WSX52 – Bioresources tables commentary

Business plan
2025-2030

Wessex Water
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WSX52b – PR24 bioresources tables commentary

CONTENTS

This supporting document is part of Wessex Water's business plan for 2025-2030.

Please see 'WSX00 – Navigation document' for where this document sits within our business plan submission.

More information can be found at wessexwater.co.uk

1. BIO1 – Bioresources sludge data

1.1. Lines 1 to 3 – Total sewage sludge produced and treated by incumbents and 3rd party sludge service provider

Increasing sludge production arises from increasing sewage load treated at water recycling centres (WRC) and from an increase in inorganic sludge production, the latter arising from increased P removal at WRCs.

A sludge production forecast model was produced in PR19 based on analysis of reported data over the last 8 years (2010-2018) to establish the underlying growth after allowance is made for inorganic sludge production as P consents have been introduced at our WRCs.

The PR19 model was updated and re-baselined using 2022/23 data to forecast sludge growth for PR24.

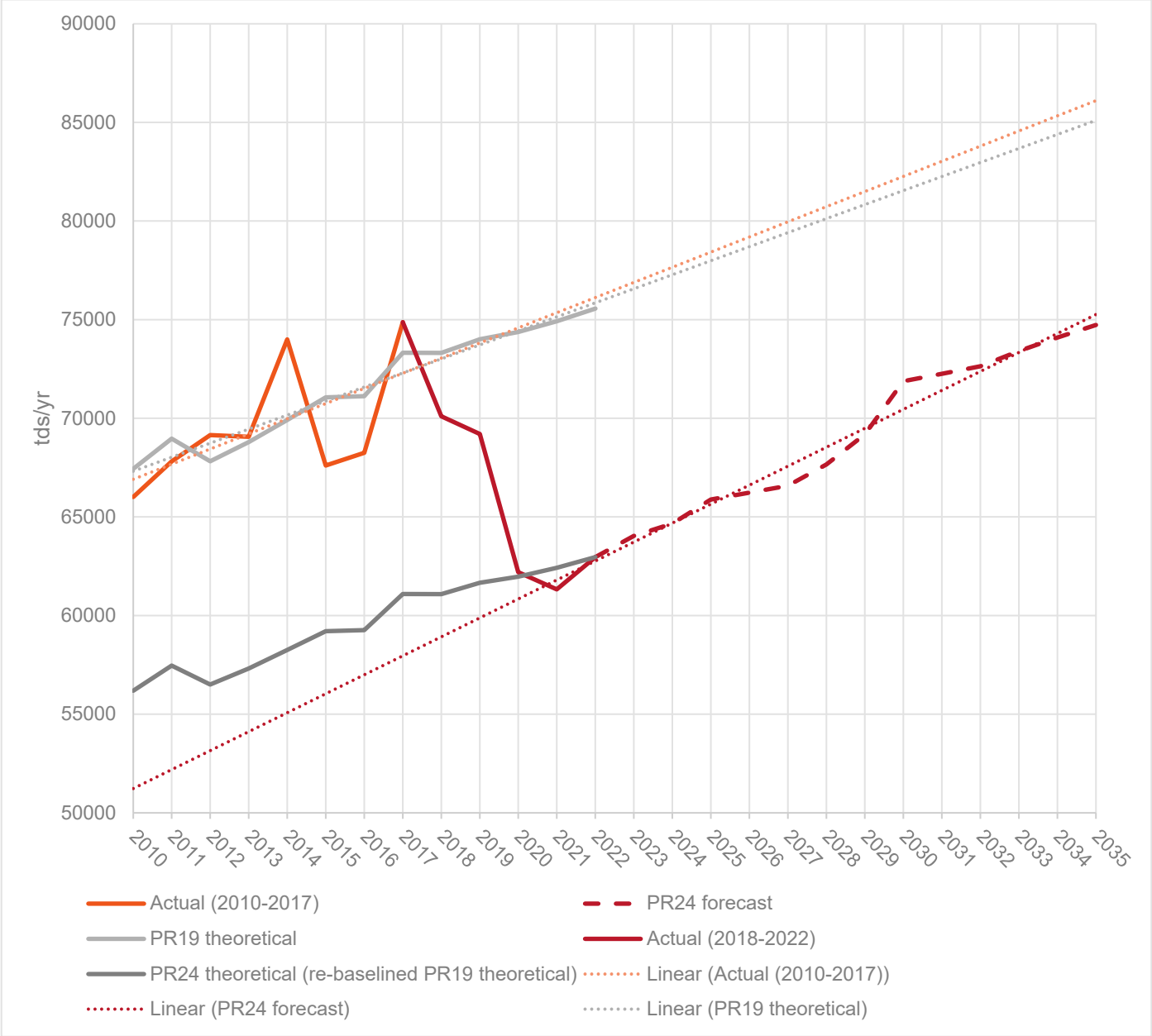
Theoretical inorganic sludge production for each year has been derived based on the timing and consent levels for existing and future P Permits at our WRCs.

The analysis uses a bottom-up approach based on sludge production at each individual WRC. This enables changes in sludge production from the introduction of new P consents to be more accurately forecast.

We used the model to forecast the total sludge production from 2023/24 to 2034/35. An underlying growth factor of 0.4% per annum has been assumed, based on the analysis of historical data described above, with increases in sludge production from additional inorganic sludge calculated when a new or tighter P consent is introduced at a WRC.

Figure 1 shows the forecast sludge production from 2023/24 to 2034/35.

Figure 1 – Sludge production model and forecast.



We believe the significant drop seen between 2017/18 and 2019/20 was due to an improvement in the measurement of cake disposal volumes. Therefore, we consider the lower volumes seen from 2020/21 to 2022/23 to be the current baseline of our forecast. However, we have only based our model on 2022/23 volumes because we believe the sludge production in 2020/21 and 2021/22 have been influenced by the impact of the Covid pandemic.

The forecast annual sludge growth from P removal in AMP8 is higher than historic increases seen in AMP6 or AMP7 due to the tightening of P consents for many sites in AMP8, with most consent limits reducing to 0.5mg/l or 0.25mg/l. This results in up to 25-30% more sludge produced from the increased chemical dosing and tertiary solids removal.

The forecast annual sludge growth from P removal is similarly high for AMP9, as even more sites will be receiving tighter P consents in AMP9.

We have forecast the annual sludge growth from P removal based on the expected completion date of each individual P removal scheme. We are expecting a large number of the AMP8 P removal schemes to be completed in 2029/30, which explains the step change in sludge production from 2029/30 and 2030/31.

Our full methodology for sludge volume forecasting is described in the Supporting Document WSX18 titled 'Bioresources strategy and investment' in Section 5.

