Phragmifiltre®: Full sewage treatment by reed beds

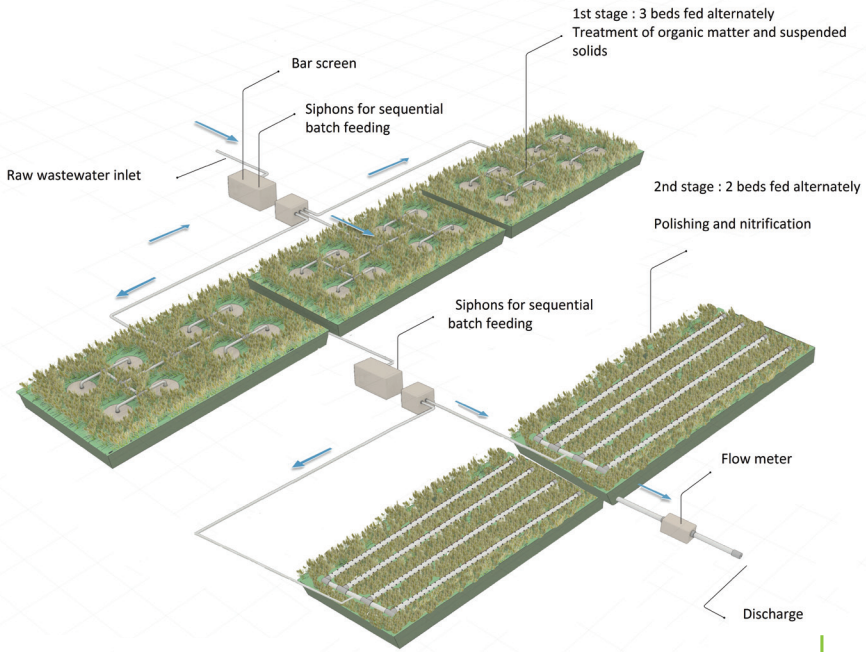
Phragmifiltre® exemplifies the rapid evolution of reed bed technology over the past 20 years, from the initial tertiary treatment application to the full treatment of sewage wastewater.





From their first application as a tertiary treatment, 'final polish', solution through secondary treatment, and nitrification, reed bed wastewater treatment systems are now widely being used for the full treatment of sewage all over the globe through the application of the **Phragmifiltre®** system.

The **Phragmifiltre®** system comprises vertical flow constructed wetlands (reed beds) for the full treatment of sewage and has been successfully operating in France through Epur Nature and SINT since the 1990's. To date there are over 800 **Phragmifiltre®** systems treating raw sewage from 20 to 5,000 PE (Population Equivalents). The systems are typically designed to have two stages. The first stage filters out and dewaters the solids in the raw wastewater on the surface of the bed. The filtrate passes down through the reed bed which acts as a typical batch flow vertical flow reed bed reducing BOD primarily but also undertaking nitrification



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epur nature SINT

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of ammonia. The second stage vertical flow beds provide additional BOD reduction and completes nitrification of ammonia prior to discharge. Wastewater, is fed to each bed in rotation thereby allowing all the beds to have a rest period. The use, where possible, of siphon technology for dosing both stages minimises, or even eliminates, power requirements.

	INLET CONCENTRATION (MG/L)		OUTLET CONCENTRATION (MG/L)		REMOVAL EFFICIENCIES (%)	
	Mean	SD	Mean	SD	Mean	SD
COD	651	282	50	29	92	7
BOD5	291	140	8	9	97	3
SS	242	133	8	6	97	3
TKN	56	34	7	12	90	12
TP	7	4	6	3	32	25

Typical treatment performance data from 70 plants

In the past the UK sewage treatment industry has tended to use constructed wetlands at the back end of the works as a sticking plaster solution for upstream process deterioration. The recent adoption of **Phragmifiltre®** by a major UK Water Company signifies a major step change in thinking and indicates recognition of the TOTEX benefits.

Conventional sewage treatment works (STW) generate sludges which have to be taken from small rural works to larger STW for treatment. **Phragmifiltre®** stores and composts sludge on site and therefore no tanker costs (opex) and no roadways (capex) are required. **Phragmifiltre®** also provides wildlife habitats that conventional STW do not. Conventional STW are hazardous areas and can be vulnerable to vandalism, they need security fencing around the whole site (capex). **Phragmifiltre®** only requires security fencing around a few chambers for safety. Conventional STW require weekly operator visits, compared to **Phragmifiltre®** which requires monthly visits (opex). **Phragmifiltre®** constructed wetlands are an ideal replacement for aging STW and an environmentally attractive, low totex option for new developments.



There is potential for this technology to be aligned with other intensive reed bed treatment technologies such as Forced Bed Aeration™ to enhance treatment capabilities further if required. The summary benefits of **Phragmifiltre®** are:

- Full primary, secondary and tertiary sewage treatment by reed beds.
- Proven robustness with high tolerance of temporary hydraulic overloading.
- Low to zero energy consumption
- Integrated sludge treatment, therefore no tankering and associated access features required.
- Simple operation
- Low cost operation
- Excellent integration into the landscape and no nuisance such as odours or noise.

ARM Ltd in association with **Epur Nature** and **SINT** in France are proud to be bringing this technology to the UK and happy to supply further information on request.

