

PR24

**NORTHUMBRIAN
WATER** *living water*

**ESSEX & SUFFOLK
WATER** *living water*

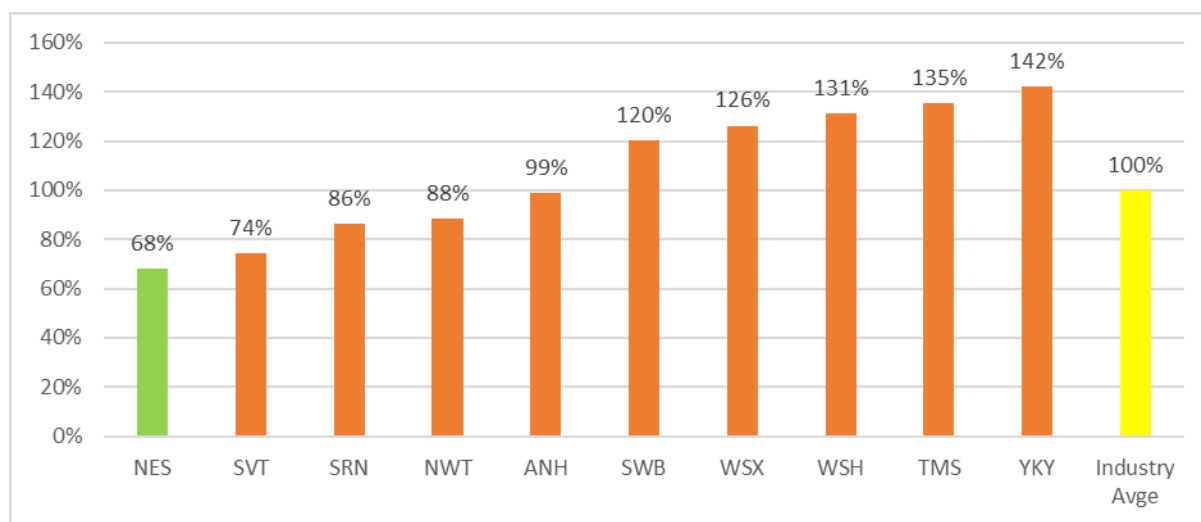
BIORESOURCES STRATEGY

NES64

INTRODUCTION AND BACKGROUND

Having already consolidated down to two locations previously, we made an innovative step-change in our bioresources strategy in 2007, by transitioning from thermal drying and lime stabilisation to advanced anaerobic digestion (AAD) processing for 100% of our wastewater sludge. This meant we became – and we remain – the most efficient and competitive wastewater company for bioresources in England and Wales (see Figure 1).

FIGURE 1: OFWAT FD19 BIORESOURCE SERVICE EFFICIENCY RATING (MODELS BR1 AND BR2)



Northumbrian Water is the frontier company, and 32% more efficient than the industry average.

We continue to efficiently manage the life cycle of our sludge that is continuously produced from 413 sewage treatment works (STWs) in the northeast of England, across an area of 9,422 square kilometres. Our region includes large sparsely populated areas that are served by a very large number of small sewage treatment works. To the west of the region we have the Pennines, to the south, the North York Moors, and the Scottish borders to the north.

The majority of our 2.7 million customers live within twenty miles of the coast around the main rivers of the Tyne, Wear and Tees. As a result, the greatest sludge volumes produced are from the main conurbations of Tyneside and Teesside.

Our network of six strategically located handling centres (SHCs) co-located on STWs at key locations across the region act as local 'hubs' that receive liquid sludge from satellite STWs by road tanker. The sludge is then dewatered and transferred to one of our two treatment centres, contributing to our continued journey to Net Zero.

