The Indira Gandhi Canal: greening the desert in India

by Ramtanu Maitra

On the first day of the new year, Union Finance Minister Vishwanath Pratap Singh presided over the completion of the Indira Gandhi Main Canal, which will bring water from the northern Himalayan rivers deep into Thar desert, the Great Indian Desert, of Rajasthan. The canal is among the greatest civil engineering feats in the world, and will help green the vast strip of desertland located in western Rajasthan, bordering Pakistan. The main canal, earlier called the Rajasthan Canal and renamed in 1985 in honor of the slain Indian prime minister, is 649 kilometers (km) long.

The canal is the hope of Rajasthan—a much impoverished state. With a land mass of 342,000 square km and a population of about 3.9 million, Rajasthan is one of the least populated states in India, its great industrial potential long curbed by inhospitable weather and lack of water. Within the state, the population density is higher in the southern and eastern parts. The western part of the state, through which the canal water now flows, has a population density of only 5-10 persons per square km. The land is dotted with small villages interspersed by huge tracts of sand and sand dunes. On an average, this part of India receives about 6 inches (15.2 cm) of rain spread over 10-15 rainy days annually during the monsoon season. But under this harsh, barren landscape is a thick layer of extremely fertile soil—unturned and ready to bloom.

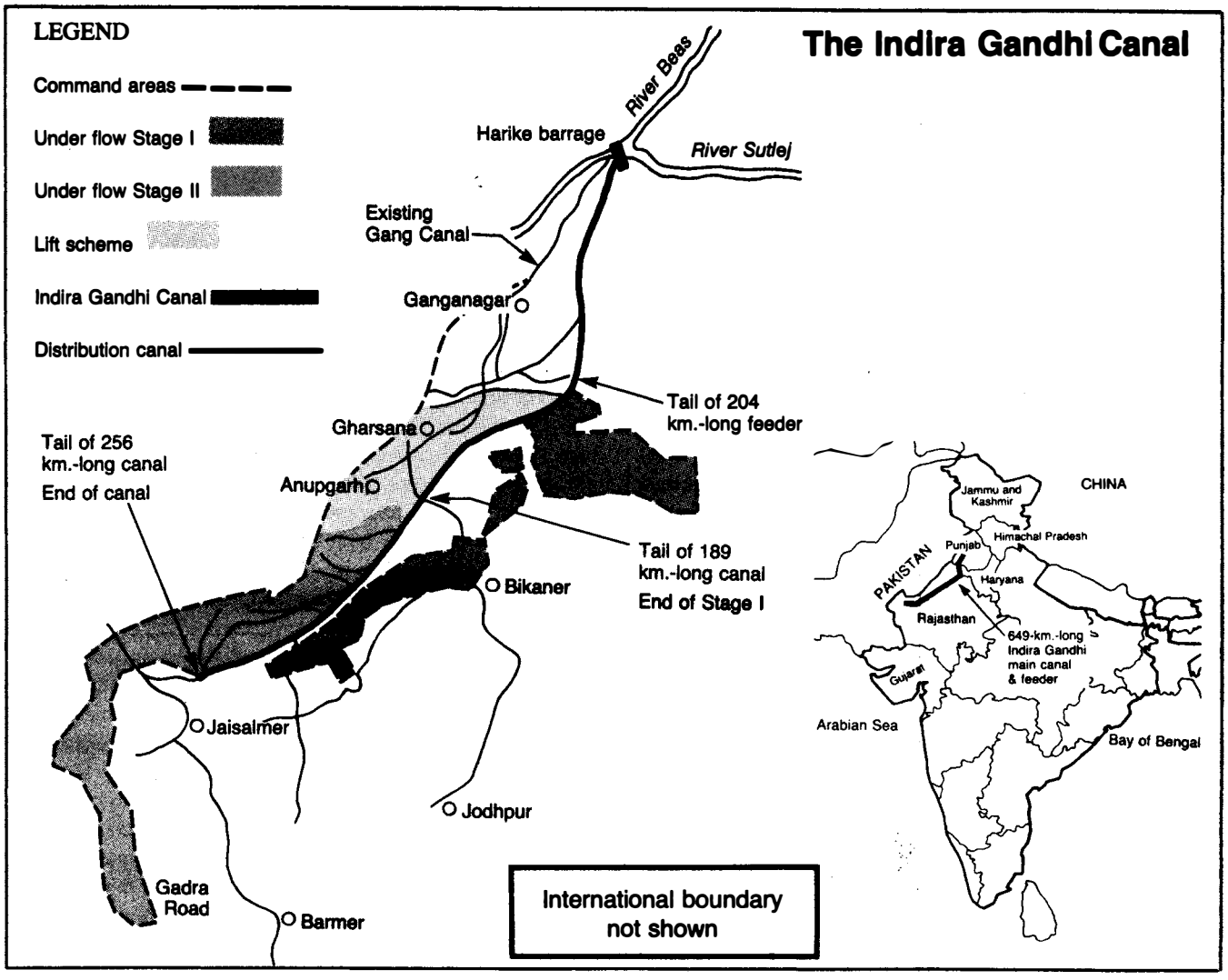
The total length of the canal system, from its headworks in Punjab to the tail end at Gadra Road, is 9,425 km—almost twice the combined length and breadth of India. If stored in the form of a pyramid with a 1,200-foot (364.7 m) square base, the earthwork done for the canal would be higher than Mount Everest (29,000 ft./8.82 km). Some 3.4 billion concrete tiles were used to line the canal—enough tiles to encircle the earth along the equator with a two-lane highway, with each lane 12 feet wide. The maximum number of people involved in canal construction at any time was 40,000, aided by hundreds of camels and donkeys. Working since 1958, the project authorities accumulated equipment worth more than $20 million in draglines, earth- and sand-diggers, levelers, cranes, and sand-removing machines. Additional annual food production, when the project is completed, alone will be about 5-6 million tons (5.5-6.6 million metric tons) valued at about $1 billion at the current market price. The area, when developed with proper infrastructure, will easily settle more than 2 million people.

