SYNTHESIS DOCUMENT: LIQUID WASTE MANAGEMENT IN SBM II

ABSTRACT

As the Jal Shakti Mission of the Government of India expands, providing tap water to rural households, grey water management will have to keep pace. This thematic discussion on the India Chapter of SuSanA examines the readiness of local government institutions, tasked with the job, to effectively plan and implement grey water management.

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Introduction

The Department of Drinking Water and Sanitation (DDWS) under the Ministry of Jal Shakti, Government of India, recently brought out the strategy and guidelines for SBM Phase II, 2020-21 to 2024-25 to consolidate gains made in SBM Phase I. While the goal in the first phase was eliminating open defecation by constructing toilets, the goals in the second phase are much more ambitious. The outlay for the period is estimated at ₹ 140,881 crores. A major focus area in the second phase is solid and liquid waste management (SLWM) in rural areas.

Like the first phase, the second one also aims to leverage the capacity of individuals and communities in rural India. While ensuring villages remain ODF, SBM II aims at providing the remaining households with toilets and improving the overall standard of living by better environmental sanitation. Thus, its objectives are

1. Sustaining the gains of SBM-I and ensuring sustained access to safely managed sanitation for all rural Indians
2. Achieve a clean living environment through SLWM

It divides SLWM into solid waste management and liquid waste management. The elements of the strategy to achieve ODF Plus are stated as under:

1. Sustained usage of Individual Household Latrines (IHHL)
2. Continuous behaviour change communication
3. Ensuring no one is left behind and providing sanitation access to new households (HHs)
4. Sanitation coverage of public spaces (through public and community toilets)
5. Implementation of Solid and Liquid Waste Management (SLWM) in rural areas

As in Phase I, five per cent of the project's funds are available for information education communication (IEC) activities. New and those households omitted from SBM Phase I are to get the same subsidy of ₹ 12,000 to make a toilet. SLWM includes management of solid – biodegradable and plastic – and liquid waste, as well as faecal sludge management.

The India Chapter of SuSanA conducted a thematic discussion and webinar on liquid waste management (LWM), that is grey water.

