Water Innovation Hub Coimbatore
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# Decentralizing for the Future

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Access to good sanitation systems is one of the rights the Indian population is entitled to. There exist large disparities in the structure of these sanitation systems in the country. Going by the numbers – only 160 out of 8000 towns have sewer and wastewater treatment plants, with only 13% of the wastewater being treated. Such disparities can sometimes be observed within town as well, with some parts of the town not being connected to centralized wastewater treatment systems. There are shortcomings in the collection system, downstream treatment, supportive sullage management and septage management. The situation demands urgent solutions and actions that reduce the wastewater load on natural water bodies.

The globally accepted and implemented solution to such cases are decentralized wastewater treatment systems (DEWATS). The concept revolves around plugging the gaps where centralized treatment is not available, hence supplementing the existing systems rather than replacing them. Suitable for a population of 5-20,000, multiple small treatment facilities can be set up in residential clusters, by institutions or even individuals. Decentralization can also be implemented in localities with potential water scarcity, encouraging localized reuse of treated wastewater.

Collecting and treating the wastewater close to the source provides a great deal of flexibility in the management of the wastewater. The modular treatment systems can be set up even in the remotest area possible, with enhanced user involvement and participation. The needs for extensive and expensive sewer systems (which often take up 80% of the costs) and complex, sophisticated mechanical and electrical components are reduced. The design period of such systems can be limited to 15 years. Due to the absence of sewer systems, the potential damage to the groundwater is minimized. Tailor-made technical solution can be implemented, depending on the source and characteristics of the wastewater, improving the efficiency of treatment. With the problems due to lack of treatment mitigated, communities can now focus on more effective ways to reuse the water.

A typical decentralized module combines pre-treatment, primary, secondary and tertiary treatments implemented in a modular fashion. The selection of the appropriate technical configuration for a decentralized system depends on multiple factors including the quantity and quality of wastewater, land availability, site and groundwater conditions, treatment standards, end use of the effluent and socio-cultural acceptability. While the treatment train is similar to the centralized system, DEWATS enables us to containerize the treatment to manageable scales. Reducing the scale also opens the opportunity to use nature-based solutions like planted reed bed filters, duckweed ponds systems etc. Aerobic and/or anaerobic treatment technologies can be implemented as well. While the aerobic systems have a smaller footprint in comparison with nature-based solutions, their energy consumption is high. Tough anaerobic systems are low

energy consumers, the start-up time is high and the effluent meet only moderate levels of quality. Hence, the technological decisions are trade-offs between the different factors and are highly dependent on the local environment.

The technological recommendations provided under the Ministry of Urban Development Guidelines can be enlisted as follows:

1. Wastewater collection systems: shallow sewer system, small bore sewer system, twin drain
2. Primary treatment systems: screens, grit chamber, primary clarifier, septic tank, Imhoff tank, biogas settler
3. Secondary treatment systems: activated sludge treatment, up-flow anaerobic sludge blanket (UASB) reactor, sequencing batch reactor, membrane bioreactor etc.
4. Tertiary treatment systems: chlorination, ozonation

A GIS-based approach (GIS, geographic information system) can also be used to identify pollution hotspots in a town and the potential sites for DEWATS. The dataset required for this include topography, land use land cover, geology, and distance from major water bodies, climate and the required wastewater characteristics. GIS can be used to create and analyse several grids of different themes to finalize the potential sites. Buffer zones can also be added depending on the local standards. Further, multi-criteria analysis can help determine the most suited site to set up a decentralized treatment system. Expanding the possibilities of RS-GIS (RS, remote sensing), we can also analyse the suitability of treated wastewater for different purposes.

Despite a general consensus on implementing decentralized wastewater treatment systems across the country, there aren't enough institutional frameworks that can aid the design and implementation of these projects in Indian towns. Efforts towards decentralization remain sporadic and fragmented. The knowledge and skill levels must be passed down to the local level for better operation and management of DEWATS. The system must be embedded into the City Development Plans and land must be earmarked in different parts of the city for the same.

The skill requirements for the day-to-day management of a decentralized system is also basic and not too extensive. Engaging stakeholders is vital throughout the development and implementation. The varying interests and participation levels of the stakeholders warrants different engagement methods like personal meetings, workshops, focus group discussions, surveys etc.

