Recommendations and Opportunities for Scheduled Desludging in Birendranagar Municipality and other Population Centers in Nepal

Between December 8 and 12, 2015, a team from SNV along with members of the local and national government conducted a Rapid Technical Assessment (RTA) in Birendranagar Municipality to gather data about onsite wastewater management and practices. The RTA considered the physical aspects of fecal sludge containment systems, the effluent dispersal practices, and constraints that may be encountered during the desludging process (figure 1). Containment tanks or pits were not desludged in conjunction with this activity and observations were made from the ground surface supported by measurements and local knowledge.

Figure 1. Enumerator from the SNV team conducts an interview as part of the Rapid Technical Assessment (RTA). The program uses the Akvo FLOW platform downloaded Android © cell phones.

The goal of the exercise was to gather data that would lead to recommendations and the design of a fecal sludge management (FSM) program at the *pre-feasibility study level* for a typical community in Nepal based on the findings from Birendranagar Municipality. Data was obtained from 254 properties within Birendranagar Municipality containing residential and mixed use buildings utilizing a variety of onsite wastewater management configurations. Based on this data, there are a number of observations, recommendations and opportunities that are presented below.

The highlights of the data

For the purpose of this exercise, the municipality was subdivided into 5 zones, each with distinctive characteristics. The zones are represented as:

a. Zone 1. The most urbanized zone characterized by many mixed use commercial and residential buildings;
b. Zone 2:
c. Zone 3:
d. Zone 4:
e. Zone 5:

Following are the highlights of the data:

1. Approximately 95% of the properties surveyed are used for residential or mixed use (residential and commercial) with only 5% being only used only for commercial purposes. 60% of the

properties surveyed are being used solely for residential habitation. Zones 1 and 2 had the highest level of commercial users and these zones are experiencing the highest growth rates.

2. All of the 254 respondent properties have some type of fecal sludge containment system. 54% of buildings are served by holding tanks while 32% are served by containment pits or wells. Septic tanks (3.1%) and biogas systems (2.4%) were also observed. A very few (1.2%) have multiple types of containment tanks. Note that the distinction between proper septic tanks (tanks with multiple chambers and an effluent structure that collects clarified effluent for discharge) and holding tanks are difficult to observe from the ground surface without first desludging the tank. In reality, it is believed that there are very few actual and proper septic tanks.
3. 79% of properties have occupancy loads of 10 people or less (52% having less than 6 occupants). Still, loads between 11 and greater than 40 people (21%) were observed.
4. Tank or pit volume is highly variable ranging from less than 5 cubic meters (28%) to greater than 40 cubic meters (5%). 22% of the properties have containment volumes between 5 and 10 cubic meters, and 18% at 10 to 20 cubic meters of total volume.
5. As far as desludging history, the vast majority (75%) have never had their systems desludged, where only 10% have had their tanks desludged within the last 3 years.
6. For all of the containment systems, almost 60% have no overflow or outlet pipe, indicating that effluent either seeps into the soils through open joints or open bottoms in the pits or tanks, or is completely contained. It is believed that the actual percentage of tanks with complete containment is very low. 15% of the properties have containment tanks that discharge their effluent to soakage wells, and 10% were observed with direct discharges to the drainage system. Very few (5%) of the system reuse the effluent on-site, and only 2.5 % of the properties were observed to have ponding effluent.
7. 75% of the containment tanks are reported to have some type of manhole or access port that would allow desludging without breaking the tank. The true percentage of access ports that are "proper", meaning that they can be easily opened by one person with hand tools is believed to be considerably less. At least 25% of the systems have no access port, meaning that at least one would need to be installed to facilitate the desludging of the tank.
8. 30% of tanks or pits are located under a building (either the main building or an outbuilding). This presents special challenges in desludging. Of those located under a building, only a few

Figure 2. Typical containment tank (off-set pit latrine) of approximately 8 cubic meters in total volume. Notice the vent pipe, which should be extended above roof level for better odor control.

were located underneath a finished floor (plaster, tile or carpet) which indicates that most people, given the proper education and incentives would be willing to install proper manholes.

