Water: Towards a Paradigm Shift in the Twelfth Plan

MIHIR SHAH

The Twelfth Plan proposes a fundamental change in the principles, approach and strategies of water management in India. This paradigm shift was the outcome of a new and inclusive process of plan formulation, which saw the coming together of practitioners and professionals from government, academia, industry and civil society to draft the Plan.

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Mihir Shah (*mihir.shah@nic.in*) is Member, Planning Commission, Government of India.

India's Water Crisis

India faces a major crisis of water as we move into the 21st century. This crisis threatens the basic right to drinking water of our citizens; it also puts the livelihoods of millions at risk. The demands of a rapidly industrialising economy and urbanising society come at a time when the potential for augmenting supply is limited, water tables are falling and water quality issues have increasingly come to the fore. As we drill deeper for water, our groundwater gets contaminated with fluoride, arsenic and uranium. Both our rivers and our groundwater are polluted by untreated effluents and sewage that continue to be dumped into them. Climate change poses fresh challenges with its impacts on the hydrologic cycle. More extreme rates of precipitation and evapo-transpiration will exacerbate impacts of floods and droughts. Resilience of ecosystems needs, therefore, to become a central plank of policy. Our flood management strategies no longer seem to provide an adequate answer to growing flood frequency and intensity. It is no wonder then that conflicts across competing uses and users of water are growing by the day (Joy et al 2008).

Eighty per cent of India's water is used for irrigation. The two main sources of irrigation are canals and groundwater. The relative contribution of canal irrigation has been steadily declining over time while groundwater, especially that extracted through tubewells, has rapidly grown in significance over the last 30 years. But the alarming fact is that both these sources of water are now beginning to hit an upper limit.

Limits to Large Dams

Recent scholarship points to definite limits to the role new large dam projects can play in providing economically viable additional water storage (Ackerman 2011). A World Bank study shows that "there is little value to additional storage in most of the peninsular river basins (the Kaveri, Krishna and Godavari) and in the Narmada and Tapti" (Briscoe and Malik 2006: 32). Similarly, a study (Amarsinghe et al 2007) by the International Water Management Institute (IWMI) suggests that the Krishna and Kaveri have reached full or partial closure. Another IWMI study shows that in the Krishna river basin, the storage capacity of major and medium reservoirs has reached total water yield (Venot et al 2007), with virtually no water reaching the sea in low rainfall years. Concern has also been expressed that

> the capture of so much water within the basin and the evaporation of an additional 36 billion cubic metres (BCM) of water has changed the regional climate, increasing humidity and changing temperature regimes, aggravating saline ground water intrusion, and putting at risk the delicate wetland and estuarine ecology which is important not only for aquatic habitats and fisheries, but also for preventing shore

erosion. The lack of adequate environmental flows in the Krishna river has significantly aggravated water pollution problems from cities, since domestic and industrial effluents can no longer be sufficiently diluted by flowing water (Ackerman 201: 16).

Given these constraints, the trend increasingly is to locate new projects in relatively flat topography that multiplies disproportionately the areas to be flooded and the people to be evicted. It also tends to aggravate already contentious relations between states, as witnessed in the Polavaram dam in Andhra Pradesh, strongly opposed by both Odisha and Chhattisgarh.

Water flow in the Himalayan rivers, particularly the Ganga is, of course, far greater than in the peninsular rivers but here there are other constraints. In the Ganga plains, the topography is completely flat and storages cannot be located here. In a study for the Asian Development Bank, Blackmore (2010) has argued that surface irrigation through dams in the Ganga river basin is of low value since water tables are already high. Similarly for the Indus, Blackmore shows that "the next major dam (at a cost of $12 billion) will yield less than 1.5% increase in regulated flow".

There is also the problem that further up in the Himalayas we confront one of the most fragile ecosystems in the world. The Himalayas are comparatively young mountains with high rates of erosion. Their upper catchments have little vegetation to bind soil. Deforestation has aggravated the problem. Rivers descending from the Himalayas, therefore, tend to have high sediment loads. A 1986 study found that 40% of hydro-dams built in Tibet in the 1940s had become unusable due to siltation of reservoirs (K Pomeranz 2009). Studies by engineering geologists with the Geological Survey of India record many cases of power turbines becoming dysfunctional following massive siltation in run-of-the-river schemes. Climate change is making predictability of river flows extremely uncertain. This will rise exponentially as more and more dams are built in the region. Diverting rivers will also create large dry regions with adverse impact on local livelihoods (fisheries and agriculture). Rapid rise of the Himalayas (from 500 to 8,000 metres) gives rise to an unmatched range of ecosystems, a biodiversity that is as enormous as it is fragile.

The north-east of India is one of just 25 bio-diversity hotspots in the world (Myers et al 2000). According to Valdiya (1999), as also Goswami and Das (2002), the neo-tectonism of the Brahmaputra Valley and its surrounding highlands in the eastern Himalayas means that modifying topography by excavation or creating water and sediment loads in river impoundments can be dangerous. Quake-induced changes in the river system can adversely affect the viability of dams as several basic parameters of the regime of rivers and the morphology and behaviour of channels may change.

The last two major earthquakes in the region (1897 and 1950) caused landslides on the hill slopes and led to the blockage of river courses, flash floods due to sudden bursting of landslide induced temporary dams, raising of riverbeds due to heavy siltation, fissuring and sand venting, subsidence or elevation of existing river and lake bottoms and margins and the creation of new water bodies and waterfalls due to faulting" (Menon et al 2003). Even more recent research published in *Science* (Kerr and Stone 2009) on Zipingpu reservoir-induced seismicity as a trigger for the massive Sichuan earthquake in 2008, raises doubts about the wisdom of extensive dam-building in a seismically active region.

The ambitious scheme for interlinking of rivers also presents major problems. The comprehensive proposal to link Himalayan with the peninsular rivers for inter-basin transfer of water was estimated to cost around Rs 5.6 lakh in 2001. Land submergence and Resettlement and Rehabilitation (R&R) packages would be additional to this cost. There are no firm estimates available for running costs of the scheme, such as the cost of power required to lift water. There is also the problem that because of our dependence on the monsoons, the periods when rivers have "surplus" water are generally synchronous across the subcontinent. A major problem in planning inter-basin transfers is how to take into account the reasonable needs of the basin states, which will grow over time. Further, given the topography of India and the way links are envisaged, they might totally bypass the core dryland areas of central and western India, which are located on elevations of 300 + metres above mean sea level (MSL). It is also feared that linking rivers could affect the natural supply of nutrients through curtailing flooding of the downstream areas. Along the east coast of India, all major peninsular rivers have extensive deltas. Damming the rivers for linking will cut down the sediment supply and cause coastal and delta erosion, destroying the fragile coastal ecosystems.

It has also been pointed out that the scheme could affect the monsoon system significantly (Rajamani et al 2006). The presence of a low salinity layer of water with low density is a reason for maintenance of high sea-surface temperatures (greater than 28 degrees C) in the Bay of Bengal, creating low pressure areas and intensification of monsoon activity. Rainfall over much of the subcontinent is controlled by this layer of low saline water. A disruption in this layer could have serious long-term consequences for climate and rainfall in the subcontinent, endangering the livelihoods of a vast population.

The Crisis of Groundwater

As far as the possibilities of further groundwater development are concerned, the situation is perhaps even more difficult in large parts of the country. While public investments since Independence have focused largely on surface water, over the last three decades, groundwater has emerged as the main source of both drinking water and irrigation, based almost entirely on private investments by millions of atomistic decision-makers.[1] The relative ease and convenience of its decentralised access has meant that groundwater is the backbone of India's agriculture and drinking water security. Groundwater is a common pool resource (CPR), used by millions of farmers across the country. Over the last four decades, around 84% of the total addition to the net irrigated area has come from groundwater. India is by far the largest and fastest growing consumer of groundwater in the world. But groundwater is being exploited beyond sustainable levels and with an estimated 30 million groundwater structures in play, India may be hurtling towards a serious crisis of groundwater over-extraction and quality deterioration.