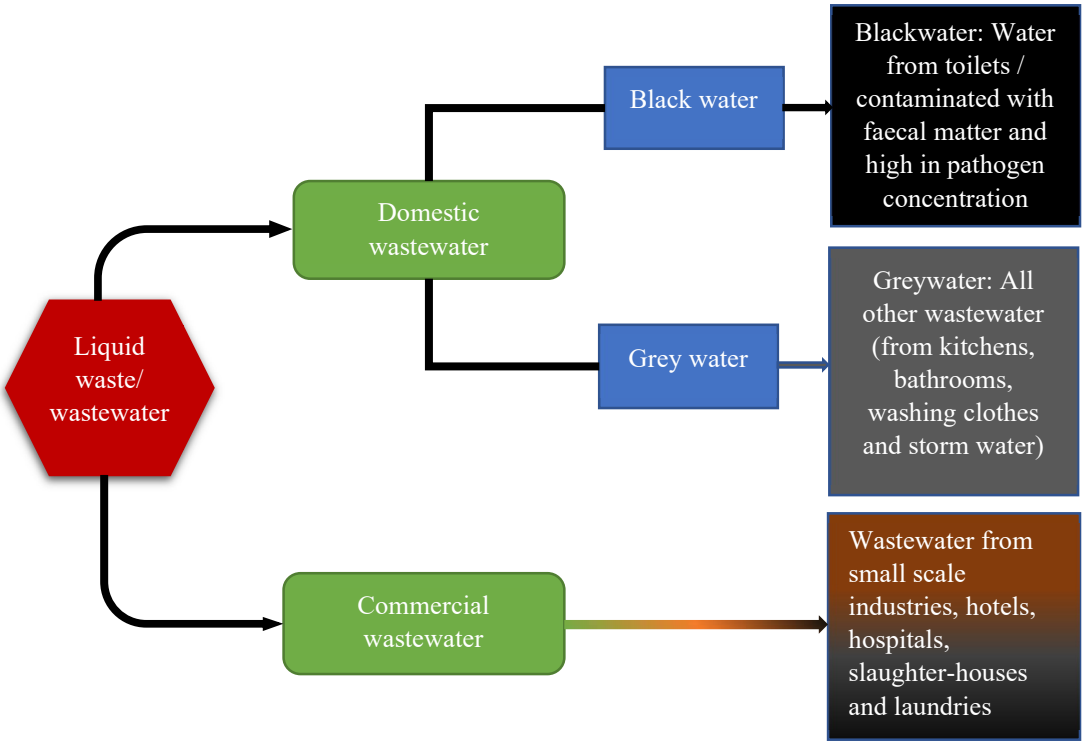

Figure 1: Characterisation of wastewater

The SBM II guidelines state 80 per cent of grey water generated by households and all public places needs to be treated and reused. This includes grey water generated from kitchens, bathrooms and storm water that flows through channels and/or individual and community soak pits. It also includes black water from septic tanks, a common occurrence in rural and semi-urban areas, where these overflow into roadside drains, ditches and eventually local ponds or wells.

Grey water from bathrooms and kitchens are a major problem in rural India as it is not treated. It will only become a bigger problem with increase in numbers of household water connections. Current per capita water use in most of rural India is low and only 28 per cent have a household water connection. However, the Jal Jeevan Mission aims to cover all households and provide 55 litres per capita per day (lpcd) of water by 2024. In the absence of proper management, i.e., treatment and reuse, grey water contaminates surface and ground water, besides providing breeding grounds for disease vectors.

There are several earlier publications on wastewater management. These are referenced in this synthesis document to provide perspective. Treatment options are given in detail in the annexure to the guidelines. They provide a decision tree and treatments for different geographical regions and populations suitable for individual households and communities. The emphasis is on methods that can be set up and maintained without external help.

These are leach pits (individual and community), waste stabilisation ponds, constructed wetlands, decentralised water treatment systems and phytorid systems. There are others such as vermi-filtration and floating islands that can be used to remediate stagnant or slow-flowing water. Each has its own space and cost implications. If made properly, designed and constructed to accommodate anticipate population growth, they require little maintenance that semi-skilled labourers can provide.

DDWS recommends that in villages with populations up to 5,000, grey water can be collected in community soak pits or treated in artificial wetlands, waste stabilisation ponds and decentralised water treatment systems using shallow small bore sewers. For larger villages, DDWS recommends covered sewage systems connected to one of the treatment methods above. The capital expenditure, the guidelines state, can come from the 15th Finance Commission and the Mahatma Gandhi National Rural Guarantee Scheme (MGNREGS).

However, these are broad strokes. The population density of villages varies a great deal from district to district, necessitating a localised approach to LWM. In densely populated areas, community soak pits and treatment may be feasible if land is available. Else, shallow narrow-bore sewers or covered drains would be a viable option.

Soak pits are just one solution that may work in certain agro-eco-climatic zones. There are several other, more popular options, that need less effort to make and maintain. There are more technically sophisticated methods as well. The guidelines cover the latter in detail but the former are omitted.

Against this backdrop, for effective grey water management, this discussion sought information from the SuSanA Forum on the following issues:

- In addition to what is suggested above, what cost-effective, technically simple LWM options exist for different population densities?
- What technical skills are needed to make and maintain these structures?
- Please describe a model LWM plan for village that have populations less than 5,000; more than 5,000

The information provided would help prepare operational suggestions for SBM 2 and will be shared with DDWS. Sandhya Haribal and Rohini Pardeep from the Consortium for DEWATS Dissemination Society led this discussion. It was open for comments from 10 – 30 August, 2020.

