

CASE STUDY

Phosphorus removal in Somerset

A new low-cost, chemical-free technology to mitigate Phosphorus contamination in water habitats

In summary

Salinity Solutions has developed a mobile, energy-efficient and chemical-free solution to removing excessive nutrients, notably Phosphorus (P) and Nitrogen (N), from wastewater. Excessive nutrient concentration creates algae blooms, which contaminate lakes and rivers.

Our batch reverse osmosis technology has the potential to encourage nature recovery and unlock thousands of housing projects held up by legislation in 'nutrient neutrality' catchment areas.

This technology could rapidly address the twin problems of nutrient and water neutrality in the UK, accelerating natural habitat restoration.

Introduction

The detrimental impact of excessive phosphorus concentration on water ecosystems, leading to harmful algae blooms, is a well-recognised environmental challenge. In recent years this has become a major environmental challenge for local government and water companies. In Somerset, engineering tech start-up and University of Birmingham spin-out, Salinity Solutions' recent field trial with Somerset Council and Wessex Water, successfully demonstrated how this problem could be overcome with its ground-breaking new technology.

Across the UK, many protected river catchment areas have excessive levels of the nutrients Phosphorus (P) and Nitrogen (N). New housing developments increase the N & P pollution loads and therefore local planning authorities can only give planning approval where a Nutrient Neutrality mitigation scheme is in place.

The Innovation

Salinity Solutions' mobile, energy-efficient and chemical-free wastewater treatment technology is the result of ten years of development at Aston University and the University of Birmingham. The company's revolutionary patented low-carbon technology recovers freshwater from wastewater and is the first commercial Batch Reverse Osmosis in the world. It's the most efficient type of Reverse Osmosis technology available today, as it reduces energy consumption by 50% compared to competing technologies while recovering up to 98% freshwater.

The field trial

Alongside Somerset Council, Salinity Solutions has been working on a new approach to remove excess nutrients from the environment. With the help of Wessex Water, this summer it undertook the first trial of its system as a method to resolve phosphorus contamination, unlocking housing projects and nature restoration programmes.

April 2023: A desktop cost-benefit study identified the amount of phosphorus to be removed, viable catchment areas, an appropriate treatment works for a trial, the number of future units required to mitigate the Somerset Levels and Moors and other protected sites, and the cost of phosphorus credits generated which could then be sold to developers.

May 2023: Findings were submitted to Somerset Council, which were then used to support a bid for government funding.

July 2023: Salinity Solutions delivered a no-cost trial for Somerset Council to demonstrate the efficacy of its modular water treatment units. With the support of Wessex Water and its manufacturing partner Te-Tech Solutions, a unit was placed at the Fivehead Wastewater Treatment Works near Taunton for two weeks, allowing independent water sampling to be undertaken. A DEFRA minister and the local MP attended, along with teams from the Environment Agency and Natural England.

How is Salinity Solutions' Technology Innovative?

Traditional phosphorus removal techniques, both biological and chemical, require significant investment and carbon-intensive civil infrastructure. Dosing with large volumes of ferric compounds is a widespread practice. In contrast, Salinity Solutions' rapidly deployed mobile plug-and-play chemical-free systems can operate alongside nature-based solutions such as reed beds, which typically take 2-3 years to establish and require large areas of land.

Batch Reverse Osmosis marks a major step forward in water treatment, giving water companies a highly effective new tool to tackle water contamination. The benefits include:

Convenience: in a single-stage operation it can remove phosphorus, nitrogen, PFAS, heavy metals, microplastics, viruses and bacteria.

Compact and deployable: the technology is housed in a 20-foot container and delivered on the back of a HIAB lorry, Salinity Solutions' system (called SAM50) can be rapidly installed in wastewater treatment works or development projects, even in small remote rural sites.

Cost-effective: The traditional cost of traditional phosphorus removal techniques is high and is ultimately passed on to new homeowners or billpayers. The cost of a single 'P credit' (equating to one kg of Phosphorus being removed in a year), was reported by Somerset Council in 2022 as over £54,000. Salinity Solutions' technology, which doesn't require new infrastructure or land acquisition, dramatically reduces the cost of P credits by a factor of at least four. SAM50 can be provided as a long-term solution but will be particularly attractive as an immediate short to medium-term measure to achieve nutrient neutrality pending the planned national upgrade of existing wastewater treatment works by 2030 and as a permanent measure to smaller rural wastewater sites, where it is not economically viable to make costly upgrades

Energy efficient: The SAM50 system uses >50% less energy than comparative membrane technologies. It can be deployed in rural areas on a domestic power supply or supplemented by wind or solar power.

Chemical-free: dosing with Ferric Chloride is the most used method of phosphorus removal at wastewater treatment works. As legislation around phosphorus tightens, the daily tonnage of chemicals required has risen dramatically, increasing the number of delivery journeys and the iron load going into rivers.

Nutrient reuse: the waste stream from the system is a concentrated nutrient brine which can be turned into a pelletised fertiliser product. During this process the remaining water is recycled, helping to make this a sustainable, closed-loop process.

In numbers:

24hrs: the time between delivery of a SAM50 on site when it starts removing Phosphorus

1500: the tonnes of Phosphorus to be removed to unlock all housing developments in Somerset region

11: the number of SAM50 units required to cover the total development potential or mitigation obligations in Somerset

x4: it is at least four times cheaper to generate a P-credit using our technology

50%: the reduction in energy consumption vs comparable membrane technologies

1.2kWh: the amount of electricity a SAM50 unit uses to treat 1000L of water (about the same as a domestic toaster), running from a 13A plug

20ft: the compact size of our containerised solution

98: % of Phosphorous removed (independently verified)

88: % of Nitrogen removed (independently verified)

Up to 99: % of PFAS, microplastic, bacteria and viruses removed

74: the number of local authorities across the country affected by nutrient neutrality

6: month duration of long-term trial ahead of the full-scale roll-out of the SAM50 product in 2024

145,000 - 180,000: The number of UK houses currently held up in planning by nutrient neutrality legislation

See also: <https://www.somerset.gov.uk/news/trial-brings-hope-for-phosphates-funding/>