9. Indeed, the vast majority of the respondents indicated that they were very willing (72%) or somewhat willing (12.5%) to upgrade their systems based on the recommendation by the inspector. Only 8% indicated they were unwilling to upgrade.
10. Volume of septic tank. There are some very large tanks in the study area, some being as large as 40 cubic meters for some of the large residential/commercial buildings. The majority however are less than 10 cubic meters in volume.
11. The presence of a proper tank or pit vent is used in this survey as an indicator of proper facility design and installation. 50% of sites were observed to have no vent or a vent terminating below the roof level indicating a high degree of non-conformance (figure 2). While some repairs are likely feasible for existing systems, such as installing a proper vent or manhole, making major repairs to existing systems is difficult and often not feasible. The fact that so many of the systems are substandard indicates that promoting proper design and utilizing inspections to assure proper installation would have significant benefits.
12. Distance from wells to containment tanks is of particular concern. An unacceptably large percentage of surveyed properties do not meet setback requirements with many wells being placed right next to tanks or pits.

Costs, recommendations, and discussion[1]

a. There appears to be an opportunity to implement a comprehensive, community-wide fecal sludge management program in Birendranagar Municipality which indicates that this would likely also be true in other similarly sized cities and municipalities in Nepal. Such programs should incorporate elements of infrastructure, promotions, and updated bi-laws supporting the program including fees and tariffs. There seems to be keen interest from top government administrators, and a strong majority of the respondents to the survey indicate an interest in seeing improvements. The main components would be:

Figure 3. 5 cubic meter pumper truck and tractor owned and operated by a private sector contractor.

[1] *The observations and recommendations discussed in this paper are those of the author and may not represent the position of SNV or any other party.*

i. Infrastructure: new desludging trucks (figure 3) and equipment, a fecal sludge treatment facility (with possible phased in implementation), and upgrading of containment tanks through a comprehensive education and outreach program;
ii. Promotions: evidence-based promotions campaigns that are designed to raise awareness while raising the willingness to pay for services would also address key issues in on-site wastewater system operation and maintenance and upgrading; and
iii. Improving the bi-laws by updating them to include a fee schedule (tariffs) for desludging, incentives, and penalties for non-compliance, as well as standard (updated) drawings of proper systems.

b. There is some evidence to support the idea of using 5 cubic meters as an incremental desludging volume, or the volume removed from each tank even if the tank has a larger volume. A 5-year desludging cycle is also supported. This is based on the indication that most people have never desludged their tanks and that containment tanks less than 5 cubic meters represents the greatest number of sampled sites. The data suggests that 5 cubic meters of desludging volume removed every 5 years would likely be sufficient for most properties. It is also the volume of the desludging tanker, so one load per property would be sufficient in most cases. This volume/time increment would represent the minimum service and owners would be charged the minimum amount. Those requesting additional volume removed or in need of intermediate service would be billed accordingly.
c. Utilizing these values for minimum desludging increments, and considering the growth rate of the community estimated at 5%, an average monthly tariff of 85 NPR per family (about $0.80 USD) seems to be supported. This includes a 15% surcharge on the operations expenses that would be billed by the private sector operators for overhead and profit (see septage management toolkit). The rate per residential user could come down if higher rates were utilized for commercial users.
d. The tariff suggested above assumes that the cost for the construction of the treatment facility will cost NPR 510,000 per cubic meter of wastewater to be treated as a rough estimate (amortized over 8 years at 11% interest). In this case the treatment plant would be sized at 83 cubic meters per day and assumes non-mechanized technologies would be used. The tariff includes the cost of the collections, to be performed by the private sector with 5 trucks assuming a 5-day work week. The tariff would also support a full time inspector that would be assigned to the program. A surplus sufficient to support pro poor activities such as micro loans for new toilets and septic tanks, or subsidies for the very poor is also provided. 85 NPR per family per month would be sufficient according to the toolkit to sustain operations for the first 5 years, after which the rate would need to be reevaluated and perhaps adjusted based on the reality of the program. Additionally, the treatment facility would likely require expansion after year 5 as well. It must be remembered that the toolkit simply provides an approximation at a pre-feasibility level. Further assessment of the program and associated costs will be required during the program design phase.
e. Consideration of scheduled desludging program. The fact that 75% of respondents have never desludged their tank coupled with a strong indication that people will be willing to participate at least at a household level indicates that scheduled desludging might be a successful business model. The benefits of engaging an inspector along with the desludging crews to observe actual

system conditions both before and after desludging would provide a unique opportunity to engage with homeowners to inform them about exactly how their systems should be upgraded.

f. It is recommended that a technical working group (TWG) be appointed to review the data and begin the process of implement the steps required for designing and launching a scheduled desludging program. These steps include but are not limited to:
    i. Engaging stakeholders through a stakeholder meeting;
    ii. Gathering evidence for the development of a promotions campaign;
    iii. Drafting text and design drawings for use in updating bi laws; and
    iv. Begin the process of identifying suitable sites where a septage treatment plant can be located, as well as suitable technologies.

