

BLACK AND BLUE, LIBYA'S LIQUID LEGACY

► Amy Otchet

Libya is mining water to feed its Great Man-Made River but is still not sure how to use this precious resource

Years can roll by without a single shower raining on much of Libya's Sahara—one of the world's most forbidding stretches of desert, covering 90 per cent of the country. Like a slab of clay forgotten in an over-heated kiln, flat bands of scorched sandstone, cracked and brittle, give way to wind-rippled dunes, offering the only gentle touch to this barren landscape, where a scraggy tree exudes an almost spiritual aura by its defiance to survive.

► UNESCO Courier journalist

Yet beneath this baked crust of earth, there is water—not just the last trickles of nearly dry streams but phenomenal supplies percolating in four sandstone aquifers. Imagine filling a pool the size of Germany, several hundred metres deep, to grasp the quantities of water contained in these basins.

The aquifers are the liquid legacy of a climate gone by. About 10,000 years ago, the barren Sahara was a green savannah, crawling with crocodiles, giraffes and elephants. Tropical rainforests bloomed on

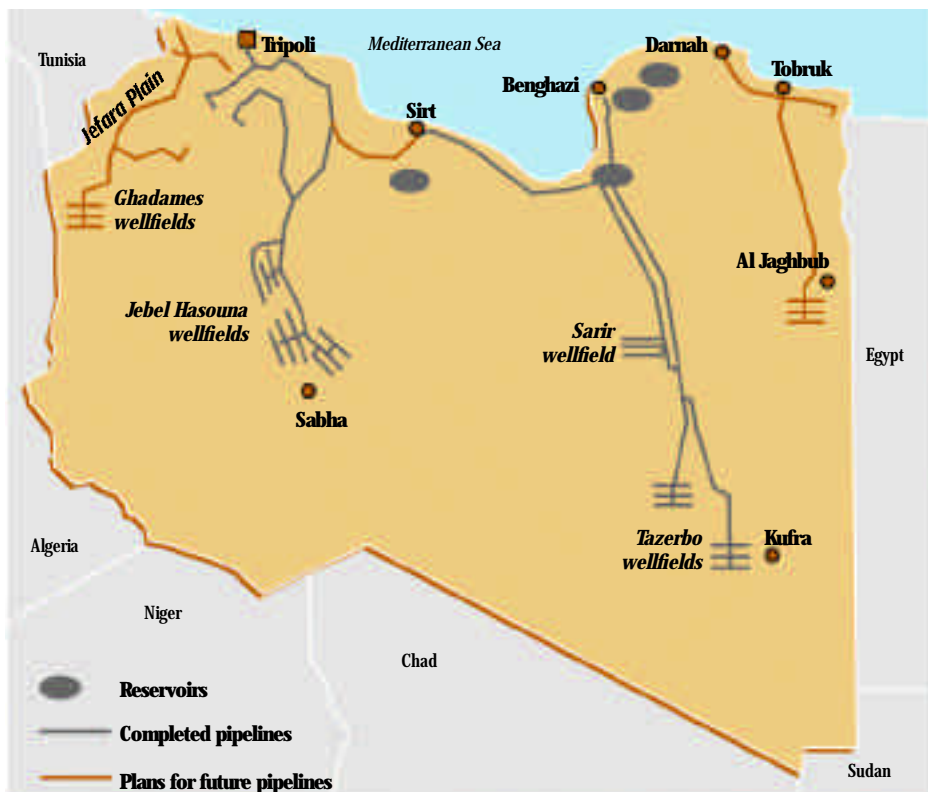
mountaintops while our Neolithic ancestors harvested wheat-like crops in the plains. Heavy rains regularly refilled the rivers and lakes, but significant amounts also seeped underground, saturating the layers of sandstone until they sloshed with water. At the bottom of the basins, reaching depths of four kilometres, there may be water millions of years old.

Little remains from that green period: climate change choked off the rains about 3,000 years ago. For millennia, the aqi-

Huge pipelines have been laid to link wellfields in the desert with the coastal strip inhabited by 85 per cent of Libya's population.



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In the next two or three years, Libya plans to irrigate 150,000 hectares of land in addition to its current irrigated area of some 500,000 hectares.

fers lay largely untouched as very little water flowed in or out, according to scientists. Yet today most of Libya's citizens are drinking and bathing in these extraordinarily pure "fossil waters".

