



Ref 2.4

## PR19 Bioresources Business Plan

September 2018

Contents

1. Executive summary ..... 2

2. Introduction ..... 8

3. Welsh Water 2050 ..... 10

4. Aim A: Maximise business profitability..... 14

5. Aim B: Increase resilience for our customers ..... 16

6. Aim C: Promote the circular economy ..... 19

7. Customers and markets in AMP7 and 8..... 22

8. Strategic risks ..... 31

9. Delivering success for our customers ..... 33

10. Glossary..... 34

11. References ..... 36

## 1. Executive summary

### *Introduction and purpose*

This document, encompassing our bioresources strategy, shows how our bioresources plan for AMP7 and AMP8 supports our long-term strategy (Welsh Water 2050) and fits within the bioresources market context.

The bioresources strategy supports our Welsh Water Business Plan, which contains greater detail on customer and stakeholder engagement; how we propose to deliver outcomes in AMP7 and beyond; the levels of service we will provide; financing implications; and impacts on customer bills.

### *Welsh Water 2050 and bioresources objectives*

Welsh Water 2050 is our strategy for managing the long-term trends we face over the next 30 years. It sets out 18 Strategic Responses that we will implement to address them. Our bioresources business strategy has been developed to support four of these Strategic Responses:

- i) delivering fairer bills for everyone by ensuring affordability for services delivered to customers;
- ii) cleaner rivers and beaches;
- iii) protecting our critical wastewater assets; and
- iv) promoting a circular economy and combatting climate change.

In addition to this, the regulatory structure around bioresources in the UK is changing. In common with the rest of the industry, from the start of AMP7 in April 2020 our bioresources business will be funded separately from our wastewater business, of which it has historically been a part. As a stand-alone business, bioresources will face complex challenges in the context of new markets and increasing competition. This includes achieving competitive performance and long-term sustainability amongst factors such as:

- Sludge market fluctuations.
- Technological developments.
- Regulatory risk around the use of our products.
- The changing priorities and demands of customers specific to the bioresources business. These include internal customers, third party waste or capacity providers, and agriculture.

Our response to these challenges has been to develop a series of specific aims and objectives for our bioresources business within the framework of the Welsh Water 2050 Strategic Responses. Our bioresources business aims are to:

1. **Maximise business profitability.** Our bioresources operation is a value-driven production business. We aim to maximise its profitability by increasing product revenues and minimising operating costs either internally or by using markets, with all profits going back into the business for the benefit of Welsh Water customers. This will help deliver our customer promise of fairer bills for everyone.
2. **Increase resilience for our customers.** Our customers include Welsh Water's customers, our bill payers; the wastewater business; and third-party businesses. We aim to ensure that we always have enough capacity to achieve required service levels using our assets and the markets. This will enable our customer operations to be more reliable, helping to deliver our customer promises to put things right when they go wrong, and to contribute to cleaner rivers and beaches.

3. **Promote the circular economy.** The bioresources business is the single biggest enabler of energy neutrality within Welsh Water. It also processes and sells valuable materials. We aim to generate more energy and to ensure that the materials we produce have an increasingly positive effect on the natural environment. This will help deliver our customer promise to safeguard the environment for future generations.

We play a key role in the environmental stewardship of Wales. bioresources are key to the sustainable management of natural resources in Wales, so we work with farming and land management to provide the best stewardship of the land and fields we work on.

Figure 1: Our bioresources aims and objectives



## AMP 6 progress

We have driven solid growth in the performance of our bioresources operations over AMP 6. With our investments over AMP 6, we are increasing our energy generation from 42 GWh in 2015-16 to 73 GWh in 2021-22. This will strongly support our bioresources business revenue growth post account separation, our Welsh Water self-generation targets, and our circular economy aim of becoming energy neutral.

Over AMP 6 we are upgrading our treatment capabilities. By the start of AMP7 we will have eliminated routine raw sludge liming and will be treating more than 95% of our product through




Advanced Anaerobic Digestion. This technology reduces sludge volume and treatment costs, enables greater conversion of sludge to energy, and eliminates a large source of odour risk, which is one of our greatest potential impacts on customers. It also enables us to produce high quality products meeting the enhanced treatment standard, which are more desirable to our agricultural customers. This supports our aims of improving business profitability, increasing resilience (particularly to landbank risks) and promoting the circular economy. Much of the available landbank in Wales is not arable but grassland, so delivering an enhanced treated product that can be spread safely on grassland is key to the long-term sustainability of our operation.


## *Strategic Responses, and measures of success*

Table 1 shows how we have performed in AMP 6 against our proposed Measures of Success (MoS), and how the MoS will help to drive our long-term Strategic Responses. It also shows our targets for AMP7, against which we will measure our success in delivering this plan. Our performance commitments and their justification are further explained in 5.2 PR19 Performance Commitments.

En8 bioresources compliance will help to drive both asset resilience and cleaner rivers and beaches; while Ft3 energy self-sufficiency and En7 bioresources product quality will both help to drive service affordability and promote a circular economy.

Table 1: Strategic Responses and Measures of Success

| Strategic Responses   | Measures of Success  | Description   | Driving Activities in AMP7  | 2019/20 Target (AMP6) | 2024/25 Target (AMP7) |
|---|--|---|---|-----------------------|-----------------------|
|  <b>10. Protecting our Critical Wastewater Assets.</b><br>Faced with an increased risk of disruption – for example, from an increase in severe weather as a result of climate change and reduced customer acceptability of pollution events – we will improve the resilience of our critical wastewater assets, which have high environmental and customer impacts of failure. | <b>En8.</b><br>Bioresources disposal compliance (% sludge disposed satisfactorily) | The percentage of wastewater sludge disposed of satisfactorily.   | <ul style="list-style-type: none"> <li>Investment in resilience of our assets</li> <li>Development of strategic storage</li> <li>Proactive operation &amp; maintenance</li> <li>Using the markets to buffer capacity</li> </ul> | 100.0%                | 100.0%                |
|  <b>16. Cleaner rivers and beaches. With increasing pressure on the natural environment from increased population, changing land use, climate change and new sources of pollution, we will improve our wastewater assets to do our part to help achieve 'good' environmental status for our rivers, lakes and coastal waters.</b>  |  |   |   |                       |                       |
|  <b>8. Ensuring affordability of services delivered to customers.</b> With inequality, debt, and poverty on the rise we aim to ensure that our services remain affordable for all customers. We will ensure that we continue to provide the best service in increasingly innovative and efficient ways and pass these savings on to our customers.                             | <b>Ft3.</b> Energy self-sufficiency  | Electricity generated and gas injected to grid as a percentage of all electricity and gas consumed (gas expressed as an electricity equivalent) | <ul style="list-style-type: none"> <li>Recovering more useful energy from our products using AAD</li> <li>Operational optimisation using production management techniques</li> </ul>  | 26%                   | 35%                   |
|   | <b>En7.</b><br>Bioresources  | The percentage of Waste Water sludge  | <ul style="list-style-type: none"> <li>Recovering more useful</li> </ul>  | 95%                   | 97.3%                 |

| Strategic Responses  | Measures of Success | Description  | Driving Activities in AMP7  | 2019/20 Target (AMP6) | 2024/25 Target (AMP7) |
|--|---------------------|--|---|-----------------------|-----------------------|
|  <p><b>18. Promoting a Circular Economy and Combatting Climate Change.</b><br/>Faced with a changing climate and increased energy costs, we will aim to become an energy neutral business, whilst maximising the opportunities to reuse treated water and other potentially valuable natural materials, contributing to the circular economy in our local region.</p> | product quality     | processed through our advanced digestion facilities, producing an Enhanced Treated biosolids product and meeting the Biosolids Accreditation Scheme (BAS) accredited standard. | <p>energy from our products using AAD</p> <ul style="list-style-type: none"> <li>Operational optimisation using production management techniques</li> </ul> |                       |                       |

## *AMP7 drivers and investments*

During AMP7 we will invest over £35 million in programmes of work to progress us towards our 2050 vision. These programmes are focused on building on our strategic shift towards centralising treatment at Advanced Anaerobic Digestion hubs. We plan to invest in our thickening and dewatering plants, which will reduce the volume and weight of sludge moved, reducing sludge movements and increasing the value of the raw material into our works. We will also enhance our resilience through a £6.62 million capital enhancement investment in the expansion of our strategic storage.

In addition to our investment programmes, we are looking to innovate through emerging markets to help provide:

- additional short-term treatment buffers;
- longer-term capacity; and
- new value and technology innovations to enhance our performance and reduce our reliance on traditional capital delivery.

