Consider Dhobi Khola A Spherical Cow

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Abstract

Lack of research and action plan reports on small rivers in the valley such as Dhobi Khola calls for an equal attention towards reviving tributaries that feeds into the Bagmati River. The goal of this project is to explore social, political, and economic prospect of constructed wetland based DEWATS in Dhobi Khola riverbanks. The key findings were lack of political incentive, apathy towards foreign funded projects, and lack of coherence among various Dhobi Khola clean up initiatives. The recommendations to Hon. Prakash Man Singh are to encourage further research on constructed wetland treatment technology to advocate in policy level, to lobby for allocating government fund for DEWATS construction, and to use authority to bridge communication and information gap among all on going government as well as community led Dhobi Khola clean up initiatives.

Acknowledgements

I would like to thank all the institutions and individuals for giving their valuable time to share their opinions and perspectives, without which this project would not have been successful. My sincere thanks goes to Hon. Prakash Man Singh for continuously guiding and supporting me throughout this project. I would also like to thank Daayitwa Abhiyaan for believing in me and encouraging me throughout my highs and lows during my fellowship period. Finally, I would like to give the entire credit of this witty project title to Dr. Dipak Gyawali and thank him for providing me with documents regarding Nepal's water resource management history.

Contents

Acronyms

DEWATS	Decentralized Wastewater Treatment System
WWTP	Wastewater Treatment Plant
ENPHO	Environment and Public Health Organization
KVDA	Kathmandu Valley Development Authority

Executive Summary

Background

Dhobi Khola is one of the important tributaries of the Bagmati River. There is no wastewater or solid waste treatment facility along the river; therefore most of the houses and industries, including government facilities, near the river release their waste directly into the river. DEWATS is an alternative approach that emphasizes on small scale, onsite wastewater treatment and reuse, often at community level (Pham, N., & Kuyama, T., 2013). The goal of this project is to explore social, political, and economic prospect of constructed wetland based DEWATS in Dhobi Khola riverbanks.

Methodology

This study lasted for approximately three months (June to August 2015). The primary methods of quantitative data collection were

- Formal and informal interview with government officials, technical experts, academicians, and locals.
- Field visit to Sreekhandapur, Nala, and Guheshwori wastewater treatment plant.
- One day hike along Dhobi Khola starting from its source at Muhan Pokhari in Shivapuri-Nagargun national park till Gopi Krishna Hall in Chabahil.

Key Findings

- Due to high initial cost of constructed wetland treatment system there is a lack of political incentive in policy level.
- Foreign funded projects often create disconnect and apathy from local government authority and community towards ownership of the facility.
- There is a lack of coherence among most on going Dhobi Khola clean up initiatives. Therefore, there are either redundancies or gradual ignorance from the groups involved.

Recommendations to Hon. Prakash Man Singh

- Use authority to bridge the communication and information gap among all on going government as well as community led Dhobi Khola clean up initiatives.
- Lobby for allocating government fund for DEWATS construction.
- Encourage further research on constructed wetland treatment technology to advocate in policy level.

1 Introduction

1.1 Dhobi Khola Profile

Dhobi Khola is one of the important tributaries of the Bagmati River. The word *Dhobi* in English means laundry person and *Khola* means river. According to tales from the locals, the river was named Dhobi Khola since in the old days many *Dhobis* used to wash clothes near the riverbanks. Although now the scenario is different, the name of the river persists.

Dhobi Khola originates from Shivapuri hills in Budhanilkantha and merges with Bagmati River at Buddhanagar (Bijuli Bazzar). The length of the river is 18.2 km and the total catchment area is 31.2 sq km (Government of Nepal and National Trust for Nature Conservation, 2009). Khahare Khola and Chakhuncha Khola are its tributaries (Government of Nepal and National Trust for Nature Conservation, 2009). Although unmanaged urbanization and waste management has polluted the river, water quality at the source is relatively pristine. A significant percentage of water flow is diverted at the source to meet the agricultural and household needs of the city. There is no wastewater or solid waste treatment facility along the Dhobi Khola; therefore most of the houses and industries, including government facilities, near the river release their waste directly into the river. As the river flows deeper into the heart of the city, the physical and chemical characteristics of the river deteriorates rapidly. Within the city boundaries, the river biodiversity is almost dead and the water looks grayish black with a very strong foul smell.

On June 13th 2015, I did a one-day hiking trip along the Dhobi Khola from Muhan Pokhari, one of the two sources of Dhobi Khola river, in Shivapuri-Nagarjun national park till Gopi Krishna Hall in Chahabil. The main objective of the hiking trip was to observe physical changes in water quality from the source of the river till its merging point with Bagmati river and brainstorm possible renovation ideas. For the most part, I followed the riverbank but some places were impossible since houses were built so close that there was no riverbank at all. From my observation, the source of Dhobi Khola at Muhan pokhari is relatively less polluted and the water might be used for household purposes like cleaning dishes and washing cloths. The water quality rapidly deteriorates towards end of Budhanilkantha as solid household waste such as plastic, organic waste, old clothes and shoes can be seen floating on the water. Apart from floating solid waste, sewer pipes can also be seen discharging directly in to the river. Although there are designated dumping sites with warning message (from the

government and local community) not to throw trash into the river, due to poor management none of the policies seem to be implemented.

