

Water Supply and Sanitation: A Case Study of Timai Bhutanese Refugee Camp in Nepal

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Abstract

This case study highlights a long-term emergency water supply and sanitation (Watsan) in a refugee scenario. One of the Bhutanese refugee camps in eastern Nepal was selected to study the implementation of Watsan under the aegis of The United Nations High Commissioner for Refugees (UNHCR). Watsan is based on the minimum standards set by The Sphere Project. An Underground water source has been used for a centralized distribution network for more than 8,500 refugees while excreta disposal is practiced with the use of ventilated improved double pit (VIDP) latrines. Other aspects of sanitation (solid waste management, wastewater disposal and hygiene practice) are implemented by the refugees themselves using the most economical means. The probable risks associated with sanitation within the camps have been mediated but the degradation of environment due to lacunae in environment management has been cited in this case study. The environmental health standards practiced have been reported as one of the best managed situations in any refugee scenario implemented by UNHCR.

Keywords: Emergency water supply and sanitation; Bhutanese refugee camps, environmental management

1. Introduction

Timai refugee camp is one of the seven Bhutanese refugee camps for more than a hundred thousand refugees administered jointly by The United Nations High Commissioner for Refugees (UNHCR) and The Government of Nepal. This camp is located on the east bank of a non-perennial Timai River. Its population of

9,846 persons comprises 1713 families who live in bamboo shelters made on plots of 5.5 meters by 3.5 meters (single unit for a family size of 8 or less) [1]. Large families are provided double and even triple plots based on the number of persons living in the shelter. Figure 1 depicts the layout of the camp with its individual plots.

