



018530 - SWITCH

Sustainable Water Management in the City of the Future

Integrated Project
Global Change and Ecosystems

D5.3.6: Results of applied research program on natural systems for wastewater treatment and reuse available via the SWITCH report series

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Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

SWITCH WP 5.3 - Maximizing the use of natural systems in urban water management

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The hydrological water cycle runs via a wide variety of ecosystems, and is aided by bio-geo-chemical activities in these natural systems. The processes in natural systems relating to water purification and remediation can be employed for effective urban water management in two ways: a) by applying the processes of natural systems in 'eco-technologies' (e.g. AWWT, constructed wetlands, stabilization ponds), or, b) by employing full scale natural systems (e.g. river bank filtration, natural wetlands, phyto-technology, eco-hydrology).

Deliverable D5.3.6 relates to task 3 in the work package, which dealt with "Natural systems and processes for wastewater and stormwater treatment and reuse".

- **Task 3a:** To perform a literature survey and collect operational data from existing wetland systems (constructed and natural), stabilisation pond systems (algal and macrophyte systems), and anaerobic treatment systems. An analysis of factors influencing the feasibility of each of these natural treatment systems in centralised (urban) or decentralised (small towns and rural) situations, will be made.

Part of this task has been reported under Deliverable D5.3.1, which was a literature review on "Wastewater treatment by microphytes and macrophytes: a review for SWITCH Learning Alliances and Researchers". More specific and detailed literature reviews have been carried out as part of the numerous MSc and PhD studies that were done under this task. These are all documented in Deliverable D5.3.12; the relevant studies are also listed further down in this overview document.

- **Task 3b:** To implement an applied research programme on selected natural systems to study their possible use, function and optimization in the treatment and reuse of wastewater and stormwater. Research will be undertaken at laboratory scale, pilot-scale and full scale. Part of the research will be executed in the wastewater research station of Acuavalle in Ginebra, Colombia, and in Kampala, Uganda (Study areas). A detailed research agenda will be developed during the inception phase of the project. Research projects will include, but not be limited to:
 - Comparison of selected anaerobic wastewater treatment systems for the removal of selected contaminants (organic matter, (trace)metals, pathogens) and for energy recovery (biogas).

- Comparison of conventional and high performance facultative and maturation ponds for removal or possible recovery of selected contaminants (same as under a, plus N and P). High performance ponds are modified waste stabilisation ponds (optimization of hydraulic performance, introduction of aerobic/anoxic zones, adding media for algal-bacterial biofilms, introduction of macrophytes).
- Comparison of constructed and natural wetlands for wastewater and stormwater treatment.
- Evaluation of the removal of selected contaminants by integrated systems (combinations of systems mentioned above).
- Evaluation of the resource recovery potential (N, P, energy) and reuse potential of effluents in above eco-technologies.
- Evaluation of greenhouse gas emissions from above eco-technologies.
- Development of a master plan for the city of Cali, Colombia (Study area), which maximises the use of natural systems for wastewater treatment and reuse.

The SWITCH report series was never started; most outcomes of this task are reported under the form of MSc and PhD studies that were done under this task. These are all documented in Deliverable D5.3.12; the relevant studies are also listed further down in this overview document.

Another major output of this task has been the "master plan" for wastewater management the city of Cali, Colombia which analysed in detail, together with the Learning Alliance, the water system in Cali, the existing and future plans of various involved institutions and finally evaluated several options for wastewater collection, treatment and reuse, including natural treatment systems. All reports related to this Master Plan have been bundled together and attached to this overview document. Note that a specific plan for using natural treatment systems is reported under D5.3.2: Workshop report on the use of natural systems in the urban water cycle & D5.3.11: Workshop reports and plan on how to maximise the use of natural systems in the urban water cycle in demo-cities.

Overview of MSc and PhD studies related to D5.3.6

Task 3 - Natural systems for wastewater and stormwater treatment		
Effect of Algal Biofilm and Operational Conditions on Nitrogen Removal in Wastewater Stabilization Ponds	M. Babu	IHE - PhD
Greenhouse Gas Emissions from Eco-technological Wastewater Treatment Systems	J.P. Silva	IHE - PhD UNIVALLE - PhD
Possibilities for Recycling Domestic Wastewater with Vertical Flow Constructed Wetlands	R. Shrestha	IHE - MSc
Grey water treatment using natural wetlands	A. Muzola	KNUST - MSc
Grey water treatment using constructed wetland at KNUST in Kumasi	P. Niyonzima	KNUST - MSc
Water quality enhancement in Sloterbinnenpolder (Amsterdam, The Netherlands) by adopting ecological engineering approaches	A.M.M. Ali	IHE - MSc
Effect of some environmental factors on nitrification in algae-bacterial biofilm	T. Munezvenyu	IHE - MSc
The use of natural systems for the treatment of greywater: A case study of Kpeshie lagoon	M. Ansah	KNUST - MSc
Faecal sludge management: the case of Madina	P. Antwi-Agyei	KNUST - MSc
Laboratory study on the emissions of N ₂ O, CH ₄ and CO ₂ from activated sludge	A.F. Saeed	IHE - MSc
Modelling the ecological impact of wastewaters on the Cauca River (Colombia)	J.E. Holguin	UGhent - MSc UNIVALLE - MSc
Estimacion de gases de efecto invernadero en humedales construidos de flujo subsuperficial horizontal - Estimation of greenhouse gas emissions from horizontal subsurface flow constructed wetlands	A. Valverde Solis	UNIVALLE - MSc
Tratamiento de aguas residuales municipales en el Valle de Cauca - Treatment of municipal wastewater in Valle del Cauca	C.L. Suarez Marmolejo	UNIVALLE - MSc
Cámaras estáticas para la estimación de gases de efecto invernadero en lagunas de estabilización para el tratamiento de aguas residuales domésticas	A.P. Lasso Palacios	UNIVALLE - MSc