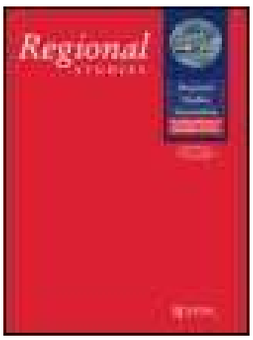

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The South–North Water Transfer Project: remaking the geography of China

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ANNUAL LECTURE

The South–North Water Transfer Project: remaking the geography of China

Michael Webber[a], Britt Crow-Miller[b] and Sarah Rogers[c]

ABSTRACT

The South–North Water Transfer Project: remaking the geography of China. *Regional Studies*. This paper uses a technopolitical approach to analyse China's South–North Water Transfer Project. The project promises to channel 25 billion cubic metres of water a year from the Yangtze River northward, connecting four river basins, three megacities, six provinces and hundreds of millions of water users. The paper argues that the project embodies a particular, engineering-heavy approach to water management; that, even so, it poses fundamental challenges to existing regional structures of governance; and that it promises continuing detrimental environmental impacts in source regions even as it invites similar future interventions in China's hydrological environment.

KEYWORDS

China; South–North Water Transfer Project (SNWTP); technopolitics; water management; governance; pricing

摘要

南水北调计画: 重塑中国地理。*Regional Studies*. 本文运用科技政治取径，分析中国的南水北调计画。该计画允诺每年从扬子江往北运输二百五十亿立方公尺的水，衔接四大河流域，三大巨型城市，六大省份与亿万的水资源使用者。本文主张，该计画体现了特定且著重工程的水资源管理方法；即便如此，它仍对既有的区域治理结构提出了根本的挑战；而即便它在中国的水文环境中，欢迎类似的未来介入，却仍在水资源区域中带来了持续的有害环境冲击。

关键词

中国; 南水北调计画; 科技政治; 水资源管理; 治理; 定价

RÉSUMÉ

Le projet de transfert d'eau Nord-Sud: refaire la géographie de la Chine. *Regional Studies*. Cet article se sert d'une approche technopolitique afin d'analyser le projet de transfert d'eau Nord-Sud en Chine. Le projet cherche à acheminer vers le nord 25 milliards de mètres cubes d'eau par an à partir du fleuve Yangtze, reliant ainsi quatre bassins hydrographiques, trois mégalopoles, six provinces et des centaines de millions d'utilisateurs d'eau. Ce présent article affirme que le projet incarne une approche particulière de la gestion des eaux lourde d'ingénierie; que, toutefois, il représente un défi fondamental aux structures de gouvernance régionales en vigueur; et qu'il annonce des effets préjudiciables environnementaux continus dans les régions d'origine tandis qu'il sollicite des interventions futures similaires au niveau de l'environnement hydrologique en Chine.

MOTS-CLÉS

Chine; projet de transfert d'eau Nord-Sud; technopolitique; gestion de l'eau; gouvernance; tarification

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ZUSAMMENFASSUNG

Das Süd-Nord-Wassertransferprojekt: Umgestaltung der Geografie von China. *Regional Studies*. In diesem Beitrag analysieren wir mithilfe eines technopolitischen Ansatzes das Süd-Nord-Wassertransferprojekt in China. Durch das Projekt sollen pro Jahr 25 Milliarden Kubikmeter Wasser vom Jangtse nach Norden umgeleitet und vier Flussbecken, drei Megastädte, sechs Provinzen sowie hunderte Millionen von Wasserverbrauchern angeschlossen werden. Wir argumentieren, dass das Projekt einen besonderen und techniklastigen Ansatz der Wasserbewirtschaftung verkörpert, dass es dennoch die vorhandenen regionalen Regierungsstrukturen vor grundlegende Herausforderungen stellt und dass es zu fortgesetzten schädlichen Umweltauswirkungen in den Quellregionen führen wird, während es darüber hinaus zu ähnlichen künftigen Eingriffen in die hydrologische Umwelt von China einlädt.

SCHLÜSSELWÖRTER

China; Süd-Nord-Wassertransferprojekt (SNWTP); Technopolitik; Wasserbewirtschaftung; Regierungsführung; Preisgestaltung

RESUMEN

El proyecto de trasvase de agua del sur al norte: transformación de la geografía de China. *Regional Studies*. Mediante un planteamiento tecnopolítico, en este artículo analizamos el proyecto de trasvase de agua del sur al norte en China. Con este proyecto se canalizarán 25.000 millones de metros cúbicos de agua al año desde el río Yangtzé hacia el norte, conectando cuatro cuencas hidrográficas, tres megaciudades, seis provincias y cientos de millones de usuarios de agua. En este artículo argumentamos que el proyecto implica un particular enfoque centrado en la ingeniería para la gestión del agua, que no obstante plantea retos fundamentales a las actuales estructuras regionales de gobernanza, que amenaza con continuos efectos perjudiciales para el medio ambiente en las regiones de fuente, y que además conlleva la creación de programas similares en el futuro para el entorno hidrológico de China.

