



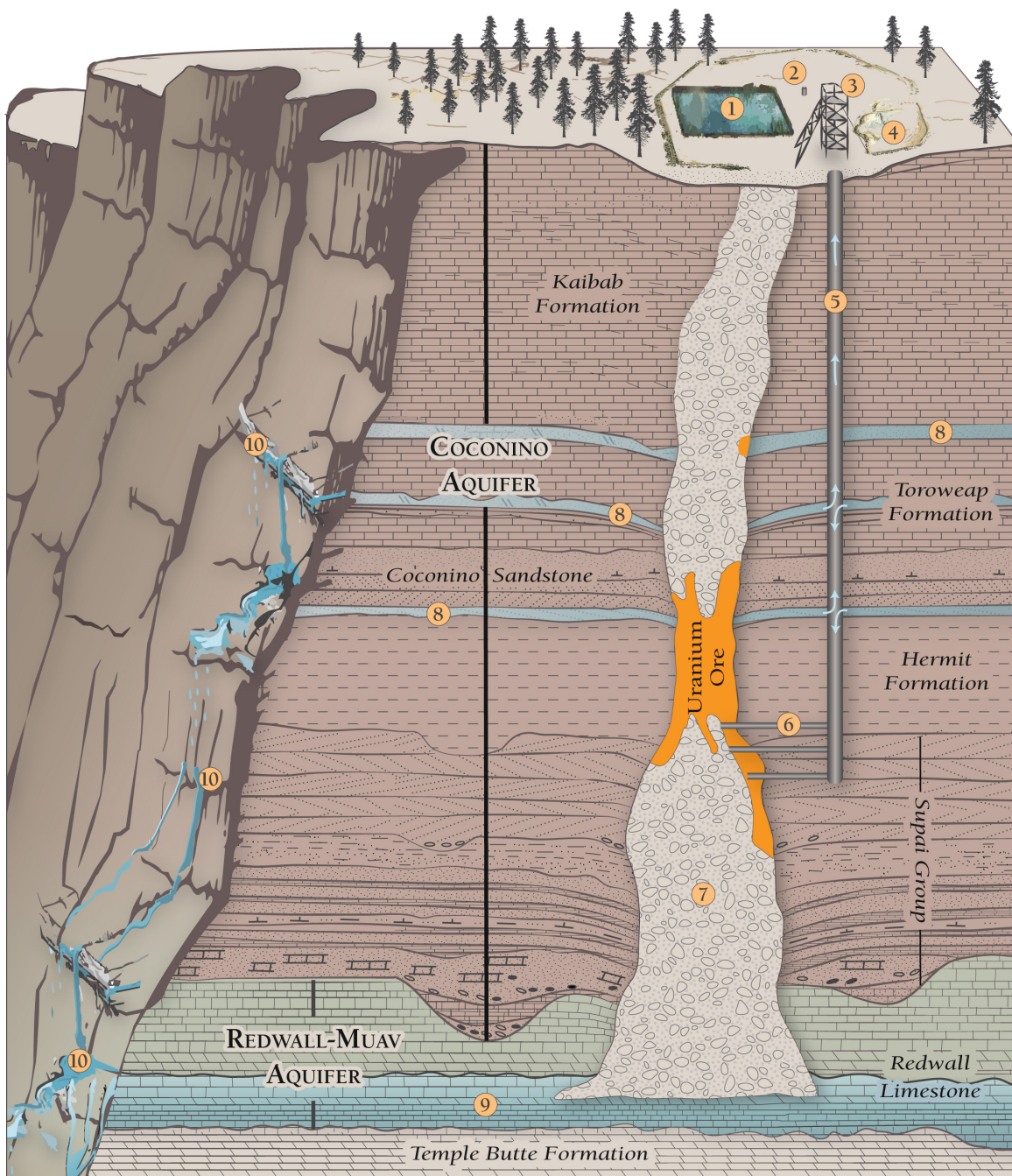
GRAND CANYON
TRUST

Canyon Mine

**Why No Uranium Mine Is “Safe”
for the Grand Canyon Region**

By Amber Reimondo · APRIL 2020

Characterization of Uranium Deposits and Mining near Grand Canyon



SOURCE: Generalized and modified from the USGS Site Characterization of Breccia Pipe Uranium Deposits in Northern Arizona and Uranium Mine Conceptual Model

GRAPHIC BY STEPHANIE SMITH, GRAND CANYON TRUST

- ① Containment pond
- ② Ventilation shaft
- ③ Mine headframe
- ④ Waste rock, ore pile, & top soil storage

- ⑤ Mine shaft
- ⑥ Horizontal shaft ("drifts")
- ⑦ Breccia collapse feature
- ⑧ Perched aquifer


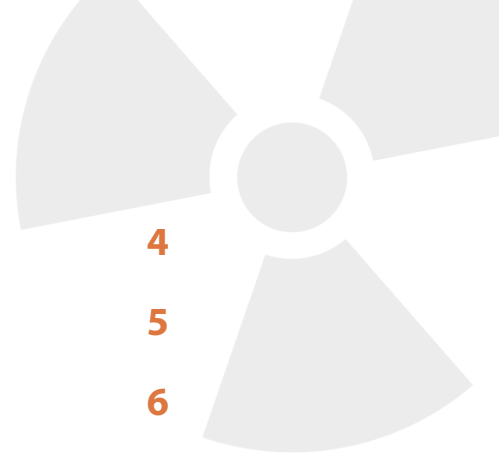
- ⑨ Regional aquifer
- ⑩ Seep or spring
-  Potential water flow in mine shaft

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Acknowledgments

This report summarizes information uncovered by the cumulative efforts of a number of people and organizations who, over many years, have submitted public records requests, searched through cartloads of paper documents dating back decades, filed lawsuits, filed formal complaints with the Arizona Department of Environmental Quality, interviewed and consulted with groundwater experts, and visited Canyon Mine in person to observe, document, film, and photograph conditions on the ground. Thanks to Alicyn Gitlin at the Sierra Club-Grand Canyon Chapter who has, among a number of contributions to this issue, put in many hours at the records department at the Arizona Department of Environmental Quality. Thanks to organizers like Klee Benally, Leona Morgan, and Sarana Riggs of HaulNo! who have worked tirelessly to bring attention to the problems at, and stemming from, Canyon Mine. And thanks to a number of other groups and individuals who have given their time to this issue. Finally, a special thanks to the Havasupai Tribe, which has been fighting to protect its homelands from contamination from Canyon Mine and other potential mines for decades. It is our great honor to stand behind the Havasupai Tribe in its long fight for justice for uranium-impacted communities everywhere.

Amber Reimondo
Energy Program Director
Grand Canyon Trust

Executive Summary

This report expands on the Grand Canyon Trust’s 2019 report, “Uranium Mining in the Grand Canyon Region,” which explains why uranium mining does not belong in the Grand Canyon region. While mining in this landscape brings little if any benefit, by comparison, the risk is great: irreversible, permanent contamination of a landscape that is critical to Native American cultures, northern Arizona’s tourism-based economy, wildlife, and the water supplies for many.

When the extensive uranium-industry contamination still affecting communities today is brushed off as merely a by-product of a bygone era of mining, it is useful to examine a present-day uranium mine in the Grand Canyon region: Canyon Mine. Approved in 1986, over 30 years later, the Canyon Mine still has not extracted a single pound of uranium ore. It has, however, experienced numerous problems, including flooding, with over 30 million gallons of groundwater pumped from the mine shaft since 2013. These problems demonstrate both the unavoidable challenges of mining in the Grand Canyon region and the risks posed by companies gambling on someday making money at the expense of those who live nearby. The problems so far at Canyon Mine represent a threat to the Grand Canyon, its water resources, and the wildlife, people, and cultures that rely on that water and call this region home. If the newest forms of mining are safe, Canyon Mine should reflect that. Instead, Canyon Mine serves as a prime example of why uranium mining in the Grand Canyon region is simply too dangerous and mired in too many unknowns.



Canyon uranium mine. The rim of the Grand Canyon is faintly visible on the horizon in blue. BLAKE MCCORD

Introduction



Fewer than 9 miles south of the south rim of the Grand Canyon, mere miles from the entrance to Grand Canyon National Park, sits Canyon Mine—an underground uranium-mining operation that targets a uranium deposit inside a vertical geologic collapse feature known as a breccia pipe. The mine's vertical mine shaft extends over 1,400 feet down into the Earth's surface, alongside the breccia-pipe formation where its target ore lies.



