











Mines & Quarries

natural waste water treatment

ARM Group Ltd
natural wastewater treatment

Whether you're thinking about a new reed bed system, or you just want some timely expert advice about effective operation, we can help.

Harnessing natural technology

Ever since natural waste water treatment systems came of age in the 1980s, ARM Ltd has led the way in reed bed and constructed wetland technology.

Working with the UK water companies, councils, contractors, industrial clients and research institutes, we have designed, built and maintained many hundreds of reed bed systems. These range in size from 10m^2 up to 20,000m^2, and we have consulted on reed beds of many hundreds of hectares.

Harnessing natural processes, we engineer them to deliver all the advantages of cost-effective, versatile and sustainable wastewater treatment – and we guarantee the performance of every system we design and install.

As the largest dedicated UK company by far in this specialised field, with a reputation dating back to 1947, ARM brings you unique expertise and experience. We can support you at every stage of the process – from initial planning and design through construction and commissioning to ongoing maintenance – ensuring the optimum performance of your reed bed system.

We continue to pioneer new and innovative ideas. Recent developments include an aggregate recycling system to reduce landfill costs and material usage, and a plough to retrofit FBA™ airlines into existing reed beds.

Why use reed beds?

The Chinese used wetlands more than two thousand years ago for their impressive effluent and water treatment capabilities.

Reed beds provide an ideal environment for a wide range of treatment processes. The combination of micro-organisms, plant roots, rhizomes and substrate matrix remove contaminants in a variety of natural ways.

They treat waste water as it flows though the system just like the process in conventional sewage treatment, but without using energy-intensive machinery.

With low maintenance requirements, low or zero power consumption and a long, productive lifespan, reed bed systems are both proven and sustainable, enhancing any landscape. Their removal mechanisms include settlement, filtration, biological and chemical action, containment and plant uptake. They can reduce levels of soluble organic matter, suspended solids, ammonia, pathogens, hydrocarbons, and metals.

The various types of reed bed can be used in different configurations to treat a variety of pollutants from industrial or municipal sources.

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Performance guaranteed

Our reed beds are used at all stages of the sewage treatment process providing primary, secondary and tertiary treatment as well as sludge dewatering.

They can also extend the life of older treatment works by providing a tertiary polish to effluent, bringing it within regulator consent, and saving capital expenditure.

They are increasingly used for tackling industrial effluent. Uses range from treating fire-fighting foam and metal removal from minewater drainage, to reducing ammonia levels in leachate and removing hydrocarbons from groundwater.

Other applications include treatments connected with:

- agriculture
- pharmaceutical
- food processing
- chemicals
- refinery waste
- distillery wastewater
- airport run off
- Sustainable Urban Drainage Systems (SUDS)

They can also be used to create wetland habitats – enhancing bio-diversity.

Whatever the application, we provide contractual guarantees of effectiveness, performance and quality – so you can be sure you're going to get the results you're looking for.

Our comprehensive range of services includes:

Consultancy: feasibility studies, process design, site surveys, landscape design, and advice on managing future changes

Project management: our experienced managers will look after your entire project from conception through to completion.

Design and build: our turnkey service delivers systems on time and within budget, including liaising with regulators and enforcement authorities on your behalf.

Design and supply of materials and equipment: a service we provide on request, for example to framework contractors.

Construction service: using our design or your own, we make it easy for contractors and save our clients significant amounts of money through design reviews based on experience – without compromising quality or performance.

Field services for system maintenance: we extend the life of your system, bring you peace of mind and help you get the best possible results.

Asset assessment: we evaluate process efficiency, check your system is operating at top performance, and make recommendations.

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ARM Group Ltd

About Us

ARM Group Ltd, a Staffordshire based privately owned company, is the leading designer and constructor of natural waste water treatment systems and associated technologies for the industrial and municipal waste water treatment market in the UK. The Company is noted for its invention and subsequent commercial development of equipment and processes within its chosen markets.

ARM Group Ltd has been trading since 1947 and was originally involved in development, design, manufacture, and construction within Agricultural Engineering. However, in the late 1980s ARM Group Ltd redefined its objectives and moved its customer and product bases into the global market of wastewater treatment specialising in the use of reed bed/wetland systems.

