MI/NE2025

Phosphate and nitrate reduction *from* Marsh Industries

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1 Phosphate and nitrate reduction in off-mains sewage treatment

For over 20 years, Marsh Industries has led the way in off-mains sewage treatment, delivering solutions that meet BS EN 12566-3 standards. Growing concerns for the UK's natural environment and waterways have led to stricter regulations from Natural England over the past 4-5 years, targeting nitrate and phosphate reduction in wastewater.

These regulations align with the principle of **Nutrient Neutrality**, where nutrient loads from wastewater are mitigated to avoid impacting protected sites. Marsh Industries has responded by investing heavily in research and development to tackle these challenges, ensuring development projects can proceed sustainably.

Nutrient Neutrality is classified as follows:

- ✓ Development achieves nutrient neutrality when the nutrient load created through additional wastewater (including surface water) from the development is mitigated
- ✓ By designing development alongside suitable mitigation measures, additional nutrient loads can often be avoided or mitigated
- ✓ This approach is called 'nutrient neutrality'. It essentially allows developments to be permitted without impacting on the condition of protected sites

Source: Local Government Association Planning Advisory Service

Innovative phosphate reduction solutions

Marsh's latest advancements focus on achieving optimally low phosphate levels. Partnering with PIA Aachen in Germany, a leading testing house for off-mains solutions, Marsh developed a sustainable, chemical-free approach. This led to collaboration with Water Warriors in Kentucky, USA, whose expertise includes projects with the EPA, USDA, and OFWAT. The result is the Phos-Lite tertiary chamber, which uses Phos-Lite Pellets:

- ✓ Up to 96% phosphate removal
- ✓ Effluent phosphate levels as low as P Tot 0.2mg/l

The system combines the Marsh Nutra-Lite Sequential Batch Reactor (SBR) treatment plant with the Phos-Lite chamber. It is tested and certified for up to 50PE, while the Gem-APS system is recommended for larger applications, using safe levels of ferric and aluminium metals.

The Aqua-Puratine range

Marsh also developed the Aqua-Puratine range, which integrates intelligent chemical dosing with sewage treatment plants. The Aqua-Puratine-G-APS achieves 83.7% phosphate reduction, delivering effluent levels as low as P Tot 0.9mg/l when paired with the Aqua-Puratine-Ensign EL system.

Supporting information

This document outlines the functionality and performance of Marsh's solutions, along with supporting certifications and technical documentation. Stakeholders are encouraged to consider the UK Forward for Packaged Sewage Treatment Plants in EN12566 testing when evaluating systems.

2 Marsh Nutra-Lite SBR (Sequential Batch Reactor)

Natural, non-dosing solution

The Marsh Nutra-Lite is an advanced Sequential Batch Reactor (SBR) sewage treatment plant designed to enhance effluent quality for off-mains wastewater systems and significantly reduce biological nitrates.

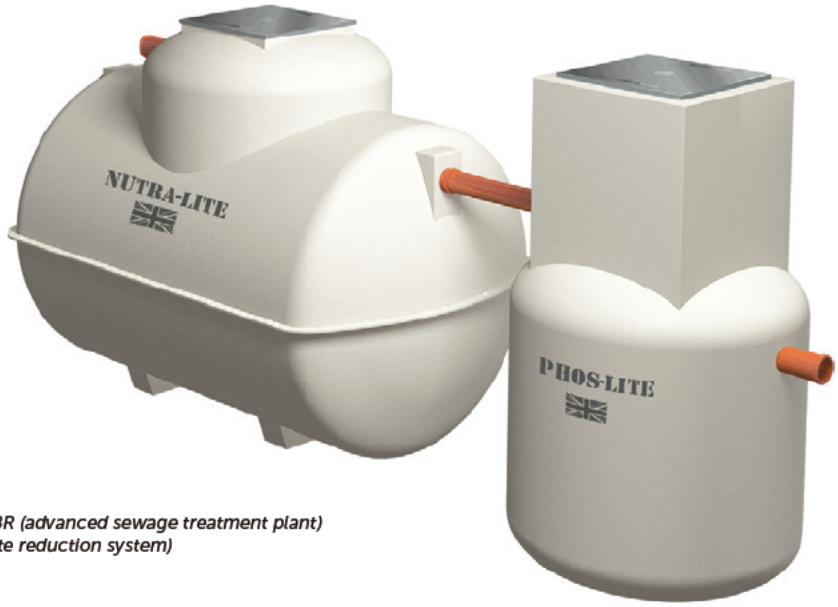


Figure 1
Combined Nutra-Lite SBR (advanced sewage treatment plant) and Phos-Lite (Phosphate reduction system)

The Nutra-Lite is available in capacities catering to sites for up to 50 people with state of the art technology and rigorously tested, the Nutra-Lite sets a new standard for sustainable wastewater management.

Boasting the highest overall discharge quality of any plant available today. A unique self-cleaning sediment reduction valve ensures total control over suspended solids. No mechanical parts provide reliability and efficiency.

The Nutra-Lite harnesses SBR technology, achieving an impressive 84% biological reduction in nitrates. Unlike other traditional methods, no chemicals or carbon are used – just biological processes.

Nutra-Lite not only excels in phosphate and nitrate removal but also significantly reduces other key effluent constituents:

COD	95.8%	33 mg/l
BOD	98.7%	4 mg/l
TNb	83.9%	11.1 mg/l
NH4n	99.1%	0.5 mg/l
Ptot	34.3%	6 mg/l
SS	97.1%	11mg/l

How does it work?

