Chapter 12

The Handpump Cometh

The drought in north-eastern India led Unicef into an area which gained tremendous importance as the 1970s progressed: supplies of clean, fresh, drinkable water for villages all over the developing world. In the early summer of 1967, Unicef airlifted nine high-powered Halco drilling rigs from England to India. Within two months they had pounded swiftly through soil and rock, bringing water to 222 villages in Bihar and Uttar Pradesh whose thirsty inhabitants had been faced with imminent evacuation to relief camps. Church of Scotland missionaries, led by John McLeod of Jalna, Maharashtra, had introduced modern hard-rock drilling techniques to India. But this was the first attempt to do so on a large scale, and it was a great success.

The despatch of the high-speed rigs was precipitated by the drought crisis, but at the same time many thousands of villages in hard-rock areas all over central and southern India, as well as in other parts of the world, were faced with an emergency of a more creeping kind. Population pressure, coupled in some places with environmental change, was lowering the water table. Where shallow digging through surface soil used to yield an adequate well, the ground water had now vanished into fissures and porous layers buried in inaccessible recesses of the rock. The 'folk' method of reaching it was to split the rock with fire and water, and dig painstakingly downwards for months at a time. Old-fashioned cable tool rigs took almost as long. But modern technology offered a revolutionary solution. The new rigs' air-driven percussion hammers could penetrate the rock swiftly and smoothly, bringing water to the surface in days—sometimes hours—instead of weeks.

Inspired by the success of the drilling experiment in Bihar, Unicef offered the Indian government support for a rural water supply programme in other hard-rock, drought-prone areas. Martin Beyer, a Swedish geologist working for a drilling company in Stockholm, was invited to travel to India in 1969 and assess the programme's viability. No drinking water drilling programme of these dimensions or in those conditions had ever been undertaken anywhere in the developing world before. His team reported favourably, and the programme began to take shape. Unicef ordered 125 of the new percussion rigs, from Halco of England and Atlas Copco of

Sweden, and began shipping them to India; a further 125 were ordered by the State governments, to be manufactured by Indian subsidiaries. In good conditions, each of the rigs could drill a tube-well over 150 feet deep in one day only. The well was capped with a concrete platform and a cast-iron handpump. Over the programme's four-year period, the plan was to supply 12,000 villages with clean drinking water. The cost of the rigs and other components to Unicef was $5·9 million, an extremely large—and exciting —investment by the standards of the time.

The Indian village water supply scheme was the first of its kind, but others soon followed. They too were spurred into place by disasters which opened the way to a longer-term response. On the night of 12 November 1970, a cyclone of unprecedented intensity in the Bay of Bengal struck the coast and off-shore islands in the low-lying delta region of what was then East Pakistan. In the worst natural catastrophe of the century, half a million people were drowned, crops on a million acres were totally destroyed, and most of the homes, fishing boats, and livestock in the flood path swept away by a tidal wave. More than 4·5 million people were affected, and a huge relief operation had to be mounted. At the moment of the disaster, a group of staff from the Unicef office in Dacca was visiting a deep-well installation on an island lying directly in the path of the storm. They took refuge and survived. Their rescue by coastal launch took them through the devastated area to Chittagong, which made possible an early assessment of the damage. As well as requirements for food and shelter, piping and parts were needed for fresh water tube-wells completely swamped by the flood waters.

In 1968, the Government of Pakistan had declared a target of providing one tube-well for each 200 people in the region, and Unicef had offered assistance in reaching this ambitious goal. At the time of the cyclone, some supplies and equipment had just been off-loaded in Chittagong. In the wake of the disaster, teams of public health engineers managed to use the equipment to repair and re-commission over 11,000 wells within a matter of months. The provision of fresh water therefore became by natural progression the major emphasis of Unicef's proposed contribution to the eighteen-month reconstruction programme drawn up by the East Pakistan authorities. Labouisse wrote urgently around to Board members asking permission to go ahead with support, and set about raising $2·2 million in special contributions. This was the first time in Unicef's history in which its major external collaborator was the World Bank.

Before more than a few months, had passed, civil conflict erupted within East Pakistan. A mass exodus of refugees began. By June 1971, five million people had fled across the border into the Indian States of West Bengal, Tripura and Assam. Eventually, ten million people left their villages in search of sanctuary in India. The task of providing shelter, food and medical care for all these refugees, particularly during the months of the

summer monsoon, presented the Indian authorities with problems of almost inconceivable magnitude. Extraordinarily, they managed, but with deepening misgivings about the prospects of repatriating or resettling this huge population influx. Meanwhile, within East Pakistan itself, effective administration broke down and the post-cyclone reconstruction programme was disrupted. Public health deteriorated, famine threatened, and cholera spread. While warfare continued, relief efforts within the breakaway State were reduced to a minimal level. On the Indian side of the borders, with the highest concentration in refugee camps around Calcutta, the programme of emergency relief continued, with the help of scores of local and international voluntary and UN organizations. Within the UN system, relief for the Bengal refugees was co-ordinated by the High Commissionor for Refugees (UNHCR). For many months during 1971, the crisis absorbed much of the energy of Unicef's staff in Calcutta and New Delhi, now under the directorship of Gordon Carter, a long-time career officer.

Unicef, with its experience in supply procurement and shipment, became UNHCR's quartermaster-general for shelter materials, high-protein foods, vehicles, sanitation supplies, drilling rigs and cooking utensils, spending altogether $33·7 million. Planes were lent by the US and Canadian Governments and, at the height of the rescue effort, at least one was in the skies with forty-two tons of Unicef cargo between the Western hemisphere and Dum Dum Airport in Calcutta in every twenty-four hours. In November 1971, another cyclone in the Bay of Bengal inflicted terrible damage on coastal territory, this time in the Indian State of Orissa. Emergencies in the hard-pressed subcontinent followed on the heels of one another with terrifying rapidity.

On 3 December, India intervened militarily in the civil war in East Pakistan on the side of the secessionists. The Pakistani forces surrendered to the Indian army on 16 December, and the exultant eastern Bengalis declared their independence in the new State of Bangladesh. But there was a bleak underside to their triumph. The world's newest country was also its poorest. 'Golden Bengal', the rich and fruitful land celebrated in the poetry of Tagore, had become a destitute land overburdened with people and poverty in which the inspiration of the freedom movement had now to be harnessed to the task of economic and social transformation. The ten million refugees—minus those of their families who had perished in the cruelties of flight or the squalor of the camps—streamed back across the borders and returned to their villages. For the next two years, the inexperienced Government of Bangladesh grappled with the immense problems of reconstruction with the help of a special UN relief office. UNROB—the United Nations Relief Office for Bangladesh—was set up in Dacca by Sir Robert Jackson, the UN's most experienced relief official, at the request of the new Prime Minister, Mujibur Rahman. Jackson, one of whose strengths was his understanding of what it took to make the various

UN organizations co-ordinate their efforts, headed an operation which administered around $1300 million in international assistance before removing itself at the end of 1973. During this extended emergency period, Unicef's representative in Bangladesh was Glan Davies; he was backed up by Robert Walker, a redoubtable character who alone among UN international staff had managed to hold on in Dacca and keep some kind of operation going throughout the civil strife. Altogether Unicef contributed $30·2 million to the joint UN programme, more than $10 million was for clean drinking water, to sink or repair 160,000 shallow tube-wells, and drill 1200 deeper ones in coastal areas where ground water near the surface was too saline to drink.

