Environment

Water Community

Solution Exchange for the Water Community Consolidated Reply

Query: Best Practices on Water Demand Management in Cities – Experiences

Compiled by Pankaj Kumar S., Resource Person and Ramya Gopalan, Research Associate
29 March 2007

From Aniruddhe Mukerjee, United Nations Human Settlements Programme, Bhopal

Posted 7 March 2007

Dear Members,

I work for the UN Habitat on the Water for Asian Cities Programme, which aims to support developing countries in Asia and Pacific to achieve sustainable access to safe drinking water and basic sanitation for the poor, particularly in urban areas. In Madhya Pradesh, the programme is working in four cities of the state, viz. Bhopal, Gwalior, Indore and Jabalpur for improvement and expansion of urban water supply, sewerage and sanitation, water drainage and solid waste management.

Traditionally, augmenting supplies has been a strategy for meeting the demand for water requiring huge capital investments, search for new water sources, laying new transmission network, construction of treatment systems, and so on. However, this approach is exerting more and more pressure on available water resources and is also leading to over exploitation of groundwater in some cases. Consequently, the approach being followed by our programme consists of influencing water usage practices, minimising losses and leakages and thereby managing the demand to meet the supply of water.

The programme intends to influence water usages practices, policies and measures for optimisation of available water in municipal water supply system. Specific steps proposed in the "Water Demand Management" strategy are:

- Formulation of strategy and implementation plan for water demand management.
- Assessment of current water supply situation, and estimation of Unaccounted for Water (UFW) in the entire water supply system from intake to final distribution to consumer; preparation of a proper water balance.
- Taking up water auditing, flow metering, extensive leak detection and establishment of district-metered areas.
- Appropriate technical, financial and institutional interventions for water demand management.

The Water Community members are requested to please share experiences, suggestions and best practices in other parts of India on the above steps. Your inputs will help us enhance the design and implementation of this programme, and will be deeply appreciated.

Responses were received with thanks from

1. **Sacchidananda Mukherjee, Madras School of Economics, Chennai**
2. **Ramakrishna Nallathiga, Centre for Good Governance, Hyderabad (Response 1; Response 2)**
3. **S. Vishwanath, Rainwater Club and Arghyam Trust, Bangalore**
4. **Irene Stephen, UNDP, New Delhi**
5. **Surendra Kumar Yadav, National Institute of Health and Family Welfare, New Delhi**
6. **Debadutta K. Panda, MP Associates, Bhubaneswar**
7. **Rahul Banerjee, Aarohini Trust, Indore**
8. **G. Misra, Directorate of Economics and Statistics, Port Blair**
9. **Shashidharan Enarth, University of British Columbia, Canada**
10. **Jyotsna Bapat, Independent Consultant, New Delhi**
11. **Nandini Gopalamenon, Health and Family Welfare Training Centre, Kozhikode**
12. **A. Prabaharan, Public Action, New Delhi**
13. **Ajit Seshadri, The Vigyan Vijay Foundation, New Delhi**
14. **R.C. Chhipa, Centre for Air and Water Modelling, Gyan Vihar, Jaipur**
15. **R. Jagannathan, FABCON Engineers (P) Ltd., Chennai**
16. **N. K. Agarwal, Geological Survey of India (GSI), Dehradun (Response 1; Response 2)**
17. **D. K. Paul, KAB-II, PUSA, ICAR, New Delhi**
18. **Mrinalinee Vanarase, IORA for Environmental Solutions, Pune**

Further contributions are welcome!

Summary of Responses

In the context of a program in 4 cities of Madhya Pradesh for enhancing water availability for the poor, the query sought inputs from members in designing and implementing water demand management interventions. Members responded by providing general principles for designing such a system, and outlined technical, economic and institutional issues related to the same.

Respondents agreed that there was an urgent **need** to take up demand management in the face of increasing water scarcity. They also stressed that judicious and non-wasteful use of water was immediately required to ensure that water could be made available to a large chunk of the poorest sections in India, and cited an ADB study endorsing this. Additionally, sustainability of water sources has been falling due to degrading ecological conditions, and as water is brought from longer distances, the costs of treatment and transportation have increased drastically. Members also pointed that the current structure of subsidies does not induce conservative water use. In this context, they recommended **collective action** for protection of local sources and for enhancing groundwater recharge both in urban and rural areas as the only way to ensure sustainability of water resources.

Discussing the process of **formulating the strategy** for such a programme, participants stressed that often, lack of adequate, reliable and realistic **data** led to poor planning and delivery of water supply schemes. Such data should include the exact and projected data on population, actual demand of water both for resident populations from all sections of society as well as from tourists, the types of sources which were currently being used by this population, the difference in the quality of water between various sources, etc. Some respondents disagreed with the paradigm that 24 X 7 piped water supply was the only way to provide water supply, and stressed that current use of other water sources should be studied, and if possible, incorporated in the planning process. This would ensure that while low quality water could be used for needs such as flushing, drinking water requirement could be met through safe piped water, thereby reducing the pressure on the piped system. Members also added that during planning, the **Unaccounted For Water** should not be always seen as a loss to society, as many a times, leakages in large pipelines served the need of the poorest populations who did not have access to regular water supply in urban and peri-urban areas.

