

## Reducing Wastewater Problems in Low-income Semi-urban Communities in Kathmandu Valley

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### Reflections on the outcomes of a workshop

#### Introduction

For a large number of communities modern sewerage systems are neither feasible nor desirable. In particular in communities where large quantities of water for flushing are not available, or where laying sewer pipes is not possible due to congested housing, and the large treatment plants required may be too expensive to build and maintain, alternative solutions need to be found. If they do not want to be left with hazardous and unpleasant situations, communities and local authorities will have to look for alternative ways to treat and dispose of wastewater in a safe and ecologically sound way.

In Kathmandu valley in Nepal many of such communities exist. A workshop was held with representatives from four of these communities (Kusunti, Siddhipur, Panga and Madhyapur) to map out their particular problems concerning waste water, to discuss a variety of possible solutions to solve these problems taking into account ecological sanitation principles and to assess people's willingness to test these alternative solutions.

#### What is the problem?

Kathmandu valley is full of high-risk communities: small urban semi-agricultural communities. Major water supply and sanitation problems exist and with a population growth of 2,2 percent per annum, these problems aggravate rapidly. Many households do not have access to the sewerage system and many even lack a well-designed septic tank. Defecation fields and alleys are found at short distances from living areas. Drains are blocked and solid waste is found everywhere. The resulting picture is grim; groundwater gets polluted through leaking tanks and once the monsoon starts, overflow from septic tanks as well as faeces lying around on defecation fields cause surface water in ponds and streams to become seriously polluted. Since groundwater as well as water from ponds and streams are used for domestic purposes like drinking, washing, bathing (human beings and cattle) and washing clothes and utensils, people face serious health risks and nuisance. In addition, this uncontrolled disposal of wastewater implies an enormous loss of nutrients that could otherwise be used for agricultural production.

These communities do not get the attention they deserve. The congested nature of these communities and increasing water scarcity make them "not easy to deal with" from the conventional engineering perspective. In addition communities with a Hindu majority may not be easily convinced to go for ecological sanitation options, since these ultimately require handling of faeces, which is considered to be extremely "jhuto".

At the same time local authorities and government departments, often unable to deliver public health services by themselves, are to find ways how they can best support initiatives towards

improving environmental sanitation of Community Based Organisations, NGOs and the private sector. Sustainability of facilities and services can only be achieved by involving all stakeholders, including these local authorities and governmental departments. Effective involvement of these stakeholders requires mutual commitment and partnership. Being able to work in sustainable partnership requires the ability to i) diagnose the needs and preferences of end users and plan small scale improvements accordingly, ii) agree on sharing management and maintenance responsibilities among the stakeholders and iii) effectively share (monitoring) information.

### About the workshop

The workshop brought together a mix of people from Kusunti, Maddhipur, Siddhipur and Panga: school teachers, local leaders, social workers and students from the communities, resource persons from Nepal as well as from the Netherlands and representatives of the Nepal Water Supply Corporation.

The Overall Objective of the workshop was:

to create the conditions for sustainable improvement of the environmental sanitation and water supply situation, in particular of the surface and groundwater quality, in selected communities in Kathmandu valley.

The more Specific Objectives were:

- to carry out a participatory analysis in four communities on needs and demands for small-scale waste water treatment and disposal facilities as a means to reduce health risks and to improve the quality of ground- and surface water;
- to provide information on small scale treatment and disposal techniques that are sound (i.e. technically appropriate and manageable by neighbourhoods or the community) for semi-urban, hilly areas in Nepal;
- to develop elements of a proposal for applied research with community representatives involved and potential support organisations.

A first step in the workshop was to work on a participatory field analysis of needs and demands for small-scale environmental measures such as wastewater treatment and disposal systems. Field visits to collect information were prepared, carried out and evaluated by the workshop participants. The field analysis was followed by knowledge exchange on small scale, community manageable disposal facilities and on possible measures for improvement of water quality, which include simple methods for water quality assessment and monitoring. These two steps led to the development of a proposal for applied research through experimentation with small, community-managed waste water treatment options and disposal facilities and other possible measures. Once funding is obtained, implementation of the action research can start. This will be followed by evaluation of the results, adaptation of processes and technologies and scaling up.