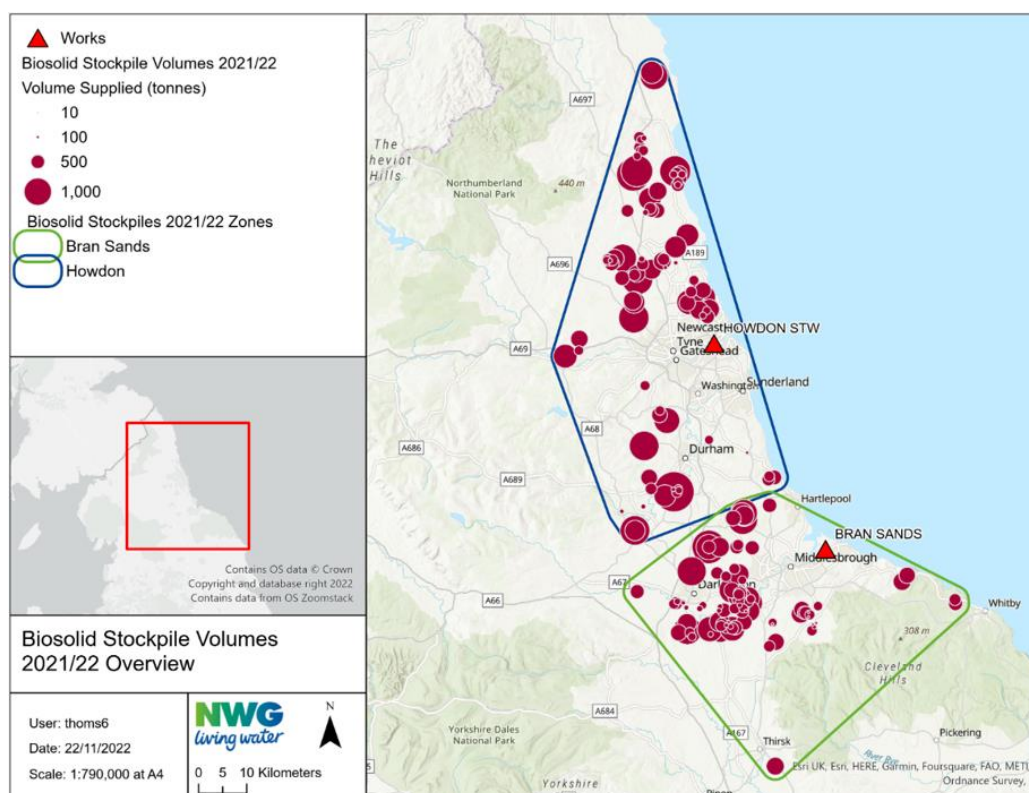
A fundamental part of realising our leading status has been delivered via our two Advanced Anaerobic Digesters and gas plants strategically located within the north (Howdon) and south (Bran Sands) of our operating regions.

This allows the business to take advantage of significant scale economies by locating our operations at two hub sites and also renewable energy recovery potential directly harnessing biogas from our AAD operations and injecting energy rich

biomethane into the natural gas grid following the remove carbon dioxide and impurities. All recovered energy is utilised at Bran Sands and Howdon to power the sewage treatment processes, thus these works are now moving closer to be 'self sufficient'.

Currently this strategy provides economies of scale in AAD processing, minimises transportation costs and maximises energy recovery by co-locating on considerable sized STWs that produce very large volumes of fresh energy rich sludge which is then deployed to agricultural landbank throughout the region (illustrated in figure 2) from our two AAD facilities.

FIGURE 2: DEPLOYMENT LOCATION AND VOLUMES, 2021/22



The infrastructure at our two major Sludge treatment centres (Brands Sands and Howdon) incorporates a range of assets to allow the input of sludge through to the treatment of that sludge via AAD and the provision of gas to grid. We have in place standard maintenance regimes on those assets to ensure their continued effective operation and the assets are subject to periodic inspection regimes.

We do currently trade some sludge capacity at our sites with other companies on short-term contracts for relatively low volumes. However, the digester capacity at these two locations is limited to deal with significant additional volumes. Moreover, following recent asset inspections we consider that additional investment in these assets will be needed in AMP 8 to ensure their continued effective operation.

2. MARKET REFORM AND TRADING

The sector could do more on developing bioresource markets – and Ofwat has set a clear challenge to WASCs to collaborate in developing a more market-oriented approach to bioresources. Ofwat [commissioned Jacobs](#) to provide support to them in assessing market opportunities, potential constraints, challenges, and enablers to overcome these obstacles.

An important part of improving market interactions and collaboration is WASCs bidding to provide bioresources services to each other, as well as providing opportunities for third parties to bid to provide cost effective services. To support this activity, Ofwat introduced the [Bid Assessment Framework](#) (BAF) in 2022, so that companies procure bioresources services in a way that promotes this market.