The group also pointed out that demand calculations must look at the impact on **groundwater** resources, which meets water need in a large number of settlements. In this connection, they also explored the linkages of urban water demand with spiraling water demand in agriculture. Since irrigation is one of the major consumers of water, participants stressed the urgent need to **improve water use efficiency** in agriculture, thus freeing up water for drinking. They suggested a number of measures that could be taken up to enhance water use efficiency in agriculture such as crop breeding for efficient water utilization and drought tolerance; improved cultural, agronomic and field practices; low cost supplemental irrigation technologies for rainfed/water scarce areas (especially in watershed management projects); improved irrigation management practices and precision irrigation; integrating recycling and reuse of waste water into basin and irrigation management and resource management to ensure sustainability of water resources within basins.

Discussants emphasized that any programme for demand management of water must start with building **awareness** of water users towards conservation of water. They proposed a number of methods for reuse, recycling and reducing wasteful use of water. For example, quoting a case study from Orissa, they mentioned that underground leakage in water distribution pipeline were often not detected for days, leading to a loss of pressure, reduction in time of availability and loss of water due to leakage. Respondents also pointed out that water infrastructure had a tendency of being distributed in an uneven manner – in some colonies, multiple modes of water supply were available (such as handpumps, pipelines, etc.), in other colonies (especially of the marginalized sections), not even one mode of water supply was available. They also described an instance from the Andaman & Nicobar Islands, where water supply had no correlation to water need and stressed for the need to collect data for ensuring better matching the demand and supply.

Discussants also emphasized that while demand management is an important issue, it is also necessary to look at the **supply of water**, which can be enhanced through ensuring that every source is protected, and through measures such as watershed development and roof water harvesting. Another reason for poor availability of water supply discussants mentioned was the **sectoral nature** of various line departments associated with water supply such as lack of clarity between functions and responsibilities, unfavorable cost-benefit analysis, inadequate demand assessment, insufficient allocation of funds, inter-state disputes, etc.

The centralized system of collecting and transporting water has proved itself unsustainable due to the extremely high energy, water and capital investments it requires, felt members. They proposed that instead of investing in wasteful centralized systems, subsidized loans should be

provided to collectives to install **decentralized waste management systems**. In this regard, they described a system being used in Indore for such treatment.

Economic measures suggested by respondents included proper metering of water supply, block tariffs to ensure that consumption above a slab was charged at an extra rate, and tariff structures to induce conservation in domestic water use. Use of pro-poor measures such as tariff structures based on house/ plot area as being done in Bangalore in this regard could also be used. Additionally, the group stressed the primary need to involve local users and communities in planning and to create and support proper **institutional mechanisms** for management of water. Suggestions from members ranged from supporting multi-stakeholder (government-community-CBOs) institutions, self help groups, to empowering water user associations and decentralized community based organisations. Among **technical measures** related to demand management, members gave a number of suggestions for treatment, reuse and recycling of water and mentioned biological measures such as reeds for leaching away contaminants.

In conclusion, members agreed that demand management was crucial, and stressed the importance of collecting the right data for proper planning and enhancing awareness of water users. Sustainability of water resources and interlinkages with agricultural water use are other areas that need to be looked at. In the long run, members reiterated, effective water demand management will depend on crafting appropriate economic, technical and institutional interventions with an aware user population.

Comparative Experiences

Madhya Pradesh

From Rahul Banerjee, Aarohini Trust, Indore

Urban Water Supply and Environmental Improvement
This Asian Development Bank (ADB) study indicates that the no-revenue component in all the state's cities is over 50% with transmission and distribution losses over 20%. Substandard services led to declining water availability, now only 30 liters/capita/day and with no wastewater/sewage treatment. ADB acknowledged the cost ineffectiveness of water supply and wastewater disposal services and initiated better cost recovery systems.

Soak Pit System in Indore
In the Aarohini Trust, office cum residence, installed a soak pit system, and planted near the soak pit big leafy creepers. This system treats wastewater before it goes into the subsoil. The creepers have grown to cover walls and roof of the building, absorbing and evapo-transpirating the wastewater, which along with the leaves keep the building cool. Thus, even at the peak of summer when the temperature hits 45 degrees C there is no need for fans.

Andaman and Nicobar Islands

Need and Availability of Water Supply in Port Blair *(from G. Misra, Directorate of Economics and Statistics, Port Blair)*
In the Port Blair Municipality, residences receive water once every three days. Irrespective of the family size, tanks are installed on roofs and filled with water (500 litres/1,000 liters according to type of quarter i.e. Type III or Type IV). No studies have been to understand the correlation between water needs and availability of water resources, thus the Municipality cannot effectively plan for the future.

Orissa

Design of Water Supply System in Berhampur and Chhatrapur *(from Debadutta K. Panda, MP Associates, Bhubaneswar)*
A study found, that in most towns, the supply of drinking water is much less than the demand. Households receive water for 2-3 hours/day and sometimes less, which is insufficient for their needs. Additionally, the faulty design of the water transportation and water supply system contributes to the leak. The situation is so bad several roads are submerged due to continuous water line leakage. Registered complaints on the situation are only attended to after 2-3 days.