The idea of bringing the waters from the Himalayan rivers flowing through Punjab and into Pakistan was conceived by an hydraulic engineer in the late 1940s, soon after India became independent following 200 years of British misrule. Engineer Kanwar Sain proposed that 2 million hectares of desertland in Bikaner and the northwest corner of Jaisalmer could be brought under irrigation from the stored waters of the Punjab rivers. Soon thereafter, a feasibility study was conducted by the Central Water Commission, a government body in charge of water survey and allocation. In its brief report, the Central Water Commission spelled out the necessity of building a canal through the western Rajasthan desert which will provide new habitation over 2 million hectares.

To convert the concept to reality, however, it was first necessary to settle the dispute between India and Pakistan over allocation of the Indus River system's waters. In 1957, India and Pakistan mutually settled the dispute by signing the Indus Water Treaty which gave India the right to use waters of three rivers—the Sutlej, Beas, and Ravi. As per an interstate agreement reached earlier in 1955 between the Indian states of Punjab and Rajasthan, the latter was allocated 8 million acre-feet of water. The proposed Rajasthan Canal envisaged use of 7.6 million acre-feet of water. In 1958, the canal work began.

At the beginning, the plan was to build the canal in two stages. Stage I was to comprise a 204-km feeder canal taking off from the headworks at the Harike barrage in Punjab, a 189-km-long feeder canal, and also construction of a distributory canal system of about 2,950 km in length. Stage II of the project was identified as construction of a 256-km-long main canal with a distributory canal network of about 3,600 km in total length. It was decided that the main canal was to be 140 feet (42.5 m) wide at the top, with a bed-width of 116 feet (35.3 m), and a water depth of 21 feet (6.4 m). The canal was scheduled to be completed by 1971.

From the start, the project ran into difficulties. Under the leadership of India's first prime minister, Jawaharlal Nehru, a grand plan to build basic infrastructures and heavy-engineering facilities had already been undertaken, albeit with extremely limited financial resources. The canal was not abandoned, but a shifting of resources destined for its construction slowed its progress. In the late 1960s, India was



plagued with food shortages, a war with Pakistan, and quick changes of leadership. Highly disillusioned planners were busy fighting the fires caused by a volatile political situation due to shortages of food products and rampant inflation. Debates broke out throughout India, instigated by the World Bank crowd, over the "mistakes" of Nehru's economic planning. Large projects were viewed as "white elephants" eating away the nation's resources and delivering nothing. Many projects got shelved; many more were slowed down to the point of becoming obsolete by the time they became productive. The Rajasthan Canal was no exception.

The canal now flows close to the town of Pokhran where India tested its first nuclear explosive meant to be used for peaceful purposes in 1974. If such explosives had been used for the canal's construction, it could have been completed long before and at a much lower cost.

There were other factors. When such an enormous project is neglected, it generates a spiral of corruption. Contractors received money for work they did not do. Local politicians dipped into the project to make hay while the sun shines. Engineers point out that the state government failed to settle enough people along the canal who could work the fields and develop the new irrigation potential.

Meanwhile, the project plan was revamped. The state government decided in 1970 that the entire canal should be lined with concrete tiles and proposed to add five lift-schemes—available up to 200 feet (60.8 m)—to bring water into the interiors. The flow command of Stage II has also since been extended by another 100,000 hectares up to Gadra Road in Barmer district. The drinking and industrial water requirement of seven desert districts of Ganganagar, Churu, Bikaner, Nagaur, Jodhpur, Barmer, and Jaisalmer has also been increased from 500 cusecs (141.7 hl/sec) to 1,200-1,800 cusecs (339.9-509.9 hl/sec). With this revised scope for Stage II, the culturable command area—the area which can utilize the canal water—for the entire project would now be about 1.6 million hectares and the length of the feeder, main, and distribution canals together would be about 9,425 km.

