Anglian Water

PR19 DRAFT DETERMINATION
DEEP DIVE ON GROWTH EXPENDITURE

August 2019

RESPONSIBLE BUSINESS OF THE YEAR 2017
BUSINESS IN THE COMMUNITY

THE QUEEN'S AWARDS FOR ENTERPRISE: SUSTAINABLE DEVELOPMENT 2015

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EXTERNAL RECOGNITION

Winner

Utility Week
Utility of the Year

Glassdoor Best Places to Work
Employee's Choice 2019

Business in the
Community Responsible
Business of the Year

ROSPA Gold – Anglian
Water and @One Alliance

Queen's Award for Enterprise:
Sustainable Development

Glassdoor Highest Rated CEOs
Employees' Choice 2017

Leading Utilities
of the World

Green Finance Award

British Construction
Industry Award

Utility Week Awards

WINNER
Capital Project
Management Award

WINNER
Supply Chain
Excellence

Content

1 DEEP DIVE AND ENHANCEMENT EXPENDITURE FOR GROWTH

Table 1 Growth expenditure details

Name	Growth	
Business plan table lines where the totex value of this claim is reported	Water Network Plus (WN+): WS2 line A8 (treated water distribution only), A11, A12, B47 (treated water distribution only), B50 and B51 Water Recycling Network Plus (WRN+): WWS2 line A25, A26, B72 and B73	
Total value of claim for AMP7	WN+: £227.03m WRN+: £430.74m	
Total opex of claim for AMP7	WN+: £2.44m WRN+: £10.44m	
Total capex of claim for AMP7	WN+: £224.60m WRN+: £420.3m	
Depreciation on capex in 2020-2025 (retail controls only)	N/A	
Remaining capex required after AMP7 to complete construction	N/A	
Do you consider that part of the claim should be covered by our cost baselines? If yes, please provide an estimate	No, while Ofwat has modelled growth as base we believe this is inappropriate. This claim reflects the full expenditure requirements which we have classified as enhancement	
Materiality of claim for AMP7 as percentage of business plan (5 year) totex for the relevant controls	WN+: 9.5% WRN+: 15.1%	
Does the claim feature as a Direct Procurement for Customers (DPC) scheme? (please tick)	Yes	No
		X

This submission relates specifically to the appropriate level of Growth expenditure which we have set out previously in our Plan. This information should be treated as either evidence to support our enhancement costs if Ofwat removes growth from its Botex Plus models at Final Determination or as a cost adjustment claim if it decides not to alter its approach. Clearly the final requirement for a cost adjustment claim for base costs or deep-dive of enhancement expenditure is dependent on the extent to which wider recommendations made in our representations are reflected by Ofwat in the Final Determination.

The need for this claim stems from two key factors that affect our efficient costs. First, the lack of scale drivers for growth in Ofwat's Botex Plus models, which has the effect of underfunding growth across the sector and in particular in high growth regions such as ours. Second, the profile of growth in our region, which tends to necessitate more onsite and offsite infrastructure than industry averages, which significantly raises our unit costs.

Our investment plans for AMP7 are driven by our Water Resources Management Plan (WRMP) and Water Recycling Long Term Plan (WRLTP), using consistent forecasts for growth across these three plans. Ofwat's approach leads to an underfunding of growth across the sector by £1.8bn (an additional £900m compared to IAP). This undermines Ofwat's priority for PR19 of improving resilience. The effect will significantly undermine the Government's drive to increase house building. Nonetheless, given the shortcomings in Ofwat's approach to modelling, this claim remains valid and material regardless of the forecast magnitude of growth used. We recommend the use of additional mechanisms to share the risk of different levels of out-turn growth between companies and customers (these are explained in the 'Focus area: growth' chapter of our main Representation).

We see no practical way of remedying the flawed Botex Plus approach followed by Ofwat at DD. Analysis carried out for several companies, Anglian Water included, sets out the shortcomings of this approach and mirrors the critique we have set out above. This is described in detail in the 'Focus area: Growth' chapter of our Representation.