As recommended by studies, introducing DEWATS at individual and institutional levels can delineate the water quality and management problems to a large extent. Many institutions and communities have set up Decentralized Treatment Systems as pilot projects. The reaches need to be widened and the impetus must be passed across different towns in the country. Team AQUA-Hub is proud to be associated with the town of Coimbatore in the development of a comprehensive decentralization framework for the city. We would like to thank our partners for their continued support in the project and hope to help Coimbatore become water smart.

## References

IIT Madras (2012): *Guidelines for Decentralized Wastewater Management.* MoUD Centre of Excellence in DWWM, Indian Institute of Technology Madras, Chennai/India

IIT & NITI Aayog; NMCG; Royal Danish Embassy (2022): *Urban Wastewater Scenario in India.* Indian Institute of Technology (IIT) Bombay & NITI Aayog & National Mission for Clean Ganga (NMCG), New Delhi & Royal Danish Embassy, India

NIUA (2017): *Handbook on Decentralized Wastewater Treatment Module.* Handbook, National Institute of Urban Affairs (NIUA), New Delhi/India

NIUA; NMCG (2019): *Decentralized Wastewater Management: Complementing Centralized Solutions for Achieving 100% Sanitation Coverage – Learning Notes.* Training Handbook, National Institute of Urban Affairs (NIUA) and National Mission for Clean Ganga (NMCG), New Delhi/India

Pal, Somnath; Bhanot, Charu (2023): *Decentralized waste water treatment systems to improve water security.* Mongabay Series: Everyday Solutions, Commentary, 23 January 2023. https://india.mongabay.com/2023/01/commentary-decentralised-waste-water-treatment-systems-to-improve-water-security (accessed: 2023-07-18)

Ramesh Sakthivel S; Seshadri A; Md. Azizu Rahman; Chariar V.M. (2012): *Standardization of Design and Maintenance of DEWATS Plants in India*. Proceedings IWA Conferences

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## The AQUA-Hub project

In the AQUA-Hub project Water Innovation Hubs are being implemented in the two Indian Smart Cities, Coimbatore (Tamil Nadu) and Solapur (Maharashtra), and accompanied by pilot measures of German technology for water quality monitoring. AQUA-Hub addresses the needs of the local water sectors identified in previous projects, as well as the challenges of the German water industry to develop projects, relationships and business on the Indian market. Qualified HubManagers as a local presence of the Water Innovation Hubs are of great importance for the relations and the exchange of information between the German and Indian actors. In addition to network activities and the mediation of business partners, the hubs fulfil the function of project centres for the realisation of technical demonstration projects, provide information on current developments in the water sector for the respective local situations and support the access to water technologies "Made in Germany".

For more information: www.aqua-hub.de

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# Appendix

Figure 1: Wastewater Treatment Plant at Selvachintamani Lake in April 2022. Source: SWF India Project Team (Beckett)

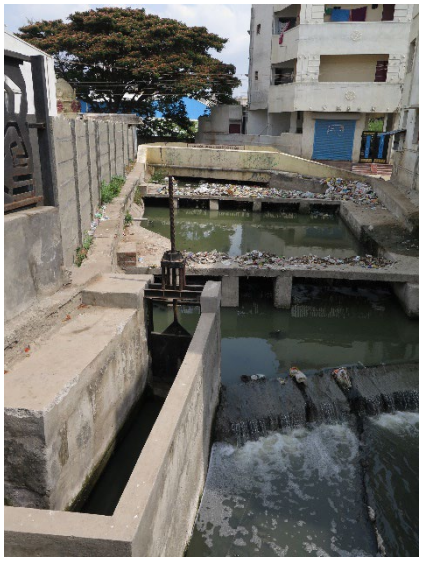

Figure 2: Inlet to Wastewater Treatment Plant at Selvachintamani Lake in April 2022. Source: AQUA-Hub Project Team (Liehr)


Figure 3: Wastewater Treatment Plant at Selvachintamani Lake in September 2022. Source: AQUA-Hub Project Team (Prakash)

Figure 4: AQUA-Hub Team at Selvachintamani Lake Wastewater Treatment Plant in September 2022. Source: AQUA-Hub Project Team (Prakash)