We also plan to realise over £4 million of efficiencies over the AMP period through optimising our logistics operations, making increased use of operational data for asset management, and improving our thickening and dewatering operations.

Table 2: Planned investments and efficiencies for AMP7

| Programme of work                                     | AMP7 Capex Base | AMP7 Capex Enhancement | Total AMP7 Capital Investment |
|---|-----------------|------------------------|-------------------------------|
| Additional Strategic storage                          | -               | £6.62m                 | £6.62 m                       |
| Planned capital maintenance to sludge transfer sites  | £2.43m          | -                      | £2.43 m                       |
| Reactive capital maintenance to sludge transfer sites | £4.86m          | -                      | £4.86 m                       |
| Sludge forward-looking capital maintenance            | £8.76m          | -                      | £8.76 m                       |
| Sludge planned capital maintenance                    | £8.03m          | -                      | £8.02 m                       |
| Sludge reactive capital maintenance                   | £9.24m          | -                      | £9.24 m                       |
| <b>Total programme (pre-efficiency)</b>               | <b>£33.32 m</b> | <b>£6.62m</b>          | <b>£39.94 m</b>               |
| Efficiency savings                                    |                 |                        | -£4.10 m                      |
| <b>Total programme (post-efficiency)</b>              |                 |                        | <b>£35.84 m</b>               |



## 2. Introduction

### *Our business*

Our biosolids treatment activities create value through the products of the treatment process and are also a crucial part of the safe, efficient and environmentally-sound operation of our wastewater treatment works. Without an effective sludge processing function, the wastewater treatment processes would soon cease to function as intended, with potentially serious impacts on the environment.

The activities of our bioresources business start at the point where we receive liquid sludge into one of our 38 tankers, or into our blending tanks by pipeline.

Thickening and dewatering of sludge is done at one of our 24 intermediate sludge centres.

We treat liquid and dewatered sludge at one of our six treatment hubs. Here we recover energy, which we use to power the treatment process and export the excess to the grid.

We also recover nutrients for our agricultural customers, who want high-quality soil conditioner products. We load the treated cake product, transport it to our agricultural customers and sometimes help them to apply it to land.

We also return some by-products to wastewater treatment.

#### In 2020 we will:

- Receive 73,000 dry tonnes of sewage sludge from wastewater treatment processes
- Deliver 38,000 dry tonnes of soil conditioner to our customers
- Generate 36,000 MWh of electricity
- Inject 24,000 MWh of biomethane into the grid

Figure 2: Our bioresources business in 2020



## *Purpose and scope of document*

This document, encompassing our bioresources strategy, shows how our plan for AMP7 and AMP8, supports our long-term strategy (Welsh Water 2050) and fits within the bioresources market context.

This document provides an outline of:

- The progress we have made in developing a sustainable bioresources business;
- Our objectives and plans for AMP7, and how these support Welsh Water 2050;
- Where we see opportunities for growth and added value in AMP8 and beyond;
- The role we see for technological and market-based innovation, and how we are working this into our operations; and
- How we will measure our progress in AMP7 using Measures of Success.

## *Relationship to wider PR19 methodology business plan*

The bioresources strategy supports our Welsh Water Business Plan, which contains greater detail on customer and stakeholder engagement (see Supporting Documents 1.1 and 1.2) and the levels of service we propose to deliver (see Supporting Document 5.2).

## *Wider Context*

Our sludge strategy has been built on the framework of Welsh Water 2050, which has been developed within the unique Welsh regulatory context. Parts of our business are regulated by Natural Resources Wales, and we work within the Welsh Government policy framework, including

the Well-being of Future Generations (Wales) Act 2015, the Water Strategy for Wales, and the Environment Wales Act 2016.

We recognise that our bioresources business has a large part to play in the delivery of wider Welsh Water objectives such as ensuring wastewater treatment resilience and achieving energy neutrality. Our focus within this document is on our bioresources business and on how we will improve the performance of the bioresources business for the benefit of customers including Wastewater Network+ and other customers to whom we provide products and services.

### *Working for our stakeholders*

As a company without shareholders, run solely for the benefit of our customers, we have a unique position in responding to the priorities of our customers.

We are always looking at ways to make our bioresources business more efficient and to increase revenue. We already use suppliers and markets to provide capacity and services, but we believe that we will drive improved and increased use of markets in the future.

Our industry regulator, Ofwat, has set an expectation for us to use markets to make our bioresources business more efficient. This means: trading with others and using processing centres in other company areas to improve efficiency in the short term; more efficient investment to make the most of sludge processing across company boundaries in the longer term; and better interaction and integration with the wider organic waste market, enabling efficient site and resource sharing.

The environmental focus in Wales is for the sustainable management of natural resources, which is the core purpose of Natural Resources Wales (NRW), our environmental regulator. Bioresources from the wastewater treatment process are key to that sustainable approach. We are proud that our biosolids are all recycled to agriculture and in a changing world, with population growth, changing land management practices, climate change and changing environmental performance standards we need to operate to the highest standards to play our part in improving the state of natural resources in Wales.

## 3. Welsh Water 2050

### *Purpose and context*

Following a major consultation with customers and stakeholders, in 2018 we published Welsh Water 2050, our 30-year strategy. It sets out the challenges that we expect to face to 2050, and the 18 Strategic Responses that will be required to address them. It also identified and scored areas of resilience strength and areas which require improvement for almost all aspects of our business.

We acknowledge that it is vital for us to identify and address emerging challenges, and harness new opportunities, to ensure that we don't store up problems for future generations. We have identified key future trends that are likely to have a significant impact on our service provision, particularly on our ability to deliver our customer promises. Our Strategic Responses set out how we will mitigate or harness future trends, including the research and innovation we will need, the organisations that we will need to work with, and how our activities will align with our customer promises and relevant legislation, including the Well-being of Future Generations (Wales) Act 2015.

## *Relevant Strategic Responses*

Our Strategic Responses include a long-term direction of travel for how we will mitigate the challenges and harness the opportunities, which will be continually reviewed and revised over time.

Relevant Strategic Responses for our bioresources business plan are:



**Strategic Response 8: Ensuring affordability of services delivered to customers**



**Strategic Response 16: Cleaner rivers and beaches**



**Strategic Response 17: Protecting our critical wastewater assets**



**Strategic Response 18: Promoting a circular economy and combatting climate change**

## *Translation into bioresources objectives*

Our bioresources business aims are driven by these Strategic Responses. We have set ourselves specific objectives within these aims. Our objectives map shows our alignment to the Strategic Responses.

Figure 4: Our bioresources aims and objectives



The Strategic Responses and their associated aims and objectives for the bioresources business form the structure for the remainder of this document.

## *Market trends and challenges*

Our bioresources business is a market-facing business, as such it needs to thrive in the context of changing pressures and challenges.

Figure 3: Our bioresources business challenges



## 4. Aim A: Maximise business profitability

### *Performance*

During AMP 6 we have invested heavily in Advanced Anaerobic Digestion (AAD) capacity. This utilises thermal hydrolysis, which is a new technology incorporating the pasteurisation of untreated sludge prior to anaerobic digestion. With AAD, we can recover a third more of the energy contained within the sewage sludge we receive than we can with conventional digestion. AAD also produces a more refined product, increasing its value and reducing the volume to transport by up to 20%.

By 2020 we will have developed 4 Advanced Anaerobic Digestion hubs:

- Cardiff (36,000 tDS per year)
- Afan (17,500 tDS per year)
- Cog Moors (28,000 tDS per year)
- Five Fords (10,000 tDS per year)

>95% of our sludge will be treated through AAD. This will put us at the forefront of the market.

We have also invested heavily in biomethane to Grid at our Five Fords facility. This is a technology which enables us to clean up our biogas and inject it into the natural gas grid, enabling us to earn greater revenues and contributing to the decarbonisation of the country's thermal energy provision.

