Factsheet on Decentralized Wastewater Treatment Systems (DEWATS) **1**

DEWATS FOR **DHULIKHEL HOSPITAL**

Dhulikhel, NEPAL

Background

Dhulikhel Hospital is a Kathmandu University Teaching Hospital located in Dhulikhel Municipality, Kavrepalanchok District Nepal. The original hospital wastewater treatment system, constructed in 1997, was the first constructed wetlands for wastewater treatment in Nepal. Due to hospital expansion, the treatment system was upgraded and expanded in 2008 to meet current and future flows.

Kind of Project	DEWATS-SME (Hospital)
Funding Agency	Self funded
Implementing Agency	Dhulikhel Hospital with technical support from BOKU Austria
Supporting Organisation	ENPHO
Construction Period	1997
Upgraded Period	2008
Construction Cost	NRs. 2,500,000 (US$ 39,683)

Purpose

- To treat the wastewater generated from the hospital and staff quarters to minimize the environmental impacts of local waterways.
- To collect and reuse the wastewater from the entire hospital for irrigation.

System in Brief

A medium sized system consisting of three phase treatment (Anaerobic Baffle Reactor, Horizontal Wetland, Vertical Wetland) with two systems operating in parallel. The system also has a sludge drying bed to complete the wastewater treatment process.

- Diversion tank to split flow between systems
- Two parallel Settlers (1 ABR large, 1 settler small)
- Two parallel horizontal flow constructed wetlands
- Two parallel vertical flow constructed wetlands
- Sludge drying bed

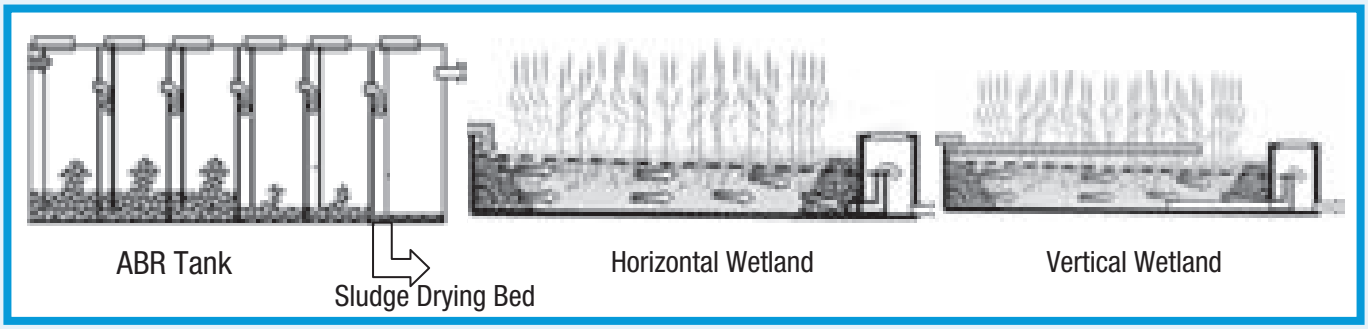
Salient Features

Source	Hospital & staff quarters
Design Capacity	90m^3/d, current 65 m^3/d
No. Users	250 beds
Peak flow	210m^3/d (Stormwater)
Influent Quality (July 2010)	BOD 60mg/L COD 432mg/L
Effluent Quality (July 2010)	BOD 6mg/L COD 223mg/L
Efficiency	90% BOD, 48% COD

Modules Adopted

Settling Tanks	Small settler	Large ABR
No. Tanks	3 chambers	4 baffle walls
Settler Volume	26m^3	52m^3
Area Construction	17.5m^2	35m^2
Planted Gravel Filter: 2 Horizontal Reed Beds		
	1 small	1 large
Surface Area	117m^2	180m^2
Depth	0.6m	
Filter Material	Gravel (2-5 mm)	
Plants Used	Phragmites karka	
Planted Gravel Filter: 2 Vertical Reed Beds		
Surface Area	120m^2	198m^2
Depth	0.9 to 1.05m	
Filter Material	Coarse sand (main media) & gravel (drainage layer)	
Plants Used	*Phragmites karka*	
Sludge Drying Bed: 1 Unit		
Surface Area	100m^2	
Depth	0.5m	
Filter Material:	Coarse sand & gravel	
Plants Used:	*Phragmites karka*	
Total System Area	800m^2	

Typical Drawing of Components– Two Parallel Systems



Operation and Maintenance

Regular maintenance works is undertaken by the Dhulikhel Hospital Engineering department which has a sound knowledge of the system with all costs funded through the hospital's annual budget. As this is the first DEWATS unit with a constructed wetland established in Nepal, it has over 13 years of experience in O&M. As the performance of the treatment unit was very good, the hospital decided to upgrade the entire plant in 2008. The most recent visit to the wetland (July 2010) indicated that there were some problems such as high storm water infiltration, need for harvesting/cropping of vegetation, breakage of tipping bucket and blockage of the bar screen on the smaller ABR inlet was blocked. This caused all of the flow to discharge into the larger wetland, causing ponding and potentially poor treatment.

The sludge drying bed is connected to the ABR's and is used every 2.5 months when sludge is apparent on the surface of wetland media, it appeared to have been used recently.

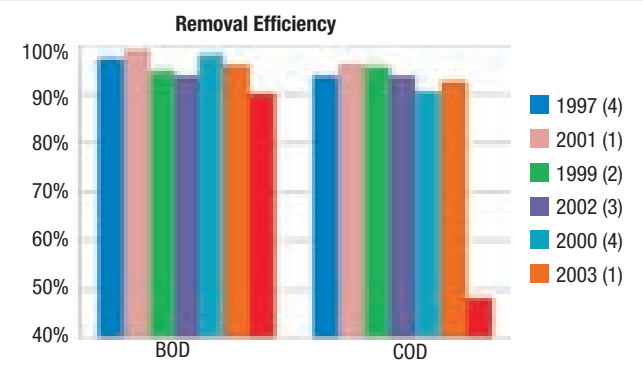
The wetland is expected to be operating below capacity with additional hospital expansion and residential facilities planned for the future. However storm water infiltration during monsoon could reduce the performance of the system.

Reuse Options

At present the treated wastewater is not used and discharges into the existing channel. However, the sludge from the drying bed is being used as fertilizer and the water could be reused for irrigation.

Monitoring Results

As the Aamaghar DEWATS unit has just been established, he previous DEWATS system had been monitored regularly since 1997 and generally performed well. The results of a survey in July 2010 shown in the table and graph indicate the current system is still performing fairly well but these results were impacted by monsoon rain and blockage of a system.



Parameter	Influent	Effluent	% change
pH	7.1	7	NA
TP (mg/L)	2	3	-50%
TN (mg/L)	19.5	16.5	15%
TSS (mg/L)	55	5	91%
Oil & Grease (mg/L)	3.6	12	-233%
BOD5(mg/L)	60	6	90%
COD (mg/L)	432	223	48%
DO(mg/L)	4	0	100%

Data from July 2010

Site Photos

For more information,
Environment and Public Health Organisation (ENPHO)
110/25, Adarsa Marg-1 New Baneshwor,
GPO Box 4102, Kathmandu • **Tel:**+977-01-4493188
Email: enpho@enpho.org • **Web:** www.enpho.org

Published by ENPHO, with assistance from
Consortium for DEWATS Dissemination Society
BORDA
Nepal Node for Sustainable Sanitation