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National Water Program
A Partnership of USDA CSREES & Land Grant Colleges and Universities

USDA-CSREES 2007 National Water Quality Conference

Commercial-Scale Integration of a Reciprocating Wastewater Treatment Technology (ReCip®) and an Anaerobic Lagoon

An integrated swine wastewater treatment system has been in operation since 2000. The integrated system consists of a commercial scale ReCip® constructed wetlands fed by an anaerobic lagoon that treats wastewater from a 5600-animal, 8-barn swine finishing facility. Designed as a retrofit, the ReCip® system consists of four gravel-filled cells operated in series and totaling 3570 m2 of area. In the first two years of operation, the average hydraulic loading rates from the anaerobic lagoon to the ReCip® wetlands were tested at two levels—107 m3/day and 208 m3/day. Over the subsequent four years, the commercial system was operated at an intermediate average hydraulic loading rate of 150 m3/day. Percent removal efficiencies for nitrogen, chemical oxygen demand (COD), and biochemical oxygen demand (BOD5) were unaffected by the doubled flow rate, and the system provided significant reduction of odors and pathogen indicators. Average influent and effluent concentrations of monitored parameters in parts per million (ppm) and the respective percent removal rates were: CBOD5 (521 ppm, 117 ppm, 78%); COD (1388 ppm, 393 ppm, 72%); NH4-N (371 ppm, 51 ppm, 86%); and PO4-P (52 ppm, 43 ppm, 17%). Prior to integrated treatment, the anaerobic lagoon wastewater was used to wash out barns and barn storage pits. With integration, the effluent from the ReCip® wetlands was recycled to wash barns or was used for irrigation. Within two months of integrated treatment operation, the initial Escherichia coli level in the anaerobic lagoon dropped 1-2 logs and remained at this reduced level on average throughout monitoring. Following this initial drop, 2-3 log reductions in E. coli were obtained on average between the anaerobic lagoon influent to- and the treated effluent from- the ReCip® system.

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