Decentralized Wastewater Management at Adarsh College Badlapur, Maharashtra, India

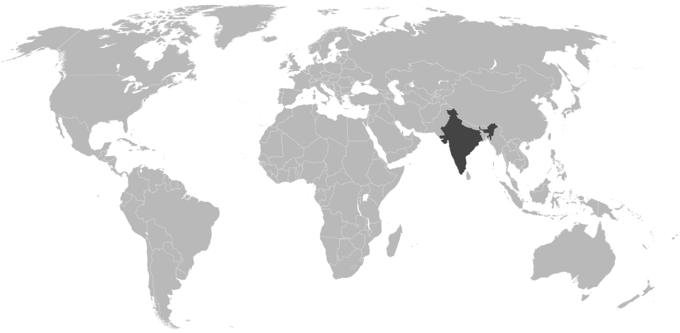

Fig. 1: Project location

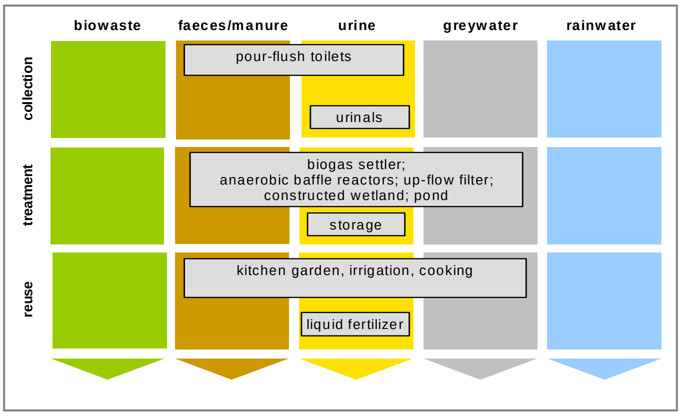

Fig. 2: Applied sanitation components in this project

1 General data

Type of project:

Decentralized Reuse-oriented Wastewater Management at Adarsh Vidyaprasarak Sanstha's College of Arts & Commerce

Project period:

Start of construction: April 2006

End of construction: June 2008

Start of operation: September 2008

Project scale:

Approx. 2,600 students attending Senior and Junior College and up to 800 people attending special programmes (such as wedding ceremonies) on about 20 occasions per year

Address of project location:

Adarsh Vidya Mandir, Kulgaon Badlapur Municipal Corporation - East, Maharastra State, India, 421503

Planning institution:

Ecosan Services Foundation (ESF), Seecon gmbh, Paradigm Environmental Strategies Ltd.

Executing institution:

Kulgaon Badlapur Muncipal Council

Supporting agency:

EU-funded AsiaProEco II – project

GTZ-ecosan project

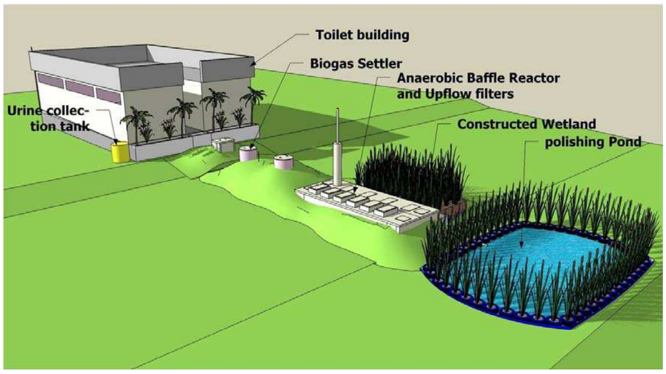

Fig. 3: Scheme of pilot project

2 Objective and motivation of the project

Badlapur Municipal Council and the Board of "Adarsh Vidya Mandir School" decided to incorporate an ecologically sound sanitation concept (Fig. 2) at the "Adarsh Vidyaprasarak Sanstha's College of Arts & Commerce". The prime objective of the project is to meet the sanitation needs of the students and the people attending special programmes such as wedding ceremonies at the school premises, but also protects the environment and raises awareness amongst the students, about the importance of water and sanitation in promoting health and hygiene.

3 Location and conditions

"Adarsh Vidya Mandir School" is located in Badlapur town, in Maharashtra's Thane district, about 68 kms. from Mumbai, 34 kms. from Thane and 10 kms. from Ulhasnagar.

