CDES/TU

THE SMALL EARTH NEPAL-2001

Proceedings of E-Discussion on

WATER FOR CITIES: RESPONDING TO THE URBAN CHALLENGES

(6-20 March 2011)

(Nepal National Water Week-2011)

Jointly Organized by
Central Department of Environmental Science, Tribhuvan University (CDES/TU)
The Small Earth Nepal (SEN)

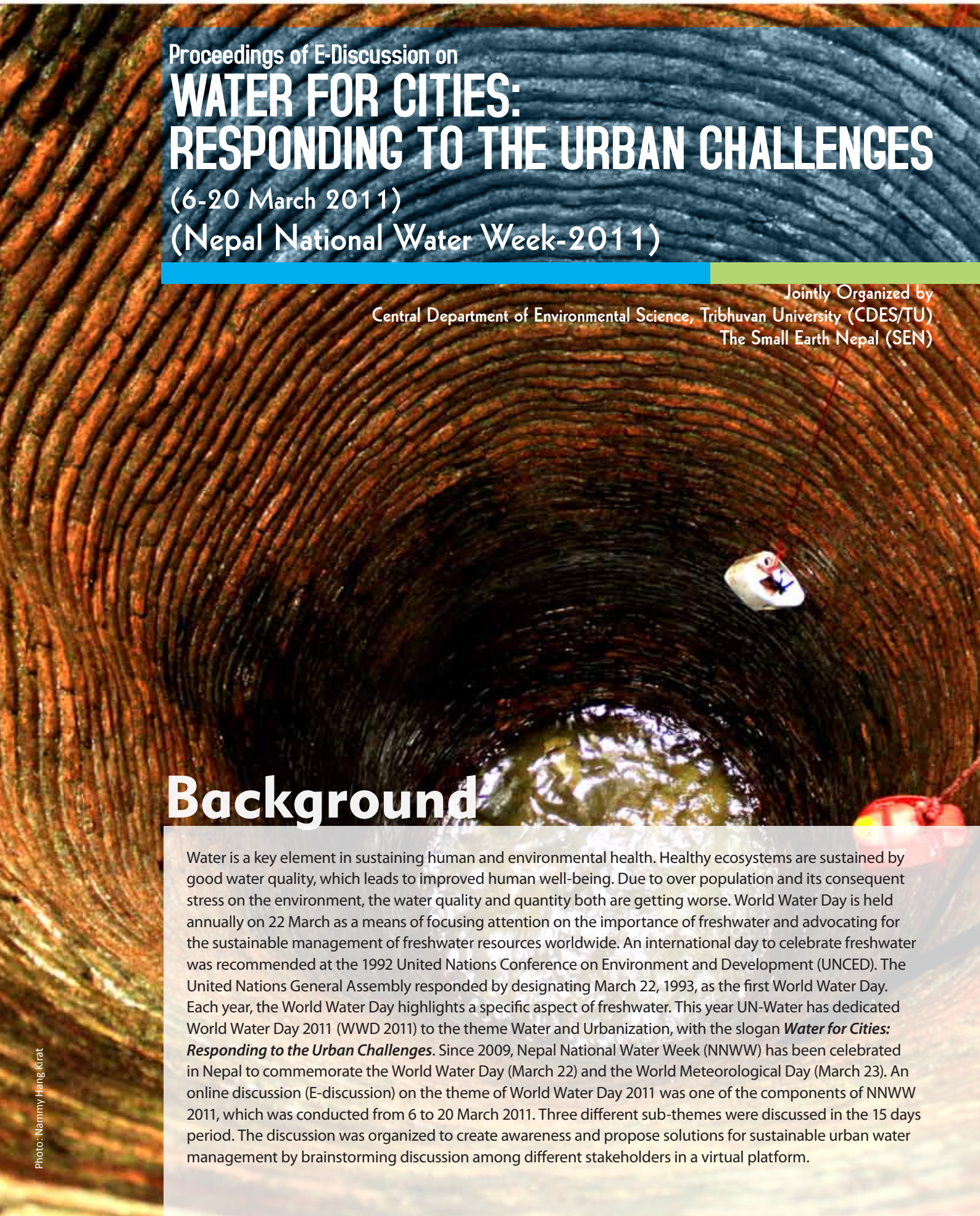

Photo: Nammy Hang Kirat

Background

Water is a key element in sustaining human and environmental health. Healthy ecosystems are sustained by good water quality, which leads to improved human well-being. Due to over population and its consequent stress on the environment, the water quality and quantity both are getting worse. World Water Day is held annually on 22 March as a means of focusing attention on the importance of freshwater and advocating for the sustainable management of freshwater resources worldwide. An international day to celebrate freshwater was recommended at the 1992 United Nations Conference on Environment and Development (UNCED). The United Nations General Assembly responded by designating March 22, 1993, as the first World Water Day. Each year, the World Water Day highlights a specific aspect of freshwater. This year UN-Water has dedicated World Water Day 2011 (WWD 2011) to the theme Water and Urbanization, with the slogan ***Water for Cities: Responding to the Urban Challenges***. Since 2009, Nepal National Water Week (NNWW) has been celebrated in Nepal to commemorate the World Water Day (March 22) and the World Meteorological Day (March 23). An online discussion (E-discussion) on the theme of World Water Day 2011 was one of the components of NNWW 2011, which was conducted from 6 to 20 March 2011. Three different sub-themes were discussed in the 15 days period. The discussion was organized to create awareness and propose solutions for sustainable urban water management by brainstorming discussion among different stakeholders in a virtual platform.

OUTCOMES

Photo: Subhadin Gautam

Sub-theme I

