

HYDRODYNAMIC SIMULATION OF PASSIVE IN-STREAM WETLAND IN RURAL AREAS OF EGYPT

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The emphasis on increased reuse of drainage water for irrigation is essential as Egypt expands its agricultural land base to meet the food supply requirements of a rapidly growing population. About 12 billion cubic meters of surplus irrigation water are collected in drains each year, but only an approximate 5 billion cubic meters are currently being reused. The sanitation facilities of Egyptian rural areas are far behind potable water supply. Economics of scale make conventional wastewater treatment cost prohibitive in smaller more dispersed rural settlements. Domestic wastewater is typically discharged to drains. This practice has contributed to widespread degradation of drainage water quality and, so, the reuse of drainage water plans in Egypt. Introduction of passive wetland treatment system on existing drains is an effective, cheap, and simple treatment alternative to improve drainage water quality.

Pilot studies in the Nile Delta drain system are conducted to demonstrate the technical feasibility of the in-stream study and adopt the design criteria suited for the Egyptian environment. A pilot area is selected and baseline studies have been conducted during 2003/2004 to collect the data/information required for the design purpose of in-stream wetlands. The objective of this paper is to present the results of hydrodynamic simulation of the different design alternatives.

The HEC-RAS modeling system is used for calculation water surface profiles for steady gradually varied flow. MATLAB software is used to develop an external transport module to simulate the convection, advection, diffusion and decay of different pollutants. A group of 25 numerical runs in a matrix are simulated to test the impact of physical interventions on detention time and pollutants removal efficiency.

The baseline studies show that the performance of the selected drain without physical engineering intervention varies in a narrow range from 29% to 37% for BOD removal with treatment efficiency of detention 6 to 8 hours. The proposed system could have detention time up to 36 hours by limited physical intervention using as sedimentation trap, weirs and baffles. Removal efficiency of such system can achieve 60% of BOD and 70% of TSS. Introducing aquatic plant would improve the removal efficiency especially for nutrients and pathogens.