A recent assessment by NASA showed that during 2002 to 2008, India lost about 109 cubic km of water, leading to a decline in water table to the extent of 3-5 cm per annum

(Tiwari et al 2009). In addition to depletion, many parts of India report severe water quality problems, causing drinking water vulnerability. Nearly 60% of all districts in India have problems related to either the quantity or quality of groundwater or both. According to the Central Ground Water Board's latest assessment (CGWB 2009), at the all India level, the stage of groundwater development is now 61%. In Punjab, Haryana, Rajasthan and Delhi, this level has crossed 100%, closely followed by Tamil Nadu (80%) and UP (71%).

Need for a Paradigm Shift

Given this apparent emergence of limits to further development of water resources in large parts of the country, the Twelfth Plan faced a challenge of how to move forward. It was clear that business-as-usual would not do. New ideas needed to be desperately put into place for which the best scholars and practitioners had to come together. Thus, a new architecture of plan formulation was designed. The working groups for the Twelfth Plan in the water sector were, for the first time in the history of the Planning Commission, all chaired by renowned experts from outside government. Secretaries of concerned departments were designated co-chairs. There was initially great resistance to this move both within and outside government, with both sides showing great reluctance to work with each other. However, it was impressed upon them that only their working together could provide the solutions the country so desperately needed, given the emerging crisis that they all acknowledged. What was also clear was the need to arrive at a workable consensus on each issue, even where there were major disagreements. Over the course of several months in 2011-12, a new path was charted out, giving rise to a tenfold paradigm shift in water resource management in India. This paper outlines the main features of this change.[2]

Ten Elements of the Paradigm Shift

1 Large Irrigation Reform[3]

Given the emerging limits to further development in the major and medium irrigation (MMI) sector, the Twelfth Plan proposes a move away from a narrowly engineering-construction-centric approach to a more multidisciplinary, participatory management perspective, with central emphasis on command area development and a sustained effort at improving water-use efficiency, which continues to languish at a very low level. Given that nearly 80% of our water resources are consumed by irrigation, an increase in water use efficiency of irrigation projects by the Twelfth Plan goal of 20% will have a major impact on the overall availability of water not only for agriculture but also for other sectors of the economy.

Huge public investments over the last 60 years have meant that the irrigation potential created through MMI projects has increased nearly fivefold from 9.72 million hectares (mha) in the pre-Plan period to around 46 mha by the Eleventh Plan. The problem is that during the same period, the utilisation of this potential has failed to keep pace. From being almost equal in the pre-Plan period, the gap between the two has only grown wider over the years. The Twelfth Plan believes that improved utilisation of these capacities can dramatically add to irrigated area and also lead to a major improvement in water-use efficiency.

The key bottleneck so far has been that capacities of irrigation departments in many states to deliver quality services have failed to keep up with growing MMI investments. While states compete for capital investments in new MMI projects, they do little to manage them efficiently. In 2005, the World Bank estimated that to minimise deferred maintenance on Indian MMI systems, we need to spend Rs 19,000 crore on annual maintenance, which is nearly 20 times more than what states actually spend. State irrigation departments are content to generate enough revenue to meet their establishment costs, which many do from the water charges they recover by selling a small proportion of MMI water to industries. But this just covers salaries and leaves little or nothing for regular maintenance and upkeep of systems, especially canals and distribution systems. This has an adverse impact on irrigation.

This is closely linked to the fact that in many states the Irrigation Service Fee (ISF) to be collected from farmers has been abolished or is as low as 2-8% of dues. In this way, the accountability loop between farmers and irrigation departments is broken. Wherever ISF gets regularly collected, irrigation staff shows greater accountability and responsiveness to farmers. There is greater contact between the two, there is greater oversight of water distribution and farmers expect at least a minimal level of service if an ISF is demanded of them. When governments abolish ISF or fix it at a token rate or fail to undertake regular collection, farmers forfeit their right to demand service and irrigation staff can afford to neglect service provision. The Thirteenth Finance Commission took note of this and recommended a grant of Rs 5,000 crore over four years for providing central assistance to each state, linked to outcomes in terms of ISF collection, MMI performance and impacts. However, this incentive grant appears too small to nudge states to take up an aggressive irrigation reform agenda.

A substantial National Irrigation Management Fund (NIMF) is, therefore, being created to incentivise states to make the required paradigm shift. The NIMF will be a non-lapsable fund that reimburses to state irrigation departments a matching contribution of their ISF collection from farmers on a 1:1 ratio. In order to generate competition among MMI staff across commands, states would allocate the central grant to MMI systems in proportion to their respective ISF collection. To encourage Participatory Irrigation Management (PIM), the NIMF will provide a bonus on that portion of each state's ISF collection which has been collected through Water User Associations (WUAs). And this will be on condition that WUAs and their federations are allowed to retain definite proportions of the ISF, which would not only enable them to undertake repair and maintenance of distribution systems but also increase their stakes in water management. Similarly, to encourage volumetric water deliveries, NIMF will provide an additional bonus on that portion of a state's ISF collection which accrues through volumetric water supply to WUAs at the outlet level. The clear understanding is that empowering WUAs is the key to making the process of pricing of water and ISF collection more transparent and participatory. These proposals are

based on experience on the ground over the last few years in Andhra Pradesh, Gujarat, Maharashtra and Karnataka.

To enable irrigation departments to effectively play their new role in irrigation management transfer, their human resource profile needs to be broadened to include disciplines such as social mobilisation, management, agronomy, etc. Capacities of civil engineers will be reoriented to move them away from a narrow construction outlook towards management roles (as being done by their counterparts throughout the world). For this partnerships will be developed with national institutes of eminence to establish centres of excellence in irrigation management to undertake research, education and training for senior MMI managers in performance management through planning, budgeting and monitoring systems. Another set of partnerships will help build management information systems for MMI schemes with the specific purpose of generating real-time information on the working and performance of these systems to enable their benchmarking.

Our huge investments in irrigation have yielded much less than what they should have mainly because command area development (CAD) has been consistently neglected and divorced from building of irrigation capacities. The Twelfth Plan stipulates that all irrigation project proposals (major, medium or small) will henceforth include CAD works from the very beginning as an integral part of the project. Thus, each proposal will plan for irrigation water from the reservoir to the farm gate and not just the outlet as at present. No investment clearance will be provided to any irrigation project devoid of CAD integration. There will be pari passu action in each irrigation command wherein works in the distributary network and software activities of CAD will be undertaken simultaneously with head works and main canal work, leading to a seamless integration of work in the head-reaches and tail-end of the command. Recognition of potential creation at the outlet of distributary will be discontinued. Potential creation will be recognised only after complete hydraulic connectivity is achieved from reservoir to farm-gate. In this manner, creation of irrigation capacities will be better matched by their utilisation, farmers will truly benefit from these investments and water-use efficiency will improve.

2 Participatory Aquifer Management[4]

Since groundwater accounts for nearly two-thirds of India's irrigation and 80% of domestic water needs, the Twelfth Plan advocates the adoption of a participatory approach to sustainable management of groundwater based on aquifer mapping that takes into account the CPR nature of groundwater. As the work of Elinor Ostrom (1990) shows, the first design principle in management of a CPR is the clear delineation and demarcation of its boundaries. And an understanding of its essential features, which in the case of groundwater includes its storage and transmission characteristics.

It is this understanding that underpins the comprehensive programme for the mapping of India's aquifers initiated during the Twelfth Plan. The aquifer mapping programme is not an academic exercise and must seamlessly flow into a participatory groundwater management endeavour. This demands strong partnerships among government departments, research institutes, gram panchayats/urban local bodies, industrial units, civil society organisations and the local community. The interface of civil society and research institutes with government will be encouraged across all aspects of the programme, ranging from mapping India's aquifers, large-scale capacity building of professionals at different levels, action-research interface with implementation programmes and development of social-regulation norms around groundwater.

