# Design of Grey Water Treatment Using Community Soak Pit Method


**Sayed Shabaj M. Sagar and Sanjeev Sangami**

**Abstract** The wastewater produced by homes is separated into two types grey water and black water, with grey water making up the majority of the flow. Grey water from residential apartments makes up 50–70%. Grey water's composition varies widely depending on where it comes from (e.g., bathroom, laundry, or kitchen grey water), and it is affected by the local water quality. Preliminary data has been collected and surveying has been done for these selected village Honnakalasapura village with a population of 509. After surveying these villages, community soak pits are provided at the end of drainage points prior to mixing with black water. If any houses are not connected with drainage, then the individual soak pits are given for a particular house. Villages with Grey water pipelines that are directly connected with sanitary lines are the villages not considered for treatment. Reusing and Recycling of Grey water can be achieved by providing a community soak pit as well as individual soak pit. The design of the community soak pit is according to the population of village. Based on this 24.48 KLD greywater is produced per day. Based on this the diameter of the soak pit is given as 1.80 m, depth = 4.3 m and 7 numbers of rings are provided, the main aspect of this method is cost effective and easy to use.

**Keywords** Grey water · Methods · Reduce · Reuse · Recycle and Recharge

## 1 Introduction

In order to improve public health in rural regions, grey water management is crucial. Grey water that is safely handled can help reduce exposure to water-borne and water-washed illnesses, as well as vector-borne diseases. Grey water management can significantly lessen the difficulties associated with freshwater consumption [1].

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Grey water is frequently collected from residential neighborhoods, business districts, and institutional settings. The water is described as being grey due to its appearance in the foggy environment and the fact that it is neither fresh nor very contaminated (black water). To be precise, grey water is any water emitted from residential structures that are not toilet waste. Grey water may still be suitable for reuse despite the presence of grease, food particles, and other contaminants [2].

Specifically, grey water is wash water, water used for baths, dishes, and laundry that is free of garbage-grinder residue and excludes toilet waste. When handled appropriately, greywater might be a resource for both agricultural and horticultural crops as well as home gardeners [3].

Grey water and black water are the two main categories of wastewater. Grey water is a type of residential wastewater that is created during activities including bathing, laundry, clothes washing, and dishwashing. Between 55 and 75% of the home water discharges were wastewater. Different from black water is grey water. Grey water varies from black water in terms of both the kind and quantity of its biological and chemical pollutants (feces water to noxious chemicals) [4].

In addition to landscape architects, builders, developers, and contractors, on-site greywater treatment and management for design and landscaping has several benefits. Greywater is a source of phosphorus, potassium and potassium nitrogen pollutants for lakes, rivers, and groundwater. Also, make this specific kind of wastewater is a great supply of nutrients for plants when it is made accessible for irrigation [5]. Wastewater is any water that has been polluted. Use and human activity. Wastewater is used to clean up any mix of home, commercial, industrial, or activities including agriculture and any sewage inflow infiltration. Consequently, wastewater is a byproduct of residential, commercial, industrial, or agricultural pursuits [6].

Grey water reuse serves two purposes: First and foremost, it uses less freshwater than is required for domestic tasks and produces less wastewater that is collected in sewage tanks or septic tank systems. Grey water naturally includes nutrients that can be useful when utilized as fertilizer. When it is treated like sewage and discharged into ponds, lakes, and rivers, it becomes a pollutant [7].

As a resource, water is becoming increasingly scarce. By 2025, one third of Indians would be experiencing water scarcity, according to the worldwide water management institute. The disparity between water availability and demand is growing as the population grows. By reusing the cleaned water, the free technologies would undoubtedly save a significant amount of water [8].

## *1.1 Technology Options for Grey Water Treatment*

(1) **On site (Decentralized)**

(a) Soak pit
(b) Leach pit
(c) Kitchen garden

(d) Community Soak pit
(e) Community Leach pit
(f) Community Kitchen gardens

(2) **Off Site (Centralized)**

(a) Small Bore System
(b) Waste Stabilization Ponds
(c) Constructed Wetland
(d) Soil Bio-Technology
(e) Phyto rid Technology
(f) Anaerobic Baffled Reactor
(g) Moving Bed Bio-Film Reactor

When comparing the above methods and lots of studies, the best method suited for rural areas are Community soak pit method and also economical method when compared to other methods. Under the *Swaccha Bharath mission Grameen phase II Ministry of Jal Shakthi Government of Karnataka has raised the fund for this method due to being Economical and Cost Effective.*

### *1.2 Comparison Between Decentralized and Centralized*

See Table 1.

## 2 Methodology

See Fig. 1.