For sludge treated by 3rd party sludge service provider, we expect that we will continue requiring short-term sludge trades with Severn Trent Water and Southern Water as contingency for the rest of AMP7 and AMP8. We forecast that we will export 50% more sludge in 2023/24 than in 2022/23 due to the ongoing refurbishment work on the digestion plant at Poole. The exported sludge volume for 2024/25 would drop to 50% compared to 2023/24 as we expect 2 of 3 digesters at Poole would be online by then. From 2025 to 2030, we forecast that we would export approximately 100tds/yr due to unplanned outages at our bioresources centres (BC).

1.2. Line 4 – Total sewage sludge produced from non-appointed liquid waste treatment

The volume of sludge arising from the treatment of organic waste cannot be directly measured - it can only be calculated from measurement of volume and load discharged into the head of the WRC.

To establish charges for organic waste we routinely measure settled chemical oxygen demand (COD) and total suspended solids and have comprehensive data for these parameters. To estimate sludge production requires further data on biochemical oxygen demand (BOD) and settable solids for which we only have limited data. To derive secondary sludge production, it is also necessary to assume a conversion factor (kg sludge produced from kg BOD) for the relevant process at each WRC where organic waste is treated.

There is limited data available to derive an estimate for organic waste sludge production. Therefore, we have used a rolling average value of 3 years to estimate each year's organic waste sludge production. This results in an approximate 4.1 to 4.4 tds/yr of organic waste sludge production from 2023/24 to 2029/30.

1.3. Line 5 – Percentage of sludge produced and treated at a site of WRC and BC co-location

In PR19, the increase in P removal has predominately occurred at WRCs that are not co-located with BCs. Therefore, the percentage of sludge produced and treated at a site of WRC and BC co-location has marginally reduced each year. However in PR24, this is no longer the case, as all WRCs co-located with BCs will have P removal by 2025/26, except for Avonmouth and West Huntspill. Therefore, we are forecasting the percentage of sludge produced and treated at a site of WRC and BC co-location to marginally increase each year from 47.21% in 2023/24 to 52.16% in 2029/30.

Our sludge production forecast, which is built up from data from individual WRCs, has been used to derive the forward forecast for this line.

1.4. Lines 6 to 8 – Total sewage sludge disposal by incumbents and 3rd party sludge service provider

The forecast for sludge disposal is based on the forecast of sludge production and changes in the capacity or type of sludge treatment at each BC.

There is significant maintenance work planned from 2023/24 to 2029/30 which will result in large reduction in digestion capacity each year:

- The ongoing digester refurbishment work at Poole, which will likely complete in 2024/25, will mean that 25tds/d of digestion capacity is unavailable in 2023/24 and 8tds/d in 2024/25.
- We plan to take 3 of our 5 anaerobic digestion (AD) sites offline to enable major maintenance and upgrade works to be undertaken safely on these sites. The sites will be taken offline one at a time, which will result in a reduction of c. 27tds/d of digestion capacity throughout AMP8.
- We will also need to refurbish all 8 digesters at Avonmouth, 1 at a time, in a rolling maintenance programme throughout AMP8. This will result in another 11tds/d of digester capacity reduction throughout AMP8.

The shortfall in digestion capacity will need to be compensated through lime treatment. Therefore, we are forecasting significant increases in lime treatment – an additional 25tds/d in 2023/24, 8tds/d in 2024/25, and 38tds/d from 2025/26 to 2029/30. The impact of the increased lime treatment (and forecast growth in sludge production) is an overall increase in sludge disposal volumes every year from 2023/24 to 2029/30. As we plan for the 1st of the 3 AD sites to be taken offline in 2025/26, we expect a step-change increase in sludge disposal volumes to occur in that year (i.e., from 47.7ttds/yr in 2024/25 to 50.5ttds/yr in 2025/26).

To accommodate the increased short-term lime treatment and provide additional treatment resilience, we plan to install additional 20tds/d lime treatment capacity at Palmersford in 2025/26 and another 25tds/d liming capacity at West Huntspill in 2026/27.

As explained in Section 1.2, we might need to export sludge to Severn Trent Water and Southern Water for additional resilience if our planned maintenance works are delayed or unplanned downtime occurs. We have forecast 3rd party disposal volumes based on 3rd party export volumes – 50% additional volume in 2023/24 than in 2022/23, and half the volume of 2022/23 for every year after 2023/24. We assume all exported sludge to be digested, as is the case in previous years. So, we apply a digestion reduction factor of 37% to the exported volumes to obtain the disposal volumes.

1.5. Lines 9 to 13 – Total intersiting ‘work’ done by pipeline, tanker, and truck

The forecast increase in intersiting work done by pipeline is based on the forecast annual increase in sludge production at Holdenhurst and Yeovil Pen Mill (the only 2 sites that deliver sludge via pipeline). The forecast increase is minimal due to the small scale of these two sites compared to rest of our sites in total.

We are expecting the intersiting work done by tanker to be higher in 2023/24 than 2022/23 due to the digester refurbishment work at Poole, which will require all indigenous and imported sludge at Poole to be diverted to other sites for treatment. We are then expecting the intersiting work done by tanker for 2024/25 to reduce slightly, as Poole’s capacity recovers. For the same reasons, we expect the intersiting work done by truck to reduce from 2022/23 to 2024/25. The phased capacity recovery at Poole will result in the gradual reduction in the amount of dewatered sludge (i.e., raw cake) that will need to be transported out of Poole by truck to lime treatment centres (Ratfyn and West Huntspill) for temporary treatment.

The 3 AD sites that we plan to take offline in AMP8 for maintenance will have a significant impact on the intersiting work done by tanker and truck in AMP8. The sites will be taken offline in the order of Taunton (2025-2026), Trowbridge (2027-2028) and Berry Hill (2029-2030). We are planning for all indigenous sludge at Taunton and sludge imports in its catchment to be diverted to West Huntspill primarily via tanker as West Huntspill will have the capability for large-scale sludge reception and dewatering prior to lime treatment. However for Trowbridge, we are planning for all its indigenous sludge and imported sludge to be dewatered at Trowbridge and transported to Palmersford via truck for lime treatment, as Palmersford would not be able to accommodate the volume of liquors generated from large-scale dewatering. The same arrangement at Palmersford is also planned for Berry Hill.

As a result of the planned works above, we are forecasting increased sludge transport distances via tanker and truck (and therefore intersiting work done by both modes of transport) in the catchments of Taunton, Trowbridge, and Berry Hill, as sludge will be diverted to West Huntspill and Palmersford. The transport of large volumes of cake from Trowbridge to Palmersford by truck can be seen in the step-change increase in intersiting work done by truck from 2027/28 to 2028/29. The step-change drop in intersiting work done by truck in 2028/29 would be due to the transfer of cake from Berry Hill to Palmersford, which is over a much shorter distance (i.e., 7 times shorter than the distance between Trowbridge and Palmersford).