Our preferred approach would be to revert to botex cost modelling using econometrics and to assess enhancement growth requirements through deep dives. We note that Ofwat undertook a high-level review of our IAP response and letter of 31 May 2019 in lieu of a cost adjustment claim for water but not for wastewater. We respond to Ofwat's challenge in that review under the relevant headings in this document. We encourage further detailed review in this vein.

Table 2 Enhancement expenditure for growth - summary table

Service	Item	Table ref	2020-21	2021-22	2022-23	2023-24	2024-25	2020-25
Water	Treated water distribution	WS2 line A8 and B47	10.00	13.58	12.14	11.63	10.75	**58.11**
	New developments	WS2 line A11 and B50	13.43	15.04	15.77	15.62	14.83	**74.69**
	New connections element of new development (CPs, meters)	WS2 line A12 and B51	16.97	19.00	19.97	19.92	18.37	**94.23**
Waste	New development and growth	WWS2 line 25 and 72	36.95	45.88	44.89	55.21	76.14	**259.1**
	Growth at sewage treatment works (excluding sludge treatment)	WWS2 line 26 and 73	17.87	46.87	34.51	48.71	23.71	**171.7**
							Total	**657.794**

1.1 Need for investment

1.1.1 Is there persuasive evidence that an investment is required?

Connecting houses and upgrading infrastructure to support housing can necessitate both on and offsite investment.

We are required to provide this under Water Industry Act 1991. Our need for investment stems from the **high level of growth** we will experience in AMP7 and the **complexity of our growth** relative to other companies.

We have a duty to provide new water and wastewater networks to meet the demand of new developments as highlighted above. The need for investment has been determined in line with Defra and Environment Agency (EA) guidance for WRMPs that growth should be based on housing forecasts as determined by Local Authority statutory local plans.

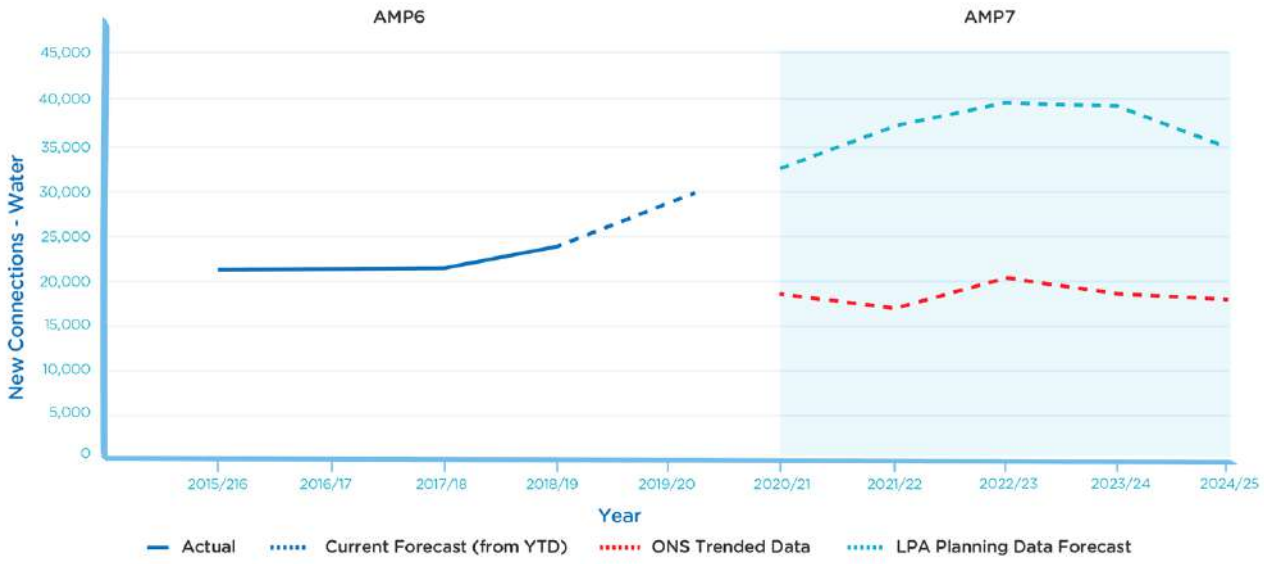
Local Planning Authorities establish housing need and distribution based upon a statutory plan preparation process, including examination in public. The methodology for defining growth rates through population trends, housing markets and spatial constraints is set out in the National Planning Policy Framework, and subject to scrutiny by stakeholders and independent planning inspectors. There is now a statutory duty on Local Authorities to prepare a local plan every five years.

