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TOP STORY

Arizona's Glen Canyon Dam might get pricey makeover

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Tony Davis

Mar 26, 2023



The electrical substation fed by hydroelectric turbines inside Glen Canyon Dam shown beyond Glen Canyon Dam, Kelly Presnell, Arizona Daily Star


Tony Davis

The Glen Canyon Dam may get a partial but pricey makeover over the next decade so it can keep producing electricity when, and if, the water it stores falls below the level where it would have to turn off the juice.

The U.S. Bureau of Reclamation is studying eight potential alternatives aimed at keeping power production going at the dam even at low Lake Powell elevations. A ninth alternative calls for building solar and wind energy installations on federal land near the dam to fill some of the electricity gap that would be left if the lake falls too low.

The study, now in its early stages, seeks to find out if there is a practical way to keep the dam carrying out one of its major functions — generating and selling power — even during a record-setting drought. Lake Powell just upstream of the dam has fallen nearly 180 feet since being virtually full in the late 1990s. It now stands at 3,521 feet, barely 30 feet above the level at which power generation would stop. It's just above its lowest level of 3,520 feet, reached earlier in March, since the lake started filling in the middle 1960s.

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The study, in the works for more than a year, is being welcomed by both utility-based interests and environmentalists as an effort they say is long overdue — to determine how the dam can best be adapted to long-term warming temperatures and the drought that has accompanied them. But while utility interests say any option to keep electric power flowing from the dam is worth considering, an

environmentalist questions whether it's worth the expense.

Federal officials, utility officials and many scientists have been concerned for years that the river's continued drying conditions could drive Powell to the point where power could no longer be generated. That concern has grown in recent years, as Powell plunged roughly 100 feet just in the past three years from a July 2019 peak of 3,621 feet.

As recently as last December, the Bureau of Reclamation's most pessimistic of three possible forecasts projected that Powell would fall below 3,490 feet at the end of December 2023 and stay there for all but three months of the following year. But since then, the Colorado River's Upper Basin has been blanketed by extraordinarily heavy snows. Recent federal projections are for the lake to receive 156% of its average April through July runoff this year.

Now, the bureau's same "minimum probable" forecast released in mid-March, doesn't show the lake falling below 3,490 at all during the next two years. Most likely, Powell will rise more than 40 feet from its current level by mid-summer to above 3,560 feet before falling again by winter, but to nowhere near as low as it is now.

But most scientists who follow the Colorado River's ups and downs say this year's plentiful snows and runoff don't lift the dam and the lake out of trouble by a long shot. This year's predicted peak elevation at Powell will be dozens of feet below where the lake peaked during the river's last big wet year, in 2019. Each time the river has had wet years since 2010, the lake's peak elevation has been lower than during the previous peak. That's a sign of how precipitous its declines have been during the river's more common dry years.

To prepare for the lake falling below 3,490, the bureau's study is looking at six alternatives requiring structural modifications of the 60-year-old dam. They include drilling new tunnels through the dam's sandstone abutments, installing new power plants at or underneath the Colorado River's surface water level, and

adding new intake works leading to the dam's turbines from the penstocks, a group of large, steel pipes that transport the water from the reservoir's face to turbines lying inside the dam.

Two other alternatives call for adjusting the bureau's broader reservoir operations so the lake doesn't fall below the minimum power generating level, or taking more minor steps to allow the dam to keep producing power very slightly below that level.

Energy security at a high price

Construction of any of the six structural modifications would range from \$500 million to \$3 billion, several persons familiar with the proposals told the Star. Because these fixes would require an appraisal of their costs and benefits, a full-blown environmental analysis and congressional authorization, it could take up to a decade to bring one of them online, said David Wegner, a former Reclamation engineer and Leslie James, executive director of the non-profit Colorado River Energy Distributors Association. It represents about 120 utilities and other entities who buy and distribute electricity from Glen Canyon and other Western dams making up what's known as the Colorado River Storage Project.

That means these measures aren't short-term fixes for the chronically low water conditions that imperil the reservoir's future, said Wegner, who today sits on the National Academy of Sciences governing board.

"Absolutely there is a danger that the lake could fall below the 3,490 foot elevation" before dam modifications are online, Wegner said. "Without a strict cutback on water allocations, the reservoir storage in both Powell and (Lake) Mead will continue to fall," added Wegner, saying the 2 to 4 million acre feet in cuts ordered by the bureau last year should at least be instituted.

These measures now under study also wouldn't generate anywhere near the amount of power that now comes from the eight turbines lodged inside the main

dam structure. The dam has the capacity to generate 1,280 megawatts of electricity at a given time. With its water levels now down around 175 feet below those of a full reservoir, the dam currently generates about 61% of capacity over the course of a typical year. In 2022, the dam produced 36% less electricity than it produced, on average, over the period 1992 through 2022.

The alternatives under study by the bureau would produce at most 350 megawatts, or about 27% of the dam's generating capacity.

One environmentalist questions whether the modifications now under study by the bureau make economic sense.

“How many billions of dollars are we going to spend, and how many hundreds of thousands of acre feet of water are going to be lost, over the course of years, to keep this dam functioning as if it were the early 1990s?” asked Kyle Roerink, a long-time critic of the dam who is executive director of the Great Basin Water Network, which is based in eastern Nevada at its border with Utah. “Is it worth the taxpayer cost, and is it worth the evaporation and seepage losses over time? It's becoming more and more apparent that we only need one big storage pool — at Lake Mead. It's a huge investment for a reservoir that isn't going to stand the test of time.

“We need to do everything we can to stop losing water to evaporation and seepage. When it's sitting at a pool at Lake Powell, waiting to be pushed through the dam's penstocks, you're having these losses. You're at the point where you need to figure out something different.”



As water in one of the nation's largest reservoirs recedes, geologic features hidden for nearly 50 years are revealed in Glen Canyon National Recreation Area in Northern Arizona. Video courtesy of Glen Canyon Institute, 2022

Glen Canyon Institute, 2022

Whether these modifications are worth the expense to produce a relatively small amount of power is a fair question, said James, director of the Phoenix-based energy distributors group. Its members, including the Phoenix utility Salt River Project, buy and deliver power from the dam and others managed by the river storage project, whose dams serve about five million people in seven states.

