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Cleaning up landfill with wetland technology



Landfill leachate is a significant threat to rivers and groundwaters due to the concentration and variability of the effluent over time making it difficult to treat effectively.

Advances in constructed wetland technology now provide a natural method of treating landfill leachate and ARM Ltd – a leading supplier of natural waste water treatment systems – has developed an innovative, sustainable and cost-effective solution.

Background

Around a decade ago, the EU Landfill Directive came into force in the UK. These regulations covered the management of existing sites, both open and capped, as well as the introduction of new sites.

The Directive set-out ‘to prevent or, reduce as far as possible, negative effects on the environment, in particular the pollution of surface water and groundwater from the land-filling of waste during the whole life cycle of the landfill’.

This meant the owners of landfill sites – regardless of the site’s existing activity – would be responsible for preventing, reducing or treating the pollution of surface water and groundwater by the extremely powerful contaminants in their leachate liquids.

Landfill leachate - the issues

Landfill sites are open to the elements. Rain falling on the site or, water entering from surface streams, permeate through the layers of waste. This, combined with the resulting



liquid from the decomposition process, produces a leachate which has the potential to contaminate surface and groundwaters.

Generated as part of the waste collection and storage process, landfill leachate is characterised by its high concentration of organics and ammonia as well as the potential for toxic levels of arsenic, nitrogen and other metals such as iron.

This leachate is typically difficult to treat as its composition can vary over time. Factors such as the age of the landfill site, type of waste and size of the site can all impact on the leachate composition.

Legislation set out by the European Water Framework Directive (WFD) states that any organisation whose activities produce leachate wastewater is required to protect the surrounding water quality.

If left untreated, the surrounding water body will become contaminated upsetting the balance of the ecosystem and water quality. This pollution not only affects the immediate vicinity of the source but also affects sites further downstream and, as such, has to be carefully managed prior to discharge.

Landfill leachate - the natural solution

A sustainable and cost-effective solution to treating leachates is with aerated treatment wetlands fitted with Forced Bed Aeration™ (FBA™) which have the capability to treat wastewater with varying strengths to improve the water quality and prevent water pollution.

Wetland technology fitted with FBA™ involves laying a network of pipes below the gravel matrix which bubbles air through the system, increasing the oxygen availability and providing greater treatment capability.

Micro-organisms attach themselves to the media and plant roots. These organisms then degrade the pollutants using the oxygen available in the wetland. Previously, oxygen was the limiting factor as once the oxygen was gone, the treatment stopped. Studies have shown that the more oxygen available to the organisms, the more pollutants it can remove.

Aerated wetlands increase those oxygen levels and are designed to achieve a specific level of pollutant removal through biological, chemical and physical treatment processes. This technology can be retrofitted into established wetland systems or as a new build.



St Michaels Golf Course - FBATM technology in action

St Michaels Golf Course - near Widnes in Cheshire - occupies an area of 45 hectares and was built on a capped landfill site between 1974 and 1989. The landfill site was originally used for the deposition of local chemical industry and domestic waste.

The golf course is surrounded by residential housing, industrial and commercial estates and Stewards Brook which flowed into the River Mersey, located 500m away.

In October 2004, Halton Borough Council (HBC) closed the golf course on the advice of the Health Protection Agency following the discovery of high concentrations of arsenic in nearby surface soils.

The area was classed as 'Contaminated Land' as it could potentially harm humans and pets and discharge polluting leachate into the local Stewards Brook and was designated a 'Special Site' under Regulation 3b as leachate mixture was causing the brook to fail the Surface Waters (River Ecosystem) Classification Regulations for dissolved oxygen.

As an interim measure, the collected leachate was pumped and transported off-site for disposal at a licensed wastewater treatment works (WwTW) but a long-term solution was needed.

In 2010, HBC needed to source a solution to treat the collected leachate once it was fully characterised. Feasibility studies concluded the most viable and sustainable solution for managing the leachate was to treat it prior to its discharge into the sewer with an aerated saturated vertical-flow treatment wetland.

ARM in partnership with Land and Water, embarked on installing this long-term sustainable and cost effective solution to treat the leachate.

The key contaminant for removal in the leachate was sulphide though the BOD reduction also needed to be factored into the solution. This meant the sulphide within the leachate needed to be oxidised to sulphate under aerobic conditions which would also support aerobic degradation of the BOD and ammonia. This solution would provide adequate aeration to meet the oxygen demand as well as effective surface mixing of the anaerobic effluent into the aerated effluent within the wetland.

Success

A 195m² wetland system fitted with FBATM was constructed to treat the leachate collected in a holding tank on site which would then discharge treated leachate into the local foul sewer.

The wetland was designed to meet discharge consents for BOD of <5 mg/L and sulphate limit of <1446 mg/L, at a flow rate of 48 m³/d.



The installation of the aerated wetland system has provided a long-term, low-maintenance and low carbon footprint, leachate treatment. This has helped save significant on-going costs associated with tankering the leachate off site.

The treatment now complies with the discharge consent criteria and provides an economically-viable solution which produces relatively little waste and accommodates varying concentration and throughput.

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