Status and challenges of urban water management in the face of climate change and conflicts and their implications on environment, public health and economy

STATUS

1. Water scarcity

a. Drinking water scarcity : The municipal water supply is very scarce in urban areas such as in the Kathmandu Valley and also in Palpa, Dhankuta, Dipayal and other areas even though Nepal is rich in water resources and ranked 43rd position in the world based on annual total renewable water (210 km^3/yr).

b. Groundwater depletion : There is high pressure in groundwater of urban areas due to a depleting level at an alarming rate. The groundwater level depletion rate is highly variable in the regions, which have diverse topography/geology like in the Kathmandu Valley.

2. Water pollution

a. Groundwater pollution : The groundwater is also at risk of pollution. Domestic sewage and industrial effluent specially the hospital effluent contains dense multi-drug resistant bacteria, which can find its way into the groundwater supply.

b. Arsenic contamination : Arsenic contamination in groundwater is also an emerging problem. Specially, in case of the Kathmandu Valley, deep groundwater has shown arsenic concentration above the accepted level, as shown in the figure 1.

c. River pollution : The surface water bodies of urban regions have become the disposal sites of domestic and industrial effluents as well as solid wastes that have adverse impact on aquatic life and their aesthetic value. The common drainage of storm water and sewage has made it more complicated. The status of urban rivers of the Kathmandu Valley is shown by water quality map in figure 4.

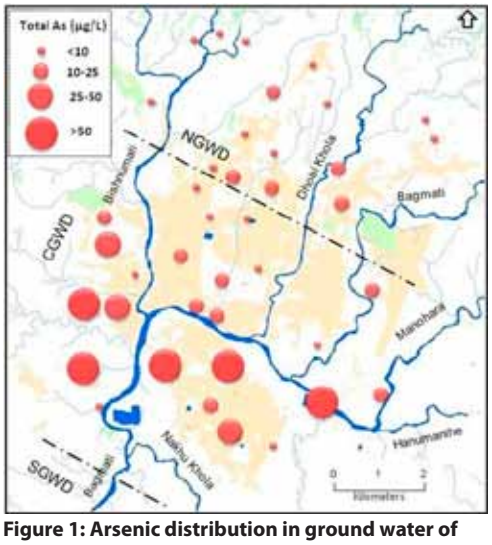

Figure 1: Arsenic distribution in ground water of the Kathmandu Valley (Chapagain, 2007)

CHALLENGES

1. Increasing pollution
Increasing amount of pollutants like sewerage, solid waste are further contaminating the groundwater and the surfacewater. Because of this, there is a probability of less quantity of water collection or even deteriorated water collection requiring costly treatment for the city supply.