PALABRAS CLAVES

China; proyecto de trasvase de agua del sur al norte; tecnopolítica; gestión del agua; gobernanza; precios

JEL P26, Q25, Q28, R52

HISTORY Received 12 April 2016; in revised form 16 November 2016

INTRODUCTION

The South–North Water Transfer Project (SNWTP) is the most ambitious inter-basin water transfer scheme in the world. It is a complex of diversion channels that promises to deliver tens of billions m^3 of fresh water a year over 1000 km from the relatively well-watered south of China to the drier north. The project connects four major river basins, three megacities, six provinces, and hundreds of millions of water users and polluters.

The project comprises three routes. The Eastern Route has the capacity to supply 14.8 billion m^3 per year from the lower Changjiang (Yangtze River) to the provinces of Jiangsu, Anhui, Shandong and Hebei and the municipality of Tianjin through a system of pumps, rivers, lakes, reservoirs and canals, including the Grand Canal, itself more than 2500 years old. The route began operating in late 2013. The Middle Route can provide 9.5 billion m^3 per year to the provinces of Henan and Hebei and the municipalities of Beijing and Tianjin from Danjiangkou reservoir on the Han River (a tributary of the middle Changjiang). Ten years in construction, it involved raising the wall of the dam at Danjiangkou by nearly 15 m and constructing a pair of tunnels to carry water under the HuangHe (Yellow River). Water began to flow in late 2014 and there are plans to expand its capacity to 13 billion m^3 per year. A third (western) route would be capable of diverting another 20 billion m^3 of water annually from tributaries of the upper Changjiang through tunnels to the upper reaches of the HuangHe. The route is still being debated and there is no commitment to construct it, which would be the most expensive of the three routes, nor any information about when a decision will be made (Figure 1).

Planning and design for the project were overseen by the Ministry of Water Resources (MWR), through its Planning, Design and Management Bureau of the SNWTP (Chinese Government Public Information Online, 2015). In 2002, this bureau completed a blueprint for the construction period and, in 2003, the Office of the Construction Committee for the SNWTP (Office of the SNWTP) was established directly under the State Council to oversee construction (State Council, 2003). Various design institutes and river basin commissions compiled the designs and plans, while construction was done by Hanjiang Water Resources and Hydropower Corporation on the Eastern Route and Danjiangkou Water Resources and Hydroelectric Corporation on the Middle Route (water-technology.net, n.d.).

Estimates of the project's cost differ enormously. The cost of constructing the Eastern and Middle routes has been estimated at US$79.4 billion (Chang, 2014); an official of the Office of the SNWTP told Li (2014) that the construction of the two routes would likely end up costing RMB 300 billion (US$47 billion at late 2015 exchange rates). There are many other estimates within this range. These costs do not include evicting and resettling 365,000–375,000 people for the enlargement of Danjiangkou reservoir and construction of canals (the Office of the

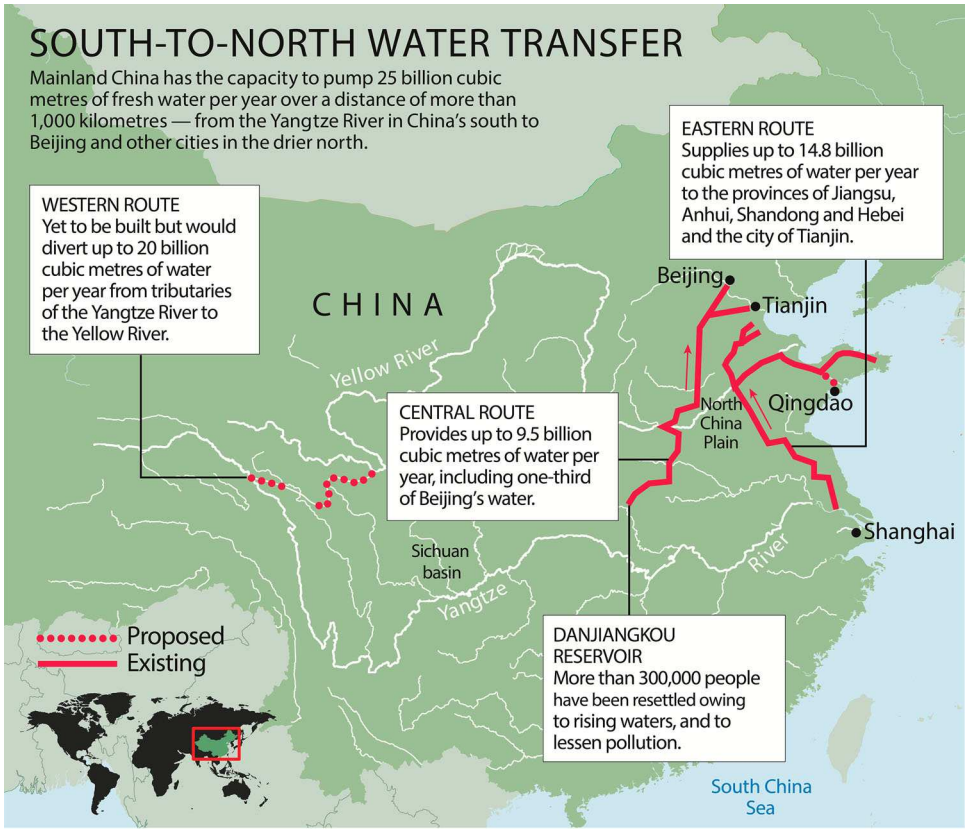

Figure 1. The three routes of the South–North Water Transfer Project (SNWTP).
Source: Barnett et al. (2015).