### Some data resulting from the field analysis

In the context of the workshop the field analysis took some six hours. It can therefore only be considered to be rough and very preliminary. Still, a picture of major environmental sanitation problems emerged:

**Kusunti:** Through the assistance of a local NGO a start was made with laying sewers, but many of the badly constructed septic tanks are not (yet) connected. However, the last part of the pipes could not be connected to a main line, because the neighbouring community doesn't want the sewage coming through this line to be discharged into the river. There are no municipal arrangements for drainage and road construction. The drainage programme started in an unplanned way, has technical weaknesses and open drainage is a big environmental problem. Wastewater, including water coming from the local tannery, badly affects agricultural land. Community members, including the women, feel the wastewater problem and seem helpful and interested to work with organisations wanting to support them to improve the situation.

**Siddhipur:** This is a more agricultural community, with a high population density. Open defecation, blocked drainage channels and bad drinking water quality from taps and wells, causing a high risk of getting water born diseases, are major problems. Sewers are not in place and some community members purchased a double vault, poor flush latrine through a programme that installed demonstration latrines some eleven years ago. Garbage is poorly managed. Villagers are conscious about the drainage problem and consider it a major problem. The Village Development Committee has a proper plan, but no finances. However, people are ready to contribute finances and labour.

**Panga:** A sewerage master plan has been developed, but no funds are available as yet. Part of Panga is not included in the master plan, since it finds itself on the other side of the local watershed. In this part of Panga a network of sewers is in place and discharge is the main problem. Much of it is discharged into agricultural land and in two big, leaking collection tanks. Open defecation is also practised. People lost faith in the government and prefer working with NGO's. There are a number of community-based organisations and people seem to be ready to contribute labour.

**Madhyapur:** A densely populated area on a ridge and wastewater flows away easily. Within the village it is somehow controlled with a sewer running through the main street, but discharge is in small rivers. An INGO built a treatment plant, but part of the construction works was washed away during the last monsoon and no maintenance is carried out. The plant is not functional and causes a major health hazard. A large part of the community is not connected to a sewer and many households discharge toilet and kitchen waste on open drains. Open defecation is yet another major problem, causing the outskirts of the community to be very dirty. Water supply is intermittent, leading to long waiting times. People are ready to contribute to improvement of the situation, but they had a bad experience with the INGO leaving the work unfinished.

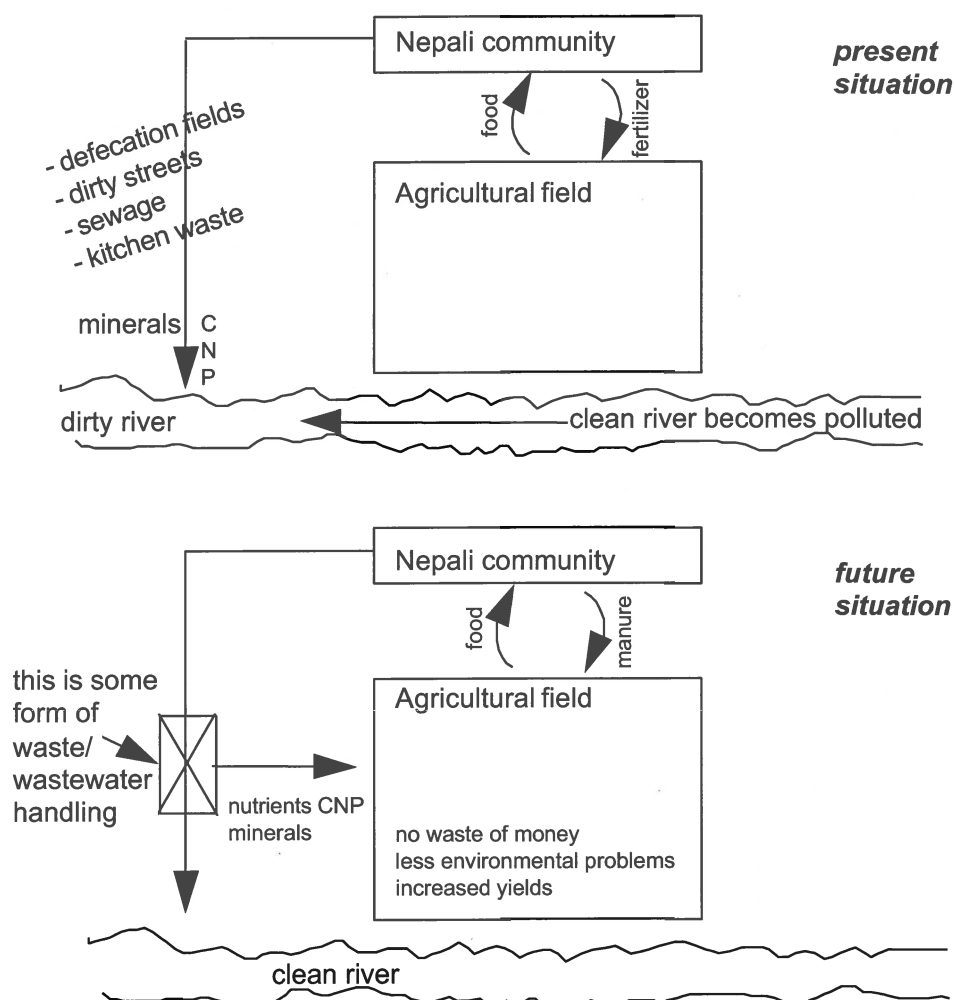
### What to do/possible solutions?