Today the Company operates out of offices in Rugeley, Staffordshire employing 21 people and using Associates and sub-contractors as required.

ARM Group Ltd is broadly divided into seven operating functions these can provide client support either individually, as a team, incorporating the requisite elements, or as a whole providing continuity of support for turnkey solutions from project conception through design construction, commissioning and maintenance, depending on the specific needs of the client. The functions are:

- Sales
- Design
- Project management
- Construction
- Research and Development
- Refurbishment and Maintenance
- Administration

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ARM Group Ltd

Experience

For the past 30 years ARM Group Ltd have specialised in reed bed and wetland systems having designed and installed over 700 beds during this period. This provides us with unique and extensive experience of their application, design and construction across the wastewater treatment spectrum. Our experience and knowledge has been accumulated through:

- Design and construction of reed bed systems
- Value engineering optimisation
- Application experience
- Working with academic institutions.
- The international constructed wetlands conference circuit
- Presenting papers
- Personal contact with leading researchers
- Working relationships with leading specialist in specific reed bed applications
- Founder member of the Constructed Wetland Association (CWA)
- Founder member of Global Wetland Technology (GWT)
- Over 1000 reed bed surveys

We have designed and constructed reed beds that provide treatment for:

- Mine water
- BOD and COD reduction
- Methanol removal
- Copper removal
- Pathogens
- Landfill leachate
- Hydrocarbons
- Septic tank waste
- Ammonia
- Surface water run off
- Solids
- Sludge dewatering
- Storm water
- Metals
- Glycol

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CASE STUDY

Veolia Environmental, Bobbingworth

Surface flow: Landfill leachate

Project
Veolia Environmental Services, Bobbingworth

Location
Bobbingworth, Essex

Project type
Design and construct

Wastewater type
Landfill leachate

Completion date
2007

Treatment system
Passive horizontal surface flow reed bed

Needs

Bobbingworth landfill site in Essex is operated by Veolia Environmental Services. Following the capping and landscaping of the site Veolia required a means of treating leachate which was accumulating within the landfill and being pumped to the surface at an average rate of 30 m^3/d. This leachate was being tankered away for treatment and disposal at a remote location at cost to the operator. A water treatment works situated a few hundred metres away could accept this leachate if the Iron loading was reduced from 100 mg/l to below 20 mg/l and any soluble methane removed.

Solution

Once pumped to the surface the Iron within the leachate was primarily in its oxidised or ferric state as an insoluble precipitate. There was also some Iron in its ferrous or soluble form. The wetland solution was a passive horizontal surface flow reed bed using *Typha latifolia* in a soil based media with a process area of approximately 560m^2. The surface flow system would allow the precipitated iron to spread and settle over the whole bed avoiding clogging along the leading edge of the system. The surface flow provides additional oxygenation of the leachate converting any insoluble ferrous Iron into precipitated ferric form. *Typha latifolia* provides a bulky rhizome and stem suited to knocking down suspended solids in the effluent stream. Methane strippers were supplied by others but installed by ARM Ltd.

Benefits

The installation of the wetland system provided a robust treatment solution with a low maintenance requirement minimising the need for operator attendance on site. The costs associated with tankering leachate away were eliminated and delivery to the local wastewater treatment works provided security of ongoing treatment for Veolia without the concern of tight consent achievement and discharge into the local environment.

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CASE STUDY

St Michaels Golf Course

Aerated saturated vertical flow reed bed: Landfill leachate

Project
St Michaels Golf Course, Halton Borough Council

Location
Widness, Cheshire

Project type
New build

Wastewater type
Landfill leachate

Completion date
April 2013

Treatment
Aerated saturated vertical flow

Need

St Michaels Golf Course is located to the west of Widnes town centre. It occupies an area of 45 hectares and was built on a capped landfill site which was used for the deposition of local chemical industry and domestic wastes. The golf course was constructed in stages between 1974 and 1986. 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 near surface soils.

The land was subsequently classed as Contaminated Land due to the arsenic and the potential of harm to humans and pets and discharge of a polluting leachate into the local Stewards Brook.

