


WHY GADDAFI'S WELLS MAY RUN DRY

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 COLONEL Gaddafi's «eighth wonder of the world», a plan to pump water from beneath the Sahara up to 2400 kilometres to coastal farms, could turn from a flood to a trickle within a few years. British geologists warned that the underground water is thousands of years old and is being replaced by modern water at less than one-tenth the rate claimed by the Libyans.

Dr. Ed. Wright from the British Geological Survey (BGS) says that Libyan estimates of the amount of water available are a «gross exaggeration».

The Great Man-Made River project was launched by Gaddafi at Sarir in the heart of the Libyan desert. The first phase, piping water from a well field at Sarir to Sidra and Benghazi on the coast, will cost \$4 billion and employ 8000 South Korean construction workers. Later phases will triple the bill. It is one of the largest civil engineering projects in the world.

But behind the project is a long-running scientific feud about the nature of the vast reservoirs of water that lie beneath 300 000 square kilometres of the Sahara, from the border between Libya and Egypt in the east to the Atlas Mountains of Morocco in the west.

The row divides Arab scientists from their European counterparts, who arrived in the pay of oil companies to drill in the desert in the 1960s. It also divides geologists from hydrologists, raises questions about survey techniques of importance to arid areas throughout the world, and involves high political and financial stakes.

The conflict surfaced recently in a sharp exchange in the *Journal Hydrology* between Wright and professor Moid Ahmad, a hydrologist at the University of Ohio, who advises the Libyan government. Ahmad claimed that water was washing into two underground aquifers beneath eastern Libya from mountain ranges in Chad and Sudan at the rate of 80 cubic metres per second. Wright said the real figure was only 5 m³ per second out of the two aquifers.

Ahmad says that Wright's techniques

are badly flawed and that «millions of cubic metres of water are discharging into the sea and evaporating from oases simply because many hydrogeologists have failed to use the modelling techniques which are now available to us».

The two aquifers, each a kilometre or more thick, are known as Sarir and Kufra. Several hundred wells have already been dug into them in recent years to feed isolated irrigation schemes in the desert. But, says Ahmad, they «tap only a small proportion of the water available».

The first phase of the pipeline project, linking Sarir to the coast, will use some 1500 km of pipe. It is scheduled for completion in 1989 and will, according to the Libyans, bring 23 m³ per second of water to irrigate 180 000 hectares of land and providing grazing for 2 million sheep.

A second phase will link up Kufra, which is deeper still in the Sahara, and double the supply. Later Gaddafi hopes to drive a similar pipeline inland from Tripoli to the Fezzan region in southwest Libya where, his scientists believe, there is more untapped water. The ultimate aim is to link the two systems along the coast, and Gaddafi, in an expansive mood, last month talked of linking this all up with the Nile.

But Kufra and Sarir may be out of action long before then, whether it happens depends on which of two conflicting notions about the Saharan aquifers proves correct: Wright's or Ahmad's.

Wright investigated the Sarir basin in detail from 1967 to 1974, initially for the oil company BP. He believes, on the basis of carbon-14 dating, that most of the water in the two aquifers is very old, between 24 000 and 34 000 years, and dates from a time when the region was much wetter. Some underground channels contain water as little as 5000 years old — again dating from wetter phases in the Sahara's past.

The oldest water is in Kufra, and Wright believes that this is very slowly draining into Sarir. But, he says, water

flow in and between the two aquifers is very slow and new water, infiltrating from the coastal region and running off the mountains of Tibesti and Ennedi over the border in Chad, is recharging the aquifer at only 5 m³ per second.

This means that the wells are draining an essentially non-renewable source of water and, while the water will not quickly run out, it will run down, making pumping costs ridiculously expensive within a few years.

Ahmad has studied the Kufra basin for a number of years, since the Occidental oil company discovered water there. He says the water is often much younger than Wright claims. He dismisses the carbon-14 data, because the age of the carbon in the water may not be the same as the age of the water and, because it may be mixed, it confuses the results.

He says there is a free and continuous flow of water between the two aquifers and that the recharge with modern water is at some 80 m³ per second. Only a «small percentage of the water [in the wells] comes from storage».