When looking at possible solutions issues such as existing practices and people's demand for improved facilities, their attitude towards the possible use of human excreta, existing and required management structures, feasibility of certain technical options. Men, women, rich and poor need to be consulted. The technical solutions proposed during the workshop to solve the environmental and nuisance problems are based on the principle that mixing of black waste, grey-, and white water should be prevented as much as possible. These three flows should be handled separately. If done properly health hazards will reduce and a good ecological system will emerge and money can be saved or even earned, because:

- less expensive fertiliser is needed;
- less water is needed, because faeces do no longer have to be flushed away;

- expensive treatment can be avoided;
- manure can be sold.

### The nutrient cycle of a Nepali community



While looking at various options to improve environmental conditions the following general points were raised:

1. As much as possible separate collection and composting of dry, black waste;
2. Collect and treat grey water;
3. Collect urine for mixing with ash as manure or simple treatment of urine with grey water;
4. Use white water for recharge of groundwater;
5. Take into account maintenance and management funds and capacity of whatever is opted for;

6. Take into account people's attitude towards the use of urine and human excreta;
7. Work on public awareness and education.

Possible technical solutions included the use of toilets allowing composting of black waste, improvement of existing gutter systems for stormwater in order to recharge groundwater and the construction of wetlands for treating grey water.

Looking at the situation in the four communities involved, the following points about the different flows of water seemed important to discuss:

### **White water**

It is important to prevent that (white) rainwater mixes with waste. Rainfall is very unevenly distributed over the year, with high rainfall during the monsoon and no or hardly any rainfall in winter. Many of the semi-urban communities have old discharge systems meant to carry monsoon water, but these are often poorly maintained and therefore less functional. These old systems of gutters and existing pipes can be upgraded for discharge of rainwater, which can be used for recharge of groundwater through ponds or for irrigating agricultural fields. However, proper management of solid waste is imperative for gutters to function.

### **Black waste**

Flush toilets are comfortable, but expensive in terms of capital costs and costs for water used for flushing. They induce an enormous amount of waste water (15,000 l of water/capita/year is needed to flush away 50 l of faeces and 500 l of urine) that is to be treated if we want to prevent a health hazard through uncontrolled discharge. Adopting a safe system of black waste collection seems more appropriate, because water is getting scarce and/or expensive. Black waste should be kept as dry as possible (night soil), by using double vault private or public toilets. Mixed with cowdung, ash, straw and agricultural waste it can be composted for use as manure at a later stage. Urine is best collected separately for reuse of nutrients in agriculture. In some communities mixing of urine with ash for use as manure is already practised.