SNWTP estimates 300,000 people, but later estimates are higher). The experience at Three Gorges (Webber, 2012) suggests that the evictions cost at least RMB 100,000 each (excluding the costs to households), adding another US$5.75 billion to the construction cost. Nor do estimates of construction cost include environmental protection and evicting farmers from the catchment of Danjiangkou reservoir. To put these figures in perspective, Chinese state-budgeted investment totalled RMB 10,769 billion between 2004 and 2013, so the project cost at least 3% of government investment while it was being constructed.

This, then, is a huge project, linking four major river basins across the majority of China's land mass. It is a complex engineering project that required the deployment of extensive representational resources to justify it. As a socio-technical infrastructure the SNWTP mediates between Chinese society and its environment, comprising a political and a material response to social needs and environmental demands and complementing at least another five interbasin diversion projects within China (Chen & Wenger, 2014). Yet while it embodies elements of China's long tradition of water resources management (Pietz, 2014), the SNWTP nevertheless poses challenges to the existing structure of China's socio-environment.

The literature on the operation and implications of the SNWTP is still in its infancy, and is principally concerned with the management of the project. Three topics dominate. One is the elucidation of the principles that should underpin operational management, including water allocation modelling and the pricing model (Nie, Duan, & Liu, 2013; Wu, Dong, Guo, & Li, 2013; Zhang, Lu, & Fei, 2013). Another concerns the evaluation of, and potential mitigating measures against, the principal risks that face managers of the project (Hu, Zheng, Li, & Shi, 2013), especially floods (Cong, Kang, Cheng, & Ding, 2012), security of water supply (Lin, Liu, & Chen, 2012; Zhang, Jiang, Li, Yang, & Sun, 2012) and high groundwater levels (Hu & Weng, 2013). The risk of pollution in sources and along the route has received particular attention (Guo & Ren, 2014; Guo, Wu, & Ren, 2013; Guo, Xiao, Shang, & Wang, 2013; Xin, Li, Finlayson, & Wei, 2015). The third topic concerns the implications of the SNWTP for source regions (Chen et al., 2013; Fan, Yang, & Tang, 2012; Huang & Zhang, 2014; Webber et al., 2015b) and the use of local water resources in the destinations (Ling, You, Wang, & Gan, 2014). None of these is concerned with the relations between the SNWTP and the broader development of China's socio-environment or between the project and ongoing processes of water management. (Socio-environments are the manner of interaction of people, social groups, cities, firms, governments and the like, as well as elements of the 'produced environment'.)

Relatively fewer are studies of the political and economic implications of the SNWTP, placing the project within the framework of socio-environmental relations within China (Barnett, Rogers, Webber, Finlayson, & Wang, 2015; Crow-Miller, 2013, 2015; Moore, 2014a). Crow-Miller argues that the SNWTP permits economic growth to continue on the North China Plain, helping

the Chinese Communist Party to maintain political legitimacy. In doing this, the SNWTP is represented as an apolitical project that conceals the anthropogenic sources of water stress on the North China Plain; this argument resurfaces later. In arguing that the SNWTP embodies a form of authoritarian environmentalism, Moore (2014a, p. 959) observes that the 'SNWTP reflects a powerful, technocratic, and controlling central government, but one capable of employing a variety of strategies, persuasive as well as coercive, to pursue its objectives'. Barnett et al. (2015) comment that in many respects the SNWTP represents an alternative to better local management of water resources and thus contradict Berkoff (2003), who argues that the social disruption that would be caused if conservation measures were adopted on the North China Plain suffices to justify the project.

This paper develops some of these political and economic arguments. It argues first that the project embodies a particular engineering-heavy approach to water management in China. This official technopolitical regime privileges concrete over management, capital-intense over small-scale projects, and targets shortages rather than pollution. Secondly, the paper argues that, even so, the project poses fundamental challenges to the existing regional structures of governance (by requiring water management at a greater-than-basin scale) and power (empowering central as compared with provincial and local governments). Thirdly, it argues that the project both promises continuing detrimental environmental impacts in source regions even as it invites similar future interventions in China's hydrological environment. This paper does not survey the social and environmental impacts of the SNWTP (examining neither the resettlement of people for the project nor the decisions about which regions should receive the water, for example); rather, it interprets some elements of the project in the light of concepts drawn from the study of technopolitics to substantiate these arguments.

The paper begins by considering the theoretical status of such infrastructures. It then describes the representations that are offered to justify the project over alternative forms of water management, and proceeds to explain the challenges thrown up by the SNWTP and its continuing environmental impacts. Represented as a straightforward, technical solution to quantitative imbalances between the regional demand for and supply of water in China, the project instead foregrounds the environmental, economic and political challenges posed by China's patterns of growth. While technopolitical studies demonstrate how technical choices and political development march hand in hand, this paper reveals that huge infrastructure projects not only represent the state of relations between society and environment, but also – as Gandy (2014) has emphasized – pose new challenges to those relations.

