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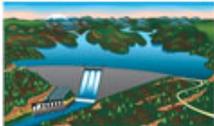
Some Dam – Hydro News™ And Other Stuff



Quote of Note: *“There is no distinctly Native American criminal class ... save Congress.”*
-Mark Twain

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(Hold down Ctrl key when clicking on this link) <http://npdp.stanford.edu/> . After clicking on link, scroll down under Partners/Newsletters on left, click one of the links (Current issue or View Back Issues).

“Good wine is a necessity of life.” - -Thomas Jefferson
Ron’s wine pick of the week: 2015 Chateau Greysac French - Bordeaux
“No nation was ever drunk when wine was cheap.” - - Thomas Jefferson



Dams:

(Oops! Maybe things aren't what they say they will be.)

New Klamath TMDLs: An Impossible Standard?

By Rachel Roberts, March 23, 2020, jdsupra.com

During a week full of COVID-19-related uncertainty, a pair of new lawsuits are a reminder of one constant: disputes over Klamath Basin water. This past week, PacifiCorp and Klamath Water Users Association each filed petitions for review of Total Maximum Daily Loads (TMDLs) for temperature in the Upper Klamath and Lost River subbasins. Both petitions argue that the TMDLs, issued by Oregon Department of Environmental Quality (DEQ), set unachievable standards and are unlawfully based on California standards, among other arguments. In the Upper Klamath TMDLs, DEQ set temperature standards for various portions of the Upper Klamath River and its tributaries at levels intended to protect certain cold-water fish species, such as salmon, which generally cannot survive high water temperatures. In setting the TMDLs, DEQ evaluated both



human and natural causes of high water temperatures, including climate change impacts. The TMDLs set by DEQ generally allow for no or very little increases in water temperatures. EPA approved the TMDLs on September 30, 2019.

PacifiCorp owns and operates the Klamath Hydroelectric Project on the Klamath River and its tributaries in Oregon and California. PacifiCorp is in the process of decommissioning some of the dams in the Klamath Hydroelectric project. In its petition, PacifiCorp asserts that DEQ violated the Clean Water Act in multiple ways, such as by setting unachievable load allocations, setting TMDLs based on water quality standards applicable to the portion of the Klamath River located in California, rather than Oregon, and setting TMDLs that are unsupported by substantial evidence. The Klamath Water Users Association, together with a number of irrigation districts that use water from the Klamath basin, also challenged the TMDLs. Their petition makes similar allegations as PacifiCorp's, arguing, among other things, that the TMDLs put the irrigation districts in the position of enforcing water quality standards, that the load allocations set by the TMDLs are unreasonable, and that DEQ unlawfully applied California standards in setting the TMDLs. It remains to be seen whether the two cases, which were filed in different county courts, will be consolidated. It is also possible that additional parties will file separate petitions for review, or will join these suits. As prior litigation shows, a lot of parties have interests in the Upper Klamath TMDLs.

The Upper Klamath TMDL itself is the result of a series of lawsuits by Northwest Environmental Advocates (NWEA) against EPA. NWEA successfully challenged the criteria the TMDLs were based on. See *NWEA v. EPA*, 855 F. Supp. 2d 1199 (D. Or. 2012). While that suit was pending, DEQ continued to submit temperature TMDLs for Klamath to EPA, which EPA approved until 2010. EPA never approved DEQ's 2010 TMDL, which DEQ withdrew in 2015. NWEA had by that time filed suit challenging EPA's failure to approve or disapprove the TMDL within 30 days. As a result of the second suit, DEQ agreed to submit, and EPA agreed to approve, temperature TMDLs for Upper Klamath within two years. See *NWEA v. EPA*, Case No. 3:12-cv-01751, 2017 Lexis 56505, *32 (D. Or. April 11, 2017). Those TMDLs are now being challenged in these new cases.

(A place to get dam failure info.)

DamFailure.org: New Case Studies and 'Lessons Learned "Posted April 3rd, 2020 // by kriley

<https://www.damsafety.org/DamFailureWebsite2020>

(If you're gonna have a dam failure, hopefully it's one like this with no loss of life.)

Flash Flood Warning cancelled in Putnam County after dam failure

By Monterey Police Dept., Apr 4, 2020, wkrm.com

PUTNAM COUNTY, Tenn. (WKRN) — A Flash Flood Warning has been canceled in Putnam County, according to the Emergency Management Agency after a dam failed Friday afternoon. Putnam County EMA said there are no additional impacts expected for the county, but Industrial Drive remained closed to through traffic while crews worked in the area. Flash flooding became possible Friday evening in areas below Perdue Farms in southeast Putnam County and northeast White County after an earth dam failed.



Putnam County Emergency Management Director Tyler Smith said about 20 feet of water drained out of a 17-acre lake located around Perdue Farms and that water was running toward US 70 in Monterey. Putnam County dispatch reported the failure around 5:47 p.m. The Flash Flood Warning was lifted as of 9:00 p.m. County Executive Denny Wayne Robinson said the majority of

the water should disperse before getting into White County. "Northern White County should be alert for rapid rise in the water level but luckily we should not have to expect a destructive wall of water coming through," Robinson posted on Facebook Friday evening. "Please be alert if you are or know someone that is on the Calfkiller."

(For those who like to watch videos.)

VIDEO: 90 Seconds over the Little Androscoggin Dam

An aerial photo and video of water cascading over the dam on the Little Androscoggin River in Auburn behind Barker Mill Arms.

<https://www.sunjournal.com/2020/04/05/photo-video-90-seconds-over-la-little-androscoggin-dam/>

BY RUSS DILLINGHAM, SUN JOURNAL
sunjournal.com, Apr 6, 2020



(Love places with these kind of names.)

Meet the Brewer: Dam Brewhouse's Sarah Dreshaj



(Not a good idea!)

Man facing charges in connection with threat to blow up dam

By Live 5 Web Staff | April 8, 2020, wmbfnews.com

MONCK'S CORNER, S.C. (WCSC) - A 55-year-old man was arrested in connection with threat to destroy a Berkeley County dam owned by Santee Cooper.

Timothy Newman is charged with threatening the use of a destructive device, Santee Cooper spokesperson Molly Gore said. Newman was accused of making a verbal threat to blow up the Pinopolis Dam, which is connected to the Jefferies Hydroelectric Facility in Moncks Corner, Gore said.