The Nutra-Lite system features two chambers: a primary chamber and an aeration chamber. Wastewater first enters the primary chamber. From there, the system runs through four distinct cycles:

1 **Fill** – Effluent moves from the primary to the aeration chamber
2 **Nitrification** – Air and bacteria facilitate nitrification
3 **De-nitrification** – The process mixes the water and starves it of oxygen
4 **Discharge** – Treated effluent is released

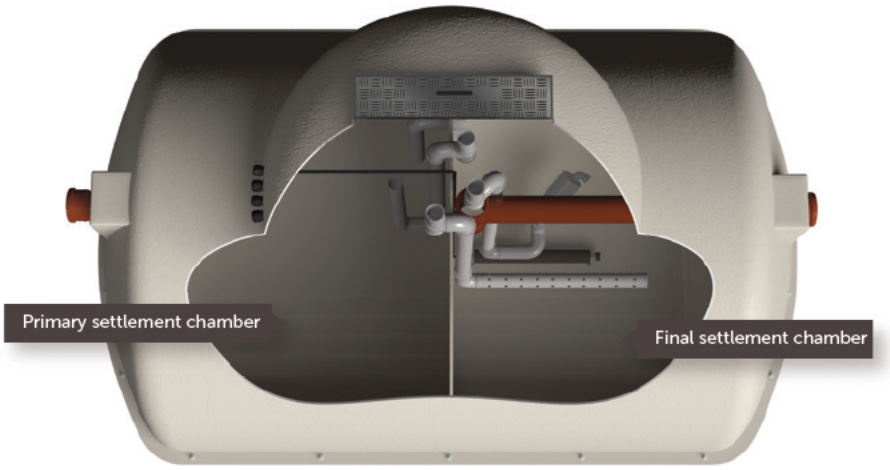


Figure 2
Nutra-Lite top view showing the two chambers

Additional sub-phases include settling and controlled sludge return, with an overflow function operating internally.

A single compressor powers the entire plant, managed by a bespoke controller that runs the process. The system is digitally enabled, with options for Wi-Fi and GSM connectivity, allowing remote monitoring, control, and programming. The low-power setup ensures energy efficiency, as it doesn't rely on continuous 24-hour aeration.

All Nutra-Lite plants feature bi-directional communication for maintenance and monitoring. Telemetry options include mobile connectivity or homeowner Wi-Fi/internet.

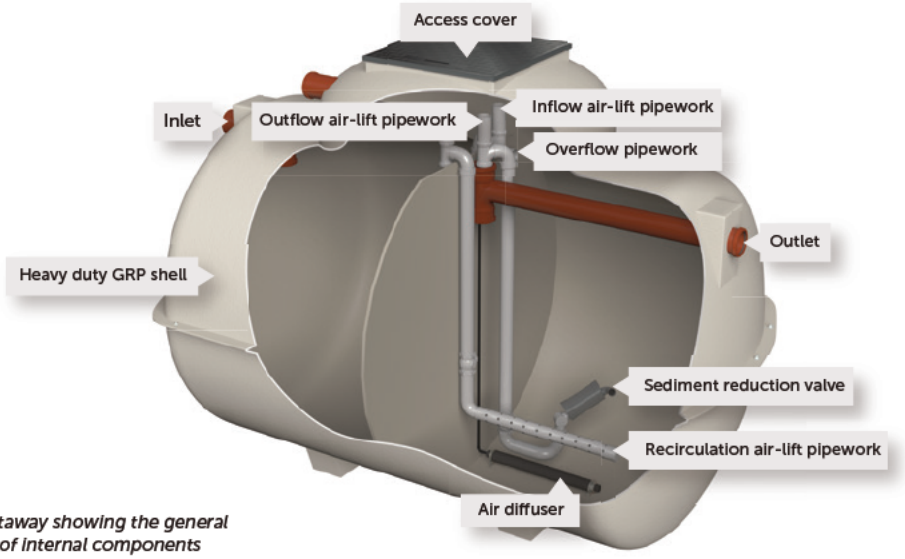


Figure 3
Nutra-Lite cutaway showing the general arrangement of internal components

Rigorously tested at the world-leading notified test centre PIA GmbH, in Aachen, Germany, the Nutra-Lite is certified to BS EN 12566-3 after 50 weeks of continuous testing. This system holds accreditation to EN12566-3 Annex B for systems of up to 50 Population Equivalent (PE) and complies with the UK Forward for BSEN12566-3, demonstrating its reliability and effectiveness.

3 Marsh Phos-Lite (Phosphate reduction system)

Natural, non-dosing solution

The Marsh Phos-Lite is a groundbreaking product designed to efficiently remove phosphate from wastewater. Utilising a unique adsorption process, Phos-Lite binds phosphorus to the surface of its media, which is composed of naturally occurring elements. This ensures long-term performance across varying flow rates and influent concentrations.



Figure 4
Combined Phos-Lite (Phosphate reduction system) and Nutra-Lite SBR (advanced sewage treatment plant)

Recommended for up to 35PE (population equivalent), Phos-Lite is fully scalable to meet larger demands. The plant is engineered for maximum retention time, guaranteeing stable, low effluent phosphorus concentrations certified by PIA GmbH at 0.2mg/l.

Phos-Lite not only excels in phosphate removal but also significantly reduces other key effluent constituents.

The Marsh Nutra-Lite treats effluent to the following standards:

BOD	4mg/ltr
Suspended Solids	11mg/ltr
Ammonia	0.5mg/ltr

When the Marsh Nutra-Lite and Marsh Phos-Lite are combined, the effluent quality is further improved to:

BOD	1.62mg/ltr
Suspended Solids	4.3mg/ltr
Ammonia	0.38mg/ltr
PTot	0.26mg/ltr
TNb	10.5mg/ltr

Test results achieved when combined with the Marsh Ensign:EL

COD	56.1%	23 mg/l
BOD	59.5%	4 mg/l
TNb	5.5%	26.5 mg/l
NH4n	24%	0.4 mg/l
Ptot	95.9%	0.2 mg/l
SS	61.1%	4 mg/l

Designed to retain up to 8.5kg of phosphorus in a 6PE domestic plant (British Water Flows and Load 4), the Marsh Phos-Lite offers reliable performance. Media performance will be assessed at pre-determined intervals and replaced if necessary. The longevity of the media will be influenced by the actual flows and loads entering the plant.

The plant uses Phos-Lite Pellets, a natural mineral media, to reduce phosphate levels, simplifying operations and reducing the environmental impact of chemical use.

The non-dosing approach minimises the need for maintenance and chemical adjustments, leading to further cost savings.

By achieving phosphate levels as low as 0.2mg/l, the plant ensures compliance with the tightest environmental standards, allowing water companies to meet regulatory obligations.

The plant is designed for seamless integration into existing systems, making it versatile for new installations and retrofits.

How does it work?

Effluent from the sewage treatment plant enters the Phos-Lite system, first passing through a nanofiltration device (technology that is also used in the Marsh Marator oil separator range).