THE TECHNOPOLITICS OF INFRASTRUCTURES

Infrastructures are networks that enable the flow of goods, people or ideas and allow their exchange over space (Larkin, 2013). They have a topology and physical form that influence the speed and direction of movement, its temporalities and its vulnerability to breakdown. Infrastructures, in this sense, are technological objects. Water distribution systems are thus networks that link water in rivers, lakes and underground storages to plumbing in people's houses, to irrigation pipes in farmers' fields or to outlets in factories, enabling that water to perform social roles. Infrastructures mediate between societies and their environments.

Water infrastructure consists of pipes, pumps and water treatment plants (machines); the links between those machines that make them into a system that delivers water; and techniques of organization – corporations, accounting, bureaucracies and the like (Molle, Mollinga, & Wester, 2009). Anand (2011, 2012), for example, considers the provision of water to Mumbai in India, tracing the interaction of two infrastructures. One system delivers water, through networks of pipes, engineers and bureaucracy that make up the technique of water provision; the other comprises the social networks, forms of patron–clientship, and relationship-building that are also important to water delivery in Mumbai. These two infrastructures interact to produce what Anand (2011, p. 545) calls 'hydraulic citizenship, a form of belonging to the city enabled by social and material claims made to the city's water infrastructure'.

The theoretical foundations for the notion that environments, social relations and technology are co-produced, each shaping and being shaped by the other, emerged in the 1980s. Various programmes, including the social construction of technology, large-scale technical systems and actor–network theory, all attend to the construction of the borders between the social and the technical (Bijker & Pinch, 2012). They all contend that technologies are socially constructed, evolving to fill niches in a world governed not only by biophysical laws but also by social rules and government policies. A parallel argument contends that the environment, too, is socially and technologically constructed, depending not only on biophysical laws but also on social modifications and technologically mediated interfaces between people and the environment (Bakker, 2012; Swyngedouw, 1999, 2004). That environment in turn has agency over human beings and societies' technological trajectories, posing conditions that shape people and their societies (Williams, 2010). The co-production of societies, environments and technologies is summarized in Hughes (2004, p. 156): much of the world 'consists of intersecting and overlapping natural and human-built systems, which together constitute eco-technological systems'.

An influential application of these ideas is the concept of the hydro-social cycle (Bakker, 2012; Swyngedouw, 2006). As developed by Linton and Budds (2014), the hydro-social cycle incorporates the ideas that the need to manage water affects the organization of society in important ways, which in turn modify the flow of water, and in their in turn give rise to new forms of social organization; nevertheless, the material properties of water play an active role in the cycle – water obeys its own laws. Specific applications of the concept of the hydro-social cycle include

Finewood and Stroop (2012), Clarke-Sather (2012), Boelens (2014) and McDonnell (2014). People, networks, institutions, water (H_2O in Linton & Budds', 2014, language) and other things, including elements of the environment, interact, producing effects, among which are particular socio-environments. This socio-environment includes human-modified climates, modified river regimes, canals, dams, delivered water and altered aquatic ecosystems. Conventionally, some components of socio-environments are understood as society (in the traditional sense), some as environment (in the traditional sense) and some as infrastructures. However they are classified, the elements of socio-environments (things) then provide the context or framework within which people, networks, institutions, water and the like interact as preformed agents in another iteration to produce yet further effects, in a continuous evolution.

One set of the elements of a socio-environment is its infrastructures. These are, on the one hand, technological systems to be understood through an analysis of networked machines, bureaucracies and the like; on the other, they are political, used to constitute, embody or enact political goals – they embody a technopolitics (Hecht, 2001). Infrastructures in this sense are hybrids of technology and politics. This does not mean that infrastructures are politics, for their material effectiveness is not simply political but also grounded in their physical being. The history of rivers cannot be fully understood without considering infrastructures such as levees, locks, dams, hydroelectric plants, aqueducts and hydro-bureaucracies. But those infrastructures cannot be understood without considering the ways of behaving of rivers and social groups. The choices related to those infrastructures cannot be examined without understanding the administrative apparatus of multi-jurisdictional governance peculiar to those rivers, or the policies that guide that apparatus. 'Society' and 'nature' meet in the history of a river (Cronon, 1990).

But infrastructures encourage path dependence. Things grow hard or stable, and fixed patterns of structure (such as bureaucracies) and behaviour emerge around them (Bijker, 2007), sometimes persisting over changes in regime and travelling across cultural contexts (Sneddon, 2015). Grounded in these institutions, technopolitical regimes (Hecht, 2001) consist of linked sets of people, engineering and industrial practices, artefacts, political programmes and institutional ideologies which act together to govern technological development and pursue technopolitics. In a society at a given time there may exist competing technopolitical regimes: in 18th-century China, Confucian and Daoist conceptions of water management (to actively direct the flow of rivers or move the population and 'let the water be', respectively) competed for primacy (Purdue, 2010). In post-colonial Pakistan, centralist (Punjabi-dominated) conceptions of the 'One Nation' competed with regionalist imaginaries of Pakistan over the control and distribution of water from hydraulic infrastructures on the Indus River (Akhter, 2015). These studies do not, however, consider the political, social and environmental challenges that are posed by huge infrastructure projects – and that is the principal purpose of this paper.

