Ostfalia
Hochschule für angewandte Wissenschaften

Performance Evaluation and Suggestions for Improvement for four existing Wastewater Stabilization Pond Systems in Lesotho

Project Scope

This thesis intends to evaluate the treatment performance of four waste stabilization pond (WSP) systems in Lesotho. The performance evaluation is based on recorded wastewater samples and surveyed pond dimensions. Tracer studies were executed to quantify the extent of hydraulic short-circuiting in different ponds. Flow measurements allowed an estimate of current pond retention times. The obtained results are compared to theoretical pond efficiencies.

The actual pond design is compared to a theoretical re-design. The re-design is based on current flow rates and wastewater data. The re-design illustrates a more efficient process design.

A new WSP system in Roma is in its construction stage and important design aspects and construction aspects are discussed within this thesis.

Treatment Efficiencies

The WSP systems MAPUTSOE OLD and HA NYENYE mainly receive industrial wastewater with a high organic pollution. The wastewater in Teyateyaneng and Roma is of domestic origin. Table 1 shows removal efficiencies for COD, SS, and ortho-phosphates.

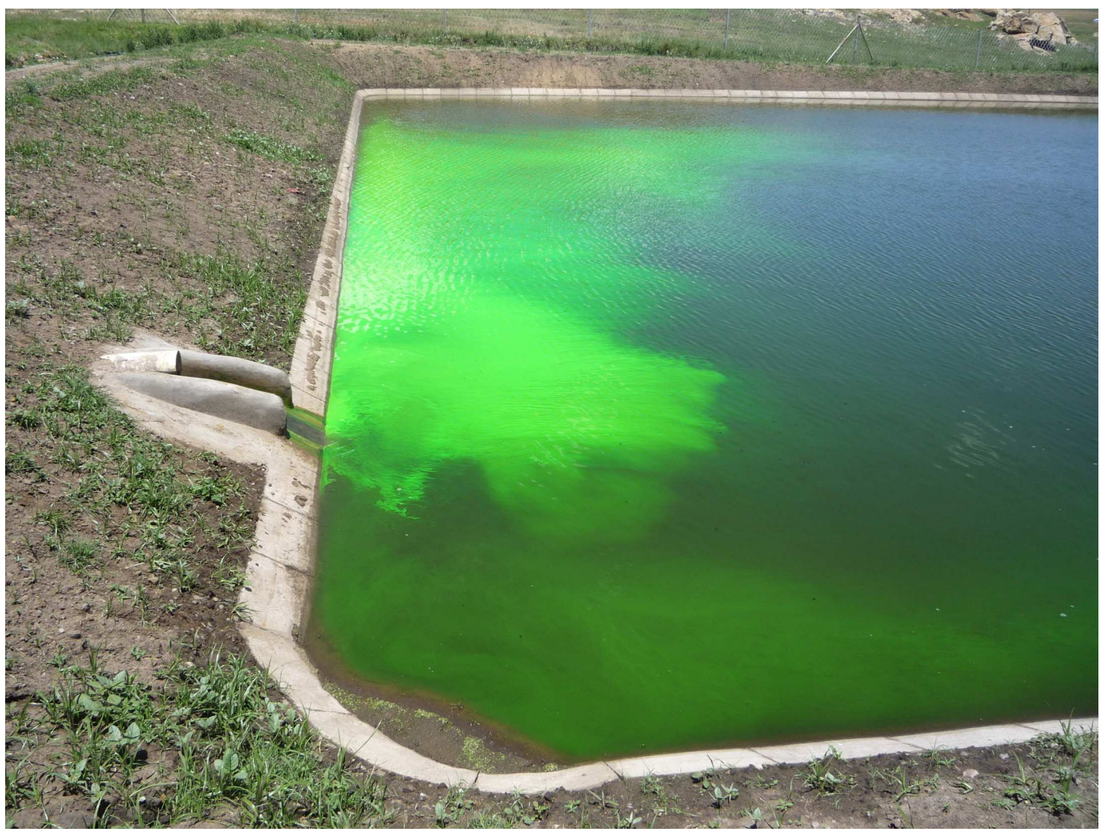
Table 1: Treatment efficiencies and surface loading rates λ_s

	Unit	MAPUTSOE OLD	HA NYENYE	TY	ROMA
Q	m³/h	320	460	40	50
COD_{in}	mg/l	983,3	709,1	306,4	350,3
COD_{out}	mg/l	326,0	317,3	159,1	142,4
Removal	%	67	55	29	60
SS_{in}	mg/l	294,0	276,4	118,0	113,7
SS_{out}	mg/l	81,0	126,8	38,3	45,1
Removal	%	72	54	68	60
o-P_{in}	mg/l	19,6	21,6	12,1	17,9
o-P_{out}	mg/l	16,8	18,6	8,8	12,8
Removal	%	14	14	27	28
λ_s	kg/(ha*d)	351,1	326,6	28,0	31,7

The permissible surface loading rate λ_s depends on the monthly average temperature in the coldest month of the year. The permissible surface loading rate in Lesotho is 102 kg/(ha*d). The surface loading rates in MAPUTSOE OLD and HA NYENYE exceed the permissible loading rate by far. The WSP sytems TY and ROMA on the other side are significanly underloaded.

Tracer Studies

The flow pattern in the maturation ponds in MAPUTSOE OLD and in HA NYENYE were investigated with a fluorescent tracer substance. Picture 1 shows the tracer distribution in a maturation pond in HA NYENYE.



Picture 1: Tracer test at maturation pond in HA NYENYE

Results

The treatment works MAPUTSOE OLD and HA NYENYE require extensions to improve effluent quality. The WSP TY can adopt higher inflows and the maturation ponds can be subdivided with baffles. The WSP ROMA will be replaced by a new pond system.

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