But James said the hydroelectric power produced by Glen Canyon and other dams is a unique resource, needed for the stability and reliability of the broader Western power grid, that's particularly as many utilities go through a transition period as they switch their emphasis from coal fired power to electricity generated by solar and wind power, she said.

“Hydropower has characteristics other renewables don't have, just by their nature,” James said. “Unfortunately, Mother Nature dictates what kind of fuel we have available. I think we have to go down the path and look at every option before doing anything.”

“We don’t know what the costs are. Any decision that anybody makes, including Congress, would require doing some cost benefit assessment. Let’s see what the tradeoffs are and see if it’s worth it.”

While examining these projects will be time-consuming and expensive, “these times we are in, I don’t think anyone ever anticipated them, certainly not when Congress authorized all these projects, not when decisions were to be made on how they funded and operated,” James said.

Wegner is a member and a founding trustee of the Glen Canyon Institute, a non-profit group that formed a generation ago to push for draining Lake Powell so the pre-dam Glen Canyon, with its cottonwood and willow-lined side canyons and its lush grottoes, can be permanently restored. Wegner himself doesn’t advocate draining Powell — he wants Glen Canyon restored by other means.

As for the modifications now under study, Wegner said he doubts they’ll get built, due to their high cost. Nevertheless, he supports the bureau’s study in principle, saying “the public and the power users need to do due-diligence on what options might be out there.

“It would be silly not to at least look at the costs and options — and then make a value — focused assessment and decision. Are these measures worth the expense? That’s way above my pay-grade to make that conclusion,” Wegner said.

Push to keep power generating

Bureau officials announced their intent to conduct this study in early 2022, using \$2 million in federal money taken from a 2021 drought bill. The announcement of this study came just as concerns were stirring that for the first time, Powell was in danger of an imminent decline to below 3,490 feet.

The reservoir had tumbled about 50 feet from June 2020 through June 2021, and then another 23 feet by the end of 2021 to 3,537 feet. Over the next few months, the bureau first cut its planned releases from Powell to Lake Mead for 2022 by

about 6%, then told the basin states they needed to slash their take from the river by up to another 28%.

This year, bureau first disclosed the alternatives in an early February, invitation-only webinar presentation, to which numerous interest group representatives were invited, but not the news media. A bureau slide presentation from the webinar has been publicly circulated. But Interior Department officials declined further comment on the study in response to questions from the Star, other than to send a statement.

The statement noted that Interior “continues to pursue a collaborative, consensus-based approach to both deploy resources that conserve water and increase the efficiency of water use in the Colorado River Basin.” At the same time, the department is prepared “to use its authorities to protect the system’s reservoirs from falling to critically low elevations that would threaten water deliveries and power production,” said the statement.

Briefings such as this one “are part of a broader set of ongoing conversations with the Basin states, Tribes, water managers, farmers, irrigators and other stakeholders to inform our work to improve and protect the short-term sustainability of the Colorado River system and the resilience of the American West to a changing climate,” the statement said.

Of the nine alternatives under study, the most expensive are likely two proposals involving the drilling of a tunnel through one of the dam’s sandstone abutments. The tunneling would allow river water to flow to new power plants that would be built downstream of the dam, either underground or at whatever water level at which the water flows even as the lake falls below 3,490

Those two proposals also resemble in many respects a plan that was informally laid out more than 25 years ago to environmentalists wanting to drain the reservoir by Floyd Dominy, a then-retired, since-deceased Reclamation commissioner who had overseen and was a cheerleader for the dam’s original construction.

Dominy, speaking to Glen Canyon Institute officials, had first dismissed as impractical an earlier proposal by a dam opponent to drill into the dam's concrete bypass tunnels to drain the lake by letting river water through. He suggested drilling new bypass tunnels around the old ones through the softer sandstone, lying on the sides of the dam, according to a story told by institute founder Rich Ingebretsen and confirmed by ex-bureau engineer Wegner.

The two alternatives now under study resemble that proposal, but they contain a new power plant that Dominy never talked about back in 1997. These proposals' purpose is to keep the dam's turbines whirring, not to drain the lake, said Wegner.

Also, these projects would allow the river's Upper Basin states to keep releasing water through the dam to the Lower Basin states, to meet requirements of the 1922 Colorado River Compact, he said. Arizona, Nevada and California comprise the Lower Basin, and Colorado, New Mexico, Utah and Wyoming are in the Upper Basin.

"These are proposals with one thing in mind: to keep power generation at Glen Canyon Dam, with an eye to also providing a safeguard, to insure water deliveries can be made to the Lower Basin in low level conditions," added Roerink. "The majority of proposals put forth are not a pathway to a Glen Canon National Park."

Proposals worth review

The proposed modifications deserve consideration because more generating capacity is needed in the Southwest to meet forecasted increases in peoples' electricity demand, says the Salt River Project utility, which uses some Glen Canyon Dam power to satisfy peak summertime demands.

SRP itself predicts that its peak electricity demand levels will rise 12 percent by 2025 to about 900 megawatts.

"This power capacity simply does not exist in the current market, meaning SRP is in the process of building new power generation resources to serve this increasing

demand” today, the utility said in response to questions from the Star.

SRP also cited a year-old study, commissioned by it and five other utilities and published by a San Francisco consultant, that concluded the Southwest faces” a significant and urgent need” for new resources due to growing energy demands and continued plans to retire coal-fired and other fossil fuel generated power plants.

At Powell’s current low levels, utilities that receive the dam’s power have needed to adjust to significantly lower output, with the dam losing between 1/3 and 1/2 of its power capability, the utility noted.

“Losing all of the capacity would be a significant reliability challenge, so if generating capacity can feasibly be preserved or supplemented, the proposed solutions are worth reviewing. It is reasonable for the Bureau of Reclamation to determine whether the costs are justified by the benefits of the various proposals” the utility said.

The reality of climate change

A leader of another environmental group, Save the Colorado, said he’s happy “to see the bureau accepting the reality of climate change and that Glen Canyon Dam is part of the problem causing the crisis on the river.

