Dams:
(It's history now.)

Oroville dam's dangerous past
By John Bartell, KXTV, February 09, 2017,

The Oroville dam spillway gates have opened many times in its 49-year life span, but the first time it opened the gates were not completed. The dam has seen many hardships in its lifetime starting with its construction. "In 1965 rock trains collided driving them on top each other in the tunnel and blew up." said historian Larry Matthews. The author who wrote two books on Oroville dam. The massive structure took massive machinery to build. It was an engineering marvel supported by Governor Brown Sr. and future president Ronald Regan, but it took more than tax payers dollars to complete.

Quote of Note: “Don’t worry about avoiding temptation. As you grow older, it will avoid you.” -- Winston Churchill

"Good wine is a necessity of life." - -Thomas Jefferson

Ron's wine pick of the week: 2014 Bedrock Wine Zinfandel "Old Vine"
“No nation was ever drunk when wine was cheap.” - - Thomas Jefferson

Copy obtained from the National Performance of Dams Program: http://npdp.stanford.edu
"There were 34 men killed on Oroville dam," said Matthews. Documenting the dam's dangerous past is one thing, but living the dangerous life is another. "The dam hadn't even gotten paved on top when it got to spill situation." said Joel McKin. The former dam operator is the man behind many of these historic pictures. It was his job to document the dam's construction from start to finish. He witnessed his fair share of danger. "We didn't have manual gates back then. Men had to take shift when the water was released," said McKin. "Oroville dam was dedicated in 1968, but spill gates mechanical components where not finished when water reached release levels for the first time. "I was one of the first to open the gates." A history of small failures may plague this dam, but lessons learned in the past help make life-saving decisions today. The Oroville dam still stands because of the sacrifice from the men and women who maintain this mighty structure.

(News on spillway.)

State engineers have discovered new damage to the Oroville Dam spillway in Northern California.
sacbee.com, Feb.9, 2017

Earlier this week, chunks of concrete went flying off the emergency spillway, creating a 200-foot-long, 30-foot-deep hole. After releasing water to test how much the facility could still handle, state engineers told the Sacramento Bee newspaper (http://bit.ly/2lmI59V ) that they found the hole had grown by an additional 50 feet. They said the new damage wasn't as bad as they'd expected. Officials with the Department of Water Resources, which operates the dam, say the dam is safe and doesn't threaten communities downstream. But reservoir levels are continuing to rise behind the critical flood-control structure.

(As Yogi Berra said "it's not over until it's over.")

Nearly 200,000 remain under evacuation near California dam
By OLGA R. RODRIGUEZ and DON THOMPSON, Associated Press, 2/12/17, msn.com

OROVILLE, Calif. (AP) — Nearly 200,000 people remained under evacuation orders Monday as California authorities try to fix erosion of the emergency spillway at the nation's tallest dam that could unleash uncontrolled flood waters if it fails. About 150 miles northeast of San Francisco, Lake Oroville — one of California's largest man-made lakes — had water levels so high that an emergency spillway was used Saturday for the first time in almost 50 years after its main spillway was damaged during recent heavy rain. The evacuation was ordered Sunday afternoon after engineers spotted a hole on the concrete lip of the secondary spillway for the 770-foot-tall Oroville Dam and told authorities that it could fail within the hour.

"I'm just shocked," said Greg Levias, who was evacuating with his wife, Kaysi. "We have two boys and our dog," said Kaysi Levias. "All the stuff we could fit in the trunk — clothes and blankets." What they couldn't fit they piled as high as they could in their downstairs Yuba City apartment and joined the line of traffic attempting to leave the city where they had moved just three weeks ago. Panicked and angry residents sat in bumper-to-bumper traffic hours after the evacuation order was given. Raj Gill was managing a Shell station where panicky motorists got gas and snacks while they waited for gridlocked traffic to clear. His boss told him to close the station and flee.
himself, but he stayed open to feed a steady line of customers. "You can't even move," he said. "I'm trying to get out of here too," he said. "I'm worried about the flooding. I've seen the pictures — that's a lot of water."

State Fire and Rescue Chief Kim Zagaris said at least 250 law enforcement officers from throughout the state are in the area or on their way to help the people evacuating. A California Highway patrol spokesman said they would have two planes out Monday to help with search and rescue and traffic control. Late Sunday, officials noted water was no longer spilling over the eroded area but said the evacuation orders remained in place. "There is still a lot of unknowns," said Butte County Sheriff Kory Honea. "We need to continue to lower the lake levers and we need to give the Department of Water Resources time to fully evaluate the situation so we can make the decision to whether or not it is safe to repopulate the area." About 188,000 residents of towns in Yuba, Sutter and Butte counties remained under evacuation orders.

 Acting Director Department of Water Resources Bill Croyle said officials will be able to assess the damage to the emergency spillway now that the lake levels have been lowered. The erosion at the head of the emergency spillway threatens to undermine the concrete weir and allow large, uncontrolled releases of water from Lake Oroville. Those potential flows could overwhelm the Feather River and other downstream waterways, channels and levees and flood towns in three counties. Oroville Lake levels had decreased by Sunday night as they let water flow from its heavily damaged main spillway. Croyle said the department will continue releasing as much as 100,000 cubic feet per second from the main spillway to try and reduce the dam's level by 50 feet ahead of upcoming storms forecast to reach the area Wednesday. Department engineer and spokesman Kevin Dossey told the Sacramento Bee the emergency spillway was rated to handle 250,000 cubic feet per second, but it began to show weakness Sunday after flows peaked at 12,600 cubic feet per second.