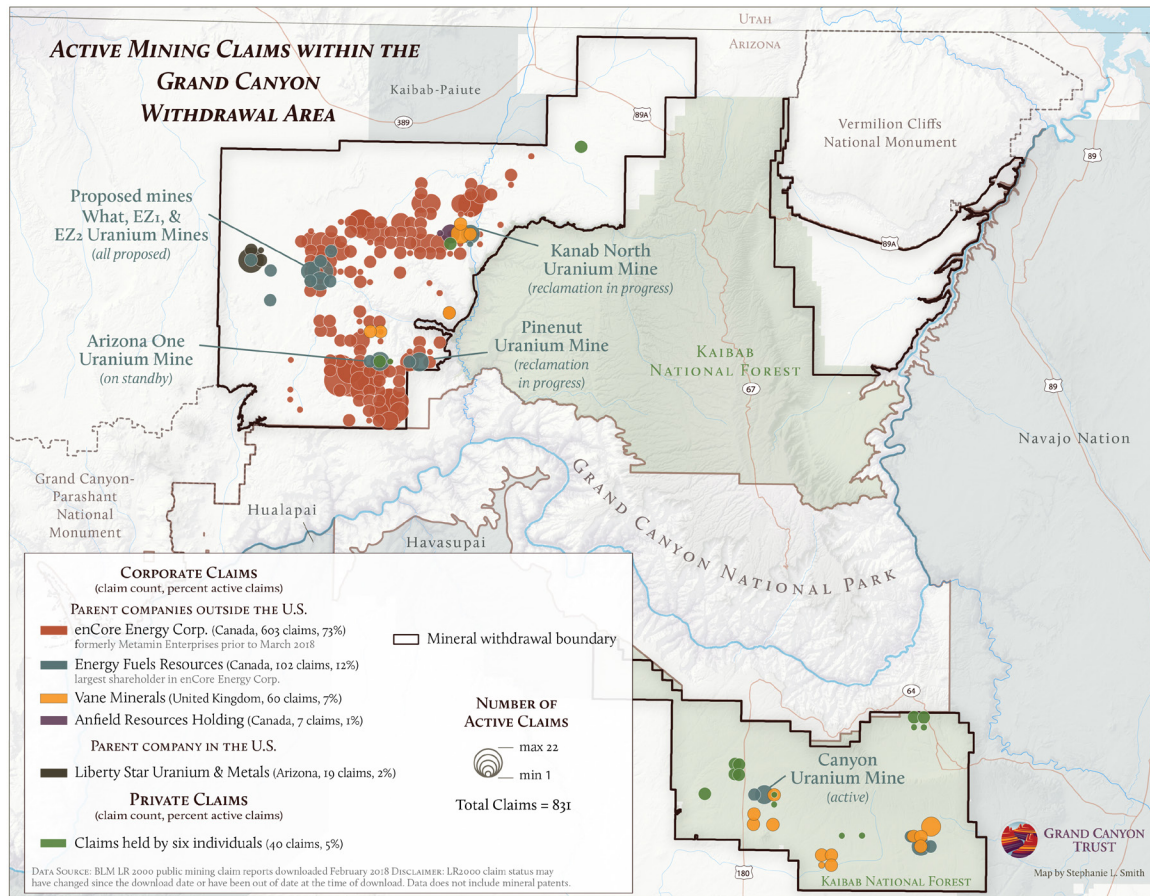


FACING PAGE TOP: Burning sage at Red Butte during the intertribal Red Butte Gathering in 2019, organized by the Havasupai Tribe to protest uranium mining at Canyon Mine. AMY S. MARTIN
 FACING PAGE BOTTOM: Red Butte, with Canyon Mine visible in the foreground. BRUCE GORDON, ECOFLIGHT
 ABOVE: Waterfalls fed by Havasu Creek, on the Havasupai reservation. ED MOSS

On the surface, Canyon Mine occupies approximately 17¹ acres in a meadow surrounded by ponderosa pines on the Kaibab National Forest. The mine is also within the boundaries of the Red Butte Traditional Cultural Property, a federal designation that recognizes the cultural significance of Red Butte and makes it eligible for inclusion in the National Register of Historic Places.

Red Butte is a prominent red rock feature on the landscape, a protruding landmark visible for miles. It is sacred to many tribes,² and the spiritual center of the Havasupai Tribe’s traditional homelands.³ Today, the Havasupai reside in Supai Village, inside a remote tributary canyon to the Grand Canyon. Flowing through Supai Village, toward the main stem of the Colorado River, are the turquoise-blue waters of Havasu Creek—the tribe’s source of water and a significant factor in the tribe’s identity and tourism economy. Havasu Creek flows from a roughly 2,000-foot-deep regional aquifer that sits beneath Canyon Mine, called the Redwall-Muav Aquifer.

Canyon Mine is also within the boundaries of a 20-year administrative mining ban around the Grand Canyon put in place by the secretary of the interior in 2012.⁴ The Forest Service, however, has concluded that the mine is allowed to operate despite the ban, based on a contested⁵ determination that the mine’s owner had “valid existing rights” to mine before the ban was adopted. At the time of



this report, Canyon Mine is the only uranium mine that has obtained government approval to operate within the 1 million acre ban area. But proponents of uranium mining have been pressing the Trump administration to lift the ban.^a

Canyon Mine is far from the only mine in the region, it is just the only one with present-day activity. Problems have cropped up at other mines in the region as well, including flooding and water and soil contamination.⁶ Canyon Mine is part of a significant stake held by one company: Energy Fuels Resources, which has an interest in 85 percent of the more than 800 active mining claims in the ban area around the Grand Canyon.^b

^a For example, see the August 18, 2019 letter from the Nuclear Energy Institute to President Trump's Nuclear Fuel Working Group requesting that the Trump administration "Lift current federal land withdrawal restrictions prohibiting access to high grade domestic uranium deposits pursuant to the Administration's Federal Strategy to Ensure a Reliable Supply of Critical Minerals" available at: <https://www.nei.org/resources/letters-filings-comments/industry-recommendations-presidents-nuclear-fuel>. Page 6. Accessed 6 April 2020. Also see the July 27, 2018 letter from the Western Caucus, chaired by Rep. Paul Gosar, R-AZ, to then Secretary of the Interior Ryan Zinke urging him to "revoke" the temporary mining ban around the Grand Canyon, available at: https://westerncaucus.house.gov/uploaded-files/7.27.2018_signed_az_uranium_mineral_withdrawal_letter.pdf. Accessed 14 April 2020.

^b Energy Fuels Resources directly held 12 percent of the 831 active mining claims in the Grand Canyon mining ban area as of March 2018. In 2015, Energy Fuels sold mining claims within the original boundaries of Bears Ears National Monument to enCore Energy Corp in exchange for 19.9 percent of shares in enCore. This made Energy Fuels Resources the largest shareholder in enCore. See: "Energy Fuels Sells Non-Core Uranium Assets to enCore Energy." 25 November 2015. Available at: <https://www.energyfuels.com/2015-11-25-Energy-Fuels-Sells-Non-Core-Uranium-Assets-to-enCore-Energy>. Accessed 1 April 2020. enCore, via a purchase of assets held by Metamin Enterprises, held 73 percent of claims in the Grand Canyon mining ban area as of March 2018. See "enCore Energy Signs Agreement to Acquire Uranium Properties." 8 February 2018. Available at: <https://www.globenewswire.com/news-release/2018/02/08/1336156/0/en/enCore-Energy-Signs-Agreement-to-Acquire-Uranium-Properties.html>. Accessed 14 April 2020.

Background



The White Mesa uranium mill near the Ute Mountain Ute reservation community of White Mesa.

INHERENT DANGERS, CORPORATE SELF-INTEREST, AND ALREADY-IMPACTED COMMUNITIES

Some argue that modern-day uranium mining is better regulated and more responsibly undertaken than in the past, effectively minimizing the risk that history will repeat itself and worsen the toxic and radioactive legacy that has gripped the Colorado Plateau since the government-driven uranium boom of the 1950s, 1960s, and 1970s.^c Mining companies often claim that mines operating in the post-Atomic Era and after the creation of environmental regulations won't pollute land, air, and water or cause cancer in communities like past uranium operations have done.^d

The reality however, is different. Uranium mining is inherently dangerous for land, water, and people. Once uranium is exposed to oxygen, a never-ending battle with Mother Nature begins to keep the radioactive element from finding its way into water, soil, plants, wildlife, and the bodies of human beings.

Uranium mining especially does not belong near the Grand Canyon, a watershed providing water for millions of people and downstream economies, a World Heritage Site, the literal and spiritual home of Native American tribes, and a primary driver of the northern Arizona economy.⁷ Mining near the

^c For example, the “Environment & Responsibility” section of Energy Fuels Resources’ website states, “Past uranium mining in the U.S. created many health and environmental issues. However, it is important to understand that most health and environmental impacts from the uranium industry resulted from operations that occurred decades ago in the years during and after WWII and at the height of the Cold War. Energy Fuels – and the regulators that oversee our operations – are working to ensure that those mistakes are not repeated.” Available at <https://www.energyfuels.com/environment-responsibility>. Accessed 15 April 2020.

^d “What we’re doing is not dangerous. It’s not harmful to people or the environment. It’s very responsible and can be done very, very safely,” Energy Fuels Resources Vice President of Marketing Curtis Moore told Courthouse News in 2017. See Buffon, Scott. “Group Opposes Plan to Haul Uranium Through Flagstaff.” Courthouse News Service. 3 October 2017. <https://www.courthousenews.com/group-opposes-plan-haul-uranium-flagstaff/>. Accessed 15 April 2020; “All we are doing at these small mines is removing uranium-bearing rock from a less than 20-acre site. Our mines, which are regulated as ‘zero discharge’ facilities, pose no threat to the Grand Canyon, water, or the natural environment,” Moore told National Geographic in 2015. See: Paskus, Laura. “Grand Canyon Development Plans Put River on Endangered List.” National Geographic. April 2015. <https://www.nationalgeographic.com/news/2015/04/150407-colorado-river-grand-canyon-navajo-uranium-escalade-mining/>. Accessed 16 April 2020.