“The dam has to be modified or in our opinion, decommissioned,” said Gary Wockner, the group’s director. “That they are considering tunneling around or through Glen Canyon Dam is a really big deal.”

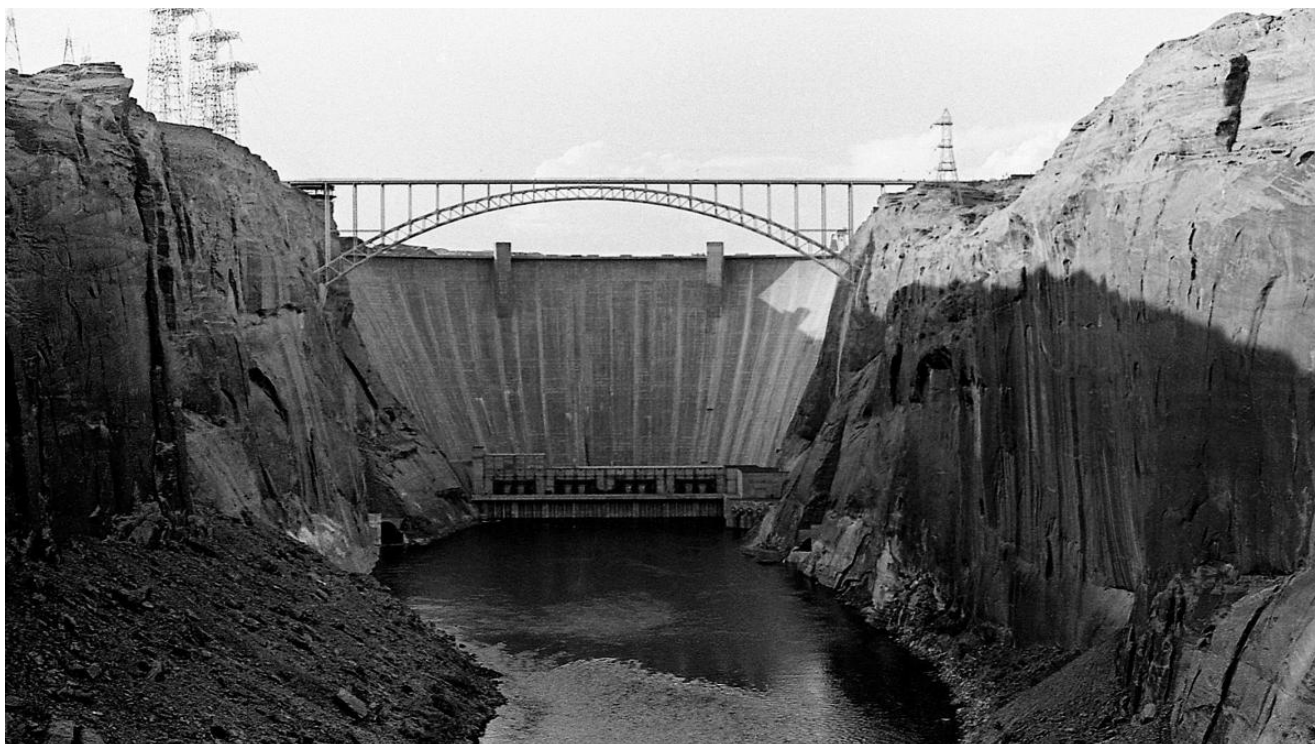
He found it particularly important — “a paradigm shift,” in his words — that one of the alternatives under study is to add solar and wind generating facilities, which he called an admission that the dam may no longer be able to generate electricity at all.

“That dam has been there for almost 60 years; and it was heralded at the time and

really ever since then as sort of a monument of man's ingenuity, of his domination over nature in the Colorado River, and now it is point blank, loud and clear that man has dramatically overstepped his role in controlling nature," said Wockner, of Boulder. "The dam is a monument now to the change that must happen and the reality of climate change and just human hubris."

Photos: Glen Canyon Dam dedicated in 1966 after years of construction

Glen Canyon Dam



Glen Canyon Bridge and Glen Canyon Dam during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

Mark Godfrey / Tucson Citizen

Glen Canyon Dam





Interior Secretary Stewart Udall, right, with Ladybird Johnson during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966. The Glen Canyon Bridge is in the background.

Mark Godfrey / Tucson Citizen

Glen Canyon Dam



First Lady Ladybird Johnson with Arizona Gov. Sam Goddard during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

Mark Godfrey / Tucson Citizen

Glen Canyon Dam



The transformer complex during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