Honea said there was a plan to plug the hole by using helicopters to drop rocks into the crevasse. But Croyle said at that no repair work was done after officials looked at the flow and available resources. Gov. Jerry Brown late Sunday issued an emergency order to fortify authorities' response to the emergency at the dam and help with evacuations. Adjunct General David S. Baldwin said at a news conference late Sunday that the helicopters will also be available for search and rescue Monday.

 The California National Guard put out a notification to all 23,000 soldiers and airmen to be ready to deploy if needed and will provide eight helicopters to assist with emergency spillway reconstruction, he said. Baldwin says the last time an alert like Sunday's was issued for the entire California National Guard was the 1992 riots. Unexpected erosion chewed through the main spillway during heavy rain earlier this week, sending chunks of concrete flying and creating a 200-foot-long, 30-foot-deep hole that continues growing. Engineers don't know what caused the cave-in, but Chris Orrock, a spokesman for the state Department of Water Resources, said it appears the dam's main spillway has stopped crumbling even though it's being used for water releases. Officials earlier Sunday stressed the dam itself was structurally sound. The lake is a central piece of California's government-run water delivery network, supplying water for agriculture in the Central Valley and residents and businesses in Southern California.
I will start with the sliver of good news. A series of weather systems have provided copious amounts of rainfall in California, a state that has been in dire need of rain over the past few years. However, the heavy amount of rainfall has led to a very dangerous situation at the Oroville Dam in northern California. At 770 feet, it is the tallest dam in the United States and some 44 feet taller than the more well-known Hoover Dam. It is a primary engineering piece in California’s efforts to transport water from the Sierra Nevadas to cities like Sacramento and vital agricultural lands to the south. The main spillway has been compromised. It actually has a hole in it. Yes, a hole. The hole was caused by erosion and repairs are estimated to be $100-200 million range according to the Los Angeles Times. The compromised spillway could mean that the water in the reservoir behind the dam will find a path of least resistance into the city of Oroville and other populated regions. For this reason nearly 200,000 people were evacuated from their homes. Early reports Monday morning suggest that the immediate danger has passed, but this situation is likely far from settled. I remember a relative telling me when I was younger, "Boy, there is no human that can stop a bunch of water when it decides to go where it wants to go."

My colleague Professor John Knox, an atmospheric scientist at the University of Georgia, put it this way:

"The dam itself isn't going, but the spillways are (the main one has the hole), and the lake behind the dam will just take the side door out into Oroville and points south (all the way to Sacramento?). Why is this a problem? Here's how much water is behind the Oroville Dam: 1.17 trillion gallons. Or, a little more than 23 billion full bathtubs' worth. And if the spillways fail and all that water escapes, it'll escape pretty much all at once. Imagine taking the Ice Bucket Challenge with 23 billion bathtubs, all at once, on your head."

Professor Knox made these "back of the envelope calculations" using data from the U.S. Geological Survey and the state of California. If you want an indication of how serious the situation was Sunday evening, Governor Jerry Brown issued an emergency order and put the state's National Guard on notice. Or consider this statement by the National Weather Service Sacramento at 4:47 pm PST on Sunday Feb. 12.

(And, more Oroville dam news.)

How Did the Oroville Dam Crisis Get So Dire?
Drought, climate change, and aging infrastructure combined to create a looming catastrophe that forced 188,000 Californians to evacuate.

By DAVID A. GRAHAM, 2/13/17, THEATLANTIC.COM

Maybe the Oroville Dam was cursed from the start. In December 1964, three years into the massive barrier’s construction, a huge flood struck the northwest, killing dozens. The dam was nearly overtopped, which could have led to its failure even before it was completed. Instead, the partially completed dam helped prevent a larger disaster by reducing the flow of the Feather

Copy obtained from the National Performance of Dams Program: http://npdp.stanford.edu
Less than a year later, two trains working on the site collided head-on in a tunnel near the dam, killing four men in a fiery crash and damaging the tunnel, slowing down work on the project.

The dam, which sits south of Chico and north of Sacramento, was eventually completed in 1968, creating the nation’s tallest dam. It forms the head of California’s massive, byzantine State Water Project (SWP). The SWP moves water from Northern California south toward Los Angeles, an average of 3 million acre-feet per year. A drop of water that starts at Lake Oroville, above the dam, takes 10 days to move all the way to the end of the system, south of Los Angeles.

At least in theory, Controlling a system that large is never simple, and the delicate flow of the State Water Project is under threat now, and on Sunday, authorities ordered 188,000 people near the dam to evacuate. “This in NOT A Drill. This in NOT A Drill. This in NOT A Drill,” the Butte County Sheriff’s Office blared in its order. Officials say the dam itself is structurally sound, but the spillways designed to take pressure off the dam in the case of high water levels are both damaged. Dramatic videos show water pouring out of the lake and over the spillways.

