JPRS NEA-86104

TECHNIQUES SOUGHT TO BUTTRESS WATER SUPPLY

East Burnham ARABIA: THE ISLAMIC WORLD REVIEW in English Jul 86 pp 88-89

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[Text] Nowadays water scarcity is regarded as a world problem, not confined to the African famine zone or the traditionally arid lands. Even the UK needs more water catchments to meet growing demand.

In agricultural terms North America does not have enough water to meet demand (even though Americans are calculated to use anything up to 5000 litres per person per day compared with as little as 12 litres per person in some tropical developing areas). North America grows enormous quantities of grain, but some experts think a one-degree average temperature rise in recent years has reduced the amount of moisture available to it through the world weather system. This "moisture deficit" could be setting an upper limit on the region's productive capacity.

If the advanced sector of the world's economy has a water problem, it is much worse for the arid zone. But how far does the definition of a world water shortage reflect the habits of people in water-plentiful areas?

Faced by the immediate need to develop a farming and industrial base, the Arab oil producing states have naturally taken what was available from the West. They have confronted the huge extra water demand first by mining fossil water — extracting ground water beyond the rate of recharge of the aquifers. In order to justify that very strategic decision, they must create an industry and agriculture that will be sustainable without subsidies from the oil, and ultimately self-sufficient in water. Secondly, they have made a large investment in desalination.

It is interesting to see that Bahrain, which relied 90 per cent on ground water, now has a programme to reverse the proportion and meet 90 per cent of its needs from desalination. Like most states in the region, Bahrain is concerned at the rapid exhaustion of aquifers. In the consumption of ground water, apart from long-term considerations, a disadvantage is that as the water table falls and the boreholes go deeper, the unit cost of water must move sharply up.

Given water and money, modern experts in resource development have shown that they can reclaim the desert and grow abundant crops. To the key question — how the water needs of the Arabian peninsula and similar areas can be met after both oil and ground water are exhausted — no one has yet produced a convincing answer.

Desalination technology makes rapid strides, with Reverse Osmosis (RO) and Multi-Stage Flash Distillation (MSF) holding out most promise, but experts draw attention to the theoretical limits of the process, and some say on those basic grounds that desalination for agriculture can never become economic. Meanwhile, in practice, desalinated sea-water plays an increasingly important part in the region's farming.

In plain language the experts mean that whichever method is used a relatively large amount of energy, implying high cost, will always be needed to take salt out of water.

whereas farming, to be economic must obtain its water supply at very low cost: a point made understandable by the calculation that with present methods it needs 1500 kg of water to produce 1 kg of wheat.

Questions of water supply are inseparable from those of drainage and waste disposal, which cost more than supply. A typically modern solution to the problem of water shortage is to increase the use of recycled and purified wastewater. Saudi Arabia's development programme includes large recycling projects. Aquifers are being recharged with waste water and within certain limits brackish water is being used for agriculture.

With enough processing, water can be brought up to any required standard of purity. In England wastewater irrigation has been successfully used for vegetable growing, but the health precautions needed are so elaborate that the method is not yet considered suitable for general use. Yet orchards and municipal parks can quite safely be watered in this way.

Purified wastewater can also find industrial uses, but since most processes need water at least up to drinking standard, and cost escalates with purity, the economic factors need careful study. However, highly saline water has proved suitable for oilfield injection in Saudi Arabia.

Drainage, sanitation and sewers are not inventions of the modern world. As already noted, Babylonia and Mohenjo-daro 4000 years ago had all the main elements of the system including the water closet. But ancient sewers provided sumps for the collection of solid waste.

The western flush-toilet and its associated sewerage have been criticised for disrupting the natural cycle which returns biological waste material to the soil, and for creating river pollution only preventable with costly processing. The modern view is that these methods do not solve the waste problem, it only transfers it from home and factory into the environment.