Karnataka

City Level Efforts to Reduce Water Consumption in Bangalore *(from S. Vishwanath, Rainwater Club and Arghyam Trust, Bangalore)*
To address their water supply problems Bangalore instituted several measures. It monitors, via a meter system, all legal water connections, so losses can be reduced. It increased block tariffs for industries resulting in demand reduction; however, there was no reduction in household level demand since they still receive water at subsidized rates. The city also adopted a policy of treating and reusing wastewater especially for flats and apartments.

Related Resources

Recommended Documentation

Human Development Report 2006- Beyond Scarcity: Power, Poverty, and the Global Water Crisis *(from Sacchidananda Mukherjee, Madras School of Economics, Chennai)*
United Nations Development Programme; 2006
http://hdr.undp.org/hdr2006/report.cfm

> *Discusses poverty, increasing demand and rising crisis in the water sector and helps establish a framework of tools, concepts and actions to address this issue*

From Ramakrishna Nallathiga, Centre for Good Governance, Hyderabad (response 1 and response 2)

Reforming Water Sector Governance and Institutions for Improving Efficiency: The Case of Mumbai
Ramakrishna Nallathiga; International Journal of Regulation and Governance
http://www.solutionexchange-un.net.in/environment/cr/res07030701.pdf (Size: 731 KB)

> *Provides quantitative/analytical overview of Mumbai's water resource status and outlines need for reforms on several fronts, particularly water institutions and governance*

Water Resource Management in Urban Context: Potential for Reforms in Mumbai
Ramakrishna Nallathiga
http://www.solutionexchange-un.net.in/environment/cr/res07030702.doc (Size: 32 KB)

> *Reviews the supply and demand component of water resources as part of urban infrastructure in cities featuring necessary reforms in the context of Mumbai*

Clean Water Needs Survey, Kentucky *(from G. Misra, Directorate of Economics & Statistics, Port Blair)*
Environmental Planning Agency (EPA), United States Government; 1996
http://www.epa.gov/cwns/1996report1/ky1.htm

Provides Names and locations of publicly owned wastewater treatment facilities currently in operation recommended as a good example of needs assessment surveys

Report on Women and Water *(from Nandini Gopalamenon, Health and Family Welfare Training Centre, Kozhikode)*
Research Foundation for Science -Technology and Ecology; January 2005
http://ncw.nic.in/pdfreports/Women%20&%20Water.pdf (Size: 3.22 MB)

The Jalnidhi Project principals are same as in Swajal Project- addressing demand driven community participation as a key factors for sustainability of the water supply schemes.

From Ajit Seshadri, The Vigyan Vijay Foundation, New Delhi

Initiatives by Community Participation on Ground Water Management– A NGO Experience
Ajit Seshadri; The Vigyan Vijay Foundation
http://www.solutionexchange-un.net.in/environment/cr/res07030704.doc (Size: 51 KB)

Paper presented at the International Ground Water Conference, Delhi that details the specifics of the initiatives possible within the context of groundwater management

Eco-Components of Green Building Campus
http://www.solutionexchange-un.net.in/environment/cr/res07030703.xls (Size: 72 KB)

Schematic plan implemented for economic water use in a campus aimed at initiating more micro-level, green buildings/campuses to get the optimum use of available water

Water Scarcity and the Role of Storage in Development *(from D. K. Paul, KAB-II, PUSA, ICAR, New Delhi)*
David Seckler, *et al*; International Water Management Institute (IWMI) Research Report Series; 2000
http://www.iwmi.cgiar.org/pubs/pub039/RR039.htm

Paper reveals that by 2025, nearly one-third of the world's population (especially India and China) will live in regions facing absolute water scarcity and groundwater depletion

From Surendra Kumar Yadav, National Institute of Health and Family Welfare, New Delhi

Groundwater Conservation for Ecosystem Development in Urban Environment Using Remote Sensing: A Case Study
Hydrology Journal, Vol. 26, Issue 4, pages 65-74; 2003

Explores the use of remote sensing to enhance conservation and management of groundwater for ecosystems particularly in urban environments

Groundwater Management using Remote Sensing Data in Urban Environment: A Case Study of South Delhi Region (India)
Journal of Human Ecology, Vol. 14, Issue 5, pages 337-342; 2003

Studies the Southern Region of Delhi, examining how groundwater can be better managed by using remote sensing data

From Ramya Gopalan, Research Associate

Issues of Pricing Urban Water
Rajan Padwal; University Of Mumbai, Working Paper No. 13
http://www.mu.ac.in/Department/economics/wp13.pdf (Size: 514.2 KB)

Paper focuses on role of pricing in Water Demand Management and on issues crucial for determining appropriate price policy and the need to initiate reforms therein.

Water Demand Management in Cities
Water and Sanitation, UN Habitat Publications; 2002
http://www.unchs.org/pmss/getPage.asp?page=bookView&book=1629

Documents good practices of water demand management in practice in five African cities namely- Cape Town, Durban, Hermanus, Johannesburg and Windhoek.