The increase in intersiting work done by a tanker throughout AMP8 is also due to the increase in sludge volumes from additional chemical dosing on a large number of sites with tightened P consents.

The increased P removal in AMP8 will increase sludge production in terms of load and volume. However, we are forecasting a larger proportion of sludge volume increase to load – a rate of 1.25m^3 increase to 1tds increase. The reason for this is that we expect chemical dosing to result in thinner sludge produced from primary settlement (i.e., sludge %ds to be lower). Subsequently, we are forecasting higher sludge volumes that will need to be transported in AMP8 and therefore an increase in intersiting work done by tanker in m^3*km.

1.6. Lines 14 to 18 – Total ‘work’ done by pipeline, tanker, and truck in sludge disposal operations

We do not dispose sludge by pipeline or tanker.

Due to the reduction in Poole’s capacity and the need for increased liming in the short term, our forecast disposal work done by truck from 2023/24 to 2024/25 is higher than previous years.

We are forecasting a drop in landbank availability in each year of AMP8, as reflected in Table BIO4 Line 10. This results in greater distances for cake disposal by truck (Line 16). We have forecast the increase in disposal distance based on the national landbank model that was produced by Grieve Strategic. The forecast reduction in landbank availability is also based on this same model. We describe this in more detail in the commentary for Table BIO5 Line 10 In Section 6.

We forecast the need for additional sludge storage in AMP8 to enable all of our sludge to be stored for a period of around 3 months. The storage is required for mitigation against wet weather and for complying with changes in environmental regulations (Farming Rules for Water) affecting sludge disposal. We have 4 existing barns – 3 in Taunton and 1 in Wimborne. We forecast the need to build 9 more barns – 1 at Avonmouth in 2026/27, 2 at Trowbridge in 2028/29 and 6 at Malmesbury in 2029/30. The need to store all sludge in barns results in additional disposal distance required (i.e., the distance from BC to barn, and then barn to field) and therefore a significant increase in disposal work done by truck. As we forecast that the 6 barns at Malmesbury would be completed in 2029/30, we would then store all our sludge by 2029/30, which results in a significant increase in disposal work done by truck in that year.

The increase in disposal work done by truck throughout AMP8 is also due to the increased sludge volumes for disposal (as a result of the increased lime treatment required in AMP8 for resilience).

For Line 18, its line title is “Total measure of 'work' done by tanker in sludge disposal operations (by volume transported)” and the guidance document that this line is a mirror of the APR Table 8A Line 18. We assume Line 18 in the APR Table 8A to include the work done by truck in sludge disposal operations, as we only dispose sludge by truck, and this is the norm across the industry. Therefore, we also assume Table BIO1 Line 18 to include the work done by truck in sludge disposal operations and we have reported a figure for this line. If this line was only for work done by tanker in sludge disposal operations, we would have reported 0 in this line, as we do not dispose sludge by tanker.

1.7. Line 19 – Chemical P sludge as percentage of sludge produced at WRCs

We forecast an increase in the percentage of chemical P sludge at WRCs every year from 2023/24 to 2029/30 due to the tightening of existing P consents and new sites receiving P consents in AMP8.

We calculate the increase in inorganic sludge production due to P removal at each site, based on the timing and limit of the P consent. The volumes of sludge produced at all P removal sites are summed against the forecast total sludge production in Line 1 to derive the percentage of chemical P sludges.

1.8. Data quality

The confidence grade of each line is listed below, based on Ofwat's definitions.

Table 1 – Confidence grades

Line number(s)	Confidence Grade
1 to 3	C3
4	B3
5	B3
6 to 8	B3
9 to 12	B3
13	B3
14 to 17	B4
18	B4
19	B4

2. BIO2 – Bioresources operating expenditure analysis

2.1. Lines 1 to 10 – Sludge transport

Operating costs have increased between 2022-23 and 2023-24 as a result of increases in business rates by £1.9m due to expected increases in contractor and employment costs between the two periods. This results in a further £0.3m increase between 2023-24 and 2024-25. Operating costs are then forecast to decrease by £0.5m over AMP8 due to expected efficiencies being achieved.

2.2. Lines 11 to 20 – Sludge treatment

Operating costs have increased between 2022-23 and 2023-24 as a result of increases in business rates by £0.3m as the rates calculation changes basis at this point in time and a number of bioresources sites will increase as a result of reassessments. This trend continues throughout AMP8 with spend increasing circa £0.2m per annum, a total of £1.3m by the end of the AMP.

Other operating costs are expected to increase up to circa £11m per annum from £14.4m by the end of AMP8 due to additional expenditure incurred relating to increased costs for personnel and fuel and as a result in increased expenditure around health and safety. This is offset by efficiencies in the same period of around £0.2m per annum. Between 2022-23 and 2023-24 other operating costs are forecast to increase by £2.4m as a result of the expected increase in employment and contractor costs.

Power costs decrease by £0.4m from 2022-23 and the same value again from 2023-24 as a result of the expected reduction and economic stabilisation of power prices. Small increases are seen year on year throughout AMP8.

Income treated as negative expenditure reduces between 2022-23 and 2023-24 by £0.5m and then by £0.1m between 2023-24 and 2024-25 for the same reasons. It remains consistent throughout AMP8.

2.3. Lines 21 to 30 – Sludge disposal

Operating costs are forecast to increase between 2023-24 and 2024-25 as a result of increases in employment and contractor costs as noted in 2.1 and 2.2 by £0.5m. Over the course of AMP8 the operating costs are forecast to decrease by £0.2m via internal efficiencies.

2.4. Data quality

The confidence grade of each line is listed below, based on Ofwat's definitions.