The challenge of groundwater management arises from the fact that a fugitive, CPR is currently being extracted by individuals, millions of farmers in particular, with no effective mechanism to ensure that the rate of extraction is sustainable. Over the last few years innovative approaches across the country have blazed a trail on how this paradox might be resolved. This requires an understanding of the following aspects:

- Relationship between surface hydrologic units (watersheds and river basins) and hydrogeological units, i e, aquifers;
- The broad lithological set-up constituting the aquifer with some idea about the geometry of the aquifer – extent and thickness;
- Identification of groundwater recharge areas, resulting in protection and augmentation strategies;
- Groundwater balance and crop-water budgeting at the scale of a village or watershed;
- Groundwater assessment at the level of each individual aquifer in terms of groundwater storage and transmission characteristics, including the aquifer storage capacity;
- Regulatory options at community level, including drilling depth (or whether to drill tubewells or borewells at all), distances between wells (especially with regard to drinking water sources), cropping pattern that ensures sustainability of the resource (aquifer) and not just the source (well/tubewell), comprehensive plan for participatory groundwater management based on aquifer understanding, bearing in mind principles of equitable distribution of groundwater across all stakeholders.

Each of these will be the central focus of the National Aquifer Management Programme being launched in the Twelfth Plan.

3 Breaking the Groundwater-Energy Nexus

The current regime of power subsidies for agriculture has had a major role to play in deteriorating water tables in most parts of India. These very same power subsidies fuelled the green revolution but given the emerging stresses on groundwater, an imaginative way needs to be found, which breaks the groundwater-energy nexus, without hurting farmer interests. The single most effective solution found by states has been the physical segregation of power feeders to provide 24×7 electricity to rural habitations and non-farm users, with separate feeders giving 3-phase predictable supply to agriculture, which is rationed in terms of total time, at a flat tariff. This provides requisite power to schools, hospitals and the non-farm economy, while allowing rationed supply of power to agriculture, which can be at off-peak hours. For example, the Government of Gujarat invested Rs 5,600 crore during 2003-06 to separate 8,00,000 tubewells from other rural connections and imposed an eight hour/day power ration but of high quality and full voltage.

This was combined with a massive watershed development programme for groundwater recharge. The net result has been: (a) halving of the power subsidy; (b) stabilised groundwater draft; and (c) improved power supply in the rural economy. Combined with other measures such as High Voltage Distribution System (HVDS), especially designed transformers and energy-efficient pumpsets, this could be a better way of delivering power subsidies that cuts energy losses and stabilises the water table at the same time. Major investments are proposed in this direction in the Twelfth Plan.

4 Watershed Restoration and Groundwater Recharge[5]

Even while emphasising the need to improve the efficiency and sustainability of our irrigation systems, the Twelfth Plan is fully cognisant of the fact that the demands of national food security necessitate a major breakthrough in the productivity of our rainfed areas.[6] A primary requirement for this is a massive programme for watershed restoration and groundwater recharge. The Twelfth Plan proposes to move in this direction by transforming Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) into our largest watershed programme, giving renewed energy to the reformed Integrated Watershed Management Programme (IWMP) launched in the Eleventh Plan and launching a completely revamped programme on Repair, Renovation and Restoration (RRR) of Water Bodies.

Given the massive investments government is making on MGNREGA and its central thrust on water conservation and drought-proofing, the programme offers the best bet to undertake watershed restoration and groundwater recharge at a large scale. The new MGNREGA guidelines[7] issued by the Ministry of Rural Development in 2012 herald the beginning of MGNREGA 2.0, which envisions a programme whose success will, in itself, pave the way for its downscaling. A large proportion of MGNREGA workers are small and marginal farmers, the productivity of whose lands has been so decimated over the years, that they have been compelled to work under MGNREGA. The real success of MGNREGA lies in creating the foundational water infrastructure that enables raising the agricultural productivity of millions of these farmers. They will then be able to return once again to farming and will no longer need to depend on MGNREGA for their survival.

MGNREGA 2.0 has expanded the list of permissible works to include many activities that build on watershed restoration to attain livelihood security. The aim is to convert the programme into a productivity-enhancing instrument based on a watershed approach. This derives from many such experiences scattered across the country that have brought about remarkable transformation.[8] Planning and implementation of works by gram panchayats (GPs) will be facilitated by multidisciplinary cluster facilitation teams that will operate at the milli-watershed/aquifer levels but with full accountability to GPs.

New guidelines have also been issued for the IWMP in 2012.[9] The Eleventh Plan proposed a radically new approach based on the suggestions of the Technical Committee on Watershed Programmes in India (Parthasarathy Committee). However, in a comprehensive review of the programme carried out by the union minister for rural development in 2012, it emerged that a number of practical impediments were coming in the way of putting the new paradigm of watershed management into practice on the ground and the pace of the programme was found to be less than satisfactory. A Planning Commission Committee has now revised the guidelines to provide necessary flexibility and momentum to the programme, even while strengthening its innovative features. One of the key deficiencies of the programme was found to be the shortage of funds to deploy high-quality professional human resources for both social and technical aspects for which a special allocation has now been proposed. A new national strategy for capacity-building has been unveiled, since this was a key requirement of the programme that needed much greater direction and momentum. A separate provision has also been made for institution building to ensure sustainability of benefits beyond the project period. All reviews of the watershed programme show that the best work has been done by civil society organisations. The new guidelines seek to provide further scope and facilitation for civil society participation in the programme. A major concern, especially in tribal areas, is the procedural complexities of work in ridge areas that fall within forestlands. The new guidelines proffer a framework within which this work can be facilitated.

There is a rich historical tradition of local water harvesting in India from the *ahar-pyne* system in Bihar, the *tankas* of Rajasthan, the Himalayan *dharas*, the *talabs* in Bundelkhand to the *eries* of Tamil Nadu. According to the 4th Minor Irrigation Census (2006-07), there are 5.56 lakh water bodies in the country, out of which 3.02 lakh are publicly owned. Tragically, many of these water bodies have been languishing in a state of disrepair and disuse. A scheme for the repair, renovation and restoration of these water bodies was launched in 2005. The Twelfth Plan proposes a major overhaul of this scheme. The major change is to place greater emphasis on not merely the physical repair and desilting of the water body itself but to address the two major challenges that limit their potential benefits to users – restoring the health of their catchment areas that would reduce the rate of siltation and prolong their life and developing the command areas that are served by these water bodies. Thus, to realise its full potential, the RRR scheme must combine work that is generally done in separate silos of watershed treatment and command area development. It needs also to absorb the central lesson of both these schemes, which is that not merely engineering but institution-building must equally take centre stage. This would enable stakeholders to fully participate in the planning and implementation of the scheme and feel a full sense of ownership over the work done and assets created/restored. Without such participation and ownership, the outcomes will be necessarily short-lived and unsustainable. During the Twelfth Plan, RRR will cover all water bodies with ayacuts of 20 to 2,000 ha.

5 A New Approach to Rural Drinking Water and Sanitation[10]

A progressive movement towards universal coverage of rural habitations with safe drinking water has been reported over the years. The difficulty has been that even as coverage

increases, there is the growing problem of "slipback", with habitations suffering a fall in the water table and water quality, especially given the growing dependence on groundwater. The fact that the same aquifer is being tapped for both irrigation and drinking water, without any coordinated management of the resource, has greatly aggravated availability of drinking water. Indeed, we are close to entering a "vicious infinite regress" (Wittgenstein 1953, Section 239) scenario, where an attempt to solve a problem reintroduces the same problem in the proposed solution. If one continues along the same lines, the initial problem will recur infinitely and will never be solved. This regress appears as a natural corollary of "hydroschizophrenia" (Llamas and Martinez-Santos 2005; Jarvis et al 2005), which entails taking a schizophrenic view of an indivisible resource like water, failing to recognise the unity and integrity of the hydrologic cycle. Thus, tubewells drilled for irrigation are more and more drying up the aquifers being used for drinking water.

