Evaluation of Septic Tank and Subsurface Flow Wetland for Jamaican Public School Sewage Treatment

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Locally designed wastewater treatment systems at two rural Jamaican public schools located in Pisgah, St. Elizabeth and Retrieve, St. James, were evaluated over a seventeen week period to evaluate their effectiveness. Primary treatment was achieved with two plastic tanks in series. This was followed by a horizontal subsurface flow constructed wetland planted with local wild cane (Gynerium sagittatum) achieving secondary treatment with nutrient removal. (In Jamaica, this is referred to as tertiary treatment.)

The toilet system in Pisgah had been operating for one and a half years supplied with water from a rainwater harvesting scheme. Per capita water use averaged 1.3 L/p-d and total water use averaged 264 L/d (70 US gal/d). This resulted in such low hydraulic loading that the septic tanks had a hydraulic residence time (HRT) of 29 days. The wetland never produced effluent so that it functioned as an evapotranspiration (ET) bed with an average ET rate of 0.27 US gal/ft 2/d (11 mm/d). Wetland BOD mass loading averaged 0.79 kg/ha-d (0.71 lb/ac-d) and TSS entry zone mass loading averaged 0.0013 lb/ft2-d (6.4 g/m 2-d). The toilet system in Retrieve had been operating for two years with a municipal water supply. Per capita water use averaged 48.3 L/p-d and total water use averaged 3,240 L/d (857 US gal/d). The average septic tank HRT was 1.2 days.

Combined sewage inflow and precipitation to the wetland resulted in an average HRT of 2.2 days equivalent to a hydraulic load of 2.6 US gal/ft2-d (105 L/m2-d). Wetland BOD mass loading averaged 15 kg/ha-d (13 lb/ac-d) and TSS entry zone mass loading averaged 0.0038 lb/ft2-d (19 g/m2-d). Five sets of water quality grab samples were collected from three points at each site. Samples from the sanitation system in Pisgah indicated an average reduction of raw sewage BOD by 78%, TSS by 85%, total nitrogen by 95%, ammonia by 99%, total phosphorus by 97%, total coliform and fecal coliform by 4 log (99.99%). Samples from the sanitation system in Retrieve indicated an average reduction of the raw sewage BOD by 50%, total nitrogen by 68%, ammonia by 97%, total phosphorus by 64%, total coliform by more than 3 log and fecal coliform by more than 4 log. An increase in TSS for the system at Retrieve may have been caused by the effluent sampling method. Average nitrate levels were below 1 mg/l throughout both sanitation systems.