2. Water leakage
There is approximately 40% leakage in municipal water supply system due to ill-distribution system. This large leakage is a great challenge to water supplier.

3. Conflict
Conflict between urban and peri-urban areas is increasing as water is being withdrawn at a higher rate in urban area. This conflict is increasing at different places of Nepal.

4. Climate change
Climate change that degrades water quantity and quality is an emerging challenge to urban water management.

Quotes of the theme

"One example of urban water quality deterioration is the increase in public and private health care institutions and their direct discharge of untreated liquid waste into nearby water bodies. Such activity has intensified the existing urban problems that generally contain relatively highly pathogenic and multi-drug resistant bacteria as shown by my study of effluents of some renowned hospitals of the Kathmandu Valley."
Dr. Bandana Pradhan, Institute of Medicine

"Pumping of water involves continuous energy consumption which ultimately adds to CO_2 emission. Hence, my opinion is to add climate change potentiality as new criteria for deciding investment for water supply project. Similarly every city is trying to improve water quality but unable to continuously ensure the standard. As a result, they go for alternative treatments mostly boiling. Boiling involves a lot of $CO_{2\ eqv}$ emissions. Hence ensuring continuous safe water by applying Water Safety Plan is necessary for making projects low carbon."
Dr. Namraj Khatri, World Health Organisation

CASE STUDY

Degrading Water Quality of the Bagmati River System

Mohan Chand and Jeeban Panthi, The Small Earth Nepal

The population of the Kathmandu Valley is mushrooming and due to the tremendous rate of haphazard urbanization, water bodies are highly polluted. A study was carried out to update the existing river water quality maps of the Kathmandu Valley prepared by DHM (1996) and KAPRIMO (2007). The major tributaries of the Bagmati River System- Bagmati, Bishnumati, Manahara, Dhobikhola, and Balkhu Khola were taken as the study sites.

The study shows that 21 sampling stations are excessively polluted, 13 stations are very severe polluted; both in the core city area. Only 1 station was in critical pollution class, 3 were in severe pollution and 2 were in moderate pollution. The numbers of the stations having excessive pollution were less than the number of stations found by the KAPRIMO in 2007, but the numbers of very severe pollution stations were more than in 2007.

The present study shows the worst conditions of the rivers along all the tributaries of the Bagmati and the Bishnumati Rivers. The values of Ammonia, Nitrate, Phosphorous, COD, BOD, and DO indicate that the water quality condition of the Bagmati River system is very much deteriorated. Manamati Khola, Dhobi Khola, Tukucha, Hanumante, Manahara, Shobhabhagwati Khola, Sangle Khola, Mahadev Khola are the tributaries that carry wastewater from different areas of the Valley and are mixed with the Bishnumati and the Bagmati making high contribution for excessive pollution of the River.

Unplanned settlements, river banks as open toilets, haphazard disposal of solid waste, and diversion of the water from upstream regions, sand mining and river bank encroachment are contributing to the worsening condition of the river. Although it seems difficult to improve the water quality condition of the River however if we go through joint collaboration with private sectors, government and local people, it can definitely be improved.

Sub-theme II

Water science and technology: Establishment and rational use of standardized laboratories and water treatment plants, water quality monitoring, national water quality database and human capacity development

1. Water quality monitoring and future needs

As mandated by the government of Nepal, Department of Hydrology and Meteorology (DHM) commenced water quality monitoring works initially in the rivers of the Kathmandu Valley and expanded to lakes and rivers of other parts of Nepal, namely, Pokhara, Narayani, Trisuli, Koshi and Karnali rivers by including limited water quality parameters using a handful of trained manpower and limited funding.

Future needs : There is a need of expansion of monitoring and research on rivers in different parts of the country especially in urban areas so that they will not be polluted like Bagmati and Bishnumati rivers on the grounds of "prevention is better than cure". Similarly, eco-friendly urban planning with water quality consideration should be done by local bodies such as municipalities, district and village development committees.