Figure 5: Five Fords biomethane to grid plant is a first for sewage sludge treatment in Wales



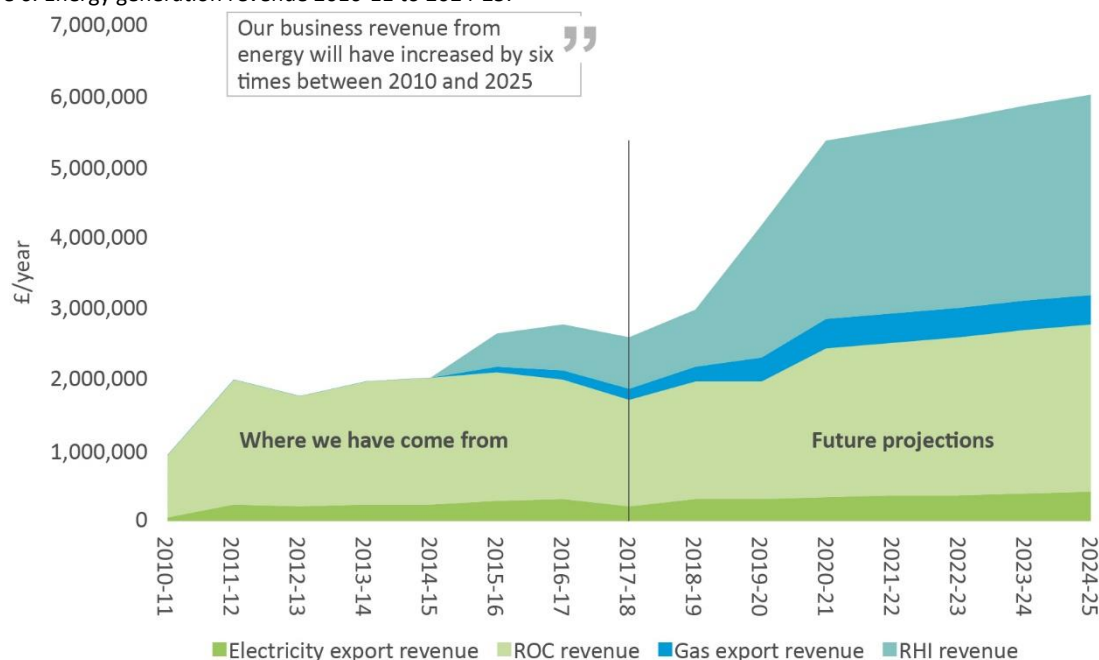
These technologies will ensure that our core treatment asset base is amongst the most advanced in the UK Water Sector, capable of a high rate of energy recovery and putting us in a good position to achieve leading performance in the future.

### *Future forecasts*

Based on our forward sludge production projections and the innovative projects we are deploying, we are forecasting that our energy generation revenues will more than double from £2.6 million per annum today to over £6 million per annum by the end of AMP7.



Figure 6. Energy generation revenue 2010-11 to 2024-25.



## AMP7 & 8 plan

By the start of AMP7, our treatment asset base at our four primary sludge hubs will be world class. But this doesn't mean we can stop our drive for continuous improvements. In AMPs 7 & 8 we will continue to maximise bioresources business profitability through:

**A1. Value Investments:** Whilst we believe we will have a world class set of treatment hubs, we will continue to invest in opportunities which deliver further value to us. In AMP7 this will include investing in our thickening plant and dewatering

hubs to minimise their running costs and to enable us to optimise our transport fleet movements.

We will aim to improve the dry solids content of the sludge that we move, to reduce the number of miles our fleet travels. As an example, improving the percent dry solids of transported liquid sludge from 4% to 5% could reduce the volume transported by 20%, delivering a related reduction in routine transport demand.

Our bioresources business is a participant in the energy market, and our drive to become an energy-neutral company by 2050 brings synergies with our commitment to ensure affordability of services. As we increase the energy that we sell and maximise energy revenues, our profits will be reinvested into the business for the benefit of customers.

**A2. Production Mentality:** Delivering world class, resilient processes to our sludge hubs is only part of the picture. In order to maximise profitability from our business, we recognise that we need to consider our treatment facilities as value-adding production lines. We have already begun this journey. During AMPs 7 and 8 we will continue to optimise our assets and reduce our costs by deploying production management techniques such as LEAN and improving data collection and information management. This will enable us to realise greater efficiency through the improved scheduling of maintenance and logistics operations and a better understanding of our asset health.

**A3. Market Value:** In AMP7, many of our assets will be relatively new. As our bioresources assets come up for renewal and where our sludge growth exceeds capacity, we will utilise the bioresources



market to provide additional capacity, or to replace asset life expired capacity where the whole life cost is lower than our internal delivery models.

## 5. Aim B: Increase resilience for our customers

### *AMP6 performance*

Our AMP 6 investments in bioresources AAD capacity have given us more headroom to deal with short term fluctuations in sludge production and will therefore assist us in supporting our Wastewater Network+ customers. This is essential to ensure that we can return compliant effluent to our river systems.

Due to sludge growth related to population growth and compliance drivers, we have needed to invest heavily in increasing our capacity, most recently through a new £50m investment in our Cog Moors AAD facility. However, as the chart in Figure 8 on page 15 shows, this increase in headroom will be temporary.

Our bioresources business provides essential support to our wastewater treatment operations by removing solids from the waste stream. When we don't do this effectively, our wastewater treatment customers are negatively affected. We can also adversely impact on wastewater treatment processes by returning poor quality liquors, which can impact upon the cleanliness of our beaches and rivers.

One of the risks to our business is the potential permanent or temporary loss of landbank due to events such as adverse customer sentiment, severe weather, livestock disease outbreaks, or regulatory changes. Our move to AAD treatment means that a greater proportion of our sludge is classified as “enhanced treated”. This means that a larger landbank will be available to us, because we can spread the product to farmland with a wider variety of crop types such as fruit, salads, vegetables and horticulture. We also do not always need to plough our product in to achieve compliance and maximise transfer of nutrients. Therefore, the risk of landbank availability impacting negatively upon our operations will be reduced.

Figure 7: Cardiff Advanced Anaerobic Digestion Facility (including Thermal Hydrolysis Plant)



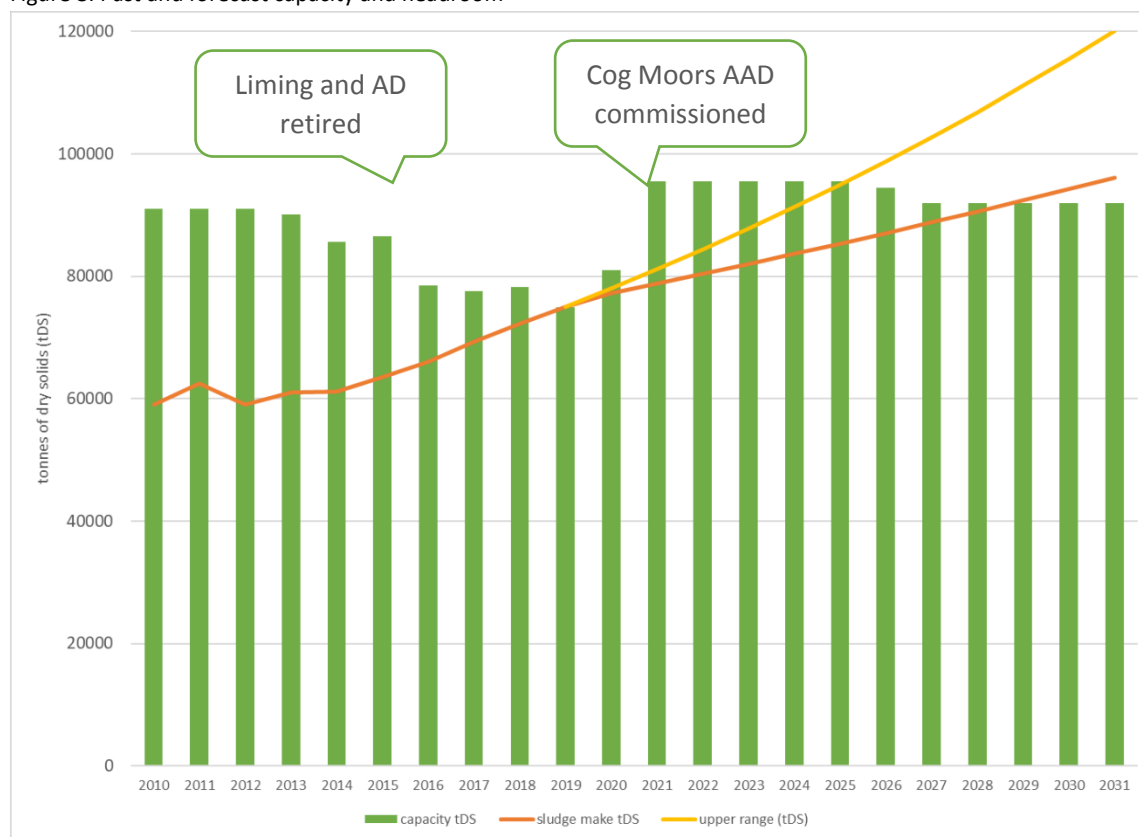
As well as providing resilient treatment capacity, our customers have told us that sewage odour is a high priority for them. We are reducing odour from sludge handling operations, in particular by ceasing routine liming operations by 2020 as our new AAD plants come on-line. Our plans to improve our resilience will also improve our odour performance.

