Cambodia
Decentralized Wastewater Treatment Systems for the Sovann Komar Orphanage
A BORDA-Cambodia DEWATS Project in Cambodia

Project Owner(s)	▪ 1) Staff of Sovann Komar Orphanage
Project Partner(s)	▪ 1) **Funding Agency**: Sovann Komar Orphanage, OAV, BORDA; **Executing Agency**: Bremen Overseas Research and Development Agency – Cambodia (BORDA-Cambodia); **Cooperating Agency**: BORDA-Southeast Asia
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Introduction and Background

The Bremen Overseas Research and Development Agency (BORDA) has a mission to improve the living conditions of disadvantaged communities and to preserve the environment through decentralized sanitation projects. As part of this mission, the Agency has developed modular, decentralized, and cost-effective wastewater treatment service packages that they have termed 'DEWATS' – decentralized wastewater treatment systems, which, with the help of funding agencies, are being installed throughout Asia and Africa.

Water and sanitation are one of the most pressing issues facing people in rural Cambodia. Of particular difficulty for sanitation advocates in Cambodia is the old habit of open defecation, with the result of exposing human excreta to the environment. This leads to water and soil contamination and to widespread disease outbreaks. The UN estimated that, in 2008, only 23% of rural residents and 82% of urban residents had access to improved sanitation, which means the country still has a long way to go to achieving 'sanitation for all'.

With this in mind, BORDA recently established itself in the country, as BORDA-Cambodia. The Agency has completed three projects in Cambodia to date, one of which is outlined here.

Cambodia

The first area chosen for DEWATS was the Sovann Komar Orphanage, in Kandal Province. In this orphanage, a mechanized wastewater treatment plant already existed, but was no longer functioning due to the very high cost of maintenance (the estimated cost of replacing a filter was $20,000USD). As well, three of the orphan houses were not connected to this system anyways. In short, all of the orphanage's wastewater was currently being discharged untreated to the Mekong River due to this unsuitable previous technology. This was helping to cause damage to the downstream activities and life along the Mekong River, which is the focus of several large rehabilitation projects, and was thus not an acceptable discharge.

Project Purpose and Objectives

BORDA's general purpose for the DEWATS projects is to further their goal of "Improved Sanitation for All". Their systems help to fulfill this purpose, which can provide wastewater treatment for domestic or industrial sources and for flows as high as 1000m^3 per day, and are tolerant to flow fluctuations, require low maintenance, and are durable. In addition to this general purpose, each project undertaken by BORDA has its own purpose and objectives, based on the problems being experienced by the project site.

For this project, the purpose was to improve the sanitation situation of the Orphanage by installing a DEWATS for the 120 children and staff that lived and worked there, capable of treating up to 15m^3/day of wastewater flow. This had the objective of reducing pollution into the Mekong River and therefore helping to reduce the health risks to downstream users and the environmental risks to the downstream ecosystem and river life.

Partners and Funding Distribution

For this project, the funding agencies were the Sovann Komar Orphanage itself, OAV, and BORDA, with BORDA-Cambodia being the executing agency and BORDA-Southeast Asia also offering support during the process. The total project cost was $25,000USD.

Project Activities

This project ran from August, 2009, until 9 March, 2010, with construction beginning on 12 October, 2009. The project activities included: consultation with the staff of the orphanage, construction of the DEWATS, connecting the toilets/wash basins of all the orphanage buildings to the DEWATS, and training the staff on operation and maintenance.

Sanitation Technology / System

This module of DEWATS used by BORDA-Cambodia consists of the following sections, in order of wastewater flow: primary settling unit, anaerobic baffled reactor, anaerobic filter, horizontal gravel filter, and discharge pipe.

The primary settling unit serves as a wastewater retention point and an area for control of influent fluctuations (an equalization tank), which allows large sludge, debris, and other floatable/visible wastes to settle or be screened out and also allows a relatively constant flow of wastewater to proceed to the subsequent chambers (rather than having high flows during peak hours and no flow during nighttime). This unit is single-chambered for this project.

The anaerobic baffled reactor (ABR) is then the main treatment area of the DEWATS. As the name implies, this multi-chambered tank is closed from the air and anaerobic. Wastewater flows slowly up (and back down through pipes) through its several identical chambers, each time entering the chamber at its bottom, where it passes through the accumulated sludge. This allows solids to settle out into the sludge and anaerobic bacteria living in the sludge to degrade much of the harmful organic and chemical components of the wastewater. The number of chambers can vary depending on available land area, wastewater strength, and funds – the ABR for this project has 4 chambers, though 5 or 6 are also common.