2. Need of a reference laboratory

Often a question is raised in the reliability of water quality (WQ) test result given by laboratories. There is no accredited laboratory with the state. Therefore, a reference laboratory for WQ monitoring has been realized. DHM laboratory after strengthening, laboratory of Department of Food Technology and Quality Control (already under the process of accreditation) or laboratory of the Bureau of Standards and Metrology can be designated as a reference laboratory. The government has to make policy and support it.

3. National water quality database and rational use

Limited data on water quality of some rivers is being collected by DHM but there is a lack of national water quality database across the country. In addition, DHM has had a bitter experience regarding the use of WQ monitoring and has been questioned whether it is worth doing postmortem of dead rivers again and again. Therefore, WQ monitoring data should be used rationally to know background quality, establish trends in quality and know whether unexpected change is occurring and act accordingly to control it as shown in figure 2.

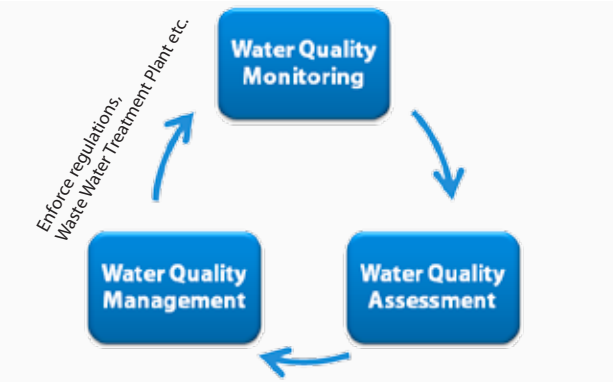

Figure 2: Rational use of WQ monitoring

4. Alternative resource and technology

a. Rain water harvesting (RWH): RWH is a potential option to capture the rainfall. Rainwater collected simply from rooftops can be stored in tanks and used directly for domestic purposes or to recharge groundwater. The following table gives estimates of water quantities that could be collected from rooftops.

Table 1: Annual volumes (m^3) of rain collected for specific rooftop sizes and quantities of rainfall **(Source: Dixit, 2002)**

Rooftop area (sq. ft.)	Rainfall (mm)								
	400	**600**	**800**	**1000**	**1200**	**1400**	**1600**	**1800**	**2000**
400	15	23	30	38	46	53	61	68	76
800	30	46	61	76	91	106	121	137	152
1200	46	68	91	114	137	159	182	205	228
1600	61	91	121	152	182	212	243	273	304
2000	76	114	152	190	228	266	304	342	379
2500	95	142	190	237	285	332	379	427	474
3000	114	171	228	285	342	398	455	512	569

Photo: Nisha Amatya

A house with a roof area of 800 sq.ft. and an effective annual rainfall of 600 mm (roughly half the average annual rainfall for Kathmandu) could collect about 46 m^3 of water in a year. Assuming a per capita consumption of 100 litre/day and an average household size of 5.44 people (2001 census), this is roughly equivalent to 85 days of supply or over 23 percent of annual need. The volume collected depends upon effective rainfall (total rainfall minus evaporation, foul flow, interception and withdrawal) and the area of collection.

b. Groundwater recharge and protection of recharge site: It is an opportune time to recharge groundwater regularly. A provision should be made that every household in an urban area should collect the rainfall on their impervious floor/building in the surface or underground. Such types of procedures should be started from governmental buildings followed by more water consuming industries or institutions. Potential groundwater recharge areas should be identified and managed similar to protected areas.

c. Inter-basin water transfer: Urban areas are generally densely populated. In order to supply adequate water to urban dwellers, an option is inter-basin water transfer i.e. supply of water from another river basin such as water supply from the Melamchi Valley to the Kathmandu Valley (under construction).

d. Decentralized waste water treatment plant: For treatment of sewage, decentralized waste water treatment plant system is effective and we have to explore low-cost, indigenous and eco-friendly technology. One possible financing option for it is Clean Development Mechanism (CDM). Capturing methane from waste water is a possible project eligible for CDM as in other many countries. For effective waste water treatment, separate drainage is necessary for stormwater and sewage. In addition, waste water treatment plants should be considered as an infrastructure like as electricity, communication and road and should be initiated from residential colonies or town planning.

e. Collaborative research and development: For sustainable management of urban water, Research and Development is necessary. Governmental organizations and I/NGOs can collaborate with academic institutions for it. A better way is to encourage graduate students by facilitating them with technical and financial support for water- research specially in action oriented research.