The filtered effluent then moves into the primary chamber, where a pump periodically pushes water through Phos-Lite Pellets. These pellets absorb phosphates by binding phosphorus to their surface. The process is optimised within a water column, ensuring maximum contact time with the media.

Marsh Industries is the sole provider in the UK wastewater market with access to these specialised pellets. These pellets can also be used for phosphate reduction in other settings, such as surface water runoff on highways or discharge to lakes.

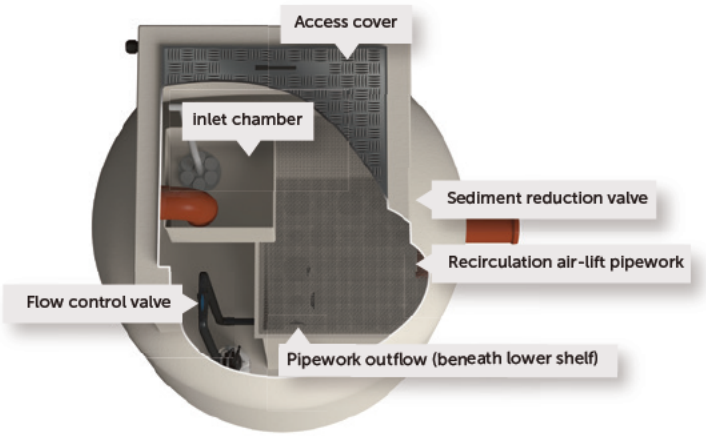


Figure 5
Phos-Lite top view showing the two chambers

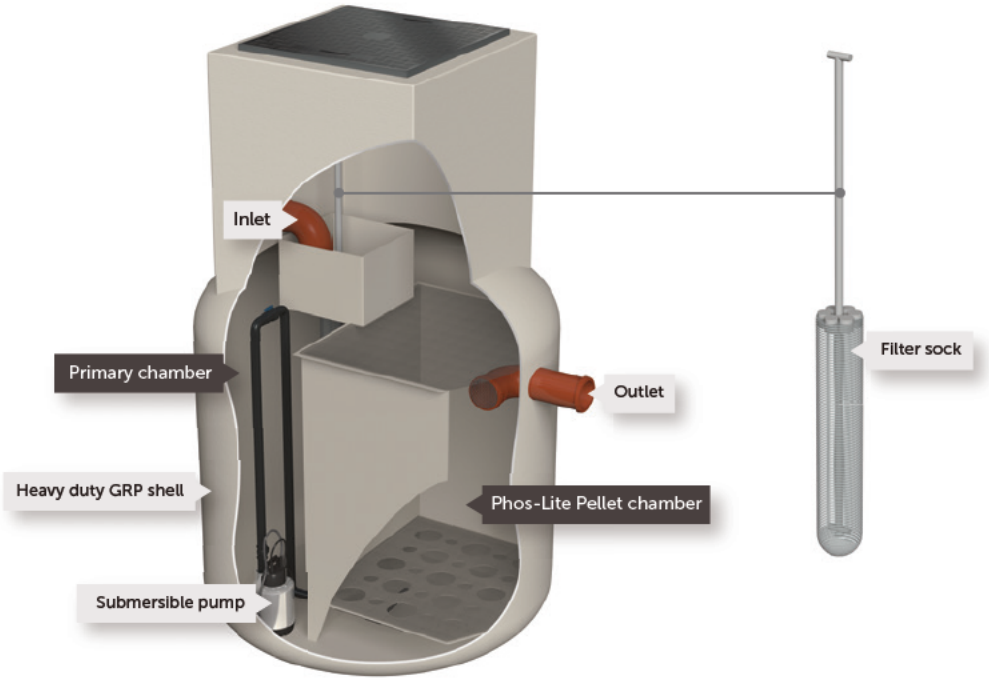


Figure 6
Phos-Lite cutaway showing the general arrangement of internal components

4 Marsh nutrient removal technology

Marsh industries offers enhanced capability wastewater treatment through its Aqua-Puratine-EL environmentally low impact process, combined with the Marsh Aqua-Puratine-G-APS intelligent controlled dosing system (Figure 7). The combination of treatment processes in each unit delivers highly effective reduction of ammonia, nitrate and phosphate as well as suspended solids and biological oxygen demand (BOD).

The process has been devised to help reduce the requirement for offsetting where new buildings are in 'Natural England' (NE) designated 'Nutrient Neutrality' (NN) areas and where tighter consent to discharge is applied.



Figure 7
Combined Aqua-Puratine-EL (environmentally low-impact sewage treatment plant) and Aqua-Puratine-G-APS (Aerated Precipitation System) provides enhanced nutrient removal

The Marsh Aqua-Puratine-EL delivers effective wastewater treatment through settlement of solids in its primary chamber, followed by aerobic biological treatment through natural biofilms supported on moving, inert media in the biozone, and settlement of excess biomass in the final chamber. Marsh has exclusive access to a biofilm support media that provides very high efficiency nitrification, for example the removal of ammonia delivering low concentrations of 1mg/l ammonia-N in the final effluent. At the same time, partial denitrification is achieved through simultaneous nitrification/denitrification to reduce the final effluent nitrate concentration.

The treatment performance of Aqua-Puratine-EL is accredited to EN12566-3 Annex B through testing with Prüfinstitut fur Abwassertechnik (PIA) GmbH, Aachen, Germany for wastewater treatment systems up to 50 PE (See Appendix C).

The Aqua-Puratine-G-APS has been developed by Marsh Industries to further improve effluent discharge standards for off-mains wastewater treatment plants. This tertiary treatment unit is primarily designed to reduce phosphate discharge to reduce eutrophication in rivers and lakes but also provides additional removal of BOD and chemical oxygen demand (COD).

The treatment performance of the Aqua-Puratine-G-APS is accredited to EN12566-3 Annex A, through testing with Prüfinstitut fur Abwassertechnik (PIA) GmbH, Aachen, Germany, for wastewater treatment systems up to 50 PE (See Appendix D).

Where there is a requirement to meet tighter discharge consents for nutrients, ie, phosphorus and/or total nitrogen, Marsh recommends deployment of the Aqua-Puratine-EL in combination with the Aqua-Puratine-G-APS. This system shows a significant reduction in phosphate and total nitrogen compared to Natural England (NE) default values for septic tanks and standard package treatment plants (PTPs) (See table 1).