Lack of convergence with sanitation, on the other hand, compromises water quality, even as it makes provision of improved sanitation difficult. Water quality has also been affected chemically due to geogenic leaching (arsenic and fluoride). Poor operation and maintenance has resulted in high rates of attrition and dilapidated facilities. This has happened mainly because primary stakeholders do not feel a sense of ownership over the facility created and in the absence of sufficient support structures and professional capacities, upkeep suffers. On the other hand, where people have been centrally involved, they have both paid for the service provided and felt a stake in maintaining the assets, garnering adequate support for the same through the revenues generated. There are also disturbing reports about social exclusion, with dalits and adivasis being discriminated against.

This understanding of the flaws in the drinking water programme has prompted the adoption of a new approach based on the principle of subsidiarity that seeks solutions to these problems as close to the ground as possible. Decisions on location, implementation, sustainability, O&M and management of water supply schemes will be devolved to local drinking water and sanitation committees with an umbrella role for GPs for effective implementation. A management devolution index (MDI) will track and incentivise more substantive devolution of functions, funds and functionaries to the GPs. The problem of vicious infinite regress can only be tackled through the sustainable and participatory aquifer management approach described earlier, so that the left hand of drinking water knows what the right hand of irrigation is doing.

Convergence between drinking water supply and sanitation will be strengthened taking up villages covered with piped water supply to get open defecation free (ODF) status on priority and vice versa. Waste water treatment and recycling will be an integral part of every water supply plan or project. Management of liquid and solid waste will be promoted together with recycling and reuse of grey water for agriculture and groundwater recharge and pollution control. This will be done on priority in Nirmal Gram Puraskar (NGP) villages.

The Total Sanitation Campaign (TSC) was launched in 1999 as a demand-driven, community-led programme. But progress remains far from satisfactory. Open defecation by around 600 million people is our biggest national shame. Latest census data reveals that the percentage of households having access to television and telephones in rural India in 2011 exceeds the percentage of households having access to toilet facilities and tap water. The APL-BPL distinction and the very low incentive under the TSC have played havoc with the programme.

Thus, the Twelfth Plan proposes a major shift in strategy. The APL-BPL distinction and the focus on individual toilets are to be replaced by a habitation-saturation approach. The idea is not to sacrifice quality and sustainability of outcomes in the mad rush to attain targets, even if this means moving somewhat slower in reaching universal coverage. Through a convergence with MGNREGA, the unit cost support for individual household latrines has been raised to Rs 10,000. Toilet designs will be fine-tuned in accordance with local social and ecological considerations. In order to focus more centrally on sustainability of outcomes, the programme will be taken up in a phased manner wherein GPs shall be identified, based on defined criteria of conjoint approach to sanitation and water supply, for achievement of NGP status. This would progressively lead to Nirmal blocks, Nirmal districts and eventually Nirmal states.

The Twelfth Plan proposes a huge jump in outlays for rural sanitation and drinking water. Scholarly work on the relationship between sanitation and health provides strong support for such a move. An article in *Lancet* (Humphrey 2009) suggests that the impact of sanitation and hygiene interventions on child under-nutrition has been seriously undervalued in the existing research as this effect has been modelled entirely through diarrhoea. The study argues that a key cause of child under-nutrition is a sub-clinical disorder of the small intestine known as tropical enteropathy. This is caused by faecal bacteria ingested in large quantities by young children living in conditions of poor sanitation and hygiene. The study finds that provision of toilets and promotion of hand washing after faecal contact could reduce or prevent tropical enteropathy and its adverse effects on growth; and that the primary causal pathway from poor sanitation and hygiene to under-nutrition is tropical enteropathy and not diarrhoea.

A recent study of the TSC (Spears 2012)[11] finds that at mean programme intensity, infant mortality decreased by four per thousand and children's height increased by 0.2 standard deviations. Relative to other children born in the same districts or in the same years, rural children exposed to better sanitation in their first year of life were more likely to survive infancy. Districts in which more latrines were constructed over this period saw a greater decline in rural infant mortality rates, controlling for other changes. Rural children born in years and districts with more TSC latrines available in the first year of their lives are taller than children born in other years or districts.

6 Conjoint Water and Wastewater Management in Urban India[12]

The challenges of safe drinking water and waste management are perhaps even greater in urban India. The Twelfth Plan will focus on the need to invest in water and waste management in

human settlements based on a strategy that is both affordable and sustainable. Indian cities and industries have to reinvent their water trajectory to both secure the water they need and do so in a way that minimises the scope for conflict with rural areas and agriculture. Indian cities and industries need to find ways to grow with minimal water and minimal waste. As important as the quantum of water to be supplied, is the problem of its management and equitable supply to all. In most cities, water supply is sourced from long distances and the length of the pipeline determines the costs, including costs of pumping. In the current water supply system, there are enormous losses in the distribution system because of leakages and bad management. But equally, there are huge challenges, for water is divided very unequally within cities. As per the National Sample Survey (NSS) 65th round, only 47% urban households have individual water connections. Currently, it is estimated that as much as 40-50% of the water is "lost" in the distribution system. Most cities spend anywhere between 30% and 50% of their water supply accounts on electricity to pump water. As the distance increases, the cost of building and then maintaining the water pipeline and its distribution network also increases. And if the network is not maintained then water losses also increase. The end result is that the government finds it impossible to subsidise the supply of water to all and, therefore, does not deliver water as needed. The poor are typically the worst-affected as they have to spend a great deal of time and money to obtain water since they do not have house connections.

Even as cities worry about water, they need to focus on the waste this water will generate. Sewage invariably goes into streams, ponds, lakes and rivers of the town, polluting the waterworks so that health is compromised. Alternatively, it goes into the ground, contaminating the same water, which will be used by people for drinking. It is no surprise then that surveys of groundwater are finding higher and higher levels of microbiological contamination – a sign of sewage contamination. This compounds the deadly and costly spiral. As surface water or groundwater gets contaminated, the city has no option but to hunt for newer sources of its supply. Its search becomes more extensive and as the distance increases, the cost of pumping and supply increases.

The 2011 Census reveals that only 32.7% urban Indians are connected to a piped sewer system and 12.6% – roughly 50 million urban Indians – still defecate in the open. Large parts of the modern cities remain unconnected to the sewage system as they live in unauthorised or illegal areas or slums, where the state services do not reach. In this situation, it is critical, we invest in sewage systems, but it is equally and even more critical that we invest in building affordable and scalable sewage networks, which requires a fresh look at the current technology for sewage and its treatment. If sewage systems are not comprehensively spread across the city to collect, convey and intercept waste of all, then pollution will not be under control. Currently, according to estimates of the Central Pollution Control Board, the country has installed capacity to treat only about 30% of the excreta it generates. Just two cities, Delhi and Mumbai, which generate around 17% of the country's sewage, have nearly 40% of the country's installed capacity. What is worse, some of these plants do not function because of high recurring costs (electricity and chemicals) and others because they do not have the sewage to treat. In most cities, only a small (unestimated) proportion of sewage is transported for treatment. And if the treated sewage – transported in official drains – is allowed to be mixed with the untreated sewage – transported in unofficial and open drains – then the net result is pollution.

The added problem is that the location of the hardware – the sewage treatment plant – is not designed to dispose off the treated effluent so that it actually cleans the water body. Most cities do not seem to think of this factor when they build their infrastructure for sewage. They build a sewage treatment plant where there is land. The treated sewage is then disposed off, as conveniently as possible, invariably into a drain.