White Mesa community members participate in the 2019 White Mesa spiritual walk, an annual protest walk organized by Ute Mountain Ute tribal members concerned about the uranium mill's impacts on groundwater, air quality, and public health. TIM PETERSON

Grand Canyon also would mean mining right next-door to communities that today are still living with the contamination and health consequences of the last government-supported uranium boom.

What's more, if ore is extracted near the Grand Canyon, on and near lands sacred to a number of Native American cultures, it would be hauled through many communities that have already been impacted by past uranium mining, home to many of the same Native American tribes, for processing at the White Mesa Mill. The mill, which is also owned by Energy Fuels Resources, is the last operating conventional uranium mill in the United States, and it sits just a few miles up-gradient of the Ute Mountain Ute tribal community of White Mesa in southeastern Utah.

With a half-life that spans millions of years, and health consequences that include a number of cancers and damage to internal organs,⁸ uranium contamination matters for people's lives today and the lives of people generations from now. Today, Indigenous communities on the Colorado Plateau continue to bear the brunt of America's sordid past when it comes to uranium extraction. More than 500 abandoned uranium mines remain in need of careful assessment and cleanup on Navajo Nation lands alone,⁹ where a recent study found that over a quarter of 781 Navajo women tested had elevated levels of uranium in their bodies, as did newborn babies.¹⁰ The Navajo Nation banned uranium mining on its 27,000-square-mile reservation in 2005, but the abandoned mines remain.



Community members voice their concerns about potential contamination and public health risks posed by Energy Fuels Resources' White Mesa uranium mill at the May 13, 2017 annual spiritual walk organized by Ute Mountain Ute tribal members. COREY ROBINSON

Energy Fuels Resources sees dollar signs in these abandoned mines. When it comes to determining the best mode of containing uranium-bearing materials at these sites, the company's CEO has downplayed government studies and told investors "we don't need to study it, we'll take the material today."¹¹ The company hopes that in the name of cleanup, the Navajo Nation and U.S. governments will allow it to haul uranium-bearing soil and rock from these abandoned sites and truck them to be processed at its mill near White Mesa. The company would then sell the processed uranium while the leftover acidic, radioactive, and otherwise toxic waste from the mill process would remain at the mill site in perpetuity. Today, groundwater contamination has been confirmed beneath the mill site itself.¹² While Energy Fuels Resources denies responsibility for the shallow groundwater contamination, White Mesa's Indigenous residents worry that their water supply, which lies farther beneath the mill, could be next.

COMPLEX HYDROGEOLOGY

The inherent dangers posed by mining uranium are only amplified in the Grand Canyon region, a place of complicated hydrogeology. Exactly what direction(s) groundwater flows and how quickly it gets from one point to another is a complex question that too often lacks a definitive answer. Rock layers adjacent to the Grand Canyon are highly fractured, meaning that even would-be "confining layers," or dense rock through which water wouldn't typically flow, can still have places that allow contaminated

water to move downward to precious groundwater aquifers and to sources of seeps and springs inside the walls of the Grand Canyon.

One way to visualize the complex nature of the region's hydrogeology is to imagine a pipe system designed by Dr. Seuss where water can flow in multiple directions from one spot, sometimes very quickly, sometimes taking thousands of years, and no two places look the same.

These complexities and unknowns matter a lot when it comes to uranium mining. If we don't know exactly where groundwater flows, and how quickly it gets there, we can't properly weigh the risks of allowing a mine to move forward. If we don't understand groundwater flow, we also don't know exactly where to monitor for contamination. That means it is also possible we simply would not know groundwater was contaminated until contamination was detected in a critical water supply, like Havasu Creek. Worst of all, even if contamination were detected, it would be, at best, extremely expensive to manage and, at worst, likely impossible to reverse. And while a mining company might move on to other places or lines of business, the people, plants, wildlife, and economies that rely on the Grand Canyon landscape for water and other life-sustaining resources, will pay the price of uranium mining for many lifetimes.

Ultimately, the unknowns, the risks, and the consequences for people, cultures, the natural world, economies, and critical water supplies are all too high. Conversely, as the Grand Canyon Trust outlined in a January 2019 report, "Uranium Mining in the Grand Canyon Region," the need to mine the uranium deposits near the Grand Canyon is low and the ever-growing costs of the legacy left behind by past uranium mining are bad enough.¹³ No matter how many times uranium-mining companies make promises that their operations are safe, even "overly regulated," the facts show that they are neither. This report digs more deeply into that reality by examining Canyon Mine.



Havasu Creek. MIKE POPEJOY

Canyon Mine: A Poster Child for the Grand Canyon Region’s Uncertainties

Despite being approved in 1986, despite receiving an exemption from the 20-year Grand Canyon mining ban courtesy of the Forest Service, and despite repeated promises about when mining will start, as of April 2020, Canyon Mine has yet to extract any ore. For more than three decades, the mine’s operators have pretended to have more certainty about risks and rewards than this region—in reality—allows. And because the Grand Canyon region is so challenging, even for this “modern” mine, Canyon Mine’s operators have made more than one promise they couldn’t keep. Today, before it has even begun mining, Canyon Mine already poses a significant, and likely irreversible, danger to groundwater that could have implications for the Grand Canyon, for plants, wildlife, and for communities—particularly the Havasupai Tribe. The Grand Canyon region does not need and cannot sustain more of the threat that mines like Canyon Mine present.

HISTORY OF CANYON MINE TO DATE

Approval to Mine

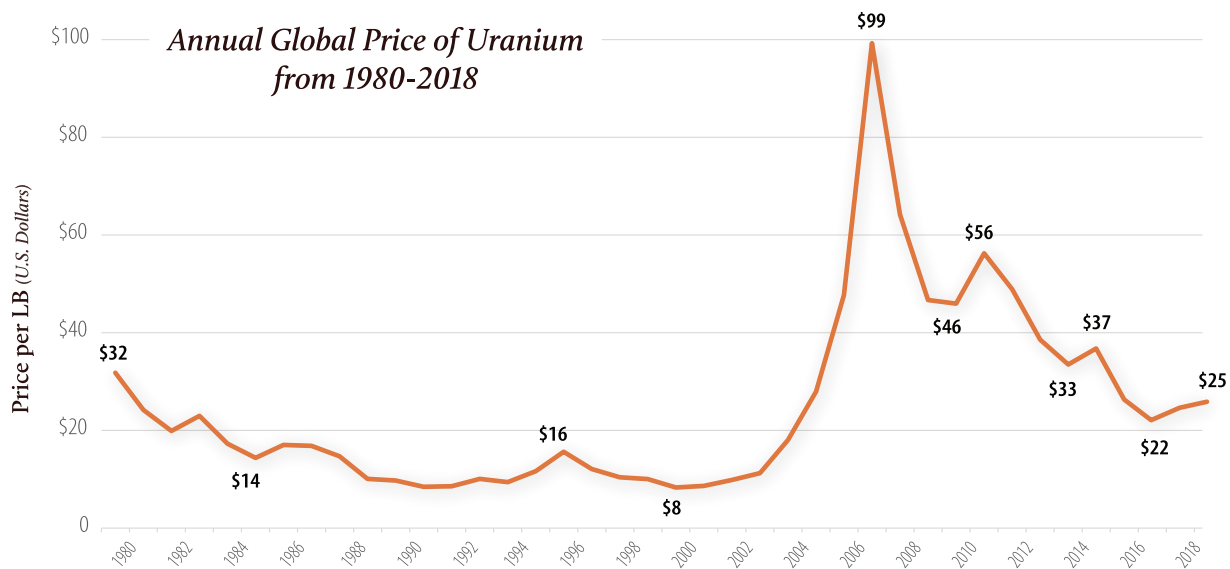
The mining claims upon which Canyon Mine sits were first staked in 1978 by a company called Gulf Oil Corporation. Four years later, Gulf Oil Corporation sold those claims to Energy Fuels Nuclear. In 1984, Energy Fuels Nuclear submitted a plan of operations for Canyon Mine to the Forest Service. The Forest Service published a draft environmental impact statement—an environmental review required in order to determine the expected environmental effects of the mine—in December 1985. Eight months later, in August 1986, the Forest Service issued a final environmental impact statement. This was followed later that year by a record of decision approving the mine to move forward under a “finding of no significant impact” indicating that the mine would not harm the environment or the public interest. That finding was challenged by 12 administrative appeals, which were later denied, and then by a lawsuit filed by the Havasupai Tribe that lasted until the early 1990s. That’s when the U.S. Supreme Court declined to hear the Havasupai Tribe’s appeal of the lower court opinions that had affirmed the mine’s approval. Alongside the final environmental impact statement, the plan of operations for Canyon Mine was also approved in 1986. It is worth noting: that plan has not been updated since.