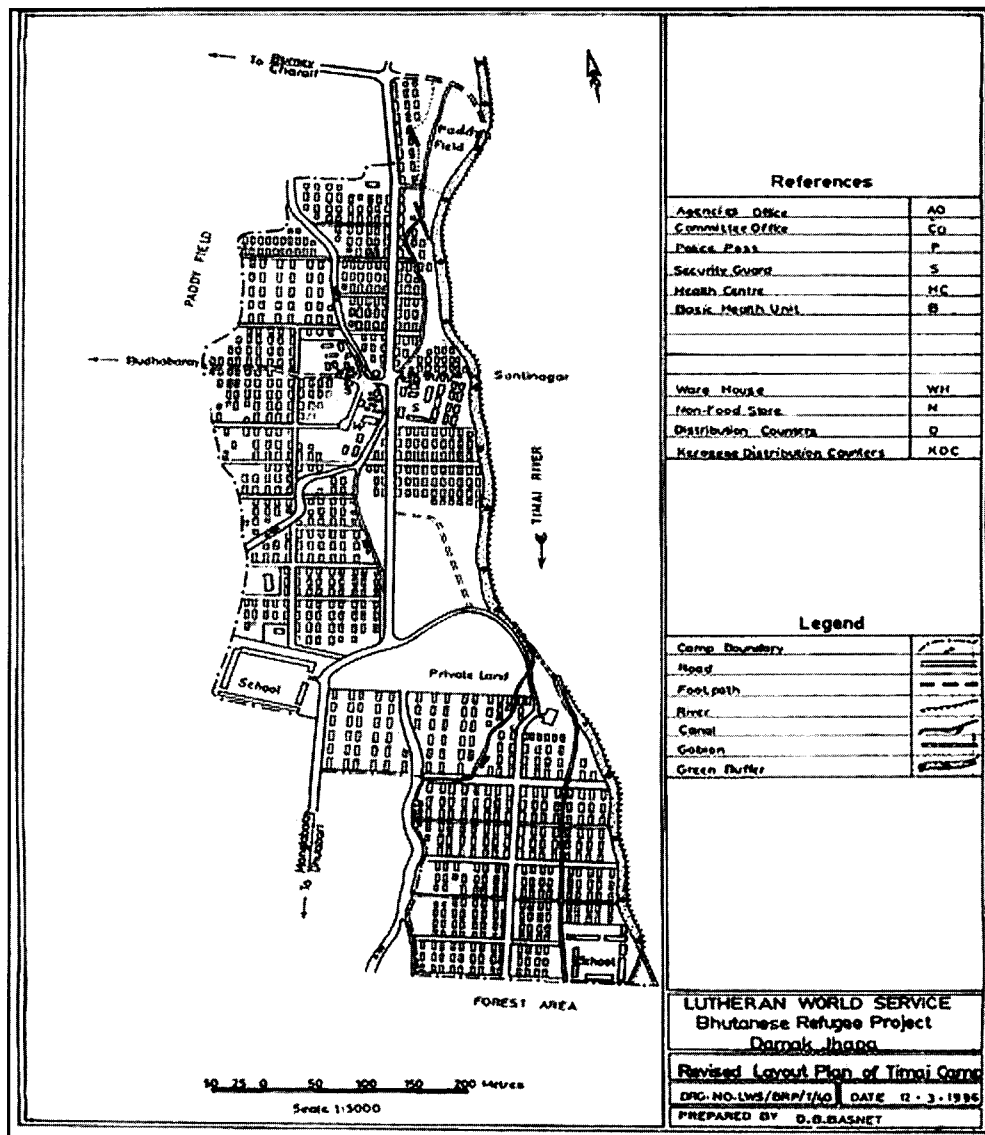


Figure 1. The layout map of Timai camp [2]

Lutheran World Federation (LWF), one of UNHCR's implementing partners for the Bhutanese Refugee Rehabilitation Project, is involved in implementing the water supply and sanitation (Watsan) program in the camps in the most economic way while maintaining the

environmental health standards of the refugees. Other implementing partners of UNHCR in the refugee relief activities are outlined in Table 1. Each refugee camp is managed in a similar way and the facilities provided are identical.

Table 1. Implementing partners of UNHCR for refugee relief activities

Relief Agency	Responsibility
Lutheran World Federation (LWF)	Approach roads and bridges; site plotting, infrastructure and Watsan
UN-World Food Programme	Supply of food to NRCS for distribution
Nepal Red Cross Society (NRCS)	Distribution of food, utensils and clothes as well as encouraging kitchen gardening and forestation
Association of Medical Doctors of Asia (AMDA) Nepal	Medical supplies, monitoring public health and hygiene, and providing basic health-related trainings
Oxfam	Adult literacy, assistance to vulnerable groups, home science and skill development training
CARITAS	Formal school education and higher studies, basic school infrastructure, logistics and training to teachers

The origin of the refugees is the southern foothills of Bhutan inhabited mostly by people of Nepali ethnicity since the 17th century. They were politically evicted from the country alleging them to be illegal immigrants. When the refugee influx to eastern Nepal grew after 1991, UNHCR and The Government of Nepal reorganized of the clustered makeshift emergency camps on the banks of Kankai River to seven different locations by March 1993. By then, resolution of the refugee crisis appeared remote and hence, each new camp was designed to meet the long-term goals for basic amenities. All the seven camps have been maintained within the minimum standards of relief aspects postulated in The Sphere Project [3, 4].

Timai camp is divided into four administrative units called sectors; each of which is further subdivided into four sub-sectors. Each sector and sub-sector elects its representatives as sector and sub-sector heads respectively, with their assistants. These elected representatives form the camp committee that elects its two leaders - Camp Secretary and Deputy Camp Secretary. The committee has a pool of technically qualified volunteers called the Incentive Pool (IP) for its various technical (Watsan and infrastructure) and social (environmental awareness and community participation) activities in the camp. The Camp Secretary acts as the focal point for all the refugee assistance programs and coordinates

each relief activity under the guidance of UNHCR and its implementing agencies.

UNHCR has contracted the refugee rehabilitation work to its implementing partners and its Sub Office in the district monitors their activities in each camp. The UNHCR Branch Office in Katmandu liaisons with the Nepalese Government and the heads of each relief partner. The host government is responsible for locating camps, managing refugee security, their protection and their legal matters, as well as negotiating with Bhutan by bilateral dialogs for the repatriation of the refugees to their homesteads. Initially, both UNHCR and The Government of Nepal were involved in the identification and registration of the refugees in the camps during the mass influx and on their phased arrivals.