Stakeholders, including local government organisations, don't always understand the environmental benefits that our product can deliver. We still have work to do to manage stakeholder perception of sludge, particularly of sludge applied to land, to ensure maximum environmental value

### *Future forecasts*

Figure 8 shows the growth of our sludge production and of our treatment capacity from 2011-12 to the end of 2030. The effect on our treatment capacity of the construction of Cog Moors, our new 28,000 tonnes dry solids (tDS) AAD facility, can be seen beginning in 2021. The orange line shows the expected growth in sludge due mainly to population increases and process improvements. The amber upper range line shows the additional potential sludge growth we could see from increased phosphorous consents in Wastewater Network+, driven by the National Environment Plan (NEP). This could erode our headroom by 2025, and we will need to consider our capacity requirements for AMP8, in the context of developing opportunities and offerings in the external bioresources market.

Figure 8: Past and forecast capacity and headroom



## AMP7 & AMP8 Plan

We acknowledge that maintaining resilient bioresources processing capacity is challenging. Proportionally, our assets are dealing with more corrosive and hazardous substances than the wider business. This means that they may not last as long and may suffer from frequent maintenance shutdowns without proper care. Phosphorous consents and resulting P sludge increases from the NEP are not yet confirmed, and sludge production rates are also variable by day and month. This all means that we need standby capacity to ensure resilient treatment routes all year round. We aim to do more in AMPs 7 and 8, improving resilience for our customers through:

To meet the requirements for safety, quality and environmental management, the process must meet strict audit requirements that have been set out within the biosolids Assurance Scheme Standard (BAS).

In 2017/18, 100% of our product was BAS compliant.



**B1 Asset Resilience:** A major driver for our AMP7 investment programme will be resilience. Assets within focus are our AAD treatment hubs, our intermediate thickening and dewatering sites and our sludge to land plant and equipment. This will ensure that sludge can be reliably transferred from our sewage treatment customers through to our agricultural customers. In addition, we plan to invest in our strategic storage. This storage will provide an additional four-month buffer to increase our resilience to operational failures, fluctuations in supply and demand, and extreme events.

**B2 Operational Resilience:** In addition to our capital investment plans, we need to ensure that we keep as much as possible of our existing capacity available at all times. We plan to do this by making

increased use of data to undertake effective pro-active operation and maintenance on our assets, and continuing to produce a high product quality to maintain agricultural demand.

**B3 Market Buffers:** Despite our best endeavours, there may be short periods of time when we don't have enough capacity to treat the raw product from Wastewater Network+. Instead of being reactive in this area, we aim to open routes to market to provide buffers for any capacity shortfalls.

## 6. Aim C: Promote the circular economy

Figure 9: Heat Exchangers on one of Our Thermal Hydrolysis Plants



### AMP 6 performance

We believe that our sewage sludge is a valuable resource, not a waste stream. It gives us the raw materials to be a net exporter of energy and means that our bioresources operations have a leading role in our wider business plan to become energy neutral by 2050.

"Faced with a changing climate and increased energy costs, we aim to become an energy-neutral business."  
Strategic response 18

We have more than doubled our energy generation from regulated sludge assets (electricity and biomethane to grid) from 19.6 GWh as electricity in 2011-12 to 47.7 GWh as electricity in 2017-18. Through improved technology and reduced transport movements, we aim to move from generating 9% of our energy needs within our sludge operations today to generating 14% by the end of AMP7. This clean, renewable energy is helping to de-carbonise the grid and to enable our energy neutrality aspirations.

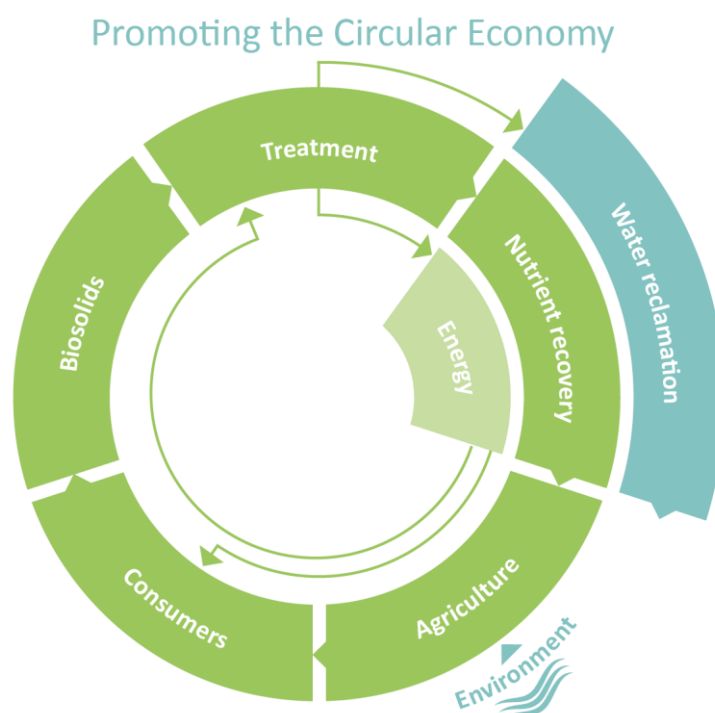


97% of our sludge will be enhanced treated product. This means it can be applied to the land without being ploughed in and can be used more easily on animal grazing land, which makes up a large proportion of our region.

The sludge cake we supply to our customers makes up the majority of the solid material leaving our business as a whole. Our product is already high quality. When applied to land, it conditions soil quality and structure and provides nutrients such as nitrogen, phosphorus, sulphur, magnesium, potassium and other trace elements. This is a sustainable product which helps farmers to avoid the need for manufactured fertilisers, reducing the carbon footprint of food production.

The effective removal of sludge is crucial to the performance of large and small wastewater treatment plants across the region. When we are not able to remove sludge due to a lack of available sludge treatment capacity, our sewage treatment works cannot function effectively and we can have a negative environmental impact on our rivers and beaches.

Figure 10: Our Circular Economy Contribution

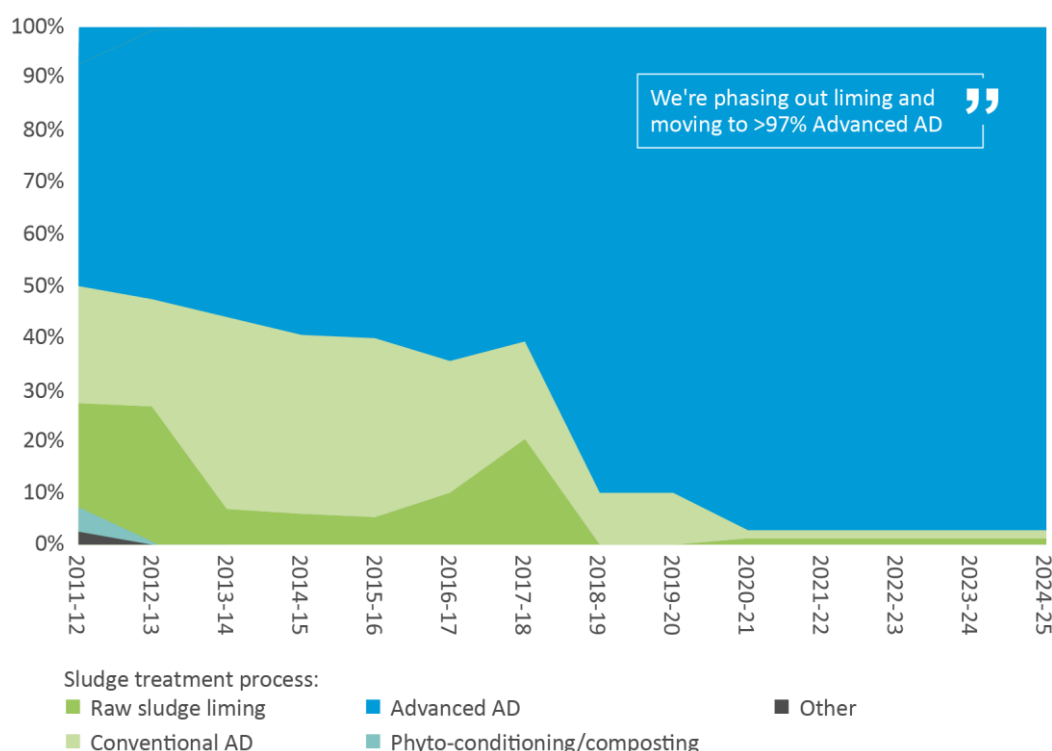


By 2020 we will have moved away from liming as a routine treatment, replacing it with AAD. This will mean a reduction in the natural resources that we are using. The volume of our product will have reduced as a greater proportion of volatile solids will have been converted to energy, and a larger amount of water can be removed and returned to the environment, whilst the nutrient content of the product remains little-changed. The product will also be more beneficial to our customers as it is easier to handle and spread, and therefore we will have a more resilient cycle.