Parameter	NE default for septic tanks	NE default for PTPs	Marsh Aqua-Puratine-EL and G-APS
Phosphate (mg/l)	11.7	9.7	0.9
Total nitrogen (mg/l)	96.3	72.9	Up to 28

Table 1
Nutrient removal performance of off-mains sewage treatment plants

5 Marsh Aqua-Puratine-EL (Environmentally low impact)

The Marsh Aqua-Puratine-EL is designed to reduce pollutants in domestic wastewater, including ammonia and nitrates, to an acceptable standard for discharge into a watercourse, ditch or drainage field. This capability is delivered through a combination of primary settlement, Marsh's unique moving bed biofilm reactor (MBBR) technology, followed by final settlement (Figures 8 and 9). These processes are combined in a single robust glass reinforced plastic (GRP) tank divided into four chambers. Approximately 40% of the volume is for primary settlement followed by a two-stage biozone, comprising 40% of the volume with 20% for final settlement. The effluent process follows this sequence as more wastewater enters the plant by gravity.

These proportions are maintained when a plant needs to be divided into multiple tanks due to geology, ground conditions or practical installation requirements. They can also be combined with tertiary treatment into a single tank, meeting all relevant and standard certifications using certified individual processes. A pump can be installed in the final settlement zone so that final effluent can be discharged to the environment or subsequent tertiary treatment when circumstances make gravity discharge impractical.

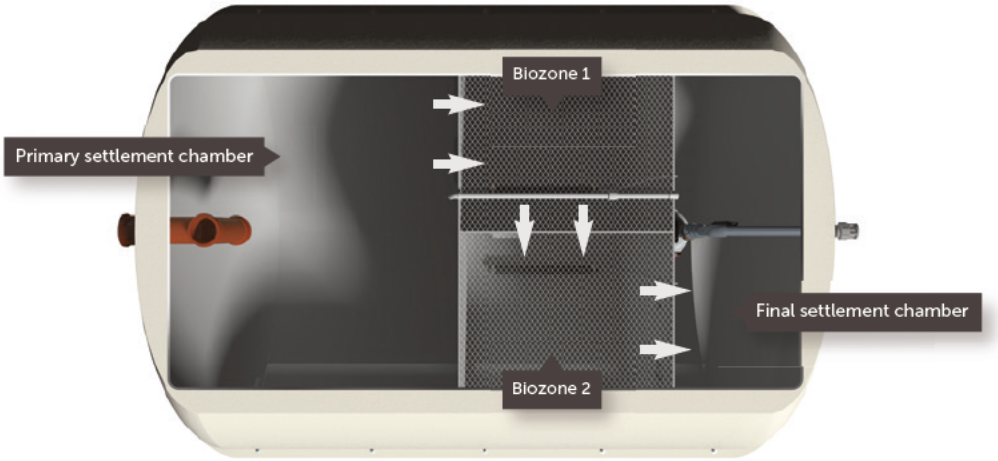


Figure 8
Aqua-Puratine-EL top view showing the four chambers

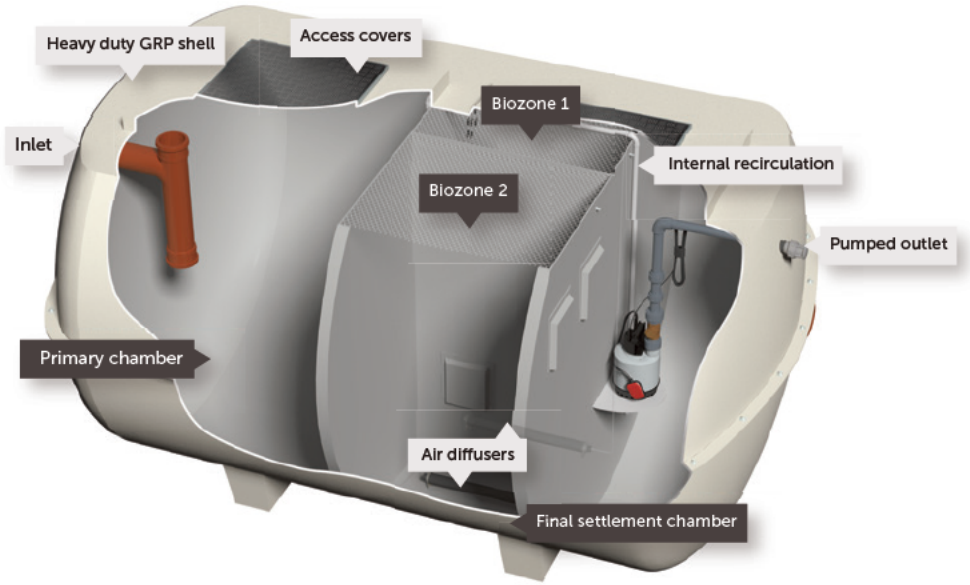


Figure 9
Aqua-Puratine-EL 3D cutaway showing the general arrangement of the four chambers and internal components

The overall design of the Aqua-Puratine-EL is based upon the UK Government endorsed British Water flows and loads for domestic wastewater treatment under the General Binding Rules. These standards provide robust guidelines so that treatment plants meet the required environmental standards, with a margin of safety, and have been agreed by the Environment Agency (EA), the Scottish Environmental Protection Agency (SEPA) and the Northern Ireland Environment Agency (NEIA).

Reference
https://www.gov.uk/guidance/general-binding-rules-small-sewage-discharge-to-the-ground#bs
https://www.britishwater.co.uk/page/publications#wastewater%20treatment%20plant%20publications

6 Marsh Aqua-Puratine-G-APS (Intelligent Controlled Dosing)

Designed and developed by Marsh Industries, The Aqua-Puratine-G-APS is a controlled chemical dosing system for the removal of phosphates for off-mains sewage treatment plants. The correct amount of chemical infusion is ensured when dosing is only initiated when there is flow to the Aqua-Puratine-G-APS. In this way, the amount of Aluminium or Ferric dosed matches the influent phosphate load and avoids wasteful and potentially harmful overdosing of the chemical.

Primarily developed to reduce phosphate discharge, the Aqua-Puratine-G-APS also provides polishing treatment through further reduction of COD and BOD. The Aqua-Puratine-G-APS can be sized for use in conjunction with any correctly sized sewage treatment plant to improve effluent discharge quality.