1.2 Key Issues

Among the many issues related to Dhobi Khola pollution, below are some of the major ones. Some of these issues are based on on-site observations where as others are based on literature research.

I. Lack of policy implementation

a) Policy regarding dumping trash into the river

During my field visit along the Dhobi Khola, I saw signboards urging the citizens not to throw trash into the river in almost every 200 m to 300 m along the riverbanks. Most of the signboards even had even penalty ranging from Nrs. 500 to Nrs. 1,000,000 and contact number of the concerning local authority to report to. At first, I was happy to see such initiative from the government and local community. However, the policy did not seem to be regulated properly as heaps of trash was seen to be thrown haphazardly.

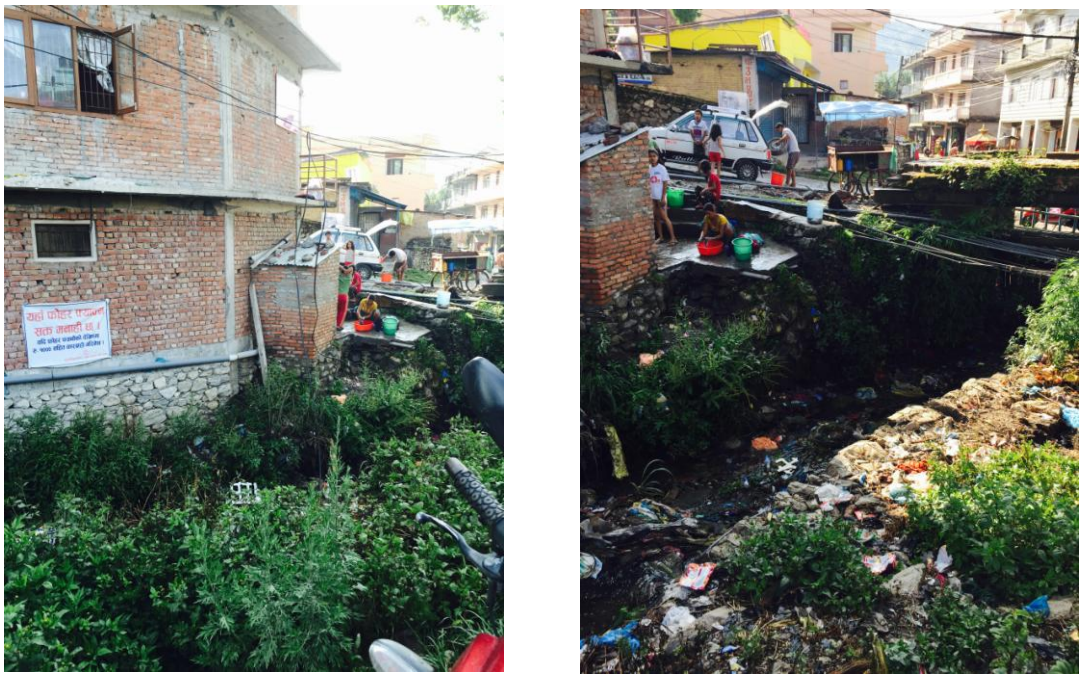

Figure 1: Both of the photos are of the Dhobi Khola riverbanks in Budhanilkantha. The photo in the right shows a signboard urging citizens not to throw trash into the river while the picture in the left, which is taken from a slightly different angle, shows trash thrown haphazardly.

b) Policy regarding land encroachment in the riverbanks

Due to weak policies regarding riverbanks encroachment, houses have been built so close to the river that there is hardly any riverbank. When I did one day hike along the Dhobi Khola, there was many times I had to circumvent shops, houses, and residential colonies to continue along the riverbank. According to an article in the Kathmandu Post newspaper, in 2007, a probe committee, which was formed to study land infringement in Dhobi Khola found that out of the 23 ropanies 14 ropanies was illegally privatized by the local residents (Sharma, 2012). The surprising fact mentioned in the article was that among the encroachers a dozen or so were high profile public figures.

Apart from land encroachment being a political issue, it is also a great threat during monsoon season due to flooding issue. Land encroachment near the riverbanks hinders the natural meandering course of the river, which means the river starts to become deeper and narrower. Any event of heavy rainfall can trigger a flood in the locality. Besides, the deeper and narrower a river becomes the water table also gets lower. This means that if the locality is dependent on ground water boring then they will have to dig deeper as time passes.