Studies in Egypt show that sewage has a great potential for desert reclamation, enriching sandy soil, improving its water-holding ability and aiding the solubility of some nutrients needed by plants. In conjunction with this approach, Egypt has adopted a large-scale engineering solution to the problem of Cairo's waste disposal. The system now under construction, replacing an old and much over-loaded one, offers to solve at one stroke problems of high water table, poor drainage and consequent risk of water-borne diseases. Based on gravity flow it avoids a mammoth pumping station to raise water to the required starting height.

Large centralised conventional plants of this kind, though still dominant, are no longer unchallenged in the West. Once they have been installed at a certain capacity it is often hard at any reasonable cost to extend their capacity (though the Cairo design allows for expansion), or add extra treatment stages for other pollutant substances. In Europe there is a revival of interest in simpler methods which may cut the cost, return biological waste material to the soil, and be flexible and adaptable to large or small populations.

Variants of the most basic land treatment method, pouring the waste water over land and collecting it again, incorporate all manner of natural filters, including sand beds and roots of plants. The stabilisation pond method uses the Sun's energy to break down pollutants in a shallow pond. Oxidation ponds, even more effective in the tropics than in Europe, exploit the action of algae in combination with sunlight for a rapid breakdown of pollutants.

Hydrologists considering the problem of wastewater recycling in areas like the Arabian peninsula, point out that whereas treated water can be used to recharge aquifers, there is need for care in the present state of knowledge. They warn against excessive optimism about recycling sewage effluent. Some would keep it for closely controlled municipal applications and the industrial use of chlorinated effluent, so long as it is possible to screen out human contact, especially with children. Similar health problems arise wherever there is a danger that pit latrines or similar sanitation systems in sandy soil may drain into ground water.

Today, throughout the Arab world there is great activity in water-related projects. Libya builds pipelines to carry

ground water 300 miles from the southern desert region to irrigate farmlands along the Gulf of Sidra. It uneconomic from one angle it continues a process of North African desert reclamation which has made encouraging headway in recent years.

Egypt continues to promote irrigation. To support its population it must find ways of expanding cultivation into the desert. Agricultural research has included work on polymer soil conditioners which can hold moisture in the root zone of desert soils or seal them against moisture loss by evaporation.

The Arabian peninsula, sustaining a massive industrial and agricultural build-up with ground water exploitation, relies on desalination and on possible future technology hardly yet in sight. The combination of solar heat and investment capital have encouraged the development of advanced farming methods.

These methods can be highly successful, but still are a phenomenon of the oil-subsidised economy. All efforts to cheapen, simplify, reduce energy and material inputs, may increase their relevance. Since they c[illegible]rate on a principle of meeting the p[illegible]t's needs very exactly, they can open the way to farming systems with a greatly reduced water demand.

Quite apart from controlled environments, desert irrigation has been revolutionised by the trickle-drip and centre pivot systems of irrigation which are also economical in water use.

Another main area of progress is in the cultivation of soil-stabilising desert plants like mesquit and jojoba, which are drought-resistant and can help to create a vegetated landscape. In Pakistan significant research is going ahead on plants which similarly assist desert reclamation.

High humidity levels associated with the monsoon in Oman means that the Darfur uplands can take advantage of atmospheric condensation without actual rainfall. Trees and plants on slopes act as water collectors in this important grazing area.

Iraq and Iran both suffer acutely from problems of salinity. Modern methods allow a limited use of saline water in irrigation, especially in soils with high vertical permeability, and modern research produces a range of salt-resistant crop varieties. Fundamental problems of drainage and leaching away salt with fresh water cannot however be avoided, especially in heavy soils.

Though the problem of water supply is being attacked from many sides, no single approach offers a clear, comprehensive answer, and it becomes imperative to see what the further horizons of science and technology may offer to the peoples of the Earth's arid zone. Certainly this must also mean some appraisal of modern technology itself in a context which will allow the suitability of particular techniques for the region to be more objectively assessed.

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CSO: 4400/240