The Aqua-Puratine-G-APS consists of two equal sized chambers (Figure 10). The primary chamber receives effluent from the previous sewage treatment process along with the correct chemical dose. Aeration ensures that there is good mixing to provide efficient phosphorus removal. The second stage provides settlement to remove the precipitated phosphorus and residual biosolids.

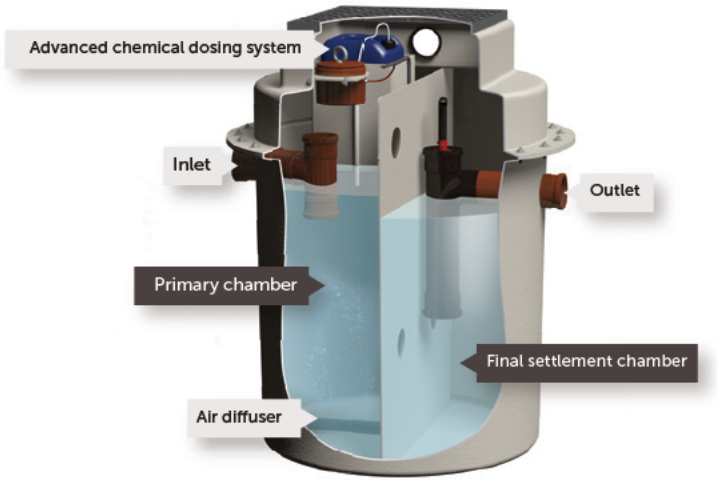


Figure 10
Aqua-Puratine-G-APS 3D cutaway showing two chambers

Key to the system's performance is control and automation. Marsh Controls and Marsh Alarms use industrial quality aeration and dosing timers in addition to high quality peristaltic pumps. This superior functionality avoids problems from siphoning and capillary dosing during operation.

The pumped outlet of the preceding sewage treatment plant is monitored by the control panel and doses the chemicals accordingly. If an existing plant uses gravity discharge, a small intermediate pump chamber is installed. This allows for an accurately measured dose of chemicals to be added when the pump chamber is emptied to the Aqua-Puratine-G-APS. It also ensures that, if the homeowner is not present for a day, weekend, or longer, no chemicals are applied. This unique feature eliminates the need for homeowner intervention during absences.

Unlike other products currently on the market that add chemicals continuously at a fixed rate, the Marsh intelligent control

system adjusts dosing based on the inflow. In the case of a homeowner being absent for days or weeks, other systems will continue to dose chemicals. This will result in increased residual concentrations of metals in the effluent that can be hazardous to children, wildlife and the environment. The Aqua-Puratine-G-APS eliminates these concerns by only delivering the chemicals when there is inflow. Furthermore, if the monitored pump stays on, or develops a fault for any reason, dosing will be turned off, as the control panel will withhold dosing for a specified period.

Although the Aqua-Puratine-G-APS can reduce phosphate to less than 1 mg/l, the application of chemicals can be adjusted for phosphate discharge levels that are less strict. This allows for a reduction in the long-term chemicals. Additionally, the Aqua-Puratine-G-APS is energy efficient requiring only 1 kWh per day of electricity.

In summary, there are a number of features to ensure that chemical dosing is carried out correctly to meet the requirements of the Environment Agency and Natural England:

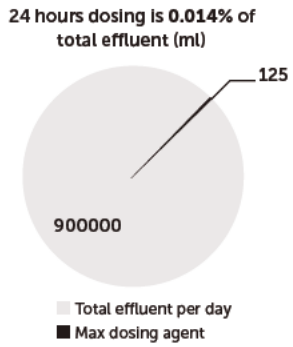
- ✓ Dosing is flow-weighted to ensure that the correct amount of chemical is added and that metal residuals are minimised
- ✓ The Aqua-Puratine-G-APS intelligent dosing system was tested in conjunction with the Marsh Ensign: EL at PIA in Germany
- ✓ The Aqua-Puratine-G-APS was tested using alum as the coagulant, as residual consents are generally stricter for alum. Iron can be used if preferred by the Regulatory Body. Either coagulant can provide the stated efficiency
- ✓ All Aqua-Puratine-EL and Aqua-Puratine-G-APS combinations have a GSM/2G/4G monitoring alarm to notify Marsh and the home owner in the case of a fault

Outstanding benefits

Marsh has combined technology, reporting, monitoring, and maintenance to produce the safest and most comprehensive treatment processes for water treatment in the UK.

- ✓ Natural England and/or the Regulator should be consulted when installing the Aqua-Puratine-EL and Aqua-Puratine-G-APS, as this could result in major reductions in mitigation for the builder/developer
- ✓ The Aqua-Puratine-EL and Aqua-Puratine-G-APS reduces phosphate levels and has extremely low Ammonia discharge results, protecting rivers, waterways, and wildlife
- ✓ The Aqua-Puratine-EL and Aqua-Puratine-G-APS provides excellent performance for the reduction of COD (chemical oxygen demand) and BOD (biological oxygen demand), to avoid eutrophication in rivers and lakes
- ✓ The Aqua-Puratine-EL and Gem were tested and certified by PIA (Prüfinstitut für Abwassertechnik)
- ✓ The Aqua-Puratine-G-APS can also be used in conjunction with any sewage treatment plant* to improve effluent discharge quality
- ✓ The Aqua-Puratine-G-APS control panel monitors the inflow from the sewage treatment plant with alarm systems and applies the measured chemical accordingly, which is a main concern of Natural England
- ✓ Aqua-Puratine-G-APS is designed with the additional safeguard that if there is no influent flow, there will be no dosing
- ✓ The homeowner and/or Marsh are alerted when additional iron or chemical is required
- ✓ The Aqua-Puratine-G-APS reduces phosphates to less than 1mg/L, but Marsh Controls allow the chemical to be adjusted where phosphate discharge levels are less strict, thus reducing the long-term cost of chemicals
- ✓ The Aqua-Puratine-G-APS is also very efficient, requiring only 1kWh/day of electricity
- ✓ The Aqua-Puratine-G-APS intelligent dosing system was tested in conjunction with the Marsh Aqua-Puratine-EL plant at the notified test house PIA in Germany

** Marsh will need to know the measured discharge in litres per day to ensure the correct Aqua-Puratine-G-APS unit is sized. Based on a functional BSEN12566-3 compliant product.*