The school accommodates about 2,600 students attending Primary School, Secondary School, Junior College or the "Adarsh Vidyaprasarak Sanstha's College of Arts & Commerce".

The college building is located at the southern fringe of the school premises and doubles-up as Senior College in the morning and as a Junior College in the afternoon. The number of students attending Senior and Junior College is about 1,400 and 1,200 per day respectively.

4 Project history

This school project is a pilot project demonstrating alternative decentralized sanitation solutions to the Badlapur Municipality Council. The council plans to replicate the concept in other areas after evaluating the findings of decentralized reuse-oriented school sanitation project.

5 Technologies applied

A single-storied sanitation block having two independent enclosures for ladies and gents has been constructed next to the school building. Each enclosure is equipped with 4 bucket-flush squatting-type toilets and 1 western-style cistern-flush pedestal (for the physically challenged). Waterless urinals are provided in the gents' toilet block; while the ladies' toilet block has an increased number of toilets. Sufficient numbers of washbasins are provided in each toilet block. A flow chart of the implemented wastewater management scheme is depicted in Fig. 4.

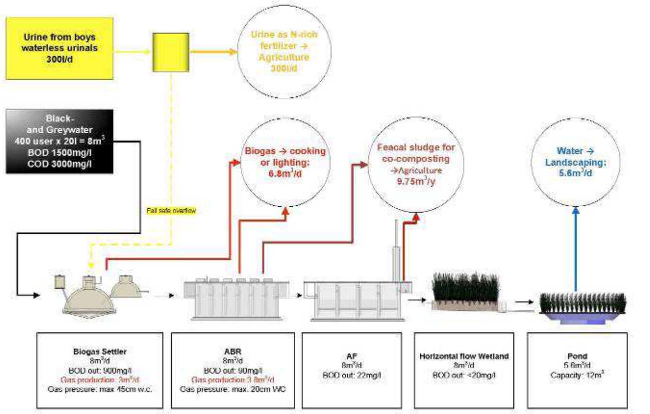

Fig. 4: Flow chart of wastewater management scheme (photo: N. Zimmermann)

Blackwater along with greywater from the washbasins is discharged to a "biogas settler" (Fig. 5) where solids are retained and subjected to anaerobic decomposition.

Fig. 5: Biogas settler (under construction) (photo: N. Zimmermann)

The biogas settler effluent is drained by gravity flow to an Anaerobic Baffled Reactor (ABR) and Up-flow Filter (UF) (Fig. 6) for further anaerobic treatment.

Fig. 6: Construction of ABR and UF (photo: N. Zimmermann)

Post treatment of the UF effluent happens in a small-scale horizontal flow constructed wetland (HFCW). The final stage of the treatment concept is a pond (Fig. 7) that doubles-up as storage tank.

Fig. 7: Polishing cum storage pond

Waterless urinals with membrane stench traps that are especially adopted to fit Indian urinals (Fig. 8) are provided in the gents' compartment for the source-separate collection of urine, which is drained into a collection tank outside the toilet block. The tank is provided with a fail-safe overflow emptying to the anaerobic treatment plant.

Fig. 8: Waterless urinals for boys (photo: N. Zimmermann)

Treated water and urine will be used in a yet to be established kitchen garden. Sludge drying beds will be constructed for dewatering the sludge from the biogas settler, baffled reactor and up-flow filter.

6 Design information

In order to keep water consumption low, specially designed squatting pans (so called "rural" or "pour-flush" pans) made of ceramic that require a little amount of water for flushing the excreta have been installed and no water taps are provided inside the cubicles. The toilet users have to fetch water for cleansing and flushing with a bucket (approx. 5 litres) from a central tank that is located inside the enclosure. Daily total wastewater production (blackwater plus greyater) is estimated to be about 8.0 m³ (i.e. 8,000 litres).

The hemispherical shaped biogas settler provides a volume of approx. 21 m³ at an inner diameter of 1.25 m.
The anaerobic baffled reactor volume is approx. 12.0 m³. The reactor comprises 6 compartments of 2.0 m3 each and provides for 1.5 days hydraulic retention time at a wastewater production of 8 m³/d).