Discussion Summary

Sandhya Haribal, Project Manager in the Consortium for DEWATS Dissemination (CDD) Society said in her opening comments that the SBM II guidelines with respect to LWM favoured soak/leach pits as the most effective and simple greywater management solutions. While these were suitable in some areas, they did not work in several conditions.

Where the water table was high, as in coastal rural areas, dug-wells used for domestic water, were contaminated. In peri-urban areas, there was no space to make soak pits. In dry and arid regions on the other hand, it was observed that low water tables coupled with high temperatures led to soaking of the greywater in the open drains itself before reaching the outfall points.

The construction of concrete rural roads (under government schemes) with poorly planned open drains caused water to stagnate. Improper levels between intersecting drains were the usual culprit the stagnation issues.

The guidelines provide a sufficient menu of technologies but, as the selection of the ideal solution rests on the judgement of the local officials, support will be required at the district or block level. These local officials help Panchayat Raj Institutions (PRIs) prepare Village Development Plans for drawing funds towards investment on infrastructure. They usually have little capacity to understand nuances of engineering or planning for grey water treatment.

They usually depend on external consultants (if there is a budget available to hire one) or on the local Panchayat Raj Engineering Division (PRED) or Public Works Department (PWD), which often propose conventional, urban-centric solutions. In short, these schemes need to be tailored to local conditions, the skills for which are usually lacking in villages or government departments.

Sandhya posed the following questions:

1. Who monitors the quality of design and construction of rural infrastructure such as wastewater treatment systems, drains and roads?
2. Are there technically competent team/s at the District or Block levels for this, and how can the capacities of the existing Engineering/Planning Divisions at these levels be built up?
3. Are there existing capacity building programmes to plug in this particular gap or any other existing Institutional structure that can support such activities?

Respondents said the trick is to expand the solution space with innovative local solutions as much as possible and not to imagine difficulties in general all around. Specific context based problems will need specific solutions. Involving the village people and farmers in finding solutions would yield many options. Instead, imposing DEWATS on villagers and would invariably result in design and O&M issues. The preferred solution could be selected based on various criterion such as suitability to the terrain, costs, land need/availability, energy requirements, resources and institutional requirements/capacities, simplicity of technology and ease of management.

The guidelines state that grey water is wastewater from kitchens and bathrooms that has no faecal content. Arunkumar, a district WASH consultant with UNICEF, gave the example of a grey water management plant recently installed in Lodra village of Gujarat. This is a DEWATS (decentralised wastewater treatment system). It uses a three-stage process: the first is a primary filtration; the second is a sedimentation tank and anaerobic baffled reactor and; the third is a planted reedbed. The treated water is stored and used in agriculture. The plant does not use any energy.

However, there were major problems in making the unit. The gram panchayat, taluka panchayat and the District Rural Development Agency refused to take the ownership of the plant. While the Guidelines say funds can be sourced from MGNREGS, this could not happen as the scheme only pays for unskilled labour. The DBOT (Design, Build, Operate and Transfer) contract needed to revisited as the contract design needed to show evidence to the panchayat that the treated water could be reused and the panchayat could earn sufficient income from it. None of the engineers in the district were aware how to calculate a retention time for treatment of wastewater.

He suggested the following solutions. MGNREGS labourers needed skilling if the panchayat planned to handle the O&M in future. These included training on planting the reedbed system, cleaning the reedbed, placing the aggregate matter in appropriate manner (larger ones in the entry, and smaller in the middle), cleaning the reactor tanks, and how and when to add cow dung to the reactor. Local people need to be instructed or sensitised to stop throwing garbage, especially plastic into open drains as these found their way to the treatment unit, along with the construction of the plant. Black water, from overflowing septic tanks connected to drains, needed to be stopped. The water quality needed to be checked frequently. This could be done

using water quality testing kits available in panchayats. The state, district and taluka level engineers need to be trained to evaluate a grey water design submitted by the contractor. Site selection was crucial; while gravity flow had to be maintained, the location should not be flooded during the monsoons. Rainwater must be diverted.