Mark Godfrey / Tucson Citizen

Glen Canyon Dam





The control room during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

Mark Godfrey / Tucson Citizen

Glen Canyon Dam

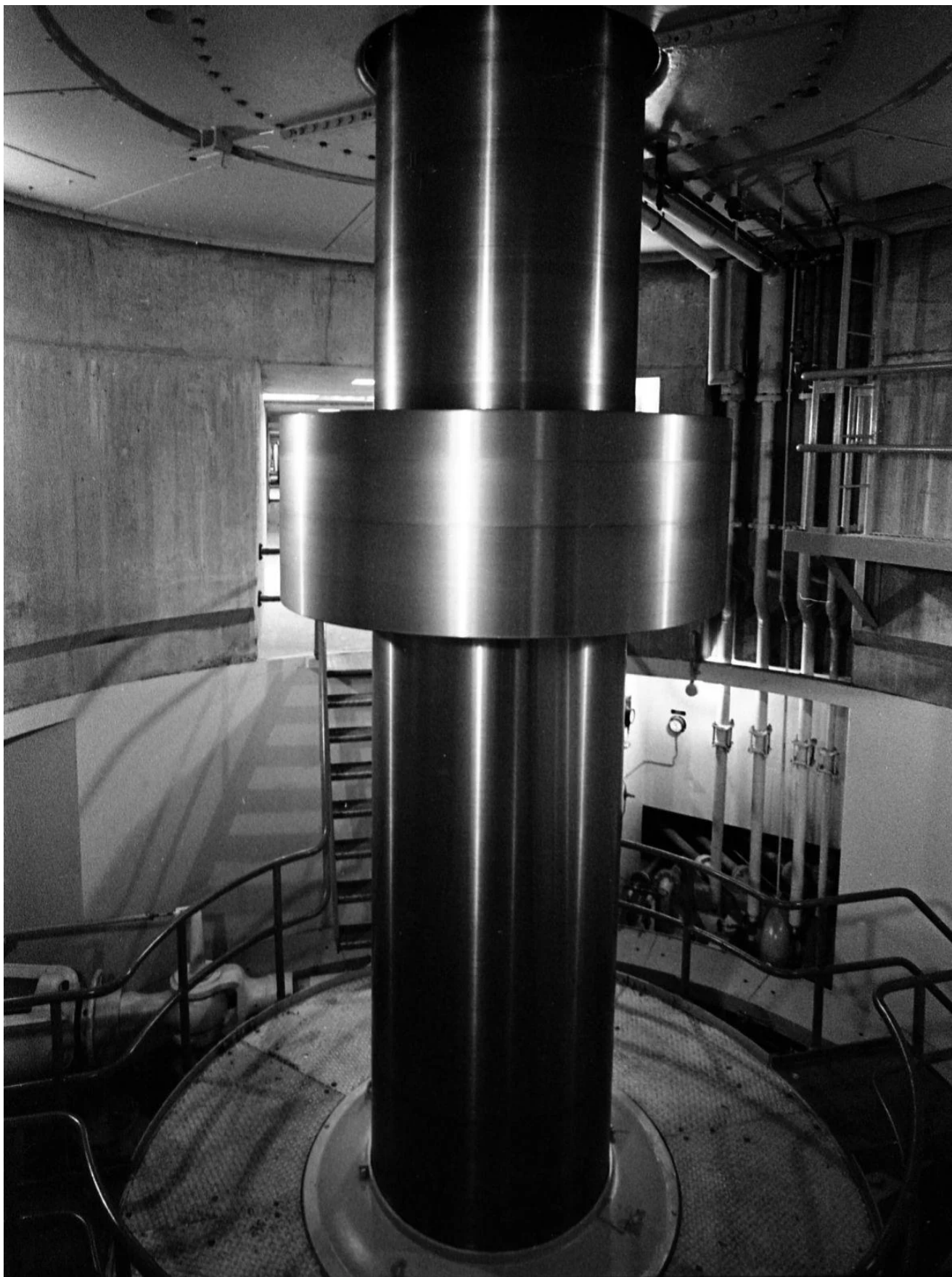


Deep underneath Glen Canyon Dam during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

Mark Godfrey / Tucson Citizen

Glen Canyon Dam





A giant steel turbine shaft spinning during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

Mark Godfrey / Tucson Citizen

Glen Canyon Dam



First Lady Ladybird Johnson, center, during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

Mark Godfrey / Tucson Citizen

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First Lady Ladybird Johnson during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

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Wahweap Marina on Lake Powell during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

Mark Godfrey / Tucson Citizen

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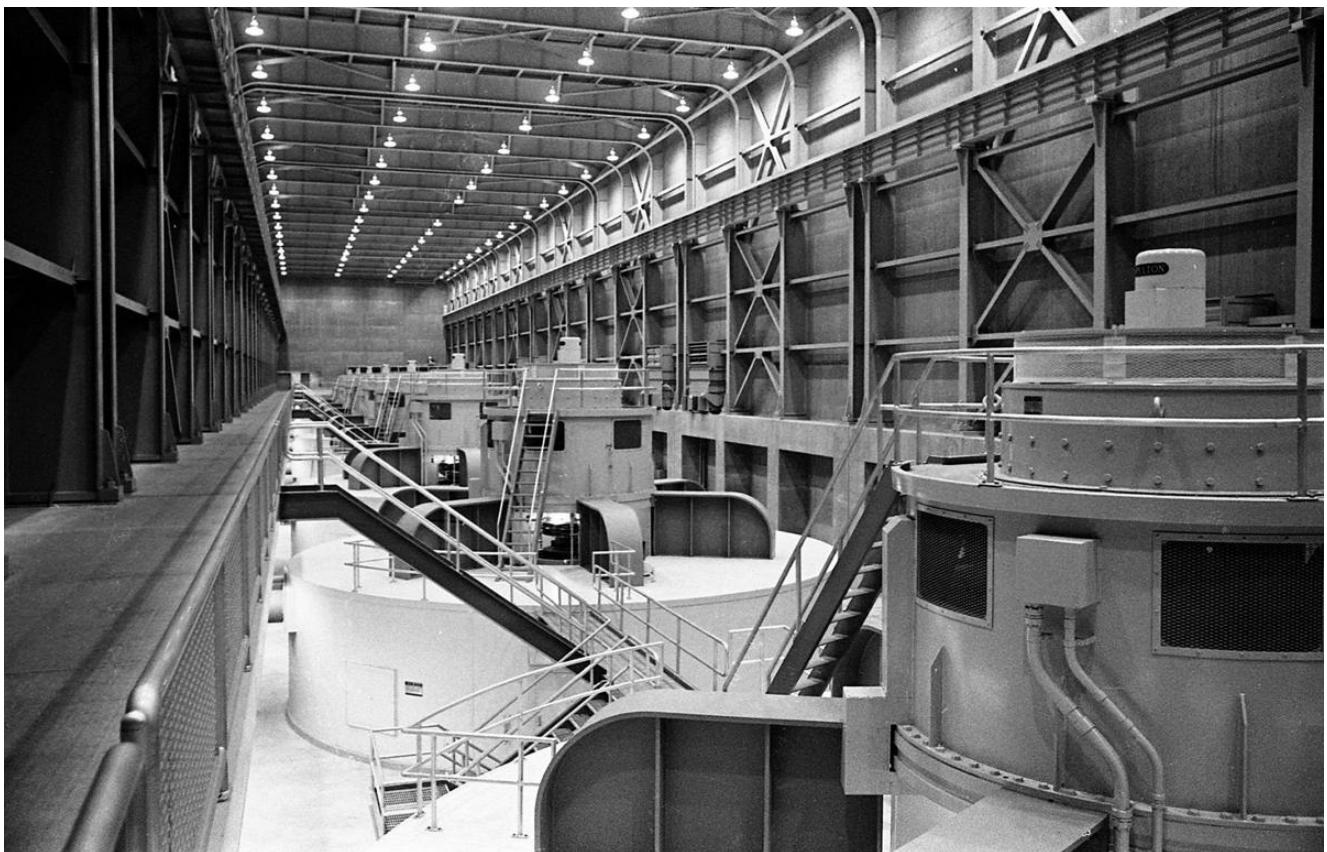




