On a cloudy September day in the humid central Chinese city of Jingzhou, a group of Chinese officials quietly inaugurated a new canal designed to address a growing water shortage in an area normally plagued by flooding. The “Bringing the Yangtze to help the Han River” canal project is needed because of a much larger project, 250km to the north, that cuts the flow of the Han, a Yangtze tributary. About a quarter of the water in the Han will be reallocated to arid northern China in a $60bn engineering effort that critics say will create shortages in the south.

Water from the middle leg of the south-north diversion project officially begins flowing this month, a moment that will probably be marked with much greater ceremony. The project, inspired by an offhand remark by Mao Zedong that the north should borrow water from the south, is designed to alleviate chronic water shortages in the industrial north and bring additional supply to growing cities such as Beijing and Tianjin. Beijing argues that its titanic effort to redistribute water is necessary for the north. But the impact is just beginning to be felt in the south. “This project from the beginning has been as controversial as the Three Gorges,” says Dai Qing, a Chinese journalist and environmentalist who led the charge against the 1990s project, which has been plagued by environmental problems since its completion in 2006.

Worrisome signs of shortage are already cropping up in central China, where cities along the mighty Yangtze were historically far more concerned about floods. The Three Gorges dam has lowered silt deposits in the river beneath it, causing some islands in the Yangtze delta to shrink, while barge traffic has been left stranded when water levels run low. Shanghai, China’s financial centre, has had to fight incursions of seawater into its water supply when the Yangtze’s flow slows. That could become worse with the regular diversion of 9.5bn cubic metres a year of water from the Danjiangkou dam on the Han river, which will feed canals and pipes running 1,400km north across two provinces to Beijing.

The Yangtze’s water is being siphoned off even as the cities, industry and agriculture along the river claim a greater share than in the past. A 2012 study by the Hubei Academy of Environmental Science found the diversion project was likely to result in water levels too low for shipping along the Han, make some irrigation networks unusable and annihilate fish species that rely on seasonal flood cycles. Less water to dilute polluted waste and run-off could pose a greater risk to human health and raise the cost to cities and industry to treat the water.

The diversion project has progressed in fits and starts, resulting in huge cost overruns (the original budget was about $20bn) and creating a complex cast of winners and losers. Among them are the 250,000 villagers forced to relocate to make way for the expanded Danjiangkou reservoir. “They wanted it to be done in one fell swoop but society has changed,” says Ms Dai. “Now everyone wants to know: what’s in it for me?”

The smaller Yangtze-to-Han canal shows how national authorities have had to accommodate local concerns. By replenishing water diverted from the upper Han, the 67km canal allows the lower Han to remain navigable and preserves the industrial base around Wuhan, a city of 6.5m at the confluence of the Han and the Yangtze. “But that won’t resolve the problem,” says Du Yun, of the Institute of Geodesy and Geophysics in Wuhan. “The problem of not enough water in the south will certainly crop up.” An initial phase of the south-north project’s middle route, designed to increase water supply to Beijing during the 2008 Olympics, depleted reservoirs needed for irrigation in the impoverished countryside around the capital. This summer water from the Danjiangkou dam was used to offset a drought in Henan province – a diversion that will not be allowed once the middle leg is fully complete and the northern cities claim their full allocation.

The eastern leg is less complex because it follows the existing route of the historic Grand Canal. But planners found to their dismay that the water pumped from the mouth of the Yangtze up the length of the historic Grand Canal to the port city of Tianjin was too polluted to be used once it arrived, requiring additional spending on water treatment plants. The tally of the cost and benefits of the water diversion projects already under way will determine whether Beijing presses ahead with the most expensive and controversial western leg, which would tunnel through the hard rock of the Tibetan plateau to bring water from mighty southern rivers into the upper reaches of the Yellow river. Critics say China would be wiser to raise the cost of water in places where it is in short supply, rather than engaging in massive transfers to suit political constituencies in the north. Leo Horn-Pathanothai, an environmental economist at the World Resources Institute, says: “China’s answer to date has been engineering to increase supply. Now the problem is national scarcity and the solutions are better economics and governance.”

(859 words)