2. Water supply

2.1 Water source and treatment

The source of water for Timai camp is groundwater from two-confined aquifer boreholes of 58 and 88 meters depth, drilled using rotary drilling with flush into alternating layers of sandstone and shale just below 10 meters of unconsolidated silt and sand formations. *Groundfos* submersible pumps of 76-meter head and rated capacity of 18m³/h pump to three ferrocement tanks of total capacity 95,000 liters. These tanks are built partly below the ground level maintaining a sufficient gravity flow pressure for water flow to

the last tap stand. The available head for the tanks is 23.13 meters [2, 4, 5]. Water storage and supply to schools, health units and other agency offices are with the use of High Density Polyethylene (HDPE) tanks of 1000 L and 2000 L capacity. A pumping time of 6 hours and total distribution time of 5.5 hours suffices a day's supply of 170 m³. Pumps are operated simultaneously using the power supply from 12 KW diesel generators.

During the initial phases of establishment of The water supply system, water quality was monitored for fecal contamination, iron and manganese, which were found to be within the prescribed limits requiring no treatment. For safety, the Incentive Pool uses bleaching powder stock solution for the treatment at a dose of 1 ppm. Approximately 10 liters of 1% chlorine solution is used to treat 95 m³ of water for a single distribution so that residual chlorine at the tap is measured to be 0.2 to 0.3 ppm. A contact time of half an hour is allowed [2, 6]. Each morning a trained person carries out the chlorination before releasing the water to the faucets. Once a month, samples are taken from the tanks and some selected taps to the LWF laboratory to analyze for fecal contamination. There has been no record of fecal contamination in the tank water but samples from discharge points have been found to be contaminated owing to the intrusion of contamination through the joints of pipelines mainly during the rainy season since there is no continuous supply. Because of that risk, people are advised to consume boiled water.

2.2 Water supply and distribution system

The designed water supply was initially 20 liters per capita daily (lpcd). With the increase in population, the per capita supply decreased to 17 liters. The water supply system has a network of PVC pipelines of various diameters depending upon the location of the network. Concrete tap stands are located within 5-20 meters of each shelter. The faucets are single, double or triple faucets based on the cluster of consumers served. For domestic water storage, each family living in a single plot has a minimum of two 10-liter plastic jerry cans and two 20-liter aluminum pitchers. Every two years, one new jerry can is provided for a single unit shelter. During water distribution, cans and pitchers are queued up. Elders monitor the orderly water collection, and

women and schoolchildren are engaged for the job. Most people prefer to consume boiled water and traditionally they consume light black tea without milk or sugar. From a survey of 50 families, it was found that occurrence of diarrhea diseases within a period of 3 months was 15 cases in a population of about 300 people. In the survey, 42% respondents stated that the water supply was not sufficient during the dry season but satisfied their needs during the rainy season. The survey revealed that rainwater was often harvested from the roof and stored in vessels for dishwashing and toilet flushing. It was reported by health workers that incidences of diarrhea diseases were more during the rainy season than during the dry season [7].

3. Sanitation

This study considered human excreta disposal, wastewater disposal, solid waste and clinical waste management, and hygiene promotion as a part of sanitation. The collection and disposal of waste should not endanger the individuals and the community as a whole [8]. Issues and findings related to sanitation during the survey are described hereunder.

3.1 Excreta disposal

Excreta disposal was a major concern during the emergency phase of refugee rehabilitation due to widespread practice of open defecation in the forest cover and the riverbanks. Communal pit latrines were not utilized. Before the camps were relocated, adoption of pit latrines posed a grave problem with the ground water level of about 1 meter in most of the proposed camp sites. That would mean digging a pit every 6 months to accommodate the excreta of a family. Open defecation posed a serious health problem with incidences of diarrhea diseases and cholera [9]. A Use of ventilated improved double pit (VIDP) latrines was found to be most adaptable. A user survey indicated 98-100% utilization. The ratio of usage is less than 1:20. Each family of more than 8 members has been provided one unit while two families of less than or equal to 8 members share the unit. The construction of the VIDP latrine is mostly within a 10-meter distance of each shelter. The superstructure is made of bamboo with a black plastic roof or a square sandwich panel roof. The interior of the

latrine is made dark using either plastic sheeting or by mud plastering that helps prevent entry of light and hence flies. For the maintenance of infrastructure, LWF provides materials through the Incentive Pool [7].