### *Future forecasts*

Figure 11 shows the increasing proportion of our product treated through advanced anaerobic digestion since 2011-12, and our plan to the end of 2024-25. In the short term, we will continue to treat sludge with conventional digestion at Queensferry, Hereford (Eign), and Swansea followed by re-digestion at one of our AAD hubs, to maximise energy recovery and product quality.

Figure 11. Treatment types / sludge disposal routes



## AMP7 & 8 plan

To contribute more to the energy neutrality of our business, we need to recover even more energy as well as new valuable products from our sewage sludge. We also need to use less energy. This includes sludge transport, which is a major user of energy within sludge processing. Our bioresources business can contribute further to the circular economy in the future. We can do this through:

**C1. Technology Innovation:** We will innovate to recover even more useful energy and resources from our product. This will include exploring new technological advances for increasing energy recovery (such as through gasification, intermediate thermal hydrolysis, or sonication); recovering new materials from our products (such as high-purity fertilisers from struvite); and improving the percent dry solids of raw sludge (such as through innovative thickening and dewatering processes).

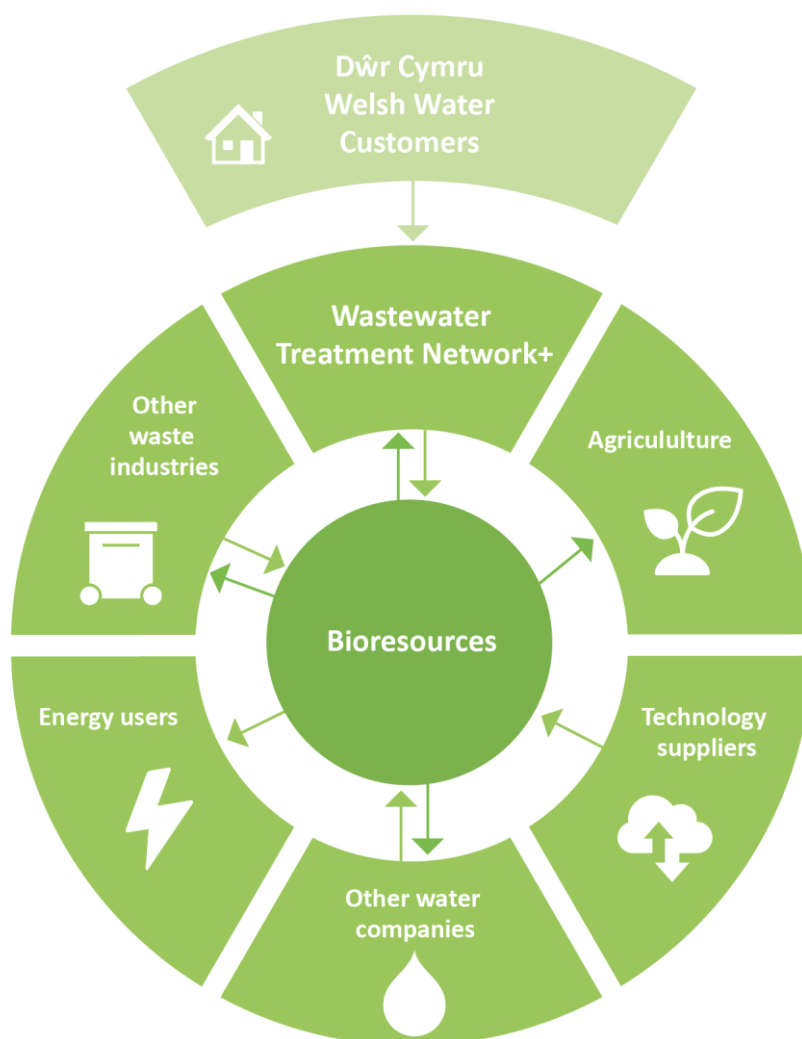
**C2. Product Quality:** Our product will be 100% compliant, leading to 100% useful sale of product as a soil conditioner and no material to non-beneficial use. In addition, our product will be manufactured using as little resource as possible to enable maximum return of recovered materials such as energy.

**C3. New Products:** We will identify opportunities to realise greater value from sewage sludge. Where there is a new product we could create from our raw materials, we will take a business case approach and where the market is best placed to offer the best value solution, we will pursue this for the benefit of our customers.

## 7. Customers and markets in AMP7 and 8

As a business, bioresources operates in multiple markets with multiple customer/supplier relationships. We have drawn out some of our key market relationships in Figure 12.

Figure 12: Some of our key marketplace relationships



### Our Customers

- Our bill-paying customers;
- Internal customers for which we provide sewage sludge collection and treatment services;
- Other water and sewage companies and third-party waste providers who want to make use of our capacity;
- Customers for our energy products; and
- Customers who take our fertiliser and other products.

### Where we are a customer:

- For the treatment of our by-products (e.g. our wastewater);

- For treatment capacity in or out of region; and
- For new products and services to enhance our business.

## Introduction to customers and markets

A number of our objectives rely on our effective use of markets and on our understanding of our interactions with the market where we are supplier or a customer. These objectives are highlighted within our objectives map, shown in Figure 13. This section covers our responses to these objectives.

Figure 13: Our bioresources aims and objectives





Our bioresources customer base is varied. Following market separation, we will develop relationships with new customers and, in addition to this, we will become the customers for treatment capacity, new products and services.

In the future we consider that transfers of goods and services into and out of our business will be open to potential delivery by different markets and into different markets. By using these markets effectively, we will be able to progress towards industry-leading value for money.

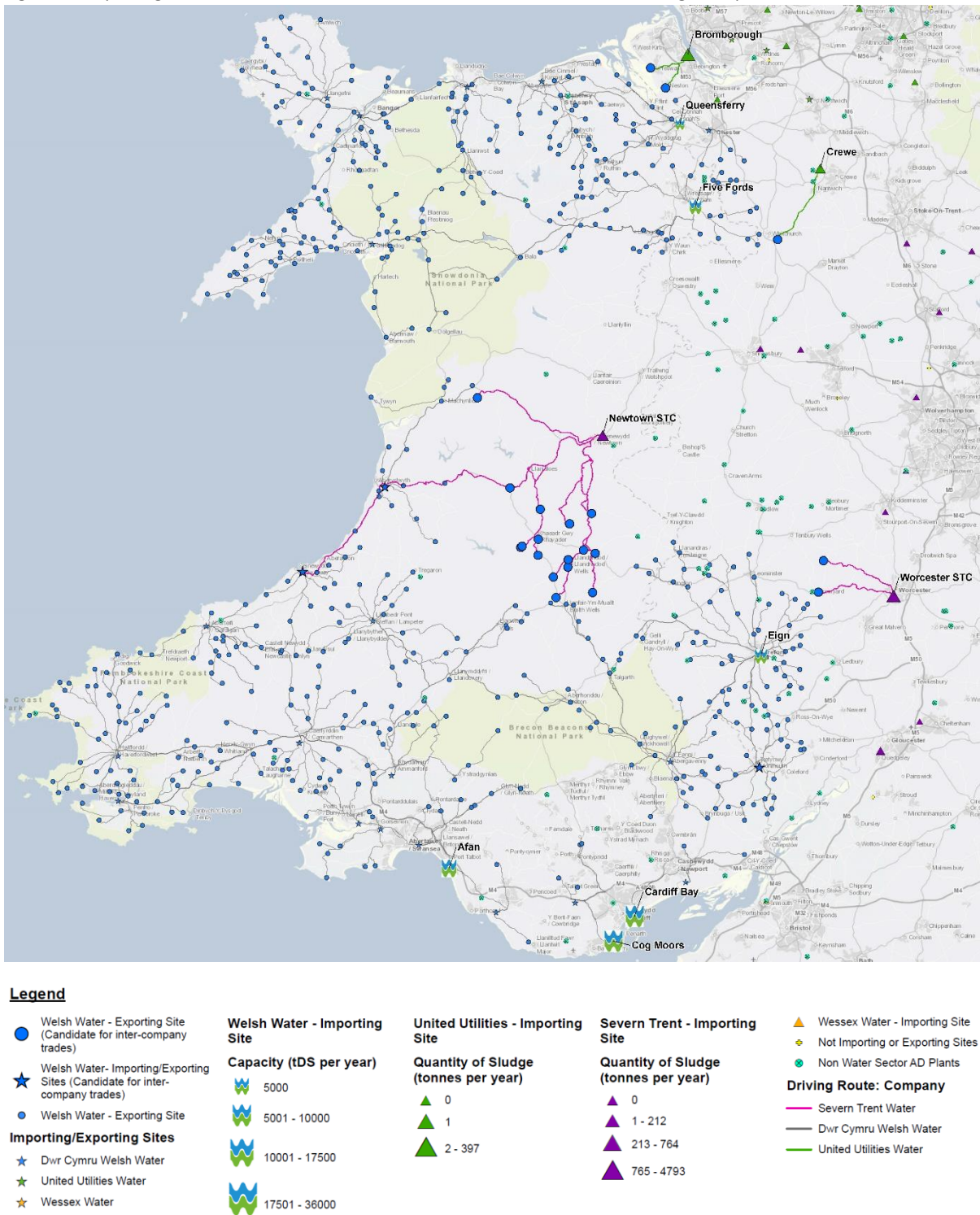
This section covers our participation in the markets (covered by sub-sections below):