    Technical assistance from SNV or other knowledgeable NGOs would be required to support the TWG in conducting these tasks and leading the group through exercises that promote informed decision-making.

g. Standard designs updates for bi laws. Discussions about the existing bi laws indicate that there is an opportunity to improve them with updated information and standard drawings for construction of new on-site systems. The team was informed that the bi laws are being reviewed anyway at this time.
h. Enforcing building codes and bi laws on wastewater for new construction. While there is a mechanism in place for design review, permitting, inspecting and approving on-site systems prior to approving occupancy, testimonials from the local officials indicates this is rarely accomplished. At a minimum, enforcing setbacks between wells and containment tanks should be practiced to avert potentially serious environmental health issues from well water contamination. Often, placement of wells on neighboring properties impacts the possible locations of wastewater infrastructure on parcels that are yet to be developed. As with containment tanks, a permit and inspection program for the siting and installation of new wells should be conducted. Property developers should be required to observe all well related setbacks for new construction.
i. Promotions campaigns on proper septic tanks, manholes and vents. The data on these topics indicate that a significant percentage of the population would benefit from this information. These might include handouts on each topic that building owners could refer to to understand the proper installation and to obtain a list of people that can do the work. Such promotions campaigns would likely spur interest and generate demand for these services that can be filled by the private sector.
j. Biogas systems are observed being used but at less than 5% of total properties surveyed. Most biogas systems were working well and most people with biogas systems were happy with their system. However, some did report problems that are believed to be caused generally by lack of proper maintenance or failure to use the system properly. This indicates a big opportunity in Birendranagar Municipality, which like the rest of Nepal suffering from fuel shortages (during the time of this study). The data seems to indicate that promotions campaigns highlighting the benefits of the technology and the experiences from existing users that are happy with their systems for testimonials would help promote and increase utilization of the technology. Additionally, promotions campaigns on proper use and care of biogas systems targeting users would likely improve performance. Finally, the data seems to indicate a real opportunity for

private sector entrepreneurs that would offer biogas installation, maintenance, and repairing services.

k. Greywater management provides another area of opportunity. In many areas around the municipality, there is sufficient land to properly manage greywater on site without discharging it to the drainage system. Promotions campaigns on proper greywater management including treatment and dispersal/reuse options would be useful.
l. Developing an educational campaign around the proper operations of on-site systems from the perspective of the building owner would be useful. Many building owners do not know much about their system, or the do's and don'ts related to on-site wastewater systems. For example, what can and cannot be placed down the drain. A concise manual or flyer would work nicely. While the main focus would be on the proper operation, additional information on the Municipality's programs regarding wastewater can be highlighted, as well as contact numbers for more information or to find a service provider.
m. During the time of the survey, a fuel shortage resulted in unusual conditions related to traffic. It may be that during the implementation of a scheduled desludging program, the fuel crisis may be over and additional traffic loads would be normal. Under such circumstances, and given the ultimate location of the treatment system, a transfer station (either mobile or fixed) might be advantageous. The TWG should look into options regarding transfer stations during the program design. To compensate for higher traffic loads, a collections efficiency factor of .5 was used in estimating the tariff.
n. Phasing. Phasing in the program over time may be advantageous. Under this scheme, scheduled desludging would begin for zone 1 while the other zones would be served through a demand based model. This would allow the municipality to install a basic treatment system at a relatively low cost while the program accumulates funds for eventual expansion. This would give the municipality and the service providers time to optimize the service delivery procedures before rolling out the program throughout the entire municipality at scale.

Conclusion

Implementing a scheduled desludging program for Birendranagar Municipality or other locations in Nepal would require training, capacity building, promotions, regulatory framework improvements, bi law adjustments and infrastructure development. Taken as a whole, the program would provide a significant improvement in onsite wastewater system functionality and overall municipal environmental health. Careful consideration of the integration of each of these components would be required. Phasing in the program by initiating scheduled desludging in Zone 1, while continuing to offer demand-based services for the remaining zones might be a good way to start. It would require lower startup capital while serving as a platform for launching the promotions campaigns and adjustments to the enabling environment that would be used to scale up for full city-wide FSM.