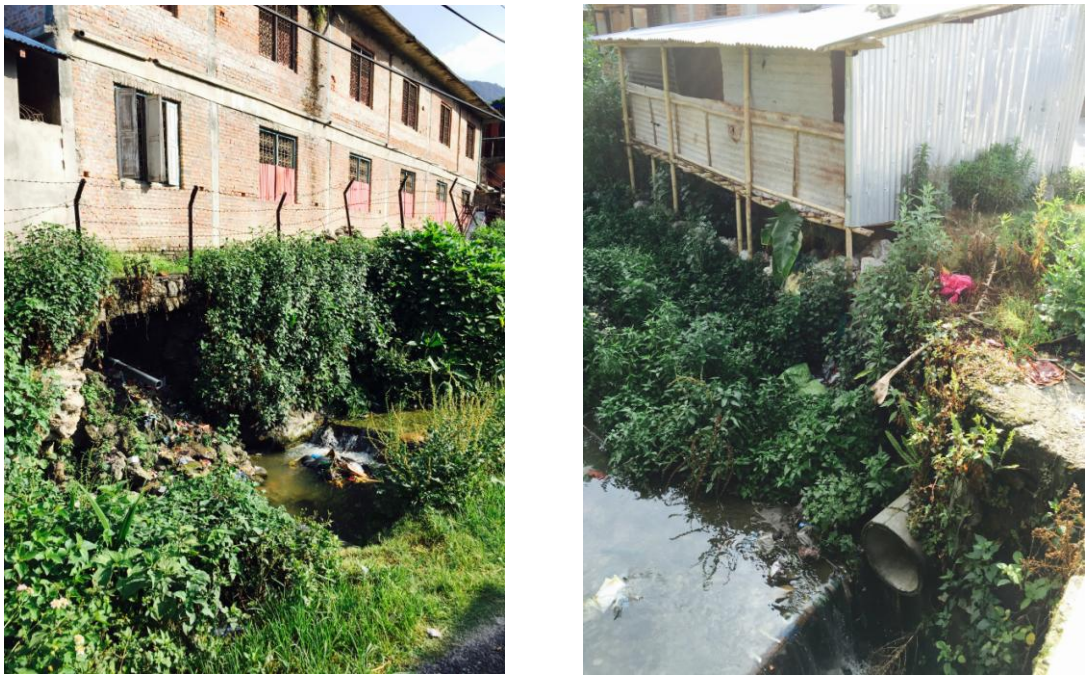

Figure 2: Land encroachment along the Dhobi Khola riverbanks by a school (left photo) and a private shop (right photo) in Budhanilkantha.

II. Lack of a proper waste treatment unit along the riverbanks

One of the major factors contributing to the pollution of Dhobi Khola is the lack of

wastewater treatment facility along the riverbanks. There are five wastewater treatment plants in Kathmandu valley; an activated sludge plant at Guheshwori, non-aerated lagoons at Kodku and Dhobighat, and aerated lagoons at Sallaghari and Hanumanghat (Green et al., 2003). All of these wastewater treatment facilities are located along the Bagmati riverbanks. Most of these treatment plants were constructed towards the end of the 1900s. However, currently only Guheshwori treatment plant is fully functioning.

III. Lack of sewer pipe management

Due to the growing concern about sewer management, the government has started to build sewer pipes along the Dhobi Khola riverbanks. However, when I asked a local person, who is also a government official of the ward seven office of the Kathmandu municipality, as to where the sewer pipes would eventually connect, he proudly replied to me that it would go some where in the Shivapuri hills!

Figure 3: Sewer pipe being constructed near Bijulibazar area.

IV. Illegal settlements by squatters along the riverbanks

Squatting along the riverbanks in Kathmandu is a big issue. Many high profile politicians have tried to get rid of the squatters but none have been successful so far. Although squatting is not as a big problem in Dhobi Khola riverbanks as it is in Bagmati riverbanks, squatters are still occupying valuable public land. According to the Bagmati

Action Plan, there are about 271 families of squatters along the Dhobi Khola riverbanks (Government of Nepal and National Trust for Nature Conservation, 2009). Most of the squatters' population in Dhobi Khola are concentrated in Shanti Binayek, Devinagar, Bishalnagar, Kalopul, and Pathivabhara (Government of Nepal and National Trust for Nature Conservation, 2009).

V. Sand mining

Restoration of sand bed is very important to revive river ecology and natural purification system (Government of Nepal and National Trust for Nature Conservation, 2009). Sand mining not only affects the natural flow of the river but is also dangerous to the near by infrastructures. In 1991, due to heavy sand extraction the Thapathali bridge collapsed (Government of Nepal and National Trust for Nature Conservation, 2009). Since then the government has ban on sand mining from river flood plains (Government of Nepal and National Trust for Nature Conservation, 2009). However, illegal mining still takes places. According to the Bagmati Action Plan report, in Dhobi Khola, illegal sand excavation is still prevalent in flood plains of Baluwakhani, Adhikari Gaoun, and Chunikhel (Government of Nepal and National Trust for Nature Conservation, 2009). However, during my field trip along the Dhobi Khola riverbanks, I did not find much sand mining activities, which might have been halted due to the monsoon season.