1. **Using the capacity of other water and sewage companies:** Where we could utilise the treatment capacity of other water and sewerage companies (WaSCs) for best value;
2. **Market use of our capacity:** Where our treatment capacity could be utilised by other water and sewage companies for best value;
3. **Market entrants:** Where external providers could offer treatment capacity, or new products and services within or outside of our region;
4. **Product markets:** Expanding and evolving delivery of new products to market;
5. **Internal markets:** Developing our markets and service level agreements with Wastewater Network+; and
6. **Other waste industries:** Where external organisations would like to use our capacity for alternative organic waste products.

#### *Using the capacity of other water and sewage companies*

Our geospatial analysis of publicly-available bioresources market information shows us that we have 21 raw sludge producing sites which are closer, by road distance, to treatment centres operated by other water and sewage companies than they are to our own treatment centres. This is based upon our PR19 plans to have six treatment hubs. This analysis provides an initial indicator of the scale of possibilities and where we should look to undertake further work.

Figure 14: Exporting facilities close to the treatment centres of other water and sewage companies



Exporting sludge from sites closer to the treatment hubs of other water and sewage companies would represent around 300 tDS, or under 1%, of our forecast 2020 sludge throughput. Our internal treatment for the majority of these sludges is typically AAD, so the market needs to demonstrate in the future that it can provide safe treatment and a competitive unit cost to make these or other cross-border trades exports viable.

To take advantage of these opportunities to use the capacity of other water industry suppliers, our plan for AMPs 7 and 8 is to:

**A3. Increase Market Value:** We will work with our neighbours to identify long-term sludge trading prices. When these added to our transportation costs, we can identify the circumstances under which it is financially favourable to use the capacity of other providers. It is likely that these decisions will be taken at the point at which our own assets require investment, which, given our investment programme, is more probable during AMP8.

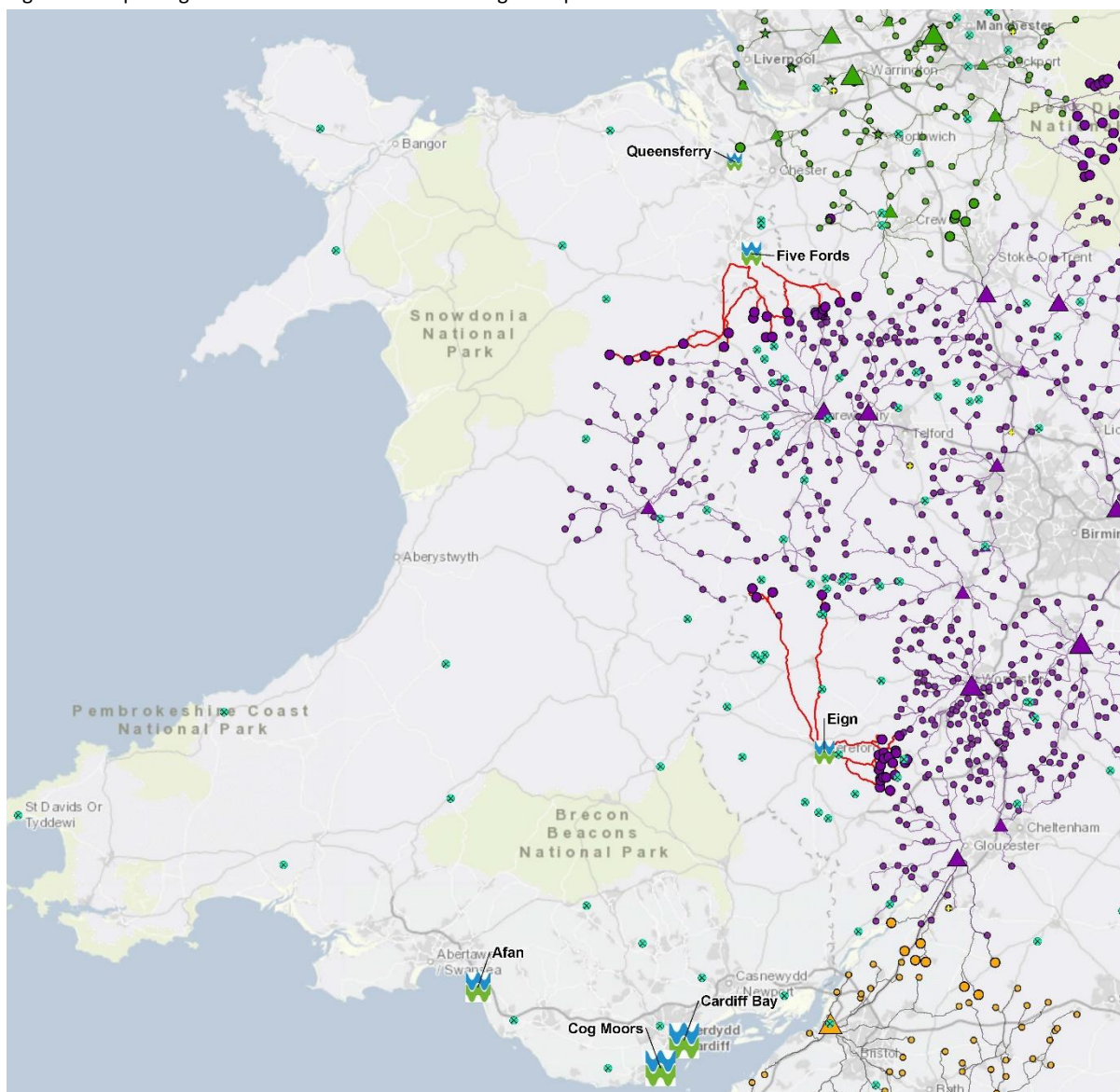
**B3. Secure Market Buffers:** Talk to our neighbours. We will maintain a view of what capacities are available and the transfer and treatment costs for short term trades where we might run short of capacity due to sludge production fluctuations or planned/unplanned downtime.

#### *Market use of our capacity*

We may have opportunities to utilise our capacity for the treatment of sludge from other water and sewage companies once we have delivered sufficient capacity to service Wastewater Network+. This will enable us to create new revenue streams to produce better business performance and deliver savings to our customers.

Our geospatial analysis of publicly available market information has shown us that there are 48 sludge-producing sites that are closer to our treatment hubs than they are to treatment facilities in their own region.