There’s some bitter irony to the problem of too much water menacing the Golden State. California has suffered through a long and severe drought, at times driving Governor Jerry Brown to institute stringent—critics say draconian—water controls. This winter has seen much more snow and rain, which is good news for the parched state, but bad news for the Oroville Dam, where huge amounts of water are collecting. The lake rose 50 feet in a matter of days. Earlier in February, as operators let water over a concrete spillway to reduce the pressure, a crater appeared in the spillway. Faced with too much water in the lake, they continued to use the spillway anyway, and the damage got worse. On Friday, the crater was 45 feet deep, 300 feet wide, and 500 feet long.

There’s a backup for the concrete spillway, an auxiliary spillway that had never been used. It’s really just a hillside sloping down from the reservoir, covered in brush and trees. As the situation became more dire last week, crews starting clearing the slope for its first baptism. Managers hoped pressing the auxiliary spillway into service would give them time to patch up the concrete spillway over what’s expected to be a drier season. (That could be easier said than done: Snowpack upstream is 150 percent of normal for this time of year, meaning there’s going to be more melt headed downstream than normal.) Initially, that seemed to do the trick: The water level in Lake Oroville was dropping, and the danger seemed to be abating. On Sunday, however, officials noticed the auxiliary spillway was starting to erode—at the same time that huge amounts of water continued to flow into the lake. The fear is that if the spillway gives out, a wall of water could push down out of Lake Oroville and toward lower ground. Workers are trying to shore up the emergency spillway with bags of rocks, including dropping them from helicopters. If it gives way, the Feather River would flood downstream, and might wash out other levees farther down the river. Meanwhile, debris from erosion also forced the state Department of Water Resources, the dam’s operator, to shut down its power plant, which could have helped to release some additional water. And there’s rain forecast for later this week.

How did the situation get so dire? One part of that is the seesaw state of the drought, with the weather moving from dry to saturated in a matter of months. (While droughts are a normal part of the globe’s climate, scientists say human-caused climate change has exacerbated them, increasing the severity of California’s drought by as much as 20 percent.) Dam operators can’t control the weather, but they can try to prepare for unexpected events like the sudden inundation of Lake Oroville with consistent maintenance. One question in this case is whether the Oroville Dam has been adequately maintained. In 2005, a trio of environmental groups filed a complaint with the Federal Energy Regulatory Commission, saying the emergency spillway was
unsafe, The Mercury News reports. Their worry proved prophetic: The groups said in the event of heavy rain and flooding, the hillside would wash out and produce flooding downstream. They asked that the auxiliary spillway be paved with concrete, like the primary one. But the federal government rejected the request after consulting with the state and local agencies involved in the water system, which said they did not believe the upgrades were needed. As for the primary spillway, the state did some repair work around the area of the collapse in 2013, CBS Sacramento reports. The last state inspection was in July 2015, but workers did not closely inspect the concrete, the Redding Record Searchlight notes, instead eyeing it from a distance and concluding it was safe. Officials say repairs should cost $100 million to $200 million, once it's dry enough to begin them.

(Fix it fast.)

Oroville Dam Emergency Spillway Repairs Starting
February 13th, 2017, by Roy W. Spencer, Ph. D., drroyspencer.com

With daylight and Oroville Lake water levels now 4 feet below the lip of the emergency spillway, we can see that the area of concern is a gouge which developed near the far end of the concrete weir, and was eroding uphill toward that structure; for scale, those yellow spots are people inspecting the gouge (click images for full-size): A wide-angle view (KCRA-TV helicopter frame grabs) shows the main, heavily damaged spillway which still has a huge 100,000 CFS flow continuing in an attempt to reduce the lake level as much as possible: Rocks have been bagged overnight and helicopters will soon start filling the gouge:

The 100,000 CFS flow through the main spillway continues to erode the break in the concrete flume, but engineers are not worried about the damage eroding uphill and damaging the main portion of the dam:

(Oh, oh what happened?)

Officials were warned the Oroville Dam emergency spillway wasn't safe. They didn't listen.
The Washington Post, by Kristine Guerra, 2.13.17, msn.com

In 2005, three environmental groups warned state and federal officials about what they believed was a problem with Oroville Dam’s emergency spillway, which was at risk of collapsing over the weekend as recent storms caused the adjacent massive reservoir to swell. Their concern, which seemed to have fallen on deaf ears: The emergency spillway, which is meant to be used in urgent situations — is not really a spillway. Rather, it’s a 1,700-foot long concrete weir that empties onto a dirt hillside. That means, in the event of severe flooding, water would erode that hillside and flood nearby communities, the groups said then.
That nearly happened on Sunday, when a hole on the emergency spillway threatened to flood the surrounding area and prompted officials to evacuate thousands of residents who remain displaced as of Monday afternoon. When the Oroville Dam was going through a re-licensing process, the three groups filed a motion in October 2005, urging a federal regulatory agency to require state officials to armor the emergency spillway with concrete so that in case of extreme rain and flooding, water won’t freely cascade down and erode the hillside. The upgrade would have cost millions of dollars, and no one wanted to foot the bill, said Ronald Stork, senior policy advocate for Friends of the River, one of the groups that filed the motion. “When the dam is overfull, water goes over that weir and down the hillside, taking much of the hillside with it,” Stork told The Washington Post. “That causes huge amounts of havoc. There’s roads, there’s transmission lines, power lines that are potentially in the way of that water going down that auxiliary spillway.” Federal officials, however, determined that nothing was wrong and the emergency spillway, which can handle 350,000 cubic feet of water per second, “would perform as designed,” according to a July 2006 memo from John Onderdonk, then a senior civil engineer for the federal agency. “The emergency spillway meets FERC’s engineering guidelines for an emergency spillway,” Onderdonk wrote. “The guidelines specify that during rare flood event, it is acceptable for the emergency spillway to sustain significant damage.”