Unlike the situation in India and in many parts of the world where the amount of water available was the critical problem, Bangladesh suffered neither from aridity, drought, hard rock, nor water scarcity. On the contrary, the new country sat astride the confluence of two of the mightiest rivers in the world: the Ganges and the Brahmaputra. Their thousands of tributaries and secondary streams disgorged the melted snows of the Himalayas into a vast alluvial plain, presenting a spectacle of water in almost too great an abundance. The crowded habitation of the fertile, water-washed plains, the deep-rooted poverty and lack of hygiene, the seasonal floods which washed dirt and germs and humankind's unhealthy detritus across the landscape meant that almost all the water drunk by Bengali fisherfolk and farming families was contaminated with bacteria. People invariably took their drinking water from the open streams where animals wallowed and waste floated, and the caseload of diarrhoeas, dysentery, and the seasonal epidemics of cholera presented a public-health problem of nightmare proportions. During the postwar period, Unicef—alongside WHO—helped reconstruct and equip a skeleton network of health services and financed the production of intravenous fluids for cholera treatment. But over the longer term, the underlying causes of diarrhoeal disease had to be tackled by cheap and effective prevention. People must be discouraged from consuming bacteria-laden water by the provision of safer sources.

In 1974, disaster once again inundated the countryside of Bangladesh. The annual flood brought by the monsoon rose remorselessly, inch by watery inch, to an unprecedented level. In August and September, the rice crops on one third of the arable land were lost, grain stocks and homes were irreparably damaged, and millions of people were thrown once again onto the mercy of relief rations and temporary shelters. Meanwhile, worldwide inflation was causing steep rises in the cost of food and essential imports. The Unicef-assisted drinking water programme was subject to the hiatus affecting all development in a country whose name by now was internationally synonymous with distress. Delays and price increases necessitated re-scheduling of well-drilling targets, and Labouisse redoubled

appeals to donor countries and Unicef Committees for special contributions. At the end of 1974, another $10 million was committed for materials and transport to sink thousands more wells in Bangladesh. The emergency years in the land of a thousand rivers had plunged Unicef up to its organizational neck in water.

Elsewhere in the world, the dynamics of other disasters were similarly deepening Unicef's involvement in an active, operational role in the provision of water for thirsty villages. In August 1973 Martin Beyer—now on Unicef's staff—was despatched to West Africa to look at another water shortage problem. Deepening drought was afflicting the mostly nomadic populations of the semi-desert Sahel region south of the Sahara. As a result of his visit, Unicef joined the UN Development Programme in providing vehicles and drilling rigs for a deep-well drinking water supply programme for Mali, Niger, Senegal and Upper Volta. This too was a part of the world where the underground water table could only be reached through hard layers of rock.

On the other side of the continent, Ethiopia had also fallen victim to the same trans-African belt of successive failure of the rains. In 1973 prolonged drought led to a disastrous famine in the central northern provinces. Tragic loss of life went unnoticed or ignored for months, and the international notoriety caused by the shocking revelation of the famine—a revelation engineered largely by the dogged persistence of Stephen Green, a Unicef programme officer based in Addis Ababa—led to a huge international rescue operation and profound political upheaval. Here again, once the immediate emergency had been met with child feeding, medical assistance and water supplies for relief camps, the post-emergency phase saw Unicef helping to drill boreholes, train engineers, set up maintenance workshops, and import rigs and piping.

The emergencies of the early 1970s definitively launched Unicef into the water supply business. When Martin Beyer returned from West Africa in 1973, he was invited to become a roving advisor on water programmes all over the world. Although the disasters had acted as a trigger, other forces had also been at work in plunging Unicef into this field, now rapidly consuming a larger amount of financial resources. The drama of the drilling rig and the magic of the water coursing from the tube-well were new weapons in the Unicef armoury; but they did not by any means constitute the opening salvo in the organization's attention to water and sanitation, merely the most spectacular to date.

In the heyday of the disease control campaigns in the 1950s and early 1960s, when Unicef was still functioning very much as the junior partner of WHO in the health field, it had become evident that two very important groups of diseases whose major victims were infants and children were not

being tackled by the onslaughts on tuberculosis, yaws, malaria and leprosy. These were gastro-enteric infections, or diarrhoeas; and parasitical infections, or intestinal worms. A bout of diarrhoea in a small child—as long as it was not cholera or typhoid—did not appear to pose the same threat to life and health as malaria or tuberculosis. Appearances deceived: statistics from underdeveloped countries which had such statistics showed that gastro-enteric infections, which were especially lethal in association with poor nutrition, were so numerous that they often accounted for more than half the deaths of children under one year. Taken together, the disease rate from all causes associated with bad water and poor sanitation was much higher. Apart from gastro-enteric infections, trachoma and skin diseases such as scabies and yaws were easily spread by lack of personal hygiene in places where water for washing was in short supply. Other diseases were caused by parasites which lived in water, and were either imbibed—such as the guinea worm; or entered the skin through cuts or abrasions—such as bilharzia or schistosomiasis, carried by water snails. Another group of water-related diseases was spread by flying vectors whose habitat was a swamp or a river: malaria carried by mosquitoes, and river-blindness carried by flies.

The great gains over the previous century in public health in the industrialized countries had proved that only the massive provision of uncontaminated drinking water and proper disposal of human excreta, accompanied by public understanding of the virtues of cleanliness, could decimate the disease and death rate from water-related causes. Campaigns against specific diseases formed a highly visible and important part of public health; but taken over the longer term, essentially a smaller part than water and sanitation. The subject first came before the WHO/Unicef Joint Committee on Health Policy in 1952, and the following year the Committee made recommendations about how far Unicef should enter the field of water supply and environmental hygiene.

The enormity of the task to be done in cleaning up the rural Third World was even more daunting than that of tuberculin testing all its children or eradicating malaria. Given the limitations of Unicef's resources, it was not thought possible for the organization to do more than dabble its toe in the pool. In the early 1950s, certain actions were taken within carefully defined parameters: water supplies and sanitation in health-care facilities and schools, where the absence of clean water and latrines radically curtailed their contribution to child health and welfare. Some of the earliest programmes were in Central America; the first project to receive pumps, pipes, and some stipends for the training of sanitarians was in Panama in 1954. Within five years, Unicef assistance—in the usual forms of supplies and training stipends—and WHO technical approval had been given to thirty-three projects, eighteen of which were in Latin America and the rest in Africa, the Middle East, Europe, South-East Asia, and the Pacific.