Water Demand Management (WDM): A Case Study from South Africa
A. R. Turton; MEWREW Occasional Paper No. 4; 1999
Click here to view PDF (Size: 153 KB)

Paper examines the need to manage demand for water against the background that at best, supply-sided solutions on its own can only buy time

Proceedings of the International Symposium on Efficient Water Use in Urban Areas - Innovative Ways of Finding Water for Cities
Newsletter and Technical Publications, UNEP
http://www.unep.or.jp/ietc/publications/reportseries/ietcrep9/4.paper-F/4-F-wege1.asp

Defines and discusses WDM as the preferred alternative to meet increasing water demand and to improve efficiency and sustainable use of water resources

Recommended Organizations

Asian Development Bank (ADB), New Delhi *(from Rahul Banerjee, Aarohini Trust, Indore)*
India Resident Mission, P.O. Box: 5331, 4 San Martin Marg, Chanakyapuri, New Delhi 110021; Tel.: 91-11-2410 7200; Fax: 91-11-2687-0955; adbinrm@adb.org;
http://www.adb.org/INRM/activities.asp

Recommended for their study aimed at improving urban water supply and the environment in Madhya Pradesh

Centre for Water Resources Development and Management (CWRDM), Kozhikode *(from Nandini Gopalamenon, Health and Family Welfare Training Centre, Kozhikode)*
Kunnamangalam, Kozhikode 67357, Kerala; Tel.: 91-495-2357151/2356242/2355864; Fax: 91-495-2357827; ed@cwrdm.orgp; http://www.cwrdm.org/Projects.htm

For information on water related projects with in-built programmes on water conservation and cost-effective water use

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Full Responses

Sacchidananda Mukherjee, Madras School of Economics, Chennai

Thank you very much for the issue that you have raised on the forum. I give below my comments on the same.

To meet the growing demand for safe drinking water, the challenges that urban water supply agencies are facing today are not only to find the sustainable source(s) of drinking water but also to meet the costs of treatment and transmission of water. Over the years, the urban drinking water footprint has been expanding at a faster rate away from urban areas, as a result of which the costs of transmission are growing up. The cost of treatment of water is also going up, and still covers (in most cities in India) only the costs of bacteriological and select chemical treatment of water (e.g. Total Dissolved Salts, Total Suspended Solids, etc.), but does not treat water for all possible pollutants (e.g., Flouride, Nitrates, Arsenic, pesticides etc.). If we include the full costs of water treatment, the costs of supplied water would be much higher. However, the

challenge for rural water supply is not always availability of water, but the quality of drinking water sources.

Also, as a researcher in environmental and water resources economics, I don't think that tackling only supply and demand side aspects of drinking water management through improvement in efficiency of water supply and use could reduce the costs of water supply substantially in the long run. Improvements in efficiency, both in water transmission and delivery, and efficiency in utilization of water (voluntary judicious utilization of water), could only reduce the costs of water supply to a limited extent. A large section of our urban population still do not have access to basic minimum level of water supply (i.e., 40 lpcd, National Human Development Report, 2006). Those who have access (water rich) are not going to reduce their usage (voluntarily) unless they are compelled to pay full cost price of water as well as cost of wastewater disposal. In the context of Indian cities, transmission and distribution loss of water is not always wasted from a social point of view, as often meet the drinking water needs of urban and peri-urban slum dwellers, and are also a source of income for water vendors.

In the long run, for sustainable access to safe drinking for a large section of the population, we could rely not only on supply and demand side aspects, but also on alternative aspects of water supply management. One of such alternatives could be the protection of drinking water sources at the most disaggregated / decentralized level (e.g., household level). Since, groundwater is a major source of drinking water for a large section of the people, protection of groundwater quality and groundwater recharge, both for urban and rural areas could be effective to augment water supply from local sources, with reduced cost in transmission, distribution and treatment. Over time, too much importance on centralization of drinking water sources has resulted in systematic neglect of local source(s) (e.g., groundwater, tanks, ponds, lakes, etc.). Both qualitative and quantitative aspects of drinking water (groundwater) protection could be effective to meet the drinking water needs of the people in both urban and rural areas. However, it requires large-scale voluntary participation (collective action) of the public, in terms of rainwater harvesting, maintaining groundwater recharge structures and also controlling non-point source pollution (e.g., sewage and sanitations, animal wastes, fertilisers and pesticides etc.). Though it will take time to make the protection of drinking water sources as a responsibility of the consumers, it will be sustainable as compared to present system, which will continuously look for alternative safe source(s) of drinking water.

Ramakrishna Nallathiga, Centre for Good Governance, Hyderabad *(response 1)*

Good to know about your efforts. Please find some arguments for the same in the context of Mumbai in the paper titled “Reforming water sector governance and institutions for improving efficiency: the case of Mumbai” attached in link below: http://www.solutionexchange-un.net.in/environment/cr/res07030701.pdf (Size: 731 KB)

S. Vishwanath, Rainwater Club and Arghyam Trust, Bangalore

Here is my take on the important question that Aniruddhe asks.

At the root of the issue lies the question of water governance. How are institutions to be made democratically accountable and responsible for a medium to long-term agenda on water? The experience here in Bangalore presents learnings on several fronts, which can lead to delivery of water to the poor:

1. Metering - If connections are not metered there is no way that you measure unaccounted for water or non-revenue water or leaks in the system. Bangalore has all legal connections metered and therefore has a fairly good idea of losses. It can therefore work towards reducing the losses.

2. Increasing block tariff - This manages demand very effectively. Industries, for example, pay Rs 60 a kiloliter for water plus a 20% sewage cess. This makes water at Rs 72 per kiloliter a clear economic good. Industries in Bangalore focus on and reduce demand for water very much.