**Table 1** Comparison of both technologies

| Decentralized | Centralized |
|---|---|
| O&M costs are low and borne by the house owner | O&M costs are more when compared to other methods |
| Requires less space | Requires more space |
| Unskilled manpower is required | Skilled manpower is required |
| Less capital cost | High capital cost depending on the price of land |
| Required less maintenance | Required periodic maintenance |
| No drains required | Required drains to convey the grey water from village to treatment unit |

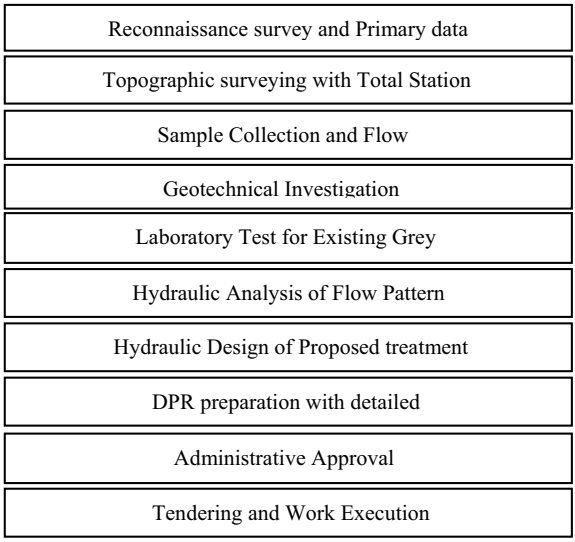


**Fig. 1** Flow chart of Methodology

## 3 Result and Discussion

See Table 2.

Design methods are taken from the Grey water resource management Book Ministry of Jal Shakthi Government of India.

### *3.1 Population Method*

Population = 509
Production Rate = 30%
Water Required = 55 LPCD
Grey water = 70 %

(Note: If we provide 100% of water in that 65–70% of the total water supply in rural areas is converted to grey water after use.)

$$= (509) + (509 \times 30\%) \times 55 \times 70\%$$

**Table 2** Data of Honnakalsapura

| Gram Panchayat | Surgajakkanahalli |
|---|---|
| Name of village | Honnakalasapura |
| Village population (present) | 509 |
| Total number of houses | 80 |

$= 25475.45$ L

$= 25.48$ KLD

## 3.2 Design of Community Soak Pit

Number of community soak pit proposed = 5
Quantity of grey water for each community soak pit = 5.10 KLD
Percolation rate = 1 min (IS 2470-1985 part II)

(Note: Based on the test, the soil is found as clay soil, for this soil the percolation rate is taken as 1)

$$\text{Percolation area} = \frac{5.10 \times 1000}{204} = 25.32 \text{ m}^2$$

Diametere of community soak pit = 1.80 m

$$\text{Depth of community soak pit} = \textbf{Percolation area} - \pi/4 \times \mathbf{D}^2/(\mathbf{D}^2)$$

$$D = (24.98 - 2.55)/(5.66)$$

$$D = 3.97 \text{ m} \quad D = 4 \text{ m}$$

Free Board = 0.3 m Total Depth = 4.3 **m** (3.2.1)

## 3.3 Soak Pit Ring Design

See Fig. 2.

Quantity of grey water = 5.10 KLD

$$V = (\pi\ d^2/4) \times h$$

$$h = V/(\pi\ d^2/4)$$

$$h = \frac{5.10}{3.142 \times 1.8 \times 1.8/4}$$

$$h = 2.00$$

Depth of each ring = 0.3

Number of rings to be provided = 2.00/0.3

$= 7$ **numbers** (3.3.1)


**Fig. 2** Village map with road connections

As per the Census 2011 information the Village code of Honnakalasapura is 613310. Honnakalasapura village is situated in Anekal taluka Bangalore urban district in Karnataka India. It is located 35 km from the district headquarters in Bangalore. According to 2009 data Suragajakkanahalli is gram panchayat of honnakalasapura. The overall geographical area of the village is 143.08 ha. There are about 105 households in Honnakalasapura village. Pincode of the village locality is 56210 (Figs. 3, 4, 5, 6 and 7).

## 4 Conclusions

The benefits of grey water recycling by using community soak pit and Individual soak pit technologies will reduce Water/Environmental pollution and mainly it is a benefit to the ground water recharge. Most of the other technologies are there such as waste stabilization ponds, Phyto rid Method and DEWATS technologies but these technologies are required centralized land, required more area and also High-cost technologies. Hence, to conclude soak pit method is suitable in rural areas and semi-rural areas. Because it required less capital cost, maintenance free, easy to construct, comparatively it required very less area to construct and it will directly improve the ground water table.