The Government commitment, which enjoys cross party support, to improve housing supply to meet established housing need means new housing levels will be greater than previous AMPs and beyond the AMP6 forecast of 96,700. Measures to increase supply range from supporting the building of more social housing and provision of grants to overcome site constraints, to the creation of large scale new communities built using enhanced development corporation powers. The proposal to plan for the forecasted 200,000 (approximately) new houses in AMP7 will ensure our investment aligns with this scale and pace of change.

Complexity of growth determines the level of investment required per connection. A number of factors can influence the investment needed to accommodate new homes. This includes whether detached houses are being built or flats; as flats require far shorter lengths of pipe overall to connect. The location of a site, especially in rural and agricultural areas, influences the need for reinforcement compared to a similar size site in a large town or city. This has a major impact on companies like Anglian Water, which is predominately rural in nature. Offsite infrastructure and treatment accounts for roughly 66% of the funding we have requested for growth. The intensity of growth can also influence the scale of investment, as more intense growth is more likely to exceed existing local capacity in assets and infrastructure.

As part of responding to the Draft Determination, we have reviewed our forecast. The number of connections we experience continues to increase and we are on a glide path towards the forecast for AMP7. On this basis we have not revised our forecast for growth. This is shown in the figure below. Our review gives us confidence that the need for this investment remains.

Figure 1 Total number of new water connections



We observe the forecast number of connections used in Ofwat's models is lower than the levels of connections we are currently experiencing. Even if lower levels of growth materialise we will still need to make a comparable level of investment in offsite infrastructure and treatment. The number of houses is not always the primary driver for network reinforcement.

1.1.2 Response to Ofwat assessment of previous evidence – partial pass

Our investment plans for AMP7 are driven by our Water Resources Management Plan (WRMP) and Water Recycling Long Term Plan (WRLTP), using consistent forecasts for growth across all three plans. These are based on the statutory guidance for developing growth forecasts for the WRMP.

We note that Ofwat has confirmed in response to a query, its error in stating Northstowe is outside of our area appointment (we have an inset appointment). We have meticulously developed our forecast to account for the difference in our appointments for water and wastewater. We have followed a bottom-up, site by site approach to account for our growth forecast. This is reflected in the lower number of water connections compared to wastewater.

Our long term plans show that significant investment is needed to accommodate growth in our region. We have considered a range of possible outcomes when developing our investment proposals. Our forecast number of new connections can be considered to be in the middle of a reasonable range.

We have taken a risk based approach to scoping reinforcement and treatment investments. We have not included expenditure in the plan for certain low likelihood sites. In developing our expenditure forecast, we went through a three tiered optimisation process, which we termed Bronze, Silver and Gold. The process was created to allow us to compare every growth site forecast in AMP7. At the end of each stage, sites with lower likelihood of of triggering reinforcement were screened from the investment programme.

- **Bronze** – this level of detail was created following high level 2-D modelling of all the forecast sites provided by Edge Analytics.[1] The Bronze list ranked all sites against by cost to upgrade the infrastructure.
- **Silver** - those sites with high risk of triggering reinforcement or treatment upgrades are promoted to a manual intervention process, where the Info Net tool is rerun using GIS growth data with higher confidence. Those at high risk after this are promoted to a full assessment.
- **Gold** - the remaining silver sites were fully modelled. This assessment used models to understand the capacity of our sewerage catchments and assess solution options.