3. The increasing block tariff structure still sends subsidised water to domestic homes and therefore does not send any economic signals for correct use and that is a problem. There is also no ceiling on the availability of water per connection.

4. A pro poor policy- Any house less than 150 square feet does not have to pay a connection charge but only the meter charge. There is also a reduced connection fee for houses less than 600 feet in plinth area. These connections also pay a minimum tariff of Rs 6 per kiloliter individual connections are planned for every household.

5. A policy of encouraging treatment of wastewater and its reuse especially for flats and apartments. Also at the city level, wastewater receives tertiary treatment and is used for industrial and non-domestic purpose at rates far below fresh water rates.

The ceiling on water availability to the city at 1,500 million liters per day and an exploding demand is a ripe pre-condition to look at demand management, integrated water management and the use of recycled wastewater.

Irene Stephen, UNDP, New Delhi

In response to your last point on technical, financial and institutional interventions for Water Demand Management, I am sharing with you points on the institutional challenges faced while formulating plans for water demand management.

As a community, we have the right to demand access to adequate potable water. However, during the course of planning to meet the demand of the community, water demand issues are segregated along sectoral Government Departments such as Department of Irrigation, Department of Panchayati Raj and Rural Development, Department of Environment and Forests, Department of Agriculture, Department of Finance and various water supply authority/boards. These departments are generally not in a position to coordinate implementation of schemes/projects but instead practice a disjointed sectoral approach. An integrated approach therefore does not evolve due to disjointed institutional operation, lack of local level presence of these institutions, and lack of accountability and responsibility toward meeting demand of water by communities in urban and rural settlements.

Secondly, the government departments and local governance institutions responsible for development, maintenance and management of water sources and supply networks face difficulties in performing their stipulated functions due to poor on-site coordination, overlapping functions and limited funds.

Thirdly, WUAs are not able to work effectively as the decision-making process is not lucid or participatory enough at community level.

Fourthly, planned projects and approved schemes face long delays in implementation due to a combination of function and feasibility concerns among authorities/departments, non-favorable cost-benefit analysis, inadequate demand assessment, insufficient allocation of funds, inter-state issues on sharing of water resources. These factors have influenced demand calculations for viable water schemes. Often, in most situations there is also no long-term guarantee of water supply from the water source, due to degraded watershed conditions.

Within the above background, I wish to emphasise two points that should be considered while designing institutional implementation plans:

1. In any project, there should a multi-stakeholder (Government-community-CBOs) body of participants to streamline coordination, clarify roles and responsibility, mechanisms for access to good quality information and institutional procedures to improve water services.

2. Strategies for ongoing capacity building at all levels i.e. within government institutions, local communities and CBOs should be given a priority in order to improve the interaction and decision making process on a range of water demand issues.

Surendra Kumar Yadav, National Institute of Health & Family Welfare, New Delhi

You are really working on a good topic. There are really a lot of challenges for sustainable water resources management in urban settings.

Water conservation, reusing water for other important activities, construction of check dams at most suitable sites are some of important issues that need to be looked at. The following papers may also be useful for you:

1. Groundwater Conservation for Ecosystem Development in Urban Environment using Remote Sensing: A case study. Hydrology Journal, 26 (4): 65-74 (2003)
2. Groundwater Management using Remote Sensing data in Urban Environment: A case study of South Delhi Region (India). Journal of Human Ecology, 14 (5): 337-342 (2003)

Debadutta K. Panda, MP Associates, Bhubaneswar

There is a constant demand of drinking water in southern Orissa. For more than a decade, the supply of drinking water is much lesser than the demand in the major towns i.e., Berhampur and Chhatrapur.

In my experience, the supply has reduced due to heavy leakage in water transportation. In a preliminary study, I found that every household complained that they receive water from the municipal water supply for only 2-3 hours/ per day and sometimes even less than an hour. They complained that this is insufficient for a big family and the water supply timings start very early in the morning i.e., 5' o clock in the morning. However, I found leakages in the water supply line in most streets/localities. Generally, a complaint is registered in 5-8 days, as underground water leakage is generally neglected. The repairing work starts after 2-3 days of a complaint getting registered. Also in many cases, outsiders have registered complaints for the repair rather than local residents. In many areas, roads get submerged due to continuous leakage in the underground pipes.

Additionally, I found 3 hand pumps lying defunct for the last 6 months in a street where households had open wells inside their house complex as well as access to municipal water

supply. In another street, I found neither hand pump, nor municipal water supply to households (because they could not afford the water rates). In the same area, when I asked 25 households about indigenous technologies for water harvesting and water treatment, only one person could respond. I therefore feel there is a fault on the design of the water supply system than on availability of water.

Rahul Banerjee, Aarohini Trust, Indore

The crucial fact with regard to water management in cities is that in both industrial and domestic use ninety percent of the treated water supplied is converted into wastewater, which then has to be treated and disposed of. The more the water supplied the more is the wastewater generated that has then to be disposed of. The treating and transport of both supply water and wastewater is a very expensive proposition. Traditionally most of these expenses have been borne by the state with the users reluctant to pay the full costs regardless of their financial situation. Thus according to the rough estimates made by the Asian Development Bank as part of its "Urban Water Supply and Environmental Improvement in Madhya Pradesh Project" the non revenue component in all the cities in the state is well over fifty percent with transmission and distribution losses themselves being well over twenty percent. This in turn means that the services provided are substandard leading to a declining water availability currently at 30 litres per capita per day (the recommended national standard is 70 lpcd) and absolutely no treatment of waste water and sewage. So people are forced to seek private supply of ground water and disposal of wastewater and sewage. However, there are no reliable estimates of the extent of this private activity and the quality of the water supplied and the treatment of the sewage and wastewater. Septic tanks which are the most common method of private disposal of sewage are ill designed and in most cases are not accompanied by soak pits and so the over flow water is let out into the surface drains without treatment. This is a dismal scenario.