The table below provides effluent standards as tested and certified by PIA:

	Aqua-Puratine-EL Efficiency	Effluent	Aqua-Puratine-G-APS Efficiency	Effluent
COD	92.2%	63mg/l	57.6%	24mg/l
BOD	95.6%	14mg/l	75.8%	2mg/l
TNb	53.5%	28mg/l	11.5%	18mg/l
NH4-N	97.8%	1.0mg/l	21.1%	0.4mg/l
Ptot	28.7%	5.4mg/l	83.7%	0.9mg/l
SS	94.5%	21mg/l	30.4%	14mg/l
Accreditation	EN12566-3 test Annex B		EN12566-7 test Annex A	

For optimum total process results above 25PE, the Aqua-Puratine-G-APS can be combined with the Nutra-Lite SBR sewage treatment plant to achieve the following effluent quality:

	Nutra-Lite Effluent	Aqua-Puratine-G-APS Effluent
COD	33mg/l	14mg/l
BOD	4mg/l	0.97mg/l
TNb	11.1mg/l	9.8mg/l
NH4-N	0.5mg/l	0.4mg/l
Ptot	6mg/l	0.98mg/l
SS	11mg/l	7.7mg/l

Achieving BOD below 1mg/l alongside TNb of just 9.8mg/l.

Natural England and/or the Regulator should be consulted when installing the Nutra-Lite and Aqua-Puratine G-APS, as this could result in major reductions in mitigation for the builder/developer.

7 Testing

The following tables provide an overview of the basic specifications, which are calculated based on a loading of 150 litres per person per day and scaled for the range.

The figures are derived from recognised flows and loads for domestic sewage treatment plants.

The sizing of the plants is determined by the working volumes of the existing certified range of Ensign Standard and Ensign Shallow plants.

The tested system was based on a Marsh Ensign:Shallow model that incorporates a Polylok Filter. However, depending on the specific application, a Polylok filter may not be required.

Aqua-Puratine-EL EN12566-3 test Annex B

Please note the testing and certification as dated on the certificates.
See Appendices C and D

Treatment Plant Providing Effluent	PIA Municipal
Load Capacity	900 Litres / Day
BOD	300 Grams / Day
BioMedia	Warden Biopebble
Aqua-Puratine-EL	System 408B25
Tank Capacity (working)	3630 Litres
Air Compressor	2 x 60 Litres / Minute

Effluent Quality Achieved	Efficiency	Effluent
COD	92.2%	63mg/l
BODs	95.6%	14mg/l
TNb	53.5%	28mg/l
NH4N	97.8%	1.0mg/l
Ptot	28.7%	5.4mg/l
SS	94.5%	21mg/l

The certificate confirms the performance of the Aqua-Puratine-EL according to the EN 12566-3 standard giving an effluent 'TNb' concentration of 28 mg/l.

The total nitrogen bound (TNb) is the total concentration of nitrogen compounds as defined by the German Institute of Standardisation (DIN EN 12260:2003). This measure, usually quoted in the UK as total nitrogen (TN) includes nitrogen that appears in the form of ammonia, ammonium salts, nitrites, nitrates, and organic nitrogen compounds (nitrogen that would be present in proteins and other natural compounds).

The Aqua-Puratine-EL uses Marsh's proven moving bed biofilm reactor (MBBR) technology (described as fluidised technology on the certificate) with a new design of support media, for which Marsh has exclusive access. This media provides an improved architecture for biofilm attachment that gives the excellent ammonia removal. This is shown by the effluent ammonia-nitrogen (NH4-N in the certificate) concentration of 1 mg/l. The ammonia removal performance of 97.8% is excellent, with almost all the ammonia expected to be converted to nitrate, with very little or no nitrite.

The certificate indicates that denitrification is also occurring, with TN removal of 53.5 % (without denitrification, the effluent TN would be a maximum of 60.2 mg/l). Denitrification is the conversion of nitrates to nitrogen gas, effectively removing the nitrogen from the effluent.

Therefore, the maximum effluent nitrate concentration will be 27 mg/l, ie, the measured TN of 28 mg/l minus the ammonia-N of 1mg/l in the effluent. The effluent nitrate will be less than 27 mg/l as there will be some organic nitrogen present contributing to the TN.

Aqua-Puratine-G-APS EN12566-7 test Annex A

The Aqua-Puratine-EL has also been tested in combination with the Aqua-Puratine-G-APS phosphate reduction unit. The certificate, Aqua-Puratine-G-APS, shows the following additional performance when installed with the Aqua-Puratine-EL range.*

The Aqua-Puratine-G-APS is designed to further reduce phosphates, ammonia and BOD from wastewater that has been previously treated in a domestic sewage treatment plant. Tested in accordance with BS EN 12566-7 Annex A at PIA GmbH it offers excellent tertiary treatment performance in a small footprint.

Effluent Quality Achieved	Efficiency	Effluent
COD	57.6%	24mg/l
BODs	75.8%	2mg/l
TNb	11.5%	18mg/l
NH4N	21.5%	0.4mg/l
Ptot	83.7%	0.9mg/l
SS	30.4%	14mg/l

8 Health and safety

These instructions are provided to ensure your safety. Please read them carefully before installing or using the equipment. It is crucial to retain this document with the system for future reference and include it in any on-site maintenance process description for cleaning and planned maintenance.

In the event of a site ownership transfer, the responsible individual must ensure that all relevant documentation is transferred as well, allowing the new owner to become familiar with the equipment's operation.

- ✓ Installation should only be performed by a qualified contractor. Any electrical work must be carried out by a certified electrician. We strongly recommend the use of protective workwear, including eye protection, dust masks, and gloves, when cutting GRP components, handling pipework, and working with aggregates.
- ✓ Contaminated surface water may contain substances that are harmful to human health, so it is important to observe good hygiene practices.
- ✓ Consideration should be given to selecting the appropriate access cover. The choice of covers should consider the unit's location and the expected traffic loads in the local area. The Marsh Ensign Standard and Shallow range of plants are supplied with a pedestrian duty access cover as standard.