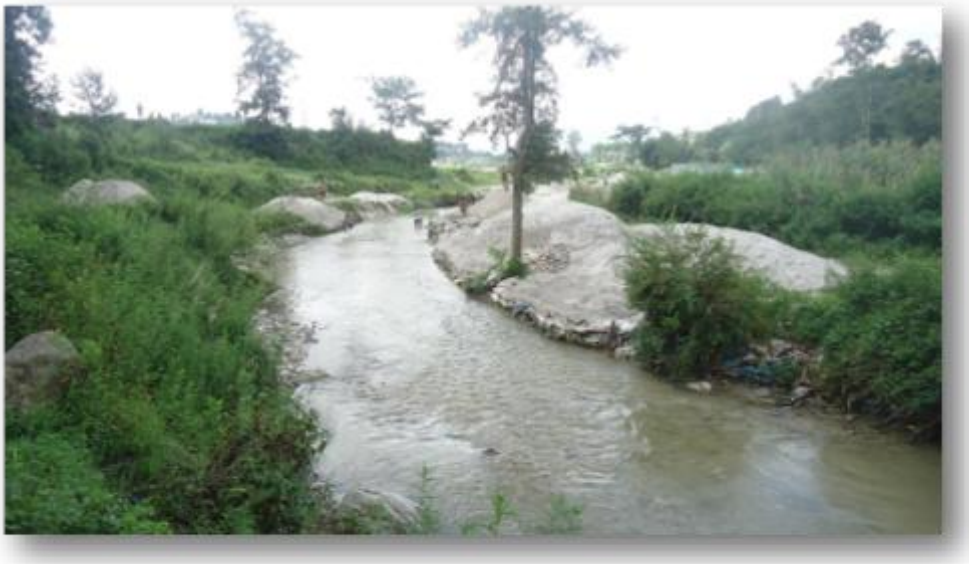

Figure 4: Sand mining at Chunikhel (Adapted from report by Pandey, 2014).

1.3 Current Restoring Activities

People and the government have slowly become serious about reviving polluted rivers in Kathmandu valley; however, most of the attention so far has only been given to the Bagmati river. There has been plenty of reports and literature review on restoring the Bagmati river. Although the Bagmati Action Plan (2009-2014) has not been accomplished yet due to political instability and technical challenges, renovation proposals and background research on the Bagmati river has been adequately carried out. Dhobi Khola, on the other hand, barely has any detailed study published on it. Only last year, Majneet Raj Pandey, Daayitwa summer fellow 2014, wrote a report on the physical characteristic of Dhobi khola together with a short and long-term action plans on improving the physical infrastructures near the river.

In the past year or two, there have been some activities to restore the Dhobi Khola by the local community and the government. During my preliminary research regarding current Dhobi Khola clean up campaign news, I spotted an article by the Republica newspaper titled 'Dhobi Khola clean up campaign begins'. According to the article, officials of ward number 5 and the local community are actively participating in the Dhobi Khola clean up campaign, inspired by the success of the Bagmati clean up campaign, initiated by the Kathmandu Metropolitan City office.

Since the news was published in 2012, in order to get an update on the Dhobi Khola clean up campaign, I visited the ward number 5 office and met with Mr. Sushil Kuwar, secretary at the ward office. Mr. Kuwar told me that the Dhobi Khola clean up campaign is still active. However, due to the monsoon season volunteers have not been able to go into the river to pick trash, so the campaign has been temporary halted. Besides, the massive earthquake and its after shocks have diverted the attention of the public towards relief and rebuilding work. Mr. Kuwar firmly believes that after the monsoon ends they will be able to continue the Dhobi Khola clean up campaign. According to Mr. Kuwar, besides the Dhobi Khola clean up campaign, the government is also

- Building retention walls on the riverbanks to prevent flooding.
- Building corridors to manage heavy traffic in the city.
- Paving sewer pipelines along on the riverbanks to prevent direct release of household sewer into the river.

According to Mr. Kuwar, with the help of ward officials and local community, a committee called the Rudramati Sarokar Samiti has been established, which will be handling the Dhobi Khola clean up and beautification campaign in a community level.

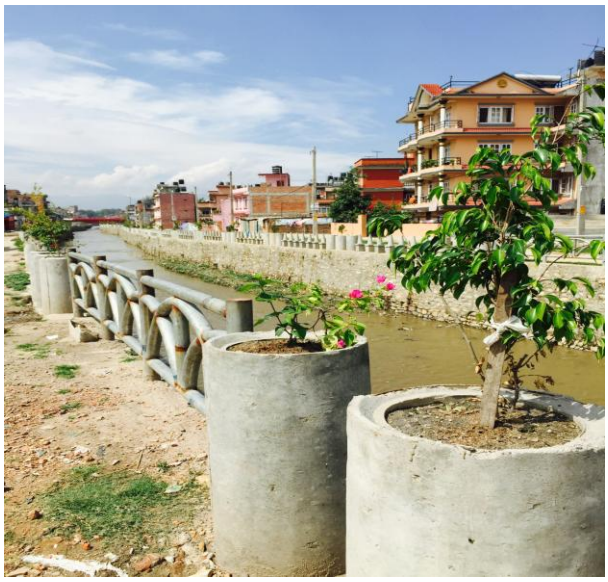

Figure 5: Retention walls and flower plantation in Dhobi Khola in Ratopul, Gyaneshwor.

However, these beautification efforts are very localized so as soon as the locality changes there is a drastic difference in the infrastructure beautification. For example, in certain places flowers and trees are planted where as in other places the cement blocks have been left barren. In front of Prabhu Bank branch in Bijulibazar, the cement blocks are painted green and red where as in other places the blocks are not painted at all.

1.4 Motivation

"Consider a spherical cow" is a classic metaphor among physicist. The implication is that scientists often simplify large and complex system, like a cow, into a much simpler version, like a spherical cow, to make calculations simpler. There is even a book titled- *Consider a Spherical Cow* (Yes, I am not joking!). This metaphor has also been used with a slight variation in the popular comedy show *The Big Bang Theory* – consider a spherical chicken in a vacuum!