In 1959, the World Health Assembly adopted a policy of greater emphasis on community water and sanitation facilities as a key to health, and WHO began to put pressure on Unicef to do more. The 1960 Executive Board addressed the question, and immersed the Unicef foot a little more deeply. Not only health centres, but also water supply schemes serving a community could in future receive support. The context must continue to be a health programme, but a building at which medical care was dispensed as the site of the supply was no longer an absolute criterion. Nevertheless, Unicef was still tentative about expanding its aid to water and sanitation. Their importance was self-evident, but it was hard to see how to make substantial progress without involving Unicef in huge expense; perceptions about water and sanitation schemes were still highly coloured by the notion of large public works. Into such schemes, Unicef resources could easily vanish like the drop in the proverbial bucket. This, all were agreed, was to be avoided. Therefore, any project to be assisted must belong to the familiar conceptual category of 'demonstration' and 'catalysis': the input would help establish a model for a much larger programme funded from the national budget or better-endowed bilateral or multilateral sources.

In some countries, the strategy worked. In Peru, a WHO/Unicef supported demonstration project in one small area led directly to government adoption of a national scheme to bring piped water by gravity into every village, financed by the government with the help of external loans. A similar outcome blessed a similar project in Taiwan. In Kenya, a modest programme with documented health and economic benefits among village children was taken up with great local enthusiasm, and looked set to move in the same direction. But not everywhere were results so impressive. A thorough survey undertaken at the request of the 1965 Executive Board included on-site evaluations in eight of the eighty countries with whose water authorities Unicef was by this time co-operating. In West Pakistan, an over-ambitious programme to provide water to a thousand rural communities had over-stretched the resources of an inexperienced public health engineering department, and much of the equipment brought in by Unicef was lying around unused. This was particularly embarrassing because this was the largest water programme Unicef had ever supported; it had been launched with great fanfare following the 1964 Bangkok Conference on the Needs of Children in Asia and, by 1969, it had consumed thirty per cent of the $16·7 million Unicef had spent on water and sanitation over the ten-year period.

Some adjustments were needed in the criteria for assistance in the public-health field. In certain countries, it was unrealistic to expect that a demonstration project on a small scale could blossom into a national village water grid. Some governments simply did not have the necessary resources, nor did they attach a high priority to rural water works and excreta disposal. Even if they were committed, there were simply not enough sanitary engineers and inspectors, and cadres took time to train.

Too many assumptions had been made about dovetailing sanitation and medical services. While both were critical to improved health, they required very different kinds of personnel who were often employed by different authorities. The paths of doctors and nurses running hospitals and health centres might never cross those of the engineers and surveyors constructing and supervising water systems and latrines. At a lower level in the public-health hierarchy, who did the sanitarian report to? Was he a technician or a health person, or was he both? Co-ordinating water with health at a conceptual level was easy; at a practical level there were all sorts of problems. And without such co-ordination, the health education which was vitally needed to persuade villagers to use a new water supply hygienically and dispose carefully of waste had a tendency to fall into the gap between the doctors' efforts to cure the sick and the engineers' efforts to build the means of sickness prevention. This dichotomy between water as engineering achievement and water as bringer of health haunted water supply and sanitation schemes then, and has continued to do so down the years.

Meanwhile, the customers for pipes and pumps, the villagers of the developing countries, were usually keen—sometimes desperate—for water. Water is life, more immediately essential to human survival even than food. The water schemes of the 1960s gave great currency to the terms 'self-help' and 'community participation', originally coined by the community development enthusiasts and becoming key tenets of development thinking. To cut down costs, free unskilled labour for digging wells or trenches for water pipelines and carting stones for catchment dams were designated as the villagers' contribution to 'their' schemes. Usually, enthusiasm for water was such that they willingly co-operated. In a parched land where the only stream is miles away across a burning plain or down the sides of a steep mountain gorge, and where every precious drop must be carried on a woman's head or, at best, a donkey's back, the benefits of a well or a standpipe in the village were keenly appreciated.

Such receptiveness on the part of most beneficiaries—a receptiveness the more welcomed because the meeting of minds between would-be helpers and would-be helped in the circumstances of many development projects was relatively rare—engendered high morale among government officials and those helping to drill, pump and gravity-feed. Unfortunately, the well-deserved sense of achievement sometimes obscured the fact that the villagers' appreciation usually had little or nothing to do with whether the children had diarrhoea or intestinal parasites. To the customers of the new supply, water was a convenience, not a health aid. In some places, people only used the new well in the dry season; when the open water course nearby their houses was still freely flowing, they continued to draw their water from there just as they had always done, however many cattle wallowed in it or other sources of pollution floated down from upstream. Some people objected to the tastelessness of clean water or found its

strange temperature upsetting—even, in their opinion, unhealthy; they might only use the new source for bathing and other non-drinking purposes unless the hazards of the old source were satisfactorily explained to them. And if the villagers in many water-short communities had a tenuous sense of the connection between dirty water and health, still less convinced were they of the value of confining ordure to a special place within the family compound. Excreta is not a popular subject in any culture. The harbingers of public health began to discover that there were few places in the world where people could be easily persuaded to attach social caché to a latrine. They had a point: its aerobic ambiance tends to compare unfavourably with that of the open field, the sea shore, or the ditch.

The mixed results of the assistance offered by WHO/Unicef to water and sanitation schemes came under scrutiny in 1969. The persistently unhygienic behaviour of the Third World's farming people was noted in a call for more training for sanitarians and more emphasis on health education. There was still some hesitation about how far Unicef's resources should be invested in this branch of public health, but by now the die was cast. The Indian hard-rock drilling programme was under discussion, and other circumstances were gradually propelling Unicef towards deeper immersion. Many countries and bilateral and multilateral donors were waking up to the heavy economic toll poor water supplies were exacting from the agricultural labour force in terms of sickness and low farming output. Health authorities were also lamenting the severe drain on their thinly-stretched budgets represented by the need to cure preventable water-related disease. It was also becoming clear that some alternatives to the large-scale public works approach to mass problems of water and sanitation shortage were in urgent need of development, in order to fill the technological gap between faucets and water closets laid on to every household, and nothing but the stream and the bush. Some pioneer work in small-scale rural drinking water and irrigation works had been undertaken by various voluntary organizations. But they did not have the resources for anything other than the micro-scale enterprise: a few wells here, a series of small catchment dams there. Missionaries with a mechanical bent were turning old automobile engines into prototype irrigation pumps for school vegetable gardens. But such efforts were truly localized. A lacuna in international co-operation with an important bearing on maternal and child health had become visible, and Unicef—with its practical bent—was ready to do something about it.