Ofwat introduced a separate price control at PR19 with the form of control based on a ‘gate fee’ for treating sludge volumes. Ofwat removed the cost sharing incentives within the control introducing volume risk to companies and driving incentives for inefficient companies to trade volumes. In parallel since 2019 appointed wastewater companies have also been required to publish significant additional information on their sludge costs, volumes and operations which has improved the transparency of costs, volumes and other information across the sector and at particular locations and treatment works. We note that not only is NWL (NES) the frontier company as per Figure 1 but two of our neighbours (UU or NWT and YKY) also have much higher unit costs for bioresources activities suggesting potential opportunities for arbitrage. This presented a commercial opportunity to NWL in order to offer terms to trade sludge volumes at certain quality parameters on long-term contracts.

In 2022, using the new available sector-wide information we engaged Economic Insight to complete an assignment measuring and assessing the potential for sludge trading with neighbouring companies and WWTW locations by combining the publicly available information from companies’ reporting with NWLs internal cost estimates. That analysis identified a number of sites where the local costs of treatment and disposal of sludge appeared to be significantly below the costs of NWL taking and treating sludge volumes even when reasonable transportation costs were included. The top 20 locations are provided in Figure 3 below for illustration.

FIGURE 3: EXAMPLE OUTPUT FROM ECONOMIC INSIGHT MODELLING

Rank	Company	Plant	Destination	Annual viable volumes (TDS)	Value of Trade during contract (£)	Value of Trade per TDS (£)
1	Yorkshire Water	WHITBY/STW	Bran Sands STC	1,839	£3,615,372	£197
2	Yorkshire Water	KNOSTROP/STW	Bran Sands STC	28,567	£2,948,551	£10
3	Yorkshire Water	SCARBOROUGH/STW	Bran Sands STC	2,121	£2,834,755	£134
4	Yorkshire Water	BRADFORD ESHOLT/NO 2 STW	Bran Sands STC	17,244	£2,755,899	£16
5	United Utilities	PRESTON (CLIFTON	Bran Sands STC	6,721	£2,105,362	£31

MARSH) WwTW						
6	Yorkshire Water	YORK NABURN/STW	Bran Sands STC	5,147	£1,414,096	£27
7	Yorkshire Water	DEWSBURY/STW	Bran Sands STC	7,883	£1,398,986	£18
9	United Utilities	WALTON-LE-DALE WwTW	Bran Sands STC	1,042	£832,322	£80
10	Yorkshire Water	SEAMER/STW	Bran Sands STC	577	£778,798	£135
11	United Utilities	HYNDBURN WwTW	Bran Sands STC	3,087	£628,068	£20
12	Yorkshire Water	HARROGATE SOUTH/STW	Bran Sands STC	943	£613,630	£65
13	Yorkshire Water	NORTHALLERTON/STW	Bran Sands STC	366	£609,980	£167
14	Yorkshire Water	HARROGATE NORTH/STW	Bran Sands STC	911	£606,442	£67
15	Yorkshire Water	COLBURN/STW	Bran Sands STC	386	£570,480	£148
16	Yorkshire Water	SOUTH ELMSALL/STW	Bran Sands STC	688	£564,830	£82
17	Yorkshire Water	THIRSK/STW	Bran Sands STC	363	£526,369	£145
18	Yorkshire Water	BRIDLINGTON/STW	Bran Sands STC	1,723	£403,987	£23
19	Yorkshire Water	RIPON/STW	Bran Sands STC	358	£401,259	£112
20	Yorkshire Water	MALTON/STW	Bran Sands STC	447	£401,038	£90

Following this work we wrote to UU and Yorkshire Water highlighting these opportunities and made formal submissions via their bid-assessment frameworks. Those submissions were made during the winter of 2022 and involved some engagement with both companies to establish quality parameters and offer pricing, etc. In both cases we were clear that we were offering the development of new digester assets at either or both of our locations and the associated capacity on a long-term contract pricing basis for agreed volumes. Following those submissions both companies took considerable time to consider those responses. Yorkshire issued a formal tender request for capacity from the market to which we have responded. Both companies wrote to NWL in mid-September 2022 confirming receipt of our proposals and suggesting that they were still considering them.