Surprisingly the ADB while acknowledging the fact that both these centralized water supply and waste water disposal systems are in disarray in cities in Madhya Pradesh due to being cost ineffective has initiated a refurbishment of the same and insisted that better cost recovery systems be put in place to eventually compensate both the capital and the running costs of these systems (In the case of Indore the cost of water supply is exorbitant because water has to be pumped up from the River Narmada which is fifty kilometers away and at a level five hundred meters below that of Indore). The Indore municipal corporation has now begun to recover pending property taxes and water and sanitation charges under pressure from the ADB and it has been revealed that the biggest defaulters are large institutions both government and private. These entities, which are all very capable of meeting the nominal charges that were due, were nevertheless defaulting and have run up bills in lakhs and crores of rupees.

Thus the question is not just one of demand management as Aniruddhe has said but also of the choice of proper systems of water supply and wastewater disposal. And the answer to this is that we should choose decentralized systems because then it is much easier and cheaper not only to supply and dispose of water but also to recover the costs of doing so at the source itself. So stress must be compulsorily laid on proper treating and recharge/recycling of storm water, wastewater and sewage at source either individually or in small collectives. There will be no flooding and no stinking rivers and drains flowing within the city. This will also obviate the need for centralized water supply from a distance because the ground water will be adequately recharged to be able to meet the needs of the population. Instead of making massive capital investments in wasteful centralized systems, subsidized loans should be provided to collectives of the needy to install such decentralized systems and those who are financially capable should be forced to adopt such systems.

In our office cum residence, here in Indore we have installed such a system. We have in fact gone a step further. Near the soak pit which treats all the wastewater before it goes into the subsoil we have planted big leafy creepers. These creepers have grown to cover not only the walls of our building but also trellises made for the purpose on the roof. They suck up a lot of the wastewater and evapo-transpirate it and this along with the leaves keep our building cool. Thus even at the peak of summer when the temperature in Indore hits 45 degrees centigrade we do not need to turn on the fans let alone use air-conditioners and air-coolers, which we do not have. Since electrical energy in Madhya Pradesh is mostly from coal burning thermal power stations this means a saving on green house gas emissions also. Incidentally, we also do not let out a single gram of solid waste from our building. The only flaw is that in the absence of any better disposal method we are at the moment incinerating our non-bio-degradable waste.

So my suggestion is that a thorough rehaul of the theory and practice of urban water supply and waste-water management is necessary for reorienting it away from the present unsustainable centralized model to an eminently sustainable and rational decentralized one.

G. Misra, Directorate of Economics and Statistics, Port Blair

So far, the issues have come out very well on this discussion forum. However one point which I wish to reemphasize (though others have also touched upon it) is that there is increasing water demand. I agree. But I think before that every panchayat, tehsil, district, state and the whole nation should have actual figures on water NEED.

There should be water NEED assessment in form of data with governance bodies involved in water management. In another discussion, we discussed on the need for a Database for District Planning. One very important aspect here was to have a database about the population. Once we have data on population, its composition or demography, then we can at least visualize the needs of water, food, shelter livelihood, education etc.

There have been many studies in US and other countries. Good examples are like Kentucky water needs survey etc. Similar survey should be prerequisites for any type of water planning in our country. If we have data on water needs of villages, then we can surely be able to chalk out a strategy for supply of water. This database should be correlated with the database on water resources available in the area, only then the planning would be good for everybody. The database will also be used for the future projections of water needs. I am only stressing the need of having a database on water need and projections before making any strategy for water management.

In Port Blair municipality, at our home we are getting water supply once in three days. Irrespective of the family size the tanks installed on the roof is filled (500 litres, 1000 litres according to the type of quarter i.e. Type III or Type IV etc). Once, we got a supply of 200 liters to be used for three days. There are reservoirs also. But the correlation between the water need data and availability of water resources etc needs to be done to plan for future needs.

The need also increases due to influx of tourists, which nobody can predict. This year there is pressure on water due to this tourist need also.

I feel that we need to have data on various factors beforehand, only then can any strategy be worked out.

Shashidharan Enarth, University of British Columbia, Canada

Irene's observation about institutional setup for managing water set me thinking about how demand management is perceived, perhaps unwittingly, among development professionals. The planning process seems to follow boundaries that are decided by the jurisdictions of the number of government departments dealing with it. These "territorial boundaries" are so firmly entrenched that even policy reforms usually get confined within these boundaries. In most cases, such an approach is heavily constrained by the departments which will safeguard their interests -- almost to the point of being self-serving. While we are working on new approaches with these boundaries (it is unavoidable politically and administratively at present), we have to simultaneously find ways of putting users interest above those of the departments and other agencies. One action that can kick start this change in is to bring in the concept of legal entitlement of water to users. This will be quite a fundamental change and therefore not happen without a fight.

