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SUSTAINABLE DEVELOPMENT OF WATER RESOURCES, WATER SUPPLY AND ENVIRONMENTAL SANITATION

**Achieving sustainable sanitation:
Lessons from tsunami reconstruction in Sri Lanka**

M.A.I.B. Navaratne, Sri Lanka

The Asian tsunami, which struck Sri Lanka in December 2004, caused havoc in the country and brought about a massive humanitarian crisis. The loss of lives and assets was extensive. The country's economy was stretched. The ensuing period saw an unprecedented flow of aid while the required rebuilding also provided an opportunity for Sri Lanka to improve the coastal infrastructure, correct past mistakes and build better. However, many housing projects, which have been handed over, lack safe water and sanitation. Sanitation that is not sustainable leads to many public health hazards. This paper is an effort to identify such failures and underlying causes in order that we learn from our mistakes. It is essential for Sri Lanka to ensure that its water and sanitation services are sustainable, thus leading to a healthy populace and in turn a healthy economy.

Introduction

The tsunami that hit Sri Lanka on December 26, 2004 caused the worst devastation from a natural disaster in the country's history. The human and asset losses from the tsunami were extensive. As per the tsunami survey of the Department of Census and Statistics (2005) around 77, 000 houses were estimated to be damaged, of which more than 36,000 were completely destroyed. The Joint Needs Assessment conducted by Asian Development Bank (ADB), Japan Bank for International Cooperation (JBIC) and World Bank (2005) highlight the loss of assets in the water and sanitation sector, to be around US\$ 42 million, whilst finances needed for related reconstruction was estimated at US\$ 117 million.

The reconstruction effort following the tsunami, presented a unique opportunity for the Government of Sri Lanka (GOSL) to take a positive step in improving the welfare of Sri Lanka's coastal population, with the possibility to rebuild better and improve social infrastructure. It was an opportunity to take measures towards a sustainable future (Environmental Foundation, 2005). It also provided the GOSL with an opportunity to work towards the targets set by them for development of nation's water supply and sanitation infrastructure. Furthermore, these set targets to provide access to safe drinking water and basic sanitation to 85% of the population by 2015 and 100% by 2025, are in line with the United Nation's Millennium Development Goals (Ediriweera, 2005).

Although donors committed substantial financial resources in the aftermath of the tsunami, implementation of the reconstruction process has been slow due to the scale and scope of work involved. In the water and sanitation sector close to 100 projects worth US\$ 185 million were commit-

ted to by the funding agencies and around 40%, amounting to US\$ 70 million, was disbursed by the end of April 2006 (RADA, 2006). All new housing requires water and sanitation services and hence housing projects coming up need to be monitored to ensure proper service delivery. However, many projects that have been completed to date have not delivered the necessary outputs thus exposing recipients to the hazards of improper water and sanitation. This paper is an attempt to identify such failures and causes with a view to providing possible recommendations that could be applied to the reconstruction process that is currently ongoing.

Why sanitation?

Sanitation is derived from the Latin word *sanitas* meaning health (Blackett, 1999). Sanitation is the means of collecting and disposing of excreta and community liquid wastes in a hygienic way so as not to endanger the health of individuals and community as a whole (WHO, 1987).

Though the principle purpose of providing sanitation is to improve public health, sanitation by itself is not adequate to do so. There are other requirements such as clean water supply and hygiene education (Mara D.D, 1996). However, in instances where ground or surface water is used for water supply, better sanitation contributes to the protection of such water resources. Poor water supply and sanitation is highly correlated to poverty and social degradation, with 80% of sickness in villages in Sri Lanka being water-related, leading to lower productivity and reduction in household earnings and funds for development (Ediriweera, 2005). Hence it was no surprise to see GOSL and donor agencies insistent on providing safe water and sanitation to recipients of all new tsunami housing projects.

For sanitation to be successful in achieving the above-

mentioned objective, the systems must continue to work over a defined period of time. A sustainable sanitation system would protect and promote human health, whilst safeguarding against environmental degradation and depletion of the resource base. It would be technically and institutionally appropriate, economically viable and socially acceptable (Kvarnström et al, 2004). The provision of sustainable sanitation solutions require not only funding but vision, the right approach, coordination, competence, institutional capacity, infrastructure, guidelines, technical knowledge, commitment and political will.

