

35th WEDC International Conference, Loughborough, UK, 2011

THE FUTURE OF WATER, SANITATION AND HYGIENE: INNOVATION, ADAPTATION AND ENGAGEMENT IN A CHANGING WORLD

Kathmandu wastewater: the way forward?

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BRIEFING PAPER 1062

Kathmandu's urban population will grow from 2.6 million to 4.4 million in 2025. Its current wastewater system barely copes. A masterplan developed in 2009/10 proposes a series of actions to improve its performance with a mix of on-site and off-systems. As with many urban centres, the success of this plan is dependent on numerous external factors. In particular, land prices and land availability for decentralised systems, and treatment technologies were major constraints. The current wastewater status the 2025 vision, a problem tree analysis, together with issues and assumptions identified in the masterplan are presented. The paper concludes with a reflective view of the process adopted, with reference to Strategic Sanitation Approaches and the Sanitation 21 agenda and considers if and how the study may have achieved different outcomes using these principles.

Background

The urban population of Kathmandu has had long-standing water and wastewater challenges. Severe water shortages, long queues for water, and poor quality delivery are facts of life in this rapidly-growing, poorly planned urban environment. A new out-of-valley water supply scheme (the Melamchi source) and associated distributed improvements are being constructed to progressively alleviate the severe water shortages. This work is being done with funding assistance from the Asian Development Bank.

Within this water supply context, existing wastewater deficiencies will be exacerbated as the water supply is improved and the population increases. The most recent report (ADB 2010) and investment plans aims to “provide capital works that assist [the utility operator] .to meet its licence conditions and to provide appropriate water and wastewater service levels by providing infrastructure which:

- optimises [new and existing] water supplies. and .provides effective and equitable water distribution;
- improves the collection and conveyance of the off-site sewerage system and wastewater treatment, and
- improves treatment services for on-site sanitation services.”

These objectives formed the basis of the brief on which the most recent wastewater masterplan was prepared. This paper reflects on the masterplan and its development process.

Where are we now?

About 70% of the existing population (1.8 million) connects its wastewater to an off-site piped system. The main trunk system was constructed in the 1980s with support from the World Bank. The remaining people rely on on-site systems. The piped system combines sewage and stormwater. In many areas of Kathmandu, the average density exceeds 450 persons per hectare and in the core of Kathmandu, the density exceeds 800 per hectare. Land is increasingly scarce and becoming very expensive. (e.g. in the outer areas of the urban settlements it is typically around USD 2-3 million per hectare).

Off-site systems: Approximately 14 agencies provide local sewers and two agencies provide the primary network. These agencies are un-coordinated with resulting downstream capacity issues and lack of quality control. Construction of neighbourhood level sewers is often initiated by the local community taking action

to improve the wastewater and stormwater drainage from their houses. The interceptor sewers (built in the 1980s) are completely blocked and non-functioning. Operation and maintenance is limited to complaint-based reactive blockage clearing. There is no coordinated and up-to-date information on the existing collection system network. For all practical purposes, there is only one functional wastewater treatment plant, although five treatment plant sites exist. Less than 4% of wastewater collected by the sewers undergoes any meaningful treatment. The balance discharges untreated and unscreened into the streams.

On-site systems: There are about 80,000 septic tank systems. The track record for sludge management from the existing tanks is poor. 18% of tanks are emptied by private tanker and 15% by municipal tankers, with the balance emptied manually. The only dedicated septage facility commissioned in c2001 is no longer functional. Approximately 250m³/day septage is dumped in streams or on land in the city. There are about three functioning (but new) small reed bed-style decentralised wastewater systems (each serving fewer than 50 households). Groundwater is used by many residents as a supplementary water source, soils are generally clayey, and plot sizes are small. This leads to concern about the long term suitability of a high density of soil absorption systems, given the ground and monsoon rain intensities.

Social/operating context: Interestingly, despite the appalling quality of the Bagmati River in the city, about 15 km downstream of the main urban area, the river has largely self cleaned to acceptable contamination levels due to natural aeration. Solid waste collection in the city is limited. This is an on-going issue for municipal authorities, and directly contributes to sewer and drainage blockages. Power supply is intermittent, with regular and long load shedding (e.g. in the 2009 dry season, power was off for up to 18 hours per day). Despite the 2006 peace accord, the political environment remains fragile. Wastewater is low on the agenda of government, although there is recent (2009) government interest in the Bagmati Action Plan to improve water quality in surface streams. Wastewater staffing levels for the utility manager are low (less than 1/1000 connections). The water utility's sewerage expenditure is about 7% of its total revenue.

Key motivation factors for the government to be involved in wastewater seem to be:

- The Bagmati Action Plan – reflecting increasing community frustration of the poor state of the rivers in the valley. The Bagmati River in particular has high cultural and religious status.
- The major donor agency (ADB) makes funding for water supply augmentation conditional on improvements in sanitation/wastewater.

Assumptions, problem tree and challenges

A simplified problem tree was prepared during development of the plan. Many actions proposed in the plan are outside of the sphere of responsibility or influence of the main water and wastewater stakeholders. These issues include: power supply; political commitment to wastewater sector; solid waste management; and the regulatory environment. The key challenges identified were:

- Poor or unknown condition and extent of sewerage infrastructure – ideally, a review should have been carried out before the planning. Ambiguous agency responsibilities complicate record keeping.
- Infrastructure capacity has lagged behind population growth. High urban population growth, uncontrolled urban development, and lack of follow through on previous recommendations and reports have contributed to this situation. The unstable political environment has not helped.
- Inadequate operation and maintenance of existing assets. This is linked to: the low staffing levels; low operational funding; insufficient sewer cleaning equipment; poor solid waste collection; insufficient flushing for self-cleansing of sewers; suboptimal construction standards; inadequate asset maintenance and record keeping; ambiguous agency responsibilities and poor institutional and regulatory capacity in wastewater sector.
- Disposal of untreated or inadequately treated sewage to water courses. Key issues here are related to undersized and ill-maintained infrastructure, and inadequate management of septage disposal.