The changing climate of opinion was connected in part to the awareness awakening worldwide about the fragile relationship between Mankind and his environment. The word 'environment', like 'development' before it, was beginning to take on an expanded conceptual significance. Not only population pressure, but urban growth, industrial pollution, the depletion of fossil fuels, the disruption of ecosystems by the use of pesticides and

artificial fertilizers: all were beginning to cause a worldwide panic. Some of the pioneers who brought the world's attention to its planetary constraints, notably the British economist Barbara Ward, regarded 'environment' and 'development' as two sides of the same coin. Rain water, sea water, river water; water for energy and for agriculture as well as for health and domestic comfort; water in all its life-giving power was an obviously overlapping concern. Since time immemorial, Mankind had disposed of his wastes into the streams from which he also drew his drinking water. The cycle of biological reaction between fish, plants, oxygen and bacteria meant that moving bodies of water had remarkable natural self-cleansing powers. But, as was so clearly demonstrated in Bangladesh, population growth had begun to overstretch those powers. Drinking water supplies which might once have been 'safe', at least for a population which used them regularly and had developed some immunity to their particular hazards, were now becoming heavily polluted. This phenomenon began to concern not only the health specialists, but a new breed—the environmentalists—anxious to prove their credentials for improving life on earth. The human reservoir of knowledge about natural resources—their value, their preservation, and their utilization—began to increase sharply.

The drought- and flood-related crises of the early 1970s certainly helped to trigger the upsurge in demand for Unicef's involvement in water supplies and sanitation; but these other forces were also at work. In Afghanistan, Malawi, Bolivia, Burma, Tanzania, Sudan, Guatemala, Mexico, Nepal, Sri Lanka, Mongolia; in mountainous areas and in plains; in scrubland and in semi-desert; in sprawling slums and shanty towns: clean water was a problem independent of whether drought or epidemic might suddenly dramatize its deficiencies in quality or quantity. By 1973, references to the need for clean water and better sanitation were surfacing more forcefully within Unicef. They stemmed in part from the striking affirmation of water's key role in rural development emerging from the Lomé Conference, held in Togo under Unicef auspices in May 1972 with the aim of strengthening the capacities of West African governments to 'plan for the needs of children'.

The statements of national priority presented at Lomé by the planning ministers of eight francophone countries—who had tried hard to remove themselves from international orthodoxies—placed water supplies at the top of their lists. Interestingly, the village tap they all thought was critical to the needs of children rated attention less because of its relationship to health than because it was a determining factor in the whole environment affecting women's and children's conditions of life, economic situation and nutritional status. Millions of women throughout Africa spent hours of back-breaking labour every day hauling water in pots, jars and enamel basins from distant streams and open wells. Water's scarcity and the labour involved in fetching it meant that far too little was used for washing

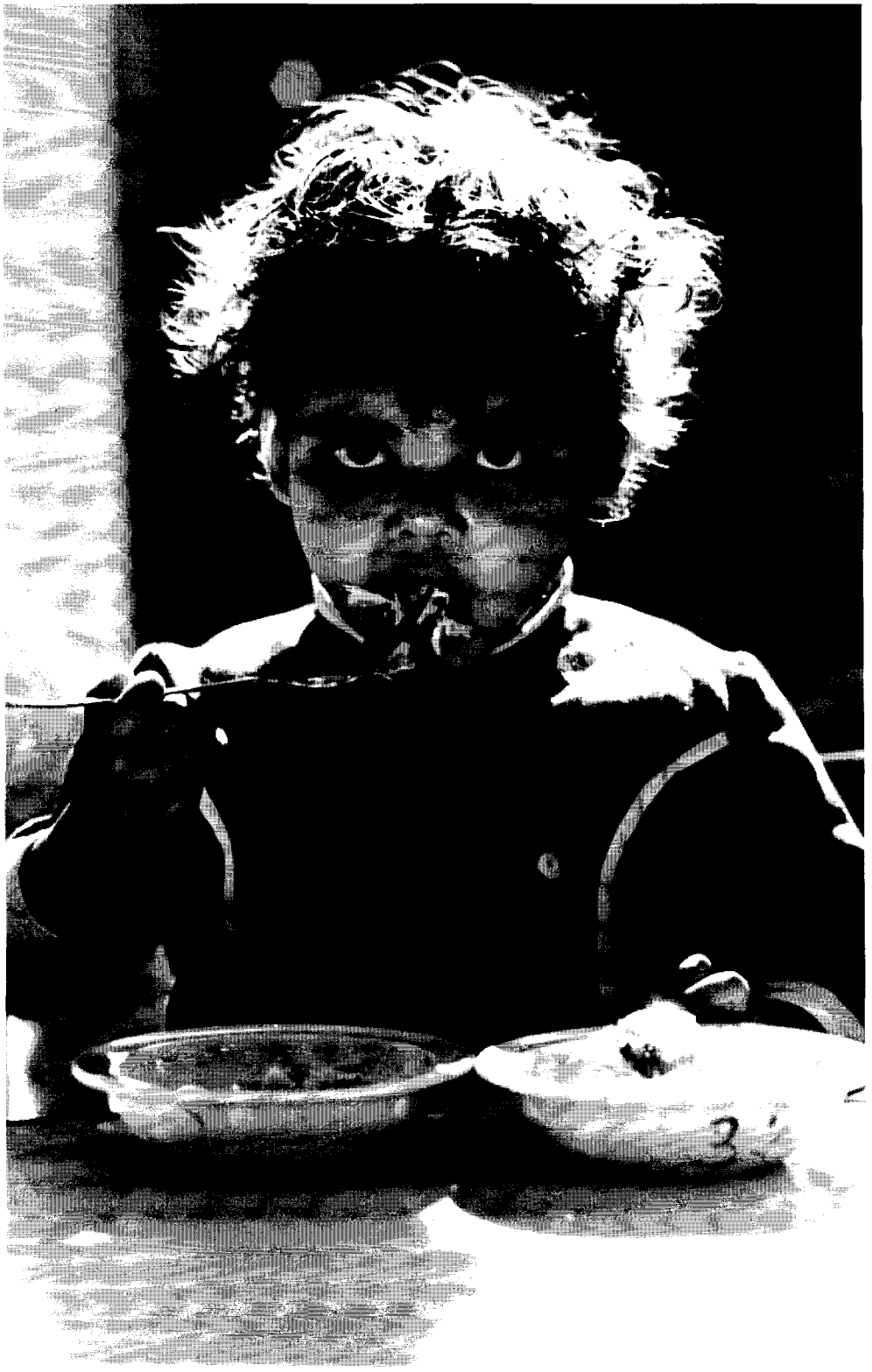
A mother and her seriously sick child at the Rawda Health Centre in the Yemen Arab Republic. They had to travel from a village 100 miles away to find medical help.
(*Unicef/Massey*)

A centre for family welfare and mothercraft opened in Zaria, Nigeria, in 1962 with the co-operation of WHO, FAO, the UN Bureau of Social Affairs and Unicef.
(*Unicef/Bernheim*)