Providing sanitation: Present status

Observations made in the course of research and site visits to sanitation work carried out by International/National Non Governmental Organisations (I/NGOs) in tsunami housing schemes already handed to beneficiaries reveal, that the quality of sanitation provided varies widely. Some key factors are discussed below:

Failures: Why?

Non compliance of treatment units used, with national standards and regulations for the provision of sanitation

Most often the wastewater management technology used by reconstruction agencies is the concrete hume-pipe septic tank and soakage pit system shown in Photograph 1. However, this system has failed to perform as a sustainable sanitation system in the permanent housing schemes. Cylindrical hume-pipe septic tanks do not conform to the SLS 745: 2003, the Sri Lanka Standard for the design of septic tanks and effluent disposal systems. Design and sizing of these systems are flawed and result in flushing of solids into the soakage pit and short circuiting. This is due to low settling depth, settling area and volume. The failure is not in the septic tank technology but the product used. Though these units were used as quick stop gap solutions for transitional houses in the short term, more appropriate technology needs to be used in the permanent housing schemes.



Photograph 1. A Hume-pipe septic tank system used in a transitional camp in Kalutara

Many lands allocated for housing were water logged and unsuitable for housing construction

Many lands identified for tsunami rebuilding were unsuitable due to high water table and marshy conditions as shown in Photograph. 2. This resulted in back-flow in toilets, and low or no soakage of wastewater resulting in the failure of sanitation systems as depicted in Photograph. 3. According to a study by Fraser Thomas (2006) for National Water Supply & Drainage Board (NWS&DB), which looked at tsunami housing schemes with more than 250 housing units at a site, more than 75% of the sites identified encounter problems with high ground water table. Further, almost a similar number have problems relating to soakage and flooding. The study data is given in Table. 1.



Photograph 2. Water logged marshy land identified for tsunami housing in Kalutara



Photograph 3. Failed hume-pipe septic tank and soakage pit system due to lack of soakage resulting in unhygienic conditions in a Kirinda housing scheme

Immediacy of need

This results in the blind implementation of on-site treatment systems without pre-assessment of site conditions, based on cheap initial investment costs, quick installation and ease of construction. Many tsunami relief agencies adopt a ‘construct and hand over’ approach with many aspects of construction being relegated to the decision making of contractors and construction workers.

Lack of a macro-level monitoring agency

The lack of such a body results in substandard projects being delivered to recipients who cannot demand better conditions as houses are given as grants. However, in some cases recipients have refused to move into new housing and preferred to live in the transitional shelters in protest of the substandard sanitation provided. Failure of such systems after hand-over is not considered to be a serious problem as at present there is no monitoring agency to look into the long term sustainability of housing schemes. Such system failures result in sanitation facilities being used for other purposes as evinced in Photograph. 4.



Photograph 4. New toilet used as a dog house due to failed hume-pipe septic tank and soakage pit in a tsunami housing scheme in Galle

Lack of consultation with the relevant authorities

NWS&DB, Public Health Inspectors and Local Authorities are rarely consulted in the selection and implementation of sanitation systems. This has resulted in different construction agencies using various modes of providing sanitation convenient to them, which are not in line with the national standards.

Spatial limitations and Scale

When the number of houses to be built is small and individual plot size is large enough, on-site sanitation can be used if the environmental conditions are conducive. However, on-site sanitation is not suitable for high-density developments due to lack of space and soakage capacity. However, in many such tsunami housing schemes on-site systems have been used. This is due to division and sub contracting of construction of large-scale housing projects to many agencies with none being in-charge of looking after the projects overall infrastructure needs. This results in all agencies using on-site sanitation, as they cannot coordinate the implementation of a collection and off-site treatment system. Further, this has resulted in many storm water and solid waste management issues as well.

Pollution of existing and new water supplies

Soakage pits have been positioned very close to water wells (public and private) causing pollution of drinking water.

As some of these wells are the sole source of water for the community, pollution of these would result in public health hazards. Public Health Inspectors should have taken a more active role in identifying such issues.