Now you would be wondering - why consider Dhobi Khola a spherical cow? Dr. Dipak Gyawali mentioned this phrase during our interview. Dr. Gyawali is a water resource engineer who also worked as a water resource minister in the government in 2002/3. I had interviewed him to discuss his views and opinions on Dhobi Khola renovation by constructing a decentralized wastewater treatment plant in the riverbank near Kapan area. The phrase "consider Dhobi Khola a spherical cow" came about when we were discussing failures of big projects like the Melamchi project, five centralized wastewater treatment plants in Kathmandu, and other big initiatives on reducing pollution in Bagmati river and its tributaries. Dr. Gyawali brought up a really interesting connection

between a spherical cow concept and Dhobi Khola pollution (not very surprising since Dr. Gyawali also did his bachelors in physics, so now you have two physicists talking!). The issue with Dhobi Khola pollution is not only the release of open sewer into the river, but also land encroachment, flooding issue, and depletion of cultural heritage near the riverbanks. With out solving land encroachment issue one cannot address Dhobi Khola pollution because to let the river ecology thrive at least 20 m of land on either sides of the bank must be left open. In order to address flooding issue, one should also address illegal settlement issue together with land encroachment issue. In order to address sewer treatment plant issue, one needs to figure out land encroachment issue. It is complicated, right? So lets consider Dhobi Khola a spherical cow! (After all, I am also a physicist by education)

Lack of research and action plan reports on small rivers in the valley such as Dhobi Khola calls for equal attention towards reviving tributaries that feeds into the Bagmati river. There are many social, political, and environmental aspects that intersects each other which makes reviving Dhobi Khola a challenge. The goal of this project is to explore social, political, and economic prospect of constructed wetland treatment system Dhobi Khola riverbanks.

DEWATS is an alternative approach which emphasizes on small scale, onsite wastewater treatment and reuse, often at community level (Pham, N., & Kuyama, T., 2013). Therefore, complicated and long sewer pipeline networks may not be necessary, which significantly reduces the cost of the sewer system. However, there are still several obstacles and difficulties in replicating this system due to efficiency issue. Despite efficiency limitations, especially in developing countries like Nepal, where there is no proper centralized treatment plant, DEWATS has been one of the successful approaches for wastewater management and treatment system.

Under the DEWATS model there are different treatment facility designs that can be implemented depending on the operational and maintenance cost, population, and geographic location. A constructed wetland based DEWATS is a biological treatment process based on natural wetland ecology. Since constructed wetland system is designed for wastewater treatment, it is more efficient than the natural wetland system. As water flows through the wetland, vegetation slows down and traps the suspended solids. Other pollutants are transformed into less soluble form and is taken up by plants or become inactive. Wetland plants also foster necessary condition for microorganism to live there, which further helps to remove pollutants.

2 Objectives

The objectives of this project are to

- Do case studies on existing wastewater treatment plants in Nepal.
- Interview government institutions and officials to explore political prospect of constructed wetland treatment system.
- Interview technical experts, academicians, and locals to explore social and economic prospect of constructed wetland treatment system.

3 Methodology

3.1 Study Design

This study lasted for approximately three months (June to August 2015). The primary method of quantitative data collection was through interview and field visits. I conducted formal and informal interview with government officials, technical experts, academicians, and locals to understand political, economic, and social hurdles related to Dhobi Khola pollution and wastewater treatment system prospect. The interviews lasted any where between 15 minutes to an hour and a half and were conducted within the Kathmandu Valley. In order to get a better understanding of the present state of Dhobi Khlola, I did a day hike along the river starting from the source at Muhan Pokhari in Shivapuri-Nagargun national park. I also visited three wastewater treatment plants in Sreekhandapur, Nala, and Guheshwori for my case study. During my field trip, I interviewed the local management committee members regarding the treatment plant operation and maintenance.

3.2 Limitations

This study primarily relies on qualitative data collected from interview and field visit, which might be limited to individual's opinion and might not reflect a general trend. It took me about two months to learn about existing Dhobi Khola clean up initiatives and another month to interview government officials, experts, and local community. There is no doubt that Dhobi Khola renovation is a complex and a challenging issue. Therefore, due to the limited time frame of this study, there might be still many details and in depth analysis lacking.

4 Case Studies

4.1 Sreekhandapur Wastewater Treatment Plant

We, a team of eight Dayitwa fellows, went on a field visit to the Sreekhandapur wastewater treatment plant in Dhulikhel on 27th July 2015. The Sreekhandapur wastewater treatment plant is a DEWATS based on a constructed wetland system. My goal for the field visit was to observe a model of a decentralized wastewater treatment plant and learn about its sustainability and limitations.

The Sreekhandapur wastewater treatment plant is spread over approximately 2035 acres and was established in 2007. UN Habitat provided funding for the infrastructure, Environmental and Public Health Organization designed the treatment facility, and the Dhulikhel municipality provided land for the construction of the facility. The total investment in the construction of the facility was about 70 to 75 lakhs and was designed to serve about 2000 people (approximately 200 to 250 houses). In order to manage the facility, a 13 member committee was also formed. Mr. Purna Karmacharya, who is the head of the management committee, facilitated our field trip.

Figure 6: Sreekhandapur wastewater treatment plant in Sreekhandapur, Dhulikhel.