I do not know if the issue of water entitlements was discussed in the visioning workshop. I would really want to hear the responses from this group.

I agree with Irene that an important pre-requisite for enhanced stakeholder participation is the capacity of Water User Associations to truly function in a participatory and democratic way.

Ramakrishna Nallathiga, Centre for Good Governance, Hyderabad *(response 2)*

I subscribe to some of your view points here in this text and a detailed paper is given in the link below: http://www.solutionexchange-un.net.in/environment/cr/res07030702.doc (Size: 32 KB)

Jyotsna Bapat, Independent Consultant, New Delhi

The query on water demand management in cities focuses on a basic assumption of piped water supply provided by the city government as the only 'legitimate' way of providing water to urban areas and as a way to provide water in cities.

To the best of my knowledge and experience I know that in every city like Hyderabad, Mumbai, Delhi, Bangalore, practically all the middle class households tap into ground water for domestic need of water other than drinking water and depend on municipal water for drinking.

If this is the norm then we should begin by 'water audit' first mapping the sources of water, its capacity and viability of meeting domestic demands from this means and then worry about municipal water supply later. By legitimizing and institutionalizing water sources other than piped municipal water the local government can map and charge people for use of all water in the municipal limits with very little investment. Then since the municipal water as 'safe water' for drinking will be the only demand it will be easy to manage it by providing it for twice a day for limited time.

I know this is what is already happening in cities and towns Why not legitimize it, instead of talking of a 24*7 water supply that is a pipe dream and not practical.

Hope this will stir up a debate.

Nandini Gopalamenon, Health and Family Welfare Training Centre, Kozhikode

I am pleased to inform about the Jalanidhi projects in Kerala. They have to share their success stories. Water literacy is lacking even in the most literate state in the country. Hence, any water related projects must have an in-built programme on water conservation and cost-effective water use. CWRDM, Calicut may also be able to contribute more.

A. Prabaharan, Public Action, New Delhi

In India, there is no adequate awareness about the water conservation. Without people having knowledge to save the water, it will be difficult to implement water reforms. Higher pricing and other taxing methods may not give desirable results. Like the environmental revolution in the eighties, women's movement in the nineties, today we need water revolution.

The water shortage and pricing have created electoral setbacks for the ruling parties. Especially the water starved Tamil Nadu. Now desalination plants and water transportation across 200 miles are initiated. Using television, radio, newspapers and other modes of communication a movement for water conservation is mandatory to reform this sector.

Ajit Seshadri, The Vigyan Vijay Foundation, New Delhi

Responding to the urban water issues and feasible initiatives, we give below our observations:

The observations sent by N. Ramakrishna and S. Mukherjee are appreciated and taking the concepts and methodologies to implementation of practices, we have observed that Decentralization and public participation is the need of the hour and very vital now.

Our paper presented during the International Ground Water Conference, Delhi that details the specifics of the initiatives which is possible is linked below: http://www.solutionexchange-un.net.in/environment/cr/res07030704.doc (Size: 51 KB)

More micro-level, green buildings/campuses initiatives should also be initiated to get the optimum use of available water. Please also find a schematic plan implemented for economic water use in a campus at the following link: http://www.solutionexchange-un.net.in/environment/cr/res07030703.xls (Size: 72 KB)

Approaches towards supply enhancement by UWBs (Urban Water Bodies) are long drawn and gets delayed. Innovative institutional and governance strategies in the water sector need to be initiated by Ward Committees, NGOs, CVOs and Citizens' groups on application of the Bhagidari [participation and contribution] concept. Also communication on eco-water literacy needs to be shared with communities.

R.C. Chhipa, Centre for Air and Water Modelling,Gyan Vihar, Jaipur

To the best of my knowledge and experience, in every city groundwater is the major resource used for domestic need and other necessities. The important things that need to be kept in mind for demand management are the following:

1. Estimating the needs of human beings
2. Methods to recycle, reuse water and to remove water pollutants.
3. Harvesting rain water both in microwatersheds and roof water harvesting from buildings

4. Water conservation techniques for available groundwater and surface water
5. General awareness and information, education and communication tools
6. Management of sewage wastes and water supply and sanitation information systems
7. Water purification techniques, water borne diseases and health hazards
8. Water conservation in irrigation
9. Encouragement for water recharging systems
10. Regulatory measures for ensuring that water supply and sanitation is safe and affordable.
11. Water audits for sanitation, and providing planning support and management

Hope this will further stir up a debate.

R. Jagannathan, FABCON Engineers (P) Ltd., Chennai

I am participating in the discussion after a very long time.

I totally agree with Rahul Banerjee that the entire system should be handled by local community with the help of Self-Help Groups so that they are able to handle the system/ problem in a better way than the govt. officials.

I appreciate your idea of preserving your building and other neighbourhoods. Good luck.

N. K. Agarwal, Geological Survey of India (GSI), Dehradun *(response 1)*

Hi Misra, This is wonderful idea. For any demand and supply equation, such data is the missing link, if not assessed properly, or if assessed inadequately. All projections fail, if such data requisites are not met. This holds good for water too and water is going to be the most sacred commodity in the near future. Our planning has failed in many fronts due to inadequate database. As a geologist, I totally agree with you.