### **Grey water**

Separate grey water lines can be constructed for washing, bathing and kitchen water. The nutrient in this waste can be used for growing products in constructed wetland systems or (fish) ponds. Management of such treatment plants can be done by organisations or private persons deriving benefits from the products. Should waste water flows become too big or when insufficient space is available, oxidation ditches can be considered. Treated water can be discharged into a river or be used to recharge groundwater or irrigate land.

## **Working towards change**

The workshop provided quite some ammunition for the development of a proposal for applied research. Acknowledging that effective management structures are as important as appropriate technical options, elements for the proposal include starting broad consultation processes, detailed investigation, participatory selection of the most appropriate technical and managerial solutions and experimenting with these solutions.

The proposal does not only focus on finding the locally most appropriate technical options, but also on finding options for sustainable maintenance and management. In particular with respect to the latter it will look into the interface between local authorities, the private sector and the community. The objectives of the research proposal have been defined as follows:

- to establish mechanisms for and carry out broad based participation processes for further investigation: area consultations, community fora, etc.
- to plan and implement micro-projects to i) eliminate hazardous situations brought about by uncontrolled disposal of wastewater, ii) help restore the ecological balance and iii) make profitable use of wastewater.
- to find effective management models and partnerships between local authorities and community based organisations for sustained service levels (also in case of growing populations) and for ensuring that people continue to make effective use of the facilities.
- to develop monitoring capacity for sustained improvements.
- to disseminate experiences within the country.

The communities involved in the workshop are prepared to act as pilot sites for testing the technical and management options.

## ANNEX (as produced by workshop participants)

### About Madhyapur (Thimi) community

#### Introduction

Madhyapur Thimi, which is one of the oldest communities of the Kathmandu Valley, is situated in the middle of the historical city called Bhaktapur and the capital city Kathmandu. Like other old cities this city is also situated on elevated land and therefore one has to climb up to reach this city. Thimi occupies an area of 2 square kilometers and the area has been divided into 8 wards. This report has been prepared with special consideration to ward no. 11,12,13 and 14.

Although the area under consideration occupies an area of 1 sq. km., it has a population of about 1400 and it is a dense community. The community has a lot of problems. These two problems have caused other problems and therefore also these problems are serious. These frightening problems have inflicted negative impact on public health and environment and one can easily guess the kind of state the people of this community are living in. An effort of one single workshop can not analyse, identify and also solve all problems. Therefore, this report has been prepared with reference to wastewater management.

#### Major problems of wastewater management

In the community, in about 90% of the area sewer have been laid for the collection of wastewater. It can be hoped that remaining 10% area will also have sewers. Therefore, there seems to be no major problem in conveyance and collection. Since there is no separate line for sanitary sewer and stormwater, there is very low flow in the dry season and very high flow in the rainy season in these sewer lines. Sometimes the flow in the sewer lines exceeds the capacity of the pipes and causes serious damage. The wastewater from the sewer lines is released in the open field. From the open field the wastewater joins gutters and small canals which finally merge into the Hanumante river. Because of lack of proper management of wastewater, following problems have been created.

1. The sewer constructed in Hatimahankal, which collects wastewater from three directions, flows towards Siddhikali. This sewer has made the area polluted and due to low capacity of the pipeline there occurs a lot of overflow. The wastewater is released untreated.
2. Problem caused by open toilet drain.
3. Wastewater from Chodetol, Dui pokhari, Simatole and Dathutole is collected near Taha dugwell. The wastewater then flows to Lhabaha where also acidic waste mixes and the combined waste has severe adverse impact in the surrounding agricultural field.
4. Open drains from Bamune area flowing towards Bappa and wastewater from Chode mix in Bappa which has made the whole area polluted.
5. Wastewater collected from Inalachi passes through Balkumari China Road and merges into Hanumante River which has very much polluted Hanumante.

## 6. Wastewater collected from Sunkha and Dadhutole passes through Bishnukundal and mixes into Khucha

A field observation was done in order to know the gravity of the situation. Various types of information were collected by filling up questionnaires in order to find out the potential solutions. Some of the aforesaid things are also based on the information thus collected. After interaction with various groups of the community overall state of the community and possible solutions were identified. The various groups were composed of elder people, women, local authorities, and men. The points identified to be considered after the interaction with these people are the following.