The charge stems from an investigation by Santee Cooper Law Enforcement about "a possible terrorist threat," the report states. Berkeley County deputies say Newman's cell phone location was tracked to the area of Winyah Power Generation Station in Georgetown County. Georgetown County deputies were notified and conducted a traffic stop during which they took Newman into custody, the report states. Deputies took him to the Hill-Finklea Detention Center where he was booked Tuesday afternoon. A judge set bond for Newman at \$45,000, jail records state.

(More on the Klamath River dam removal.)

Calif. greenlights massive Klamath River dam removal

By Jeremy P. Jacobs, E&E News reporter, April 9, 2020, eenews.net

The largest dam removal project in U.S. history came one step closer to fruition this week, as California issued permits for breaching the four dams on the Klamath River. The State Water Resources Control Board issued a Clean Water Act certification and environmental assessment for the proposal to remove three dams in Northern California and one in southern Oregon. "Decades in the making, this historic and comprehensive project will help restore native fish populations, and improve water quality in the Klamath Basin," board Chairman E. Joaquin Esquivel said in a statement.



At issue are four dams on the Klamath River, which snakes from southern Oregon through a rugged and remote part of Northern California to the Pacific Ocean. The river is the second largest in California, and it is home to multiple tribes that have relied on its salmon runs for millennia. Those runs have dwindled significantly due to a variety of factors including climate change and the river's four downstream dams. After years of lobbying and pressure, the four hydropower dams — Copco No. 1, Copco No. 2, J.C. Boyle and the largest, Iron Gate — are set to be removed after their operator, PacifiCorp, concluded the dams no longer made financial sense; they produce very little power, and relicensing them with the Federal Energy Regulatory Commission would likely be costly because fish mitigation would be required (Greenwire, March 13, 2017).

PacifiCorp is seeking to transfer the dams' license to the nonprofit Klamath River Renewal Corp. It says breaching the dams could begin in 2022, and FERC could vote on the transfer as soon as this spring. The local tribes on the river cheered this week's announcement from the State Water Resources Control Board as the clearing of a key hurdle. "This represents another milestone in our decades long effort to remove dams and restore our fishery," said Frankie Myers, vice chairman of the Yurok Tribe, in a statement. "Working with PacifiCorp, we have found a way to remove dams, restore our river, and dramatically improve water quality." Nevertheless, the roughly \$450 million dam removal project remains controversial in the region, one of the most conservative areas of California. In particular, landowners along the river and the reservoirs behind the dams say their property values will plummet (Climatewire, March 30). Other supporters of dams in the West, including in Congress, have raised concerns about the precedent the project would set.



Hydro:

(Looks like the attack may move east.)

Fifteen Mile Falls

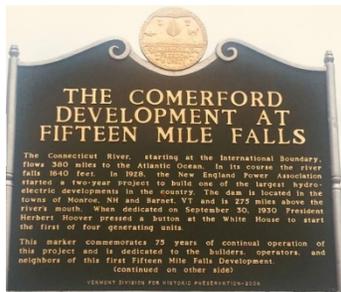
By Andy Schafermeyer • Special to the Union Leader, Mar 25, 2020, unionleader.com

When considering the overall health of a river and the fish that use it, a dam is often considered to be one of the most significant challenges to success. Interrupting the connectivity of an ecosystem and restricting organisms from crucial habitat are some of the more significant limitations caused by dams. Yet here in New Hampshire, some of the best fishing opportunities in the state are found within a short section of river perforated by three massive hydroelectric dams. The area is known as the "Fifteen-Mile Falls" section of the Connecticut River,



Comerford Dam

along the shoulder of the state in northern Grafton County. Many residents are unaware of this massive hydro development or its history, current use and the recreational opportunities it presents.



Today, the outflows of Moore, Comerford and McIndoes dams provide awesome tailwater fisheries while their reservoirs offer big-lake fishing at its finest. Before any of the dams were built, this section of the river — from Dalton to the confluence with the Passumpsic River in Monroe — fell more than 300 feet in under 20 miles. With a steep gradient such as this, the river created a gorge that would have been considered significant white water, rushing over huge boulders and ledges. It was because of these characteristics that it was chosen as a prime location for hydroelectric dams. A plan was designed to build three dams

beginning in 1928. At the time, there was little public resistance — people welcomed the comforts that electricity could bring. Even though it meant the flooding of significant acreage that included homes and farms, the job opportunities for thousands of workers and subsequent economic boom was very appealing.

The Comerford project was the first to get underway, and even by today's standards, was a massive project. Temporary railroads, concrete factories and housing for workers transformed the landscape as much as the dam would transform the river. For almost three years, more than 3,000 men and women built what would eventually change the ecology of the Connecticut River. On Sept. 30, 1930, the Comerford Dam was ready to begin its job of producing energy and sending it to a substation in



Massachusetts, over 125 miles away. President Herbert Hoover pressed a button at the White House that sent a signal to a circuit starting the first wheel in motion. Water that had been stored in the 8-mile-long lake known as Comerford Reservoir began to fill the empty structure and power the four generators that are still in use today. Over 2,200 feet long and 170 feet high, this giant structure was just the beginning of the Fifteen-Mile Falls Hydroelectric Project. In 1931, the McIndoes Dam was built below Comerford, and in 1957, the Moore Dam was built upstream.

Environmental matters

In a generous attempt to offset environmental impacts created by hydro dams, a licensing and re-licensing stipulation exists. The Upper Connecticut River Mitigation and Enhancement Fund (MEF) supports restoration, protection and enhancement of the river and all of its connected ecological systems. This fund has generated millions of dollars that have been used to further improve the fishery and aquatic system as a whole. In 2019, almost \$700,000 was awarded in grant funds for 13 separate projects designed to improve the health of the Upper Connecticut River. In all, the fund has provided over \$15 million toward fishery and river restoration. The riverine habitat below impoundments such as these is known as a tailrace and creates some very unique conditions for fish and fishermen.

One of the most important factors of fish biology is water temperature, which will determine which species will exist and to what extent they will thrive. A dam that holds water above and delivers it below often releases it from the bottom of the reservoir. This means that the coolest water of summer and warmest of winter is being channeled into the tailrace. The welcoming influence of these temperatures will bring fish from miles downstream and keep them contained and comfortable near the dam. A constant flow is ensured by intakes that are located very deep in the reservoir. Few fish venture to these



depths and get caught up in the flow, but those that do are sent tumbling downstream significantly injured, confused or both. These are usually smaller, weaker fish that become an easy meal for those larger fish basking in the cool water below the dam. **As fish like trout and salmon spend their time in their optimal temperature zone, they are also provided with highly oxygenated conditions created by the turbulence of rushing water.**

Distinct habitats

These three variables — temperature, oxygen and plentiful food — **make for fantastic river fishing below the dams on 15-Mile Falls.** Above the dams, the reservoirs of stored water are vast in acreage and great in depth. These manmade lakes have become popular fishing destinations for all types of anglers. Moore Reservoir alone occupies over 3,400 acres **and is officially New Hampshire's fourth largest lake.** All three of these waterbodies have an extremely diverse population of fish, including largemouth and smallmouth bass, northern pike and huge trout. The state record pike — 26.5 pounds — was caught in 2013 through the ice of Moore Reservoir. In addition to the gamefish, there are literally millions of baitfish including shiners and suckers that provide a substantial food source on which more desirable fish can grow.