1 Edge Analytics are an independent provider of data science services. They provide data to several water companies to inform growth forecasts.

This thorough, bottom up process of identifying sites that need investment gives us confidence in the investment proposals we have put forward.

A future driver for growth beyond our forecast is the Oxford-Cambridge (OxCam) Arc. This additional growth is not yet captured in Local Authority plans, and so not reflected in our investment proposals. In it's response to the National Infrastructure Commission's report in October 2018, and through the joint declaration with local partners in March 2019, the Government has affirmed its ambition for up to on million new homes between Oxford and Cambridge by 2050. This is being backed by £4.5bn of committed government funding for supporting transport infrastructure, including the Oxford to Cambridge Expressway and the western section of East West Rail.

1.1.3 Where appropriate, is there evidence – assured by the customer challenge group (CCG) – that customers support the project?

Our business plan for AMP7 is built on our Strategic Direction Statement (SDS) and will facilitate sustainable growth.

Supporting sustainable housing growth is one our four long term ambitions in our SDS, which we developed through engagement with our customers. Our Customer Engagement Forum (CEF) has commented that they were impressed to see that we took customers on a journey with us as we developed our priorities and plans for PR19 and beyond – looking at both current and future challenges facing the region, particularly in terms of population growth and climate change.

Customers are concerned that population growth and new development should be sustainable. In the Acceptability testing on our SDS, enabling growth was seen as the second most important of the company's four long-term goals. Customers want the company to plan ahead, influence the planning system, and work with developers to design-in water efficiency for new homes and communities. (Anglian Water Customer Research & Engagement Synthesis report, 2018, v.14, p175).

Our CEF has commended us for the length, breadth, depth, scale and innovative nature of our customer engagement programme for PR19 and notes that our plan is driven by the requirements of our customers.

1.2 Need for adjustment

In this section, we explain why exogenous factors for our costs in this area create the need for an adjustment to our DD allowance. We demonstrate that:

- the level of adjustment required is highly material, at 9.5% and 15.1% of gross totex for the water network plus and wastewater network plus price controls respectively;
- that none of the scale or complexity drivers of our costs are adequately reflected by the allowance 'in the round', including the botex+ modelled allowances and the developer services revenue adjustment (DSRA) uncertainty mechanism;
- that our costs, uniquely in the industry (see figure below), are significantly and adversely affected by all of the key exogenous drivers, compared to the industry average.

The section sets out narratives on the determinants of efficient on- and offsite costs for wholesale water and wastewater services, and presents company-level measures of relevant drivers. These drivers include measures of scale used by Ofwat in previous cost assessment exercises and measures of complexity, covering the mix of connection types (onsite costs) and the local intensity and remoteness of growth (offsite costs). The latter metrics were developed by Vivid Economics, using publicly available data on development patterns from the Land Registry, as set out in the methodological annex included in this document.

As the figures below show, we are the only water or wastewater company that faces greater than average drivers in all relevant areas (even normalising the scale drivers included in the botex+ models). Furthermore, the figures are based on growth forecasts used by Ofwat in the DD. The need for adjustment, particularly for offsite costs, therefore does not hinge on the local plan growth projections in our business plan. The use of business plan data significantly increases our scale drivers but does not affect the complexity drivers.

Figure 2 Industry comparison of complexity drivers of growth expenditure for water