We have prepared a business case internally for additional capacity which is standing by based on the long-term demand from these companies.

3. REGULATORY UNCERTAINTY

The Best Practicable Environmental Option (BPEO) for sludge disposal is widely recognised as the deployment of biosolids to land. This adds plant nutrients and humus-forming material to enrich the solution within the region, and is supported by the UK Government.

However, we expect considerable regulatory change and a subsequent reduction in land bank availability during the PR24 period. This will result in deployment of biosolids over greater distances or – in a worst case scenario – total cessation of deployment to farm land during the autumn spreading period. This would have a major impact on our operating model, with around 80% of our biosolids being deployed in this period.

The sector is currently facing significant regulatory uncertainty about the continued deployment of biosolids to agricultural land. This could affect the start of the PR24 period, but the regulatory approach will not be decided and communicated until after we have submitted our PR24 business plan to Ofwat. This means that there is a risk that we would not have the appropriate levels of funding to meet new obligations.

These regulatory uncertainties are associated with:

3.1.1. EA Sludge Strategy

The pending EA Sludge Strategy will move sewage sludge treatment and recycling from the Sludge Use in Agriculture Regulations (SUiAR) to an Environmental Permitting Regulation (EPR) framework within the new Sludge Strategy.

This change will provide the Environment Agency (EA) with controls to enforce their interpretation of nutrient management (nitrogen and phosphorus) which will result in considerable reduction in land bank availability. The EA had planned to publish their Sludge Strategy in late 2023, but our latest updates from the EA suggest that they are still reviewing this strategy, and do not currently have a planned publication date.

3.1.2. Farming Rules for Water

The Environment Agency will interpret Rule 1 of the Farming Rules for Water (FRfW), and we expect this to have considerable impact on the available landbank for biosolids recycling during autumn spreading periods. Although deployment of biosolids to land is currently accepted as best practice, we expect that an additional interpretation of the FRfW will be completed after our PR24 business plan submission but no later than September 2025.

We have considered these risks during the development of adaptive pathways, as reflected in our PR24 Water Industry National Environment Programme (WINEP) submission. We explain this in our [enhancement case for sludge at PR24](#) (NES34) and in our [long-term strategy](#) (NES_LTDS), where this is responsible for a large amount of uncertainty in future investment periods. The Environment Agency accepted some, but not all, of the mitigating actions we proposed for PR24.

4. PR24 WINEP

As part of PR24, the Water Industry National Environment Programme (WINEP) has introduced new statutory sludge obligation on WaSCs aimed at delivering improvements in the resilience of the sludge management chain. This means improving management practices and creating robust contingency measures, via two drivers.

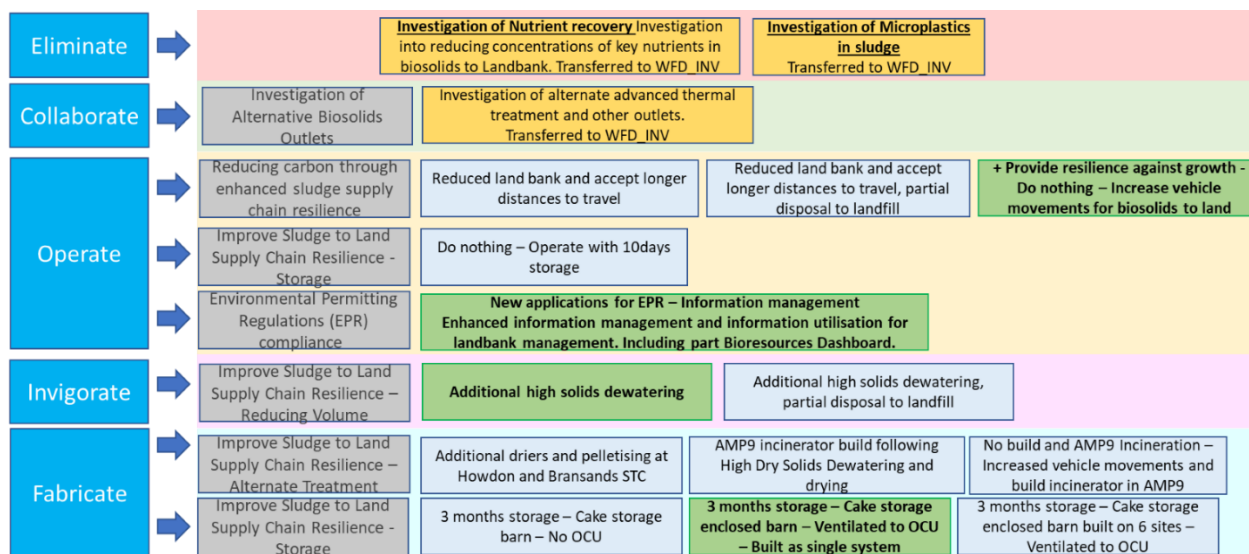
Driver code	Description
SUIAR_IMP	Actions to improve resilience in the sludge supply chain to agriculture and other relevant use or disposal outlets
SUIAR_ND	Actions to meet requirements to prevent deterioration in soil quality or water quality (see footnote 1)