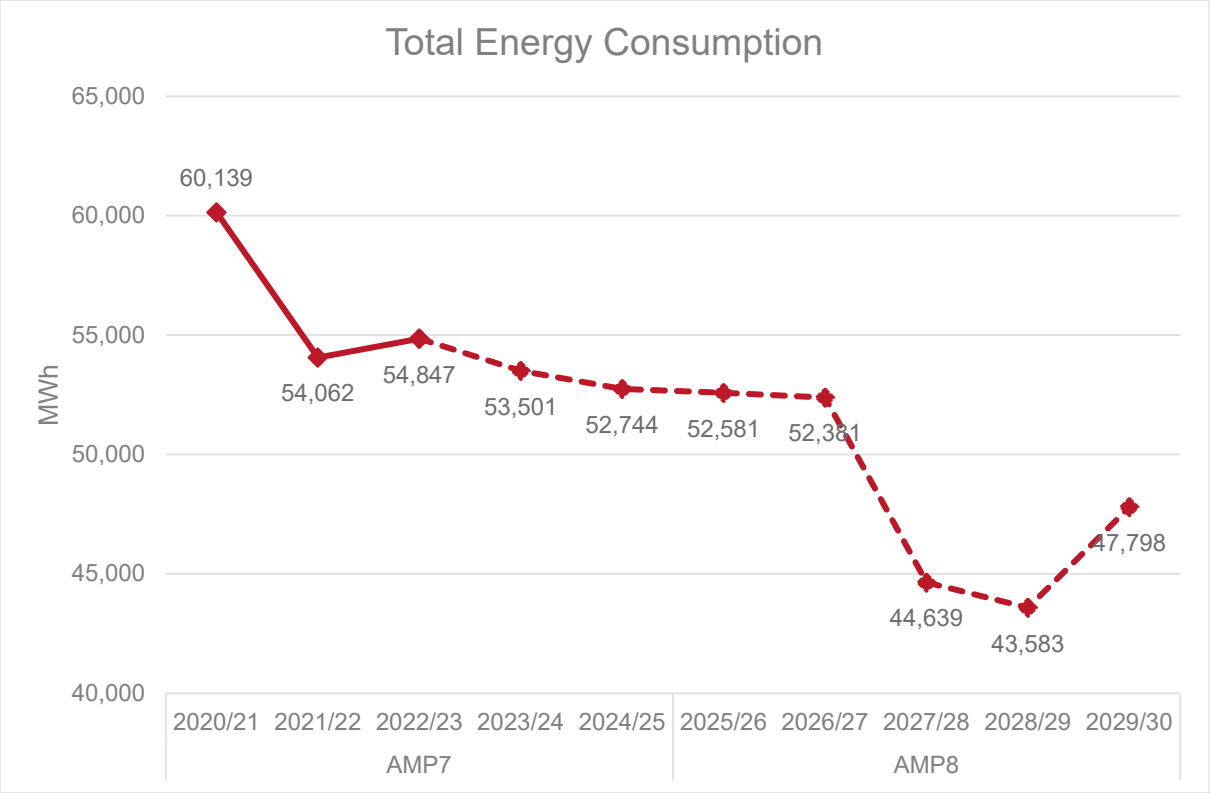
Table 2 – Confidence grades

Line number(s)	Confidence Grade
1 to 30	B3

3. BIO3a – Bioresources energy analysis

3.1. Line BIO3a.1 / BIO3a.12

Figure 2 – Total energy consumption



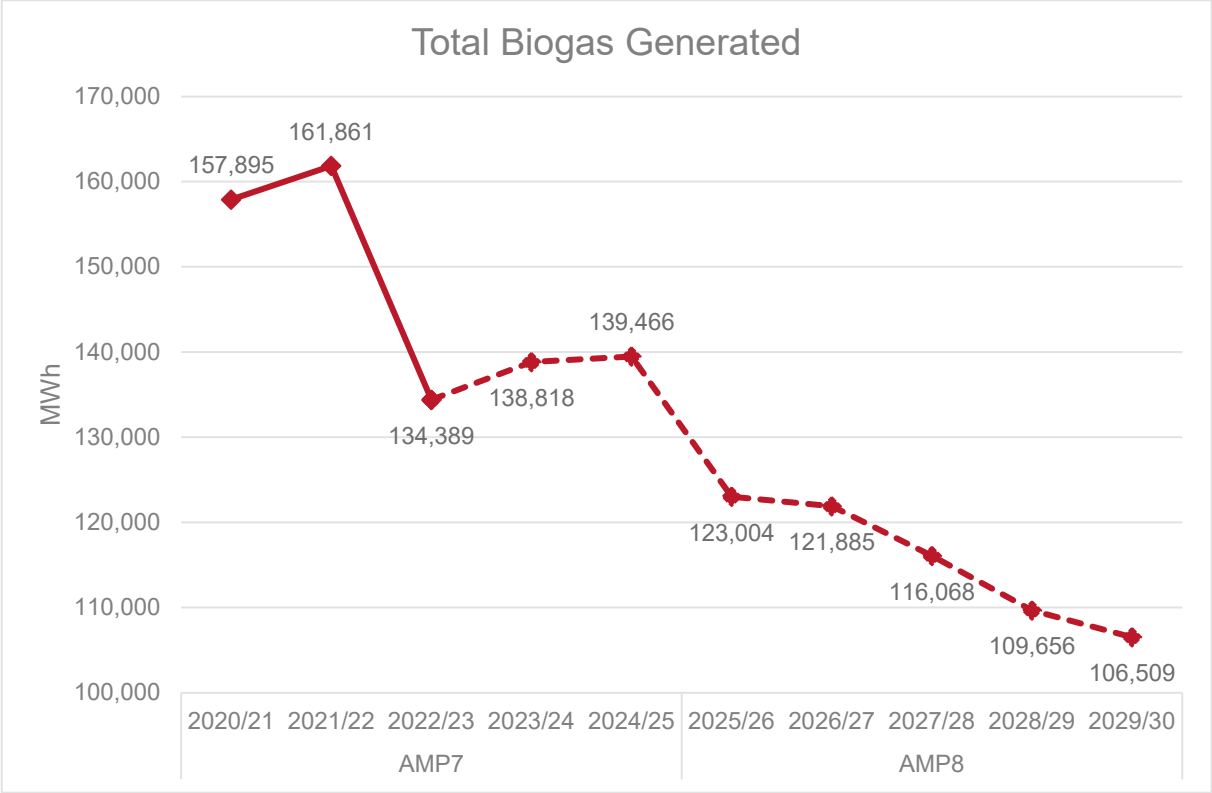
Total energy consumption is expected to reduce each year from 2023/24 to 2028/29, before increasing in 2028/29 and then decreasing again in 2029/30. The decreases in AMP8 are due to forecasting the need to take sites offline within AMP8. This forecast follows our bioresources maintenance plans for AMP8, as detailed in Sections 1.4 and 1.5 above.

3.2. Lines BIO3a.2 to BIO3a.3 / BIO3a.13 to BIO3a.14

All energy generated by bioresources is exported to a third-party and this will continue in AMP8. Therefore, we report zero for these lines.