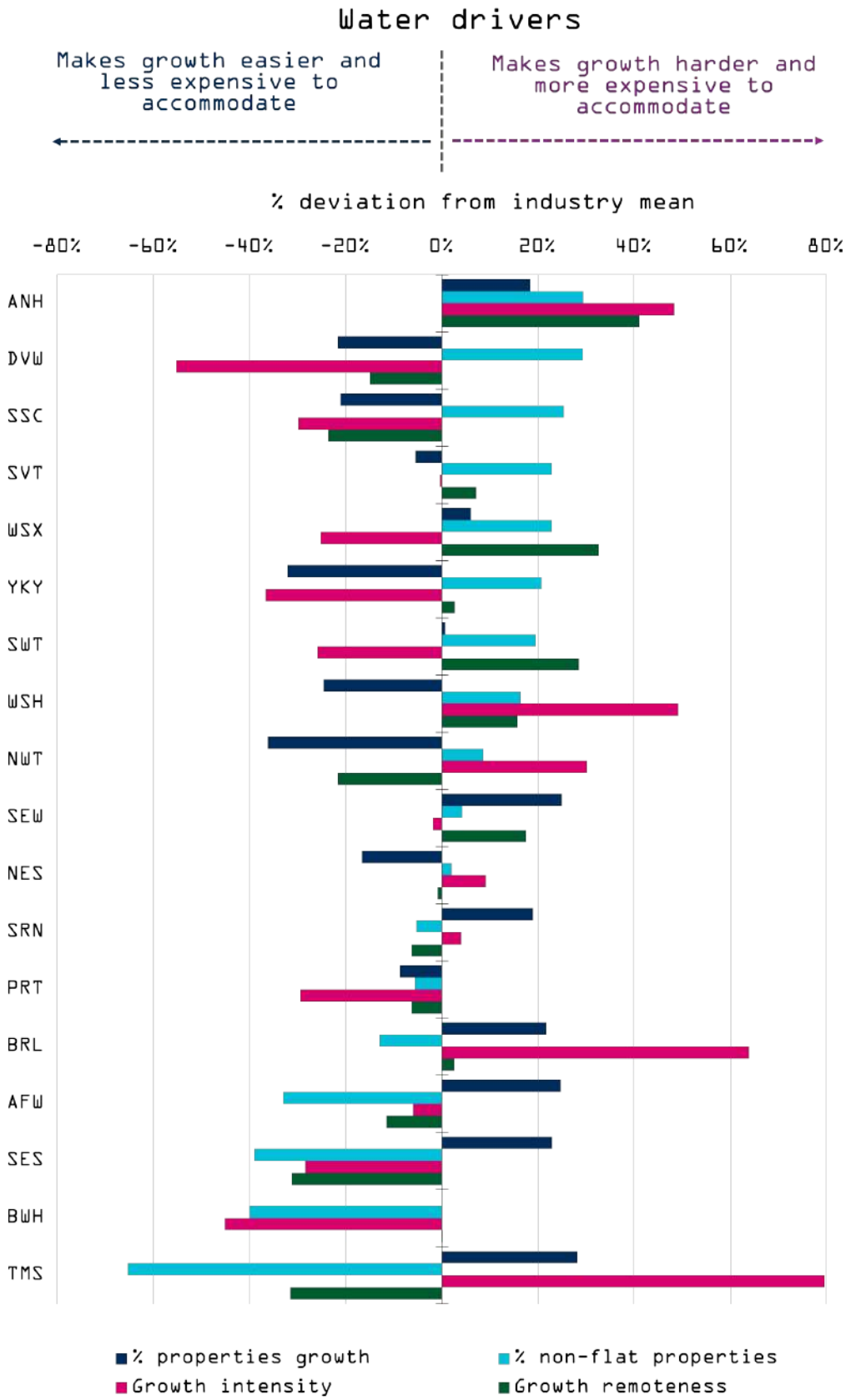