Quote of the theme

> When we talk about the arsenic issue of Nepal particularly of the Kathmandu Valley, there requires much detail and systematic scientific studies. The efforts so far merely tell us that there is presence of arsenic in groundwater exceeding the limit. Unless we understand the contamination mechanisms, we can not avoid it from the rational development of the inevitable resources. Therefore, research/studies should be intensified to have the real data.
> **Dr. Jaya Kumar Gurung, HIMCCA**

CASE STUDY

Water Quality Monitoring: An Experience of DHM and KAPRIMO

Ms. Indra Kumari Manandhar, DHM and Sushil Anu, KAPRIMO (former officer)

On water quality monitoring of Bagmati and Bishnumati, much has been done by different sectors to show the state of the rivers as horrifically polluted. Simply, these rivers have turned into an open sewerage causing impact on public health and environmental degradation. Department of Hydrology and Meteorology (DHM) has been continually monitoring the river water quality since 1992 in Kathmandu Valley, Pokhara, Narayani, Koshi, Trishuli and Karnali Rivers too. We have come to a point of questioning whether it is worth doing post-mortem of Dead River time and again in the form of water quality monitoring. Government and local bodies with active participation of the populace can improve the situation with proper planning and implementation. Intensified monitoring of these rivers is a must once the intensive mitigation efforts are applied as recommended by monitoring results.

In the years 2007-2008, KAPRIMO (Kathmandu Participatory River Monitoring) team, conceptualized by ECCA developed a sustainable model for funding the river monitoring programs. Tripartite agreement among Kathmandu Metropolitan City, Lalitpur Sub-Metropolitan City and DHM was made to allocate budget for monitoring of Bagmati and Bishnumati catchments but for the funding part DHM was again left alone, which was not sufficient. A handful of trained manpower and limited funding are the major factors hampering its efforts on water quality monitoring activities expansion.

In addition, the establishment and use of standardized laboratories is a part of the plans of KAPRIMO, but we should apply the concept of using "Reference Laboratories" too if we think of managing the nationwide water quality database. DHM would be an ideal organization to keep the nationwide water quality database of river systems but its laboratories must be strengthened first since DHM is the only organization continually taking river water quality monitoring for the past two decades. However, opportunities are to be looked upon in integrated approaches like collaboration with National Bureau of Standards (NBS), private labs and NGOs.

Local bodies like municipalities and Village Development Committees have a leading role coming forward with proper programs to prevent the growing trend of water quality degradation caused by haphazard urbanization.

Photo: Sangita Maharjan

Sub-theme III

Policy and practice from Government to citizen for sustainable urban water management

1. Integrated water resources management (IWRM)
Water management should be based on IWRM and the river basin planning approach. In Nepal, Water Resources Strategy 2002 and Nepal Water Plan 2005 which are on IWRM and River Basin approach, are being implemented. However, their implementation part is not so encouraging.

2. Payment of ecosystem services (PES)
For the justice of natural resources utilization and also to manage potential conflict between water users of rural and urban settlement as well as upstream and downstream users, an innovative tool is PES, where the urban users/downstream users compensate adequately to the rural/upstream providers for services. Therefore, the mechanism of PES could be the best option to maintain harmony between upstream and downstream communities.

3. Public private partnership (PPP) approach
From providing drinking water to managing wastewater, PPP - a popular development tool can be utilized in various modalities based on the projects. The waste water management should be based on Polluter Pays Principle i.e. there should be a system of effluent charge and be managed by PPP approach. For sustainability of PPP based projects, we should develop such projects at larger scales and should be demand driven rather than donor driven. There is need of PPP policies that can make mutual trust among people, public and private sectors.