This point illustrated that the simpler greywater management designs were, the more likely that they will get implemented and maintained. S Vishwanath gave another example from Minijenahalli village in the Kolar District, Karnataka. Asha, an NGO worker, got a farmer and some workers together to clean the village drain. The farmer provided assistance of a tractor and a trailer to pick up the silt and take it to his farm to be used as soil conditioner.

Grey water, including water from washing cows, was is led into a farm pond which the farmer had made with government funds. The pond has a debris trap at the entrance. The grey water is aerated in the sun for a few days and then pumped through a drip irrigation network to the farmer's field. The farmer maintains the drain since it provides him with water. In Kolar's semi-arid landscape water is gold.

Residents have agreed to cooperate by not throwing garbage into the drain as this caused water to stagnate. As the water flows freely, they benefit since no vector-borne (flies or mosquitos) disease affects them. A pandemic has also taught lessons of cleanliness. It cost the NGO that Asha runs ₹ 2000 to get the whole thing done.

The simplicity of this model has encouraged neighbouring villages to take it up. It is a striking partnership within a village. It shows how sustainable low-cost solutions can be found to handle sludge from the twin leach pits, greywater, drains and villagers.

The two examples above indicate the need to pay attention to operation and maintenance of grey water treatment systems or processes. Being long-term solutions, they will require continuous upkeep. It is possible to provide this at low cost by unskilled labour. However, it must be included in the planning and execution, along with provisions for funding, training those charged with upkeep and oversight. Upkeep over the design life of a grey water treatment process/system is likely to be 2 to 2.5 times its capital costs, should any of the options provided in the Guidelines be adopted. The second simpler option is likely to cost next to nothing but needs a participatory assessment of resources available and methods applicable in a community.

Others said household level solutions should become the primary preference, except for exceptional locations. Even though SBM does not prioritise funding individual or household level solutions, it is critical to inform people about these. Specifically, information, education and communication on the grey water management should cover the household level solutions and their importance, and the overall emphasis of the program should be to get most of the households to adopt appropriate technological options. V R Raman and Kanika of WaterAid India said the challenge was to shape the grey water management solutions based on the community needs and ecological viability, not just the availability of government funds. As JJM is aimed at providing household tap connections, wastewater emanating from households has to be treated at that level.

But at the community level structures should be focusing on protecting the storm water from getting mixed with black water and other contaminants and to provide it a safe and cleaner passage to a proper destination. Protection of water bodies, where such water is reaching, needs to be seen from this perspective. Additionally, drinking water sources need to be protected from

contamination by grey water. Grey water management in institutional premises such as schools, Anganwadis, Panchayat offices, health care facilities etc., should also become critical priorities under the GP level plan for the same.

Local government institutions could be provided technical support in planning and managing various water, sanitation and related infrastructure, technological solutions and their proper maintenance. In case they engaged technical service providers or expert agencies, contractual modalities were important to benefit both sides

Grey water needed to be treated in a decentralised manner and used for irrigation, said Ajit Seshadri. However, people needed to be discouraged from using chemical cleaners. It would be hard to build capacities of technical team at the district or block levels, and those of the engineering/planning divisions, because local government bodies lacked the political will.

The proposed treatment method of grey water must follow the principle of subsidiarity. That is, it must be treated at the household, community and village level in sequence, said Ravishankar Sunkadakatte. This would happen only if there is subsidy or outside funding. The treatment method should be simple and local contractors should be able be build it. They should not use energy or be complicated to maintain.

The proposed method of treatment depended on the space available to make the system, the soil type, depth to the water table, proximity to a water source, socio-economic conditions in the village, capital and running costs, reuse potential and rainfall.

He suggested that the drawings and estimates for different hydro-geological conditions be made available in the Panchayati Raj Department. These would provide the various options for different conditions. Demonstration units could be made in different regions.

