

Feasible low cost sustainable options to maintain river quality: Case of Kathmandu Valley Rivers

Megha Raj Regmi / Senior Researcher
Email: megha_rajregmi@yahoo.com

Postal address:
GPO Box: 4836
Kathmandu, Nepal.

Abstract

As a significant size of population of the world is still struggling for a bucket of water, most of the urban populations are using precious water to flush excreta. Technically using flush water means converting potable water into more waste and making rivers and water bodies into open sewers. Socially, it is a crime to poor and deprived people. To overcome this problem, new skills are required for improved sanitation services, as the conventional wastewater treatment technologies require high investment and proper operation and maintenance cost. Water availability in Nepal is greatly influenced by its geographical location and high Himalayan Mountain Ranges. The flows in the rivers vary very much seasonally. In spite of the total quantum of water flow annually is very large.

Existing inadequate sewerage system and direct disposal of household waste into the watercourses has tremendously multiplied the water pollution in the cities. Kathmandu, a historical and World heritage city is situated in central part of Nepal. All the rivers and rivulets that originate from this middle mountain valley, drain into the major river Bagmati, a tributary of the Ganges. Not so long ago Bagmati, which is sacred to all the Hindu populace, used to be the source of livelihood to people, fauna and flora living in the valley and down stream. At present all the sewerage system within the valley is fed directly into the streams nearby. The pollutants thus being fed into the tributary streams have rendered the river useless and serve just as a wastewater drain. Rapid urbanization and absence of reliable wastewater treatment facilities are the major causes of rivers pollution. Drastic action is required to revive it to its original glory.

Every year in Kathmandu there has been organised the Bagmati River Festival to raise the awareness among all river users about the need to conserve the river, and develop an economical and environmentally sustainable river , also incorporates adventure activities, such as kayaking, mini-marathon to mountain biking, down river rafting races, with environmental education seminars and live entertainment and has been organised to sensitise the public about the river's deteriorating condition and to encourage community participation in conserving River Bagmati. It is believed that people can help to save the Bagmati River by treating all waste water with a septic tank, not throwing garbage into the river, composting all organic matter at home.

This paper thus describes the scenario of the rivers in Kathmandu, analyses the chronology of river pollution, discusses the adopted wastewater treatment technologies like, oxidation ditch and stabilization ponds and their performances and suggests measures to counter the problem in a sustainable manner to restore the rivers in a healthy state.

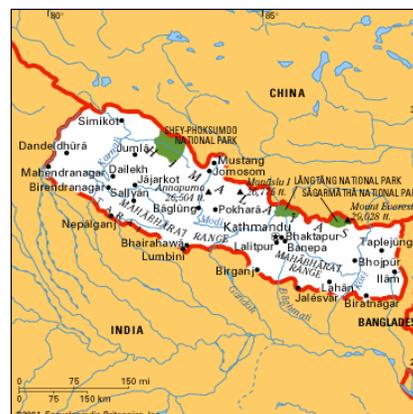
Introduction

Nepal is a developing country with physical and cultural diversities which has per capita income of US\$ 270. Renowned as a mountainous country and perched between India and Tibet, Nepal has an area of 147,141 km² speaking 117 different languages. More than half of the Nepalese population live under the poverty line. The society is agrarian which derive their livelihood mostly from the land in the rugged topography and the rivers originating from the mountains. Nepalese topography has the largest variations in altitude in the world, ranging from less than 100m to 8845m (The Everest). Nepalese rivers are sacred to all the Hindu people.

In terms of the hydropower and the fresh water reserve, Nepal is the second most endowed country in the world. It has total theoretical hydropower potential of 83 GW and about 2.27% of the world's fresh water resources. Every year Nepalese rivers contribute 225 billion m³ of surface water to the Ganges River, this amounts to 118,200 m³ per km², four times the world average. There are 6000 streams gushing from north to south. Precipitation, surface runoff and groundwater are the country's main sources of water. Nepalese water sector economically focuses on three sub-sectors – water supply, irrigation and hydropower. The difficult topography and poor financial resources has caused meagre basic physical infrastructure development.

As per their origin rivers in Nepal can be broadly divided into three categories. Himalayan rivers originate from high mountains and are snowfed whereas Mahabharat rivers from middle mountains and Churia rivers from the lesser mountains are rainfed. The first category comprises the main river systems - Koshi, Gandaki, Karnali and Mahakali, Whereas the Bagmati river under study here originates from the middle mountains. All of them ultimately drain into the Ganges River in northern India.

Nepal's rivers descend further and faster than any other rivers in the world. As a result, many have cut sheer-sided valleys thousands of meters deep, creating enormously unstable hillsides. These rivers therefore have become increasingly popular for Rafting and river sports.