With several maintained boat launches on each reservoir, access is never a problem. Most have adequate parking and picnic tables for having a nice midday lunch.

In 2005, the dams, owned by USGen New England, were sold to the TransCanada Corporation. In 2017, they were sold again to Great River Hydro, which operates and maintains them today.

Their commitment to healthy water and public access is a great story of partnerships among users of a very precious resource. Although not well known by most New Hampshire residents, **the 15-Mile Falls section of the Connecticut River is one of my favorite places to fish.** The varying habitats and diversity of sportfish make it a great destination for adventures afield.

[\(This project is jinxed.\)](#)

Barber Dam still for sale after bidders no-show auction

By THOMAS PLANK, idahopress.com, 3/30/2020

BOISE, IDAHO — The Barber Dam in Ada County won't be sold quite yet, after a planned Monday auction saw neither of the prospective bidders for the dam show up. Hull Street Energy, a Bethesda, Maryland-based energy investor, and Ted Sorenson, project engineer with Idaho's Sorenson Engineering, had each put a \$100,000 security deposit down earlier in March to reserve a place in the bidding for the dam, but no bidder showed on Monday morning to offer a \$1 million minimum offer for the structure. Ada County Board of Commissioners Chairwoman Kendra Kenyon said the commission would be considering **two different paths** after Monday's failed auction: **waiting for the COVID-19 crisis to subside** in order to hold another auction, or selling directly to an interested party. "We're in a good position," Kenyon said about selling the dam.



Ada County went through with the auction in the midst of the pandemic because the commission believed the small number of parties and holding the auction outside would allow for social distancing. Gov. Brad Little on Wednesday issued a 21-day statewide stay-home order that "requires Idaho residents to stay and work from home as much as possible while ensuring all essential services and businesses remain available," according to the order. Commissioners voted unanimously Dec. 23 to begin the process of selling the dam and some parcels around it. **The dam is three miles east of downtown Boise** and provides hydroelectric power to Idaho Power, according to Ada County spokeswoman Elizabeth Duncan.

Owned by Ada County since 1977 and operated by Enel Green Power, the dam has had problems over the last few years. Power outages at the site have disrupted or stopped the flow of water into the Boise River below the dam on multiple occasions, according to reporting done by

the Boise Weekly. The Idaho Department of Water Resources fined Ada County \$50,000 this summer and ordered fixes after a power failure at Barber Dam cut off the entire flow of the Boise River in the early morning hours of Aug. 2. **The county owns the dam because the previous owner failed to pay property taxes**

(The rest of the world likes hydro.)

Spotlight on the Fastest Growing Renewables: Hydropower

Apr 05 2020, envirotech-online.com

The most recent report from the International Renewable Energy Agency (IRENA) shows that the renewable revolution is continuing apace. Last year, 171GW of renewable generating capacity were added to the grid, meaning that the overall capacity from sustainable sources has reached 2,351GW. That's roughly equivalent to a third of all electricity generating capacity in the world.



Hydropower continues to be the biggest contributor to renewable capacity. Despite significantly slowed growth in recent years, hydro still accounts for approximately half of all renewable capacity, making it crucial in achieving reduced greenhouse gas emissions targets in the coming years. Having said that, both solar and wind power have shown impressive growth over the last decade and are expected to continue at a similar rate of expansion in the coming one. Nonetheless, the International Energy Agency (IEA) still expects hydro to be the biggest supplier of renewable energy by 2024, the end of its next forecast cycle.

What is hydropower?

Capitalising upon the inherent power of water has been a practice of humankind for millennia; we know that over 2,000 years ago, the Greek civilisation used water to power the wheels that ground their grain. Today, a similar process is employed to generate hydropower, only instead of turning watermills, the currents drive turbines. There are two basic types of hydropower facilities: those which store water in a reservoir and release it as needed through a dam, wherein the turbines are contained, and those which utilise the currents of rivers and streams to generate energy. Some countries are more suited to installing hydropower plants than others. Norway, for example, has a landscape comprised of steep valleys, cascading waterfalls and plentiful rivers. Add in the fact that the west of the country experiences a high volume of rainfall throughout the year, and it's clear that Norway was built for hydropower. Today, the country gets 98% of its electricity needs from hydropower, making it the ninth most sustainable in terms of renewables in the world. However, the colossal amount of hydropower it generates is greater than all eight countries above it put together!

Hydropower in the 2020s

According to the forecast report for 2019 to 2024 from the IEA, hydropower will continue to swell by 9% over the next six years, adding an additional 121GW to global capacity. Most of those newly installed facilities will be undertaken by China (who were responsible for all 8.5GW added in 2018), Brazil and India. Other areas where hydropower is expected to increase include sub-Saharan Africa and the ASEAN region, but on the whole, growth from this sector is projected to slump in the forecast window. Despite its apparent decline, hydropower is still expected to comprise the largest share of renewable capacity by 2024. Solar and wind are both tipped to make substantial inroads into its current lead, while the optimisation of biogas plants means that bioenergy will also improve upon its current capacity of 121GW. Geothermal and tidal energy comprise the other renewables expected to contribute to the ongoing upsurge in the industry over the coming six years

(Colorado river water is sure scarest.)

Shoshone agreement keeps water flowing down Colorado River while hydro plant is inoperable

The Shoshone hydropower plant in Glenwood Canyon has been down since at least Feb. 14 and could be down until June, but a 2016 safety-net agreement has kept water flowing down the Colorado River. The Shoshone Generating Station, owned by Xcel Energy, is the keeper of one of the largest water rights on the main stem of the Colorado River. In February, ice jams on the spillway caused water to flood the plant and damaged equipment inside, according to Xcel media-relations representative Michelle Aguayo. Xcel said the COVID-19 crisis is complicating repair plans. “Given the current circumstances, it’s more challenging to get contractors to repair equipment, but even so, we expect to be back in June,” Aguayo said in a prepared statement. Xcel said service to electric customers will not be impacted by the outage.