These drivers seek improvements in operational resilience, considering the impacts of climate change and potential periods of supply chain disruption. In addition, WINEP requires prevention of both soil and catchment deterioration, using both investigations and implementing measures in practice. This obligation also seeks to contribute to wider benefits to, including the natural environment, Net Zero, catchment resilience, access, amenity, and engagement.

It has been challenging for the industry to align the need to specify the projects to be delivered in WINEP with current regulatory uncertainty – we have had to develop our WINEP and our PR24 business plan before there are clear, published requirements for bioresources.

In response to this, we have developed an adaptive long term strategic pathway which considers the regulatory about the EA's Sludge Strategy and potential future emerging themes. We are planning to spend £80m during 2025-30 to address the near-term challenges and to understand how we might mitigate these challenges in future – including, for example, nutrient recovery at source; alternative biosolids outlets; and microplastics. Figure 3, taken from our [bioresources enhancement case](#) (NES34), shows the options we considered in developing our plan.

FIGURE 4: WINEP ADAPTIVE PATHWAYS DEVELOPMENT



Eliminate – identification of processes and practices that can be stopped possibly by stakeholder management or other, and by challenging the need for existence. Eliminate options are likely to have the lowest costs to deliver the benefit. They may be used in combination with other options. There are no eliminate options as these are new statutory requirements.

Collaborate - work with stakeholders to re-assign the issue or co-fund. Costs can be shared with third parties either to deliver the same or an extra level of social and environmental benefit. Our optioneering considers collaborative research to understand the lack of resilience in the supply chain of sludge to agricultural land, and cross-border treatment of sludge – there are currently no options identified to collaborate with stakeholders other than those sludge investigations which the Environment Agency have agreed we should include within the WINEP Water Framework Directive Business case (NES28). We will continue to work with the farming community during the transition to the new statutory requirements.

Operate - improved operational management practices to enhance existing capacity. Restrictions on when sludge can be applied to land would mean an increase in tanker movements – we estimate up to 84km. We have calculated that an extra 9 tanker loads per week will be required.

Invigorate - invest in the existing infrastructure installing additional assets to improve performance. These options will provide an increased level of benefit but may be of a lower cost than “fabricate” options.

Fabricate - new assets to augment or replace existing. These options are likely to have the highest costs. Green options will have lower carbon and potentially higher biodiversity and amenity benefits. There are no green options for sludge. Traditional grey options are likely to have highest certainty that service-related benefits will be realised. Innovative options have the potential for greater benefits and lower costs but have the lower certainty that benefits will be realised.

5. DESTRUCTIVE SOLUTIONS

The industry deploys more than 87% of treated sewage sludge to land, with 75% of applications being spread before the sowing of cereals in autumn. If there are restrictions placed on sludge spreading at this time – and it is likely that there will be – then the current available landbank will become competitive, with neighbouring WASCs seeking to secure their access to dispose of their sludge. We expect the average deployment distance for Northumbrian Water to increase from 19km to 84km to accommodate the forecast sludge volumes.

We continue to seek methods of reducing the volumes of sludge produced at source, but delivery of other WINEP obligations will mean that we generate additional sludge associated with, for example, tighter phosphorus consents at our sewage treatment works.