Remediation measures included the capping of the land with clean soils to prevent access to contaminated soils including a capillary break layer and the installation of a leachate collection system to prevent potentially polluting leachate from entering Stewards Brook. As a temporary measure the collected leachate was pumped and transported off site for disposal at a licensed Waste water treatment works (WwTW).

HBC were keen to install a long term sustainable and cost effective solution to treat the collected leachate once it was fully characterised. Following the commissioning of feasibility studies by Amec and Land and Water, including ARM Ltd, it was concluded that the most viable, cost effective and sustainable solution for managing the leachate was the use of aerated vertical flow reed beds for treatment of the leachate prior to discharge to sewer.

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CASE STUDY continued

St Michaels Golf Course

	Inlet			Discharge consents
	Minimum	Maximum	Average	Average
Flow rate (m^3/day)	19	91	48	–
BOD (mg/l)	–	–	38	<5
Suspended solids (mg/l)	–	–	107	<15
Ammonia (mg/l)	–	–	1.1	<1
Sulphide (mg/l)	5	93	19	<1
Sulphate (mg/l)	–	–	–	<1446

The flow and loads of the leachate to be treated are given to the left along with the consents to discharge to sewer set by the local Water Company.

Solution

If the leachate were to be discharged to the water course (Stewarts Brook) then an Arsenic consent would be enforced and an anaerobic first stage reed bed would be needed. Because the leachate can be discharged to foul sewer none is needed and the aerated vertical flow system will suffice.

The Key contaminant for removal in the leachate is sulphide though the BOD reduction also needed to be factored into the solution. The mechanism of action is oxidation of the sulphide to sulphate under aerobic conditions which would also support aerobic degradation of the BOD and ammonia. An aerated saturated vertical flow system was selected as the optimum treatment solution. This provides adequate aeration for oxidation as well as effective surface mixing of the anaerobic effluent into the aerated effluent within the bed. A 195m^2 reed bed was constructed to treat leachate collected in a holding tank on site and to discharge treated leachate into the local sewer.

Benefits

The installation of the aerated reed bed system provided a means of long term low maintenance; low carbon footprint leachate treatment on site saving the significant ongoing costs associated with tankering the leachate off site. Other benefits are listed below

- Economically viable due to the relatively low capital and operational costs
- An effective treatment with high durability and long term performance that will achieve an effluent that will comply with the Discharge Consent Compliance Criteria to foul sewer
- A sustainable treatment option which produces relatively little waste/by-product in-situ
- Low maintenance requirements
- Adjustable treatment to accommodate varying concentrations and throughput
- A fully warranted design with performance guarantees.

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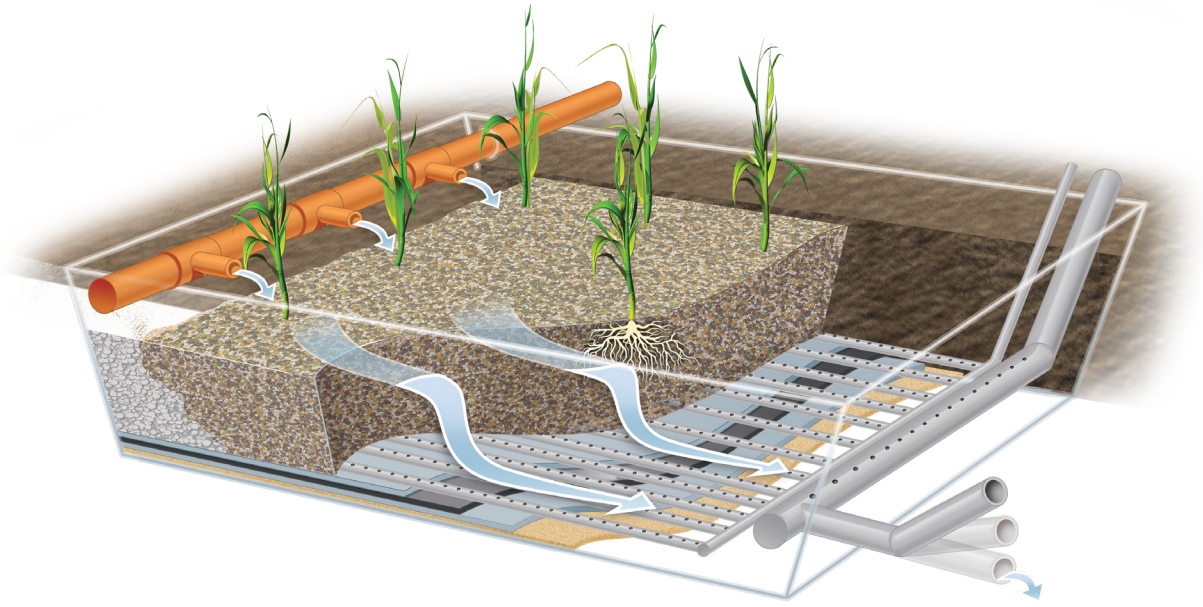
Forced Bed Aeration (FBA)