Early Aquifer Protection Permit Attempts

In 1988, after about three years of testy back-and-forth with Arizona state regulators when regulators found inadequate information and even disinformation had been provided by mine owner Energy Fuels Nuclear regarding the mine’s risk to groundwater,¹⁴ a groundwater protection permit was ultimately approved for the mine. That approval remained in appeal proceedings initiated by the Havasupai Tribe until the Arizona Department of Environmental Quality stayed the proceedings in 1993 to review the company’s application for the state’s replacement for groundwater protection permits: an aquifer protection permit (APP).^e

But around the same time, Energy Fuels Nuclear was acquired by the Concord Group, which went bankrupt in 1995, apparently without taking Canyon Mine’s aquifer protection permit application any further. And with nothing more than a mine shaft dug to a depth of 50 feet, Canyon Mine remained on standby for the next 17 years. During that time, the mine received at least four aquifer protection permit denials from the Arizona Department of Environmental Quality, in part because of wastewater pond liners that did not meet state standards and because “deficiencies” in the 1993 application had remained unresolved.¹⁵ In that time, the mine also underwent three changes of ownership. It was acquired by International Uranium Corporation in 1997, then by Denison Mines Corp. when the company merged with International Uranium Corporation in 2006, and finally by the current owner, Energy Fuels Resources, in June 2012.¹⁶

^e Arizona Revised Statutes 49-241.C required the Arizona Department of Environmental Quality to issue permits for all existing facilities, as defined in ARS 49-201.14.



Grand Canyon Mining Ban

As Canyon Mine was changing owners and struggling to get an aquifer protection permit, the usually abysmal economic outlook for uranium mining briefly changed.

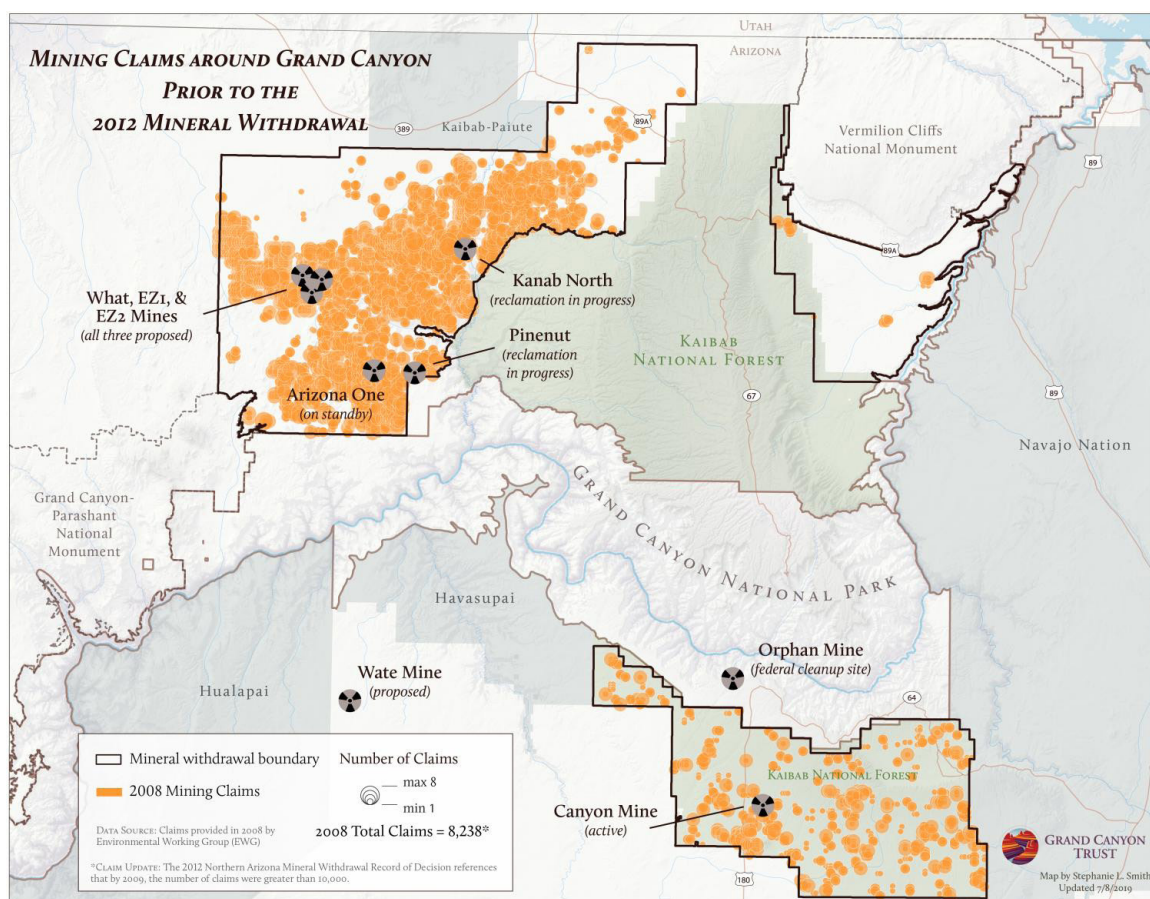
The price of uranium spiked in 2007¹⁷ to a historic all-time high, prompting mining companies by 2010 to stake more than 10,000 mining claims on public lands north and south of the Grand Canyon.

With daily reminders of the cross-generational consequences of uranium-mining contamination on their minds, northern Arizona residents from a variety of backgrounds drew a line. A broad group of entities and sovereign nations, including Native American tribes, local governments, businesses, and non-profit organizations, asked the Interior Department to use its authority to put an end to the priority access mining companies had been given on public lands near the Grand Canyon by the permissive and antiquated 1872 Mining Law.

The Interior Department listened. After a comprehensive public process, in January 2012, then Secretary of the Interior Ken Salazar announced a 20-year withdrawal of approximately 1 million acres of federal public land north and south of the Grand Canyon from mining claim location under the 1872 Mining Law. This temporary mining ban included an exemption for miners who had established “valid existing rights” to mine before the ban. To have such rights, a miner must have, before the ban, discovered and unearthed a “valuable mineral deposit”—one that can be extracted, removed, and marketed at a profit.

Lack of Research

When establishing the ban, the Interior Department acknowledged serious uncertainties and risks associated with groundwater flow and uranium mining in the region. The temporary ban would also—it was thought—allow time for the U.S. Geological Survey (USGS) to conduct extensive research



to help decision makers understand if there was any way for uranium mining to proceed safely in the region. However, this research, on top of being more aspirational than operational, would also be fatally handicapped by woefully insufficient funding allocations from Congress. This has resulted in a severe lack of comprehensive data collection, though the USGS has done some simplified research that is still manageable on its shoestring budget. But that simplified research has not answered the fundamental questions of what groundwater connectivity looks like in the region to determine where water flows to and from, and how quickly, or whether past uranium mining has caused contamination. Proponents of mining have often used the fact that studies are being done and that little to no data has been collected to make the misleading claim that those bigger questions have been answered and “no evidence exists” to say uranium mining in the region is dangerous.

Economic Factors

In August 2011, the mine owner notified the Forest Service that the company wanted to do more work at Canyon Mine.¹⁸ That prompted the Forest Service, while uranium prices were still abnormally high, to issue a determination that Energy Fuels Resources had “valid existing rights” to operate Canyon Mine despite the 2012 mining ban. The Grand Canyon Trust and its allies are challenging that determination in court. In the meantime, Energy Fuels Resources has built some of the mine’s infrastructure, including digging the mine’s main shaft. Yet all along the price of uranium has remained too low for the company to turn a profit running the mine.



Members of the Havasapai Tribe, including former Havasupai tribal councilwoman Coleen Kaska (third from right) voice their concerns about Canyon Mine at the 2017 Red Butte Gathering. BLAKE MCCORD

Uranium Lobbying Efforts

It is within this context that since 2017, Energy Fuels Resources and uranium-mining proponents have spent significant time lobbying the Trump administration. The uranium industry has asked for everything from easier access to uranium deposits on public lands to trade measures and taxpayer subsidies. Mining companies hope that taxpayer dollars will help them finally circumvent a saturated global uranium market that doesn't need U.S.-mined uranium, least of all Grand Canyon region uranium, which is more expensive given the mining method. The global uranium market has essentially been saturated for most of the past 30 years.

GROUNDWATER AT CANYON MINE

Water in a uranium mine is dangerous. The presence of oxygen is a key component that allows uranium to dissolve in water. Uranium ore deposits are formed over millennia in environments with little to no oxygen, a condition that causes trace amounts of uranium to come out of solution, forming a concentrated ore deposit over time. But the mining process introduces oxygen into the equation. That means that concentrated quantities of uranium and other toxic elements like arsenic that were mostly, if not entirely stabilized underground, once exposed to oxygen, become available to be dissolved in water. Once dissolved, water can carry the contaminants into places we don't want them to go—like drinking water aquifers, springs, seeps, and the bodies of living things.