Fast forward 11 years later, the erosion of the emergency spillway became so severe this weekend with only up to 12,000 cubic feet of water per second. That’s a little more than 3 percent of what officials said the spillway can handle. Lake Oroville’s level rose significantly after potentially record-setting rain surged through California following a long drought. The Oroville Dam, the tallest in the country at 770 feet, remains stable, officials said. But the structure of the spillways, which are designed to release water from the reservoir in a controlled fashion, have crumbled. Earlier this month, a portion of the main spillway — a 3,000-foot-long structure lined in concrete — eroded because of the high volume of water spilling from the reservoir, creating a craterlike hole. Officials with the California Department of Water Resources, which owns and operates the dam and reservoir, then decided to use the adjacent emergency spillway for the first time since the dam was built nearly 50 years ago. Sheets of water began spilling over the emergency spillway and onto the hillside, carrying mud and debris into the nearby Feather River. The emergency spillway appeared to be working as expected — until Sunday, when officials spotted a hole. That raised fears of a catastrophic flood that could wipe away Oroville, a town of 16,000 people, and prompted officials to evacuate nearly 200,000 area residents. “Auxiliary spillway at Oroville Dam predicted to fail within the next hour. Oroville residents evacuate northward,” the state water agency tweeted shortly before 5 p.m. Sunday. Stork believes none of that would have happened had officials listened to his and others’ concerns and built a proper emergency spillway 12 years ago. The two other groups that filed the 2005 motion are the Sierra Club and the South Yuba River Citizens League.

“They told us not to worry. All was good. Everything was fine. It’s all safe,” Stork said. “First of all, they’re not supposed to fail. That’s not what we do in a first-world country. We don’t do that. We certainly don’t do that with the nation’s tallest dam. An auxiliary spillway isn’t supposed to cause lots of havoc when it’s being used.” Construction would’ve cost at least $100 million, Stork said, and the state contractors in Southern California that buy water from Northern California would’ve had to pay for it. The Metropolitan Water District of Southern California, which provides water to 19 million people in Los Angeles, San Diego and other areas, and the State Water Contractors, would’ve had to shoulder the cost and deemed the upgrades unnecessary, according to the Oroville Mercury Register. “The people who are bearing the personal risk of being killed and having their homes washed away are the people of Northern California,” Stork said.

Pressed during a news conference Monday afternoon about the 2005 motion, Bill Croyle, acting director of the Department of Water Resources, said he’s not familiar with the conversations that happened then. “It’s the first time it’s ever taken water,” Croyle said of the emergency spillway. “We don’t know exactly why this erosion occurred.” Lester Snow, the agency’s director from 2004 to 2010, told the Oroville Mercury Register that he does not recall specific information about the debate over the emergency spillway 12 years ago. “The dam and the outlet structures have
always done well in tests and inspections,” Snow told the paper. “I don’t recall the FERC process.”

The crisis seemed to have been averted by Monday. Lake Oroville had dropped to 898 feet by 4 a.m., according to the Sacramento Bee. Water flows into the emergency spillway at 901 feet. Officials doubled the flow of water out of the main spillway to 100,000 cubic feet per second, with the hope of lowering the lake level by 50 feet to leave room for upcoming rain. Rain is expected through the region on Wednesday and Thursday, with showers lingering on Friday and Saturday, according to the National Weather Service. Water levels also are expected to rise later this week and into early next week. Officials said Monday that they’re continuing to monitor the spillways for further erosion. It remains unclear Monday when residents will be allowed back to their homes. Inmates at the Butte County Jail also have been moved to Alameda County about 170 miles away.

(Here’s a question on everybody’s mind who lives downstream of Oroville Dam.)