REPRESENTING THE NEED FOR THE SOUTH–NORTH WATER TRANSFER PROJECT

The imaginary of a water-rich south versus a water-scarce north – 南方水多，北方水少 (*Xinhua Net*, 2014) – is central to all accounts of the SNWTP, which seeks to 'balance' the allocation of water at the national scale. As *Xinhua Net* (2014) expressed the words of prominent Chinese geographer, Liu Changming:

> 我国人均水资源占有量很低，只有世界平均的四分之一，特别是时空分布不均匀，北方地多水少，南方地少水多。除此之外，水资源的时间分配又集中在夏季。南水北调的必要性就在于平衡这种不均匀性.
>
> [China's per capita water resources are low – only one quarter of the world average. A special characteristic is uneven spatial and temporal distribution, with much agricultural land but little water in the North and little agricultural land but more water in the South. In addition, the water resources are concentrated in the summer. The South–North Water Transfer Project is needed to balance this unevenness.]

This geographical imaginary is evident in maps of the project, and in the expression used to describe its overall outcome, which refers to 'four horizontals, three verticals' (四横三纵): the four major rivers – Changjiang, HuaiHe, HaiHe and HuangHe – provide horizontal movement, while the three routes of the SNWTP provide vertical movement (*People's Daily Online*, 2014). This imaginary implies absolute control over the water resources within China's territory: water no longer flows west to east as it did for centuries; it is also now flowing south to north. The maps communicate the delivery of water over space and the delivery of a political project to dominate hydrological landscapes that began thousands of years ago. In light of the historical association between political legitimacy and the control of resources, including water (Mukerji, 2003), the visible forms of the SNWTP are important political symbols, signifying the authority of the state.

Rather than approaching water management from a local or bioregional perspective in which hydrological units (watersheds and river basins) serve as the management unit (Thayer, 2003), the SNWTP locates the problem of north China's water shortage at the national scale. The threat of water shortage is a threat to the survival of the Chinese nation, according to former premier Wen Jiabao (quoted in Moore, 2009); former president Hu Jintao identified water as exerting an 'evident impact on China's economic security, ecological security and national security' (*China Daily*, 2011). Water is needed to secure food supplies and energy production, vital to continuing national development and therefore the survival of the state and Party (Yong, 2006) (Figure 2).

The imaginary of the SNWTP as a solution to the water scarcity of the north through the use of abundant water from the south hides the anthropogenic drivers of water insecurity in north China. It is true that China's

Figure 2. The SNWTP as a national project ('The South–North Water Diversion Project – a noble undertaking of a thousand years'): the Middle Route canal outside Baoding City, Hebei province.
Source: Mu Lan & Probe International (2015); reprinted with permission.

north has less water resources per unit area and per capita than the south (outside Manchuria, at least); in the Huang, Huai and Hai river basins, annual average per capita availability of water ranges between 314 and 672 m^3, well below the levels at which water shortages can threaten food production and economic development (Jiang, 2009; Wang & Jin, 2006). Furthermore, in one year of four, discharges in the Huai and Hai rivers fall to less than 70% of their annual average (Berkoff, 2003). The shortfall is met by mining groundwater resources (Jiang, 2009; Varley, 2005), the over-extraction of which affects over 70% of the north China plain (MWR, 2007). However, China's rapid economic growth since 1978 has resulted in large increases in agricultural and industrial production in the drier northern provinces, causing significant increases in demand relative to supply, as well as pollution on such a scale that much of the north's water is unfit for consumptive uses (Barnett, Webber, Wang, Finlayson, & Dickinson, 2006; Jiang, 2009; Ma, Hoekstra, Wang, Chapagain, & Wang, 2006; Webber, Barnett, Wang, Finlayson, & Dickinson, 2008a; Yang, Zhang, & Zehnder, 2003). In the north, 40–60% of the region's water is continuously in the non-functional water classification categories (Jiang, 2009; Xie, 2009).

Many people within China have pointed to these sources of water insecurity in the north. Xie (2009), in a report for the World Bank, argued that to address China's water scarcity there needed to be improvements to water governance, the development of water markets, increases in the price of water, new ecological compensation payments for the use of ecosystem services and controls over water pollution; the report did not even discuss the SNWTP. Xie was joining a long line of Chinese environmental scientists who had argued that water-saving measures, protection of resources from pollution and improved water management were the key means of resolving water shortages (Chinese Academy of Engineering, 2000; Chinese Academy of Sciences, 1998; Mei & Luo, 2000; Wang, 1990; Zhang, 1999). Such views, moreover, were represented within the central government itself: the then Vice Minister of Housing and Urban–Rural Development, Qiu Baoxing (Qiu, 2014), observed that if one-third of Beijing's buildings collected and used rainwater, that would have saved the investment in the SNWTP.

At the time when the critical decisions to proceed with the project were made, all nine members of the Politburo standing committee were trained as engineers (Kuo, 2014); and party leaders have close personal ties to the corporations in China's water machine – Hu Jintao is a former employee of Sinohydro and Li Peng was father of the president of Huaneng. Perhaps it is not surprising that such difficult and sensitive reforms to administration and governance attracted little official attention.