4. Inter-sectoral harmony and legislation
A harmonious relation in inter-sectoral policy and inter-intuitions is needed to be improved such as among Department of Hydrology and Meterology, Department of Water Induced Disaster Prevention, Ministry of Irrigation, Department of Soil Conservation and Watershed Management, Department of Water Supply and Sewerage and local bodies.

Effluent standard: The "Effluent Standards/Tolerance Limits" enforced by Ministry of Environment is supposed to cover effluents discharged from all industries. In case of hospitals, which are service industries, the standard is silent on microbial parameters that is an important contaminant in waste water.

5. Safe water and sanitation as a fundamental right
If safe water and sanitation is provided as a fundamental right in the new constitution, every citizen will be ensured of clean water and sanitation. Presently in the Interim Constitution of Nepal (2007), there is a provision regarding Environment and Health in Fundamental Right as: (a) every person shall have the right to live in a clean environment and (b) every citizen shall have the right to get basic health services free of cost from the state as provided by the law.

If the state provides safe water and sanitation to all citizens freely, its cost of providing free health services will be drastically reduced as 50% OPD visits are water related diseases as per Department of Health Services. For its effective implementation, a good mechanism of implementation, political commitment and public awareness on safe water and sanitation is necessary.

Quotes of the theme

> Recently, Public Private Partnership (PPP) has been a popular development tool for many projects. It has been practiced for many projects in a number of municipalities in Nepal. I think PPP can also be used successfully for sustainable water management. For providing drinking water to managing waste water, PPP can be utilized in various modalities based on the projects. There are few donor funded projects in Nepal which can not run if the fund is stopped. This is the problem facing small scale PPP projects in Nepal. So instead of donor driven PPP projects, we must try to develop demand driven PPP projects. Scale should be larger, so that a real sense of PPP models can exist and produce targeted goals and which can be replicated in other parts. For this, clear cut PPP Policy creating mutual trust among people, public sector and private sectors is necessary and also support from the government is a must.
>
> **Dr. Sunil Babu Shrestha, Clean Development Consult**

> What the most important is that the new constitution is being drafted in our country, so in the new constitution safe water and sanitation must be addressed as a fundamental right.
>
> **Er. Ganesh Shah, Former Minister**

CASE STUDY

What Next to Privatization?

Dilli Ram Bhattarai, CDES, TU

Despite of several efforts made by the government during the 90's, the chronic water shortage problems in the Kathmandu Valley remained unimproved. In its ninth five-year periodic plan, government endorsed the policy to involve local government and private sectors in the development of water supply and sanitation with an objective to make such agencies more autonomous and also to reduce political interference in the day to day administration of the then Nepal Water Supply Corporation (NWSC). On the basis of this, the Government of Nepal privatized the NWSC by forming the Kathmandu Upatyaka Khanepani Limited (KUKL), a water utility operator, to solve the water problems in the Kathmandu Valley three years ago. The main objective of KUKL, to reform and improve the water supply services in the Kathmandu Valley qualitatively and quantitatively, has been badly affected by continued political influences. This is seen from management change two times in its three years period and also by the frequent obstruction in its daily routine by its politically organized staff.

Under international law, the right to water is unconditionally and explicitly protected as human rights. The United Nation has declared that access to clean and safe water and sanitation is fundamental human rights. Nepal has also addressed the right to clean and safe drinking water in its policy. But, KUKL says 34% of its water supplied, even in the capital of Nepal, is contaminated with coliforms. The present water demand of the valley is 195 MLD (for permanent residents), however, the total water production in wet and dry seasons is about 140 MLD and 100 MLD respectively. Among these, approximately 40% is leakage indicating a poor distribution system in the Valley. People in most of the areas barely get one hour supply every fourth day. Limited water resource availability and a rapidly growing population are other challenges to meet the demand. Not only leakage problem, the data from 2010 shows that KUKL failed to collect overdue water bills of NRs 250 million, although it had full authority to take action against those dues defaulters. Political influences, the same story from NWSC, have been continued here, too.