Towards Sustainable Solutions

Nothing less than a paradigm shift is required in the Twelfth Plan if we are to move towards sustainable solutions to urban water and waste management:

(1) Investments in water supply must focus on demand management, reducing intra-city inequity and on quality of water supplied. This will require cities to plan to cut distribution losses through bulk water meters and efficiency drives. User charges should plan to cover increasing proportions of operation and maintenance (O&M) costs, while building in equity by providing "lifeline" amount of water free of charge, with higher tariffs for increasing levels of use.

(2) Each city must consider, as first source of supply its local water bodies. Therefore, cities must only get funds for water projects, when they have accounted for the water supply from local water bodies and have protected local water bodies and their catchments. This precondition will force protection and will build the infrastructure, which will supply locally and then take back sewage also locally. It will cut the length of the pipeline twice over – once to supply and the other to take back the waste.

(3) No water scheme will be sanctioned without a sewage component. Planning for "full coverage and costs" will lead cities to look for unconventional methods of treating waste. For instance, cities would then consider treatment of sewage in open drains and treatment using alternative biological methods of waste water treatment. Biological methods of waste water treatment introduce contact with bacteria (cells), which feed on the organic materials in the waste water, thereby reducing its BOD content. Through their metabolism, the organic material is transformed into cellular mass, which is no longer in solution but can be precipitated at the bottom of a settling tank or retained as slime on solid surfaces or vegetation in the system. The water exiting the system is much clearer than the one that entered it. The principle has to be to cut the cost of building the sewage system, cut the length of the sewage network and then to treat the waste as a resource – turn sewage into water for irrigation or use in industry. Indian cities have the opportunity to leapfrog into new ways of dealing with excreta, which are affordable and sustainable, simply because they have not yet built the infrastructure.

(4) Cities must plan for reuse and recycling of waste at the very beginning of their water and waste plan and not as an

after-thought. It is also clear that cities must think through the plan for reuse for affordability and sustainability. The diverse options for reuse must be factored in – use in agriculture, for recharge of water bodies, for gardening and for industrial and domestic use. In each case, treatment plan will be different. But in all cases, the treated effluent will improve the hydrological cycle. It will return water and not waste to the environment. While a larger sewage treatment plant affords economies of scale in operation, a plant fitted to size – collecting the waste of a group of houses, an institution or even colonies – may have higher costs of operations but there are substantial savings in the piping and pumping cost.

7 Industrial Water[13]

As the economy industrialises, it is extremely important that industry adopts the best international practices to improve water use efficiency. This can be broadly done in two ways: (i) reducing the consumption of fresh water through alternative water-efficient technologies or processes in various manufacturing activities; and (ii) reusing and recycling the waste water from such water intensive activities and making the reclaimed water available for use in the secondary activities within or outside the industry.

Such an approach is extremely important to reduce the water footprint of Indian industry, both in terms of fresh water used, as also polluted wastewater released untreated into the environment. The urgency of this issue is because water conflicts are increasingly arising across the length and breadth of India between competing users and uses. And industry, as a relatively new user of water, needs to recognise that economising on the use of water is now an essential ingredient in ensuring sustainability of its operations and may be in its own enlightened self-interest.

The first step in this direction during the Twelfth Plan period will be to make comprehensive water audits a recurring feature of industrial activity so that we know what is being used by the industrial sector at present so that changes can be monitored and the most cost-effective basket of water efficiency technologies and processes designed and implemented to reduce water demand and increase industrial value added per unit of water consumed. The water audit will consider both quantity and quality aspects as the need to reduce polluting discharges to the aquatic environment or to sewage systems is often the key driver to water saving. The starting point will be large units in water-intensive industries such as paper and pulp, textiles, food, leather (tanning), metal (surface treatment), chemical/pharmaceutical, oil/gas and mining.

It is proposed to make it mandatory for companies to include every year in their annual report, details of their water footprint for the year. This would include (i) the volume of fresh water (source-wise) used by them in their various production activities (activity-wise), (ii) the volume of water used by them that was reused or recycled (again activity-wise), and (iii) a commitment with a time-line that the company would reduce its water footprint by a definite amount (to be specified) within a definite period of time (to be specified).

The second step would be to examine the measures to levy charges for water use and incentivise water conservation. Currently, the Water (Prevention and Control of Pollution) Cess Act 1977 is the only instrument to impose cess on discharge of effluent water from industrial units. This charge is based on the quantum of discharge from the industry and is used to augment the resources of the central and state pollution boards. The charges imposed through the water cess are not enough of a disincentive for industries to reduce their water footprint. It is important to examine this Act and other provisions and options to increase the charges imposed on water use and effluents substantially. This is particularly important where industries use groundwater and do not pay municipalities, water utilities or even irrigation departments for water use. The importance of water pricing as an instrument for change is critical.

The third step would be to publicly validate the water audit of industries so that this builds experience and confidence on the best practices. This water reduction commitment of each industry will be tracked for compliance and enforcement through environmental regulatory institutions. In order to more credibly move industry along this path, central and state governments need to set an example by undertaking their own audits of water use in their premises and setting targets for ensuring less water use and changes in technology and behaviour that will reduce waste. It is also very important to develop a forum which would (i) provide information on industry-specific good practices in wise water use; (ii) undertake to develop expertise in water audits and water use advisory services; (iii) provide details of "exemplar" case studies that are relevant to the different industrial sectors operating in India; and (iv) provide a "gateway" for accessing information about water saving and water efficiency technologies in rain-water harvesting, recycling and reuse, water conserving devices and support to helping behaviour change.

Once such systems are in place, there is enough experience from across the world to show that significant economies can be effected in water use. Reported water savings range from 15% to 90% of current water use, depending on the industrial sub-sector considered, the individual process investigated or the combination of water saving measures analysed, with the most commonly found figures being within the 30-70% range.

8 Renewed Focus on Non-Structural Mechanisms for Flood Management[14]

In addressing the problem of floods, the central focus over the years has been on engineering/structural solutions. Apart from the massive investments in large dams, India has already constructed over 35,000 km of embankments. But these are rapidly reaching their limits. Recent studies show, for example, that

> the existing storage infrastructure in Peninsular rivers is mostly designed to smooth out the southwest monsoon flows in, say, nine out of 10 years. There may still be the one in 10 year flood, for which, however, there is no economic justification to invest in substantial additional infrastructure. Instead, better weather and flood forecasting is required, along with flood insurance and possibly the designation of flood diversion areas, whereby farmers are asked to temporarily (and against compensation) set aside embanked land to accommodate flood

> overflow...for the Ganges system, out of 250 BCM of potentially utilisable water, about 37 BCM are presently captured, and a total of at most 50 BCM would be captured if all possible dams under consideration were to be built. These would add little in the way of irrigation or flood prevention benefits. Tributaries at risk are already fully embanked, and floods have occurred not because water has flown over the embankments, but because embankments have been repeatedly breached as a result of poor maintenance (e g, Kosi in Bihar) or inappropriate dam management (e g, Hirakud in Orissa) (Ackerman 2011).

Evidence from floods in the Ghaggar river basin, both in 1993 and 2010, clearly shows the damage caused in Punjab and Haryana by breaches in embankments and unused, poorly designed and maintained canals, as also because settlements have been encouraged on flood plains and drainage lines. In 2008, a breach in an upstream embankment of the Kosi led to the nearly thousand deaths and the displacement of around 3.35 million people (Government of Bihar 2008). In north Bihar, despite the continued construction of embankments, the flood-prone area has increased 200% since independence, at times because embankments end up obstructing natural drainages and impede the natural building up of river deltas and flood plains.