Forced Bed Aeration™ compliments and enhances existing reed bed technology, increasing treatment capacity by up to 15 times.

Forced Bed Aeration™ (FBA™) is a new wastewater treatment technology which enhances constructed wetland treatment performance. Significantly higher contaminant removal rates are attained along with an increased consistency of performance. Developed in the USA, by our partners Naturally Wallace, FBA™ can be used in both horizontal and vertical flow constructed wetland systems. Blowing air through the wetland system makes the system oxygen unlimiting increasing the treatment capacity by up to 15 times. This new technology can treat wastewaters high in BOD, SS, NH_4-N and other organic contaminants.

Forced Bed Aeration™ reed beds can reach performance levels which have been unobtainable in standard reed bed systems with less performance variability. Aeration of horizontal and vertical flow reed beds has multiple advantages.



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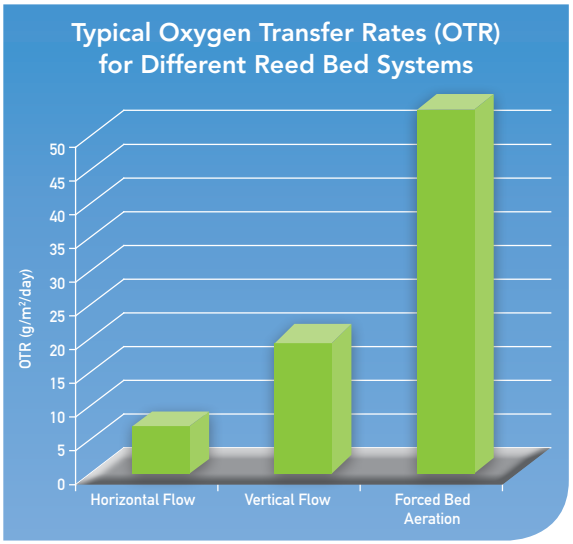
- FBA™ can completely nitrify wastewater
- FBA™ systems can be deeper than conventional reed beds therefore taking up 50% less space than passive systems.
- Plants thrive in FBA™ systems because the introduced oxygen prevents the formation of toxic products that can stunt plant growth in strongly anaerobic, passive system
- FBA™ reed beds can be divided into aerobic and anoxic zones to both nitrify and denitrify.
- FBA™ reed beds are ideal for treating fluctuating loads such as CSO's and locations with variable occupancy.
- Initial studies indicate FBA™ systems have reduced clogging rates extending the operational life of a treatment system.

Pipelines

FBA™ has a unique network of pipelines which provides a constant flow of oxygen into the reed bed. Patented rootguard technology prevents root rhizomes penetrating the emission points.