- ✓ If your unit is not equipped with the optional Marsh turret guard, take precautions to prevent falls into the unit when removing covers.
- ✓ Adhere to all local and legislative health and safety requirements.
- ✓ Ensure that you are familiar with the working area and make sure the site's responsible individual is aware of your work. Document a Safe System of Work, and it may also be necessary to obtain a permit to work.

9 Maintenance

Correct and timely maintenance is crucial for the correct operation of the system. It is important not to solely rely on alarms to indicate when emptying or maintenance is required. Regular visual inspections of the system should be conducted, and a functional test of any installed alarm system should be performed periodically.

The removal of any waste should be carried out by a licensed waste carrier. You can obtain a list of licensed waste carriers from your local authority.

10 Handling and storage

Upon delivery, ensure that the unit is placed in a safe location before installation. Keep in mind that the centre of gravity of the unit may not be at the centre of the tank. This risk increases as the size of the system increases, so it is crucial to take great care to ensure the stability of the unit during lifting.

- ✓ Note that if the unit has been stored on-site for an extended period before installation, water may accumulate inside, which can add to its instability.
- ✓ When lifting, do not use chains around the body of the unit. Instead, use a spreader bar to ensure stability during the lift and to distribute the load evenly. Use a spreader bar when slings are at an angle of less than 30 degrees from vertical.
- ✓ Select lifting equipment based on the weight and size of the unit, as well as the required lifting distance on-site. Marsh Industries does not accept responsibility for the selection of lifting equipment.
- ✓ When stored on-site, the unit must be placed on a flat, level ground that is free from risks of impact damage or piercing.

11 Site planning

Consider the following points before installing the equipment:

- ✓ The outfall from the unit must have consent from the relevant local authority and/or Environment Agency.
- ✓ The installation should have Planning and Building Control approval.
- ✓ Consider the use of manual or automatic cut-off valves upstream and downstream of the unit to isolate the system during emergencies or maintenance.
- ✓ Exclude roof water from the system.
- ✓ Assess ground conditions and water table levels.
- ✓ If the discharge is to a soakaway (for class 1 units only), conduct a percolation/porosity test as part of the assessment for suitability of sub-soil drainage. Refer to Part H of Building Regulations for further information.
- ✓ Allow at least 1 meter of clear, level ground around the access covers for routine maintenance.
- ✓ Ensure that a mains water supply is accessible for routine cleaning and refilling the unit after waste material and liquid removal.
- ✓ Provide an electrical supply for the system.

12 Installation procedure

- ✓ When designing the concrete backfill, consider specific site conditions, and ensure it can withstand any applied loads during and after installation to prevent the tank from being subjected to excessive stress.
- ✓ If the excavation cannot maintain a vertical wall safely, use a suitable trenching sheet system and bracing to shore up the sidewalls and maintain a vertical wall throughout the excavation.

- ✓ Do not remove the shoring system completely until the backfill is complete, but before the concrete fully hardens.
- ✓ In areas where the water table is above the bottom of the excavation or flooding is possible, use an appropriate pumping method to dewater the excavation.
- ✓ During installation, take care to uniformly support the body of the unit to avoid placing excessive "point loads" on the unit.
- ✓ Excavate a hole with sufficient length, width, and depth to accommodate the tank, along with a minimum concrete surround thickness of 225mm.
- ✓ Consider the depth of the unit, concrete base slab, haunch, and proposed inlet invert depth.
- ✓ Construct a suitable concrete base slab that matches the site conditions and ensure it is flat and level.
- ✓ Once the concrete base slab is set enough to support the unit, lay a concrete haunch on the cast slab to provide even support beneath the unit.
- ✓ Lower the unit onto the haunch using appropriate lifting equipment.
- ✓ Ensure that the unit is level after installation to facilitate correct operation of the internal components.
- ✓ Pour approximately 300mm of clean water simultaneously into each chamber of the unit. Do not overfill.
- ✓ Pour concrete backfill to a depth of approximately 300mm beneath and around the tank, ensuring good compaction to eliminate voids. Do not use vibrating pokers.
- ✓ Ensure a continuous pouring of concrete backfill, while maintaining the internal water level no more than 300mm above the backfill level at all times. Continue this process until the backfill reaches a level slightly below the underside of the outlet connection, allowing sufficient space for connecting the inlet and outlet pipework.
- ✓ Connect the inlet and outlet drains and vent pipes when safe access to the backfill is possible. If the inlet and outlet pipework are not immediately compatible with the fittings on the unit, you can use proprietary flex seal couplings.
- ✓ Continue backfilling with concrete over the tank body until reaching the required level.
- ✓ Build up a shell of concrete with a minimum thickness of 225mm around the access shaft(s).
- ✓ Temporarily brace the access shaft to prevent distortion.
- ✓ In areas with traffic, construct a suitable top slab that rests on a suitable foundation to prevent superimposed loads from being transmitted to the unit and access shafts.
- ✓ Loads applied to covers and frames should bear on the top slab, not the access shaft.
- ✓ Fill the unit with clean water up to the invert level of the outlet pipe.
- ✓ Place or mark the unit identification inside the neck for future reference.

13 Waste removal and servicing

- ✓ The frequency of waste removal (desludging) depends on the influent quality and the required effluent quality.
- ✓ Adjust the desludging frequency to ensure optimal performance of all tanks, considering any changes in sludge generation at each visit.
- ✓ Maintain a log documenting any waste removal or cleaning activities.
- ✓ Inspect the volume of waste accumulated at least every 6 months as a minimum requirement.
- ✓ If alarm probes are fitted, remove, and clean them with water whenever waste material is removed.

14 Desludging procedure

- ✓ Isolate the unit and ensure no flow enters the system.
- ✓ Temporarily turn off and electrically isolate the control panel to pause dosing and aeration.
- ✓ Secure the area to prevent access by animals and children and remove the access cover.
- ✓ Lower the desludging hose to the base of the tank and empty the unit of any accumulated sludge. Remove only the necessary amount of water and avoid removing any bio-media.
- ✓ Remove, inspect, and clean any filters. Replace them if necessary.
- ✓ Ensure access to and clean all compartments.
- ✓ If an alarm probe is fitted, remove it, clean it with water, and then replace it.
- ✓ Turn on the compressor(s) and check that aeration continues.
- ✓ Verify the functionality of any pumps.
- ✓ Refill the system (all tanks) with clean water up to the outlet level.
- ✓ Securely replace any covers or guards and check the security of any locks that are fitted.