Boaters on the new Lake Powell during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

Mark Godfrey / Tucson Citizen

Glen Canyon Dam



The turbine hall during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966. The first electricity was generated on September 4, 1964, with the power sent into the

regional electric grid through a pair of long-distance transmission lines as far as Phoenix, Arizona and Farmington, New Mexico. [

Mark Godfrey / Tucson Citizen

Glen Canyon Dam

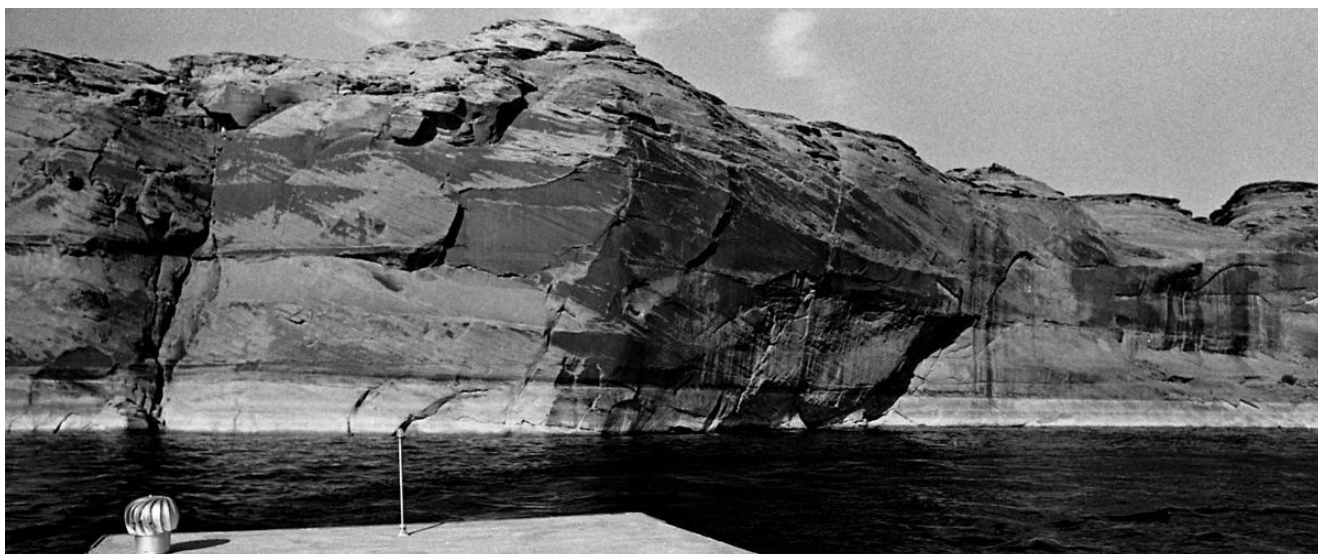


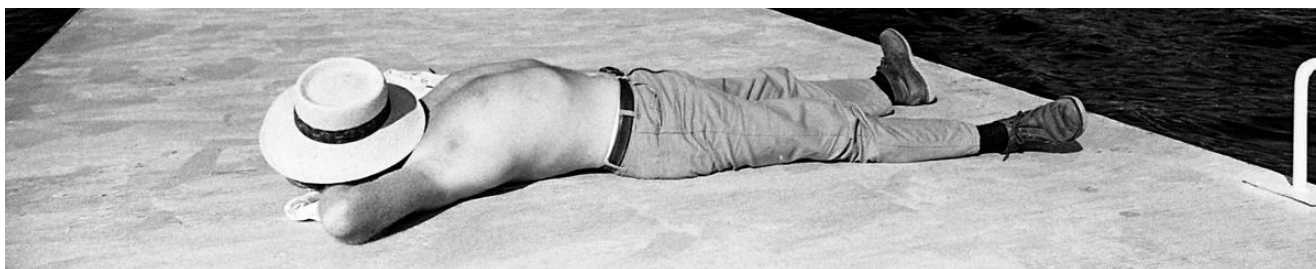


The eight penstocks that provide water for generation of electricity are revealed on the back of Glen Canyon Dam during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

Mark Godfrey / Tucson Citizen

Glen Canyon Dam





A man catches some sun during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

Mark Godfrey / Tucson Citizen

Glen Canyon Dam



Boaters on Lake Powell during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