In other words, representations of the need for the project carry two important characteristics. First, the problems of water supply are represented as national imbalances of national strategic significance rather than shortages that principally affect Beijing and Tianjin and that would be the responsibility of Beijing and Tianjin to resolve. Secondly, they are represented as issues of quantitative shortage rather than induced by poor pollution control (as argued by World Bank & SEPA, 2007) and a national growth pattern that has seen the north's share of agricultural production expand dramatically in the past 40 years (Webber et al., 2008a). Even though alternative diagnoses of China's regional water shortages had been available long before the decision was made to commit to the SNWTP, the solutions to which those diagnoses pointed were ignored in a political decision that prioritized investment in technology and infrastructure over reforms to administration and governance. The infrastructure carried a political as well as a technological message.

CHALLENGES TO EXISTING REGIONAL STRUCTURES

The project in this sense reflects the distribution of power in China – that the central government has greater capacity to invest billions in an infrastructure scheme than to reform water management systems in which local jurisdictions have a high degree of local autonomy and little incentive to manage water at the expense of jobs (Wang, Webber, Finlayson, & Barnett, 2008). The project is consistent with a model of growth in the 1990s and 2000s that was dominated by investment, including central government-led investment: according to World Bank data, gross capital formation in China exceeded 35% of gross domestic product (GDP) in the 1980s, and since 1991 has averaged over 40%. Yet the SNWTP is throwing up challenges to China's political order – the infrastructure is doing political work (now and into the future) as well as reflecting political work of the past.

The first challenge is to China's governance regime.

The governance of the SNWTP intervenes in an already highly complex regime, what some have called fragmented authoritarianism (Lieberthal & Oksenberg, 1988;

updated in Mertha, 2009). The management of water in China is highly decentralized (Webber, Barnett, Finlayson, & Wang, 2008b) and characterized by inter-jurisdictional conflicts (Moore, 2014b). The state is unbundled into ill-coordinated congeries of territorial bureaucracies and vertically and horizontally segmented administrative boundaries, which do not map well onto the hydrological cycle (Nickum & Lee, 2006, p. 232). It involves the MWR; for most river basin management issues, the MWR's responsibilities are delegated in one line of command to river basin commissions and in another line to provinces, counties and townships or cities. But many other ministries have their hand in water management, including the ministries of Environmental Protection, Housing and Urban–Rural Development, and Agriculture. Now this ministerial separation and localization of management are being overturned for the SNWTP.

The construction phase has been managed by the SNWTP Construction Committee chaired by the Vice Premier, and under the auspices of the State Council (Nickum, 2006). The committee includes representatives of line ministries – the ministers of Water Resources and of Environmental Protection as well as the Chair of the National Development and Reform Commission (NDRC) – and of provincial-level administrations – the mayors of Beijing and Tianjin, and the governors of Hebei, Jiangsu, Shandong, Henan, Hubei and Shaanxi provinces (State Council General Office, 2013). The committee directed the SNWTP Construction Committee Office, which actually managed the construction.

The institutions to manage the operations of the project are now being stitched together, though with disagreements (*Caijing*, 2014b). The Ministry of Environmental Protection is responsible for pollution control (State Council General Office, 2014). Responsibility for deciding on the volumes to be transferred lies with the MWR and its Bureau of South–North Water Transfer Planning, Design and Management, which should seek final approval for allocations from the State Council (State Council General Office, 2014). These decisions are intended to reflect abstractions proposed by the river basin commissions and water-use plans prepared by provincial and municipal governments. However, the 2014 regulations did not conclusively establish a specific management unit responsible for the operation of the project, with the result that the MWR and the SNWTP Construction Committee Office are disputing their roles in this decision-making (MWR General Office, 2012b; *Caijing*, 2014a). The SNWTP Construction Committee Office proposal seems to be (*Caijing*, 2014a) that in accord with the requirements of a modern enterprise system each route should be managed by a limited liability company, with boards of directors composed of representatives of investors, as the project legal person responsible for ongoing work on the project, its operational management, loans and the value of assets, and it should operate independently in accordance with the law. Such a management company would remove the administration of some water from the MWR.

The second challenge is to the hierarchical distribution of power in China, which is also being reorganized through the project, as the centre takes over control over land use in some regions and determines the prices of water in specific cities.

The NDRC has developed an economic and social development plan for Danjiangkou reservoir and upper reaches of the Han River (NDRC, 2012). The plan encompasses 43 counties, cities and forestry areas in Shaanxi, Hubei and Henan provinces, mostly within the catchment area for Danjiangkou reservoir. The plan attempts to manage water quality for the SNWTP by dividing the catchment into water-source-conservation areas where new construction is prohibited and the population resettled; ecological agricultural areas where economic restructuring will take place and fertilizer and pesticide use reduced; and cluster development areas where cleaner production will be promoted (NDRC, 2012). In other words, economic and social planning for these water-source areas is now being dictated by the central government in the interests of protecting water quality. The source areas are said to be sacrificing their own interests and development for the project (*Southern Weekend*, 2013; *Caijing*, 2014b). In addition, the State Council has approved a water pollution and soil conservation plan for Danjiangkou reservoir and its upstream areas which includes targets for water quality, chemical oxygen demand and soil conservation (MWR General Office, 2012a). Around Danjiangkou reservoir new rules regulate sewage control, shipping-related pollution and fish farming (*China News*, 2014). Water quality protection at Danjiangkou has become the 'core work' for local officials involved in the SNWTP (*Southern Weekend*, 2013). In effect, the control of land use in a small, distant region is now a prerogative of one of the most important central government agencies, the NDRC. Power over land use around the SNWTP is moving up.