The VIDP latrine has two pits of 1.2 m diameter and 1.2 m depth. Cast ferrocement rings are used and the bottom is lined with a layer of stones enabling seepage of wastewater into the soil strata. A one-meter square squatting plate with twin drop chutes is placed above the pits as in Figure 3. The twin pits are used alternately. It is reported to take about 8 - 10 months for the pits to fill up in high water table areas with clayey soil, but in sandy soil in the case of Timai camp, the actual changing of pits was reported only after one and a half to two years [6, 7, 9]. Once one pit is filled up, the owners approach the IP workers to change it. The excreta filled pit is then covered with soil and left to decompose. Generally it has been observed that it takes 6 or 7 months for the contents to decompose and become nonpathogenic before the pit can be emptied of its contents [6]. VIDP latrines are used for camp schools along with two urinals, one each for boys and girls. The high school has a semi-permanent type of communal latrine with cylindrical pits. In addition, each school has one five unit VIP latrine with seven pits to serve excreta disposal. Similarly, the camp has two Basic Health Units (BHU), each with a latrine, while the Primary Health Centre (PHC) has three (for male and female patients, and staff members). Figure 2 shows the plan and front views of a VIDP latrine.

3.2 Emptying of pits

The refugees welcomed the initial choice of VIDP, but there was a cultural barrier (due to the caste system) regarding emptying of pit contents after the decomposition of night soil. Higher caste refugees were reluctant to empty their own pit contents. A few educated among them were convinced of the safety in handling the composted matter after pathogen test results were shown by LWF and volunteered to empty their own pits with proper gear, and others followed suit. Presently most people use the decomposed night soil for vegetable gardening after further keeping it covered in a manure pit for over six months [7].

3.3 Solid waste management

Each sub-sector has a pit of size 5 m by 5 m and 1 m depth located at 30 – 80 m distance from the camp boundary on higher ground of the riverbank. Each pit receives about 50-75 L/day of refuse. If dry and comprised of paper and plastic, the waste is burnt, but this also depends upon its composition and the weather. Once a pit is filled, it is covered with available sand or soil and a new one is dug close by. Thus, there is no final disposal system. Each household or a community unit (school, training center, camp office, etc.) takes its refuse to the pit for disposal. Table 2 gives the average composition of the solid waste in the camps from samples taken over a seven day period from one selected shelter in each sub-sector. The sampling indicated a per capita waste generation of 0.20 to 0.40kg but the actual disposed waste was reported to be much less as most of the food and combustible wastes were segregated before disposal in the pits.

Camp solid waste is domestic in nature with over 70% biodegradable (mostly food) wastes. Each family has a 5-liter plastic container for waste collection and the refuse is emptied every day at the communal pit. Biodegradable and combustibles are segregated at source. Most food waste is collected by the camp inmates for piggery. Other biodegradable waste is used to generate compost, a part of the kitchen gardening project sponsored by The Nepal Red Cross Society. Compost is used for gardening within the camp area and social forestry in the vicinity of the camp. The composting unit has clearly instructed camp inmates, especially the women regarding type of waste to be sent to the composting plant, which includes grass cuttings and leaves from the surroundings. Combustibles like slicing of bamboo, thatch, paper and plastic, are burnt in the hearths as fuel, despite regulations against lighting open fires. (Kerosene is provided as fuel for cooking.) Recyclables like glass bottles are collected by local vendors and sold to the local scrap dealers. The disposed solid waste is comprised of shelter sweepings, non-combustibles and hazardous wastes like broken glass, the percentage of which is very low. Each school has its own waste pit at the periphery of its compound. Solid waste from the compound and sweepings are collected every day and the combustibles are burnt after school hours. Each classroom has its

own waste bin and students learn the importance of hygiene practices and clean environment as a part of the school curriculum.