The inoperable plant would be a major concern to water users on the Western Slope, except for the 2016 Shoshone Outage Protocol, which mimics conditions as if the plant were still operating and using its full amount of water. When the plant is operating, a senior water right from 1902 draws 1,250 cubic feet per second of water downstream to meet the plant’s needs. That means that upstream junior water-right holders must leave enough water in the river for Shoshone to receive its full amount. It also means that the 1,250 cfs is available for other downstream users on the Western Slope. The water used by the Shoshone plant is diverted at a low riverwide dam about two miles above the plant near the Hanging Lake exit on Interstate 70. The water is then sent through pipes along the cliffs to penstocks that send it down to the plant, where it spins turbines. All of the water is then released back into the river via a spillway at the top of what’s called the “Shoshone” section of the Colorado River, which is about five miles east of Glenwood Springs and is popular with kayakers and rafters.

This water is crucial for endangered fish in the often-dry, 15-mile reach near Grand Junction; for boaters and rafters near Glenwood; and for Grand Valley irrigators, who have begun filling their canals for the start of irrigation season, which began Wednesday. In the past, if the hydropower plant was not operating, the water right tied to it is not being put to beneficial use and cannot be used. The 1,250 cfs could have been lost — either diverted to the Front Range or kept locked in reservoirs. But the Shoshone Outage Protocol took effect March 1 to keep water flowing in the river. “We are very happy that the outage protocol exists,” said Andy Mueller, general manager of the Colorado River Water Conservation District. “It’s to make sure the water keeps flowing this way. It’s really about the fish as well as bringing the water to the Grand Valley.” Formalized in 2016, the agreement is signed by many Colorado River water users, water providers and government agencies, including the U.S. Bureau of Reclamation, the Colorado Division of Water Resources, Denver Water, the River District and the Grand Valley Water Users Association. Between Feb. 14 and March 1, flows were kept up by a winter maintenance outage agreement, according to Victor Lee, an engineer with the Bureau of Reclamation.

Lee said that about 1,400 acre-feet of water from Green Mountain Reservoir in Summit County has been released so far to meet the Shoshone Outage Protocol requirements. He said the protocol will probably be relaxed in the next week or two because spring runoff will begin to naturally boost river flows. The Shoshone plant and its big water right have long been a concern for the River District, especially since outages have increased in recent years, including a penstock rupture in 2007. Since about 2018, River District officials have been in talks with Xcel about ways to preserve the Shoshone water right for the Western Slope. “Those efforts are ongoing,” Mueller said. “We still view that as a significant priority for western Colorado.”

(Hydro helping to fight the Coronavirus.)

BURLINGTON HYDRO: HYDRO DONATES ELECTRICAL SERVICE AND EQUIPMENT TO POWER JOE BRANT COVID UNIT

APRIL 6, 2020,

Burlington Hydro is pitching in to pick up the costs of bringing new electrical service and equipment needed to power the temporary Pandemic Response Unit being built at Joseph Brant Hospital. The Pandemic Response Unit will increase the hospital's capacity to support COVID-19 patient care, providing approximately 90 additional beds. "We're currently working with the hospital to ensure the electrical service fully satisfies the power needs of the temporary response unit," says Gerry Smallegange, President and CEO, Burlington Hydro Inc. "Our engineers are finalizing the configurations and our crews will soon be able to safely install the much needed service. We're proud to be able to do our part."



Construction of the modular structure is well underway on the hospital grounds. The Pandemic Response Unit will connect directly to the South Tower of the Hospital. From the engineering design of the electrical service, to the installation of transformers, cabling and conduits, powering the structure will ensure the safe and reliable operation of essential equipment for patient care. A statement from Burlington Hydro reads, "Burlington Hydro salutes the tireless work of our frontline healthcare workers, nurses, and doctors. Joseph Brant Hospital's preparations and commitment to provide local patient care through this very difficult time, is a testament to their professionalism, and compassionate commitment to our community."

(When you dig a hole, who knows what you'll find.)
Brothers Unearth 130-year Old Turbine



Environment:

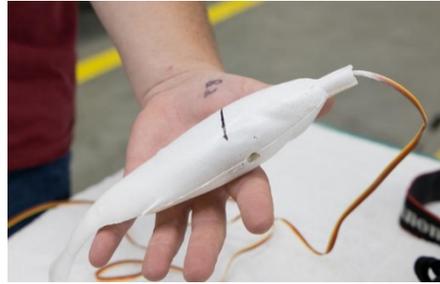
(There's something other than fake news – fake fish!)

ORNL Scientists Make Fake Fish with 3D Printing and Sensors to Research Environmental Impact of Hydropower Dams

By Sarah Saunders, 3D Printing, Apr 6, 2020, 3dprint.com

Hydropower – electricity generated with the energy of moving water – is the largest source of utility-scale energy storage and renewable energy in the US, making up 6% of the country's total generation of electricity. But, developers need to research how the environmental impact to fish populations can be reduced when they renew a hydropower project license or a new one. Fish can get into all sorts of injury-causing trouble, such as turbulence, turbine blades, and pressure changes, when they swim through hydropower dams. Before changing or creating a new project, you need to consider how big each fish is and where its center of mass is, the thickness and angle of turbine blades, and how fast they're spinning.

Researchers at Oak Ridge National Laboratory (ORNL) in Tennessee have supported hydropower in the past, through improving regulatory processes and licensing, but they decided to dig a little deeper this time...or should I say swim? ORNL created a system to analyze the impact of turbine designs on high-value species, like certain types of fish, for its hydropower-related environmental assessment work. There's not much in the way of standardization when it comes to hydropower projects, as these dams are mostly built to meet the power needs of the customer and constructed according to the geography of the specific site. "We want to produce hydropower in a way that's not damaging to the fish passing through." There is a lot of pressure on power dam owners and operators to reduce their environmental impact. There are lots of challenges, and giving fish safer passage is one of them," explained Mark Bevelhimer, a recent ORNL retiree who launched the project, which was funded by ORNL's Laboratory Directed Research and Development program.