In acknowledgement of the limits to further possibilities of building large storages and embankments, some state governments (such as Bihar) have decided to broaden their strategy of tackling floods by placing greater emphasis on rehabilitation of traditional, natural drainage systems, leveraging the funds available under MGNREGA (Samaj Pragati Sahayog and Megh-Pyne Abhiyan 2012). Since this involves a process of complex social mobilisation and social engineering, civil society organisations will work in close partnership with the state government in this endeavour. The Twelfth Plan strongly endorses such a paradigm shift in flood management away from building more and more embankments and towards a "room for the river"[15] kind of approach.

Indeed, an attempt will be made to, as far as practicable, convert adversity into opportunity. Part of the waterlogged area could be used for construction of small multi-purpose farm ponds. The mud of the ponds would be raised on the side as embankments on which crops like banana, papaya, mango, pigeon pea and cashew nut can be grown. The pond water will be used to irrigate the non-waterlogged, upland area. Experiments have shown that in waterlogged areas, cultivation of water chestnut (*Trapabi spinosa*) can be quite profitable. Research and field level trials have identified extra-tall varieties of paddy that can grow fast and can tolerate waterlogging. Waterlogging is often aggravated by the mismanagement of rainwater in the upper catchment. In-situ rainwater conservation in the upper catchment and intensification of the use of groundwater through shallow tubewells are possible interventions to mitigate the problem. Through integrated management of land, water and nutrients, agricultural productivity of these uplands could be stabilised and enhanced, which would, in turn, have a positive impact on the waterlogged lowlands.

In addition, far greater priority will be given to non-structural measures such as the efficient management of flood plains, flood plain zoning, disaster preparedness and response planning, flood forecasting and warning, along with disaster relief, flood fighting including public health measures and flood insurance. Many reservoirs were initially constructed without any flood cushion but with development and population growth, habitations have come up very close to the downstream of these reservoirs and operation of such reservoirs needs to be done carefully. The existing flood forecasting network of Central Water Commission (CWC) is not sufficient to cover the entire country adequately. The Twelfth Plan will draw up a concrete plan for extension of CWC's flood forecasting network in consultation with the state governments and IMD to cover A, B-1, B-2 and C-class cities located near rivers under the network of automatic data collection, transmission and flood information dissemination. At present, the CWC provides inflow forecast to 28 reservoirs in the country. In the Twelfth Plan this will be extended to an additional 160 reservoirs, which will cover 80-90% of the total live storage capacity.

Moreover, a majority of the flood warning systems in India is not timely, primarily due to poor transmission. Delays cause enormous damage to property and lives every year. Models used for flood forecasting and its influence zones are not rigorous enough due to a lack of integration of hydrology and the weather forecasting systems. The lead time for flood forecasting can be improved through the use of hydraulic and hydrologic models which are linked to the weather forecasting system, the real time data acquisition system, and the reservoir operation system. It is possible to improve the current forecasting methods by using satellite-based information for better estimates of rainfall and snowmelt.

In order to support the manifold paradigm shift in water management described above, two major enabling initiatives are being taken in the Twelfth Plan. These are in the area of water database development and management and in fashioning a new legal and institutional architecture.

9 Water Database Development and Management[16]

As part of the preparation for the Twelfth Plan, the Planning Commission decided to constitute, for the first time, a working group to carry out a comprehensive and critical review of the present system for collection and dissemination of water-related data, identify deficiencies in the data being generated and used for planning and policy, and to suggest a programme of action to overcome them. The working group highlights serious gaps and inadequacies in the scope, coverage and quality of data currently used for assessing India's potential and utilisable water resources from different sources, their actual utilisation for, and impact on, various end uses. It also spells out a concrete programme for phased action to improve physical facilities, methodologies and mechanisms to generate more comprehensive, detailed and reliable data and outlines changes needed in institutional arrangements for collection validation and dissemination of data and for facilitating intensive analysis through research.

Data improvement is a national effort of the central and the state government agencies that requires active involvement of specialised government agencies and scholars in universities, research institutions and non-governmental organisations in a

way that fragmentation of focus and effort is minimised. This calls for a common agreed framework of concepts. It is, therefore, suggested by the working group that the central government take the lead in creating appropriate institutional arrangements to ensure independent and professional conduct of the surveys, providing financial and technical support to the states, ensuring that all agencies follow prescribed protocols to transmit data to the central pool and to work out (a) the strategy, modalities and funding for building a comprehensive, technical and scientific data base on potential and utilisable water from different sources; (b) details of the scope, content, methodology and mechanisms of the surveys to assess performance and impact of programmes through sample surveys of users and specific projects; and (c) the design of an integrated and digitised National Water Resources Information System by suitably expanding, reorganising and equipping the existing Water Resource Information System in the Central Water Commission.

The bulk of the expenditure on the programmes for data improvement in the Twelfth Plan will be for expanding and upgrading facilities for assessment of resource potential and utilisation. Sample surveys to assess actual performance and impact of schemes at the ground level will be a small but critical component. Altogether this small investment in improving information and knowledge will provide huge returns in terms of improving efficiency and sustainability of water use.

10 New Institutional and Legal Framework

State-level Regulators[17]

The Twelfth Plan recognises the need to evolve an institutional framework backed by a legal regime that facilitates setting up of regulatory bodies that would enable resolution of water conflicts. To protect the right to drinking water for all, there is no alternative to entitlements and appropriate pricing of water. This demands a transparent and participatory process of determination of entitlements and prices. Again to ensure sustainability and meet environmental needs, a regulatory authority is a must in each state.

Since the water sector is a natural monopoly, international experience clearly indicates that it is regulators who provide the cutting-edge that is otherwise missing in a non-competitive environment. Regulators have contributed to major improvements in water-use efficiency, water quality and provision of environmental services.[18] And given the impact that their operations can have on public health and the environment, the water and wastewater industry have to be highly regulated to protect customer interests. The water quality, environment and health standards set by the regulator have a bearing on tariffs. The final call on tariffs would, of course, be a political one but the regulators have a crucial role in advising governments on the objective basis for tariff determination (somewhat akin to what the Commission on Agricultural Costs and Pricing (CACP) does for agriculture pricing). The basic requirements of drinking water and of the environment need to be determined and ensured in a transparent manner and kept as a "Reserve" (as it is called, for example, in South Africa).[19] The determination of this level requires an independent regulator who can transparently, accountably, and in a participatory manner conduct the processes and procedures required for this.

As part of the Twelfth Plan, a model bill for state water regulatory system has been drafted.[20] This draft is based on a thorough study of latest international thinking on regulation as also the experience of the Maharashtra Water Resources Regulatory Authority (MWRRA). The draft bill tries to resolve the conflicting demands of autonomy and accountability brought into sharp relief by the Maharashtra experience. It does so by proposing a regulatory system with inter-related but separate institutions that handle distinct governance functions. The bill proposes a separation of the authority to make "political" or 'normative' decisions and the authority to make "technical" or "predominantly non-normative" decisions. Thus, the State Water Regulatory and Development Council (SC) is expected to ensure accountability by providing the "normative" or "political" framework for the techno-economic regulatory decisions of the State Independent Water Expert Authority (SIWEA). The SIWEA will, in turn, be accountable to technical experts through the mechanism of regular peer reviews.

The model bill incorporates the principle of subsidiarity by laying out water governance at four levels: (i) state, (ii) river basin, (iii) sub-basin, and (iv) local. At all these four levels of governance, institutions with different structure, compositions, functions, authorities, and roles are provided for in the bill. The apprehension that such decentralisation might prove dysfunctional or sub-optimal, especially because of the lack of capabilities and understanding, is sought to be taken care of through the concept of phased institutional transition by providing step-wise, gate-protected processes for gradual introduction of the decentralised institutional structure.

The bill also builds in enough flexibility in its design to take care of differences across states through a modular structure, from which modules based on the state-specific situation, requirements, priorities of water sector governance, and other factors could be selected by the state government while preparing and enacting their final draft of the bill.