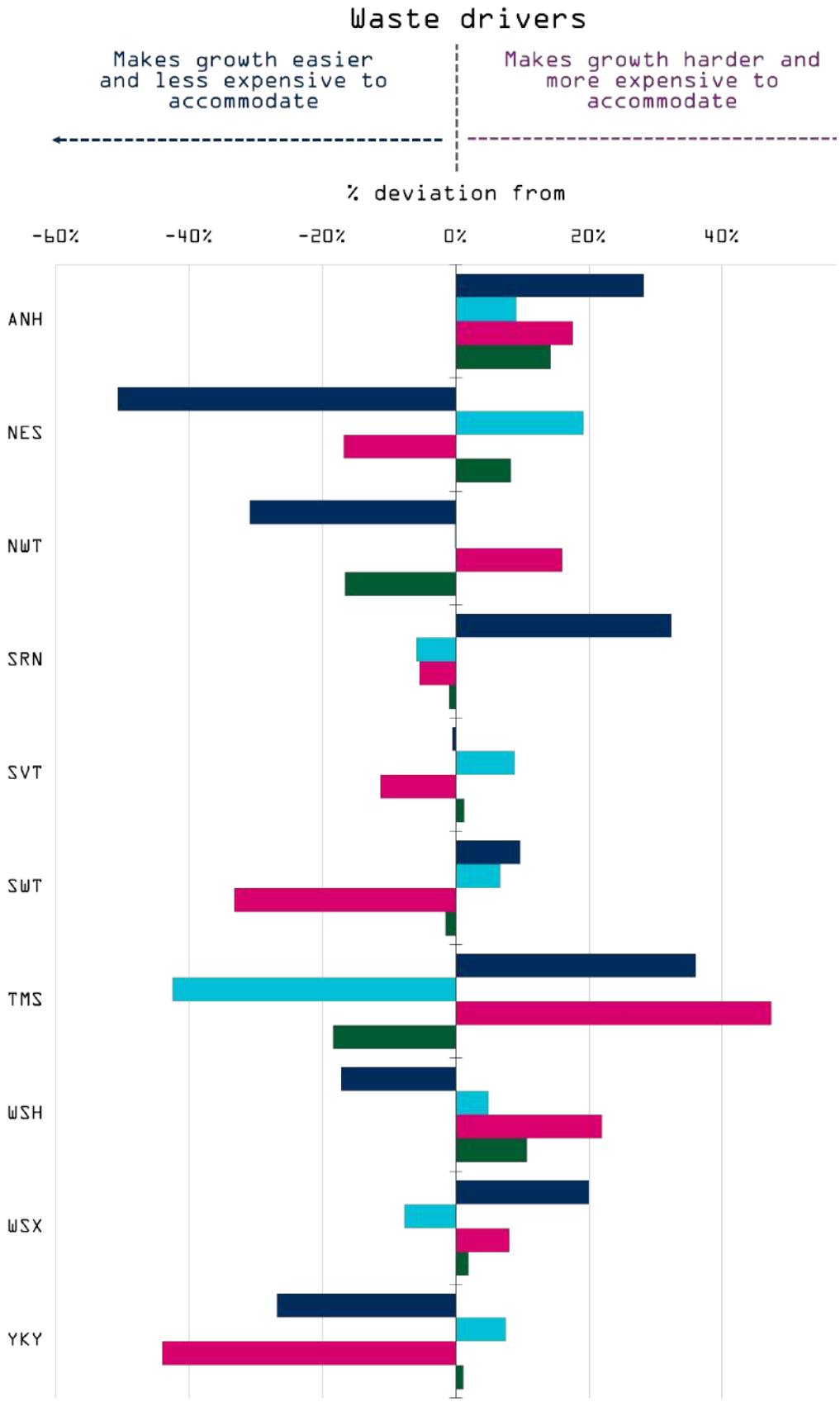