Is Failure of the Oroville Dam Possible?
February 11th, 2017, by Roy W. Spencer, Ph. D., drroyspencer.com

The last couple of days have not made me very confident in the predictions of engineers associated with the Oroville Dam. While I am a climate researcher, and not hydrologist, it took me less than an hour midday yesterday (see comments here) to estimate that the emergency spillway would be breached around 9 a.m. PST this morning. I was off by an hour…it was breached at 8 a.m. But engineers were leaning toward the lake level never getting that high (901 ft.) This kind of calculation isn’t rocket science. As long as inflow into the lake exceeds outflow (both of which are monitored hourly), the lake level will rise. Why were engineers reluctant to predict the (admittedly historic) event? Now let’s talk about something that is much more uncertain…the damage now occurring as water continues to erode the dam under the gaping hole which has split the main concrete spillway:

One dam engineer who has worked on similar dams is worried that this is a structural threat to the dam. Furthermore we haven’t even entered snow melt season yet, and already Lake Oroville has exceeded its 100% capacity (here’s yesterday’s plot, at 97%): So, I am merely raising the question: if engineers were reluctant to predict the current topping of the emergency spillway — a relatively benign event that was rather easily predicted — how much confidence can we have that the damage to the main spillway won’t compromise the dam? I think engineers are going to have to be a little more forthcoming about whether such a failure — which threatens thousands of people immediately downstream — is indeed possible in the coming weeks and months as the massive mountain snowpack melts and continues to fill the lake — and continues to erode the spillways.

(Looking for help. These are the times when Calexit doesn’t sound like such a good idea.)

California Gov. Brown seeks federal assistance for 'potential failure' of Oroville Dam emergency spillway
By Jeff Daniels, 2/13/17, CNBC.com

California Gov. Jerry Brown on Monday evening requested federal assistance with the Oroville Dam emergency spillway crisis as mandatory evacuation orders remained in effect for about 188,000 residents downstream from the nation's tallest earthen dam. "I respectfully request that you issue an emergency declaration for direct federal assistance for the counties of Butte, Sutter and Yuba, as a result of the potential failure of the Lake Oroville Dam emergency spillway," Brown said in a letter

Copy obtained from the National Performance of Dams Program: http://npdp.stanford.edu
to President Donald Trump. Added Brown, "As a result of the potential for catastrophic flooding, approximately 188,000 residents from Butte, Sutter and Yuba counties were forced to immediately evacuate their homes for life and safety. Officials are aggressively attempting to lower Lake Oroville's water levels, as another atmospheric river storm system is scheduled to arrive within 48 hours." In asking for assistance, the governor said Oroville Dam emergency is "of such severity and magnitude that continued effective response is beyond the capabilities of the state and affected local governments and supplemental federal assistance is necessary to save lives and to protect property, public health and safety, and to lessen the effects of this serious situation." Also late Monday, workers scrambled to place giant sacks of rocks into portions of the eroded emergency spillway using heavy-lift helicopters. They also planned to use grout in damaged areas of the emergency spillway to prevent further erosion. State and local officials worked into the night Sunday to evacuate thousands of residents downstream from the dam after a hole in an emergency spillway raised fears of flash floods. Oroville Dam — California’s second-largest dam — is located about 70 miles north of Sacramento.

State officials have denied allegations there was lax safety at the Oroville Dam despite a report of previous warnings about the emergency spillway. The hole found Sunday in the emergency spillway — essentially a natural hillside of soil, rock and brush — led engineers to shift major water flows away from this unlined channel. The main spillway is damaged from significant concrete erosion but was being utilized to release water from the swollen dam Monday, according to the California Department of Water Resources. There have been concerns about Oroville Dam safety since the erosion of the primary spillway was discovered Tuesday. The crippled primary spillway last week was unable to release a sufficient amount of water to keep up with inflows from the plentiful rains in the surrounding area. State and federal officials failed to heed safety warnings about Oroville more than a decade ago, according to the Mercury News. The report Sunday said three environmental groups warned the Federal Energy Regulatory Commission about the vulnerability of the hillside emergency spillway. The Oroville Dam was completed in the late 1960s when Ronald Reagan was governor of California.

FERC confirmed last week it had several engineers onsite at the Oroville Dam but Monday the agency didn't respond to requests for comment. Earlier Monday, DWR officials denied that the state had ignored earlier concerns about the Oroville Dam's emergency spillway or had been lax in inspections there. "We have a very rigorous schedule of inspections that is determined by state and federal regulators," said DWR spokesman Eric See. "We actually do those inspections annually." DWR's acting director Bill Croyle defended the agency's handling of the Oroville situation and the emergency spillway's safety when questioned at Monday's press conference. "I'm not sure anything went wrong," Croyle told reporters. "That system has been monitored. This is the first time it's ever taken water over the system." The emergency spillway at Oroville Dam was activated Saturday for the first time ever in the dam's 48-year history after the dam reached above its capacity following a barrage of rain in the Northern California region. However, state engineers on Sunday discovered significant erosion had occurred back towards the face of the emergency spillway at Oroville Dam after huge water outflows, meaning the structural integrity of the dam's auxiliary spillway was at risk. That led state and local authorities Sunday to order an immediate evacuation of communities downstream from the dam. "If the emergency spillway were to fail, it would send a 30-foot wall of water downstream, resulting in catastrophic flooding," Brown said in his Monday letter to the president. If there were an uncontrolled discharge of waters from the dam, it would flow downstream to the Feather River and tributaries and flood communities in the eastern Sacramento Valley. On Saturday, Oroville Dam reached its elevation capacity of 901 feet, which automatically triggers the emergency spillway. At noon on Sunday the elevation topped 902 feet and by Monday at 7 p.m. after major outflows from the primary
spillway the elevation was down to around 893 feet, according to the DWR data website. Engineers were urgently working to lower the lake level by 50 feet in order to prepare for future inflows of water due to storms and precipitation.

