions on both of the Acts to make sure our partners were able to convey to Reclamation the best ideas they had for using those various sources of funding. And that was critical to getting public input and engagement before we launched on implementations. Second, when the organization begins to turn dirt, how do people know that their communities benefited from an infrastructure investment if they can't see it? And because a lot of water infrastructure is out of sight and out of mind, part of the job incumbent upon us is to make sure we're telling the public what we're doing with the funding provided to us.

Deputy Commissioner Brain delivers remarks at a Denver All Hands Meeting.

You've previously worked to develop funding bills to support "climate resilience across the West." What do climate resilient infrastructure and policies resemble going forward?

If you were to ask 10 people that question, you would get 10 different answers. What is resilience? Climate resilience to me is implementing policies that consider the volatility of a changing climate. We have drier dries and wetter wets now, so how do we adapt or implement policies so that we can best use our existing infrastructure? Our canals, our storage reservoirs that already exist, how can we change the way we use those to be able to be more flexible to respond to volatile changing climates?

Thank you for your remarks at the National Disability Employment Awareness Month events. Can you speak to the importance of promoting diversity and inclusion in Reclamation's workforce?

I learned at an early age that it's essential to work with and engage with the entirety of our communities. To me, it's very important that we foster participation from everyone because you are doing a disservice if some are excluded from the conversation. It's important that we hear from everyone because we come to our best solutions by having everyone engaged.

Are there initiatives in action to support recruiting a diverse workforce?

The Commissioner has made recruitment a priority. With the robust funding we've received, we need to increase our workforce to get that money out on the ground. She has made it a point to increase our recruitment and head out to universities to do so. There are some universities that we have a lot of alums from, but we need to do everything we can to ensure that we're broadening our recruitment base.

Commissioner Touton and Deputy Commissioner Brain at Reclamation's 120th Birthday and the B.F. Sisk Dam Safety Project Groundbreaking on June 17, 2022.

One initiative of late is going to some of our HBCUs [Historically Black Colleges and Universities] to make sure we're touching base with them as well. We want to make sure that opportunities to work at Reclamation are afforded to everybody.

What advice can you share for those starting careers in Reclamation?

I too am just starting in Reclamation. The tack I have taken in my career has been to listen with the intent of understanding, as opposed to listening to be the first to ask a question.

Reclamation is celebrating its 120th Anniversary this year. The challenges that we and our partners face in operating our system are unlike anything we have seen before. But we are up to the challenge of continuing our mission into the future, using the best available science, deploying all of our tools at our disposal, and implementing the Bipartisan Infrastructure Law on investments that build a more resilient future for the American West.

I am fortunate to work with professionals who care greatly about what they do and are very knowledgeable, and I learn from them every day. Asking questions is part of that, but allowing yourself to take a beat, listen, and truly understand the messages being conveyed is key, particularly early on. We have very impressive colleagues. They've been doing what they do for a long time, and they're the best in the nation at it. It would be presumptuous of me to not patiently listen to them because they have so much to share.

Updates & Due Dates

2023 Water Management Workshop

We are excited to be back in person! Please join us for the 2023 Water Management Workshop (WMW), to be held February 14-16, 2023, at the Denver Federal Center. Registration is now open. Please see below for further guidance. For Bureau of Reclamation (Reclamation) employees, this workshop will count for annual training requirements.

Background

The WMW is a seminar for supervisors, managers, water masters, and others responsible for or associated with the operation and maintenance (O&M) of water systems. It is held when field activities are generally at a minimum for the convenience of operating personnel. The Reclamation-sponsored workshop has been held since 1961. Participants will spend their time attending multiple educational sessions with opportunities for discussion and collaboration. The objective of the workshop is the self-improvement of personnel who are directly responsible for the technical details of operating and maintaining water systems.

Presentations

- Water Operations and Maintenance
- Aquatic Endangered Species
- Project Case Studies
- Reservoir Sedimentation
- Lining Repairs
- Pipeline Condition Assessment
- Performance Monitoring
- Funding Opportunities
- Lab Visits

FY 2022 WMW Special Inspections presentation by the Lower Colorado Basin's Rope Access Team.

Registration

Please email watermanagementworkshop@usbr.gov for the required registration form, which needs to be returned via email by January 20, 2023.

Cost

There is no tuition fee for this workshop.

Next Steps

The 2023 WMW agenda and other materials for the three-day event will be emailed to attendees soon after registration closes on January 20. For questions, please contact the Water Management Team.

We look forward to seeing you there!