3.3. Lines BIO3a.4 / BIO3a.15

Figure 3 – Total biogas generated



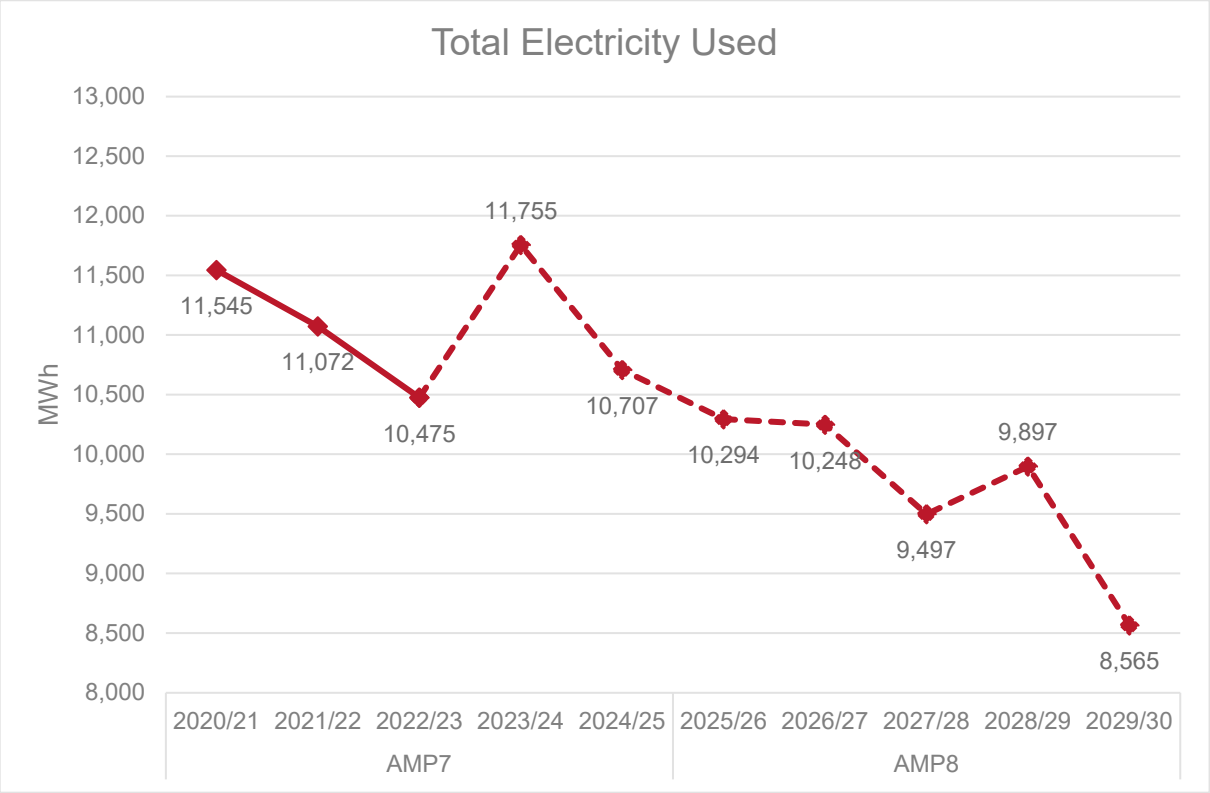
Biogas generation is expected to increase in 2023/24 and 2024/25 before reducing each year in AMP8. The reductions in AMP8 are due to planned capital maintenance on our anaerobic digestion sites, which require these sites to be taken offline. For further details on our planned site outages, please refer to Sections 1.4 and 1.5 above.

3.4. Lines BIO3a.5 / BIO3a.16

All energy generated by bioresources is exported to a third-party and this will continue in AMP8. Therefore, we report zero for these lines.

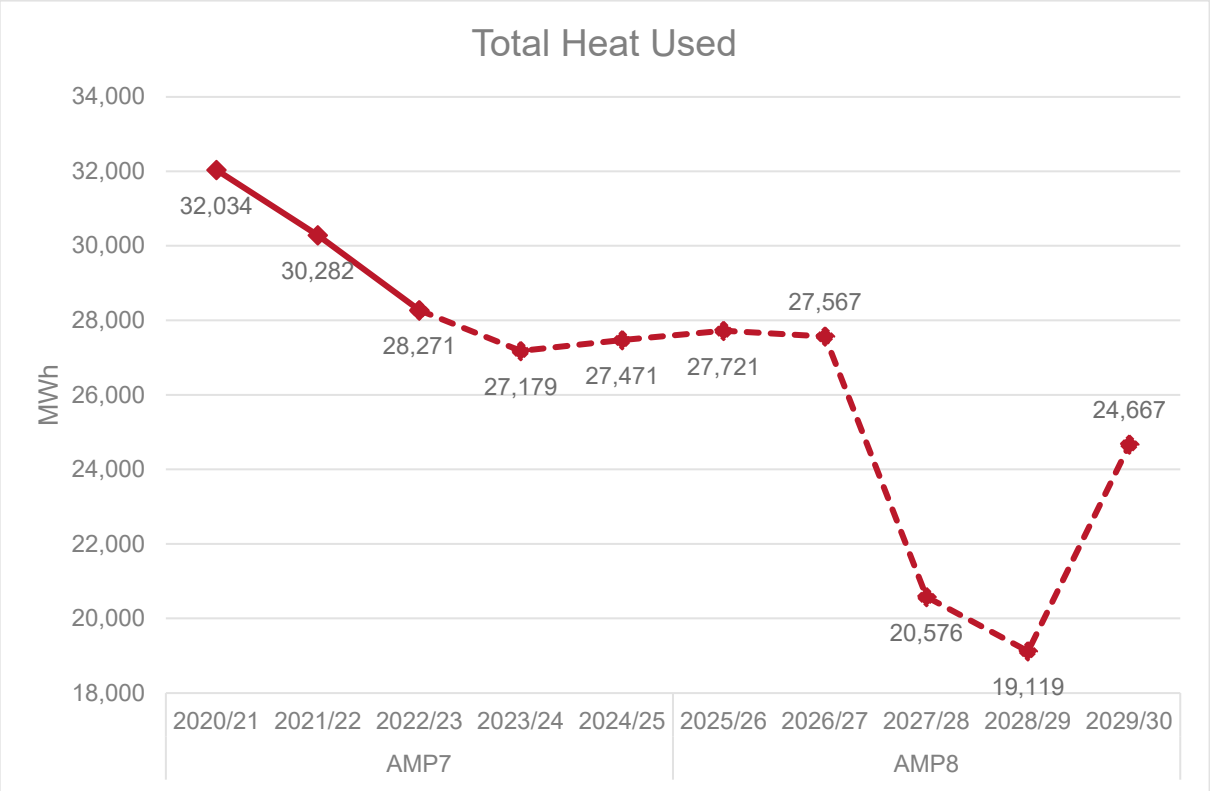
3.5. Lines BIO3a.6 / BIO3a.17

Figure 4 – Total electricity used



Total electricity consumption is expected to increase in 2023/24 and then reduce each year from 2024/25 to 2027/28, before increasing in 2028/29 and then decreasing again in 2029/30. The decreases in AMP8 are due to forecasting the need to take sites offline within AMP8. This forecast follows our bioresources maintenance plans for AMP8, as detailed in Sections 1.4 and 1.5 above.