Butte County Sheriff Kory Honea told reporters at the press conference Monday there was progress with "no water flowing over the emergency spillway...and the lake levels are continuing to fall." Even so, the sheriff said the evacuation order will remain in effect as experts were still trying to assess the damage at the Oroville Dam emergency spillway. "We need to make sure that before we allow people back into those areas that it is safe to do so," said Honea. "I recognize that this is displacing a lot of people. I recognize what a hardship it has placed on our community." Oroville Dam is located in the foothills of the western Sierra Nevada mountain range. The pressure is on state officials to resolve the spillway crisis at Oroville since the heavy snowfall in the Sierras will be melting in the spring and bring more water to area reservoirs. Rain is forecast in the Oroville area as early as Wednesday night from incoming storms. The arriving storm systems are expected to be significant and remain in the Northern California region through next week.

"This is a series of storms coming in and we could see potentially 4 to 8 inches of precipitation," said Idamis Del Valle, a meteorologist with the National Weather Service office in Sacramento. DWR's Croyle reiterated Monday that the "dam itself is sound. We have some little pieces that are critical to the operation of the dam that have been impaired." Also, state officials have stressed that the dam itself is a separate structure from the emergency spillway. The cost to repair the primary spillway was estimated to be as much as $200 million, state officials said over the weekend. With the significant damage to the emergency spillway, the price tag on repairs is likely to go much higher. Brown's request for direct federal assistance to the president could help cushion the blow of the repair costs. The state indicated Sunday it might fix the existing spillways or build new ones. California's governor spoke to emergency response officials at the State Operations Center late Monday, then told reporters afterward he spoke to a Trump cabinet official about the request for assistance but Brown wouldn't divulge the name of the cabinet member other than to say they had been confirmed. The governor also was asked about Trump's threat to take money away from California could impact the state's request. "I'm sure that California and Washington will work in a constructive way," Brown said. "That's my attitude. There will be different points of view, but we're all one America."

(To this website for more on Oroville Dam. Although, some of the facts are inconsistent with other articles, the photos and videos are good: http://www.dailymail.co.uk/news/article-4221808/Officials-warned-Oroville-Dam-12-years-ago.html?ito=email_share_mobile-masthead

(Maybe the cracks weren't properly repaired.)
Oroville Dam Has Cracks
By JUSTIN PRITCHARD and ELLEN KNICKMEYER, Associated Press, usnews.com, Feb. 15, 2017

Six months before rushing water ripped a huge hole in a channel that drains a Northern California reservoir, state inspectors said the concrete spillway was sound. As officials puzzle through how to repair Oroville Dam spillway, federal regulators have ordered the state to figure out what went wrong. Earlier inspection reports offer potential clues, including cracks on the spillway surface that if not properly repaired could let water tear through the concrete. In recent years,
construction crews patched cracks — including in the area where water burrowed a huge pit last week.

Damage to the main spillway triggered a series of problems culminating with the first use of the emergency spillway, which quickly began eroding and threatened to unleash a torrent of water on cities downstream. On Tuesday, officials said the immediate danger had passed, and allowed nearly 200,000 residents to go home after evacuation orders scattered them for nearly two days. Inspectors with the state agency that both operates and checks the dam, the nation’s tallest at 770 feet, walked the half-mile-long spillway in 2014 and 2015 and did not find any concerns.

(Look at the headline in this article.)

Engineers have been using 'patch and pray' techniques to repair Oroville Dam for YEARS as shocking pictures show the scale of the erosion caused by huge hole opened up in the spillway

Article here: http://dailym.ai/2kIM38F

(So true!)

2 dams illustrate challenge of maintaining older designs

By MICHAEL R. BLOOD, Associated Press, February 19, 2017, wsiltv.com

LOS ANGELES (AP) - Twelve years ago, widespread destruction from Hurricane Katrina on the Gulf Coast helped compel federal engineers 2,000 miles away in California to remake a 1950s-era dam by constructing a massive steel-and-concrete gutter that would manage surging waters in times of torrential storms. The nearly $1 billion auxiliary spillway at Folsom Dam, scheduled to be completed later this year, stands in contrast to the troubles 75 miles away at the state-run Oroville Dam, where thousands of people fled last week after an eroded spillway threatened to collapse - a catastrophe that could have sent a 30-foot wall of floodwater gushing into three counties.

Together, the two dams illustrate widely diverging conditions at the more than 1,000 dams across California, most of them decades old. The structures also underscore the challenge of maintaining older dams with outdated designs. “Fifty years ago, when we were evaluating flood risk, the fundamental assessment was the climate was stable, not changing. We now know that is no longer true,” said Peter Gleick, chief scientist with the Pacific Institute, a California-based think tank specializing in water issues. “We need to look at the existing infrastructure with new eyes,” he warned. Back in 2005, Katrina’s deadly path became an arguing point for U.S. Rep. Doris Matsui, a California Democrat who was among those pushing Washington for improvements at Folsom Dam, perched 25 miles from 500,000 people living in Sacramento, the state capital. “I used that, vigorously, to say we are the second-most at-risk river city in the nation,” Matsui said, after the Category 5 storm swept through New Orleans.