D. K. Paul, KAB-II, PUSA, ICAR, New Delhi

Please refer to your query on best practices for demand management in cities. With my background in agricultural water management, I would like to suggest the following for improving macro level water use:

A study by the International Water Management Institute, Colombo on water scarcity (Seckler et. al., 1998) reveals that by 2025, nearly one-third of the world's population (1/3rd of India's population will be 465 million people) will live in regions that will face absolute water scarcity. Groundwater reserves will be increasingly depleted in large areas of the world, and more so in fast developing economies like India and China. This will be accompanied with increased water logging, salinization and pollution of soils. The people most affected by growing water scarcity will continue to be the poor, especially the rural poor. The women and children are expected to suffer the most.

A policy change is needed for increasing water allocation for urban settlements (which is mostly sold to consumers at whatever the rate may be) compared to allocation for the highly inefficient agricultural sector (mostly free water as consumers/farmers pay practically a pittance). So the basic change or "best practice" should start with administrative/political action in making agricultural water use more responsible.

There are 3 basic approaches for meeting the increased water demand whereby the same water can be used for more food production (Jinendradasa, 2002):

1. Supply Side: Develop more infrastructure and increase irrigation to the rainfed area.
2. Conservation: Reduce wastage and loss of water by agriculture and other sectors.
3. Increase the Unit Productivity of Water for each drop consumed by agriculture (demand side management).

The supply side approach is aimed at improving overall food production by supplying more water for more land. This can be done by large projects, such as dams, diversions, and canals, but also by small-scale works like pumps and water harvesting structures. India has already completed more than 232 major irrigation projects and another 187 projects are under different stages of construction. More than 900 medium projects have also been completed. Groundwater now constitutes 58 per cent of the total irrigated area in the country. But, most of the potential sites have been exhausted and future financial costs and social implications have become prohibitive for taking up new projects. Clearly, improving the process of developing more supplies to minimize social and environmental costs through better management is the need of the day.

The conservation approach focuses on eliminating wastewater and pollution of water supplies by agriculture and other users for productive use and is a method of improving productivity of water supplies to agriculture. In basins like Indus and Cauvery - and probably many more areas - farmers within the area are responsible for converting more than 80 per cent of supplies to productive evapotranspiration – a practice that could be considered highly "efficient". The real problem in these areas is the threat to agricultural sustainability and ecosystem degradation by growing crops driven by economic necessity (e.g. rice in Punjab and Haryana and sugarcane in Maharashtra and Tamil Nadu). When ill managed, this situation leads to exploitation of non-renewable groundwater resources, mining it from important ecosystems, or build up of pollution or salinity (Molden, 2002). This calls for changing the whole set of institutional management rules and enhancing the willingness of the users to comply to these rules in association with administrators and in the light of the changed market scenario.

Under this existing scenario of supply side augmentation and resource conservation, the following water management policies and institutional arrangements become highly relevant:

Improving Water Productivity

Producing more food with the same amount of water is an alternative to the supply side approach. In highly stressed areas, producing more food with less water may be the only option to ensure food security, and to restore systems so that they can sustain long-term agricultural practices.

There are a variety of inter-connected paths that can improve the productivity of water:

- Crop breeding for efficient water utilization/drought tolerance
- Improved cultural, agronomic and field practices
- Low cost supplemental irrigation technologies for rainfed/water scarce areas especially watershed management projects
- Improved irrigation management practices and precision irrigation
- Integrating recycling and reuse of waste water into basin and irrigation management
- Integrated natural resource management within basins
- Reforming of policies, institutions and incentives

Increase in water productivity with a focus on alleviating poverty and improving livelihoods in India will help the poor reap the gains of increases in water productivity in agriculture and would release more water for urban sector/municipalities.

Mrinalinee Vanarase, IORA for Environmental Solutions, Pune

I agree with Rahul on the issue of treating wastewater, at least grey water, at point source, which is possible in cities. The system, which Rahul has installed, is also called a zero discharge system through Soil Bed Treatment or a subsurface treatment system. There is a scientific method of installing such systems, and there is plenty of information available on internet on this technology. However, where it is not possible to use this technology in a completely scientific manner and where we need something less sophisticated and easy to install, I would suggest using different 'reeds' downstream as soakpits. These have a heavy root mass, which are very effective in treating wastewater. So, along with evapo-transpiration, we also achieve subsoil treatment, if at all there is any discharge. There are different types of reeds found in different parts of our country; most common amongst them are Phragmities spp, Typha and Cyperus spp. There is enough literature available on reeds and their effectiveness in treating contaminants.

N. K. Agarwal, Geological Survey of India (GSI), Dehradun *(response 2)*

Hi Rahul, most of your points are valid except that in M.P. most of the electricity is from thermal power stations. Electricity generated from different sources like hydro, thermal, nuclear etc. cannot be separated out at the consumer end. It is a mix of all through grid supply except in case of captive power plants, which are mostly with some industries or with industrial townships.

Many thanks to all who contributed to this query!

If you have further information to share on this topic, please send it to Solution Exchange for Water Community at se-wes@solutionexchange-un.net.in with the subject heading "Re: [se-watr] Query: Best Practices on Water Demand Management in Cities– Experiences. Additional Reply."