ORNL scientists are combining their expertise in environmental science, physics, sensors, and additive manufacturing to create model fish for use in testing of hydropower turbine designs. The project supports healthy ecosystems and hydropower—the nation's largest renewable energy resource. The scientists decided that their best bet would be to build an anthropomorphic test device (model fish, in layman's terms). The fish models could generate multiple data points for analysis, and help the team better understand the forces of turbine blades. "We want to understand the forces different fish species encounter and how those forces may result in injury or mortality." There may be tweaks that turbine designers and manufacturers could make that would conserve fish species while at the same time minimizing the impact on energy production," explained Ryan Saylor, a Bredesen Center for Interdisciplinary Research and Graduate Education student working in ORNL's Environmental Sciences Division.



They used 3D printing to build the fake fish models. We've seen 3D printed fish and fake fish with 3D printed parts used in research projects before, from studying fear and anxiety to saving the real thing. But rather than using the technology to create the actual fish models, they instead made 3D printed molds to make them, which is much faster and less expensive. The scientists brought real fish to the Manufacturing Demonstration Facility (MDF), a US Department of Energy-designated user facility for 3D printing at ORNL, where they were laser-scanned. Then, a CAD design program used the contours to make 3D printed molds of the fish that would be tested.

"Each species has a different morphology, so making molds allows us to capture those differences. We can make a one-of-a-kind fish pretty easily," said Brian Post, who led the MDF effort. "If you were to conventionally produce the molds, it would take longer to subtract the shape out of a block of material." 3D printed molds let the researchers create a variety of fish models in a shorter time period. Ballistic gel, developed originally for the military, was used to make the fish bodies, as it can be controlled for multiple densities to simulate muscle tissue. Cinnamon oil, an inexpensive antimicrobial agent, was mixed with the gel, and the combination was poured into the molds and left to set. In order to make them as close to the real thing as possible, the scientists tested how "squishy" each fake fish was. Once they were satisfied, the fish models were then coated in a plastic-like paint that mimics skin and scales and makes them more rigid. "Mimicking biology is difficult. We've worked to get as close as we can to a good representation without the use of specialized equipment that could increase costs," said Saylor.

The final step was embedding sensors in the fake fish, which measure acceleration and G-force in three dimensions in a turbine simulator. Additionally, strain gauges measured how the fish

models would contract or stretch because of the simulated turbine blade strikes. So far, the ORNL scientists have 3D printed molds for, created, and tested models for four different fish species so far – bass, bluegill, rainbow trout, and shad. But they're not done with the model yet – they're continuing to make improvements, such as increasing the response rate in order to achieve advances in data analysis and extraction, as well as a higher resolution of the data itself. This way they can make hydropower dams more fish-friendly, which supports a healthier ecosystem. They discuss this story and other 3D printing topics at 3DPrintBoard.com or share your thoughts in the Facebook comments below.



Water:

(On a planet that is mostly covered with water.)

Water key to mitigating climate change effects

23 March 2020 | BY MANAS RANJAN SENAPATI, dailypioneer.com

The history of human civilisation reveals that water supply and civilisation are almost synonymous. Water resources are sources of water that are potentially useful and essential for existence of life. Several uses of water include agricultural, industrial, household, recreational and environmental activities. The majority of human uses require fresh water which is scarce. About 97% of the water on the earth surface is in the ocean and only 3% is fresh water. Slightly over two-thirds of this is frozen in glaciers and polar ice caps. The remaining 1 per cent unfrozen fresh water is found mainly as groundwater, with only a small fraction present above ground which is suitable for human consumption.

The seas and oceans are the products of gigantic acid-base titrations during the early stages of formation of earth. Sea water contains about 2,000 times more dissolved salts than fresh water. The constant pH of sea water (8.1 ± 0.2) all over the globe is due to ion exchange equilibrium of dissolved cations with silicate phase in the marine sediment. It is estimated that 8% of worldwide water use is for domestic purposes. These include drinking water, bathing, cooking, toilet flushing, cleaning, laundry and gardening. Basic domestic water requirements are at around 50 litres per person per day, excluding water for gardens. Drinking water is water that is of sufficiently high quality so that it can be consumed or used without risk of immediate or long term harm. Such water is commonly called as potable water. In most developed countries, the water supplied to domestic, commerce and industry is all its fresh water supplies, the most important is of drinking water that is furnished with a standard even though only a very small proportion is actually consumed or used in food preparation.

It is estimated that 70% of worldwide water is used for irrigation, with 15%-35% of irrigation withdrawals being unsustainable. It takes around 2,000-3,000 litres of water to produce enough food to satisfy one person's daily dietary need. This is a considerable amount, when compared to that required for drinking, which is between two and five litres. Major industrial users of water include hydroelectric dams, thermoelectric power plants, which use water for cooling, and ore and oil refineries, which use water in chemical processes, and manufacturing plants, which use water as a solvent. Water withdrawal can be very high for certain industries, but consumption is generally much lower than that of agriculture. Overexploitation of water use will cause the depletion of water resource from both surface and underground water.

The United Nations designated March 22 as the World Water Day in 1992 at the Conference on Environment and Development in Rio de Janeiro. This year's theme, 'Water and Climate Change', explores how water and climate change are inextricably linked. Water plays a pivotal role in how the world mitigates and adapts with the effects of climate change. Water is the

primary medium through which we will feel the effects of climate change. Climate change intensifies this cycle because as air temperatures increase, more water evaporates into the air. Warmer air can hold more water vapour, which can lead to more intense rainstorms, causing major problems like extreme flooding in coastal communities around the world. According to the World Health Organisation, increasing temperatures on the planet and more variable rainfalls are expected to reduce crop yields in many tropical developing regions, where food security is already a problem.

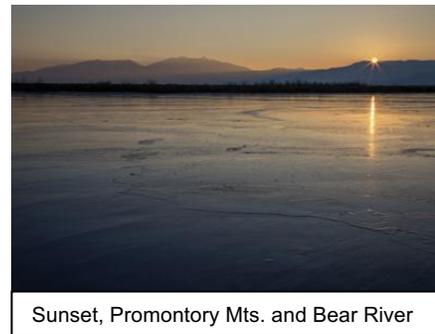
It is estimated that by 2040, one in four of the world's children under 18 – some 600 million in all – will be living in areas of extremely high water stress. One of the most effective ways to protect children in the face of climate change is to safeguard their access to safe water and sanitation. The World Water Day has seen an increase in the quantity and quality of education initiatives within schools and universities, to raise awareness of the importance of conserving and managing water resources. (Dr Senapati is Dean Science, Biju Patnaik University of Technology)

(Oh well, there goes the Lake. Imagine, Salt Lake City without the Great Salt Lake.)

Bleak questions: Dam the Bear River or save the shrinking Great Salt Lake?