The pricing of water in China is also highly contentious. On one side are the World Bank, Asian Development Bank (ADB) and a good proportion of the nation's economists arguing that water should be priced at market rates to achieve allocative efficiency. On another side are the local water-resource bureaus, ultimately responsible to the MWR, that supply water to farmers for irrigation; they recognize, at least implicitly, that farmers are already the poorest group in society and have limited capacity to pay prices that urban users could pay. And finally there are the municipal water authorities, again ultimately responsible to the MWR, that are caught between the needs to restrain demand and to pay for improvements to water supply infrastructure, on the one side, and vocal urban consumers who protest proposals to raise prices, on the other. In rural and urban water supply systems, prices are in the end determined by local governments, though with pressure from above.

The price of water supplied by the SNWTP, however, is going to be centrally determined. The NDRC stipulated in 2003 that water projects should involve a two-part pricing system (Jiangsu Province Water Conservancy Office, 2008). A basic price is to be paid by local water authorities,

in this case provinces. This basic price covers the capital and overhead costs of the project – paying off construction loans, operational management, maintenance – and is payable no matter what volume of water is used by that province. A calculated or metered price is to be paid to cover running costs and allow for profit; it is charged volumetrically. The theoretical basis for this system was laid out in 2006. Figure 3 illustrates the corresponding calculated prices for the Middle Route. The NDRC's initial determination of actual prices to be charged for Middle Route water (Office of the SNWTP, 2014) is slightly lower than the basic plus calculated prices; Beijing is to pay 2.33 and Tianjin 2.16 RMB/m^3 rather than the basic plus calculated prices of 2.96 and 3.03 RMB/m^3, respectively (allowing for a 1% profit on the capital costs). Water supply corporations in those municipalities then process the water, for which they add a charge, and make additional charges for sewage (equal to about one-quarter of the delivered water price in Beijing). Thus, the delivered price to most Beijing consumers was raised to 5 RMB/m^3 in 2014 (*China Daily*, 2014). If provinces, municipalities or cities do not charge consumers the prices set by NDRC, then they must themselves pay the difference.

In fact, local jurisdictions face not only relatively high prices for the SNWTP's water, but also they have to construct the infrastructure of pipes, pumping stations and treatment plants needed to deliver water to consumers. These two charges, for water and its infrastructure, have apparently led some jurisdictions to decline to use the water supplied by the SNWTP (Chen, 2015), for it is cheaper to continue to deplete local groundwater resources. Centralized pricing does have its oppositions.

Figure 3. Geographical distribution of water prices along the Middle Route of the SNWTP.
Source: Modified from the original. Retrieved from http://club.kdnet.net/dispbbs.aspid=10352277&boardid=3/.

The SNWTP, in other words, is creating both the need for and a space within which the horizontal and hierarchical distribution of power in China can be remade. Some institutions of water governance are being brought under the control of a body that reports directly to the State Council and some traditionally local policy arenas (water pricing and land use) are being determined centrally. These are only a few elements of the complex of bodies and environmental objects that constitute the management of water in China, but they do illustrate how an infrastructure – admittedly a big one – can require changes in the very structure of governance. Paradoxically, the fragmentation of political authority – both vertically and horizontally – that has contributed so much to failures of earlier programmes of water conservancy and pollution control (Economy, 2004) is now being threatened by the very infrastructure that seemed designed to bypass that fragmentation.

ONGOING WATER MANAGEMENT

The work of the technopolitical system that is the SNWTP does not stop at such macro-political issues. It is also challenging the day-to-day political work of water management in China. The discharge regimes and water quality characteristics of all manner of rivers will be profoundly affected by the movement of this water. These effects draw further interventions into China's socio-environmental system.

For example, the discharge of the Hanjiang downstream of Danjiangkou reservoir will be reduced by 30% (Wong, 2011), leading to threats of higher pollution intensity in a river that was considered one of the cleanest in China (Kuo, 2014) and to problems of navigation. The response to this problem is to construct another water diversion, a 67 km canal from the Changjiang (Three Gorges Reservoir) to Danjiangkou (Hornby, 2014). Meanwhile, Shaanxi is building a project to divert water from the Hanjiang, in the Yangtze basin, to the Wei He, in the Yellow river basin (Pohlner, 2016), permission for which seems to have been compensation for SNWTP's use of Shaanxi's water (Moore, 2014a): in other words, the exclusion of Shaanxi from use of the SNWTP water is leading to the construction of yet another diversion.

