The Water Hub: a research and innovation centre

THE WATER HUB
Bringing together innovation and development

Origins of the Water Hub

In 2013 the old Franschhoek WWTW overreached its capacity to treat wastewater because of the expansion of human settlements in the Franschhoek valley. The plant was discontinued in 2013 and lay abandoned until 2016 when the Western Cape government awarded an open tender for the development of a business plan for the site, and this included a small budget to modify existing infrastructure on the site for treating contaminated water from upstream informal settlement. In 2017 UCT's Future Water Institute got involved in developing the site for research purposes and has continued to direct research and innovation along with its international partners. The land, which Stellenbosch Municipality owns, comprises 3.2ha which is largely contaminated from previous WWTW operations. owned by the Stellenbosch Municipality. The site is situated 2.5km north of the centre of the formal town of Franschhoek.

Biofiltration cells in 2018

New SMART Cell construction and raising water tanks in 2024

Treatment of polluted runoff

The first efforts began by modifying the existing drying beds and converting these into 6 biofiltration cells, each filled with different natural media: stone aggregates, peach pips and biochar. Two years of data collection and analysis showed significant reductions in orthophosphate (80 – 95%); ammonia (75 to 90%); *E.coli* bacteria (95 to 100%). About 50 to 100Kl are treated each week. Water quality meets general irrigation and discharge guidelines. Further advancements, currently under construction, include an adaptation of old drying cells into a SMART aeration cell that has the potential to remove chemicals of emerging concern (CECs) and improve the reliability of water quality for irrigation.

The stormwater system is used as a convenient conduit to discard grey and black water

River restoration

The Stiebeuel River bisects the Water Hub and meets a relatively pristine Franschhoek River at the lower end of the site. The discharge of a polluted river into the Franschhoek River is highly problematic: elevated chemical concentrations cannot be used by farmers before further treatment; solid litter in the streams threatens international tourist interests in the area, but it also represents the state of human behaviour and failure of waste management and recovery services. In June 2023, the Western Cape government (DEA&DP) employed a contractor to restore the banks of the lower Stiebeuel River and plant it with indigenous shrubs. An experimental litter trap at the Water Hub has been installed where waste is collected, weighed and characterised.

Restoration of river with a rich variety of plant species

Irrigation using biofiltered treated water

Experimental vegetable gardens are used to examine crop health by using a clean municipal supply for irrigation water and comparing the results with plants that are treated from biofiltration water (i.e. without the addition of the chemicals). Analysis of six successive harvests (beetroot, carrots, lettuce and spinach) shows that vegetables grown from biofiltered water treatment often have a higher biomass and better water retention compared to municipal water use.

Different soil types with addition of biochar and duckweed to test infiltration, carbon % and crop biomass

Soil regeneration

Two experimental gardens provide a comparison of different means of enhancing soil. Both soils were originally sourced from green organic waste obtained from a commercial recycling centre. The beds are divided into a control section; another section infused with duckweed, *Lemna minor;* and a third section containing inoculated biochar and worm manure. Best results were achieved with the combination of biofiltered water and biochar with evidence of higher mineral content (Mg & Fe), higher biomass and water retention.

Sludge management and recovery

Crude ways of dewatering maturation ponds and the removal of pollutants from WWTWs usually involve abstracting water, some on-site treatment, followed by the discharge of water to the receiving environment. Sludge (solids) are often excavated and transported to a landfill. Experiments at the Water Hub are being conducted to treat a maturation pond water by using natural media. Evidence shows that it is reducing nutrient concentrations and chemical oxygen demand (COD). For example, lime is being used to increase the pH of the sludge column resulting in the precipitation of heavy metals to the bottom of a sludge column. Different ways are being explored to reuse the treated sludge, e.g. to insulate corrugated iron shack dwellings after UV treatment and as a feedstock to generate energy.

Cool shack project

Heat stress is a significant factor affecting people who are living with conditions such as epilepsy, cardiovascular disease and diabetes. Poorly insulated dwellings and a lack of ventilation often result in the rapid rise of temperature in these homes making them very uncomfortable to live in when temperatures exceed 30°C or more and the relative humidity is above 70%. Two shacks have been constructed at the Water Hub: a control (standard 3 x 3m corrugated iron without modification); and an experimental shack with a pitched roof; insulated with plastic bottles filled with treated biosludge; and a biochar air conditioner with a flue (air vent). During very warm days, temperatures inside the experimental shack can be 3°C degrees cooler than the environmental temperature and at least 15°C cooler than the control shack.

Experimental and control shack dwelling project

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