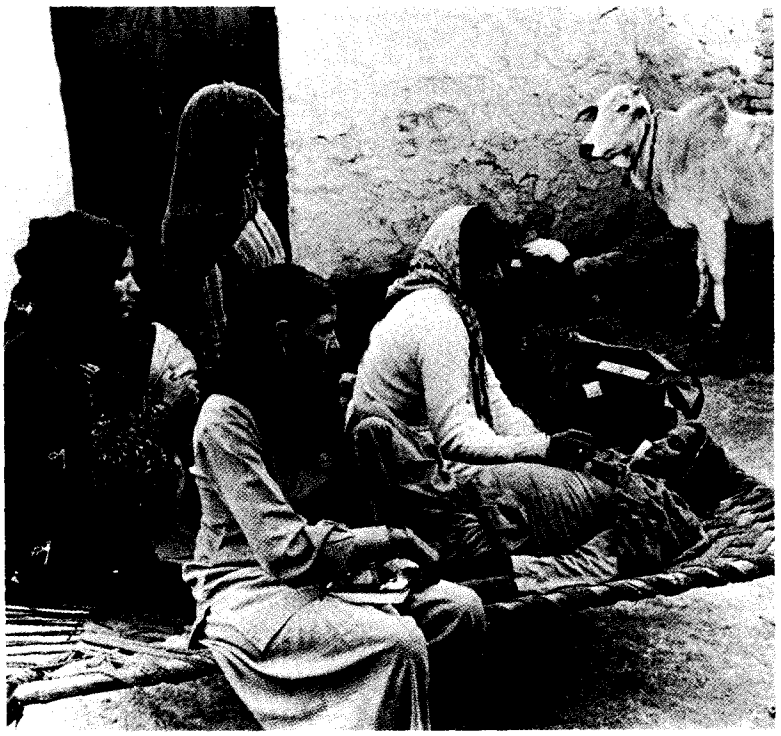
At a mother-and-child health care clinic in Zinder, Niger, classes are given in nutrition and cooking. (*Unicef/Watson*)

Opposite:
In 1966, Unicef helped Algeria produce a nutritious food mix from processed grain. Here, a little girl eats her lunch of Superamine. (*Unicef/Wolff*)

Dhandlan, India, 1981: a day-care centre worker administers a dose of orange-flavoured vitamin A to a three-year-old boy at his own home while his grandmother looks on. (*Unicef/Nagarajan*)



Selected by his own community, one of India's community health volunteers gives first aid and simple medicines, and looks for early signs of TB, leprosy and other diseases. (*Unicef/Nagarajan*)



An auxiliary nurse/midwife examines a pregnant woman in Dhandlan, India. (*Unicef/Nagarajan*)

children and keeping domestic utensils and environment clean. Bound to a daily cycle of incessant drudgery, women had too little time and energy to spend on such matters. Nor on other domestic tasks, including cultivation of the family's food which, more often than not, was their exclusive responsibility. Without water in the village, the Lomé Conference suggested, not only was the drinking supply stagnant, but the entire rural economy.

This, within Unicef, was a new perspective to add to the health imperative for water supplies. It made another dent in the earlier resistance to large-scale support. In 1974, soon after Martin Beyer had set up his advisory service in Unicef headquarters and begun to travel ever further afield, Unicef expenditures on water supply and sanitation reached nearly $12 million for the year. Water was becoming more popular, both with aid donors willing to give special contributions, and with recipients. As the requests piled up, a new breed of technicians were joining Unicef's staff: hydrogeologists and master drillers. The survey requirements for hard-rock drilling and the operation of the new high-speed rigs required special technical and operational skills. As yet, such skills were mostly available only in countries with advanced technology. A new chapter in Unicef programming had opened, and its heroes were the rugged personalities prepared to work in remote and sometimes dangerous conditions in waterless corners of the globe.

Early in 1974, Hakan Landelius, the head of Radda Barnen, the Swedish Save the Children Fund, visited his compatriot Martin Beyer in New York. He had been travelling in India visiting projects assisted by Unicef with which Radda Barnen had a close association, and had observed that in most villages where the hard-rock drilling programme had provided new wells, the handpumps which brought the water to the surface had broken down. Gordon Carter and his Unicef team in New Delhi were trying to address this problem; meanwhile Unicef was on the point of committing a further $9 million for the rural water supply programme in India and Beyer was justifiably anxious. A spot survey carried out in the States of Tamil Nadu and Maharashtra had shown that, for all its high technology and its cost, the Indian rural drinking water programme had managed to provide three-quarters of the villages with nothing better than a hole in the ground and an inoperative pump on top of it.

The teams of drillers with their high-powered equipment had gone to the villages, performed their marvels, and disappeared. No-one had realized that the pumps they were installing were too fragile for sustained use by a whole community. The number of breakdowns had overwhelmed the resources of sewing-machine and bicycle-repair shops and others entrusted by state authorities with the job of pump maintenance. In many areas, it was not clear to villagers what steps they could effectively take to bring a

handpump breakdown to the attention of those who might repair it. They waited for the miracle men who had put the pump there in the first place to reappear, and resorted to the waterholes they had been obliged to rely on in the past.

The cast-iron pumps used in the drinking water programme were poor quality copies of old-style European and American handpumps designed for use by a single family, long since out of use in the land of their birth and therefore unimproved for at least a generation. Their unsuitability for use by an entire village had already been registered by a handful of Indian officials and mission workers involved in small-scale water programmes. At Jalna in Maharashtra, Church of Scotland missionaries cum water engineers had already invented a tougher handpump made of steel. A mission at Sholapur improved upon the Jalna design and began to manufacture it to uniform professional standards. Other nearby projects began to copy these designs, and by 1974 several thousand durable pumps had been installed over tube-wells in Maharashtra. When Unicef water staff realized that continued well-drilling could not be justified unless something was done to improve handpump quality, they turned to the Sholapur pump. Two Unicef water engineers, Rupert Talbot and Ken McLeod, sought authorization to buy up several thousand Sholapur pump sections to allow State governments to replace the broken down cast-iron variety. This initiative—whose costs were met by Radda Barnen—convinced the Indian authorities of the need for a sturdier handpump for use in village water supply schemes. The handpump then developed by Unicef, in association with the government-run company of Richardson & Cruddas in Madras, was a refinement of the earlier Jalna and Sholapur pumps and was named by Unicef the India Mark II.

The India Mark II handpump is an unqualified success story, and a story in which Unicef is justifiably proud to have played a significant role. The main development phase took place between 1975 and 1977. The aim was to design a pump that would operate for a full year without breakdown; that could be manufactured entirely from components available in India; would cost less than $200; be easy to operate; maintainable in working condition by people with a minimum of engineering knowledge. It was important that the pumphead should be solidly encased so that nothing unhygienic could fall down the hole and pollute the water source; also that children playing with the pump could not easily damage the handle or block up the spout. Cast iron was abandoned in favour of mild steel. The fulcrum of the pump was a sealed ball bearing without need of oiling or greasing, and the pump rods were linked to the handle with a flexible chain. These critical design features were and are the crux of the India Mark II; over the years minor modifications have been incorporated to minimize maintenance.