The treatment facility is located in a riverbank of Punyamati River. Sewer enters the facility through an inlet and into an anaerobic baffle reactor, where solid waste (sludge) and wastewater is separated. The wastewater is directed into the reed beds, all of which are horizontal bed system. The reed beds are covered with pebbles of varying size and are mostly populated by *Arundo donax L.,* which is locally known as 'Narkat'. The roots

of the 'Narkat' plant create small gaps in the soil, which acts as a filter. The solid waste collected is supposed to go in to a sludge drying bed, where the dried waste can be used as a fertilizer. However, soon after the completion of the facility, Bio Gas Nepal installed a biogas unit in the facility as a pilot program. Since all of the sludge goes into the biogas unit, the sludge drying bed is not in use. The anticipated biogas production from the unit was about two LPG cylinders per day, which would have serve 40-50 houses annually. However, since the facility is running under capacity, enough sludge has not been collected to meet the anticipated target. Currently, only five houses are being served.

According to Mr. Karmacharya, the facility has been operating for about eight years without any glitches. Although the facility was build to serve about 2000 people (200-250 houses), currently only about 120 houses have connected their sewer line to the facility's waste collection pipe. Most people living in these 120 houses goes to work in Kathmandu and Bhaktapur daily so sludge collected is even less. Therefore, the sludge collection unit has not been evacuated since the establishment of the facility. The maintenance budget of the facility primarily comes from the annual Nrs. 2,500 (Nrs. 500 per household) that is collected from the five households for their biogas use. The only significant cost of maintenance is to clean the pebbles in the red beds every 2 to 3 years. According to Mr. Karmacharya, no additional fund has come from UN HABITAT however; ENPHO has given NRS 50,000 twice for maintenance purpose.

Mr. Karmacharya also highlighted some difficulties in the operation and maintenance of the facility. Firstly, the facility is dependent on outside funding. Theoretically, the facility is supposed to be self-sustaining from the revenue collected from the biogas service. However, users are not very punctual in payment and occasionally do not pay at all blaming on the irregular biogas supply. Although the facility earns some money from treating waste from private collectors, it is not a steady revenue. The facility has tried to charge an annual fee of Nrs. 200 to each household for wastewater treatment; however, the users have not been responsive to this change. According to Mr. Karmacharya, the fault lies in the initial planning of the facility. During the construction of the facility, the sewer lines were already built. Households near by were dumping their waste through the sewer pipes and into the river without any cost. Since no prior consent was taken from the locality regarding service payment during the construction of the facility, people do not see the need to pay for a service that was initially free. Secondly, the salary for the caretaker is not enough. Currently the caretaker earns about Nrs. 2,500 annually. However, the salary is not enough to sustain a comfortable livelihood. Therefore, the caretaker has to do multiple jobs and cannot solely devote his time to the facility. If the facility revenue were to be better, the caretaker can also be paid better, which in turn benefits the facility.

When asked about future plans of the management committee regarding expansion of the facility, Mr. Karmacharya told that the municipality is planning to collect sewer from more households through septic tank system and direct the waste into the treatment facility. Sewer pipes and septic tank have already been built but logistics still needs to be figured out to safely direct the waste into the treatment facility. So far, some private sewer collectors occasionally evacuate their waste into the facility for treatment. The facility charges Nrs. 500 per load whereas the municipality charges Nrs. 1,500 for the same amount. According to Mr. Karmacharya, if proper marketing and advertisement can be done then the facility can treat more waste in a sustainable way and also earn more revenue.

Although the facility is running smoothly, it is under capacity so I was not able to assess its sustainability under maximum capacity level. Nevertheless, the facility's wetland greenery was aesthetically pleasing and free from strong foul odor, which traditional wastewater treatment plants tend to have.

4.2 Guheshwori Wastewater Treatment Plant

Guheshwori WWTP is located in the Bagmati riverbank inside the compound of the High Powered Committee for Integrated Development of Bagmati Civilization office. The treatment plant was built in 2001 to maintain the water quality of the river section flowing through the Pashupatinath Temple area (Jha, A., & Bajracharya, T., 2014). The treatment plant is based on Japanese technology and has the capacity to treat 17.3 million litres of water a day. Although the exact number of houses served is not know, the treatment plant has been treating water from Bouddha, Chabahil, Mitrapark, and Tusal area. The primary treatment plant design consists of an inlet grit compartment for screening, aeration tanks where the activated sludge process is done, a settling reservoir, and a sludge drying bed.

Since the treatment plant is a basic activated sludge model, its efficiency is not very high. In a 2003 study, Green, H., & Poh, S. (2003) reported that the Guheshwori WWTP outlet water quality was satisfactory as it could only remove 54% of Total Dissolved Solid, 78% of Chemical Oxygen Demand, and 91% Biological Oxygen Demand. According to Mr. Khadka Jung Shah, mechanical engineer at the treatment plant and my tour guide, the treatment plant efficiency is just about 60%. Therefore, instead of discharging the treated water into the Pashupati river section, the outlet is connected to a sewer pipe that goes all the way till Tilganga and then release its content back into the river.