3.4 Medical waste management

In the medical centers, waste is also segregated at the source as far as possible. Combustibles as well as organic wastes are

collected and incinerated every day with the help of other chemical wastes. Hazardous wastes like sharps and needles are collected and buried in a specified site. Organic wastes from childbirths are safely buried in the camp burial grounds [1].

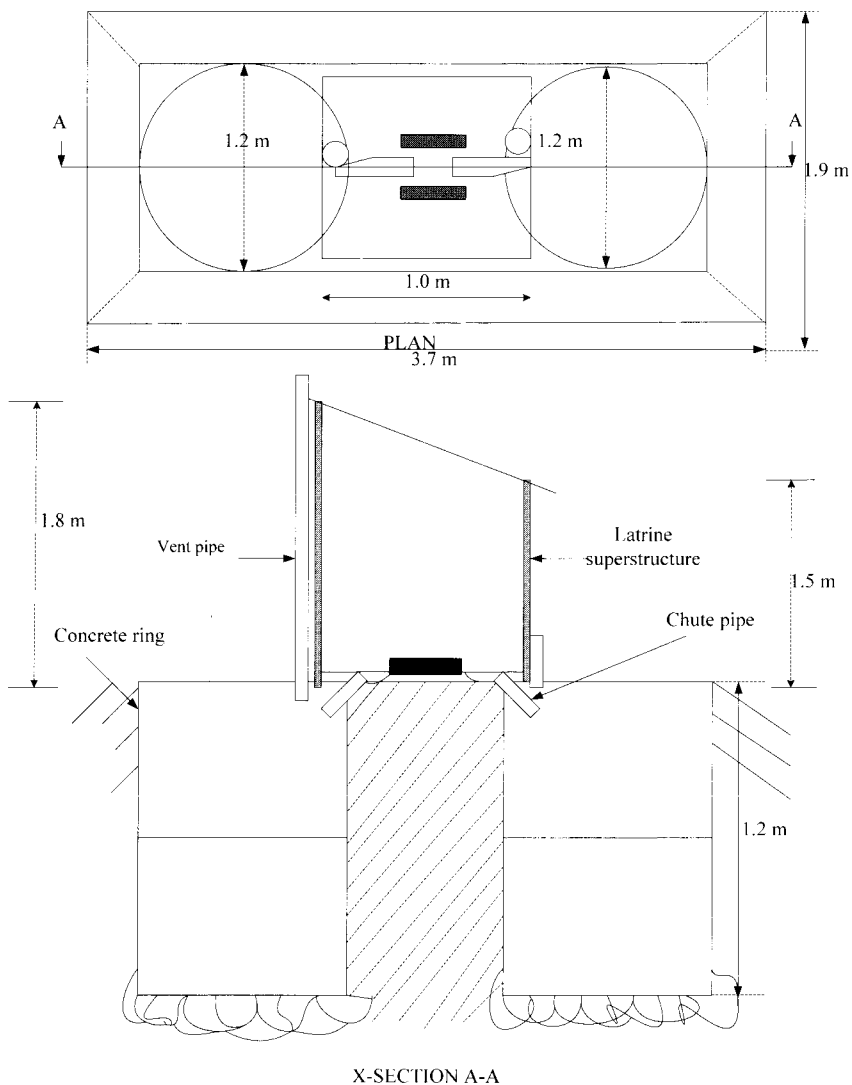


Figure 2. Plan and X-section of VIDP latrine

Table 2. Solid waste composition of Timai refugee camps [7]

Waste type	Average composition (%)
Biodegradable (food, weeds and vegetables wastes)	70-75
Combustibles (mostly wood, bamboo splits and paper)	15-20
Non-combustibles (stones, sand, construction wastes, etc.)	5-7
Hazardous (broken glass, metal pieces, wires, etc.)	3- 5