In 1983, Stage I was finally completed—20 years behind

schedule. As of now, the Stage II main canal and 50% of its distributory system have been completed. It is estimated here that if no new thrust is given, the rest of the project work could require another decade to complete.

If completed in time, the Indira Gandhi Canal would have already generated an enormous amount of wealth for the nation.

The project is not only an irrigation project bringing 1.6 million hectares of virgin and fertile land under year-round cultivation. Western Rajasthan, plagued by a shortage of rainfall and subjected to repeated famines, has been condemned to being sparsely populated over the centuries. No reasonable development or progress was possible without such a basic amenity as water.

The canal project has already started to change that numbing sense of hopelessness. The area that has already enjoyed a decade of canal water now produces $200 million worth of food products. In the northern district of Ganganagar, where the canal water reached in the sixties, the area has become lush with greenery. Anupgarh, a town south of Ganganagar, was a dusty little desert village before the canal water came. Today, it is marked by wide, well-laid roads, shops, stores, and schools. The price of land in Anupgarh is now comparable to that in Jaipur, the capital city of Rajasthan. Anupgarh has already become the nerve-center of trade and commerce in the border area, sending out the ample produce of the land into the interior and buying back what the local community needs. Another town, Gharsana, located between Ganganagar and Anupgarh, has turned into a grain market.

Challenge of national water policy

Since independence, 20.8 million hectares of land have been developed for their irrigation potential. Out of that, fully 5.2 million hectares still remain to be utilized. At the going cost of $3,000 per hectare to develop, it would take another $16 billion to make the "potential" utilizable! Even more important, due to lack of groundwater management, the canal irrigation has resulted in water-logging and salination that has already affected about 7 million hectares of land. In some places canal irrigation has turned into a curse.

The Ministry of Irrigation limits its concept of groundwater management to simply pumping up the water for farm work. Pumped groundwater accounts for irrigation of about 26 million hectares of land, about the same that the large dams and canals have achieved so far—and at a fraction of the large projects' cost. However, pumping groundwater without systematic recharging of the aquifers has caused salination and a lowering of the groundwater table.

The "tunnel vision" in India's water management policy is disastrous. India receives annually about 330 million hectare-meters (mhm) of water, excluding 70 mhm which evaporate immediately after precipitation. Of these 330 mhm, around 150 mhm enter the soil, where about 110 mhm are retained as soil moisture and the remaining 40 mhm enter the deeper strata in the form of groundwater. Of the remaining 180 mhm of water which do not find their way into the soil, only 17 mhm are impounded as run-off to the reservoirs. The rest—163 mhm of water or 90% of the run-off—goes to the sea and is lost. After four decades of massive irrigation projects and expenditures reaching $30 billion, only 10% of India's annually renewed water resources can be captured for use.

Even then, effective use is seriously undermined by lack of command area development. In areas where the "Green Revolution" has been a success, farmers mostly use groundwater. In these areas, the groundwater table has dropped dangerously. Farmers have met this situation by deepening the tubewells and lowering the pumpsets, at considerable cost. In certain areas, as one report shows, particularly along the Saurashtra coast, excessive withdrawal of groundwater has allowed the seawater to intrude into sweetwater aquifers, turning fertile areas to wastelands.

Promise of the Imperial Valley

The Rajasthan Canal can be compared to the Imperial Valley—a man-made oasis in southern California and Arizona just north of the Mexican border. In 1901, a group of enterprising settlers built the first canal there. Gradually over the years, 2,800 km of canal was laid out, and the desert, which has an annual rainfall of less than 3 inches (7.6 cm), began to green.

The canal network of the Imperial Valley gets its water from the Colorado River. Along with the water come dissolved salts, washed away from disintegrated rock. In areas where the rainfall is plentiful, this salt is washed away as the rain leaches deep into the soil or floats it down the river into the ocean. But in desert areas where soil moisture evaporates into the air instead of running through the ground, the salt concentration is built up, and the rivers flowing through such regions become heavy with salt. Over a period of time, this salt is deposited back onto the land where the river water is used for cultivation.

In the Imperial Valley, this salt formation began quickly. Within 20 years of the building of the first canal, about 20,000 hectares of land had been surrendered to "Imperial Valley Snow," with 1,000 more going out of production each year. Only after extensive study and sheer hard work, could the land be recovered and the Imperial Valley made the cornucopia that it is today.

Looking under the soil in the Imperial Valley, one finds tiled drainage pipes laid in a complex network. Miles of drains soak up the irrigation water and spill it into the network of waste ditches, almost as complex as the canal system itself. The ditches send it rushing into the catch-basin of Salton Sea. Today, an almost-perfect balance has been reached in the Valley, whereby the amount of salt coming in is about the same as that flushed out.

The Indira Gandhi Canal has the possibility of bringing the success of the Imperial Valley to this region of India, opening up a whole new area for full economic development.