However, it seems very likely that eventually, we will have to deliver some solutions that are not efficient or desirable – in particular, largescale destructive solutions such as incineration – to maintain our operational capability in the future. This might need to be as soon as PR29, though we expect it to take ten years to deliver such technology at the scale needed to efficiently manage Northumbrian Water volumes. We discussed this with regulators during the WINEP process, but our proposed preparations for such incineration were rejected by the Environment Agency as they are not needed now.

6. EMERGING CHALLENGES

We know that future emerging challenges could influence how and when biosolids are deployed to land. To meet these challenges, we need to improve collaboration across the sector, as well as exploring opportunities outside the sector.

We also know that there is more to be done in the medium to long term to understand the risks from microplastics, “forever” chemicals, and antimicrobial resistance. Although we know these are present in water sources, we need to better understand their source, processing pathway, and impact on the environment – both on soil health, and within catchments. Understanding this will allow us to develop the appropriate strategies to mitigate these risks.

We have already started to collaborate with the sector and regulators on this, with the continuation of the Chemical Investigation Programme (which is included within our WINEP obligations).

7. COLLABORATIVE MARKET OPPORTUNITIES

We also show our commitment to trading by considering medium to long-term trade periods – of up to 25 years – with funding outside of price control allowances for key infrastructure to maximise both resilience and service offerings. We have also considered short-term trades, such as the recent tender published by Yorkshire Water. Before the BAF, the approach to bioresources trading has mostly been reactive, focusing on marginal gains from short term agreements with limited contractual commitments.

To support this collaborative philosophy, we are a key partner in the Innovation in Water Challenge for “unlocking bioresources market growth”, using a collaborative decision support tool. This project, in collaboration with Anglian Water (as main sponsor), Thames Water, and Yorkshire Water aims to provide WASCs with a collaborative tool to support the strategy development needed to overcome existing barriers and unlock the benefits of market collaboration by integrating into a single decision support platform.

8. LONG TERM STRATEGY

Our previous sludge strategies have helped us to become the sector leader in bioresources – with leading efficiency and innovative bioresources solutions such as introducing gas to grid facilities at our two treatment centres.

We will continue to reduce our emissions from logistics, through enhanced volumetric measurement at our treatment works and optimising storage capacity throughout the supply chain. We have started investigations into alternative fuels, and it will be critical in future long-term strategies to consider how we can further reduce our process emissions and improve resilience.

We will also need alternative solutions to landbank deployment to remain efficient and compliant, given the likely reductions in landbank availability in the future. We will continue to pursue innovative ideas in providing these alternatives, including working in collaboration with all stakeholders including other WASCs and the farming community (who are fundamental in ensuring the continuity of deploying biosolids to land). Their importance is reflected in recent changes to our operating model, where we have brought back some outsourced activities under our direct control in order to provide improved engagement and communication with our agriculture stakeholders.

We will also implement adaptive resilience strategies from our small sewage treatment works all the way through to our treatment centres, focusing on those area which can deliver economic benefits and continued reductions in our process emissions. This will include thickening sludge, appropriate storage capacity aligned to long-term regulatory changes, and key enablers to enhance our maintenance schedules associated with key infrastructure.

We also consider industry collaboration to be increasingly important throughout PR24 and beyond PR29 – in order to deliver customer value through the BAF and developing mitigation strategies to remain operational in the face of emerging challenges. Innovation will play a key role.

We will continue to monitor our PR24 strategy against regulatory changes and customer expectations, so that we can transition to alternative pathways if needed – particularly including destructive technology in future price control periods. Our success in learning and understanding our sludge processes and the impact on the environment will play a key part in determining whether we need this destructive technology, or whether alternatives can be found such as eliminating certain products or materials (for example, fitting microplastic filters to commercial and domestic appliances such as washing machines).

We do not think that incineration is the right solution – but we will need to work together to develop reliable and efficient alternatives, which are not currently available at the scale we would need.

We will need to decide early in 2025-30 whether we need to go ahead with incineration, to allow time to develop detailed plans in time for PR29 and to start delivering these investments from 2030. This decision, and the level of investment needed over time, will depend on the process we make in investigating alternative approaches to future challenges.