Rivers of Kathmandu Valley



The Bagmati, which rises at Bagdwar and drains out through the Chobhar gorge in Kathmandu, is the principal river of the Kathmandu Valley. The river is rain-fed type with noted variations in seasonal flows. It is a tributary of the river Ganges. Total drainage area of Bagmati river basin is about 3681 km² and is 163 km long. The average annual daily discharge of Bagmati at Pandhera Dovan some distance downstream of Kathmandu is 136 m³/sec (records of 1979-1990). The maximum is 4050 m³/sec and the minimum 5.8 m³/sec. This river system consists of streams like Bishnumati, Rudramati, Icchumati, Manohara, Nakkhu, Hanumante, Karmanasa and Godavari river.

Nepalese decline to the Bagmati River by their heart. People see Bagmati as a source of civilization rather than just a river. The main tributary of the system, river Bagmati is destroyed by the pollution, the water is black and poisonous, crawling with flies and contaminated with sewage. In absence of proper plans the river environment is under intense degradation for last couple of decades. The degradation thus depicts the degradation of the civilization within the river valley. The water in the river gives off a terrible stench but Hindus believe that it purifies bodies and souls.

The pollution in Bagmati river is caused by several factors like throwing of garbage directly, encroachment of river banks, withdrawal of sand and the disposal of untreated wastewater. Over 60 MLD (million liters a day) of wastewater is generated in Kathmandu and domestic households contribute a whopping over 80 percent of this. The waste effluents from industries and factories contribute to 7 percent of the total wastewater. These are all thrown into the Bagmati river. The practice of quarrying sands from the riverbank has also affected. Sands act as natural purifier. They trap pollutants and also maintain steady water table. The rampant digging of the sands for commercial purposes has destabilized the whole river system. The course of the river has already changed at many places.

The most visible impact of pollution in Bagmati has been on the aesthetic part. River, everywhere are considered as jewels of cities that lie on its banks. But the degradation of Bagmati has severely defaced the beauty of Kathmandu. Then, there are socio-cultural and religious aspects that are at risk. All of our activities related to river have been hampered by the pollution, our civilization is linked with Bagmati. The practice of taking holy ablution in the Bagmati river has vanished around the city as people fear the water of Bagmati instead of respecting them. They do not touch water even when performing rituals. It has also been observed that people carry water from their homes when they go to Aryaghat for performing cremation of their loved ones.

Twenty years ago people used to swim in the river but now it has turned into a sewer, which is a truth that is hard to accept. Today, people don't even wish to be cremated at the riverside, which used to be so holy. It's a tragedy that surmounts the entire life of Kathmanduites because it's a holy river.

The following activities have directly or indirectly influenced in polluting the river:

1. Most of the water in the Bagmati is tapped for drinking water supply to meet the demand of an ever increasing population of Kathmandu directly affecting the cleanliness of the river
2. Haphazard establishment of carpet factories along the bank of the Bagmati river
3. Development of new residential zones without sanitation provision.
4. Discharge of the untreated sewage into the river
5. Lack of proper rules and regulations for the control of river pollution and non-implementation of existing regulation
6. Lack of coordination between the Municipality, the Nepal Water Supply Corporation and other related agencies.

Besides these, population growth in the recent past, excessive extraction of sand from the river bed for building work, industrialisation as well as lapses on government policies and plans have all contributed to the degradation of the river's ecology.

Water pollution in kathmandu.



There are altogether 6000 streams in nepal, but the irony is that there is scarcity of water in the kathamndu valley. Surface water in the Kathmandu valley is severely polluted by industrial effluent, waste, dumping, and by the discharge of untreated sewage from the residential areas. Rivers in the valley including Bagmati, Rudramati, Bisnumati, Manohara and Hanumante are all seriously fouled for this reason.

Kathmandu is growing fast and studies suggest that every year 20,000 new houses are built and slums population is also rising up. The conventional wastewater treatment systems are in place but they are inadequate to solve the ever worsening problem. The river within the valley in addition to the groundwater sources with the available ground water extraction serves the drinking water need of one and a half million people. The ongoing new constructions within the watershed have tremendously reduced the recharge rate and caused reduced river discharge during lean flow period. In last twenty years, the environmental degradation has become a major problem in Kathmandu valley. Heavy density of the traffic, industrial establishment like cement factories, improper solid waste management, and air pollution by the brick kilns are the major causes. Today, in the dry season all the watercourses look like earthen sewers causing foul nuisance, bad aesthetic view and adverse impact on health of the people and the Environment. Excessive use of the river water from upstream and disposal of increasing amounts of waste have affected to the whole ecosystem of the valley. There is really a lot needed to do before one can take a bath or drink the river water as happened to be the case some 20 years back.

Exceptionally the waters of Kathmandu valley river systems are very much polluted. The ground waters of deep aquifers are found to contain high quantity of ammonia, iron and manganese above acceptable level, which require adequate treatment before human consumption BOD values are relatively higher. The river sources in rural area become turbid during wet season due to environment disturbances (soil erosion, landslides, deforestation, etc). There is a lack of institutional and legal frameworks for well coordinated and legal activities among water related sub-sectors. The existing situation has led to a non-coordination, duplication of efforts and unidirectional approach without promoting conservation, utilization and development of water sources.