By MARK SHENEFELT, Standard-Examiner, Feb 11, 2019, standard.net

SALT LAKE CITY, UTAH — As the Great Salt Lake ebbs, hastened by decades of upstream water consumption, would-be protectors are prodding the state to marshal political will for a difficult rescue. At stake are the lake's \$1.3 billion annual economic impact, fragile wetland habitat for millions of waterfowl and shorebirds, and a future of unhealthy dust storms fueled by the exposed lake bed. Nothing less than Utahns' quality of life is in the balance if the lake shrinks away, said Rep. Tim Hawkes, R-Centerville, sponsor of a resolution intended to increase political and social awareness of what appears to be an inexorable decline. "We as a state need to say, hey, it's important to preserve the lake, it's important to preserve our water supplies,"



Hawkes told the House Natural Resources, Agriculture and Environment Standing Committee, which approved his HCR 10 on Tuesday. "But how to do that is enormously complicated," he said. "I can't think of a more difficult challenge out there as our state grows, to still find ways to make sure we don't lose this resource that's important to our quality of life and our economy and everything else." While the lake level has fluctuated during alternating drought and flood periods since the Mormon pioneers reached the Salt Lake Valley in 1847, water diversions over time have lowered the lake by 11 feet and sapped its volume by 48 percent, according to a 2016 study at Utah State University. The lake level was measured at 4,192.4 feet above sea level as of Thursday afternoon, according to the U.S. Geological Survey. The previous lowest point in modern times was 4,191 feet in 1963, compared to the high level of 4,210.8 feet in 1987, as reported by the Utah Climate Center in Logan. The Bear, Weber and Jordan river drainages feed the lake, but upstream use due to population growth divert those natural flows. Despite water conservation that has cut per capita use by 18 percent, additional growth and the potential development of dams on the Bear River will crimp flows to the lake even more.

DEAD SEAS

Researchers who have calculated how to save the Great Salt Lake are encouraged by a legislative effort toward accomplishing that goal, but planned regional water programs remain a dire threat to the shrinking inland sea. "If the water developers in Idaho and Utah get their way and develop while not worrying about conservation, it's going to look pretty bleak for the lake," Wayne Wurtsbaugh, co-author of a 2017 study published in the journal Nature Geoscience, said Friday. The research team determined that increasing river flows into the lake by 24 to 29 percent would stabilize the

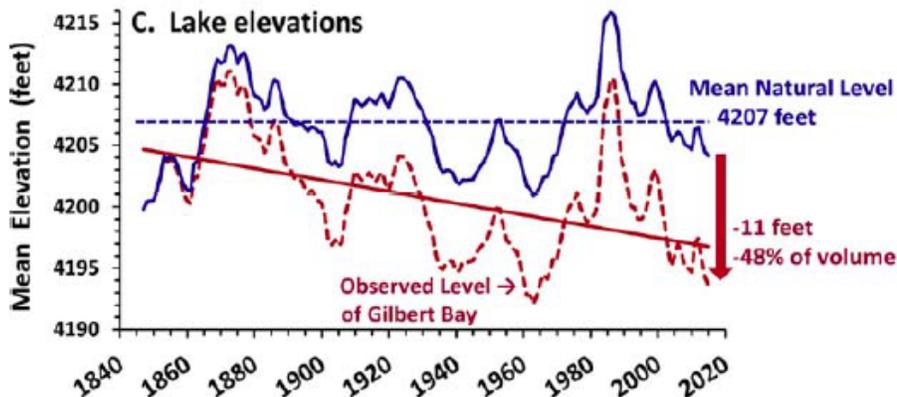
body of water, which experts fear is on a path to desiccation like similar saline lakes around the world.

The infusion would help maintain lake levels to protect millions of migratory birds and other wildlife, keep marinas open, prevent dust storms that cause respiratory illnesses, and preserve the lake's \$1.3 billion economic impact. Wurtsbaugh, a Utah State University emeritus professor

Table 1. Types of human water consumption (depletions) and their influence on decreasing the level of the Great Salt Lake (Source, Utah Division of Water Resources, 2016).

Source and percent of water use	Median estimated decrease in lake level (Total = 11.1 ft)
Agricultural (63%)	7.0 feet
Mineral extraction—salt ponds (13%)	1.4 feet
Municipal & industrial (11%)	1.3 feet
Impounded wetlands (10%)	1.1 feet
Reservoir evaporation (3%)	0.3 feet

Chart supplied Utah State University of watershed sciences, said he was glad to hear about House Concurrent Resolution 10, which calls on the state to plan and carry out programs to preserve the lake. "Instead of getting into a situation where we dried everything up and tried to recover things later, it's a much better approach to start with conservation," Wurtsbaugh said. "Once we develop all the water supplies, people won't be inclined to give that water back." And multiple major projects are under discussion in Utah, Idaho and Wyoming, members of the Bear River Compact. "There's so much planned development," he said. If Utah develops its share of the Bear River, "we'd still have a pretty sizable lake but there would be more dust, more health problems, we would lose more shallow bays," Wurtsbaugh said. "It's not a completely dead lake at that point." But once Idaho



and Wyoming build out too, "we'll lose the brine shrimp, a large portion of the birds. It would be a dire situation."

GROWTH A POWERFUL FORCE

Proposals to allocate additional water to preserve shrinking saline lakes meet social, political and economic challenges, including entrenched support for the status quo, the study said. "The direct benefits of consumptive use are easily quantified" and supported by decades of water law and

management practices, the study said, "as well as deeply held values regarding population growth and agricultural history." Sufficient lead time will be necessary so solutions can be developed and implemented before the Great Salt Lake is desiccated, the report said. It found that 39 percent of water from contributing rivers is already diverted for agriculture and other uses. Wurtsbaugh also pointed out that Utahns use far more water per person than people in most arid countries. With conservation and changes in water laws, there would be no need for more water development projects in the basin, he said.

FAULTY ASSUMPTIONS

Natural variabilities in lake levels due to drought and flood years, and assumptions about the effects of climate change, sometimes are incorrectly cited as reasons for the lake's decline, according to the research report. That leads to inaction. For example, Great Salt Lake managers previously blamed declining lake levels only on natural precipitation cycles, without a direct analysis of the cause. "However, after water-budget analyses were done it was clear that water diversions were the primary cause of the long-term lake-level decline," the study said. "We argue that a basic water budget is critical to supporting science-informed discussions on the difficult tradeoffs between consumptive use and maintaining saline lakes at sustainable levels." It's a "no-brainer" to take action now, said Wurtsbaugh, who has been studying the Great Salt Lake for 30 years. "There's a lot more awareness, but on the other hand, people have huge demands for more water," he said.