Figure 5 – Total electricity used



Heat usage is expected to decrease in 2023/24, rising slightly each year to 2026/27, before reducing each year to 2028/29. The decreases in AMP8 are due to forecasting the need to take sites offline within AMP8. This forecast follows our bioresources maintenance plans for AMP8, as detailed in Sections 1.4 and 1.5 above.

3.6. Lines BIO3a.7 and BIO3a.18

Total energy consumption costs are expected to be consistent across AMP7 and AMP8, ranging between £1,69m and £1.77m per annum due to variations in consumption which are offset by expected reductions in power prices.

3.7. Lines BIO3a.8 to BIO3a.11 and BIO3a.18 to BIO3a.22

As per 3.6, for line BIO3a.21 we are forecasting the income from energy generated by bioresources and exported to the grid or third party to be consistent across AMP8, varying between £2.9m and £3.7m due to power prices and estimated changes in production.

The reduction seen in AMP7 from 2022-23 to 2023-24 of £0.4m is forecast in line with expected reductions in power prices despite an increase in production. Reductions in forecast production then lead to the reduced income in 2024-25 and 2025-26 by £0.1m per annum.

The reductions in costs seen on line BIO3a.22 between 2022-23 and 2023-24 is again due to the forecast reduction in energy prices for electricity. The forecast throughout AMP8 is consistently between £1.4 and £1.7m due to the factors noted in 3.6.

The heat costs are expected to reduce in 2023-24 due reduced use of CHPs and then the cost will remain consistent at circa £0.9m throughout AMP8 aside from the reduction observed in 3.5 due to reduced heat requirements from Avonmouth although the reduction will only be £0.3m.

3.8. Data quality

The confidence grade of each line is listed below, based on Ofwat's definitions.

Table 3 – Confidence grades

Line number(s)	Confidence Grade
1 and 12 4 and 15 6 and 17 18 to 22	B3
2 to 3 and 13 to 14 5 and 16	A1

4. BIO3b – Bioresources; income, liquors and metering

4.1. Lines BIO3b.1-8

There is no income forecast regarding Renewable Energy Certificates, Renewable Heat Incentives or Energy Subsidies in Wessex Water Services Limited in either AMP7 or AMP8. All such income is recognised in the group company Wessex Water Enterprises Limited.

4.2. Line BIO3b.9-10

Our forecast of BOD and ammonia load of liquors is done at site level, based on the forecast total sludge production reported in BIO1.3. The volume of liquors produced at each bioresources centre is derived from the forecast sludge volumes treated at each bioresources centre. The BOD and AmmN load in the liquors at each site is estimated based on historic liquor sample results.

We are forecasting an increase in the BOD and ammonia load of liquors returned from bioresources to network plus from 2023/24 to 2029/30 due to larger volumes of raw sludge liquors that will be produced as a result of the lack of digestion from the planned maintenance works as described in Sections 1.4 and 1.5.

The ongoing digester refurbishment scheme at Poole will result in an additional 10tds/d of raw sludge in 2023/24 and 3tds/d in 2024/25 due to the lack of digestion at Poole. Dewatering the additional raw sludge will generate large volumes of liquors for treatment in network plus. We estimate that an additional c. 600kg/d of BOD and c. 4kg/d of AmmN will be generated from liquors in 2023/24, and c. 200kg/d of BOD and c. 1kg/d of AmmN in 2024/25 as a result of this scheme.

The planned digester refurbishment scheme at Avonmouth from 2023/24 to 2029/30 will result in additional 5tds/d raw sludge to dewater each year. We estimate that an additional c. 300kg/d of BOD and c. 2kg/d of AmmN will be generated from liquors each year as a result of this scheme.

The planned AD site closures throughout AMP8 will result in additional c. 11tds/d raw sludge to dewater each year. We estimate that an additional c. 700kg/d of BOD and c. 4kg/d of AmmN will be generated from liquors each year as a result of each site closure.

The steady increase in BOD and ammonia loads year-on-year is also due to the forecast growth in sludge production in AMP8. The large jump in the BOD and ammonia load in 2029/30 would be due to the forecast increase in chemical P sludge volumes as a result of a large number of P removal schemes that will be completed in 2029/30.

4.3. Line BIO3b.11

The recharge to Bioresources by network plus shows a large increase in AMP8 with the fluctuations primarily driven by power costs.

4.4. Line BIO3b.12

All consumed electricity and heat, and generated biogas, in the Bioresources control is directly metered and this will continue throughout AMP8. Confidence grade assigned to this line is A1.

4.5. Data quality

The confidence grade of each line is listed below, based on Ofwat's definitions.

Table 4 – Confidence grades

Line number(s)	Confidence Grade
9 to 10	B3
11	B3
12	A1

5. BIO4 – Bioresources sludge treatment and disposal

5.1. Lines 1 to 7 – Sludge treatment process

The forecast of total sludge production for Table BIO1 Lines 1 to 3 is based on the forecast of sludge production at each WRC which considers growth from population and changes to P removal consents. This bottom-up approach allows the annual sludge loads for each BC to be forecast based on the sludge imports catchment of each BC. As the sludge treatment process of each BC is known, we are then able to forecast the percentage of sludge treated by each treatment process. There are only 3 types of sludge treatment processes on our sites – conventional anaerobic digestion (CAD), advanced anaerobic digestion (AAD) and raw sludge liming. Each BC has only one type of treatment process, except for Avonmouth which has two – AAD and raw sludge liming.

We are forecasting an increase in raw sludge liming % in 2023/24 and 2024/25 due to the digester refurbishment works at Poole and Avonmouth. The reduction in digestion capacity at Poole will require up to 25tds/d of sludge to be diverted to Ratfyn and Palmersford for lime treatment, while the reduction in digestion capacity at Avonmouth will require 11tds/d of sludge to diverted to temporary on-site lime treatment. The transfer of sludge from Poole to Ratfyn also results in the need to shift sludge to Berry Hill (a CAD site) and therefore an increase in CAD% in 2023/24 and 2024/25. Meanwhile, we forecast the digester refurbishment works at Avonmouth to result in a decrease in AAD% in 2023/24 and 2024/25, as Avonmouth is an AAD site.

As outlined in Section 1.4 and 1.5, we are planning major capital maintenance works at 3 of our AD sites throughout AMP8 which will result in the closure of each site in sequence over AMP8. We are planning for Taunton be taken offline from 2025/26 to 2026/27, Trowbridge from 2027/28 to 2028/29, and Berry Hill from 2029/30 to 2030/31. We are forecasting the need to divert c. 27tds/d of sludge from each AD site to either West Huntspill or Palmersford for lime treatment. Therefore, we are forecasting a significant increase in raw sludge liming % throughout AMP8.