Great effort was made to ensure that the India Mark II maintained its

quality and did not lose its reputation to poor quality imitations entering the market at a lower price. At the same time it was important to assure that there were competitive manufacturers in different parts of the country. In 1979 the Indian Standards Institute brought out a very detailed standard with specifications for all components. Unicef, on its side, prepared a list of approved India Mark II handpump manufacturers. Any prospective supplier first had to give satisfaction that it was capable of manufacturing the pump; if this screening procedure was successfully accomplished, a trial order was placed, and the handpumps submitted for independent quality testing. Only after this process could the manufacturer be entered on the list of recognized suppliers. By 1984, thirty-six suppliers had qualified, of which there was one at least in every Indian State. Their combined production output in that year was 13,000 handpumps per month. By this stage, more than 600,000 had been installed in Indian villages, of which Unicef had procured 100,000 and State governments the rest. Handpump production was an established industry, and some suppliers had exported large quantities of India Mark II handpumps to countries in Africa and elsewhere in Asia for other village water programmes supported by Unicef.

Faulty handpump manufacture was not the only potential cause of breakdown. Correct installation, in which the engineering staffs of public health departments were trained, was also important. Unicef put together a manual with precise instructions: the three legs of the pump must be embedded in a concrete platform covering the tube-well so that dirty water could not trickle back into the source; a drain must lead away the water which inevitably collected around the pump base. An effective maintenance was also necessary: handpumps, whatever the excellence of their design, are bound to break down from time to time. What has since become known as the three-tier handpump maintenance system, and has been adopted widely throughout India, was pioneered in Tirunelveli and Thanjavur districts of Tamil Nadu State at the southern tip of the sub-continent. Tamil Nadu was the home of Richardson & Cruddas, and its Water Supply and Drainage Board pioneered the introduction of the India Mark II. The concept was championed by M. Francis, an energetic State government official who had a gift for mobilizing people and keeping them enthused.

The three-tier maintenance system was based on the idea of the designation of a bright young man in the village as the 'handpump caretaker'. He was to form the first link in the chain which would ensure that a handpump never broke down for more than a few days at a time. The caretaker must live near the pump, and ideally be a school-teacher, a shopkeeper, or someone with a little social standing. The first group of handpump caretakers from Tirunelveli were selected in 1976 in consultation with local village councils, and 100 or so candidates presented themselves at a two-day training camp. Out of this camp a pattern developed which

was used elsewhere to set up the caretaker network as close as possible to the time when handpumps were installed. The caretakers were volunteers; their only badge of recognition was a certificate and a log sheet with their name at the top. They were armed with two spanners and some grease, and taught how to open the pump-head, check the action of the chain, grease and tighten nuts and bolts. If the pump suffered a serious breakdown, the caretakers used one of their pre-stamped and addressed postcards to summon the block engineer, the next of the three maintenance 'tiers'. If the problem turned out to be beyond the competence of the block engineer, he would call in the third tier: the district mobile repair team.

For some years, the village caretakers in Tamil Nadu were a model of successful community mobilization. Francis was seconded to Unicef, and became the mainstay of the training programme and its follow-up. He sustained the enthusiasm of the village caretakers by writing a monthly newsletter, sending them greetings for Tamil festivals, and organizing competitions and radio appearances for the best. Although the model was adopted elsewhere, it never quite reached the same star quality. In a land where each of hundreds of thousands of rural communities had its own environment to contend with and its own mysterious codes and dynamics, it takes an individual with the charisma of Francis to make widespread mobilization of villages behind such a programme truly effective. But even its moderate success, coupled with the sturdiness of the India Mark II, has prevented large-scale pump breakdown. The teams who drill the holes and install the pumps upon them are no longer visitors from another planet who perform a conjuring trick and vanish. They are accessible, and with some pushing, the village can command a re-appearance when they need one. Because the caretaker is unpaid, and because the pumps rarely suffer serious breakdown, the maintenance system is cheap: around $32 a year per pump.

Apart from his maintenance duties, the village handpump caretaker is supposed to act as an informal public-health worker. During his training, he is taught the message at the heart of all rural drinking water programmes: that clean water is the key to health, and that everything must be done to make sure the handpump water stays pristine pure all the way from spout to mouth. He is supposed to make sure that the concrete platform under the handpump is swept and dry, and the drainage channel flows free. He is also supposed to admonish those women using dirty pots, or who still resort to the old open well because it is closer to their homes.

But a man with a spanner and a can of grease is a mini-mechanic, not a mini-nurse or doctor. The women in the village might heed a midwife who told them such things. But a young teacher or shopkeeper? What would he know about children's health? Male village caretakers tend to feel uncomfortable about interfering with the women's domain and are at best half-hearted in their public-health performance. In some States, including

Tamil Nadu and Maharashtra, women have also been selected as handpump caretakers to reinforce the health messages. But women are less keen on the mechanical role, and carry less clout when it comes to summoning the water authorities. In the end, the essential task is for the caretakers, male and female, to keep the handpump in working order and the water supply uncontaminated. Hopefully, time will prove to the villagers that handpump water is not only more convenient, but healthier.

Within water-supply and sanitation schemes, health education as a component was for a time somewhat overshadowed. The lustre of hard-rock drilling, the technical challenge of the cheap and durable village handpump, the feat of capping springs high on Himalayan mountainsides and in the southern and central African massifs: these were the consuming preoccupations of the engineers who dominated the rural water supply business during the 1970s. And rightly: without the hydrogeologists, the engineers and the master drillers there would be no new sources of drinking water in many parts of the world where the deadly partnership of drought and population increase was making the task of water collection more and more difficult. Some of the technicians recruited by Unicef during these years, who have spent their working lives in some of the wildest places on earth, were larger-than-life personalities—men whose dedication and whose spirit of adventure were redolent of the great tradition of humanitarian exploration in the nineteenth century. In post-revolutionary Ethiopia, a Yugoslav, Vlado Zakula, who had served the Emperor Haile Selassie's Government mining for gold, joined Unicef's staff to mine what to village people was as valuable: water. Moving heavy, sensitive equipment through difficult terrain from site to site presents problems requiring superhuman endurance and skill. Zakula's rig, and what it could mean in a relief camp or a village deep in areas where guerilla activity added to the hazards of his existence, became such an extension of his life that he camped alongside it wherever he felt its own life was in danger. Fausto Bertoni, an Italian, who joined Unicef's staff in Afghanistan and took similar hardships in his stride, became an almost legendary figure in villages from the Sudan to the Punjab. Men like Zakula and Bertoni trained scratch crews of local engineers to master modern drilling technology and form the backbone of their country's water engineering departments. They were the heroes of the rural water supply revolution.

When Unicef first became deeply involved in water and sanitation, the most important immediate task was seen by Martin Beyer and his growing cadre of water experts as the development of low-cost technological responses to the worldwide drinking water problem.