3.5 Wastewater management

Wastewater generation by a population of about 10,000 is substantial. However, the wastewater so generated depends from season to season. During the rainy season, disposal is carefully done. However, in the dry season, the soil stratum of the camp area helps in disposal. Simple soakpits are sufficient for most of the domestic wastewater where the ground or the soil is consolidated. Each household has a soak pit near its washbasin. In many of the units, the washbasin is made above the soakpit. Once the pit is filled, another one is similarly made while the former is covered and the wastes are left to decompose. Figure 3 shows the sketch of a drum soakpit 0.6 to 0.8m deep and 0.8m in diameter. Such soak pits are made where the soil is unconsolidated or sandy for which oil or tar drums are used. At the top of the pit, pieces of bamboos are laid generally with plastic sheeting and covered by soil. The washwater from bathroom is sometimes disposed in the same pit but most often in the dry season, it is reused for irrigating the small family kitchen garden plots. Each soakpit lasts considerably long – 10 to 14 months. The porous soil stratum for Timai camp helps the seepage of water while solids accumulate in the pit. During rainy season, wastewater is generally discharged into storm drains and/or into the two local irrigation canals that pass through the camp while the temporary drains discharge storm water into the river.

3.6 Hygiene promotion

Hygiene promotion is one of the important aspects of environmental health in the camps to avoid any health risks. Hygiene practices promote proper use and maintenance of

sanitation facilities by actively participating in the camp sanitation program [3]. Each sub-sector has a hygiene promotion (HP) focal point called the Community Health Volunteer (CHV), most often a female member whose sole responsibility is to visit different shelters and advise people against communicable diseases, water-borne or water-washed diseases. The CHVs instruct people to properly use sanitation facilities by keeping the interior tidy, and ensuring the cleanliness of water vessels. The target groups are women and children, as they carry out most of the domestic chores. The most commonly used methods are door-to-door visits, small and large group meetings, and display of posters and leaflets.

Disposal of dead bodies is either by burial or by cremation depending upon the family tradition and religion. The area for cremation is located near the riverbank to enable washing the corpse while the relatives of the deceased bathe and offer water to the deceased. For cremation, 300kg of wood per corpse is provided. Burials are also common for about 40% of the populace. The local graveyard is located one kilometer south of the camp in the forest area. Graves are placed in an organized arrangement to facilitate proper utilization of the available land. Each dead body is removed from the house of the deceased within 12 hours of the incident of death, unless the death is in the late afternoon or a weather problem arises, or if it is certified by medical personnel that it does not pose a hazard immediately [1]. In case of medical deaths, doctors or designated camp health personnel certify the safety of handling the corpse.

The camp committee and volunteers organize public participation in all the activities

in the camps. This enables proper use of facilities provided by the agencies. Health, an important aspect of camp life, is well understood by all refugees. Unit heads are helped by schoolteachers and health workers to organize

people's participation. The SWOT analyses of the Watsan program taken up by this study are summarized in Table 3.