War of attrition between land and sea

Authorities first turned on the taps of the Great Man-Made River Project (GMRP) in 1991. Considered the world's largest civil engineering project, the river is a work in progress. Today, about half a million cubic metres of water are flowing daily through two giant underground pipelines connecting well-fields deep in the desert to the coastal rim where about 85 per cent of the population live. The government is mining water in much the same way as oil—and in so doing adds a new twist to an old debate: what are the risks of relying on a non-renewable resource? With every litre used today lost for tomorrow, what about generations to come? You don't only inherit resources from your parents, say conservationists, you borrow them from your children.

But as the Libyans remind us, scarcely a whimper is heard today about the world's dependence on another finite fossil resource, petroleum. Why balk at mining water and not oil? The two come hand-in-hand in Libya. In the mid-1960s, discovery of the country's vast petroleum resources led geologists to explore the aquifers for a simple reason: oil rigs require water. But the scale

shifted in the 1970s when the oil boom triggered a looming water crisis with the sharp rise in living standards and population growth (from 1.5 million to the current five million). Officials didn't need a crystal ball to see groundwater supplies falling prey to the sea's intrusion. Imagine a war of attrition between land and the sea, ever-hungry for more territory. The groundwater supplies reinforce the land's resistance to the battering waves of the sea. So a steep fall in water tables is like an open invitation for the sea which now intrudes another 100 metres underground each year. This saline trail contaminates what little freshwater remains and ravages the fine coat of ochre soil, leaving the roots of orange trees so choked with salt that many bear little more than green fruit the size of ping-pong balls.

"The question has never been: should we mine water or not?" says Omar Salem, director general of the General Water Authority. "Rather it's been: if we don't find a solution to the water shortage, we will face a very dark future." After weighing the options, the government ruled out desalination, considered too expensive and risky as the country would be entirely dependent on foreign technology and expertise to maintain the plants, explains Salem. With such fabulous supplies lining the desert (very roughly estimated at 120,000 cubic km), the choice was clear: move the people to the water or the water to the people. With few families enticed by desert life, the government opted for the lat-

ter in 1983 and began building the Man-Made River which is both praised as the World's Eighth Wonder and branded as Col. Qadhafi's "Pipe Dream".

It took an army of Asian construction workers years to dynamite and dig the tunnels to lay the giant concrete pipes, four metres in diameter, wide enough for a subway train to pass—or tanks, missiles and troops, according to a few Western media reports citing anonymous sources which claim that the Man-Made River is intended for covert military purposes. While these stories are rejected as fantasy by experts in international organizations (including UNESCO), the scale of the project opens the floodgates of the imagination. A road from Tripoli to Bombay could be paved with the five million tons of cement used to build the pipelines, which stretch over a total length of 3,500 km. Imagine

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transposing the conveyance system on a map of Western Europe: the pipeline would begin in southern Switzerland and head through Germany and on up to Poland before cutting west to northern Scotland. In reality, it takes an average of nine days for every drop of water to travel from Libya's desert well-fields to the coast.

The nightmare of construction logistics took a surreal turn in 1986 when the U.S. government imposed sanctions limiting travel and commercial operations with Libya¹, says Mr A.M.El-Gheriani, general manager of the GMRP. The first order of business lay with the project's designers, a consulting firm based in Houston and ▶

¹ In 1992, the United Nations also imposed sanctions (including a ban on civil aviation and severely restricting commercial activities) in response to Col. Qadhafi's refusal to extradite two suspects in the 1988 bombing of a Pan Am jet above Lockerbie, Scotland. The UN suspended these sanctions in 1999 after Tripoli handed over the suspects for a trial to take place in the Netherlands.

owned by Halliburton, whose CEO is none other than Dick Cheney, former U.S. secretary of defence. The company quickly passed into the hands of a subsidiary, Brown and Root, conveniently located in England. The wheeling and dealing required to obtain spare parts has inflated the project's hefty price-tag, estimated at a total of \$27 billion—which the government has been financing mostly by converting oil into water by taxing petroleum exports.

"All major civil engineering projects are criticized, but especially the GMRP given the country that Libya is," says Dr Abdulgader A. Abufayed, who is responsible for allocating GMRP water. Libya is not the only country mining fossil water. Egypt is tapping into aquifers in its western desert for a massive project to irrigate 200,000 hectares. Even the United States is pumping non-renewable sources. While California's water mining is marginal compared to that of Libya, it is controversial given that the U.S. is a water-rich country with alternative supplies. But what choices are open to hyper-arid countries? For these countries, the question is not whether to use fossil water, but when and how?