The cartographic and diagrammatic accounts of the SNWTP obscure the degree to which the scheme takes water from the Changjiang and may have critical effects on its flow (Chen et al., 2013; Li et al., 2015). The visual representation of the Middle Route (Xinhua, 2008) shows the water originating from Danjiangkou reservoir, and not from the Hanjiang, which is a tributary of the Changjiang (Crow-Miller, 2013). A flow chart of the water diversions for the Eastern Route (Geng, Jiang, Fu, & Mao, 2012) similarly shows the diversion beginning at canals in Jiangsu and flowing along the Grand Canal, whereas the source is in fact the Changjiang. The Changjiang does appear in some descriptions of the Eastern Route, though it is said that even in extremely dry years

there is 'enough water' in the lower reaches to be pumped north (see http://www.nsbd.gov.cn/). Such representations preclude discussion of negative impacts of the diversions on the lower Changjiang, thus helping avoid claims that people and provinces may make for compensation, or for input into the management regime.

The official line is that the project will divert only 5% of Changjiang's annual discharge: the negative impacts will so small as to almost not exist (according to head engineer Shen Feng Sheng, as reported by Kuo, 2014). However, the Changjiang has a highly seasonal discharge regime, with discharges in winter only one-quarter those in summer (Finlayson et al., 2013). That difference is critical. Shanghai, for a variety of reasons associated with pollution in alternative sources and the political difficulties of negotiating access to water intakes in neighbouring provinces (Webber et al., 2015a), takes an increasing proportion of its water supply from the Changjiang estuary. That estuary is subject to intrusions of salt water that threaten this supply: the SNWTP together with other abstractions on the river raise the likelihood of intrusions that threaten Shanghai's water supply. In 1950–2014, the number of consecutive days with chlorinity ≥ 250 mg l^{-1} averaged 21.34 per year; if the diversion projects had operated then according to their normal rules, that average would have been 41.20 per year. For a randomly selected year of discharge history from 1950–2014, under normal operating rules the probability of an intrusion rises from 0.25 (for 30-day intrusions) or 0.05 (for 60-day intrusions) to 0.57 or 0.28, respectively (Webber et al., 2015b).

Shanghai's water storages can hold just over 60 days' supply and cannot treat water with chlorinity ≥ 250 mg l^{-1} to a potable standard. In other words, because of the abstractions of water by the SNWTP, the likelihood is high that Shanghai is going to have to reduce its dependence on the Changjiang – by storing and using rainfall or recycling – or it is going to have to build new infrastructure to reduce the threat that saline intrusions pose to its water supply (such as barrages to prevent tidal intrusions into the estuary or desalinization plants).

But not all of the newly emerging needs are for infrastructure. The quality of water in source regions has to be protected (as at Danjiangkou) and pollution of the canals along the routes has to be prevented, otherwise '[w]hen water comes to Beijing, there's the danger of the water not being safe to drink' (Dai Qing, quoted in Wong, 2011). This is an especial problem for the Eastern Route, which passes through highly industrialized coastal provinces and uses existing canals and lakes that are highly polluted (Moore, 2014a). The central government invested about US$3 billion on controlling pollution along the Eastern Route (Jiang, 2012), including over 400 sewage-treatment plants (Wong, 2011), between 2003 and 2013. Accompanying this investment has been the rhetoric of 'three firsts, three laters': 'first conserve then transfer water; first control pollution then let the water flow; first protect the environment and then use water' that former premier Zhu Rongji enunciated in 2000 (Nickum, 2006). Figure 4 is another expression of this rhetoric.

Figure 4. Poster advertising the SNWTP ('Success or failure depends on water quality; the key is resettlement; the priority is completion').
Source: Mu Lan & Probe International (2015); reprinted with permission.

The SNWTP is a large and complex infrastructure. It affects the operation of all manner of existing water management systems and in so doing it requires changes in those systems. Often in China those changes comprise the creation of additional infrastructural schemes – barrages, desalinization plants, new diversions. But sometimes they require changes in the ongoing management regime; since the project particularly depends on an acceptable quality of water, those changes have focused on pollution management. The political work being done by the project continues.

CONCLUSIONS

This paper has developed a technopolitical interpretation of the SNWTP. It argued that the project embodies an official technopolitical regime that privileges concrete over management, capital-intense over small-scale projects and resolves shortages rather than pollution. The SNWTP reflects a particular political regime and enacts political goals that are quite distinct from those identified for such cities as London (Gandy, 2014). Nevertheless, the project poses fundamental challenges to existing regional structures of governance (requiring water management at a greater-than-basin scale) and power (empowering central as compared with provincial and local governments). In this sense, the SNWTP requires political change, too. The project also interacts with existing hydrological conditions – the material characteristics of rivers, lakes and groundwater storages – to do environmental work: it promises continuing detrimental environmental impacts in source regions. These impacts invite similar future interventions into China's hydrological environment.

In other words, the SNWTP embodies a technopolitics in the sense of Hecht (2001): it constitutes, embodies or enacts political goals. It is a hybrid of technology and politics. However, the project has political and environmental consequences that appear to have been incidental to the

original planning: like the Three Gorges Dam before it (Webber, 2012), the SNWTP does political and hydrological work, remaking the geography of water, pollution, authority, production and people into the future rather than simply reflecting the present. Huge infrastructure projects not only represent the state of relations between society and environment, but also they require and set in motion changes in those relations. This is not a Chinese way of being technopolitical; rather it is a technopolitics within the particular political and environmental contexts of China.

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