Mark Godfrey / Tucson Citizen

Glen Canyon Dam

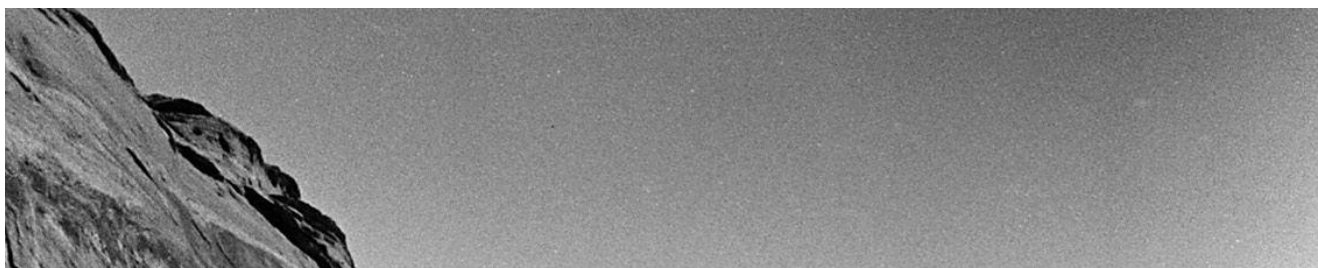


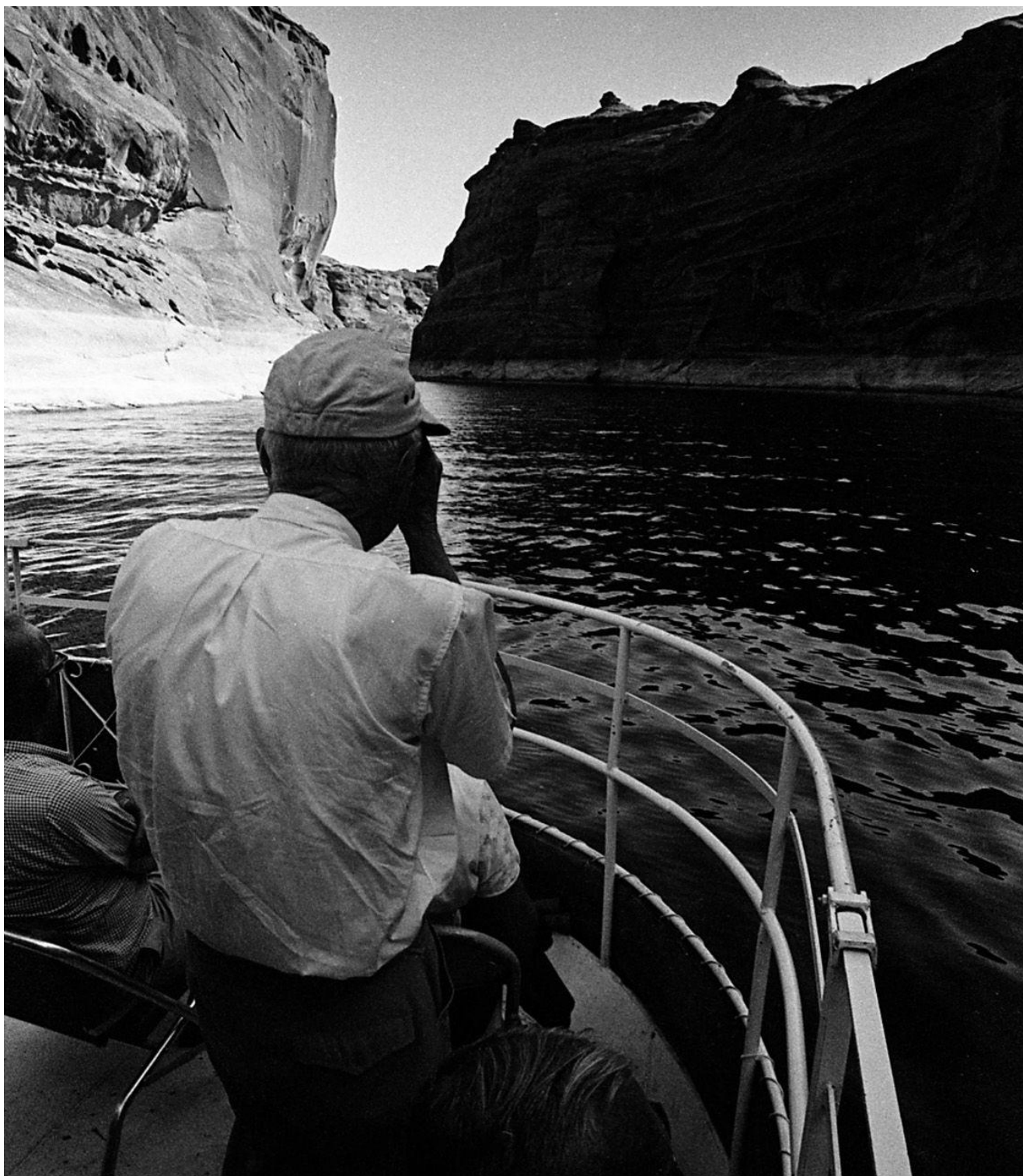


Boaters on Lake Powell during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

