

Case Study

Agriculture run-off water quality improvement Singapore PUB project – Kok Fah Technology Farm

Background

Agricultural practices such as chemical fertiliser application, fertigation and intensive irrigation currently result in nutrient and chemical compounds present in run-off that, while retained in holding ponds on the farm, could impact surrounding catchments should groundwater seepage and/or overflows occur during heavy rainfall events.

Singapore's Public Utilities Board (PUB) worked with the Centre for Organic Research & Education (CORE) to find solutions to improve agricultural run-off quality into catchments within Singapore. Locally sourced Advanced Biofiltration Media (ABM) technology is integrated into farm management practices in a number of ways to reduce run-off into surrounding catchments.

The project

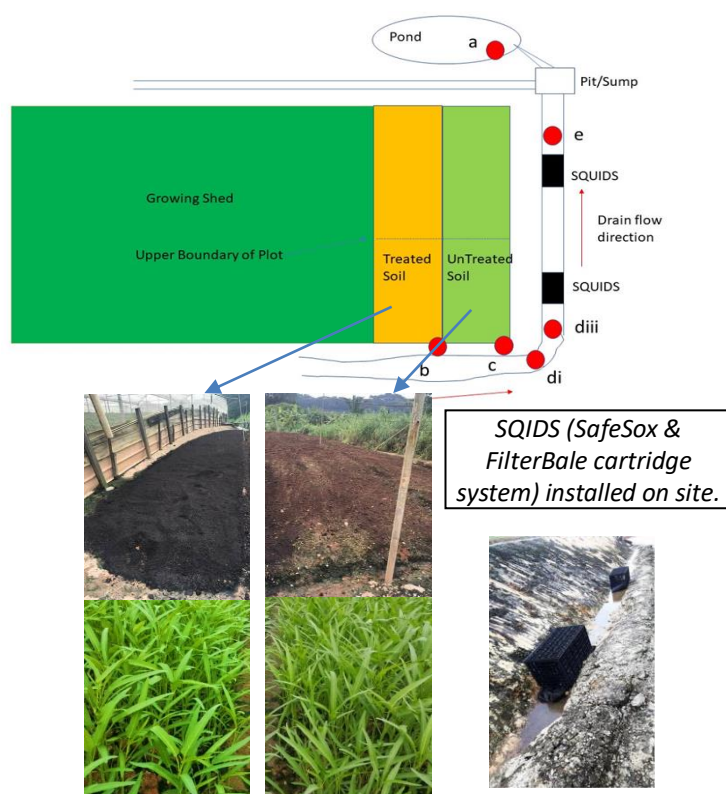
The aim of the project is to demonstrate a treatment train approach to reduce agriculture run-off at the source, including:

- Adding ABM amendments to existing soil structure and composition to enhance the retention of water and micro nutrients.
- Installation of ABM Stormwater Quality Improvement Devices (SQIDS), FilterBales™, and SafeSox.™

These ABM technologies are used to filter out suspended solids (containing contaminants) and treat dissolved pollutants such as nutrients and heavy metals through the amendment and cartridge systems.

The project site consists of two plots, which are Plot b (test plot) with amendment installation and Plot c

(control plot) without amendment. Plots are planted with Kang Kong crops. Existing sprinklers were used to simulate an indicative rainfall event at a depth of around 80mm per hour. SQIDS are installed in a downstream drain, samples were collected at sprinkler, location b and e to monitor water quality improvement (See location map below).



Results

Plot b with ABM amendment installation shows better growth crops after 20 days planting (see above).

Site observation of surface runoff passing through the SQIDS showed visible turbidity removal:



View of drainage flow before (left) and after (right) the first SQID

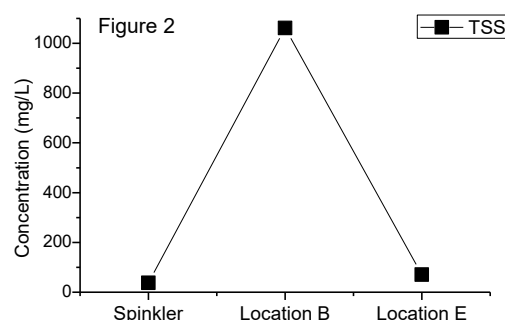
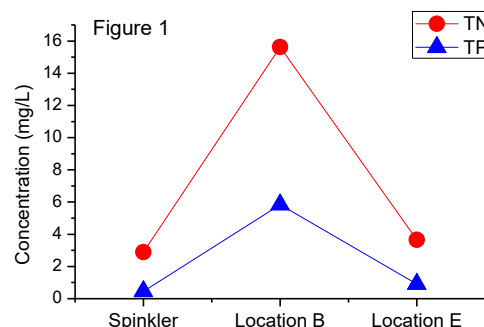


View of drainage flow before (left) and after (right) the second SQID

Singapore has very dispersive clay soils which are common all over Asia. Clay soils only temporarily hold pollutants. When subject to surface runoff pollutants are liberated in very high concentrations.

Figures 1 and 2 show dramatic increases in nutrients and TSS concentrations in the site runoff (location b). The water quality data in these figures indicate that simulated rainwater from “Sprinklers” was reasonable quality; however, TN, TP and TSS concentrations rose by up to 10-30 times in location b samples.

This evidences that dispersive clay soils release major pollutants to surface runoff during rain events, which will exacerbate water body pollution without appropriate treatment. The onsite ABM SafeSox cartridge system (SQID) showed superior pollutant removal, reducing the TSS, TN, TP concentrations down to acceptable levels (location e).



Summary

The project is designed to support PUB’s ABC Waters Program and Guidelines by demonstrating ABM technology’s ability to protect Singapore’s precious water resources.

The project demonstrates strong evidence of soil improvement and crop growth supported by the ABM amendment, as well as achieving superior runoff treatment performance for removal of nutrients and sediments using ABM SQIDS.

The field test data also draws awareness to the impact of soil structure (dispersive clay) on surface runoff water quality.

The project demonstrates that ABM technology can successfully treat contamination in agriculture runoff.