More today means less tomorrow

"The difficult choice is between two development options," says Mohamed Bakhbahi, a Libyan hydrologist with the Nubian Sandstone Aquifer System Programme, which promotes data exchange between the four countries sharing these basins (Chad, Egypt, Libya and Sudan). "Do we want large-scale extraction of groundwater for maximum benefit of the present generation or limited extraction that ensures sustainable development and conservation of the resource base?" Libya is now at a crossroads: the Man-Made River is only flowing at about a tenth of its capacity to cover domestic needs on the coast. The government must now decide how to use the rest of the water and put the needed infrastructure in place. Should it use every last drop for large-scale irrigation projects or opt for a more conservative policy, focusing more on ensuring drinking supplies and industrial use, which require far less than agriculture?

Officially, agriculture is the top priority of the Man-Made River. For the next 50 years, the project is designed to deliver about six million cubic metres of water daily, with 75 to 80 per cent going to farms, according to Dr. Ali Giuma, secretary (minister) of agriculture. It's important to understand that major infrastructure projects are normally built to last at least 50 years. The aquifers will not dry up at the end of that period but they may be far more difficult to mine. "You might

be able to extend the conveyance system or put in another well-field," says John Lloyd, a British professor at Birmingham University and a leading groundwater expert. In the Libyan desert, the wells reach between 400-600 metres underground. In 50 years, the water tables of the western aquifers, for example, are expected to fall about 80 metres if they are pumped at full capacity. Technically, it will be possible to continue pumping at these lower levels (assuming that the water quality doesn't change). In Saudi Arabia, for example, water wells reach down a kilometre or two underground even though they are more expensive to operate. But as Lloyd points out, "Water may be more precious in the future, so it might be worth pumping deeper."

With this in mind, the agriculture minister, Dr Giuma, ploughs ahead with irrigation plans to work towards the national goal of agricultural self-sufficiency. "In the next two or three years, we plan to add another 150,000 irrigated hectares to the current total of about half a million," says Giuma. While fruits and vegetables are in ample supply, Libya relies on wheat and barley imports to satisfy 60 per cent of domestic demand. To redress the balance, government-sponsored farms are starting to sprout around Sirt, Colonel Qadhafi's native city, and Benghazi.

This is big sky country, with the flatlands surrounding Benghazi looking picture perfect for a giant wheat belt. Red topcoats of soil are carefully tilled beside white-domed

water tanks crowning each of the 520 new farms, which the government is preparing to virtually give away at prices of just 2,000 dinars (\$1,000 at the black market exchange rate) for 10 hectares. Not by chance, the Man-Made River flows nearby via two reservoirs the size of football fields.

Importing wheat saves precious water

But the apparent abundance of irrigation water is a kind of mirage, hiding the fact that this is an arid zone where water evaporates at rates of 40 to 60 per cent. Indeed, half of all water now used for irrigation is wasted, according to Ayad S. Kaal, a hydrogeologist with the Agriculture Research Centre. Kaal is hoping that conditions will improve as farmers learn to use more efficient techniques such as drip irrigation.

But the decision to invest in agriculture leaves many scientific experts, particularly from the West, baffled. With the international grain market in a glut, why not import wheat and save precious water for industries that not only use less but also produce better paying jobs? "Of course it might be cheaper to buy wheat abroad but what if there is another embargo to limit these imports?" asks Dr Ibrahim Salem Haffala, an economist with the Agriculture Research Centre.

As Haffala explains, Western principles of economics don't seem to apply here as they fail to take account of surrounding

RIVALING THE NILE

National pride runs high with the Great Man-Made River. The charming weather forecaster on the evening national newscast points to brewing storms over a continental map in which the Man-Made River appears as naturally as the Nile. And those giant pipelines offer the perfect backdrop for Col. Qadhafi to strike a regal pose beside women and children beaming in good health beside bundles of wheat—signs of hydrological abundance depicted in the billboards lining Tripoli's streets. But the River has brought another benefit that isn't as easy to illustrate: a generation of highly skilled engineers and hydrologists.

While foreign consultants have provided the lion's share of operational and technical expertise, the project has been "Libyanized" according to the general manager, Mr. El-Gheriani, who says that nationals now make up 80 per cent of all personnel except for construction which is in the hands of a South Korean contractor, Dong Ah.