He believes that the two aquifers, taken together, are in rough equilibrium, rather than emptying. Perhaps 30 m³ per second is lost from evaporation at oases and another 50 m³ per second drains to the sea or east into Egypt.

Much depends of assessments of the speed of water flow through the aquifers. Wright bases his «slow flow» theory on figures from a few pump tests, which he admits may be unreliable. Ahmad again dismisses this field work entirely and looks rather at «regional transmissivities», that is the amount of water he estimates is entering and leaving the aquifers.

If Ahmad is correct, even a massive development of well fields should be able to keep going for many decades. But the consequences both upstream in Sudan and downstream in Egypt could be considerable. Sudan is making efforts to tap its groundwaters to bring fresh water to outlying villages. If this groundwater does leak into Libyan aquifers, then a lowering of water levels in those aquifers could leave Sudanese villages high and dry.

And if, as Ahmad says, large volumes of water currently leak out of the Kufra aquifer towards Egyptian oases, then that country's irrigation projects, based on a long line of oases in a north-south, could also be threatened.

CONTROVERSY OVER THE WORLD'S MOST AMBITIOUS WATER-RELATED PROJECT

WILL THE GREAT MAN-MADE RIVER IN LIBYA RUN DRY!

LIBYA'S urgent need for water has been answered by an ancient sandstone aquifer deep in the Sahara desert. Over the next six years a South Korean construction firm, aided by US advisers, will be laying 2,000 kilometres of pipeline to bring water from the aquifer to the population centres along Libya's Mediterranean coast.

The desert aquifer was first discovered in the 1960s during oil prospecting. Detailed studies made since ten years ago

by a group of Libyan hydrologists, headed by Dr. Moid Ahmad, professor of Hydrology and Chairman to the Department of Geological Sciences in Ohio University in Athens, U.S.A. revealed the presence of a huge underground reservoir. The problem which faced the Libyan planners was: should the people be taken to the water, or the water to the people.

Failure to attract enough people to the desert regions persuaded the government to press ahead with one of the world's most ambitious water-related projects. In November 1983 South Korea's Dong Ah Construction Industrial Company was awarded a \$3,300 million contract to build pipelines linking Tazerbo and Sarir in the Sahara with the long coastal strip from Benghazi to Sirte.

Almost 300 wells are needed to extract the water at Sarir and Tazerbo.

Submersible pumps will push the water to a height of about 300 metres above sea level. It will then flow through two pipes at an average rate of 2 million cubic metres a day to a reservoir at Ajedabia, 100 metres above sea level. From the reservoir the water will flow along two further pipes to Sirte and Benghazi, providing irrigation for 37,000 small farms of around five hectares each.

The land along the Mediterranean coast is the most fertile in Libya, but years of

usage and encroaching salinity from the sea have put a severe strain on existing water supplies. Once completed, the «great man-made river», as the scheme has been grandly titled, will irrigate around 180,000 hectares — more than twice the present area. If, as planners predict, wheat yields reach four tonnes a hectare, Libya could become a net exporter of wheat before the end of the century. The area is also intended as grazing land for up to 2 million sheep or 200,000 dairy and beef cattle.

IS THERE ENOUGH WATER IN THE DESERT?

The possibility of not having enough water in the desert as evaluated by Dr. Moid Ahmed was questioned by a group of British Geologists. They say that the water in the Libyan Sahara is many thousands of years old and it is being replaced very slowly.

Dr. Ed Wright of the British Geological Survey and his associates in an article published in the September 1984 issue of *New Scientist* «Why Gaddafi's wells may run dry» fears that the Libyan's massive exploitation plans would affect the water table and threaten the ecology of an immense area of North Africa. The project may run out of economically accessible water supplies long before the investment is realized.

Wright has studied the region for a British Oil Company. He considers, on the basis of carbon dating, that the water is up to 34,000 years old; older indeed than the desert above. He assumes — that the two reservoirs are connected by a slowly flowing channel of ground water and that they contain an essentially non renewable resource.

LIBYA: Route of Irrigation Pipelines