Early Assumptions

Throughout the permitting processes for Canyon Mine, beginning in the 1980s and repeated over the course of the next three decades, there were a multitude of assumptions that the mine would never encounter water, or that, in the unlikely case that it did, there wouldn't be very much water. The 1986 Final Environmental Impact Statement for Canyon Mine published by the Forest Service reads: “The possibility of significant ground water contamination from the mine is remote. Ground water flows, if they exist, are likely to be at least 1,000 feet below the lower extremities of the mine. This, plus the low potential for encountering groundwater in the mine, effectively eliminates the possibility of contaminating the Redwall-Muav aquifer.”¹⁹ Over the next 30 years, mine owners assured Arizona environmental regulators that the mine would not encounter water at all,²⁰ and then that “substantial inflow is not expected to occur.”²¹

General Versus Individual Aquifer Protection Permits

Aquifer protection permits are required for a number of facilities under Arizona law, including things like gas stations, and are supposed to ensure that groundwater quality is protected. The kind of aquifer protection permit a mine needs in Arizona is based on the type of facility it is, what circumstances are present at the facility, and the likelihood that an operation poses a serious threat to groundwater. In simplified terms, facilities that can be considered “typical” with easy-to-predict needs and standard safeguards are usually given “general” aquifer protection permits. Whereas, individual aquifer protection permits are for facilities that are more nuanced, with less predictable, but significant risks to groundwater that require more specific safeguards. General aquifer protection permits are more streamlined. The Arizona Department of Environmental Quality can issue one without first holding a public comment period, to save staff time. The general permits include more “voluntary conditions” that, while important, are not enforceable. Conversely, individual aquifer protection permits include more involved consideration of an operation and public comment processes, and the state regulatory agency can institute additional, situation-specific requirements (like more groundwater monitoring wells), which are enforceable if a company falls short.

In Arizona, mining facilities may be allowed to operate under a general aquifer protection permit as long as contaminated solutions from mining activities are not a “normal function” of operations and any contaminated solutions due to “process upsets or rainfall...are promptly removed.”²² But if that's not the case, or if the facility will “discharge a pollutant directly to an aquifer or to a land surface or vadose zone” where there is a reasonably probable threat to groundwater quality, that facility is required to get an individual aquifer protection permit.²³

Failed Permit Attempts

Canyon Mine was denied an “individual” aquifer protection permit in 2002.^f The director of the Arizona Department of Environmental Quality's Water Quality Division at the time wrote: “In accordance with Arizona Revised Statutes (A.R.S.) 49-241 through 252, the applicant is required to obtain an individual APP for operation of the Canyon Mine...IUC's application for an individual APP was received...on December 20, 1993...IUC has not corrected the deficiencies in the pending APP application...The permit application is being denied.”

^f Smith, Karen, Arizona Department of Environmental Quality. “State of Arizona Denial of An Individual Aquifer Protection Permit Application Inventory Number 100333.” Arizona Department of Environmental Quality. 22 March 2002. “In accordance with Arizona Revised Statutes (A.R.S.) 49-241 through 252, the applicant is required to obtain an individual APP for operation of the Canyon Mine... The facility is currently required to operate according to a Groundwater Protection Permit (GWPP) (#G-0004-03) signed on May 23, 1988...IUC's application for an individual APP was received by ADEQ on December 20, 1993...IUC has not corrected the deficiencies in the pending APP application...The permit application is being denied as the facility and its operation cannot comply with the requirements of ARS 49-243 and R18-9-A202.”

In 2008, the company instead applied for three separate general aquifer protection permits for the mine's wastewater pond, ore stockpile, and vehicle washing. All three general aquifer protection permits were denied²⁴ because "the proposed facility does not conform to the requirements of the general permit."²⁵ The Water Quality Division director at the time also penned an internal email stating the mine's operator would need to submit "applications for individual, area wide APPs."²⁶

2014 Aquifer Protection Permit

But less than a year later, in March 2009, and under a different Arizona Governor, Jan Brewer, Canyon Mine's operator went ahead with another application for a general permit. That application was eventually approved, and in 2014, still under the Brewer administration, the Arizona Department of Environmental Quality approved a 5-year general aquifer protection permit for the mine, with an expiration date of August 2019.²⁷ This was the mine's first groundwater permit renewal since 1988.⁹

In its 2009 application, the mine owner claimed there would not be much contaminated water in the mine and implied that any inflow would be "lost to evaporation due to intensive mine ventilation." The company further asserted: "for the Canyon Mine the inflow into the [onsite wastewater pond] from the underground mine area is assumed to be a maximum of 0.3 gpm [gallons per minute] or 432 gpd [gallons per day]."²⁸

Mine-shaft construction resumed in 2013, paused in 2014, and restarted again in 2015. During those years, the mine took on some water as the mine shaft reached 450 feet of depth.²⁹ But in 2016, any hope that the mine would really be dry evaporated. As Energy Fuels Resources continued excavating the mine shaft from a depth of 450 feet to 1,400 feet below the surface, the mine began taking on water in a serious way; the total gallons of water flooding the mine shaft would soon be counted in the millions.³⁰

FLOODING AT CANYON MINE

Mine Shaft Hits Water

Beginning in 2013, miners reported removing tens of thousands of gallons of water from the mine shaft.³¹ Then in November 2016, the mine shaft pierced something bigger. In the final two months of that year, the total volume of water that flowed into the mine shaft more than doubled from 492,650 gallons by October 31, 2016 to 1.4 million gallons by December 31, 2016.³² As a point of comparison to the company's "maximum" expected inflow of 0.3 gallons per minute or 432 gallons per day,³³ by December 2016, water was flooding the mine shaft at a rate of more than 12 gallons per minute or 17,815 gallons per day. And the problem would only get worse.

Emergency Use of Sprayers and Trucking

Canyon Mine continued taking on millions of gallons of groundwater into 2017 and, as it did, it became clear that the mine's owner had been caught off guard. As water filled the lined onsite wastewater pond to capacity, Energy Fuels Resources resorted to both spraying water into the air for "enhanced evaporation" and loading water into trucks marked "non-potable water" to be hauled to its White Mesa Mill north of Bluff, Utah.

⁹ Smith, Karen, Arizona Department of Environmental Quality. "State of Arizona Denial of An Individual Aquifer Protection Permit Application Inventory Number 100333." *Arizona Department of Environmental Quality*. 22 March 2002. "In accordance with Arizona Revised Statutes (A.R.S.) 49-241 through 252, the applicant is required to obtain an individual APP for operation of the Canyon Mine... The facility is currently required to operate according to a Groundwater Protection Permit (GWPP) (#G-0004-03) signed on May 23, 1988... IUC's application for an individual APP was received by ADEQ on December 20, 1993... IUC has not corrected the deficiencies in the pending APP application...."



Energy Fuels Resources misting water into the air at Canyon Mine on March 15, 2017 to speed up evaporation. BLAKE MCCORD

The company seemed to know the groundwater inundation was bad news. Energy Fuels Resources executives gave at least one upbeat presentation to investors in January 2017 seemingly aimed at trying to head off any loss of confidence in the company’s ability to adequately anticipate, prepare for, afford, and manage the mine-shaft flooding problem.³⁴ One slide in the company’s presentation,³⁵ in what looks like an attempt to appear as though it had known and planned for this to happen all along, included statements like “water inflows from the Coconino are contemplated by the Plan of Operations and underlying environmental analysis.” The company followed this with cherry-picked excerpts from statements in the planning and environmental review documents that—if you read them in full—actually talk about what the mine operator planned to do in the case that “small”^h amounts or “a few

^h United States Forest Service. “Final Environmental Impact Statement, Canyon Uranium Mine.” August 1986. Pages 4.38-4.39, https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5346657.pdf. Accessed 11 March 2020. “...much of the water that percolates into the mine will evaporate. Excess water will be collected and used for industrial purposes...After mining operations are complete...native material, including radioactive minerals, will continue to be leached and move to points of discharge with the groundwater. Because groundwater discharge is small, no measurable impacts are expected.”

gallons per minute”ⁱ of groundwater discharge were encountered. And as if to slap another spoonful of frosting into the center of the fallen birthday cake, Energy Fuels Resources wrapped up that point in the presentation with “The Canyon Mine water balance is 100% manageable....”³⁶

But behind the scenes, documents show the company was in full-fledged crisis mode. Emails and other correspondence between representatives for Energy Fuels Resources and the state of Arizona, obtained via records requests, reveal a company struggling to manage a problem it hadn’t planned for. In its response to technical questions from state regulators in the initial permitting phase of the mine in 1987, the owner/operator wrote, “the [wastewater] Pond Needs estimate of 6.3 acre feet is not only sufficient, it is extremely conservative.”³⁷ But in June 2017 emails with the Arizona Department of Water Resources,^j Energy Fuels Resources can be seen attempting to justify the company’s “emergency” decision to truck water to its White Mesa Mill in Utah precisely because the wastewater pond was not large enough and was in danger of overflowing. For context, the term “freeboard” below refers to the minimum pond capacity that must be available to allow room for storm runoff to also enter the wastewater pond without overflow occurring. In one email, the company wrote:

Due to unexpected initial inflows, unusually wet winter/spring conditions, and reduced evaporation potential, the impoundment was earlier this year at risk of overtopping and exceeding the freeboard requirements in the permit. In coordination with ADEQ and the US Forest Service (USFS), Energy Fuels proactively implemented emergency response actions including enhanced evaporation through the use of land sharks. Energy Fuels also attempted to reduce the amount of inflow into the lined impoundment by segregating clean inflow from higher up in the mine shaft. While helpful, these emergency efforts were not sufficient to meet the freeboard requirements and the company was then forced to ship some of the impacted wastewater to its White Mesa Mill for disposal to ensure compliance with environmental obligations...³⁸

Violations

Ultimately, as it scrambled to take emergency actions, Energy Fuels Resources put air and water resources in danger. Regulators at the Arizona Department of Environmental Quality and the Arizona Department of Water Resources found (after complaints and alerts from environmental groups) that Energy Fuels Resources had violated multiple environmental and water supply safeguards. The company was not fined for any of these missteps. Energy Fuels Resources’ choice to haul groundwater out of the state was a violation of Arizona law. The company was informed of this violation in a July 27, 2017 letter from the Arizona Department of Water Resources.³⁹ The Arizona Department of Environmental Quality determined that the company had also violated its air quality permit.