Moving forward

The donor agency requested a capital improvement and development plan for wastewater services. The plan adopted was based on a fairly conventional approach for improvements to piped sewers and a mix of centralized and decentralized treatment facilities, as summarised below.

Centralised systems: An extensive asset condition survey will be conducted in conjunction with sewer cleaning. Extensions of the sewerage network to maintain 70% coverage is programmed. Upgraded treatment plants for a 1.4 million population are proposed. These treatment plants will have similar technology to the existing (functioning) plant (an activated sludge process). This decision was, in many

senses, reluctantly made by the planning team, recognising the inherent sustainability problems with high mechanical /electrical plants. However, in the context of severe land availability and cost constraints for less mechanically intensive but larger footprint plants, there seemed to be no viable option.

Decentralised and on-site systems. Small decentralised plants will provide sewage treatment for approximately 100,000 people. Ten septage facilities will be provided, most of which will be located in existing treatment plant sites owned by the utility manager/operator.

The plan recognized that there will also be a role for improved services in small pockets where sanitation coverage is substandard, but these issues were not the main focus of the study.

The wastewater project is intended to work alongside related institutional capacity strengthening and organisational components that are being supported separately by the donor although, to date, these reforms have had little effect on the planning or operation of the water utility. Indicative capital investments costs to 2025, via soft loans, excluding land costs, for the project are:

Sewer network: USD 60 M, WWTPs: USD 78M and Decentralised WWTPs: USD 4M

Discussion

Key issues and concerns facing the planners

Sustainable operation of the sewerage system is highly dependent on improved institutional, organisational arrangements and power supply. Preconditions for the sustainable maintenance of the existing and new systems are those noted by many studies - e.g. poorly defined agency responsibilities, lack of incentives to improve performance and inadequate funding. There are concerns about the future sustainability of the system as planned, largely because of its dependence on factors which need to be addressed by a higher level in Government than the water utility.

Kathmandu's wastewater situation has many similarities with other large urban cities in Asia, with the possible exception of:

- its relatively large coverage of off-site pipe system (even if it is poorly functioning downstream, and drainage and sewers are combined in a haphazard fashion);
- extremely high land prices and limited land availability;
- the self cleansing purification that occurs 15 km downstream of the city, with few people living adjacent to the river in that area;
- apparent little incentive to change the situation from an MDG perspective, as current definitions classify the vast bulk of Kathmandu as "improved sanitation".

Strategic planning approaches

Recent approaches to strategic planning for urban sanitation (e.g. Wright 1997, IWA 2010) are appropriate to Kathmandu's context. Particularly relevant foci from the Strategic Sanitation Approach (SSA) are: wider choice of technology options; recognition and analysis of consumers' willingness to pay for perceived benefits; and methods of matching service levels to affordability (Wright 1997: 7,8). Sanitation 21 (IWA 2010) suggests a framework to identify the "real objectives". To do so, the framework hopes to enable "stakeholders to evaluate their interests alongside ... some of the technical drivers, which might otherwise be used in isolation to develop technically 'orthodox' solutions" (IWA 2010:25).

Some of these considerations were included in the study. For example, the blind application of international conventions regarding wastewater discharge standards was questioned. The study suggested a relaxation of these standards as an interim measure. For a short period, it proposed that untreated sewage be discharged to the river in its lower reaches. Perhaps one or both measures should be a more permanent feature of the system, given the downstream self cleansing in the river.

However, the Kathmandu masterplan's approach was largely constrained by the consultant's brief. The timelines did not allow meaningful input from the wide range of domains in the city as suggested by the alternative paradigms in IWA 2010. The plan's objectives were directed to be strongly infrastructure orientated. It's as if the brief forced an orthodox technical solution. There appears to have been insufficient strategic planning thought into wastewater services prior to preparing the brief. This could be because most planning efforts had focused on addressing the chronic and urgent poor water services. *But would SSA or the Sanitation 21 agenda's tools/approaches have made much of a difference to the study's outcomes?*

In Kathmandu's case, the availability and price constraints of land, the almost universal use of water borne septic systems, and the extent of the existing assets, are overwhelming factors that influenced the plans.

Even given the constraints, efforts were made in workshops with many agencies and NGOs to provide more localised small-scale wastewater solutions. However, the viability of on-site systems and decentralised systems was influenced significantly by land constraints and the scale and growth of wastewater volumes generated.

Lessons learnt

An SSA or Sanitation 21 approach may not have significantly changed the investment plans in this case. However, it may have changed how the plans would be implemented in a phased way to reflect the reality of external factors beyond the control of the water utility, and have forced more thought on relevant capacity building and innovative financial mechanisms to be part of the solution. Simply by the going through process, the domain approach suggested by Sanitation 21, for example, might have ensured more commitment by government and agencies to agree on actions at local and higher level domains. And it's that commitment which will, in all probability, make or break the future sanitation situation in Kathmandu, and the health and well-being of its people.

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