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CASE STUDY

Clabby

Phragmifiltre®: Full sewage treatment

PRIMARY SEWAGE

Project
Clabby

Location
County Fermanagh, Northern Ireland

Project type
New full treatment reed bed WwTW

Wastewater type
Raw domestic sewage

Treatment process
Phragmifiltre®: Full sewage/ sludge treatment

Need

A lack of headroom in the existing Wastewater Treatment Works (WwTW) in the rural village of Clabby was restricting planning applications and subsequent essential development of the rural community. In addition, tighter discharge consents were applied in 2013. The original WwTW was constructed in 2002 with Rotating biological Contactor (RBC) technology for a design population of 271. The population had risen to 450 putting the WwTW under stress and spatial constraints limited options to extend the existing process in its existing location. There was no further capacity at the nearest larger works at Fivemiletown, over 5km away. A new WwTW was needed at a different location and Northern Ireland Water's guidelines were to consider greener solutions, reduce energy demand and sludge transportation costs. Three options were considered; an Integrated Constructed Wetland, an upgraded RBC or a **Phragmifiltre®** solution. A feasibility study identified the first two options as being too land intensive and too costly respectively and so the **Phragmifiltre®** was chosen as the preferred solution.

PARAMETER	INFLUENT	CONSENT
Flow (m^3/d)	210 Average	699 Formula A
Biological Oxygen Demand (mg/l)	214	13
Ammonia (mg/l)	29	3
Total Suspended Solids (mg/l)	268	20

Solution

Phragmifiltre® systems comprise two stages of multiple vertical flow reed beds. The first stage consists of 3-4 reed beds which are operated alternately. These trap all the suspended solids on the surface of the reed beds and, through rotation of the beds, have a resting period between effluent dosing periods allowing the solids to dewater and compost /mineralise. The liquors pass down through the free draining reed bed media which removes soluble organic matter and ammonia through conventional means as an attached growth reactor. The liquors pass on to the second stage of reed beds where final polishing of the effluent occurs before discharge to the local water course. In this instance

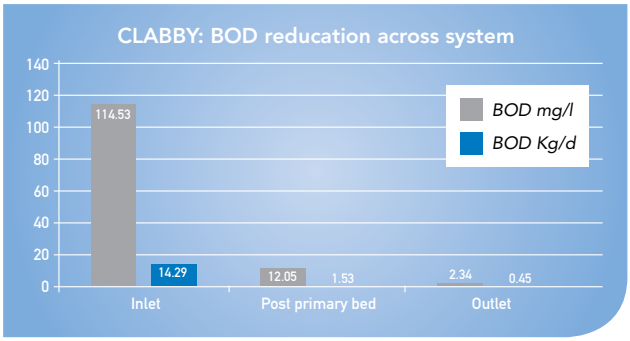


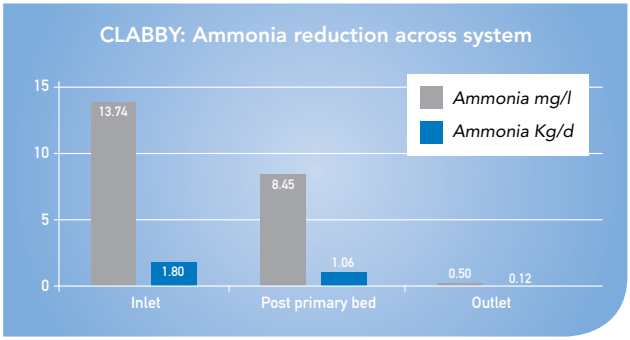


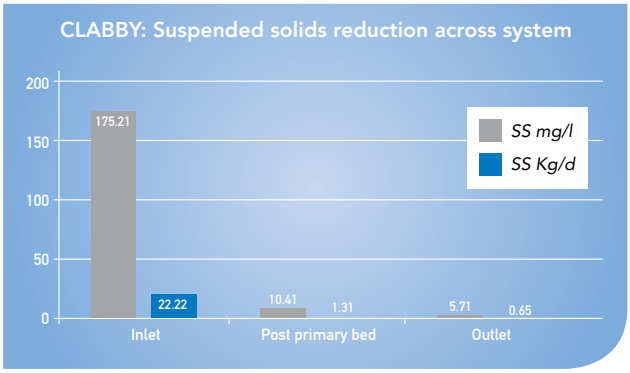
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CASE STUDY continued

Clabby







aerated reed bed technology was used for the second stage. Overall the system is very versatile and provides complete sludge management and secondary treatment on site eliminating sludge transportation costs as well as providing full treatment to the required discharge consents for the receiving water.

The design load was a 750 population equivalent. Ground conditions were challenging, comprising forest and peat which necessitated specialist civils construction knowledge supplied by local contractors. The system required a 0.2-hectare footprint. Local weather conditions informed design as well as a tight 3mg/l ammonia consent. The system is designed to treat flows up to Formula A so a stormwater management system is not required. Performance information is given on the left.

Benefits

The installation of a new WwTW comprising a **Phragmifiltre®** system provides the security of ongoing full sewage treatment to discharge consents for the village allowing essential development to support the community. The **Phragmifiltre®** system installed also offers the significant other benefits of full sludge management on site (no sludge transportation required), low whole life costs, low maintenance, low power consumption and will bring an element of enhanced biodiversity to its setting.





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