In the early 1970s, the latest buzz word in development circles was 'appropriate': 'appropriate technologies' for water supply and sanitation in

Third World villages meant something more modest and affordable than a national water grid with faucets in every home and flush toilets connected to a central sewage system. Public works on this scale remained, and still remain, absolutely beyond the reach of the budgetary capacities of the poorer developing nations, except in the cities, or in parts of the cities, where the risk of serious epidemic has to be taken into account. Other technological answers had to be found, some of which—like the highly sophisticated percussion-hammer drilling rigs—were the direct product of late twentieth century industrial invention; others—like the India Mark II handpump—were adaptations of devices which had been familiar in Europe and North America a generation or two ago.

Largely as a result of the popularity of E. F. Schumacher's proposition that 'Small is Beautiful', even technologies that had been around for a millennium or two now suddenly swept into vogue. Schumacher articulated to a mass audience the dawning realization that the large-scale industrial technology of the Western world, expensive both to build and maintain, was a hopeless misfit economically and otherwise in most parts of the rural Third World. The quest for new, more 'appropriate', technological responses to the problems of poverty and underdevelopment was graced by the moral overtones of its rejection of dehumanizing industrialization, itself a fashionable doctrine of the time. The fledgling village water and sanitation business became caught up with this new religion. Hydrological devices invented by the ancient Chinese for raising water from the depths of the earth; Cretan windmills with sails set for the prevailing breeze; solar stills which would use the sun's rays to convert salt water into fresh; all were grist to the new 'appropriate' mill. Some of the endeavours foisted on Third World villages under this banner belonged to the wilder shores of humanitarian boy scoutism. Others were more realistic.

Whatever its excesses of zeal, the new technological creed contained an essential truth. The place to start the search for appropriate responses to problems in the rural Third World was not necessarily among the pattern books of nineteenth-century mechanical devices in Europe and North America, nor among the texts of the ancients, but in the places where people had long since devised their own technological solutions: the villages themselves. Some of these solutions, as the development experts discovered to their surprise, turned out to be already remarkably 'appropriate'. Dick Phillips, a water programme officer in Unicef's Dacca office, contemplated the effectiveness of the local method of well drilling and, together with officials from the Directorate of Public Health Engineering, decided that with minor modifications, nothing could be more suitable for the Unicef-assisted well-drilling programme in Bangladesh. While in countries elsewhere, hard rock below ground was making drilling an ever more sophisticated adventure in which water must be as expensively mined as precious metal, the alluvial plains of Bangladesh consisted of layers of

sand and clay deposited over the centuries by the great rivers. The soil was like a huge soft sponge which soaked up rainfall during the seasonal monsoon; the water table was no more than a few feet beneath the surface, but was usually heavily polluted at that depth. Deeper down, at 100 feet or so, it had been filtered through layers of sand and cleaned and purified in the process.

To drill a well to such a depth through the rock-free soil required nothing more than human energy. With the help of a bamboo scaffold and a lever, three or four drillers could 'pump' a galvanized iron pipe to the necessary depth within a day. The method was called sludging. One member of the team used his hand as a valve over the mouth of the pipe, flushing out silt and sludge so as to allow the pipe to descend. When one length of pipe was fully inserted, another length was screwed to its end, until a depth of around 100 feet had been reached. It was then removed, length by length, and replaced by a durable PVC water pipe covered by a filter to prevent sand and soil particles from entering the bore-hole. A handpump was then bolted to the pipe and mounted on a concrete platform. Because the clean water rose quickly to the level of the water table, only a small handpump which lifted by suction was required. As in India, a prototype pump was modified and made more durable at Unicef's initiative; once a standardized design was approved, Unicef helped to import pig-iron, limestone and coke to enable the pumps to be manufactured in local foundries. Even when prices rose in the mid-1970s, the entire cost to Unicef of supplying the materials for a finished tube-well averaged only around $75, half the cost of the finished installation.

The Directorate of Public Health Engineering built up a staff of well-drilling teams to carry out installation and maintenance, and every village wanting a tube-well taxed its members a few cents each to off-set part of the installation costs. Gradually, demand from the villages grew to the point where the drilling teams could not keep up, even at a rate of 50,000 new tube-wells each year. By 1978, over 300,000 tube-wells had been sunk with Unicef assistance, an average of one handpump with clean water for each 250 inhabitants of Bangladesh's rural areas, an achievement very close to the goal of one tube-well per 200 people set by the Pakistani authorities in 1968. The country's drinking water problem had moved a considerable distance towards being solved, in spite of the disasters which had so disrupted the country during a decade of turmoil.

The Indian and Bangladeshi water-supply programmes were the largest in terms of Unicef's involvement, but there were many others in which Unicef played a role closer to the pump-priming initiative envisaged in 1969. An example of a different kind of appropriate technological response to rural water shortage was a scheme in southern Malawi, which capitalized on natural energy sources to keep costs to a minimum. Its design required the capture of waterfalls into a main reservoir high on the 9000-foot slopes

of Mount Mulanje, and the water's descent by gravity through a series of main and branch pipelines to 450 villages in the 100 square miles of the plains below. The Ministry of Community Development devised and carried out the plan, and Unicef provided all 148 miles of pipe.

The most impressive feature of this kind of scheme was the role played by the people of the villages in its construction. Here was 'self-help' in action on a spectacular scale. Each village turned out in force under the direction of its own committee to dig the miles of wide and narrow trench which would house the pipes bringing the water to their communal standpipe. This feat of intervillage organization and the provision of voluntary labour on such a scale for something other than famine relief works was a phenomenon common to many rural water-supply schemes. It reinforced the thesis which held that if villagers wanted something badly, if it was a 'felt need', they would turn out en masse to make it happen. On the lower slopes of Mount Mulanje, men dug trenches for miles over rocky and difficult terrain; women carted sand and stones for dam construction in baskets on their heads; elders organized community self-taxing schemes for water rates.

The day the water actually travelled the full twenty miles from the reservoir to the village at the furthest edge of the plain was a day of wonder and riotous celebration. The success of the scheme led to eleven other similar gravity-fed rural water systems in other highland areas of Malawi. Subsequently, an assessment of the country's surface water availability forced the authorities to the conclusion that a ground water drilling programme was also necessary. Drawing on the lessons of the Mulanje project, every effort was made to involve the villagers in the programme's execution. The site of each borehole was determined not only by the geological experts, but also by villagers, including the women, taking into account factors such as who owned the land and how steep would be the gradients up and down which water would be carried. Village committees were set up to oversee handpump maintenance and use.

While the popularity of water-supply schemes was being rapidly proven in countries all over the world, the same could not be said for sanitation. Everyone paid lip service to the necessity of providing for waste disposal as part and parcel of any scheme for water supply; in practice, no-one—neither public health nor engineering departments, village communities, nor donors from voluntary or intergovernmental organizations—showed a similar degree of enthusiasm for schemes to confine human excreta to places where the hazards it posed to health could be minimized. Even the Indian rural water-supply programme—such a success in many of its aspects—managed to achieve almost nothing in the context of sanitation. 'Excreta disposal has not been touched', it was reported in tones of frustration in 1974. Little could be expected to change without more health education; 'Just about impossible to obtain a collaboration between health educators and engineers',

the same rapporteur lamented. While water was a deeply 'felt need', a latrine decidedly was not. While communities willingly organized themselves to dig a hole in the earth for a pipeline, they evinced little or no enthusiasm to do the same for a latrine.