Another solution to disposing grey water was to divert it to kitchen gardens. T K Das said excess water could be drained into fields. Soak pits in households were another way, as proposed in the guidelines. However, the problem in most villages was that water from as many as 32 per cent of septic tanks, and 41 per cent of single pit toilets, was let into open drains. While soaking areas were required for septic tanks, these had not been made. In the event, the only option was to channel this black water from septic tanks to waste stabilization ponds.

A report in Quartz (https://qz.com/india/661119/toilets-toilets-everywhere-in-india-but-where-does-the-shit-go/) showed 44.4 per cent villages had not arrangements for waste water disposal, while 36.7 per cent had lined drains and 19 per cent had unlined drains.

In Patoda village in Maharashtra, all the drains were covered and connected to a waste stabilization pond system consisting of six tanks. The treated water was used in community gardens. The BOD and COD was found to be 13 and 44, respectively. A large number of waste stabilisation ponds had been made in Punjab using the SLWM component of Swachh Bharat Mission Phase I and the Sustainability fund under NRDWP.

Another method of treating grey water is vermifiltration that uses earthworms. It has been developed at Griffith University, Australia. Several plants are operating in Gujarat and Maharashtra and the treated water is being used for farming, said Rajiv K Sinha.

Using local materials kept costs down and structures, easy to maintain. In an example from the North-East part of India, D K Manavalan, said AFPRO had developed a bamboo leach pit latrine, that safely managed human excreta and eliminated the need for water

treatment. In hilly areas, installing a grey water treatment system was expensive even in urban areas.

The AFPRO model used bamboo to minimize construction costs. Bamboo strips were woven into open ended cylindrical frames, plastered with cement both sides and used for lining the pits instead of bricks. Bricks were only required for the squatting platform as even the superstructure was made of bamboo. For AFPRO, this Bamboo leach Pit latrine was more than a technical innovation: the people for whom they were constructed, and the technical team, came together to devise a way in which to minimize cost using a variety of ways. As part of this participatory experiment, they adopt the twin pit latrine. The permanent nature of the construction pits, relative ease of emptying them and optional use of the pit contents as soil conditioner after two years made them an obvious choice. People contributed towards the cost of the structure.

Before installing the latrines, AFPRO ensured water supply through a gravity flow system (GFS). The piped water was stored in tanks at advantage points and was easily accessible to individual Hamlets. For villages of the North East which depend on springs and streams for water, this was a suitable solution as it reduced the distance women had to travel by bringing good, clean water near households.

Sandhya provided a clarification about what constituted liquid waste. Technically it could be any waste in liquid form from different sources. The SBM-II guidelines only included domestic wastewater from two sources: blackwater for the wastewater generated from the toilets, and grey water for the wastewater generated from kitchens, bathrooms and washing.

The idea was simply to help address each differently since their management was different in case they were not mixed. The greywater is generally let out into open drains if it cannot be used within the house compound, and hence treatment would need to be planned based on the quantity.

Blackwater, if collected in soak pit or a properly designed septic tank, would not ideally be let out an open drain and hence would need to be planned for in this manner. In India, however, most septic tanks were improperly made and had an outlet to open drains which already received greywater from the household in addition to stormwater during rains.

Elisabeth had asked why the Indian government used the term “liquid waste” instead of simply “grey water” for SBM Phase II since liquid waste seemed to be exactly that same as grey water. Additionally, effluent from septic tanks would be called "partially treated domestic wastewater".

Vasanth said while liquid waste referred to both greywater and septage (effluent from septic tanks/pits), this discussion focused on the greywater part alone. Liquid waste was water unsuitable for human consumption or any other use.

Further, Paresh added liquid waste referred to both greywater and septage. The advisory issued by the then Ministry of urban development in 2013 defines septage and effluent differently as the settled solid matter in semi-solid condition at the bottom of septic tank. Effluents were the wastewater that flowed out of a treatment system (in this case septic tank) or supernatant liquid discharged from the septic tank.