Despite the company’s claim to the Arizona Department of Water Resources that it had worked in “coordination with ADEQ and the US Forest Service” on its emergency use of the giant water sprayers known as “Landsharks,” on March 30, 2017, Energy Fuels Resources was issued a notice of violation (later revised to a notice of opportunity to correct) for operating the Landsharks, which create particulate matter, without submitting an air quality permit revision to the Arizona Department of Environmental Quality.⁴⁰

ⁱ “Plan of Operations Notice of Intent, Canyon Mine.” October 1984. Page 14. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd475369.pdf. Accessed 31 March 2020. “A water source of a few gallons per minute is needed for sanitation and underground drilling...It is hoped that shaft sinking may generate a flow of a few gallons per minute of potable water from the base of the Coconino formation at approximately the 1,000-foot depth. If this does occur, this water will be collected and used at the site.”

^j These email exchanges were sparked by a complaint filed with the Arizona Department of Environmental Quality by Uranium Watch in early 2017 in which Uranium Watch questioned the legality of Energy Fuels Resources hauling the contaminated water from Canyon Mine to its mill in Utah and whether or not it was legal for the mill to accept that water.

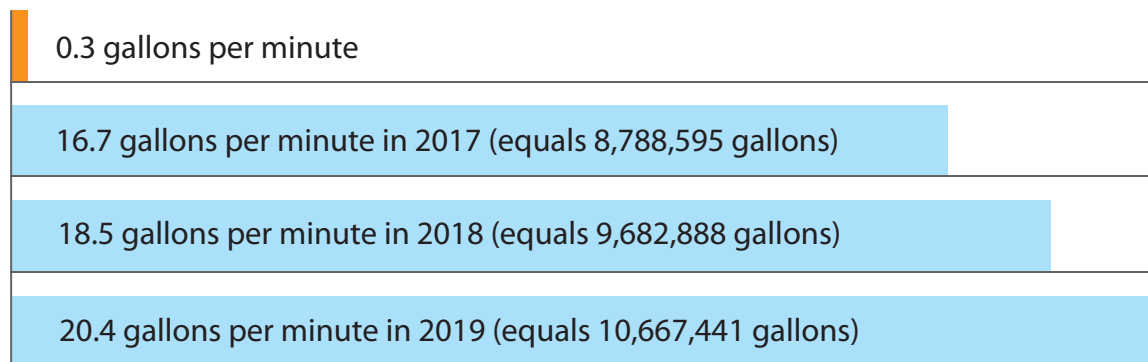
Draining Groundwater

The company’s go-to statement to imply that the water situation is understood and under control is found in the Final Environmental Impact Statement for Canyon Mine, which reads: “Because groundwater discharge is small, no measurable impacts are expected. If a perched groundwater reservoir is intercepted by the mine shaft ... [t]he rate of water discharge to the shaft will decrease as the perched reservoir is depleted.”⁴¹ This is repeated in early mine owner responses to state regulators, including in a December 1986 letter stating that “[d]ata for existing wells in the Canyon Mine area indicate that the perched groundwater is expected to drain over time after it is intercepted by construction of the mine shaft...Drainage to the mine is expected to be small, and a large fraction will be lost to evaporation...”⁴²

Even if the company’s and regulators’ assumptions about groundwater characteristics beneath the mine site were accurate and the mine-shaft flooding problem could be solved by depleting the aquifer, that “solution” is a questionable one at best in the arid Southwest. And if the aquifer does recharge, that means more water problems in the future. Those issues aside, the fact is that the predictions about no and then small and decreasing inflows have, so far, been flat-out wrong.

Every year since 2016, flooding of Canyon Mine’s mine shaft has, in fact, only increased. Water volumes pumped out of the shaft rose from over 1.4 million gallons in 2016, to more than 8.7 million gallons in 2017, to more than 9.6 million gallons in 2018, and to nearly 10.7 million gallons in 2019.⁴³ That’s an average of 16.7 gallons per minute in 2017, 18.5 gallons per minute in 2018, and 20.4 gallons per minute in 2019. Remember, the general aquifer protection permit for Canyon Mine is based on the estimate that maximum inflow would be 0.3 gallons per minute.

Canyon Mine flooding into the mine shaft

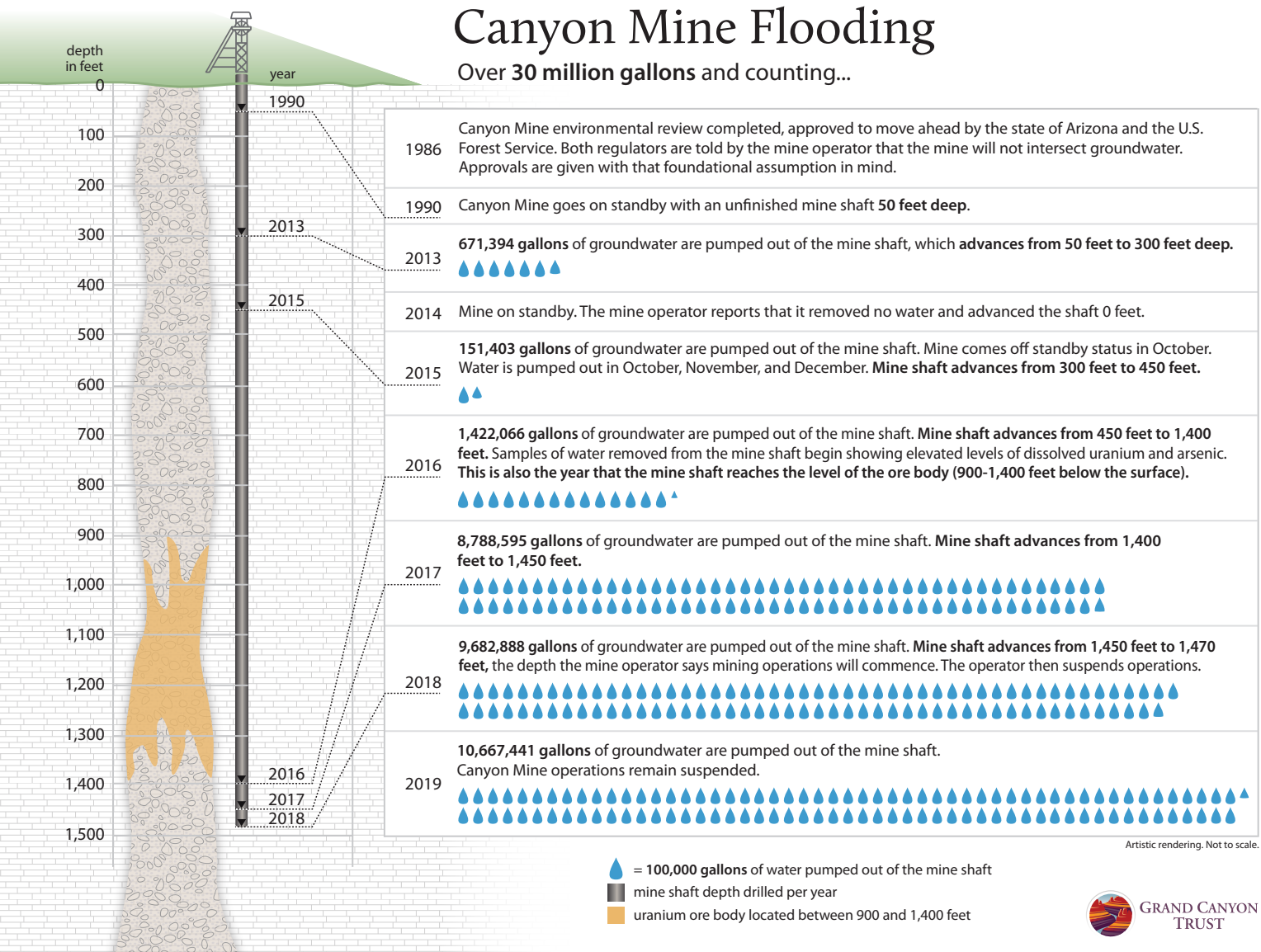


Estimated maximum flows vs Actual flows

(over 29 million gallons flooded in a 3-year period)

Canyon Mine Flooding

Over 30 million gallons and counting...



The fact that the wastewater evaporation pond at Canyon Mine was full in the winter of 2016-2017 was initially characterized by Energy Fuels Resources as a temporary circumstance, a product of “unusually wet winter/spring conditions, and reduced evaporation potential.”⁴⁴ But since then, northern Arizona has experienced plenty of dry weather, including an exceptionally dry 2017-2018 winter and a record dry monsoon season in 2019 with just 1.02 inches of rain.⁴⁵ And as floodwater volumes have increased, seemingly permanent “enhanced evaporation” sprayers have been installed on site and they’re still in consistent use today, nearly four years later. So far, there simply seems to be no end in sight to the mine flooding.