Mark Godfrey / Tucson Citizen

Glen Canyon Dam

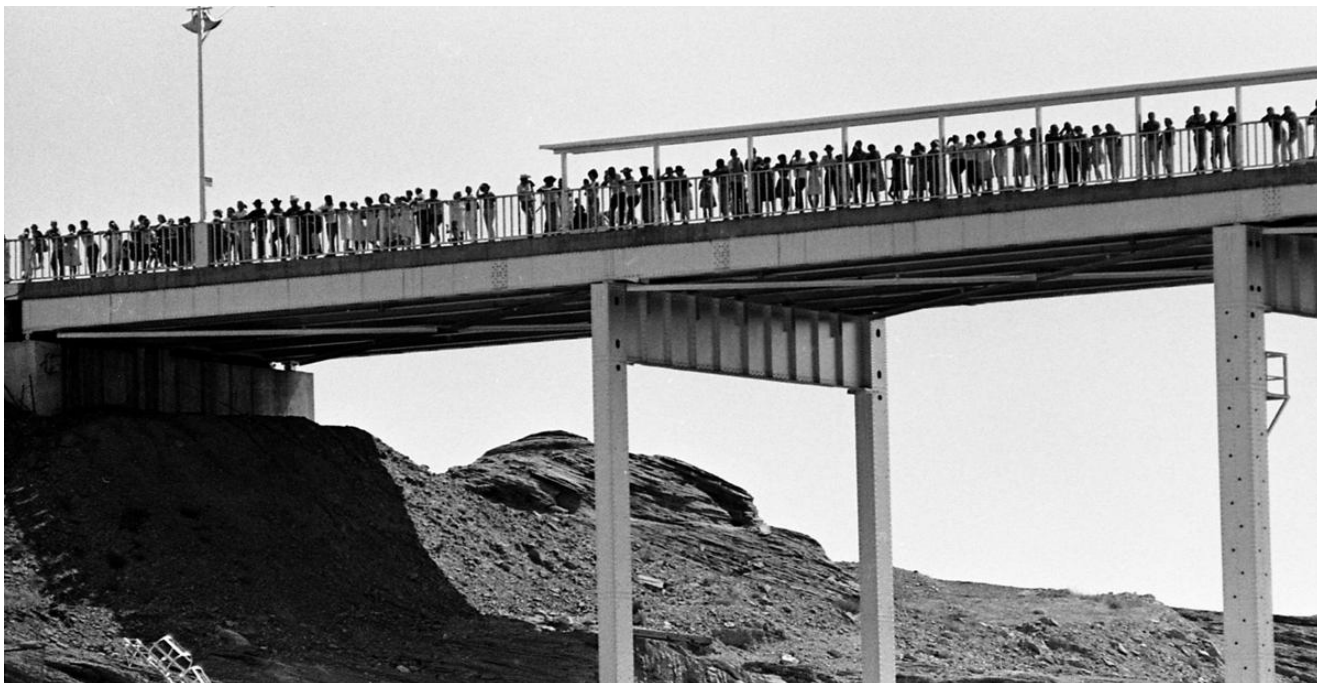




A guest photographs Arizona's newest lake during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

Mark Godfrey / Tucson Citizen

Glen Canyon Dam



Spectators watch the dignitaries from a distance during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

Mark Godfrey / Tucson Citizen

Glen Canyon Dam



A boat ride on Lake Powell during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

Mark Godfrey / Tucson Citizen

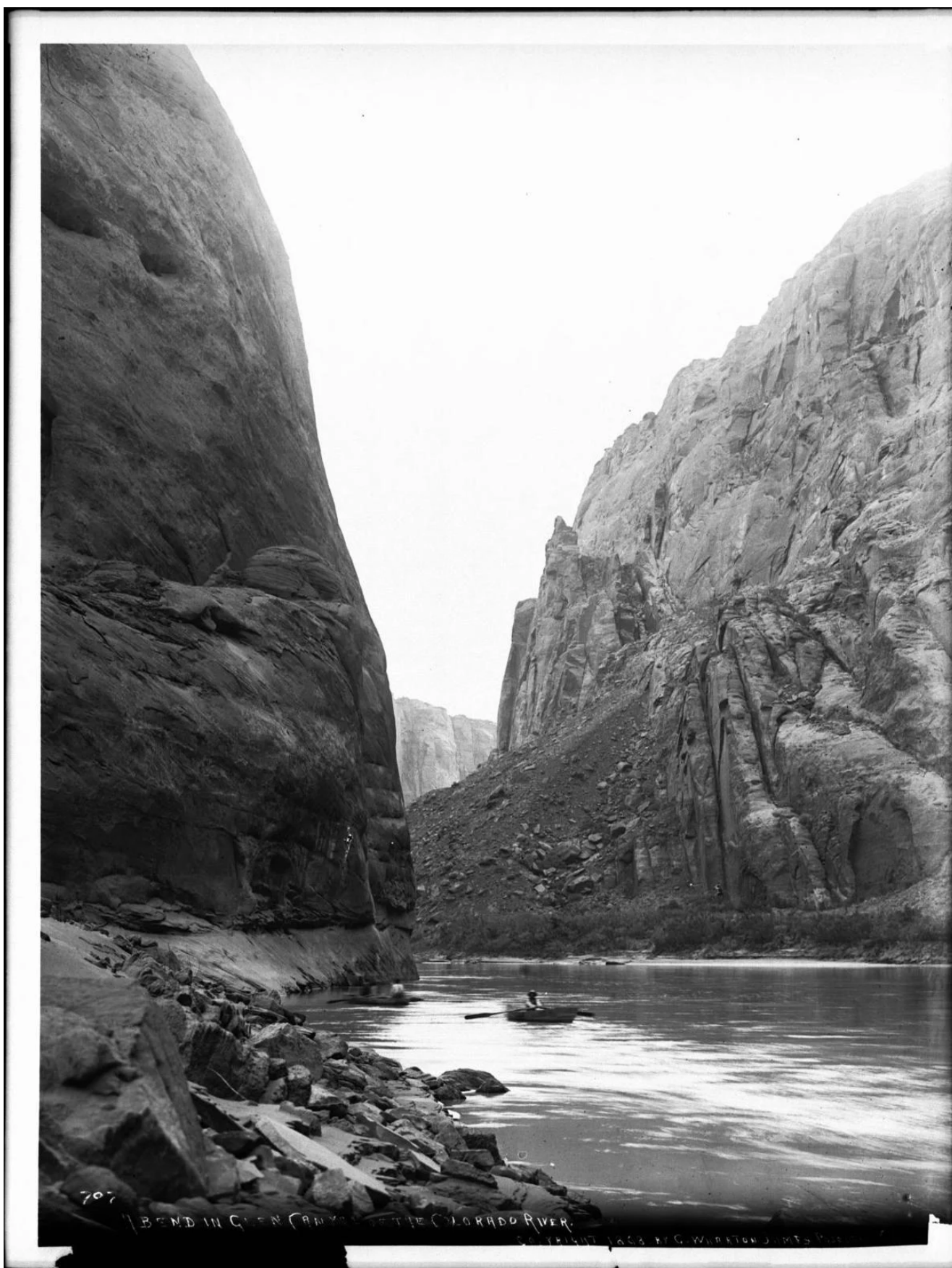
Glen Canyon Dam



Wahweap Marina on Lake Powell during the official dedication of Glen Canyon Dam near Page, Ariz. on Sept. 22, 1966.

Mark Godfrey / Tucson Citizen

Glen Canyon Dam



Photograph of a bend in Glen Canyon of the Colorado River, Grand Canyon, ca.1898. The towering

nearly-vertical rocky canyon walls loom over the placid river. The canyon rim is visible in the distance. A rocky embankment forms the shore on one side of the river. Two men row small boats on the river.