State officials now face questions about maintenance at Oroville Dam, the nation’s tallest at 770 feet, and why a decade ago they dismissed warnings from environmentalists that more needed to be done to strengthen its earthen emergency spillway. After years of drought, Northern California has become waterlogged this winter from heavy rain and snow. Oroville Lake is brimming, and water managers have been using the main spillway, which is lined with concrete, to lower the water level. The emergency spillway is a brush-covered hillside below a masonry lip and had
never been used until last weekend. When water gushed onto it, the ground began eroding, and it was feared the intake lip could collapse and water would surge down the hill. An investigation into what went wrong could take months.

John France, vice president and technical expert on dams for the engineering consulting firm AECOM, said the problems at Oroville should raise alarms across the country. "Most of the dams in the United States are over 50 years old, when we didn't understand floods as well as we do now. So we have a number of dams in the U.S. that have spillways that aren't large enough for the floods that they should be designed for," France said. Arguments over water, how it's stored and who gets it are as old as the state, and California has often been criticized for not doing more to improve its water systems as the population edges toward 40 million. In a place known for alternating cycles of prolonged drought and biblical rainfall, the idea of asking reservoirs to store extra water for dry times frequently clashes with environmentalists, who want to see rivers flow freely.

At Oroville, opened in 1968, construction crews recently patched cracks on the main spillway, and a state inspector judged the repairs "sound" in a February 2015 report. However, a gaping hole ripped open on that spillway two weeks ago, starting the series of events that led to use of the emergency spillway and evacuation orders for nearly 200,000 people. Since then, crews dumped thousands of tons of rocks to shore up the damaged spillways and residents were allowed to return home Tuesday, after the lake level dropped. Butte County Supervisor Bill Connolly, whose district includes the dam, has criticized dam managers for years. "They never spend money unless they have to," he said. "If we were a federal facility, you don't see this happening."

At a 340-foot high Folsom Dam, operated by the U.S. Bureau of Reclamation, the huge concrete-and-steel chute being constructed by the Army Corps of Engineers is expected to add as much as 40 percent capacity to the main spillway that controls water flowing from the reservoir behind it. It's designed to allow safer releases during times of high water, precisely the challenge that led to fears of catastrophic flooding at Oroville. Rick Poeppelman, chief of the Army Corps engineering division in the Sacramento district, said extensive data about probable maximum flood levels, not available decades ago, helped prompt the decision to build the auxiliary spillway at Folsom Dam. When completed, the spillway can act like a second dam, allowing operators to release water through a series of gates and lower the reservoir level when a major storm is approaching. It includes a chute more than half a mile long. Another advantage: The new spillway gates will be 50 feet lower than those on the dam, allowing for earlier releases of water. The government needs to test the spillway this year to see how it will work. Meanwhile, there are proposals to increase the height of the dam with the potential for extreme weather. In light of the Oroville crisis, Republican state Sen. Ted Gaines said he is considering asking the federal government for a safety review at Folsom Dam, the new spillway and nearby levees, given their proximity to Sacramento. It's not an abstract concern. During heavy storms in 1986, a temporary dam broke open, sending roaring waters downstream to Folsom Dam. In response, officials released more water from the dam than flood levees that guard Sacramento were designed to handle. That time they held, Given the scare at Oroville, "I don't think we are out of the woods yet," Gaines said.

Associated Press Writer Rebecca Boone in Boise, Idaho, contributed to this report.

(This article is baloney. Climate change had nothing to do with what happened at Oroville Dam. The question is not the flow. The question is why did a spillway chute fail that was supposed to handle an even greater flow.)

**California Dam Crisis Could Have Been Averted**

A dismissed lawsuit to strengthen the dam because of climate change effects predicted catastrophic flooding

By Jane Braxton Little, February 20, 2017, scientificamerican.com

By now we have all seen the spectacular images of volumes of water crashing down the Oroville Dam spillway in California and blasting upward into the air as they hit an enormous crater in the spillway floor, flooding down the adjacent hillside, threatening people in towns below. Those images reveal a big mistake: failure to update infrastructure to defend against climate change.
The menacing floodwaters last week forced the emergency evacuation of 188,000 residents. Yet the impending disaster came as no surprise to officials in Butte and Plumas counties. The rural counties, which surround Lake Oroville, had challenged the state’s environmental review of dam operations in a 2008 lawsuit, arguing the state “recklessly failed” to properly account for climate change in its long-term dam management plan.

The dam was built in the 1960s when temperatures were cooler and more precipitation was stored in a greater snowpack in the mountains of the Feather River watershed, which drains into Lake Oroville. Today warming temperatures are bringing more rain as well as melting the Sierra Nevada snowpack earlier in the spring. As the counties’ attorneys predicted, among the results is a rush of downhill water much faster than in the past. “We anticipated that this crisis might come about,” says Tony Rossmann, special counsel to Butte County. That’s exactly what happened a week ago, leading to the crater.