Appendix A

Nutra-Lite test certificate



Certificate

Nr. 420.01C03

MI Nutra-Lite

Plant with active sludge in Sequencing Batch Reactor (SBR) and primary settlement

Marsh Industries Limited
Units 3-13 Addington Park Industial Est., NN14 4AS Northants, UK

EN 12566-3:2005+A2:2013, Annex B: Treatment efficiency test
Small wastewater treatment systems for up to 50 PT – Part 3: Packaged and/or site assembled domestic wastewater treatment plants

Detailed results and information on the test are provided in test report PIA2024-420B06.

Extract of performance details (EN 12566-3, Annex B: Treatment efficiency test)

Organic daily load (influent, nominal)	0.20 kg BOD_5/d	
Hydraulic daily load (nominal)	0.6 m^3/d	
Treatment efficiency (nominal)	Efficiency	Effluent
COD	95.8 %	33 mg/l
BOD_5	98.7 %	4 mg/l
TN_b*	83.9 %	11.1 mg/l
NH_4-N*	99.1 %	0.5 mg/l
P_{tot}	34.3 %	6.0 mg/l
SS	97.1 %	11 mg/l
Electrical consumption (nominal)		0.7 kWh/d
Number of desludging (30 weeks testing EN 12566-3 without desludging)		2 after 30 week test cycle
Number of maintenance operations during the test (without start-up phase)		0

* determined for temperatures ≥ 12° C in the bioreactor

Tested by:
PIA – Prüfinstitut für Abwassertechnik GmbH
Hergenrather Weg 30
52074 Aachen, Germany

This certificate is for information purposes or
replaces neither the related test report nor th
declaration of performance or the CE marking
The results relate only to the tested object.

[redacted]

Notified Body
No.: 1739

Certified according to
ISO 9001:2015

Appendix B

Phos-Lite test certificate

Certificate

Nr. 469.01C1

MI Phos-Lite

Module for chemical-physical after-treatment of sewage, tested in combination by use of a gravity operated plant



Marsh Industries Limited
Units 3-13 Addington Park Industial Est., NN14 4AS Northants, UK

EN 12566-7:2013, Annex A: Tertiary treatment efficiency test
Small wastewater treatment systems for up to 50 PT – Part 7: Prefabricated tertiary treatment units, chemical / electrical

Detailed results and information on the test are provided in test report PIA2024-T7-469S14.

Extract of performance details (EN 12566-7, Annex A: Tertiary treatment efficiency test)

Organic daily load (influent, nominal)	0.01 kg BOD_5/d		
Hydraulic daily load (nominal)	0.9 m^3/d		
Treatment efficiency (nominal)		Efficiency	Effluent
	COD	56.1 %	23 mg/l
	BOD_5	59.5 %	4 mg/l
	TN_b*	5.5 %	29.6 mg/l
	NH_4-N*	24.0 %	0.4 mg/l
	P_{tot}	95.9 %	0.2 mg/l
	SS	61.1 %	4 mg/l
Electrical consumption (nominal)			0.03 kWh/d
Number of desludging (complete test – 7 weeks)			0

** determined for temperatures ⩾ 12 ° C in the bioreactor*

Tested by:
PIA – Prüfinstitut für Abwassertechnik GmbH
Hergenrather Weg 30
52074 Aachen, Germany

This certificate is for information purposes only a
replaces neither the related test report nor the
declaration of performance or the CE marking.
The results relate only to the tested object.

[redacted]

Head of department "Wastewater Testing"

Notified Body
No.: 1739

Certified according to
ISO 9001:2015

Appendix C

Aqua-Puratine-EL test certificate

PIA

Certificate

408.01C01

Marsh Industries Limited
Head Office Addington Park Industrial Park. Little Addington NN14 4AS UK

EN 12566-3, Annex B
Small wastewater treatment systems for up to 50 PT

Small wastewater treatment system Ensign Range E L
Fluidised bed reactor system in a GRP tank

Test report PIA2022-408B25

Evaluation of the nominal sequences of the 38-week testing

Nominal organic daily load (influent)	0.30 kg BOD_5/d
Nominal hydraulic daily load	0.9 m^3/d
Material	GRP

Treatment efficiency	Efficiency	Effluent
COD	92.2 %	63 mg/l
BOD_5	95.6 %	14 mg/l
TN_b	53.5 %	28 mg/l
NH_4-N	97.8 %	1.0 mg/l
P_{tot}	28.7 %	5.4 mg/l
SS	94.5 %	21 mg/l

Evaluation of the complete 38-week testing

Electrical consumption	1.9 kWh/d
Number of desludging	0

Tested by:

PIA – Prüfinstitut für Abwassertechnik GmbH
(PIA GmbH)
Hergenrather Weg 30
52074 Aachen, Germany

This document replaces neither the declaration of performance nor the CE marking.

[redacted]

Martina Wermter August 2022

Notified Body No.: 1739

DAkkS Deutsche Akkreditierungsstelle D-PL-17712-01-00

Appendix D

Aqua-Puratine-G-APS test certificate



Certificate

405.01C01

Marsh Industries Limited
Units 2-20 Addington Park Industrial Est., NN14 4AS Northants, United Kingdom

EN 12566-7, Annex A
Small wastewater treatment systems for up to 50 PT

Small wastewater treatment system Gem APS – (P & NH4-N)
APS - Aerated precipitation system

Test report PIA2021-T7-405S25

Nominal organic daily load (influent)	0.01 kg BOD_5/d		
Nominal hydraulic daily load	0.9 m^3/d		
Material	GRP		
Treatment efficiency		Efficiency	Effluent
	COD	57.6 %	24 mg/l
	BOD_5	75.8 %	2 mg/l
	TN_b	11.5 %	18 mg/l
	NH_4-N	21.1 %	0.4 mg/l
	P_{tot}	83.7 %	0.9 mg/l
	SS	30.4 %	14 mg/l
Electrical consumption	0.1 kWh/d		
Number of desludging	1		

Tested by:

PIA – Prüfinstitut für Abwassertechnik GmbH
(PIA GmbH)
Hergenrather Weg 30
52074 Aachen, Germany

This document replaces neither the declaration of performance nor the CE marking.

Notified Body No.: 1739

[redacted]

Martina Wermter January 2022

Notes

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