2019 Aquifer Protection Permit Application

Yet, despite these drastic changes to mine conditions, when Canyon Mine’s 5-year general aquifer protection permit came up for renewal in August 2019, Energy Fuels Resources applied to renew under another general aquifer protection permit. In response, the Havasupai Tribe,⁴⁶ Rep. Tom O’Halloran,

D-AZ,⁴⁷ the Arizona Indigenous Peoples Caucus,⁴⁸ the Grand Canyon Trust, the Grand Canyon Chapter of the Sierra Club, the Center for Biological Diversity, Wild Arizona, and the National Parks Conservation Association⁴⁹ all sent letters to the Arizona Department of Environmental Quality. The letters explained why the mine does not qualify for the more lenient general aquifer protection permit and urged the department to, at a minimum, instead require a more stringent individual aquifer protection permit.⁵⁰ At the time of this report, nearly nine months later, no decision has been announced by the department.

WATER CONTAMINATION: WHEN “LOW” MEANS 29 TIMES DRINKING WATER STANDARDS

In October 2018, the Arizona Department of Environmental Quality inspected the Canyon Mine site and reported that, among other non-compliance issues witnessed that day,⁵¹ sprinklers spraying the contaminated mine water along the boundary of the wastewater pond “are currently discharging outside of the lined impoundment [wastewater pond]. The permittee shall cease use of the sprinklers that circle the non-stormwater impoundment [wastewater pond] with potential to reach unlined portions of the facility.”⁵² It is worth noting that this was not the first time this type of problem was observed. Witnesses who visited the mine in early 2017, including staff from the Grand Canyon Trust and the Sierra Club, members of the group Haul No!, and at least one local resident, noticed and documented water from the Landsharks falling and pooling onto the bare ground and even drifting beyond the fenced perimeter of the mine.



Landsharks next to the evaporation pond misting water into the air at Canyon Mine on March 15, 2017 to speed up evaporation. BLAKE MCCORD



Enhanced evaporators at work in the middle of the evaporation pond at Canyon Mine on March 7, 2020. AMBER REIMONDO

And as recently as February 2020, spray from the larger enhanced evaporators in the center of the pond, which have replaced the Landsharks that had been at the pond's edge, has blown not just outside of the pond liner, but beyond the fence boundary. As of the date of this report, the latest known instance of this was witnessed and documented on February 25, 2020—a windy day—and reported to the Arizona Department of Environmental Quality by the Grand Canyon Trust on March 3, 2020.

Days after the October 2018 inspection, before an official notice of opportunity to correct deficiencies was issued, Energy Fuels Resources wrote a letter to the Arizona Department of Environmental Quality disputing “alleged non-compliance issues in the field inspection report.” The company wrote “no mining is currently taking place” and that “constituent content of the mine’s floodwater was “low, just marginally above drinking water standards.”⁵³ But in fact, while official mining indeed had not begun, the mine shaft reached the depth of the ore body in 2016. So, while concentrated uranium ore was not being actively hauled up the mine shaft, mineralized deposits of toxic and radioactive elements that were not exposed to oxygen previously, may nevertheless have been exposed.

Uranium and Arsenic Levels

Prior to 2016, levels of arsenic and dissolved uranium in the mine-shaft floodwater were low. But in 2016, as the mine shaft reached the 900-1,400 foot depth of the ore, levels of dissolved uranium and arsenic dramatically increased in the water being collected in the mine shaft.

Dissolved uranium spiked to more than four times the EPA’s safe drinking water standard, and arsenic levels reached 29 times the EPA drinking water standard.^k With little to no surface water nearby (a pond called “Owl Tank” is another source of surface water in the area, but it is frequently dry), the contaminated water in the pond attracts birds and other wildlife. While the mine perimeter is fenced, birds have been photographed using the pond, and smaller wildlife have found their way under the fence.

^k The EPA drinking water standard (the maximum level allowed in drinking water) for arsenic is 10 micrograms per liter (ug/L). For uranium, the standard is 30 ug/L. Water quality data collected by Energy Fuels Resources and reported to the Arizona Department of Environmental Quality on an annual basis—in the mine’s annual aquifer protection permit reports—show levels of arsenic in the mine-shaft floodwaters reaching 292 ug/L of arsenic (29.2 times the EPA standard) and 130 ug/L of dissolved uranium (4.3 times the EPA standard) in the fourth quarter of 2016. These contaminants have continued to reach similar levels each year since. In 2019, dissolved arsenic was as high as 286 ug/L and dissolved uranium was 132 ug/L.

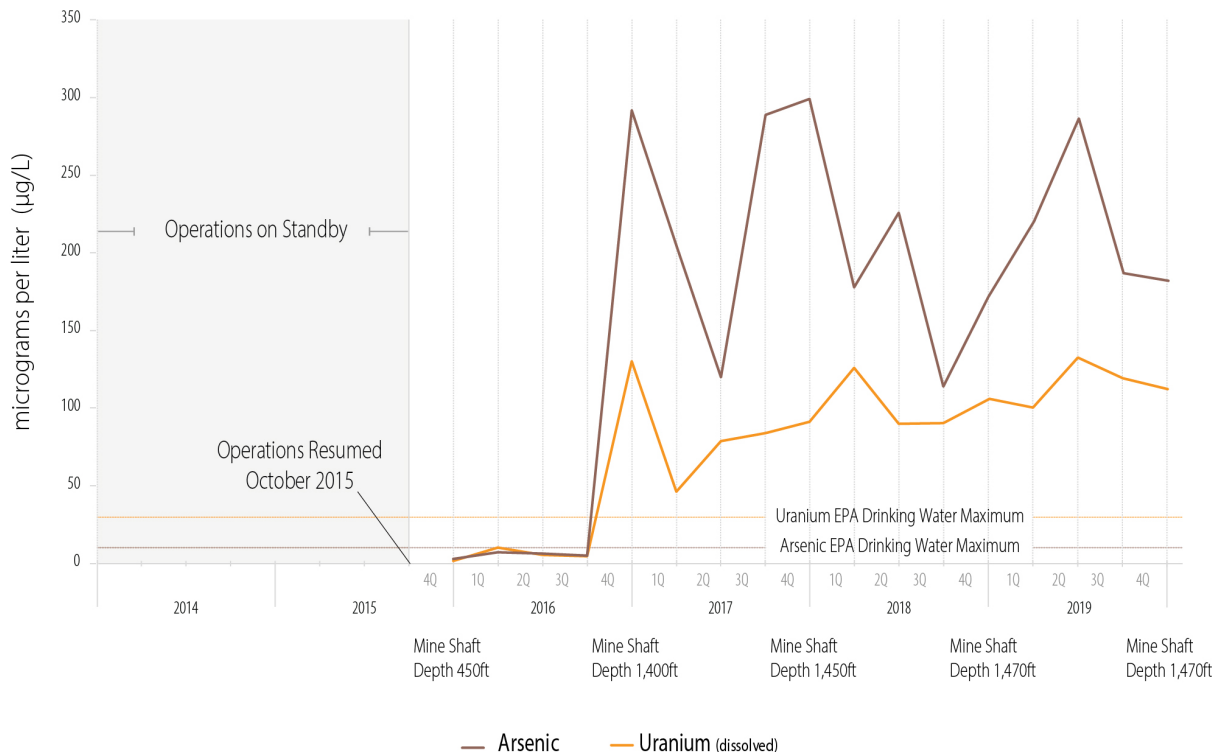


Birds photographed drinking and bathing in the evaporation pond at Canyon Mine on May 29, 2018.

TAYLOR MCKINNON, CENTER FOR BIOLOGICAL DIVERSITY

But Energy Fuels Resources’ comments raise the specter of a problem many fear, which is that if mining commences, levels of radioactive and toxic contaminants in the floodwater may be far worse than 29 times the EPA safe drinking water standard. And if contaminated water finds its way beyond the company’s control, it could become a problem for other water sources in the future, including drinking water.

Canyon Mine Shaft Water Contamination



Data Source: Canyon Mine Non-Storm Water Impoundment 3.04 General Aquifer Protection Permit No. P-100333 Annual Report for 2016, 2017, 2018, & 2019

Insufficient Groundwater Monitoring

The 1993 aquifer protection permit application for Canyon Mine reads, “[d]ata are sparse for altitude of groundwater level in the Redwall-Muav aquifer for the area south from the Grand Canyon, and the direction of groundwater movement at the Canyon Mine site cannot be determined precisely.”⁵⁴ But in its earlier 1986 response to questions from the Arizona Department of Environmental Quality, Canyon Mine’s operator implied it understood groundwater flow direction beneath Canyon Mine and used that implication in its attempt to justify the installation of just one monitoring well on-site deep enough to reach the Redwall-Muav Aquifer.⁵⁵

To monitor any mine site with confidence, at least three groundwater monitoring wells should be drilled: one up-gradient (in the direction flow is coming from) and two down-gradient (in the direction groundwater flow is going) of the mine. This helps provide a clearer picture of what groundwater quality looks like before it reaches the mine and as it is leaving the area. Having at least two wells down-gradient of the mine increases the chance of catching contamination as it flows away from the mine site.