The anaerobic up-flow filter volume is approx. 14.6 m³. The up-flow filter comprises of 4 compartments of approx. 3.6 m³ each. The height of the filter media (gravel of 40 mm diameter) is 0.75 m.
Length and width of the horizontal flow constructed wetland is 6.00 m by 3.00 m. Main filter media is fine gravel with a grain size of 4 – 8 mm. Height of filter media (at inlet) is approx. 0.70 m. Saturated water depth is approx. 0.60 m. The pond has an effective volume of 12 m³ at a maximum depth of about 1.20 m. (Fig 8 and 9)

Table 1: Treatment system characteristics

Component	**Approx. Volume [m³]**
Biogas settler	21.0
Baffled reactor	12.0
Up-flow filter	14.6
Constructed wetland	12.6
Pond	12.0

7 Type and level of reuse

Although the toilet block and treatment system is in operation since end of November 2008, the reuse part is not yet fully established. For the time being only the final effluent, which is collected and stored in the polishing pond, is reused for irrigation purposes.
Within the next weeks/months the remaining activities will be finished to allow also for the reuse of biogas and hygienized urine.

- The produced biogas (from biogas settler and the anaerobic baffled reactor) will be used either for cooking or lighting purpose.
- The collected urine will be stored and used for agriculture/gardening purpose within the school campus (especially on the yet to be established kitchen garden).
- The dried sludge from the biogas settler, baffled reactor and up-flow filter will be applied as soil amendment within the school premises for agricultural/gardening purposes.

8 Further project components

Students attending environmental classes will be involved in the monitoring of the treatment system and practise the reuse of recyclates in the kitchen garden.
Next to the decentralized treatment system an exhibition hall has been constructed, the permanent posters on ecologically sound sanitation concepts are exhibited.

9 Costs and economics

The costs for establishing the above mentioned treatment scheme are summarized in Table 2.

Table 2: Costs of treatment system

Component	**Costs [INR]**
Biogas settler	120,000
Baffled Reactor	120,000
Up-flow filter	120,000
Constructed wetland	50,000
Pond	40,000
Total	**450,000**

10 Operation and maintenance

For O&M of the toilet block and reuse of the recyclates caretakers cum resource managers (1 female and 1 male person) are hired.
Students will support the resource managers in their daily work (e.g. application of nutrients, gardening activities, etc.).

11 Practical experience and lessons learnt

The lesson learnt in this project is involvement of students and teachers ie. direct beneficiaries of the project is very important to keep sustainability and better utilization of the project.

12 Sustainability assessment and long-term impacts

With regards to long-term impacts of the project, the main expected impact of the project is improved sanitation, demonstration of substitution of LPG by biogas, and the safe reuse of the treated water for irrigation purposes.

Table 3 depicts a preliminary assessment of the five sustainability criteria for sanitation of this project.

Table 3: Qualitative indication of sustainability of system

	collection and transport			treatment			transport and reuse		
Sustainability criteria:	+	o	-	+	o	-	+	o	-
• health and hygiene	X			X			X		
• environmental and natural resources		X		X			X		
• technology and operation	X			X			X		
• finance and economics		X			X			X	
• socio-cultural and institutional		X			X			X	

Sustainability criteria for sanitation:

Health and hygiene include the risk of exposure to pathogens and hazardous substances and improvement of livelihood achieved by the application of a certain sanitation system.

Environment and natural resources involve the resources needed in the project as well as the degree of recycling and reuse practiced and the effects of these.

Technology and operation relate to the functionality and ease of constructing, operating and monitoring the entire system as well as its robustness and adaptability to existing systems.

Financial and economic issues include the capacity of households and communities to cover the costs for sanitation as well as the benefit, e.g. from fertilizer and the external impact on the economy.

Socio-cultural and institutional aspects refer to the socio-cultural acceptance and appropriateness of the system, perceptions, gender issues and compliance with legal and institutional frameworks.

For details on these criteria, please see the SuSanA Vision document "Towards more sustainable solutions" (www.susana.org).

13 Available documents and references

This project has received 'National Urban Water Awards (NUWA)', 2009 in Special Category by Ministry of Urban Development, Government of India by the hands of Honorable President of India Smt. Pratibha Devisingh Patil.

14 Institutions, organisations and contact persons

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Case study of SuSanA projects

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Fig. 9: Side view of the treatment system

Fig. 10: View of entire treatment system with toilet block