(My favorite place to appreciate the power and beauty of water.)

Ten Minutes of Magic – Majestic Niagara Falls

By Marc Marcuse, April 5, 2020, micechat.com

Today's moment of zen is a bit different, we're taking you beyond the theme parks to another of the most popular tourist destinations in the world, Niagara Falls! Iconic for its beauty, and as a valuable source of hydroelectric power, Niagara Falls has long been a honeymoon destination and tourist attraction. The video below is of the Horseshoe Falls, which is the largest of the three waterfalls that make up Niagara Falls. This video is shot from the Canadian side of the falls and you can see boats taking tourists into the mist of the waterfall and the drastic lighting changes from passing clouds. Sit back and enjoy the beauty of nature from the comfort of your home.

Video here: <https://www.micechat.com/255747-ten-minutes-of-magic-majestic-niagara-falls/>

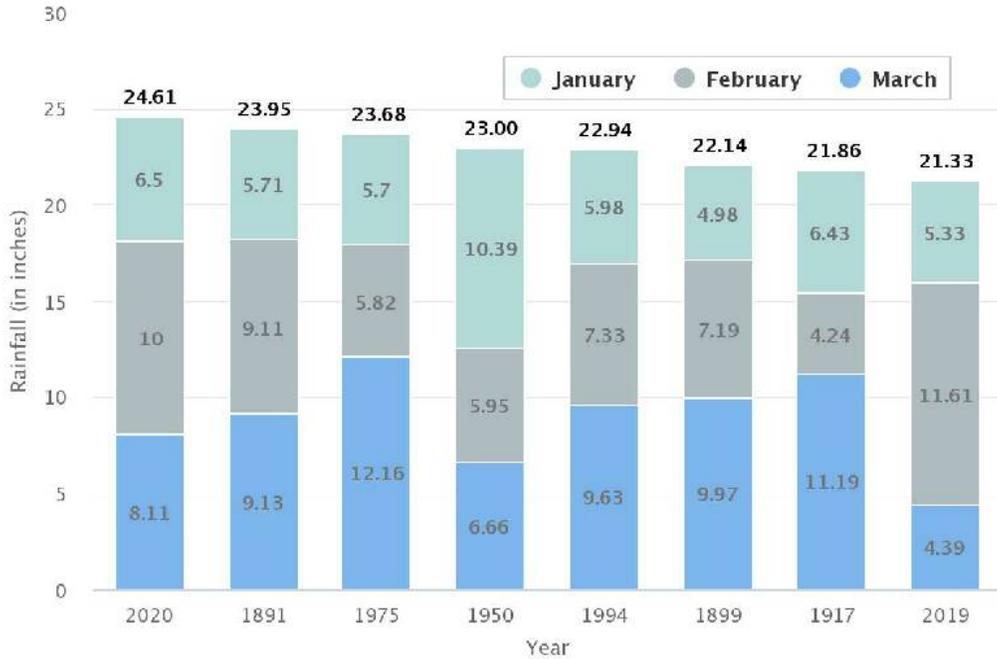
(That's a lot of rain.)

The first three months of 2020 were the wettest start to any year in the Tennessee Valley

April 7th, 2020 | by Emily Crisman and Dave Flessner, timesfreepress.com

The first three months of this year were the wettest start to any year in history across the Tennessee Valley, surpassing the previous record set in 1891. A record 24.61 inches of rain drenched the region in the first quarter, raising river and lake levels, flooding some low-lying areas and shutting down some riverfront parks and river shipments through Chattanooga. But for the most part, Chattanooga has avoided much flooding so far this year even with nearly half of a normal year's total rainfall coming in just three months. That's because through the wet winter, TVA's network of 49 dams held back 2.2 trillion gallons of water in storage reservoirs upstream of Chattanooga, which is the drainage point in the Tennessee River basin for more than 20,000 square miles of East Tennessee, western Virginia, western North Carolina and North Georgia. TVA estimates it averted nearly \$1 billion of flood damage, including \$772 million in damage in Chattanooga that would have otherwise been caused by the heavy rains if the agency's dams and water management programs were not in place. Without those dams, TVA engineers estimate the Tennessee River would have risen 15.8 feet above what it reached on Feb. 11, leaving many riverfront, downtown and North Shore properties under water.

"The last three months have been an ongoing cycle of holding back water to avert flood damage, releasing a large amount to recover storage and balancing Tennessee River flows through a sustained above-normal rain event," said James Everett, senior manager of TVA's River Forecast Center. Prior to TVA erecting its dams on the Tennessee River and its tributaries upstream of Chattanooga, heavy rains in 1917, 1867 and 1891 left much of Chattanooga underwater.



Contributed graphic from the Tennessee Valley Authority

In Chattanooga, rainfall totaled nearly 26 inches during January, February and March, or nearly double the normal 14.9 inches of rain for the quarter, according to the National Weather Service. This year's rainfall in the first quarter was slightly below the record level set in 1990 when 26.67 inches fell in Chattanooga in the first three months of the year. According to the National Weather Service's outlook for this spring, there is a higher probability of above-normal precipitation in the next three months, said Lyle Wilson, meteorologist in charge at the National Weather Service office in Morristown, Tenn.



Watts Bar Dam

During much of February and part of March, heavy flows on the Tennessee River forced the closure of the Nickajack gorge for commercial navigation. Downstream at Savannah, Clifton, Perryville and Johnsonville in Tennessee, thousands of acres of low-lying farmland were flooded this winter. River levels have crested or are expected to crest this week in those areas,

but all will remain above flood stage for the next few days. TVA spokesman Travis Brickey said additional spilling at TVA dams is still possible in coming weeks, depending on rainfall. TVA typically raises the lake levels in its storage reservoirs to summer pool levels by June 1, but lower main river reservoirs fill before the upper main river. Fort Loudoun, Watts Bar, and Chickamauga have already begun transitioning from winter to summer pool with a target of May 16 to be at higher summertime levels. "We are currently recovering flood storage on many of the tributaries that are well above their normal elevation for this time of year and will transition to a filling operation over the next few weeks," Brickey said.



Other Stuff:

(Earthquakes and tornadoes don't give much time to protect.)

Earthquake shakes Boise with 6.5 magnitude that could be Idaho's second-strongest ever

BY CHADD CRIFE, XIMENA BUSTILLO, KATE TALERICO, HAYLEY HARDING, NICOLE BLANCHARD, AND NICOLE FOY, MARCH 31, 2020, idahostatesman.com



An earthquake shook Boise and the Treasure Valley at 5:52 p.m. Tuesday, according to the U.S. Geological Survey.