Adequate groundwater monitoring should be a standard business expense for a mine. A single monitoring well to the Redwall-Muav Aquifer reportedly costs around \$1 million to install. Without adequate monitoring systems in place, it is taxpayers, local communities, their economies, and wildlife that stand to pay the price of any contamination for years to come.

But to date, there are just two wells available for monitoring at Canyon Mine. The first and only one installed by the mine operator—a 2,500-foot-deep water supply well for the mine, which taps into the Redwall-Muav Aquifer—is also the only well fully below the ore body and the 1,400-foot depth of the mine. It is sampled by the USGS on an approximately annual basis.⁵⁶ The other is a roughly 1,000-foot-deep, taxpayer-funded USGS observation well.⁵⁷ The latter is sampling groundwater in the Coconino Formation—the same formation supplying the water that is flowing into the mine shaft, then falling hundreds of feet, past ore access points, to the “sump” at the bottom of the shaft, and being pumped out to the lined wastewater pond. The water samples collected annually from the USGS well, to date, have shown good quality water in the Coconino Formation itself.⁵⁸

All in all, groundwater data points are being taken by the USGS at the shallower monitoring well and in the mine’s single deep-water supply well. And the mine-shaft floodwaters are being sampled by the company as the water is pumped from the mine shaft to the onsite wastewater pond. But as long as state regulators are unwilling to require Canyon Mine to obtain a more rigorous individual aquifer protection permit and install additional deep monitoring wells, groundwater monitoring at Canyon Mine will remain inadequate.

Contaminated Wastewater Spraying

Since the water being pumped from the mine shaft is contaminated with levels of uranium and arsenic above safe drinking water levels, it makes sense that all mine water should be placed in the mine’s lined onsite wastewater pond and that every effort should be made to prevent discharges of any kind from the pond, onto unlined ground. Actions and statements by both the Arizona Department of Environmental Quality and Energy Fuels Resources seem to acknowledge this. In 2018, the department issued a notice of violation ordering changes to contaminated pond-water sprinklers that were overshooting their mark and spraying on to bare ground.⁵⁹ Prior to the notice, the company responded to regulator concerns vocalized during the inspection with a letter to the state regulators saying, “Energy Fuels has standard operating procedures to ensure that all enhanced evaporation occurs within the lined impoundment, including procedures not to conduct enhanced evaporation during windy

periods.”⁶⁰ However, documents and the Grand Canyon Trust’s own eyewitness accounts show that the company has not only continued to spray contaminated mine water onto unlined ground and to use sprayers in high-wind conditions, but is intentionally applying contaminated water outside the lined wastewater impoundment.⁶¹

A 2017 presentation to investors and an October 2018 post-inspection letter to the Arizona Department of Environmental Quality show that Energy Fuels Resources had actually begun using this contaminated water for onsite dust suppression (i.e. spraying the water directly onto unlined ground to meet the company’s dust suppression requirements) as part of their mine floodwater management plan.⁶² In the October 2018 post-inspection response letter⁶³ (the same letter in which the company acknowledges the need to avoid over-spraying^l), Energy Fuels Resources wrote:

As a part of water balance issues that arose towards the end of 2016 and the first of 2017, Energy Fuels voluntarily took steps to segregate Coconino water before it reported to the bottom of the mine shaft and to use the segregated water beneficially both onsite and offsite. We no longer have the ability to segregate the Coconino water. However, consistent with our approved [1986] mine plan of operations, we have used water from the impoundment for dust control at the mine site....^m

Correspondence between Energy Fuels Resources and the Arizona Department of Environmental Quality following inspections where regulatory personnel witnessed mine-shaft water and wastewater from the pond being used for dust suppression reveal two problems in particular. First, the agency appears unclear about what mine operators are and are not allowed to do with contaminated water.ⁿ And second, Energy Fuels Resources has explicitly sprayed the contaminated water outside of the lined wastewater pond in order to offload more of the contaminated water volume for which it is liable.^o To protect groundwater, the state requires Energy Fuels Resources to place mine water into a lined pond.⁶⁴ It defies reason to then pump the water out of the pond to be sprayed onto bare ground.

^l The October 30, 2018 letter from Scott Bakken of Energy Fuels Resources to Dave Dunaway of the Arizona Department of Environmental Quality reads: “Energy Fuels has standard operating procedures to ensure that all enhanced evaporation occurs within the lined impoundment, including procedures not to conduct enhanced evaporation during windy periods.”

^m This quote suggests that the floodwater is being contaminated by the mine since the company attempted to separate the water before it could reach the sump (bottom of the mine) so it could be used elsewhere and has characterized it, in slides 8 and 10 of the January 2017 presentation (see endnote 61 in this report), as meeting state and federal drinking water standards, being “excellent quality” and “clean” water. Instead, the water flooding the mine shaft flows to the sump where it is then pumped to the impoundment (the wastewater evaporation pond) and we know that water being pumped from the mine shaft to the pond is contaminated, at least, with elevated levels of dissolved uranium and arsenic.

ⁿ Arizona Department of Environmental Quality. “Aquifer Protection Permit Field Inspection Report for Type 3.04 GP” 29 October 2019. Inspection No. 334925, Inventory/Permit # 100333, Facility Name: Canyon Mine Non-Stormwater Impoundment. “Shaft sump water is sent to two (2) water tanks, and then used for dust suppression. Water from the Non-Stormwater Impoundment (NSI) is evaporated and or sent to the Development Rock Stockpile for dust suppression. Confirmation needed for whether ADEQ agreed that NSI could be used for dust suppression for the Development Rock Stockpile.”

^o Chalmers, Mark, David Frydenlund, and Lee Decker. Energy Fuels Inc. Slide 10, “Canyon Mine.” Energy Fuels Inc. January 2017. PowerPoint presentation. Under “Further water balance management (now and onwards)” the company presents five management strategies, only two of which remain now that separation of Coconino water is no longer possible (per Oct. 30, 2018 letter to ADEQ): “Land Shakes – weather permitting,” and “Site watering, as needed, for dust suppression.” The three that are no longer possible were “Clean Coconino water in the first instance can be used for access road dust suppression...”; “Discharge clean Coconino water as uncontaminated groundwater under AZPDES stormwater permit and/or under Type 1.01 General APP”; and “If Coconino water persists, seek/consider alternative water uses and controls of this valuable resource.”

Conclusion

URANIUM MINING DOESN'T BELONG NEAR THE GRAND CANYON

Uranium mining is inherently dangerous and presents risks of irreversible contamination that will impact communities and the environment long after the mines have closed and corporate managers have been paid. These risks are amplified in the Grand Canyon region as a result of complex hydrogeology that no one fully understands—not even scientists.

Canyon Mine's operators have repeatedly made promises and professed to know the nature of groundwater flow near the mine. But in the 1980s, regulators had doubts.^P And since 2016, significant and increasing volumes of floodwater have proven just how little the mine's current owner appears to actually understand. When confronted with the problematic mine-shaft flooding and levels of contaminants found in the floodwaters, Energy Fuels Resources has repeatedly downplayed the problem. The company has claimed that it had planned for it when it hadn't, that flooding is temporary, even though the past three years of data show that if anything, flooding is only increasing, and characterized contamination 29 times the EPA drinking water standard as "low." The company has repeatedly claimed that it is operating within the bounds of all rules and regulations. But it's clear that's not true. Canyon Mine alone has been issued several notices over the years indicating that the company has failed to adhere to environmental standards, including allowing vegetation to grow in the wastewater pond, which can compromise the pond's liner,⁶⁵ allowing contaminated pond-water spray to reach beyond the lined impoundment,⁶⁶ operating Landsharks without air quality permit approval,⁶⁷ and failing to maintain berms⁶⁸ meant to protect the mine site from being overcome in flashflood events. Additionally, because the company is now dealing with an influx of large volumes of contaminated water, it seems to be disregarding common-sense environmental safeguards, spraying contaminated water onto bare ground where it could leach into groundwater as another outlet for reducing the volume of contaminated water it is responsible for. And Arizona state regulators seem unclear about whether or not this is allowed.

The bottom line is this: Canyon Mine's underlying hydrogeology remains a mystery after three decades and Energy Fuels Resources is finding itself in dangerous predicaments. The risks are only made worse if strict environmental protections and monitoring are not required. Setting aside the regulatory uncertainty and a private company's incentive to protect its own bottom line over all else, the hydrogeological uncertainty makes it simply impossible, given what is currently known, for uranium mine operators to be sure that environmental health and the public in the Grand Canyon region will be protected. Canyon Mine is a case study of how things can go wrong in the Grand Canyon region and, with water continuing to flood into the mine shaft with no guaranteed end in sight, it is also the most recent example of why uranium mining does not belong near the Grand Canyon.

^P Ullinskey, Gary. "Re. Canyon Mine, Energy Fuels Nuclear." Memo. Received by Chuck Anders, 29 October 1986, Arizona Department of Environmental Quality. https://www.grandcanyontrust.org/sites/default/files/documents/Canyon_Mine_Groundwater_Memo_1986.pdf. Accessed 3 March 2020. Page 3 of memo. "I have developed a mistrust of the accuracy of information supplied by [Energy Fuels Nuclear]."

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