This particular 'appropriate' response to the task of human waste disposal has had the utmost difficulty in passing the ultimate test: acceptability. Even where health education has managed to establish in sceptical minds the connections between dirt, germs, flies and infection, habits concerning the human being's most basic bodily function are deeply ingrained and not easily abandoned. Since no-one even wants to discuss the subject, it is difficult to encourage people to change their ways. In Bolivia, where between 1968 and 1977 Unicef supported a very popular well-drilling programme, the public health department in Santa Cruz resorted to the device of refusing to sink a community well unless latrines had already been built in three-quarters of the village houses. Latrine slabs were provided at cost by Unicef, and reluctantly householders complied. But when public-health officials later toured the community, they found that the latrines were mainly being used as chicken coops and larders for the cool storage of beer, not for their intended purpose.

The Bolivian experience was not uncommon. In spite of technical modifications which have made latrines environmentally more pleasant, and have turned them into safe natural fertilizer production units, the problem of acceptability remains. One possible key is an improvement in the status of rural women: in some societies modesty and a densely-inhabited rural landscape make for women's great discomfort in daylight hours. In other places, the attention of a free source of fertilizer may persuade the menfolk—who invariably control public works of any kind—that latrines have distinct advantages. In some urban parts of the developing world, attitudes have already changed. They have been forced to: the numbers of those willing to accept a life-long career in nightsoil disposal at the very bottom of the social heap have declined sharply since the days when Mahatma Gandhi took up their cause. But in rural areas, particularly where households are spaced at a reasonable distance from one another, the latrine may take some years to command an enthusiastic following. Until the human race is able to abandon its inhibitions about the subject, as it has done for sex and reproduction, excreta disposal is likely to remain the joker in the health-care pack.

By the mid-1970s, water supplies and sanitation had begun to command ever greater attention on the world stage from those caught up in the twin concerns of 'environment' and 'development'. In 1972, a UN Conference on the Human Environment met in Stockholm; this, the first of many grand global events staged to address the problems which had so far defeated

Mankind's best intentions—population growth, hunger, human settlements, women's rights—owed a large part of its genesis to Barbara Ward and the allies she had managed to assemble behind her particular vision of what was going sadly wrong with the planet Earth. Out of it came a new offshoot within the UN system: the UN Environment Programme.

In an attempt to make a convincing connection between the ills of underdevelopment and those of shrinking planetary resources, the Stockholm Conference declared that the 'pollution of poverty' was the worst of all pollutions. The prophets of the post-industrial world tried to convince the developing countries that condemnation of Mankind's voracious consumption of non-renewable resources did not conflict with their own demand for a greater share of the consumption process. The drive to improve man's habitat and keep his global village clean encompassed international outrage at the statistics concerning access to a supply of clean water and proper waste disposal. In the developing world, less than half the people drew their domestic water supply from a source which would pass a laboratory test for cleanliness; three out of four had no better facilities for excreta disposal than a disgusting bucket or a walk in the fields. The squalor of the crowded slums in so many mushrooming cities of the developing world presented a frightening picture of the hazards of epidemic and ill-health. The effect of all this unsanitariness on the disease and death rate of children was almost incalculable.

In 1976, the situation was brought to the attention of another UN conference: Habitat, the Conference on Human Settlements meeting in Vancouver, passed a resolution declaring that clean water should be provided for all the world's people by 1990 at the latest. Yet a third UN conference in March 1977 took up the same theme, with even greater emphasis. The delegates met in the Argentinian city of Mar del Plata to examine all the statistics associated with the consumption of water by humankind in the fourth quarter of the twentieth century, and consider what to do about them. With more bravado than realism, they elaborated an action plan costing $144,000 million in 1977 US dollar value which would provide clean water and sanitation for everyone in the world, and declared that 1981 to 1990 would be the International Drinking Water and Sanitation Decade during which the goal should be reached. They envisaged that developing countries would themselves supply most of the necessary investment; but that large amounts running into the thousands of millions would have to come from external funding sources.

During the 1970s, when not only Unicef but also many other bilateral and multilateral donors began to commit much larger investment flows to dams and reservoirs and public works all over the developing world, the engineers and other technicians were seen as the arbiters of global cleanliness. The underlying assumption was that the existence of a plentiful and clean water supply would perform a similar miracle on the rates of

disease and death as had the public health installations of a century earlier during the industrialization of Europe and North America. Down the years, much rhetoric but too little practical attention had been paid to the need for health education alongside the water works. Now, on the threshold of a major push for 'drinking water and sanitation for all by the year 1990', doubts began to assail the underlying assumptions of previous years. Studies were published showing that a clean, protected water supply did not automatically confer health—in the narrow definition of the term—on village and slum inhabitants. Disease rates, particularly the gastro-enteric infections which so seriously affected children, had not plunged as far downwards as had been predicted. However 'appropriate' their technologies, however sophisticated their drilling rigs, however immaculate their design of gravity-fed water systems and handpumps, the technicians did not have all the answers. The health specialists began to re-assume ascendancy in water and sanitation.

Unicef had entered the world of water for one very specific reason: its impact on child health. The villagers and slum dwellers of the developing world had responded with enthusiasm to schemes to supply them with water, but for different reasons: they wanted rid of thirst, drudgery and inconvenience. No-one in the world wants to drink water that is dirty or foul-smelling, and most people instinctively appreciate the risks of ill-health that doing so carries. But germs and worms too tiny to be seen are not self-evidently harmful to those who do not know that they are there. If the water is clean, but the water pot dirty; if hands are not washed; if food is not covered; if human ordure is not confined; if compounds and streets are not swept: the water supply on its own will not do all it could to transform the health of children.

As the decade of the 1970s drew to a close, the critical question concerning water and sanitation had become how to ensure the maximum health advantages for children from the new water source. Whatever the water supply had not done, it had achieved a release of village women from back-breaking toil, an advantage sometimes underrated by those fixated purely on measuring declines in certain water-related disease rates. With more time and energy on their hands, women might well embark on other life- and health-improving activities around the home. This begged a wider question: what, actually, was 'health'? Was it merely the absence of debilitating disease and infirmity? Or was it, as the village women of the rural Third World might suggest, enough food for the children to eat, plentiful rainfall for a good harvest, and a shorter distance to walk to the well? On the plains below Mount Mulanje, as they celebrated the instalment of their new standpipe, the villagers might sing: 'Health is wealth'. The question of what good health truly consisted of, and how it might best be provided to far-flung communities all over the world, was itself undergoing a reappraisal.

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