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Hanningfield – Breaking new ground in sustainable drinking water treatment

Essex & Suffolk Water, part of Northumbrian Water Ltd, has completed the installation of a natural treatment system at its Hanningfield Water Treatment Works resulting in the world's first natural reed bed system to treat water works sludge produced during the production of drinking water.

The utility company has been working with ARM Limited and its Danish partner Orbicon since 2008 to design and build a system to treat the ferric sludge produced at its works.

Hanningfield Water Treatment Works near Chelmsford in Essex treats up to 240MI/day of drinking water for a large part of Essex and east London. The existing sludge settlement lagoon system is almost full so a new treatment system is required to enable continued water production at Hanningfield.

The initial part of the treatment process involves the introduction of ferric sulphate in to the pulsator clarifiers to remove silt and algae contained in the raw reservoir water. This generates up to 3MI/day of a ferric based liquid sludge by-product which must be treated.

This sludge contains 99.8% of valuable water which once separated, can be returned back to the reservoir for future use.

Trials were initially undertaken to determine if ferric sludge was treatable in reed bed systems and following two years of successful trials where dry solids content of the sludge reached up to 60% and 99% of the valuable water held in the sludge returned to the reservoir, the decision to move ahead with a full scale system was taken.

The new system was constructed in 2012 and consists of 16 basins, covering a total of 4.5ha.

The £4.5 million construction project is the first of its kind and is leading the way in helping to provide sustainable drinking water to the UK's population.

Historically, reed beds have been used to treat a wide variety of wastewaters from sewage and industrial process waters but never for ferric sludge.



Whereas traditional methods of dewatering involving centrifuges and belt presses resulted in high energy and maintenance costs, this system reduces both and provides a long term sludge treatment solution.

With no requirement to remove the dried sludge from the system for at least 20 years the operations expenditure of just the vehicle transportation removing dried sludge from site makes this system extremely attractive on OPEX expenditure.

“Unlike mechanical treatment solutions, there is no need to use polyelectrolyte to thicken the sludge as the reed beds need a thin layer of liquid sludge so the water can filter through,” says Tori Sellers, a director at ARM.

“The dewatering happens on several levels; evapotranspiration, filtrate percolating through the system and then mineralisation.

“This leaves a dry solid content of up to 60 per cent and a better quality of reject water. Comparatively centrifuges only leave dry solid content of about 25 per cent.

“The reed bed basins will be loaded and rested for determined periods. With 16 beds in total, when it is time to reload the first the water will have passed through the vertical bed leaving a layer of dry content.”

This innovative approach to water management has already been recognised by the government - Natural Environment Minister, Richard Benyon - visited the works earlier this year.

Paul Grimwood, project manager – investment delivery at Essex & Suffolk Water, says: “These are the first reed beds we have put into the drinking water treatment process.

“Our extensive on-site trials gave us the confidence to progress with the full scale system. The tests highlighted that the media filter had a good filtration capability and the sludge residue on the surface cracked well, which is indicative of good dewatering.

“We considered both options carefully, both natural and mechanical, before embarking on a natural reed bed system and the results have been great.

“It is a flexible operation with low energy consumption and requires low operational costs. It significantly reduces the amount of energy we use and eliminates the costs for chemicals required at this stage in the process.

“We have estimated that the reed beds will save 70 tonnes of CO2 emissions a year and as we only need to remove the dry content once every 20 years, further cuts have been made by not sending the waste off-site on a regular basis,” says Paul.



ARM has also installed a SCADA controlled system linked to Essex & Suffolk Water's software to manage the load to the reed beds to ensure optimal efficiency.

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Kinetic Communications

0121 212 6250