The decrease in CAD% in 2025/26 to 2026/27 would be due to the closure of Taunton (a CAD site), while the decrease in AAD% in 2027/28 to 2028/29 would be due to the closure of Trowbridge (an AAD site), and the decrease in CAD% again in 2029/30 would be due to the closure of Berry Hill (a CAD site).

We are also planning for all 8 digesters to be refurbished at Avonmouth in a rolling programme that will span throughout AMP8. As a result, we are expecting c.11tds/d of sludge to be diverted from the AAD process to lime treatment. Therefore, this maintenance programme will contribute to the increase in raw sludge liming % and decrease in AAD% throughout AMP8.

The forecast for percentage split of 3rd party treatment processes is based on sludge being exported to Severn Trent Water and Southern Water, as we have ongoing short-term trades with them. Based on 2022/23 data, sludge exported to Southern Water was treated at Millbrook, a CAD site; and the majority of the sludge exported to Severn Trent Water was treated at Finham, which was a CAD site, but in 2023/24 will be an AAD site. The change in treatment type at Finham is the reason for the forecast increase in 3rd party AAD% from 2023/24 (and corresponding reduction in 3rd party CAD%).

5.2. Lines 8 to 13 – Sludge disposal route

We forecast that all CAD and AAD treated sludge will be recycled to land, as it has been in previous years.

We also forecast all 3rd sludge disposal to be 100% landbank, as we forecast all 3rd party sludge exports to be taken to neighbouring WaSCs, such as Severn Trent Water or Southern Water, who would be responsible for treatment

and disposal. In discussions with both companies, we understand that they recycle all their sludge to land, so we expect that all our sludge will also be recycled to land.

5.3. Data quality

The confidence grade of each line is listed below, based on Ofwat's definitions. Please refer to Annex A for details of the confidence grades.

Table 5 – Confidence grades

Line number(s)	Confidence Grade
1 to 7	B3
8 to 13	B3

6. BIO5 – Bioresources additional treatment and storage

6.1. Scope of the sludge drivers in the PR24 Water Industry National Environment Programme (WINEP)

The Environment Agency (EA) have provided clarification on the scope of the sludge (use in agriculture) drivers (SUiAR_IMP and SUiAR_ND) in the PR24 WINEP in an Information Letter sent to water companies on 19th May 2023. The letter states:

"The sludge (use in agriculture) driver seeks environmental enhancements in sewage sludge (biosolids) to deliver contingency measures (such as storage) when business as usual is disrupted. An objective of the sludge (use in agriculture) driver is to deliver improvements in the resilience of the sludge management chain; a supply chain that is almost totally reliant on agricultural outlets. The sludge (use in agriculture) driver supports actions to bring change to the way sludge is managed to ensure its soil conditioning and fertiliser value meets its full potential.

Storage + is a hybrid assessment in the sewage sludge (biosolids) supply chain. It includes both storage and other actions which deliver environmental improvements of sludge quality and handling prior to storage and before supply to agriculture, such as enhanced dewatering and pelletisation. The assessment also supports in principle the options associated with future EPR requirements for the agricultural use of sludge. The Storage + assessment does not support actions associated with addressing growth or volume of sludge. This means there is an in-principle presumption against options such as thermal destruction technologies and optimisation of sludge treatment processes."

Consequently, the EA have only approved in principle our proposals to provide additional storage barns.

We have identified enhancement needs in the areas of sludge treatment, thickening and dewatering that do not fall within the scope of the sludge drivers in the PR24 WINEP. Therefore, we plan to propose these investments as non-WINEP enhancement activities in our PR24 Business Plan.

6.2. Lines 1 and 8 – Additional sludge treatment

We are not proposing any quality enhancement schemes for additional sludge treatment.

6.3. Lines 2, 7 and 11 – Additional sludge thickening or dewatering

We are proposing to install additional sludge thickening of 5,475 tds per year at Avonmouth due to the deterioration in the quality (dry solids) of the imported sludges from satellite sites that have increased chemical dosing for achieving tighter P consents. We forecast the additional sludge thickening to be delivered through two schemes in 2026/27. We consider the additional sludge thickening to be a quality enhancement, but not within the scope of the sludge drivers in the PR24 WINEP. Therefore, we have listed the sludge ttds undergoing additional sludge thickening in Line 11 and left Lines 2 and 7 blank, as per the response of the Ofwat query ref. DTR-322. The query and response are as follows:

Query*: BIO5.1 & 2: In the guidance, OFWAT refer to WINEP/NEP drivers. Are they after the Tons of solids treated via main sludge treatment/undertaking thickening/dewatering in general or specifically as part of a WINEP scheme?*

Response: *We confirm that BIO5 1 & 2 refer to Quality Enhancement under WINEP. If your named action is not under WINEP, please include details using the additional lines under table BIO5 and provide further details of the actions undertaken in this space in the Tables Commentary document. For transparency, we will add additional lines in Table BIO5 in the next revision of our tables.*

Please note that the annual sludge ttds values in Line 11 are cumulative.

A summary of Line 11 is provided below:

Line	Description	Units	In or out of WINEP	Investments
11	Tonnes of dry solids undertaking thickening/dewatering	ttds/yr	Out of WINEP	Additional sludge thickening at Avonmouth in 2026/27 (2 schemes)

6.4. Lines 3 to 6 – Additional sludge storage

We are forecasting that we will require additional sludge storage prior to sludge disposal in AMP8 to mitigate against wet weather and manage the impact of changing environmental regulations (Farming Rules for Water).

We calculated the additional storage required in AMP8 based on the forecast increase in sludge disposal volumes in Table BIO1 Line 6 and the expected required storage duration of 3 months (based on a sludge storage assessment undertaken by Atkins). The required additional storage was determined to be approximately 46,900m^3, or equivalent to 9 storage barns with a total footprint of 40,294m^2 (based on the footprint of our existing storage barn at Wimborne).

The forecast number of schemes required to deliver the additional sludge storage is based on the proposed locations of the storage barns. We are proposing for 1 storage barn to be built at Avonmouth in 2026/27 through a scheme, 2 storage barns to be built at Trowbridge in 2028/29 through another scheme, and the remaining 6 storage barns to be built at Malmesbury in 2029/30 through a 3rd scheme.

We have not proposed any additional raw sludge storage (pre-thickening or post-thickening) in or outside the WINEP. Therefore, we have left Lines 3 and 4 blank.

Please note that annual storage m^2 values in Line 5 are cumulative.