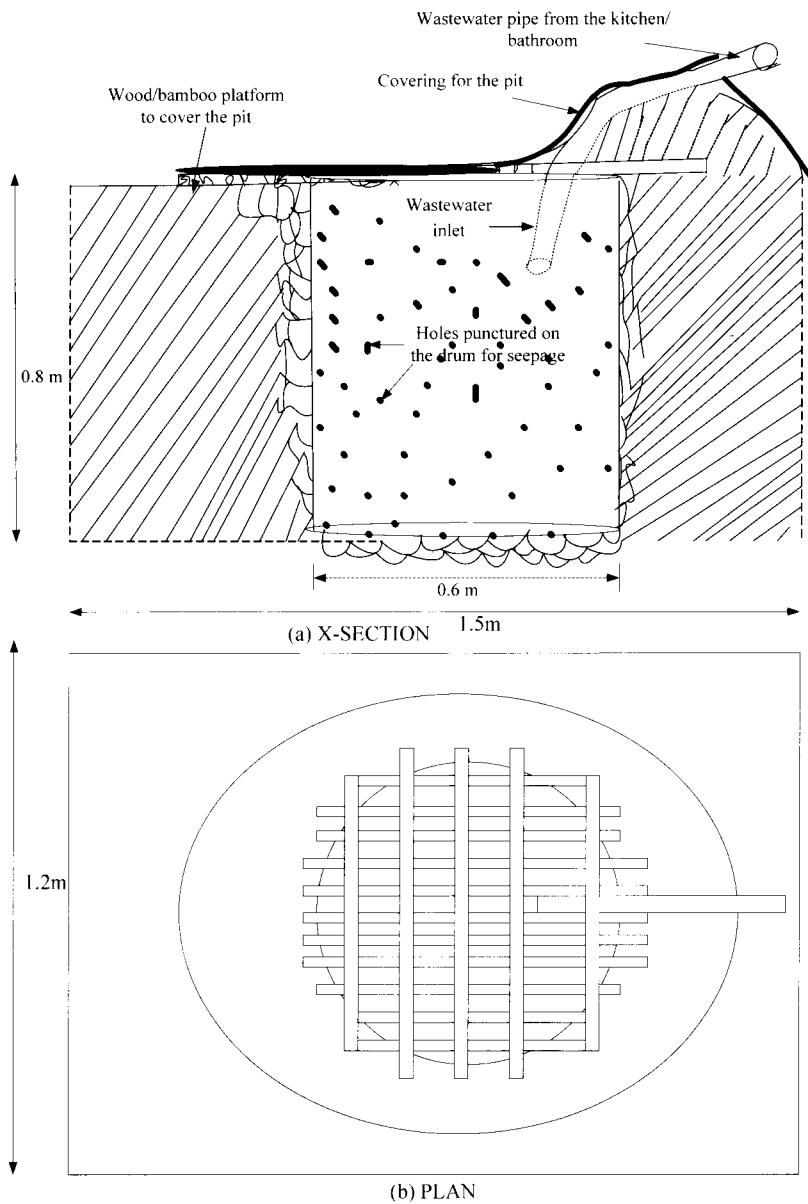


Figure 4: Cross-section and plan of a domestic wastewater drum soakpit [7]

Table 3. SWOT Analysis of the Watsan Program

Strengths	The camp is properly planned with adequate infrastructure with the refugees managing most of the relief activities with agency coordination. Centralized water supply and distribution is according to the minimum standards, and incidence of water related health problems are a minimum (lower than in the adjacent local villages). Excreta disposal, solid waste management and wastewater disposal has been found satisfactory, and people's participation is an example to be followed elsewhere.
Weaknesses	There is shortage of water due to population growth, pipeline leakages and open-end tap stands, causing a loss of 10-20% water. Scattering of refuse is common in market places and hazardous solid waste disposal in pits is risky. Blocked storm drainages cause flooding and contamination of water supply lines. Incineration of medical waste is close to the dwellings.
Opportunities	Refugees get training in self-management of camp facilities - Watsan and environmental health with participatory learning.
Threats	Refugees encroach into forestland for firewood and other needs. Conflict with locals arise due to the given facilities. There were reports of sexual harassment of the girls and women, thefts and feels of uncertainty.

4. Conclusion

On critically reviewing the Watsan situation in the refugee camp, the salient features of the centralized water supply system are potable water quality that does not require any disinfection and reliability of supply. Another feature is management and participation by the refugees who manage its operation and maintenance.

Improvements in water supply to increase the overall efficiency of the system could be with the provision of faucets instead of open pipes to decrease substantial loss of water during the changing of vessels in a collection line. Leakages in the trunk line as well as in the entire network of subsurface pipes, which lead to the fecal contamination from close-by latrines, could be avoided. supply could be increased with an increase in pumping and distribution timing. Owing to the possibility of seepage, fecal contamination is likely to occur and hence disinfection should be more frequent, preferably once a day during the rainy season.

The overall sanitation of the camps was found to be satisfactory and its salient points are the excellent maintenance of the excreta disposal system; change from the habit of open defecation to the use of environmentally safe system; source segregation of solid waste and adoption of composting technology (resource recycle); and the practice of effective

wastewater disposal. The associated problems with sanitation are occasional negligence of children's feces; contamination of aquifers due to the sandy strata, which could affect the local water supply; accessibility of solid waste pits to children; unplanned storm water disposal system; and the location of the medical waste incinerator too close to the dwellings.

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