California Historical Society

Glen Canyon Dam

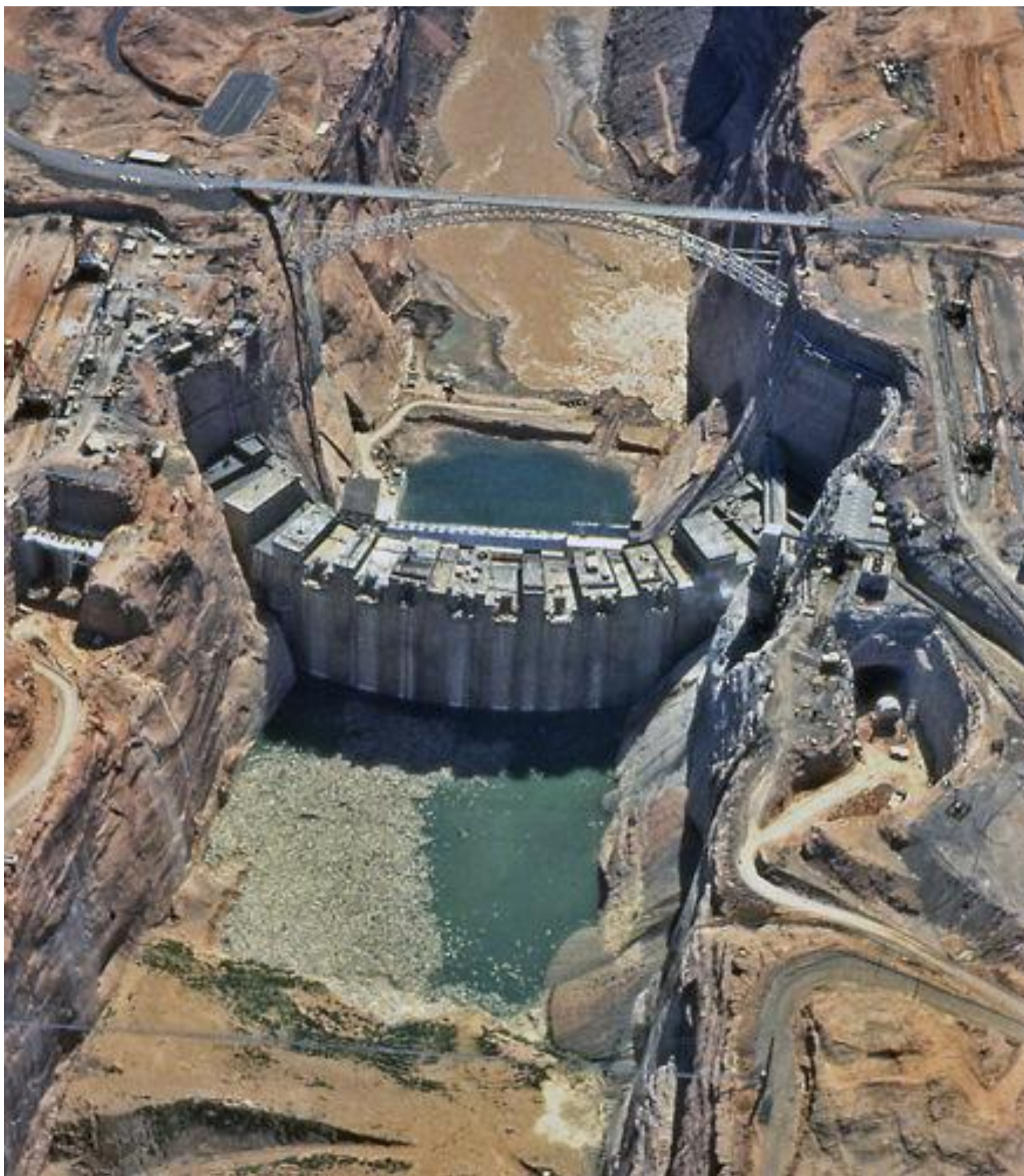


Glen Canyon damsite from the air in November 1957, prior to construction of the Glen Canyon Bridge

U.S. Bureau of Reclamation

Glen Canyon Dam





Aerial view of Glen Canyon Dam during construction - 1962

U.S. Bureau of Reclamation

Glen Canyon Dam





Construction of Glen Canyon Dam in 1963.

U.S. Bureau of Reclamation

Glen Canyon Dam



Lake Powell filling underway, 1965

U.S. Bureau of Reclamation

Glen Canyon Dam, bridge, construction



Steelworkers sit on the steel span for Glen Canyon bridge under construction high above the Colorado River in the late 1950s.

Arizona Daily Star file

Glen Canyon Dam, bridge, construction



The bridge span emerges from the anchorage in the wall of Glen Canyon just west of the dam site under construction, late 1950s.

Arizona Daily Star file

Glen Canyon Dam, bridge, construction



Heavy equipment moving rock at Glen Canyon Dam site, late 1950s.

Arizona Daily Star file

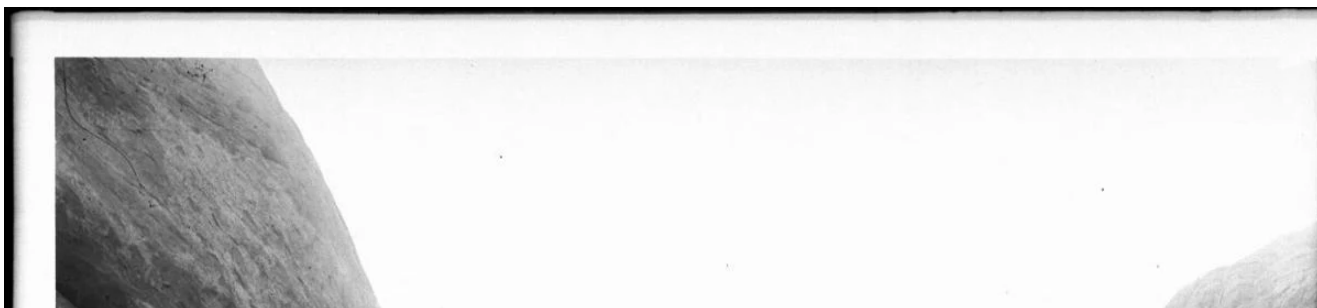
Glen Canyon Dam, bridge, construction



Dozens of survey marks dot the wall of Glen Canyon at the site of the dam in the late 1950s.

Arizona Daily Star file

Glen Canyon





Bend in Glen Canyon of the Colorado River, Grand Canyon, ca.1898. Photographer: George Wharton James

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