Though the use of the term blackwater is confusing, my interpretation from above is: liquid waste = greywater + effluent/supernatant from septic tanks + storm water.

Nitya said the scope of the discussion was grey water from kitchens, bathrooms and storm water. That said, there were other definitions of what comes out of septic tanks, CSE's faecal sludge management page says: Faecal sludge (Septage) is the slurry that contains both solid and liquid waste that accumulates in onsite sanitation systems (OSS) e.g. septic tanks. It is raw or partially digested slurry that results from the collection, storage or treatment of combinations of excreta and blackwater, with or without greywater.

This has three main components – scum, effluent and sludge. It has an offensive odour, appearance and contains significant levels of grease, grit, hair, debris and pathogenic micro-organisms. In the current scenario, the construction and management of OSS are left largely to ineffective local practices and there is lack of holistic septage management practices. Faecal sludge (septage) management involves collection, treatment and proper disposal/ reuse. Efficient faecal sludge (septage) management include safe disposal of the treated septage.

The webinar conducted on 28 August, 2020, dealt with additional issues of grey water management. About 160 participants attended the webinar. The speakers were

1. Sandhya Haribal, CDD Society
2. Harish R, Assistant Director, SBM-G, Rural Drinking Water & Sanitation Department (RDW&SD), Government of Karnataka
3. Siddharth Singh, former Mission Director, SBM G, Govt. Of Assam
4. Devidas Kisan Nimje, Samarthan
5. Chanakya N. Hoysall, IISC

The speakers emphasised that grey water management needs to be context-specific. The broad guidelines must be fine-tuned for different types, sizes or villages in different geographies and climatic zones. Grey and black water should not be allowed to mix, said Sandhya Haribal, project manager with the CDD Society at a webinar on Grey Water Management under SBM-II. Panchayats need support to build, operate and manage these systems. [Presentation]

The Government of Karnataka had developed state level policy and model bye-laws for managing grey water and is rolling them out. It had piloted local approaches in 200 panchayats at 16 locations to understand how to contextualise the guidelines and develop liquid waste management plans and detailed project reports. Harish R., said these guidelines are in keeping with what are proposed under the SBM 2 guidelines. Grey water management solutions will be implemented along with the Jal Jeevan Mission. The Government will come out with templates for decentralised grey water management, capacity building through experts, training manuals and technical support.

Greywater management is a major challenge because it needs to be contextualised to the habitation and households. The North-Eastern states have a short working season owing to a long rainy season, said Siddharth Singh. Grey water management has much more to it than engineering practices; changing mindsets through IEC is very important. It is necessary to ensure ownership and the active ownership of panchayati raj institutions. A dedicated cadre of rural sanitation workers is needed for both JJM and grey water management along with IPC. Plans need to be developed and scaled up from the village to the district levels. The private sector needs to be involved. Convergence is a challenge; there is a case for allotting more funds with the department concerned.

Villages have successfully dealt with wastewater for centuries. However, if this is to be done systematically, panchayat members need support. The steps are to setup a planning team with people from different departments, survey wastewater management practices, and analyse the different methods to handle wastewater at the household and community levels. Sharing experiences from Samarthan's projects in Chhattisgarh, Devidas Kisan Nimje, programme manager with Samarthan, said plans need to be made in a participatory manner, taking these into consideration, along with village water and sanitation committees.

This encourages ownership, resource mobilisation (from the community, panchayat and MGNREGA for different aspects of the work), ideas for grey water management and monitoring. Interestingly, such planning indicates a preference for plant cultivation using waste water instead of drains and leach pits. Grey water systems should be appropriate and low-cost and manageable by VWSCs. There is an opportunity to cultivate kitchen gardens using grey water. [Presentation]

Greywater characteristics in rural areas are very different from urban areas, said Chanakya Hoysall from the Indian Institute of Science. The flows are high only at certain times of the day. Nutrient loads are different. Usage must be in tandem with local needs and seasons. The water use in the lean seasons should help determine which method is used. Forest plantations and aquaculture are two possible methods of absorbing grey water.