The anaerobic filter (AF) follows the ABR and consists of a tank with a submerged layer of material like crushed gravel or specially formed plastic. On to this media grows a thick layer of anaerobic bacterial biofilm, which the upflowing influent wastewater then passes through. These biofilms help remove more of the dissolved solids in the wastewater, as well as other pathogens and chemicals still remaining in the wastewater. This unit has 2 chambers for this project.

The horizontal gravel filter (HGF) (synonyms include: planted gravel filter & horizontal constructed wetland) follows the AF and consists of a shallow concrete basin filled with fine gravel, with influent and effluent pipes on opposite ends of the basin. Hardy reed plants, such as Canna, are planted in high density in this gravel layer before the DEWATS becomes operational and are allowed to grow in clean water that is initially flowed through the basin. Once the plants are established, the DEWATS can become operational and introduce the wastewater from the AF into the basin. The plant roots within the gravel help to oxygenate the wastewater, which has been anaerobic to this point and still usually has a noticeable odor, as well as remaining organic compounds. This oxygenation helps to degrade these remaining organic pollutants, which also reduces the odor.

After the HGF, effluent is usually considered clean enough for safe river discharge, or can be held in a separate tank for reuse in watering plants or flushing toilets.

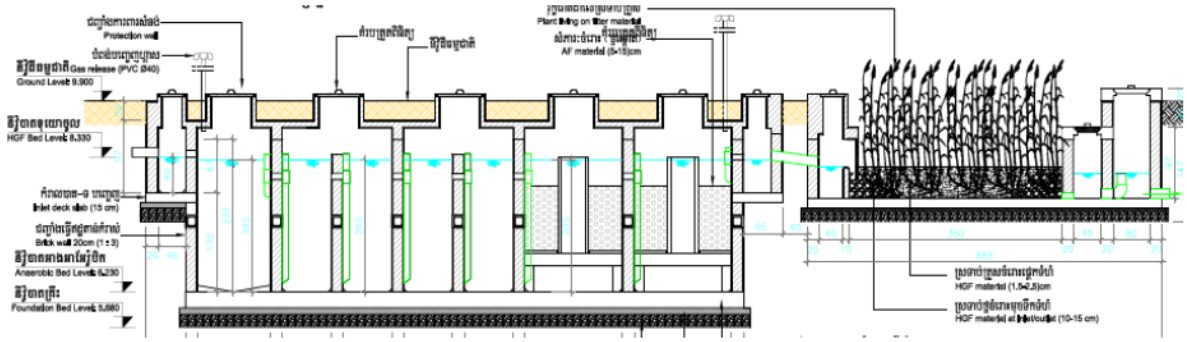

Figure 1. A cross section of the Sovann Komar project's DEWATS, showing the 1 chambered primary settling tank, the 4 chambered ABR, the 2 chambered AF, and the HGF, as well as influent and effluent piping.

For this project, this DEWATS was designed to treat 15m^3/day of wastewater.

Number, Type, and Location of Beneficiaries

For this project, there are approximately 120 orphans and staff who are now covered by the DEWATS. The improvements made in wastewater management, however, extend beyond this orphanage, as downstream users and river life will also benefit from the reduction in pollution to the

Mekong River, in terms of reduction of health risks for users of the river water and less stress on existing marine life.

Impacts and Challenges

This project is now underway and is being operated and maintained successfully by the community members of the orphanage. The funding grant was used to cover construction costs, community engagement costs, and initial water quality testing costs. The staff of the orphanage were trained in appropriate O&M and will take this responsibility. The costs of this O&M and the costs of desludging the system every 2 to 3 years are currently being covered by the orphanage itself, with no data yet available on the average monthly O&M costs for the system.

The water quality testing carried out upon the completion of the project indicates the efficient nature of the DEWATS design. The treated effluent had BOD and COD values (in mg/L) that complied with the Ministry of Environment's regulations for wastewater effluent discharged into public waters and sewers, the standards of which are: COD < 100 and BOD < 80. This compliance should continue given proper O&M and indicates that this project was successful in its objective of treating the wastewater from this orphanage, more so than its previous, 'high technology' treatment plant, which was clearly built without much thought given to the local circumstances, since its O&M costs were much too high for this low-income orphanage to handle. This highlights the importance of BORDA's low cost, low maintenance, localized approach, which can be much more effective for projects like these.

Photos

Figure 2. Sovann Komar orphans and the completed DEWATS

References

BORDA-Cambodia. (2010). *Technical Data Sheet for Project Code 2010.CBOR.DEWATS.002*

UNDP. (2010). *Current status of the Cambodian Millennium Development Goals.* Power Point presentation from: http://www.un.org.kh/undp/mdgs/cambodian-mdgs/what-are-the-cambodia-millennium-development-goals [Accessed 8 Apr. 2011]