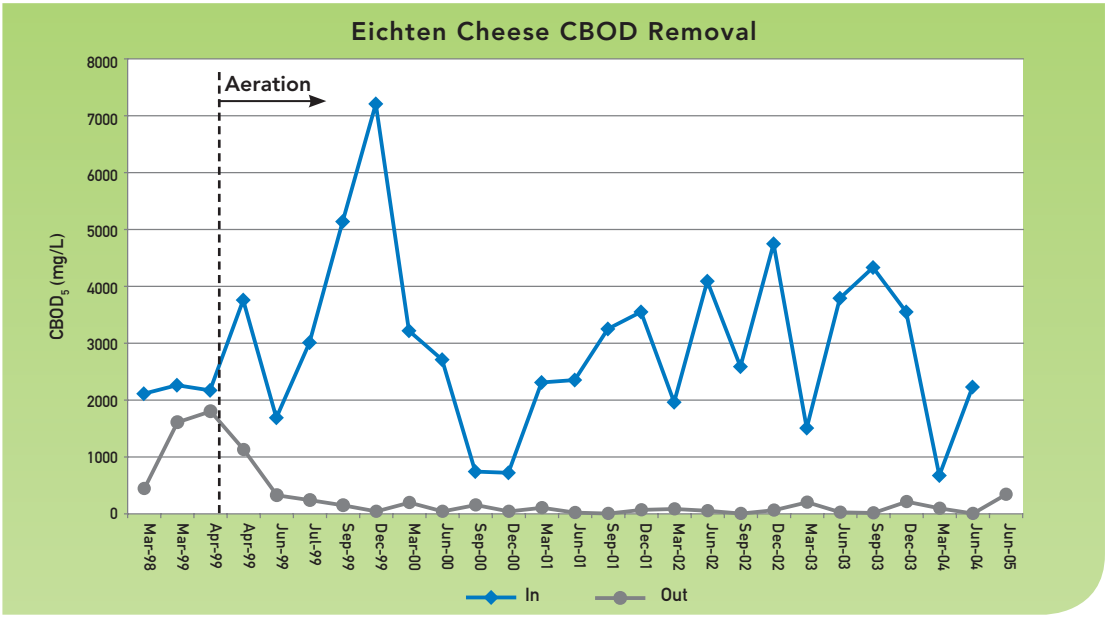
Adapting FBA™

FBA™ can be retrofitted to existing reed bed systems, especially those which are overloaded. This prolongs the life of the reed bed and enhance effluent treatment.



FBA™:

- Improves treatment capability.
- Reduces clogging rates.
- Requires minimum power input.



Graph indicating the treatment performance of an FBA™ wetland system treating cheese production effluent

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ARM Group Ltd

Asset Assessment & Support Package

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Knowledge and proactive management of assets is a key area where water companies can cut operational and capital expenditure. The optimisation and enhancement of remote reed bed treatment systems can secure performance for many years without the need for full site refurbishment and the associated costs.

In the September 2012 issue of *Water & Wastewater Treatment* it was reported by the editor that knowledge by the majority of water companies of the condition of their assets is poor. According to the report from the consultancy company E C Harris, some 90% of maintenance in the UK water industry is reactive. Yet it is well known that proactive maintenance will cut costs by upwards of 50%.

Although this is not the case with all water companies we thought it would be an ideal opportunity to offer a simple solution. ARM Ltd have been designing, constructing, refurbishing and retrofitting reed beds for many of the UK's water companies for decades. It is for this reason we feel best placed to offer you our new Asset Assessment and Support Package (**AASP**).

Reed beds are generally tucked away in Sewage Treatment Works and because they provide treatment with minimal maintenance requirements often get overlooked until the works are close to breaching consent. Our Asset Assessment and Support Package will highlight the condition of the system and give an indication of when refurbishment may be required. This allows expenditure to be planned and therefore controlled and ensures the works performs to its full capability.

Our Asset Assessment and Support Package works in two ways:

1. Asset Assessment

Visual Appraisal

- Condition of the reeds
- Extent of sludge build up on and in the gravel matrix
- Condition of the flow path
- Site layout and accessibility
- Photographic evidence

Fitness for Purpose

- Review design basis, 'as built' drawings and O & M Manual
- Review current and future loads and recent performance data

Monitoring program

- Sampling and monitoring program to include influent flows\loads and discharge levels to characterise performance

Reporting

- Verbal and written report of the assessment complete with conclusions, recommendations and indicative prices of any required remedial work

2. Support Service

- Asset longevity prediction
- Sampling and monitoring to establish performance
- Refurbish to 'as built'
- Re-engineering to improve performance
- Maintenance
- System operation
- Retrofit with latest technologies to enhance capability

We would be happy discuss any aspects of this service with you and can be contacted at info@armgroupltd.co.uk or telephone on 01889 583811.

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