KUKL has recently begun a 15 years long term project with a loan from the Asian Development Bank to replace the old pipes in the Kathmandu Valley to control leakage. This is expected to be completed by 2025. But, by the direct political interference to the board of KUKL, it has been made powerless to run even its normal routine and daily administration. Therefore, neither privatization nor any policies and nor the institutional changes solve the urban water problems. Similarly, public participation also may not perform well if there is political pressure and intervention. It needs autonomous institution in real practice with strong political interest and stability for effective water supply in the Valley.

Conclusion

The quantity of urban water is decreasing and the quality of available water is degrading in Nepal. The situation is even threatened by climate change. Nepal also lacks scientific database particularly on water quality. Therefore, national WQ database should be made and used rationally by making reference laboratory. For sustainable urban water management, a better option is the use of PPP tool at a larger scale. However, safe water and sanitation to all citizens can be ensured by making it as a fundamental right in the new constitution of Nepal with good implementation mechanism.

E-Discussion Statistics

There were a total of 464 participants, out of which 61 active participants from 8 countries have posted their views, research findings and experiences on respective issues/subthemes as shown in figure 3. During the moderated e-discussion, participants debated the urban water issues and proposed suggestions with a total of 131 postings.

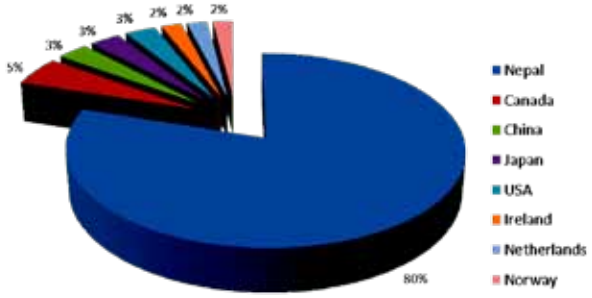

Figure 3: Participants of the E-Discussion

Figure 4: Water Quality Map of Bagmati Water System

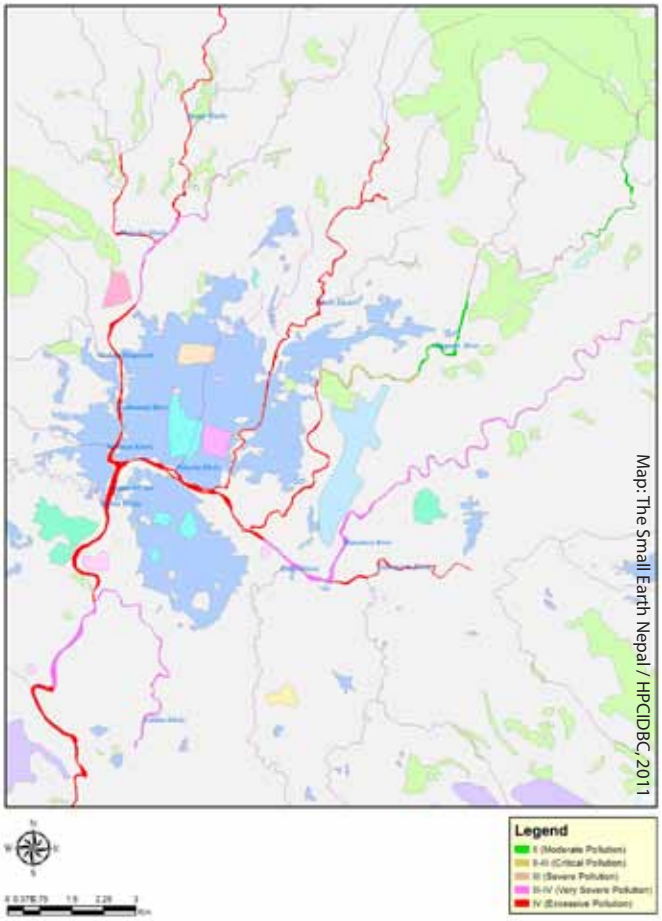


Photo: The Small Earth Nepal

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