New Groundwater Law[21]

Sustainable and equitable management of groundwater based on aquifer management requires a new legal framework to support efforts in this direction. Since the 1970s, the Government of India has put forward several model bills to regulate groundwater for adoption by the states. But these model bills only introduce a limited regulatory framework and amount to little more than "grandfathering" existing uses. What is remarkable is that some of the most important legal principles governing groundwater even today were laid down in British common law as early as the middle of the 19th century and have not been updated since.

Existing rules of access to and control over groundwater are still based on the common law doctrine of absolute dominion. This gives the landowner the right to take substantially as much groundwater as desired from wells dug on own land. Landowners do not own groundwater but enjoy access as

part and parcel of their ownership rights to the land above.[22] Contrary to established hydrogeology, a distinction is also made between "defined" and "undefined channels": "Groundwater that percolates through underground strata, which has no certain course, no defined limits, but which oozes through the soil in every direction in which the rain penetrates is not subject to the same rules as flowing water in streams or rivers".[23] On the other hand, where groundwater was found to flow in defined channels, case law says that rules applicable to surface water would also apply. This has been interpreted[24] to mean that the right of the landowner would then be limited to use and consumption for household and drinking purpose, for watering their cattle and even for irrigating their land or for purposes of manufacture provided that the use is reasonable, it is required for their purposes as owners of the land and it does not destroy or render useless or materially diminish or affect the application of the water by riparian owners below the stream in the exercise either of their natural right or right of easement, if any.

A lot of legal hermeneutics was devoted over the years to clearly spelling out the distinction between defined and undefined channels of groundwater.[25] This differentiation is completely meaningless in scientific hydrogeological terms since groundwater occurs in aquifers, which do not necessarily take the form of "channels" like streams and rivers. Aquifers are rocks or rock material possessing the capacity to store water in different openings and transmit water from one point in the aquifer to another, due to the interconnectedness between these openings. Hence, the question of water flowing through streams generally does not arise.[26]

Indeed, water flowing underneath any parcel of land may or may not be generated as recharge on that specific parcel. Recharge areas for most aquifers are only a small part of the land that overlies the entire aquifer. Hence, in many cases, water flowing underneath any parcel of land will have infiltrated the land and recharged the aquifer from another parcel, often lying at a distance. When many users simultaneously pump groundwater, complex interference results between different foci of pumping, a common feature in many parts of India, where wells are located quite close to one another. In such situations, natural groundwater flow is changed and groundwater moves depending upon the distribution of pumped water levels in different parts of the aquifer, again making it difficult to create rules based on defined streams of water akin to surface water movement.

What is worse, the present legal framework only considers the interests of landowners, completely overlooking the hugely important fact that groundwater serves the basic needs of life of so many people who do not own land. New developments in jurisprudence have created both the basis and the necessity to redefine the legal framework for groundwater. These include (i) new water law principles (for instance, the Public Trust Doctrine enunciated by the Supreme Court),[27] which suggest that water, and groundwater specifically, is a public trust and that the state at all levels (from the panchayat to the state government) is the custodian of the resource,[28] (ii) environmental law principles (for instance, the precautionary principle), (iii) decentralisation principles embodied in the 73rd and 74th amendments to the Constitution, (iv) changes in irrigation law focusing on participatory irrigation management over for the past 15 years and implemented in a number of states,[29] (v) the fundamental right to water that has been a part of Indian law for the past two decades[30] and (vi) protection principles, such as the prevention and precautionary principles, most recently statutorily recognised in the National Green Tribunal Act, 2010 (Section 20).

Keeping these in mind, the Twelfth Plan has proposed a new Model Bill for the Protection, Conservation, Management and Regulation of Groundwater.[31] It is based on the idea that while protection of groundwater is key to the long-term sustainability of the resource, this must be considered in a framework in which livelihoods and basic drinking water needs are of central importance. The overall objectives of the model bill are to (i) regulate iniquitous groundwater use and distribution to ensure that the safe and secure drinking water/domestic needs of every person and irrigation needs of small and marginal farmers can be met; (ii) regulate over-extraction of groundwater in order to ensure the sustainability of groundwater resources, equity of their use and distribution, and to ensure fulfilment of ecosystem needs; (iii) promote and protect community-based, participatory mechanisms of groundwater management that are adapted to specific locations; (iv) prevent and mitigate contamination of groundwater resources; (v) promote and protect good conservation, recharge and management practices; and (vi) protect areas of land that are crucial for sustainable management of groundwater and ensure that high groundwater consuming activities are not located in areas unable to support them.

National Water Framework Law[32]

The Twelfth Plan sub-group to draft a National Water Framework Law (NWFL) states that while under the Indian Constitution water is primarily a state subject, it is an increasingly important national concern in the context of: (a) the right to water being a part of the fundamental right to life; (b) the emergence of a water crisis; (c) the inter-use and interstate conflicts that this leads to, and the need for a national consensus on water-sharing principles, and on the arrangements for minimising conflicts and settling them quickly; (d) the threat posed by the massive generation of waste by various uses of water and the severe pollution and contamination caused by it; (e) the long-term environmental, ecological and social implications of efforts to augment the availability of water for human use; (f) the equity implications of the distribution, use and control of water between uses, users, areas, sectors, states, countries and generations; (g) the international dimensions of some of India's rivers; and (h) the emerging concerns about the impact of climate change on water and the need for appropriate responses at local, national, regional, and global levels.

The above considerations cast several responsibilities on the central government. Some of these can be dealt with only partially under existing laws. Several states are enacting laws and developing schemes on water and related issues. These can be quite divergent in their perceptions of water. Some divergences of policy and law may be inevitable and acceptable, but they

have to be within reasonable limits set by a broad national consensus on certain basics. State governments tend to adopt different positions on the rights of different states over the waters of a river basin that straddles more than one state. Such legal divergences tend to render the resolution of interstate river-water conflicts even more difficult than they already are. A national statement of the general legal position and principles that should govern such cases seems desirable. Water, like air, is one of the most basic requirements for life. If a national law is considered necessary on subjects such as the environment, forests, wildlife, biological diversity, etc, a national law on water is even more necessary. Water is as basic as (if not more) than those subjects. Finally, the idea of a national water law is not something unusual or unprecedented. Many countries in the world have national water laws or codes, and some of them (for instance, the South African National Water Act of 1998) are widely regarded as very enlightened. There is also the European Water Framework Directive of 2000. It is this recognition of the need for a minimal national consensus on certain basic perceptions, concepts and principles that led to the adoption of the National Water Policy (NWP) of 1987 and 2002. Currently the NWP is under fresh revision. However, a national water policy has no legal status. A national water law is, therefore, necessary to make the tenets of such a consensual statement justiciable.

Having thus stated the case for drafting a national water framework law, it is important to clarify the nature and scope of this law:

(i) The proposed national water law is not intended to either centralise water management or to change centre-state relations or to alter the constitutional position on water in any way. What is proposed is not a central water management law or a command-and-control law, but a *framework* law, i e, an umbrella statement of general principles governing the exercise of legislative and/or executive (or devolved) powers by the centre, the states and the local governance institutions.

(ii) No administrative machinery or institutional structure (except for a national water information system) is envisaged at the centre under this framework law, and consequently no penal provisions are envisaged. This, of course, does not exclude the necessary administrative machinery, institutional structure and penal provisions in state laws within this framework.

(iii) But the law is intended to be justiciable in the sense that the laws passed and the executive actions taken by the central and state governments and the devolved functions exercised by panchayati raj institutions will have to conform to the general principles and priorities laid down in the framework law, and that deviations can be challenged in a court of law.

(iv) The law incorporates all major legal pronouncements by the Supreme Court with reference to water such as the Public Trust Doctrine and the recognition of the fundamental right to water as also the principle of subsidiarity, as explicated in the 73rd and 74th constitutional amendments, the prevention and precautionary principles, most recently statutorily recognised in the National Green Tribunal Act, 2010 and the transparency principles of the Right to Information Act, 2005.