Figure 15: Exporting facilities of other water and sewage companies close to our treatment centres



## Legend

|  |   |  |  |  |  |
|--|---|--|--|--|--|
| <b>Exporting Site (Candidate for inter-company trades)</b><br><ul style="list-style-type: none"> <li>Severn Trent Water</li> <li>United Utilities Water</li> <li>Wessex Water</li> </ul> | <b>Welsh Water - Importing Site</b><br><b>Capacity (tDS per year)</b><br><ul style="list-style-type: none"> <li>5000</li> <li>5001 - 10000</li> <li>10001 - 17500</li> <li>17501 - 36000</li> </ul> | <b>United Utilities - Importing Site</b><br><b>Quantity of Sludge (tonnes per year)</b><br><ul style="list-style-type: none"> <li>2379 - 6228</li> <li>6229 - 10813</li> <li>10814 - 16788</li> <li>16789 - 40182</li> </ul> | <b>Severn Trent - Importing Site</b><br><b>Quantity of Sludge (tonnes per year)</b><br><ul style="list-style-type: none"> <li>894 - 1985</li> <li>1986 - 3354</li> <li>3355 - 5293</li> <li>5294 - 8361</li> </ul> | <b>Wessex Water - Importing Site</b><br><b>Quantity of Sludge (tonnes per year)</b><br><ul style="list-style-type: none"> <li>1883 - 3408</li> <li>3409 - 6916</li> <li>6917 - 9493</li> <li>9494 - 27017</li> </ul> | <ul style="list-style-type: none"> <li>Not Importing or Exporting Sites</li> <li>Non Water Sector AD Plants</li> </ul>   |
| <b>Exporting Site: Company</b><br><ul style="list-style-type: none"> <li>Severn Trent Water</li> <li>United Utilities Water</li> <li>Wessex Water</li> </ul>                             |   |  |  |  | <b>Driving Route: Company</b><br><ul style="list-style-type: none"> <li>Opportunity for inter-company trade</li> <li>Severn Trent Water</li> <li>United Utilities Water</li> <li>Wessex Water</li> </ul> |
| <b>Importing/Exporting Site: Company</b><br><ul style="list-style-type: none"> <li>United Utilities Water</li> <li>Wessex Water</li> </ul>   |   |  |  |  |  |

Other water and sewage companies sludge production closer to our treatment hubs than their own totals 4,500 tDS, or 5% of our forecast 2020 sludge treatment capacity. This is an initial indicator of potential for raw material imports to our treatment facilities.

We believe that we can offer a competitive unit cost to treat at our Advanced Anaerobic Digestion facilities for long- and short-term trades. Our capacity will need to be fully unlocked and explored in the face of upcoming sludge volume increases to make these offers (see Aim B: Providing resilience



for our customers). We will work to understand the costs to treat at each site and understand available capacity to allow us to offer the most economic option.

To take advantage of these opportunities to utilise our capacity, our plans are to:

**A3. Increase Market Value:** Develop a long-term sludge trading plan. The plan will provide long term trade gate fees for treatment of different types of sludge at different sludge hubs. This will be provided to our neighbours and to the organic waste markets and explored in conjunction with their future investment plans.

**B3. Provide Market Buffers:** Continue to provide short-term sludge trading options to our partners to facilitate enhanced resilience when they are temporarily short of capacity.

## *Market entrants*

It is likely that, over time, there will be new market entrants to the bioresources sector. Some of these entrants will be offering services such as:

- Design, build, financing and operation of capacity inside or outside our region combining one or more sources of organic waste (including sludge) into an optimal treatment package;
- Delivery of services to design and/or operate and maintain our bioresources assets where services can be combined to provide increased efficiency;
- Design, build, financing and operation of new technologies which may enable the recovery of new materials from our product streams, for example more energy, or different soil conditioning products; and/or
- Products, technologies and services which will help us to optimise our operations.

In 2020, 95% of our sludge will be enhanced treated. In AMP7, our AAD facilities will be relatively new, and we anticipate using the markets to explore new ways to optimise our assets and recover more energy and new products. In AMP8, we will explore opportunities for the market to support our need for capacity and capital maintenance.

We will engage these new emerging markets to help move us towards frontier performance for unit cost to treat, through:

**A1. Value Investments:** Where we have a business case to improve the value of our operation, we will look to the market at alternative funding and technology models to provide best value for our customers.

**C1. Technology Innovation:** New technology innovations are continually being made within the bioresources sectors. We will engage with the technology market and evaluate promising technologies against our bioresources business aims.

**A3. Market Value:** Where new entrants can provide future capacity or renewed capacity at the right quality and safety with lower cost than we can ourselves, we will consider these value propositions against our internal models of delivery.

**B3. Market Buffers:** We will seek options to use the market for buffer capacity to deal with sludge fluctuations and planned or unplanned capacity outages.

**C3. New Products:** If a participant in the market is better placed to deliver a new product or service to our customers than we are, we will consider their value proposition to improve our revenue streams.

## Product market

We are continually improving our energy and fertiliser products, for example, moving away from liming and towards AAD and generating useful energy in new ways (such as injecting biomethane into the grid).

Our customers feed back to us regularly on the quality of our product. We want to take on that feedback and continuously improve our processes and what we sell to them.

We will improve our customer relationships and products through:

“The biosolids cake rapidly broke down on the surface quicker than I anticipated and transformed the colour of the grass within a week enabling a quality first cut of silage to be taken with reduced fertiliser inputs. I now intend to use biosolids annually as part of a sustainable nutrient budget plan and look forward to seeing further cost efficiencies and improvements regarding soil health.”

*Pembrokeshire farmer*

**C2. Product Quality:** Over time we will develop a reputation for consistent, high quality and 100% compliant enhanced treated sludge.

**C3. New Products:** New products will become available over time as new materials are recovered from our processes (for example high quality fertilisers from struvite). We will use the markets to make these products available and will explore ways to increase our output (e.g. through new energy recovery options).

## Internal raw materials market

Our bioresources business has historically been heavily integrated into our wastewater treatment operations. This integration has included everything from shared profit and loss accounts, to shared operators and shared site machinery and equipment. By 2020, we will understand the revenue, cost and profitability of our bioresources business better than we have ever done before.

Figure 16: Cardiff advanced anaerobic digestion facility



Following implementation of the bioresources price control, our business will become both a customer and a supplier for our Wastewater Network+ business. To deliver a high quality service to Network+, we need to be able to understand the value of the different interactions which are made across business boundaries as well as the volume and constituent components of these interactions.

The crucial role that our bioresources processes fulfil in maintaining the service levels of Network+ will need to be recognised in the relationship that we define between the two businesses.

Bioresources will become an effective standalone business, with clearly defined service levels for our customers by:

**A2. Cultivating Production Mentality:** Treating our operations as the value-adding factories that they are. This will include developing a clear understanding of our raw material inventory and value and the added value of our production line. We will develop Service Level Agreements with our wastewater treatment business, including value recognition and incentivising of good performance.

With so many small rural wastewater treatment works across a difficult and large geography, we need an exemplar logistics operation to make our sludge operations cost effective. From Figure 14

on page 23 it can be seen that collecting small volumes of sludge from so many sites, setting up regional thickening centres, and then feeding the six treatment centres requires us to focus heavily on a professional, efficient logistics operation. We will continue to focus on driving efficiencies in this area and exploring innovative ways to drive further efficiencies.

**B2. Increasing Operational Resilience:** We will focus on putting customer satisfaction measures in place and aiming to improve satisfaction through increasing our resilience, service, value for money, and capacity – adding value to the wider business.

#### *Other waste industries*

Co-digestion and other sharing of facilities has traditionally been difficult due to the cost associated with the application of waste permitting regulations to sludge treatment facilities. We will continue to review and explore co-digestion opportunities as the market matures, and we intend to utilise our capacity to provide additional value to our business through gate fees.

We will become more effective in our engagement with other organic waste markets by:

**A3. Increasing Market Value:** Continually reviewing and updating our understanding of environmental regulations and identifying change which could enable us to participate more fully in other organic waste markets. We will review this in conjunction with developing our understanding of our own treatment capacities and future sludge volumes to identify capacity that could be used to generate value which would enable savings for our customers.

Welsh Water Infrastructure (part of the Glas Cymru group, which also owns Welsh Water) took over a food waste anaerobic digestion and composting plant in Cardiff in December 2017. This has helped the wider company to develop our organic waste treatment skills and develop our knowledge of the wider bioresources market. Our expectation is that boundaries between sewage sludge and other forms of bioresources treatment, such as food waste AAD, will break down over time as markets develop. However, this will need regulatory change, for example regarding disposal of waste products, to maximise the potential opportunities.

## 8. Strategic risks

We regularly review operational, business, regulatory, and other risks to bioresources. Table 2 shows a selection of identified risks and how we are working to manage these through our strategy.

Our mitigations are phased through time according to how risks could emerge, and the opportunities that could be realised as part of our investment. Our priority for AMP 6 has been to transform our asset base from conventional treatment to advanced anaerobic digestion. This has helped us to manage a broad spectrum of risks and is ongoing for the rest of the AMP with the construction of the Cog Moors AAD plant. With the development of the bioresources market in AMP7, our focus will be on developing market buffers for sludge treatment and driving increased use of our product for energy generation, in agriculture, and in innovative new ways. This will help us to address some of the market risks we currently face.

Through AMP7, we will build resilience to operational and market risks through increasing our strategic storage, while using our capital maintenance investment to improve the percent dry solids of raw sludge. This will provide benefits across resilience, profitability, and the environment.