UNESCO began co-operating with the government in 1990 to organize training for Libyan engineers and geologists at institutions in the

Netherlands, UK and Australia. All expenses are covered by a trust fund, paid for by the government, which has also been used to finance training and documentation centres set up with UNESCO's assistance in Benghazi.

Once the river began flowing, UNESCO assistance shifted to evaluating the project, with studies comparing, for example, the costs of the GMR water with desalination options. An international advisory board—composed of experts in fields like geo-hydrology, agriculture and engineering—also meets regularly to assess the risks and resilience of the system. The major priority is to evaluate the next stages of construction, including a third pipeline to connect the other two. New well-fields are also under study.

UNESCO is also focusing on wider environmental and socio-economic issues surrounding the management of non-renewable water resources notably in North Africa and the Middle East. To find out more about the first major international conference organized on the subject (Tripoli, November 1999), contact: www.unesco.org/science/waterday2000 ■



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A ceremony held in September 1996 to inaugurate part of the Great Man-Made River.

political and cultural factors. For example, farming is seen as a partial solution to rising unemployment, says Dr Giuma. The government wants to diversify the job market, dominated by the energy sector, by subsidizing a new managerial class in agriculture. These “gentlemen farmers” would supervise foreign workers from Egypt, Sudan and elsewhere in Africa.

“It’s impossible to make a definitive statement like, ‘Don’t use water for agriculture,’ ” says Phillipe Pallas, a French consultant with the Food and Agriculture Organization who has worked closely with Libyan officials for the past 25 years. “But there are people questioning whether or not it might be cheaper to import wheat. This marks a big change. Five years ago, no one in the government would even agree to dis-

cuss the option. Today there is a national debate, though it’s difficult to say at what level it’s taking place.”

In the revolutionary rhetoric of Col. Qadhafi’s *Jamahiriya*—state of the masses—agricultural self-sufficiency appears to be an exalted principle, which few would publicly disavow. But respect for the principle might not translate into active commitment to the goal. “We will be as sufficient as possible with our resources,” says Dr Aboufayed, who is responsible for allocating water to farms. “The Great Man-Made River Project is not the magic solution to all of our water problems. It gives us the breathing space to develop new technologies and an integrated water policy. To raise public awareness of the value of water, we are setting up economic disincentives for waste by

making farmers pay for the water they use.” The apparent pragmatism should, however, be taken with a grain of salt: at just 48 dirham (25-50 cents) per cubic metre, the price tag reflects only a fraction of the true costs of delivering the water. And even this nominal rate won’t be charged until farms are deemed “profitable”.

It may be a matter of time before officials admit to what experts like Pallas see as obvious: “They would need another two of three Man-Made Rivers to be self-sufficient in agriculture,” he says, pointing to projections calculated with Libya’s General Water Authority. In the year 2025, Libya’s population is expected to reach almost 12 million (including non-nationals), with domestic water needs swallowing up about 55 per cent of the total capacity of the Man-Made River. Yet even if every last drop of water (GMRP, renewable groundwater sources and recycled supplies) was used exclusively for agriculture, Libya would still need to import about half of its food supplies.

‘Big fixes’— a technological mirage

“The responsible use of such an extraordinary project demands that you develop the very best conservation policies possible so that nobody in the future can look back and say: ‘What a waste!’ ” says Mike Edmunds, a member of the British Geological Survey team which explored the aquifers in the 1960s. His praise for the project is tempered by caution: “I just hope they [officials] understand that big engineering ‘fixes’ to water crises won’t always be there.”

Big fixes are a virtual obsession for the general manager of the GMRP, El-Gheirania. Sceptical that desalination will ever be affordable, he aims to keep the Man-Made River flowing as long as possible. In August 1999, pipes burst along the eastern corridor, forcing the government to close the taps of this pipeline for about a month. Corrosion is the likely culprit. “With hundreds of thousands of pipes crossing through so many different kinds of soils across a scorched desert, you can expect to have difficulties,” says El-Gheirania. Given the uncertainties, might it be time to invest in infrastructure to better conserve the precious water. “In the future, conservation will be an area of concern for all countries,” says El-Gheirania. Besides, “we don’t have the experience to know that the aquifers aren’t being recharged,” he says, brushing aside the studies showing the contrary. “They [Western experts] said we only had enough oil for 30 years but it’s still flowing. Why not water?” Inshallah!* ■

*Arabic for “God willing”