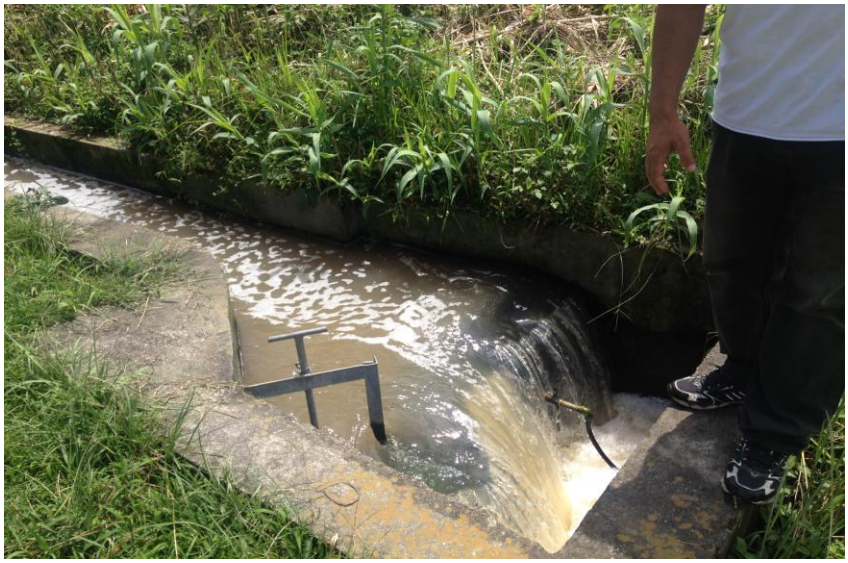

Figure 7: Outlet at the Gusheshwori WWTP before it connects to a sewer pipe that goes all the way till Tilganga.

According to Mr. Shah, the treatment plant does not collect any service fee from its users. The government funds the entire operation and maintenance cost. Therefore, if there is any major mechanical problem requiring heavy expenditure then the facility has to depend on foreign aid. Also, since the entire mechanical parts of the treatment plant are manufactured in India, any replacement takes days - as they have to wait for the parts to be transported from India. Therefore, the treatment plant maintenance is not only expensive but also delayed. Apart from high maintenance cost, in the past, the treatment facility also had to suffer frequent shutdown due to load shedding. However, only recently has the Nepal Electricity Authority agreed to supply continuous electricity to the facility. Therefore, the facility is now operational 24/7. Although there are plans to upgrade the facility's capacity by switching to advance technology, due to heavy expenses the facility is again waiting upon foreign aid.

5 Social, Economic, and Political Perspectives

5.1 Interview With DEWATS Expert

After the Sreekhandapur wastewater treatment plant visit, I met with Mr. Rajendra Shrestha, ENPHO's DEWATS expert, to clarify on some of the issues brought up by Mr. Purna Karmacharya regarding the facility management and design and also discusses about some bottle necks regarding DEWATS implementation in policy level.

One of the issues brought up by Mr. Karmacharya was regarding service fee. According to Mr. Shrestha, service fee charge is important (which they have learned from Sreekhandapur facility management), but at the same time the facility has been designed with a biogas unit (as an economic activity) to sustain operation and maintenance cost. One of the important lessons learned from Sunga wastewater treatment plant, also a community managed DEWATS designed by ENPHO, was the importance of economic activity pegged to the operation of the treatment facility. According to Mr. Shrestha, economic activities such as biogas unit and organic fertilizer produced from sludge drying bed gives an incentive for the community to sustain and support wastewater treatment facility. Therefore, a biogas unit was installed in Sreekhandapur wastewater treatment plant. But this system has not been able to run smoothly since the facility is under capacity.

Mr. Shrestha mentioned that although only five houses are receiving biogas from the facility, mathematical calculation from the biogas meter suggests that the production is enough for about 5 more houses (in total 10 houses). However, the management committee is hesitant to add more houses because they are not confident that the biogas service will be continuous through out the year. Adding five more houses also means that the existing users will have to share their resources and adjust to a more constrained use, which the management committee thinks might create extra communication burden on themselves. Therefore, although ENPHO tried to push for the addition of extra 5 houses to the biogas distribution line, there was little initiation from the management committee side.

As per Mr. Shrestha, since Sreekhandapur is a pilot program that was set up to operate with out collecting service fee charge; it will be difficult to implement service fee policy. However, as an alternative, ENPHO is trying to introduce a Public-Private Partnership (PPP) model to increase sludge collection and consequently biogas production too. In

this model, the facility partners with private companies and municipality sewer collection division to de-sludge their waste into the facility and pay the facility minimum service charges. In this way, there is less burden on the de-slugging private and municipality trucks on disposal issues and the facility also gets more revenue. During our field visit, Mr. Karmacharya also mentioned this idea. However, the implementation part has been going slow. One of the reasons for the slow progress might be because the municipality is hesitant to pay for de-slugging. According to Mr. Shrestha, since the facility was built on municipality-funded land, the facility is municipality's property so they might not be will to pay for the de-slugging charge. However, the facility will exhaust sometime in future so the municipality will have to pay for the repair cost anyways so it is better to collect money in a regular basis and save it for rainy day fund. Nevertheless, strong advocacy needs to be done on this matter.

5.2 Interview With Government Official

In order to successfully implement any type of community level approach, it is very important to get support from the government. Therefore, to better understand the government's stand on having a constructed wetland treatment system in Dhobi Khola riverbanks, I interviewd Mr. Sushil Kuwar, secretary at ward number 5 office of the Kathmandu Metropolitan City. According to Mr. Kuwar, the government is also doing its best to clean Dhobi Khola. If higher-level government institutions like Kathmandu Metropolitan City support the wetland based treatment approach then the ward officials as well as the locality will support the idea too. I also interviewed Mr. Ram Prasad Shrestha, an engineer at the KVDA Dhobi Khola development unit. According to Mr. Shrestha, having a wastewater treatment plant in the Dhobi Khola is important. However, the KVDA Dhobi Khola unit is only responsible for the physical infrastructure development so it currently does not have any plans for wastewater treatment plant in Dhobi Khola.