This shows that the quality of river is not at all different than that of sewage. It has therefore; become urgent to transform the sewage drains back to rivers recover to their original status. Steps have been taken to control the river pollution but they are inadequate and inappropriate, though some mechanical treatment units are operated, the heavy costs incurred in operation of the system is not appropriate to overcome the situation. In such sanitation it is necessary to adopt a proper simple, local based and replicable appropriate measures to tackle the problems.

Actions to Control pollution

First of all there must be set standards and checks and controls on the disposal of raw sewage directly into the river. Watershed management though going on well needs to be further improved. And last but not the the least important in the pollution control in the tributaries.

As one of the poorest countries in the world, the government alone cannot afford to tackle key environmental problems on its own. It will need community involvement and awareness as well as worldwide help to ensure Bagmati to remain sacred.

Environmental Issues of the Rivers of the Kathmandu Valley

With the increase in population and development of the human society, mankind has been using rivers and their resources increasingly. The rivers have been used not only for withdrawing water for different purposes, they have also been used as sediment mining sites and appropriate site for disposing the wastes coming out of the settlement. As a result the rivers flowing through the city are being converted to a trunk sewer line. The river flood plain have been encroached. This has inflicted the natural function of rivers. Additionally. Different uses are becoming increasingly conflicting depending upon the stage of development of the river basin. Also, developments in the whole catchment, like deforestation, urban development have caused conflicts. These conflicts are much severe in developing countries compared to developed countries. The major human interventions made on the Bagmati River are given below.

Sand mining from different locations

The catchment area of Bagmati river in Kathmandu valley is covered by sandy and silty soil, so the river transports huge amount of sand during high stages of river, the quality of sand transported by this river has been well recognized. Accordingly, along the Bagmati, Bishnumati, Monohora and Rudramati several sand extraction sites are located. The government institution formally invite bids from the local contractors to allow such extraction. Extensive damage has already taken place at Thapathali and Balkhu Bagmati bridges.

Disposal of solid waste

It is estimated that about 600 T of solid waste is discharged by the residents of Kathmandu daily, which are dumped along the bank of the rivers. This has been causing the leachate problem. Since the dumping of garbage was carried out few hundred meters away from the international Airport, several accidents took place due to collisions of the airplanes with the birds roaming in search of food near dumping site. Several domestic and international airlines had to postpone their flights and ground the airplanes for maintenance.

Encroachment of floodplain

Kathmandu valley is growing fast. The fertile lands in the valley have already been encroached. There is an urgent need to integrate environmental aspects with the urban development. Environmental degradation is reflected in all aspects of physical landscape and urban livings.

Solution for River Pollution

Experts suggest there are many ways to solve the problem of river pollution. Establishing treatment plants and wetlands could be an answer. Although there are six different water treatment plants in Kathmandu, only one in Guheshwori is operational. Demand of water in Kathmandu valley is 230 million litres per day (MLD), whereas the supply is about 120 MLD and 15% of supplied water is used to flush the excreta. In the Kathmandu valley all the rivers including the Holy Bagmati River now looks like an open sewer due to the direct disposal of untreated sewage into the watercourses. To reduce the environmental degradation dry toilet is the only realistic option in the context of Nepal. Dry toilet is defined in this report as the on-site disposal of human urine and faeces without the use of water as a carrier. The dry toilet not only lessens the pollution in the water course but also enables the reuse of the urine & faeces as nutrient & conditioner to increase the fertility of soil. This could eventually reduce the haphazard use of chemical fertilisers.



Conclusion

Nepal being one of the poorest countries do not have sufficient financial resources to tackle key environmental issues. Kathmanduites who have not yet been able to manage the supply of adequate water for the dwellers of the valley yet, are not in a position to pay for the costlier wastewater treatment plants. Here are some recommendations for the solution for the regeneration of the rivers of Kathmandu valley:

- A. Necessity of the Comparative Study and appropriate choices of the following wastewater treatment technologies by the national debate:
1. Conventional wastewater treatment System
 2. Small Bore wastewater treatment System
 3. Onsite sanitation System
 4. Ecological Sanitation system
 5. Constructed wetland System
- B. Government has to solve the problem of the squatters who are living along the bank of the rivers of the valley
- C. Strict implementation of "Polluters Pay" principle
- D. Once the sewage from the rivers of Kathmandu valley is separated, a major battle in the war to clean up the river will have been won.

References

- (i) Aussie A. & Louiza D. (2002) *Urine Diversion ecological sanitation systems in South Africa*. CSIR, Pretoria, South Africa.
- (ii) Regmi, M. R. (2002) Lab Reports, Kathmandu, Nepal.
- (iii) Regmi, M. R. (2003) *Exploration of the concept of dry Sanitation*, Kathmandu, Nepal.