Table 2: Bioresources risk matrix





| AIM                |  | A. Maximise business profitability                                    |  |  | B. Increase resilience for our customers                  |   |  | C. Promote the circular economy  |   |  |
|--------------------|--|---|--|--|---|---|--|--|---|--|
| OBJECTIVE          |  | A1. Value Investments   | A2. Production Mentality   | A3. Market Value   | B1. Asset Resilience                                      | B2. Operational Resilience  | B3. Market Buffers   | C1. Technology Innovation  | C2. Product Quality   | C3. New Products   |
| MITIGATION ACTIONS |  | Move away from liming and towards AAD. Optimised transportation hubs. | Production management techniques. Customer Service Level Agreements. | Using the market to provide future capacity. Supplying our capacity to the market. | Additional Strategic Storage. Improved dewatering assets. | Pro-active maintenance of our capacity. Ensuring enhanced product is available. | Open short-term routes to market. Regular discourse with our neighbours. | Recover more energy and resources. Explore new technological advances. | 100% compliant product. 100% useful deployment. Minimise resources for manufacture. | Maximise implementation of new products. Use markets where best placed to implement. |
| External risks     | Short term loss of access to the landbank (e.g. weather event) | ✓   | ✓  | ✓  | ✓✓  | ✓   | ✓✓   |  |   |  |
|                    | Long term loss of most or all of the landbank                  | ✓✓  |  | ✓  | ✓✓  | ✓   | ✓✓   |  |   |  |
|                    | Treatment capacity constraints due to growth                   |   |  | ✓✓   |   |   | ✓✓   |  |   |  |
|                    | Treatment capacity constraints due to production fluctuations  |   |  |  | ✓✓  |   | ✓✓   |  |   |  |
|                    | Transportation capacity constraints                            |   |  |  |   |   | ✓✓   |  |   |  |
|                    | Future soil improvement product prices                         | ✓✓  |  |  |   |   |  | ✓✓   | ✓✓  | ✓✓   |
|                    | Future energy prices   | ✓✓  |  |  |   |   |  | ✓✓   | ✓   | ✓✓   |
| Internal risks     | Odour nuisance   | ?   | ✓  |  | ✓   |   |  |  |   |  |
|                    | Sludge management costs increases                              | ?   | ✓  |  | ✓✓  | ✓✓  |  |  |   |  |
|                    | Ageing asset base leading to capacity shortfalls               |   |  | ✓  | ✓✓  | ✓✓  |  |  |   |  |
|                    | Missing energy neutrality or GHG emission targets              | ?   | ✓✓   |  |   |   |  | ✓✓   |   | ✓✓   |
|                    | Non-compliant product  |   |  |  |   | ✓✓  |  |  | ✓✓  |  |
|                    | Not achieving best value                                       | ?   | ✓✓   | ✓✓   |   |   |  | ✓  | ✓   | ✓  |
|                    | Ageing decommissioned storage tanks presenting H&S hazard      |   |  |  |   | ✓✓  |  |  |   |  |

✓✓ - Would strongly assist in mitigating risk or addressing challenge

✓ - Would assist in mitigating risk or addressing challenge

## 9. Delivering success for our customers

Our Measures of Success encapsulate our ambitions and align with our strategic objectives.

| Strategic Responses   | Measures of Success  | Description   | Driving Activities in AMP7  | 2019/20 Target (AMP6) | 2024/25 Target (AMP7) |
|---|--|---|---|-----------------------|-----------------------|
|  <p><b>10. Protecting our Critical Wastewater Assets.</b><br/>Faced with an increased risk of disruption – for example, from an increase in severe weather as a result of climate change and reduced customer acceptability of pollution events – we will improve the resilience of our critical wastewater assets, which have high environmental and customer impacts of failure.</p> | <b>En8.</b><br>Bioresources disposal compliance (% sludge disposed satisfactorily) | The percentage of wastewater sludge disposed of satisfactorily.   | <ul style="list-style-type: none"> <li>Investment in resilience of our assets</li> <li>Development of strategic storage</li> <li>Proactive operation &amp; maintenance</li> <li>Using the markets to buffer capacity</li> </ul> | 100.0%                | 100.0%                |
|  <p><b>16. Cleaner rivers and beaches.</b> With increasing pressure on the natural environment from increased population, changing land use, climate change and new sources of pollution, we will improve our wastewater assets to do our part to help achieve 'good' environmental status for our rivers, lakes and coastal waters.</p>   |  |   |   |                       |                       |
|  <p><b>8. Ensuring affordability of services delivered to customers.</b> With inequality, debt, and poverty on the rise we aim to ensure that our services remain affordable for all customers. We will ensure that we continue to provide the best service in increasingly innovative and efficient ways and pass these savings on to our customers.</p>                            | <b>Ft3.</b> Energy self-sufficiency  | Electricity generated and gas injected to grid as a percentage of all electricity and gas consumed (gas expressed as an electricity equivalent)   | <ul style="list-style-type: none"> <li>Recovering more useful energy from our products using AAD</li> <li>Operational optimisation using production management techniques</li> </ul>  | 26%                   | 35%                   |
|  <p><b>18. Promoting a Circular Economy and Combatting Climate Change.</b><br/>Faced with a changing climate and increased energy costs, we will aim to become an energy neutral business, whilst maximising the opportunities to reuse treated water and other potentially valuable natural materials, contributing to the circular economy in our local region.</p>                | <b>En7.</b><br>Bioresources product quality  | The percentage of Waste Water sludge processed through our advanced digestion facilities, producing an Enhanced Treated biosolids product and meeting the Biosolids Accreditation Scheme (BAS) accredited standard. | <ul style="list-style-type: none"> <li>Recovering more useful energy from our products using AAD</li> <li>Operational optimisation using production management techniques</li> </ul>  | 95%                   | 97.3%                 |

## 10. Glossary

|                                       |   |
|---------------------------------------|---|
| Advanced Anaerobic Digestion (AAD)    | A digestion process with pre-treatment that alters the nature of the sludge to enhance the process in some way, typically to increase gas yield, improve the handling characteristics of the treated product, and/or provide a more hygienic product. |
| Biomethane                            | Gas which is released by digestion processes. With current technology it can be injected into the gas grid, used to drive electrical generators and produce heat, or burnt in a flare.  |
| Bioresources                          | The business of processing sewage sludge and making use of the products.  |
| Biosolids                             | Sewage sludge.  |
| Co-digestion                          | Digestion of a mixture of multiple feedstocks together, for example sewage sludge and food waste.   |
| Conventional Anaerobic Digestion (AD) | A digestion process which does not have pre-treatment which alters the nature of the sludge. Thickening and dewatering can precede conventional anaerobic digestion, because they do not alter the nature of the sludge.                              |
| Digestion                             | A process which uses micro-organisms to reduce an input material to a more desirable state.   |
| Dry solids                            | The non-liquid element of sewage sludge.  |
| Dry tonnes                            | A measurement of sludge, giving the weight of the solids in the sludge without accounting for the water in it.  |
| Enhanced product                      | Treated sludge which is superior to that produced by conventional digestion or liming, for example through easier handling or the ability to be used on more types of farmland.   |
| Intermediate site                     | A site which thickens and/or dewateres sludge from multiple wastewater treatment works, before the sludge is forwarded to a treatment hub.  |
| Landbank                              | The area for which we have an agreement with farmers for them to use our treated biosolids as a soil conditioner.   |
| Liming                                | A sludge treatment process involving the mixing of sludge with quicklime.   |
| Liquor                                | The liquid returned from thickening and dewatering processes. Liquor requires further treatment before release to the environment or reuse.   |
| Raw sludge                            | Raw sewage with some of the water removed.  |
| RHI                                   | Renewable Heating Incentive.  |
| ROC                                   | Renewables Obligation Certificate.  |
| Sludge treatment                      | A group of processes which can be used to transform raw sludge into one or more products which can be used or safely disposed of.   |
| Struvite                              | A mineral which forms scale on sewage treatment equipment. It can be refined for use as a fertiliser.   |
| Thermal hydrolysis                    | A pre-treatment process for digestion in which sludge is heated to break down the cellular structure of the input material, releasing more nutrients for the digestion process.   |

|                           |  |
|---------------------------|--|
| Thickening and dewatering | Processes which remove water from sludge, increasing the percent dry solids. Dewatering removes a greater proportion of water and can result in a relatively dry product that is no longer a liquid. |
| Treatment hub             | A digestion or liming site which receives imports of sludge from multiple wastewater treatment works, often including from intermediate sites.   |

## 11. References

Welsh Government (2015). Water Strategy for Wales. Available at <https://gov.wales/topics/environmentcountryside/epq/waterflooding/publications/water-strategy/?lang=en>.

Welsh Water (2018). Welsh Water 2050. Available at <https://www.dwrcymru.com/en/Company-Information/Business-Planning/Welsh-Water-2050.aspx>.