Emerging problems are increasing uses of detergents, pharmaceuticals, household disinfectants and plastics. These chemicals are affecting the flora and fauna in rural area, sometimes even leading to genetic mutations. However, treatment technologies can be very simple, not simplistic. Grey water is harder to treat because of its low nutrient load but high chemical load that affect biological treatment.[Presentation]

The webinar brought out the options, procedures, challenges and solutions for grey water treatment. Speakers highlighted what two state governments are doing, and are planning to do, in this regard. They underlined the need for supporting panchayats as the nodal agencies for grey water treatment in planning, technology, maintenance and monitoring.

You can access the recording of the webinar here.

Recommendations

The following recommendations emerged from the discussions.

- Grey water management systems are highly context-specific. Broad parameters suggested in the SBM-II guidelines will need to be 'localised' to be useful. For instance, soak pits were useful in some conditions, but failed in others. The parameters to be considered include terrain, costs, land need/availability, energy requirements, HR and institutional requirements/capacities, simplicity of technology and ease of management.
- Simple solutions devised in consultation with village people are more likely to succeed and be long-lasting than high-tech ones. DEWATS would work if there was land, skilled people to make and maintain it and the funds to do so
- Village people have their own ways of dealing with grey water that need to be understood and incorporated. Planting fruit trees and kitchen gardens were common methods. Local engineers, bureaucrats and elected representatives would need technical support to develop suitable solutions

- Local people and staff need training in planning, design, construction and maintenance of grey water treatment systems. These skills are lacking at the panchayat level PRI members need technical support to plan and manage infrastructure. People with technical training, such as civil engineers, could provide this support.
- Grey water management was a long-term issue and needed commitments of resources to match. Ownership by panchayati raj institutions was critical
- Grey water needs treatment before reuse owing to the changing characteristics of the chemicals used in households. Several rural households now use detergents and chemical cleaners that could harm plants unless the water was treated before being reused
- The existing legal/ regulatory framework and pollution control norms/standards regarding the disposal or reuse of treated grey water need to be adapted to rural conditions, especially to measure and monitor the quality of grey water management initiatives
- The panchayat development plans need to include funds and human resources for construction and maintenance, given the long-term nature of grey water management. The plans also need to allot responsibilities and monitor the performance of duty bearers

Participants

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Kanika Singh	WaterAid India	India

Resources and Links

1. SBM Phase II Operational Guidelines https://jalshakti-ddws.gov.in/sites/default/files/sbm-ph-II-Guidelines_updated_0.pdf
2. Toilet toilet everywhere but where does India's shit go? https://qz.com/india/661119/toilets-toilets-everywhere-in-india-but-where-does-the-shit-go/
3. Pond renovation project – reuse of treated wastewater. http://cdn.cseindia.org/userfiles/Mohd%20Ishfaq-Ponds%20Renovation%20Project-DWSS%20Punjab.pdf
4. Approaches and options for grey water management. https://www.susana.org/en/knowledge-hub/resources-and-publications/library/details/3912
5. Wastewater management – participatory planning, budgeting and implementation https://www.susana.org/en/knowledge-hub/resources-and-publications/library/details/3913
6. Grey water reuse, potential and technical challenges https://www.susana.org/en/knowledge-hub/resources-and-publications/library/details/3909

The Thematic Discussion Series Host

This document was prepared by Nitya Jacob. It was reviewed by V R Raman and Kanika Singh, WaterAid, and Sanjeev Jha, India Sanitation Coalition.

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To view the whole discussion, please go to the SuSanA Forum: https://forum.susana.org/swachh-bharat-abhiyan-in-india-sba-or-sbm/24225-susana-india-chapter-thematic-discussion-liquid-waste-management-in-sbm-2