Long-term maintenance,

Though septic tanks have been provided, emptying and disposal of sewage in an environmental friendly manner has not been considered. Local authorities, who are responsible for such service delivery, have not been given the required support in this regard. Local authorities have to be provided with equipment, training, financing, bio-solid treatment and capacity building to manage such systems.

Successes: How?

Though the discussion has been mainly on the failures, there have been successful sanitation projects, though they may be a few. Reasons are as follows;

Genuine interest in the recipients long term well being

The analysis of sustainable and successful sanitation systems reveal that many have succeeded due to their detailed efforts and interest in the recipients’ future well being and promotion of sustainable sanitation which goes beyond the target achievement.

Consultation

Some agencies involved the recipients in the decision making process in selecting the suitable sanitation option in order to ensure sustainability. Further, consultation with all relevant stakeholders such as NWS&DB, local authorities and environmental authorities in the decision making process has resulted in the implementation of successful projects.

Use of appropriate technology

The designed septic tanks and, technologies such as anaerobic filters, constructed wetlands and gravel filters can be also used for on-site systems. Even in high water table areas, sanitation has been provided in a sustainable manner with the use of suitable technology. Further, for high-density developments simplified and settled sewerage (shallow sewers) have been used with off-site treatment. Furthermore, dry toilets have been used in areas with issues of water scarcity and threats of serious ground water pollution with wastewater.

Conclusion

Sanitation is not limited to the provision of latrines or toilets. It is also not providing a quick gap solution by installation of a concrete hume-pipe for treatment of the toilet waste in an ad hoc manner irrespective of the surrounding environmental conditions. Many tsunami relief agencies adopt a ‘construct and hand over’ approach to sanitation projects as similar to housing projects due to urgency of the moment. Hence, many of the sanitation development programs encompass toilet construction and, installation of concrete hume-pipe septic tank and soakage pit systems, which ultimately fail.

Therefore, while statistical figures will show full sanitation coverage in tsunami-affected areas, the real situation will be far from it.

Recommendations to reduce sanitation problems in future resettlement projects with a view to providing sustainable solutions are given below:

Use of appropriate technology

- Discontinue the use of concrete hume-pipe septic tanks in tsunami housing schemes where environmental conditions are not conducive for their use.
- Promote the use of designed septic tanks, anaerobic filters, wetland and percolation bed units suitable for the given site conditions. Corea (2001) and SLS 745: 2003 explain the design of such units for on-site treatment of domestic waste. Such systems have been successfully used by some agencies for tsunami housing.
- Use of settled sewage with shallow sewers coupled with off-site treatment is an alternative for high-density housing schemes. Mara (1996) explains the design of such systems.
- The technology used should not be based on minimum cost and, quick and easy installation. It should focus on the functional performance of the system.

Rebuilding guidelines formed and enforced

- International Relief Agencies should familiarise themselves with local guidelines and standards as a first step. Compliance should be made mandatory by the relevant state agencies with systemized inspection and monitoring mechanisms.
- A technically competent coordinating/supervisory agency is needed to monitor tsunami reconstruction carried out by all agencies with monitoring against comprehensive guidelines set up by such agency. At present, any sub-standard system seems to be deliverable to the recipients, as they do not have a say in the standard of housing and other facilities they receive.
- Depending on scale of project, NWS&DB, local authorities or environmental authorities should be consulted by the implementers during reconstruction process.
- The capacities of local implementing authorities must be increased to ensure proper regulation of sanitation systems, to advice communities/individuals regarding available technology options and recommend the best solutions. They must also be able to handle the extra burden of providing services to these new housing schemes. Sustainable sanitation can only be achieved if these authorities can support the system used.
- Housing recipients must be consulted (where previously identified) to enable informed decision making and ensure best practices in usage.

High priority for provision of water and sanitation in land identification

- Water supply and sanitation needs must be given high priority in identification of land for housing construc-

tion. Suitable land identification, in turn would minimize negative impacts of water supply and sanitation in many of these sites.

Table 1. Issues identified at site locations for tsunami housing schemes with more than 250 houses per site

Total no of such sites in Sri Lanka	High ground water level	Soakage/ Flooding problems	Grey water release problems
52	38	34	29

(Source: Fraser Thomas, 2006)

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Contact address

Achala Navaratne, MSc Env Eng
 achala.navaratne@gmail.com