The shaking lasted for 20-30 seconds, with a small pause, at a home in East Boise and at the Idaho Statesman building on the Boise Bench. The U.S. Geological Survey pegged the earthquake at 6.5 magnitude, with an epicenter in the mountains northwest of Stanley and 45 miles west of Challis. The quake hit near the northern-most turn in Idaho 21 between Stanley and Lowman, or 73 miles northeast of Meridian.

There were at least 20 aftershocks, according to USGS, with a magnitude-4.6 tremor giving parts of Boise a strong, brief shake at 6:27 p.m. A 4.4 struck at 8:09 p.m. Stanley Mayor Steve Botti told the Idaho Statesman about 8:45 p.m. that he hadn't seen any

damage but the town was "still surveying for damage." "Stuff was flying all over the place," Botti said earlier. "I was upstairs and I tried to walk down the steps and I couldn't because it was shaking too much." Officials in the Treasure Valley also had encouraging early news. "We don't have any reports of damage just yet," Hayley Williams of the Boise Police Department said shortly after the first quake. "We haven't sent any first responders out — police or fire," said Stephany Galbreath, of the Meridian Police Department.

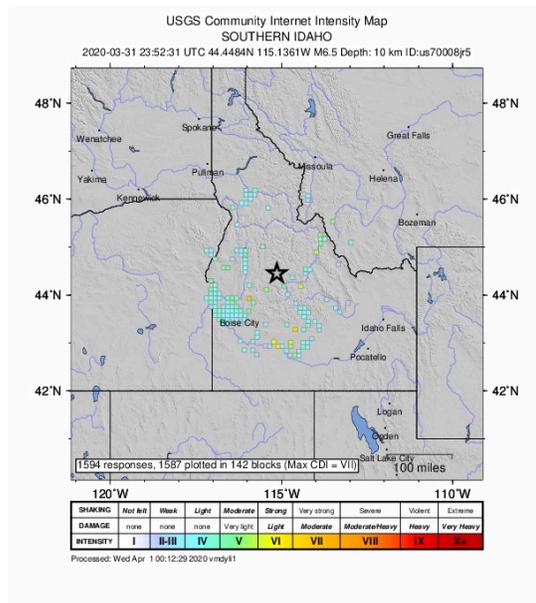
Boise Mayor Lauren McLean said that "first responders are out doing building checks downtown. We've already done a scan of all of our public works facilities and they all look good." According to past Idaho Statesman research, the magnitude-6.5 quake would be the second-largest in Idaho history if it stands (the number often is adjusted with more information). The Borah Peak earthquake in 1983, which was a magnitude 6.9, killed two people in Challis near the quake's epicenter. The second-largest on the books now is a three-way tie at 5.8 from 1983-84. The five strongest previous Idaho earthquakes were all in the Challis area. Expect more earthquakes in the days to come, USGS says. There's a 48% chance of a magnitude-5.0 quake or higher, its forecast says.

"According to our forecast, over the next one week there is a 4% chance of one or more aftershocks that are larger than magnitude 6.5," the USGS forecast says. "It is likely that there will be smaller earthquakes over the next one week. ... Magnitude 3 and above are large enough to be felt near the epicenter. The number of aftershocks will drop off over time, but a large aftershock can increase the numbers again, temporarily." Local resident Anna Eberlin sent the Idaho Statesman a photo of a mirror that crashed to the floor in her house. "It scared my kids and me half to death," she said. "Everyone is OK after some tears and nervous excitement about their first earthquake." Typically, Idaho earthquakes occur in the central and southeast parts of the state. Recently, a swarm of low-magnitude quakes rumbled across parts of Idaho, Utah and California.

Two earthquakes rattled the Boise area in the mid-1940s, according to the Idaho Geological Survey. Another in 1916 "wrecked several brick chimneys at Boise and sent residents rushing into the street." Central Idaho has seen its share of seismic activity in recent years. The region saw swarms of earthquakes in December 2015; December 2014 to January 2015; December

2014; and April to May of 2014. Those included a 5.0 earthquake on Jan. 3, 2015, and a 4.8 earthquake on April 13, 2014. There were immediate reports that Tuesday's earthquake was felt in Coeur d'Alene, Twin Falls and Hailey in Idaho; Spokane, Washington; Utah; and Missoula and Bozeman in Montana. "I am from Florida and we have always had hurricanes growing up, but I had never been in an earthquake," said Kurt Wisheart, of Boise. "This was the first time for me, which is why I walked out because this is weird. Like, what's everyone to do?" Meridian resident Zach Borman said he and his wife experienced nausea after the quake. "Felt a bit longer than a minute," Borman said. "While minding our social-distancing business, the house started a low rumbling. I assumed it was a heavy wind, or some sort of issue with our air conditioning, but my wife and the dogs were both reacting to it and it just kept going. "My first thought when I realized it was probably an earthquake was: 'Wow. More stacked on top (of the coronavirus pandemic)? Way to add insult to injury.' " Spencer Tangen of the National Weather Service in Boise said it might not be unusual to feel aftershocks with an earthquake that size. So did McLean. "I'd just like the community to know that there is likely a very real possibility with a quake of that size that you'll feel more," McLean said.

Intermountain Gas spokesman Mark Hanson said the company had received some calls from people smelling gas, and technicians were responding and assessing. He didn't have further information. Idaho Power immediately began inspecting its 17 hydroelectric plants across Idaho after the earthquakes, spokesman Jordan Rodriguez said. That was the main infrastructure concern, he said. The dams are mostly along the Snake River. "We have completed onsite inspections at each of our power plants and found no damage," Rodriguez texted Tuesday night. "In addition, no power outages or system problems were reported as a result of the quake." The Ada County Sheriff's Office tweeted a request for people to stop spreading "false online rumors" about damage to Lucky Peak Dam. A message left with the U.S. Army Corps of Engineers, which manages the Lucky Peak Dam and Lake area, wasn't immediately returned.



Suez Water Idaho also didn't immediately return a message. Savannah Brehmer, spokeswoman for Federal Emergency Management Agency region 10, which includes Idaho, Washington, Oregon and Alaska, said you should not attempt to run outside or hide in a doorway during an earthquake. "Dropping, covering and holding on is the best action to take as soon as you realize an earthquake has hit," Brehmer said. "That's what's going to keep your most precious organs safe from potential injury."



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