Given the present constitutional division of legislative powers between the Union and the States, the only way a national water framework law can be legislated is to follow the procedure laid out in Article 252 (1) of the Constitution. Thus, if two or more state assemblies pass resolutions in support of Parliament enacting such a law, Parliament can also accordingly enact it.[33]

Conclusions

Putting in place this multifaceted paradigm shift in the Twelfth Plan has been a massive challenge of initiating change that was in many respects long overdue but was being resisted by a range of players within the system. There has, in the process, been a complete change in the principles and approaches animating water management in India across various sectors – a move away from a narrow engineering-construction perspective towards a more multidisciplinary understanding of water with central emphasis on the goal of resilient eco-systems, a focus on the principle of subsidiarity, incentivisation of participatory approaches, modern data management systems, innovations in technology and path-breaking legal changes that recognise the common pool nature of water and are based on the most updated scientific knowledge. What is more, this shift in perspectives is backed by a completely new and vastly enlarged package of incentives and financial and technical support, whether in the Nirmal Bharat Abhiyan, National Irrigation Management Fund, National Aquifer Management Programme, Integrated Watershed Management Programme or the RRR scheme.

What lies ahead is the even more difficult task of implementing this new approach. What gives hope is the fact that the process of hammering agreement on change has been deeply inclusive and has buy-in from key implementers, especially the state governments. They were a central part of fashioning this change and the most innovative ideas sketched out in this paper are based on examples of best practice from the states. There is also the fact that the emerging water crisis is forcing the pace of change from below, with a range of stakeholders no longer willing to countenance business-as-usual. Even so, the road ahead is a long and difficult one of confronting the recalcitrance of entrenched attitudes and vested interests. The same preparedness of civil society, academia and government of closely working together that transformed the Twelfth Plan agenda will now be required in its implementation, with close involvement of local communities, if success is to be achieved on this path.

NOTES

1 Of course, it must be acknowledged that the massive investments in public electrification hugely contributed to groundwater development

2 The Twelfth Plan and this paper derive in large part from the insights contained in the reports of these working groups, which are all available on the website of the Planning Commission.

3 The Twelfth Plan Working Group on MMI was chaired by Tushaar Shah.

4 The Twelfth Plan Working Group on Groundwater Management was chaired by Himanshu Kulkarni.

5 Deep Joshi chaired the Twelfth Plan Working Group on Watershed Management.

6 See Shah et al (1998) for the first articulation of this argument, later updated in GoI (2006).

7 See the Report of the Mihir Shah Committee on Operational Guidelines for MGNREGA (MoRD 2012a).

8 See Reports of the National Consortium of Civil Society Organisations on MGNREGA as also Shah, ed. (2012).

9 See the Report of the Mihir Shah Committee

on Common Guidelines for Watershed Development Projects (MoRD 2012b).

10 The Twelfth Plan Working Group on Rural Drinking Water and Sanitation was chaired by Joe Mediath.

11 This study uses administrative records on implementation of TSC and data from the third round of the District Level Household Survey (DLHS-3) and bulletins of the 2010-11 Annual Household Survey.

12 Sunita Narain chaired the Twelfth Plan Working Group on Urban and Industrial Water.

13 This section partly draws upon a working paper "Developing a Water Conservation Strategy for Industry" prepared for the Planning Commission by the Centre for Energy, Environment and Water.

14 Nirmal Sengupta chaired the Twelfth Plan Working Group on Flood Management

15 This is the name of the new Dutch approach to flood management that shifts focus from dike reinforcement to river relief (Government of Netherlands 2007; ClimateWire 2012).

16 A Vaidyanathan chaired the Twelfth Plan Working Group on Water Database Development and Management.

17 Subodh Wagle chaired the Twelfth Plan Sub-Group on Water Regulators.

18 Thus, for example, while Scottish Water is a state monopoly, the legal and regulatory framework within which it functions ensures that efficiencies are achieved, quality standards adhered to and expectations of consumers satisfied.

19 In South Africa, the "Reserve" constitutes an attempt to quantify an amount of minimum flow in the country's rivers and impoundments reserved for the maintenance of basic ecological functions (such as habitat for fish and plants) and to ensure that the South African population is guaranteed a minimum of 25 litres per capita per day for domestic purposes. Thus categories of use that are perhaps not sufficiently defended vocally are nevertheless declared to be non-negotiably in the public interest. The Reserve is an attempt to decide what level of loss is acceptable rather than an attempt to determine what "the environment" needs.

20 The draft model bill is available on the website of the Planning Commission

21 The Twelfth Plan sub-group on legal issues related to Groundwater Management was chaired by Philippe Cullet. For full details see Cullet (2012).

22 "The person who owns the surface may dig therein, and apply all that is there found to his own purposes at his free will and pleasure; and that if, in the exercise of such right, he intercepts or drains off the water collected from underground springs in his neighbour's well, this inconvenience to his neighbour falls within the description of damnum absque injuria [damage without injury], which cannot become the ground of an action", *Acton vs Blundell* (1843) 12 Meeson and Welsby 324 (Court of Exchequer Chamber, 1 January 1843). This was confirmed in *Chasemore vs Richards* (footnote 21), which found that the right of the owner of a mill using spring water had no action against other landowners abstracting groundwater to the extent of affecting his own use of the water. This was because the judges determined that such a right would "interfere with, if not prevent, the draining of land by the owner".

23 *George Chasemore vs Henry Richards* (1859), VII House of Lords Cases 349 (House of Lords, 27 July 1859).

24 B B Katiyar (ed.), *Law of Easements and Licences* (New Delhi: Universal Law Publishing), 13th, 2010.

25 Thus, for example, in the words of Justice Seshagiri Aiyar "It must have a fairly defined course. It must move. Its water must be capable of identification. It need not always be confined within banks. It need not have a continuous flow. Its width need not be of particular dimensions", *Unde Rajah Raja Sri Raja Velugoti Sri Rajagopala Krishna Yachendrala Varu Bahadur, K C I E Maharajah of Venkatagiri vs Secretary of State for India* in Council (1915) 28 MLJ 98 (High Court of Madras, 19 October 1914).

26 Except in case of carbonate rocks which have large openings on account of the phenomenon called karst.

27 *M C Mehta vs Kamal Nath*(1997), 1 SCC 388 (Supreme Court 1996); *State of West Bengal vs Kesoram Industries* (2004) 10 SCC 201 (Supreme Court, 2004).

28 This applies to groundwater as a resource (aquifer) and not to mechanisms (wells/tubewells) for abstracting it. The model bill is built around the need to regulate unreasonable use of sources of groundwater that threaten the aquifer to ensure that the resource (aquifer) itself is protected and can provide a sustainable basis for meeting the basic needs of every person for decades to come.

29 For example, the Andhra Pradesh Farmers' Management of Irrigation Systems Act, 1997; Gujarat Water Users' Participatory Irrigation Management Act, 2007; Maharashtra Management of Irrigation Systems by the Farmers Act, 2005 and Tamil Nadu Farmers Management of Irrigation Systems Act, 2000.

30 For example, *Subhash Kumar vs State of Bihar,* AIR 1991 SC 420 (Supreme Court, 1991).

31 The draft is available on the website of the Planning Commission

32 The Twelfth Plan Sub-Group on National Water Framework Law was chaired by Ramaswamy Iyer. The draft NWFL is available on the website of the Planning Commission. In July 2012, the Ministry of Water Resources constituted a Committee under Y K Alagh to finalise the draft National Water Framework Law, which would become the basis for deliberations with States, to be initiated by the Union Ministry of Water Resources with a view to evolving a national consensus.

33 This was the procedure adopted in the case of the Water (Control and Prevention of Pollution) Act 1974 and more recently for the Dam Safety Act 2010. An Act so passed will be applicable to the states that had passed the resolution and to other states that adopt the Act.

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