The summary of Lines 5 and 6 is provided below:

Line	Description	Units	In or out of WINEP	Investments
5	Additional sludge storage - cake pads/bays area or equivalent (cake)	m^2	In WINEP	1. One barn at Avonmouth in 2026/27 (1 scheme) 2. Two barns at Trowbridge in 2028/29 (1 scheme) 3. Six barns at Malmesbury in 2029/30 (1 scheme)

6	Total number of sludge treatment schemes providing sludge storage	nr	In WINEP	3 schemes (as above), all in the WINEP

6.5. Lines 9 and 12 – Volume of sludge thickened or dewatered

Our forecast of the volume of sludge that will undergo additional thickening or dewatering is based on the tds of sludge that will undergo additional thickening at Avonmouth in Line 11. We estimate that the % dry solids of the sludge that will undergo thickening to be 3%. We calculated the equivalent volume of sludge using this % dry solids figure. As the additional sludge thickening is not a WINEP activity, we listed the volume of sludge undergoing additional thickening in Line 12 and left Line 9 blank.

Please note that the annual sludge m^3 values in Line 12 are cumulative.

The summary of Line 12 is provided below:

Line	Description	Units	In or out of WINEP	Investments
12	Volume of sludge processed via thickening or dewatering	m^3	Out of WINEP	Additional sludge thickening at Avonmouth in 2027/28

6.6. Line 10 – Landbank availability

A national landbank model has been produced by Grieve Strategic for water companies to forecast landbank availability by 2035. The model is based on forecast sludge disposal volumes and sludge nutrient levels provided by each company, assumed farmer acceptance rates, and forecast nutrient limits for different soil indexes (due to changes in the Farming Rules for Water (FRfW) regulation). The model does not consider external factors that are outside the control of water companies, e.g. potential changes in government policy or impact of public perception on sludge.

The model produces 3 possible scenarios of landbank availability by 2035:

- Benign – this scenario assumes minimal changes in FRfW, resulting in a reduction in available landbank but still sufficient for all water companies to recycle their sludge by 2035.
- Most likely – this scenario assumes the most likely changes in FRfW, resulting in larger reductions in available landbank, with water companies unable to recycle all their sludge by 2035.
- Adverse – this scenario assumes plausible maximum changes in FRfW, resulting in drastic reductions in available landbank and a further reduction in the capability of water companies to recycle their sludge by 2035.

We have used the 'Most Likely' scenario in the national landbank model to estimate landbank availability in AMP8. In this scenario, we will require 6 times more landbank to recycle our sludge by 2035. We have then pro-rated this additional landbank required over 10 years to produce a profile of landbank reduction over 2025 to 2030. This results in 95% landbank availability in the first 3 years of AMP8, and 94% in the last 2 years of AMP8.

As there are external factors that can impact landbank availability, the national landbank model and the forecast landbank availability figures from this model should be considered theoretical estimates. We consider landbank availability to be mostly out of our control.

For further details on the landbank assessment by Grieve Strategic and the impact of future landbank availability on our bioresources strategy, please refer to the Supporting Document WSX18 titled 'Bioresources strategy and investment' in Section 3.

6.7. Data quality

The confidence grade of each line is listed below, based on Ofwat's definitions. Please refer to Annex A for details of the confidence grades.

Table 6 – Confidence grades

Line number(s)	Confidence Grade
1 to 9 and 11 to 15	B3
10	C5

7. BIO6 – NMEAV for capital enhancement schemes

7.1. CPIH / CPIH lagged

The inflation adjustments used in this table are obtained from table PD1.

7.2. Depreciation

Depreciation is in line with the CAPEX for the assets included and calculated for standard asset lives for the fixed asset categories assigned. As such, depreciation increases in line with the capitalisation profile.

7.3. Lines 15 to 21 – Sludge storage

We are proposing to build additional sludge storage barns in the PR24 WINEP to improve the resilience of our sludge disposal activities. We plan to build 1 storage barn at Avonmouth in 2026/27, 2 barns at Trowbridge in 2028/29, and 6 barns at Malmesbury in 2029/30. We have profiled the expenditure in Line 17 accordingly.

The provision of a barn at Avonmouth in 2026/27 provides early mitigation for the risks associated with the expected changes in the Farming Rules for Water regulation which will impact sludge spreading. The proposed barn at Avonmouth will allow 25% of Avonmouth's sludge to be stored early in AMP8. The proposed barns at Trowbridge and Malmesbury in 2028/29 and 2029/30 will then allow the rest of Avonmouth sludge to be stored, as well as all the sludge from Trowbridge and Ratfyn. The existing barns at Taunton and Wimborne will provide storage for sludge from all our sites in the Western and Southern regions. By 2030, our proposed sludge storage barns will provide 3 months' storage for 100% of our sludge.

The provision of these barns will not result in the disposal of any existing assets.

There are no quality enhancement schemes proposed for sludge storage tanks (pre- or post-treatment) in or out of the WINEP.

The list of sludge storage schemes is summarised in the table below:

Table 7 – Sludge storage schemes

Scheme	In or out of WINEP	Forecast delivery
One new sludge storage barn at Avonmouth	In WINEP	2026/27
Two new sludge storage barns at Trowbridge	In WINEP	2028/29
Six new sludge storage barns at Malmesbury	In WINEP	2029/30

7.4. Other lines

We have not included any non-WINEP quality enhancement schemes in this table. We have therefore left the other lines blank.

7.5. Data quality

The confidence grade of each line is listed below, based on Ofwat's definitions. Please refer to Annex A for details of the confidence grades.

Table 8 – Confidence grades

Line number(s)	Confidence Grade
CPIH / CPIH lagged (Line 15)	B2 (taken from Table PD1)
Capex (Line 16)	B3
CCA Depreciation (Line 17)	B3

Confirmed inflation data originates from the Office for National Statistics (ONS), which is a high quality and trusted source. Inflation forecasts are based on the forecasts of three prominent and reputable UK banks.

All CAPEX figures are obtained from cost estimates produced on a bottom-up basis, in which the scope of engineering works for each proposed scheme is assessed at site level. The cost estimate for each scheme is then built up from the items in the scope. The cost estimates for the proposed IED schemes have been benchmarked externally for assurance.

Annex A – Ofwat confidence grades

The Ofwat confidence grades are used to assess the reliability and accuracy of data. The Ofwat definitions are included in the Regulatory Assurance Manual. The following factors are considered in the assessment:

Table 9 – Ofwat confidence grade description

Reliability band	Description
A	Sound textual records, procedures, investigations or analysis properly documented and recognised as the best method of assessment.
B	As A, but with minor shortcomings. Examples include old assessment, some missing documentation, some reliance on unconfirmed reports, some use of extrapolation.
C	Extrapolation from limited sample for which Grade A or B data is available.
D	Unconfirmed verbal reports, cursory inspections, or analysis

Table 10 – Ofwat accuracy bands

Accuracy band	Accuracy to or within +/-	But outside +/-
1	1%	-
2	5%	1%
3	10%	5%
4	25%	10%
5	50%	25%
6	100%	50%
X	Accuracy outside +/- 100 %, small numbers or otherwise incompatible	