### Technical need

There seems to be no significant problem relate to aspects. Due to Thimi's geophysical feature wastewater can be transported via gravity flow. A lot of public land is available. Besides, local authorities have realised the local situation and therefore are committed to solve the problems by providing technical human resources. As has been said before, the main need of the community is to manage the wastewater collected by the drainage pipes already laid in 90% of the area of the community. On top of that most of the drainage pipes were laid within past few years only. They are still in good condition, but need to be maintained.

Before managing wastewater it is essential to know the nature of the wastewater. Local authorities do not seem to be much aware of the nature of wastewater. After field observation it is believed that the wastewater is mostly organic. However, the non-biodegradable component is gradually increasing. Hanumante river receives a lot of industrial wastes. At Lhabaha area the wastewater is acidic due to the acidic effluent from the production of alcohol in households. An appropriate method of treatment should be sought for such wastewater. Besides, analysis of the cause of the failure of the treatment plant constructed by Plan International can provide some insight into the technicalities of wastewater treatment. Although there is a big problem of wastewater management, there is not any significant plan and programme to overcome it and the problem is growing. The problem has been compounded by the lack of sufficient water supply.

### Cost of construction

A huge amount of funds may be needed to manage the wastewater. However, this cost is far outweighed by the benefit that can be reaped from it. Local community is of the opinion that it is possible to contribute partial fund which will be little as compared to the total amount needed. However, the local authorities are willing to contribute some from their side and local people may also contribute some labour. These in total may mount up to a significant portion of the total cost. Therefore, it is almost certain that a donor agency is needed to meet the large part of the financial need. Since the sewer drain has been laid only a little cost is needed for maintenance of the lines. Availability of the public lands will also lessen the financial burden of construction.



### Management and operational cost

Since the wastewater problem has caused a lot of discomfort local people are committed to solve it. People are also aware of the need for proper operation and maintenance of any project after implementation. There are several NGOs and clubs which have shown interest and they can also help in operation and maintenance. Similarly, user groups can be formed in order to make the project sustainable. Donation can be collected from the households and also minimum fees can be collected to meet certain operation and maintenance cost. In a nutshell, the cost of maintenance and operation of a project can be met by the local community.

### Technical capability to operate and maintain

The community should be technically capable to operate and maintain the projects related to wastewater management. If the community is not capable then all the effort could be wasted. Since the people of Thimi are educated they can understand simple technicalities about wastewater management. Technical human resource is also locally available in order to run a project in a sustainable manner. With some training local people can also operate different equipment if needed. Therefore, this community is technically capable.

### Social Acceptance

The community has suffered due to lack of wastewater management. Although the community is aware of adverse impact of unmanaged wastewater on health and environment it has not been able to solve the problem due to its complex nature. However, any step taken towards solving the problem will be highly appreciated by the community. The community knows that it is their problem and they are the ones who should take initiative towards managing the wastewater. Somehow this is not happening. In case any external institution can take the initiative the local community is ready to help as much as possible. They are also committed to appropriately manage any project. They strongly believe the projects can be run smoothly without disturbance. However, due to some previous incomplete projects local people sometimes raise doubts about upcoming projects. For example, since the treatment plant constructed by the Plan International was left incomplete, local people have become not only unsatisfied, but also angry.

### Environmental impact

It is undisputed that unmanaged wastewater has caused adverse environmental impact. The wastewater has made the canals and Hanumante river highly polluted. Since the wastewater also flows in open canals it has also caused a lot of nuisance. This pollution has imposed harmful effects on public health. All the people suffer from diarrhoeal diseases. All of this has resulted into decreased living standard because a major portion of their income is used for medical treatment. Besides, the wastewater has also been used for irrigation which has imposed negative impact on the health of farmers and the crops as well and this has affected the overall economy of the community. The acidic wastewater has further heightened the problem. Since the water in the canals and creeks are polluted due to wastewater, farmers use stone taps, wells and piped supply for washing their vegetables and therefore drinking water

shortage has increased. Besides, the signs of soil erosion and landslides due to rain have emerged and the overall physical feature may be damaged ultimately.