With the reservoir brimming over from rain and rapid snowmelt, and the spillway maxed out as the crater widened, officials activated Oroville’s never-used unpaved emergency spillway—a broad hillside a short distance from the spillway along the same dam wall. The combination of rocks, trees and floodwaters pummeling down toward the cities below the dam forced the mandatory evacuations. Hard rain is happening again today as new storms continue to deluge the area 150 miles north of San Francisco.

The California Department of Water Resources (DWR) owns and manages the Oroville reservoir as part of the State Water Project, a massive utility providing water to 23 million residents and farmers as far south as Los Angeles County. When its dam license expired in 2007, DWR applied to the Federal Energy Regulatory Commission (FERC) for a 50-year renewal. The ensuing lawsuit by the two counties challenged the environmental review that was part of the renewal process. In response, DWR attorneys said their environmental analysis adequately considered climate change “based on the limited information available at the time.” They called specific information about climate change in the Feather River watershed “too speculative” to include. The hydrologic models DWR used are based on the colder decades of the 1940s and 1950s—a hypothetical future that DWR knows to be dangerously false,” the counties responded. Ironically, the counties based their challenge on climate change science developed by DWR’s own scientists, Rossmann says: “They’re among the world’s experts.” He called DWR’s “stubborn refusal to consider 21st century science” particularly surprising for a state agency where the governor repeatedly touts preparedness for climate change.

In 2012 Yolo County Superior Court Judge Daniel P. Maguire upheld DWR’s environmental review. The counties appealed to California’s 3rd District Court of Appeal, where the case has been sitting ever since. The ongoing crisis at Oroville adds new urgency to concerns over the operation and physical integrity of the dam. In 2005 a motion filed by three environmental groups recommended lining the earthen emergency spillway with concrete. The improvements might have prevented the erosion that forced the evacuation of downstream communities, says Ron Stock, a senior policy advocate with Friends of the River, one of the plaintiffs. On February 13, the day after the Butte County sheriff issued the evacuation orders, FERC ordered California to convene a five-member board to assess how to reduce the risk of flooding and analyze what went wrong.

The hydrological changes that provoked the Oroville crisis are likely to affect other dams throughout California and the West. Scientific models project a climate that is more variable, with hotter, longer droughts and bigger precipitation events—specifically, more rain and more intense

Copy obtained from the National Performance of Dams Program: http://npdp.stanford.edu
rainstorms as well as less snowpack. Drought is driving one type of reservoir emergencies: low water. Lake Mead, on the Colorado River, has dropped to its lowest levels since the Hoover Dam was built in 1936. Heavy rainfall and melting snow are driving the other threat of reservoirs overtopping their walls and flooding communities downhill. The Feather River watershed, the lowest in the Sierra, is the first to exhibit the dramatic increases in precipitation and decreases in water stored in snowpack, says Michael Jackson, an attorney representing the Plumas County Flood Control and Water Conservation District. Isabella Dam, at 2,600 feet in the southern Sierra, and Shasta and Trinity lakes, in north-central California, may soon experience similar changes, he says.

Most of the nation’s 84,000 dams were built between 1950 and 1980 and were not designed for the populations now surrounding them, or for today’s changing climate. Nearly 3,000 have no emergency plans, a 2013 engineering report found. Rossmann said dam managers throughout the West should be updating their scientific data to avoid crises similar to Oroville. “It’s irrational and risky to operate without considering modern” climate trends and the changes they could create in rainfall, snowpack, runoff and flooding, he says.

(Nobody is perfect.)

Mind the gaps in dam safety
San Francisco Chronicle, February 20, 2017, sfchronicle.com

An examination of California’s dam safety precautions by staff writers Joaquin Palomino and Cynthia Dizikes highlighted some unacceptable gaps in both rules and practices. Their report, published Sunday, came at a time of heightened concern about the conditions of all of the state’s 1,585 dams after the deterioration of spillways at the nation’s tallest — the Oroville Dam — at a time when rains were pushing its reservoir levels to the limit. Its precarious condition recently resulted in a mass temporary evacuation of residents and businesses within the Feather River’s potential flood zone.

To its credit, California is one of 16 states that require high-hazard dams to be inspected annually. However, Chronicle reporters found that at least 38 facilities — 13 of which posed a risk of property damage or death if they failed — had not been inspected within the required time frame. Examples included Sonoma County, where 10 of the 13 high-risk dams went multiple years without an official review of the state. State Assemblyman Marc Levine, D-San Rafael, has just introduced legislation that would require more extensive annual inspections of spillways on state-managed dams. Levine’s measure should merit a high priority in the state Capitol.

Another area of deficiency — one in which California is behind other states — involves emergency preparedness. This state does not require owners of high-hazard dams to have an action plan that would include mapping out the areas vulnerable to flooding, a warning system to alert residents of pending disaster or an emergency response strategy that would be ready to activate on short notice. The near-miss at Oroville should give state legislators and regulators all the warning they need that dam safety systems need to be reassessed and strengthened.

Herculean emergency repair efforts and a timely reprieve in the weather prevented an ecological and human catastrophe this time. This state cannot simply count on luck and hasty spillway patches to spare lives in the future.
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