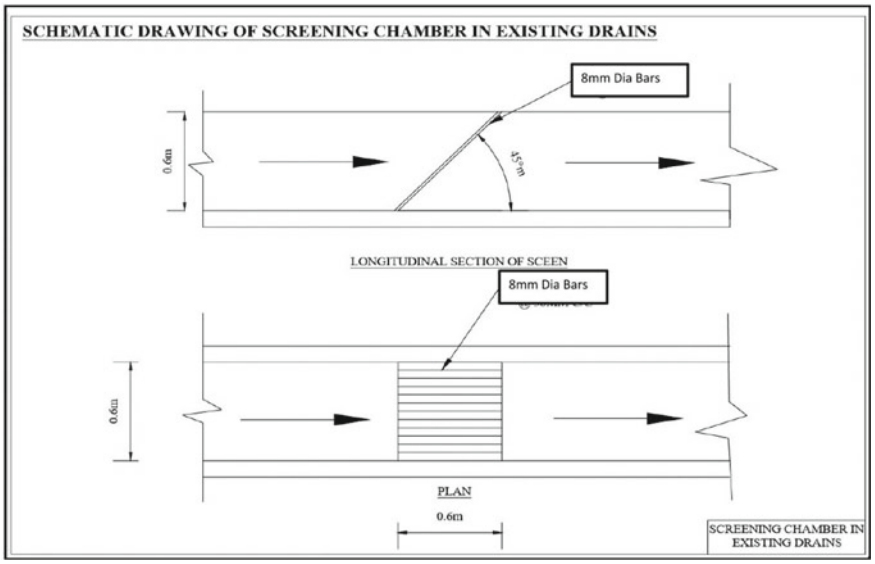


**Fig. 3** Screen Chamber is provided at the end of drainage it is a type of mesh which eliminates the unwanted objects at the beginning of the treatment process

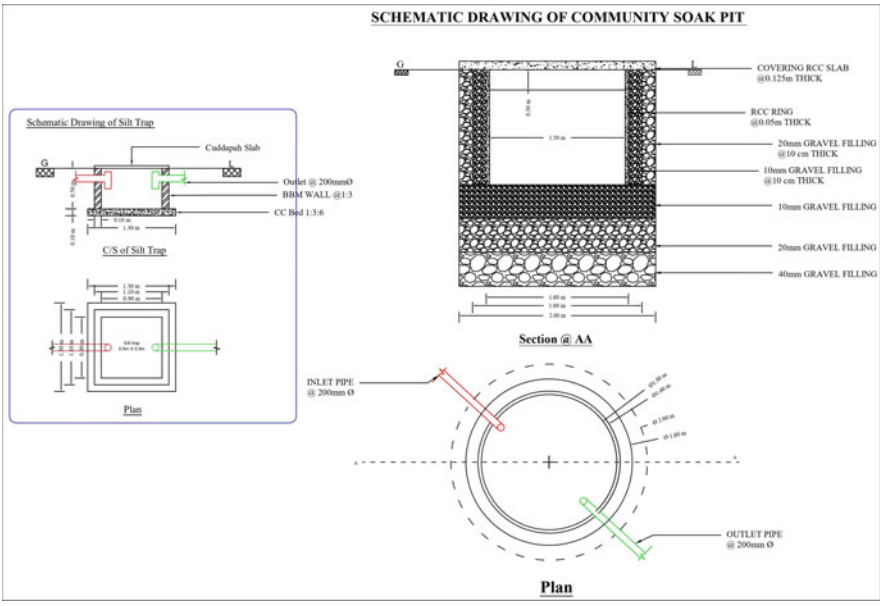


**Fig. 4** Community soak pit, is given after the screening this is a pit where the grey water percolates in this pit then the water can be used as groundwater recharge or else it can be used for gardening purpose

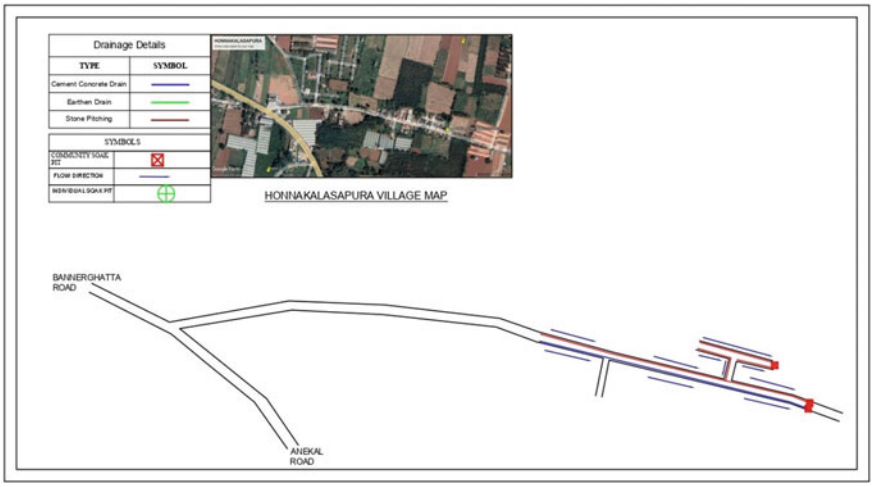


**Fig. 5** Layout of Honnakalasapura Village Which comes under the Surgajakkanahalli GP after surveying and data collected from this village, three community soak pits are required according to the population of this village the red symbol shows the community soak pit at the end of drainage and blue arrow mark shows the flow directions

This method is highly suitable where the areas have very low water table (Most of the Study area's water table is more than 1200 ft or 400 m) hence the soak pit technology is most suitable for rural areas in the community level and house hold level.


**Fig. 6** Outfall point 1 at the end of drainage. Where the community soak pit is to be propose


**Fig. 7** Outfall point 2 at the end of drainage

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