5.3 Interview With Academic Expert

In order to get opinions from academic expert of Nepal, I interviewed Dr. Dipak Gyawali. Dr. Gyawali is a water resource engineer who also worked as a water resource minister in the government in 2002/3. Having worked in and outside of the government, Dr. Gyawali did not show much positive response towards any development in the water supply and management sector in Nepal. According to Dr. Gyawali, one of the major problems is the combination of foreign aid and Nepalese field experts. A lot of the times foreign funded projects are designed without consulting with the local government authority and the community, which means that neither the government and the local

community nor foreign donor has any idea of what the other person is doing. In such case, there are lots of redundancies, ignorance, and technical mistakes. Unless, there is proper communication between foreign aid, local government, and the beneficiary community there is very little hope in bringing any change in the water supply and management system and it is no different in the case of constructed wetland treatment system in the Dhobi Khola riverbanks.

5.4 Interview With Local Community

During my Dhobi Khola expedition, I came to realize that due to land encroachment there isn't any riverbank in a lot of areas. The only place that has considerable land left for any type of wastewater treatment plant is in Kapan. Therefore, I randomly meet with few locals in Kapan and asked them about their opinions on having a wastewater treatment plant in Dhobi Khola riverbanks. Everyone expressed the need of cleaning the Dhobi Khola. However, majority was indifferent towards having a treatment plant near by. This might be because Kapan area already has lots of pig farming. Therefore, people have become indifferent towards foul odour and waste. However, the number of interviewee was just five people so it does not reflect a general view of the Kapan community.

6 Key Findings

According to literature research, the constructed wetland treatment system has been a success in many private sectors in Nepal. However, in community level, the technology has not been able to perform well. Some of the bottlenecks found were

- Lack of political incentive
  Constructed wetland treatment technology is a natural filtering system that requires minimum operational and maintenance cost and monitoring. However, a major draw back of this technology is that it needs a big plot of land and big plot of land means more money. Therefore, the proposed initial cost of the facility is high, which make this technology unattractive for advocacy as politicians expect natural resources to be minimum cost if not free.

- Apathy towards foreign funded projects
  Most of the water supply and sewer management projects are foreign funded projects with high technology design and expensive operation and maintenance cost. Foreign funded projects often create disconnect and ignorance of the local

government authority and community in ownership, which impact the long-term sustainability of the facility. Even with the existing community managed constructed wetland based DEWATS facilities, all of which are foreign funded, local community and government authority apathy can be observed.

- Lack of coherence among various Dhobi Khola clean up initiatives
  There are several government as well as community led projects on Dhobi Khola renovation such as Dhobi Khola corridor project, clean up campaign by volunteers, and sewer management project. However, most of these projects are mutually exclusive, which means that one group does not know what the other is doing. Therefore, there are either redundancies or lack of initiatives from the concerned groups.

7 Recommendations to Hon. Prakash Man Singh

Some recommendations to Hon. Prakash Man Singh would be

- Use authority to bridge communication gap between various Dhobi Khola development projects.

  Hon. Prakash Man Singh, being the Deputy Prime Minister, has enough authority to bring various stakeholders, working in the unified cause to clean Dhobi Khola, together in a room and collectively discuss the future plans. I would also suggest Honourable to authorize one of the stakeholders, preferably the local youth clubs, to publish quarterly review on all the on going Dhobi Khola initiatives and make the data publicly accessible. Youth clubs near Dhobi Khola area are very active in the river clean up campaign so it would be a good strategy to channel their energy towards managing information flow.

- Lobby for allocating government fund for wastewater treatment system construction.

  Hon. Prakash Man Singh is also the head of the Minister of Federal Affairs and Local Development. I would suggest Honourable to leverage his ministerial connection to allocate more national funds for wastewater treatment systems in Dhobi Khola and in Kathmandu valley. Allocating and investing more

government funds can help gather more positive response from the local community compared to foreign funded projects.

- Encourage further research on service fee policy for wastewater and sewer treatment facilities.
  So far, there is no service fee policy in any of the existing wastewater treatment plants. The entire operation and maintenance budget comes from either the government or foreign donors. Honourable should assign government officials to research on creating service fee policy for the wastewater treatment facilitates so that the facilities can be self-sustaining and public ownership can be promoted.

8 Conclusion

This project is a research-based approach. Therefore, policymakers in water supply and sewer management units can refer to this project as a preliminary study before indulging into a detailed research on constructing a wastewater treatment in Dhobi Khola. I also hope Hon. Prakash Man Singh will be able to use this study to stir dialogue among stakeholders to work collaboratively for a more effective action plan.

As mentioned earlier, people and the government both are gradually becoming aware about cleaning the polluted rivers in the valley. Although there might be a lack of coherence among various clean up initiatives by the government and local community, the fact that some initiatives have been taken in it self shows that there is still hope in achieve a unified goal of a clean Dhobi Khola.

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