Figure 3 Industry comparison of complexity drivers of growth expenditure for wastewater



As Ofwat's models do not adequately model growth expenditure, Ofwat must conduct deep dives of growth costs or reflect an appropriate adjustment for us to its base allowances.

1.2.1 Materiality of growth expenditure

As shown below, our proposed expenditure is £648.79m.

Table 3 Enhancement expenditure for growth - summary table

Service	Item	Table ref	2020-21	2021-22	2022-23	2023-24	2024-25	2020-25
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	Growth at sewage treatment works (excluding sludge treatment)	WWS2 line 26 and 73	17.22	45.65	32.66	46.04	20.06	**161.63**
							Total (£m)	**648.79**

The impact of the change in approach on different aspects of companies' wholesale expenditure allowances is far from transparent. Ofwat has not shown or explained the impacts in its Draft Determination publications. The lack of transparency is so extreme that we, in conjunction with a number of other companies (Northumbrian Water, Welsh Water, Yorkshire Water, Wessex Water and South East Water), commissioned Reckon LLP to unpick growth allowances. This compliments our own analysis and that undertaken by Vivid Economics solely on our behalf.

Triangulating these analyses, we estimate that Ofwat's approach results in a **£352m** shortfall between the allowance and the expenditure set out as required to enable growth in our Plan. This is clearly material.

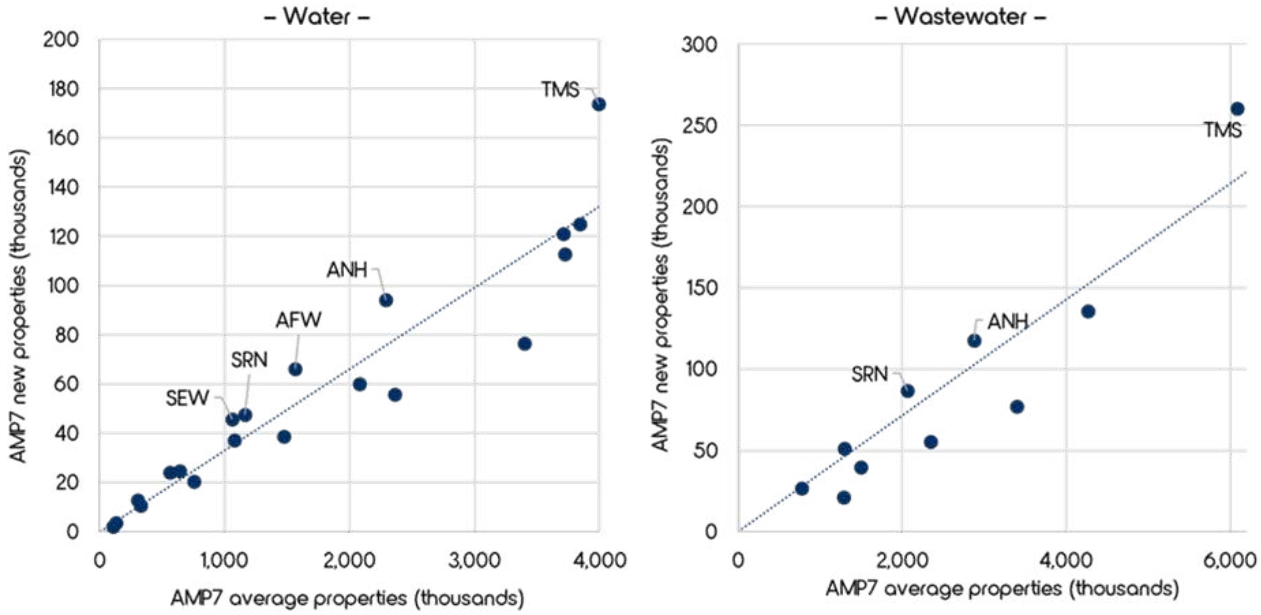
1.2.2 Modelled allowances inadequately account for scale drivers

The DD Botex Plus models systematically underfund growth across the entire sector relative to business plan proposals. There is an aggregate 'gap' between plans and allowances of £1.85bn across the sector (£670m in water and £1.17bn in wastewater), around double that at the IAP.

The principal reason for this is that Botex Plus models do not have a scale driver for growth in new connections. This leads to understated allowances across the sector for two reasons:

- new connections cost significantly more than existing connections, but botex+ models treat the two as equivalent. The marginal cost of a connection in the Botex Plus models is around £320-£330, whereas the industry median historical unit cost of new connections was £890 in water, and £1,8bn in wastewater.
- new connections are not perfectly correlated with existing company scale (see the figure below). Given the greater costs of new connections, this means that scale coefficients will be attenuated, leading to marginal allowances per connection below the weighted average cost of serving new and existing customers. This attenuation is so severe that in the case of sewage collection, scale coefficients in the botex+ models are less than in the botex only models.

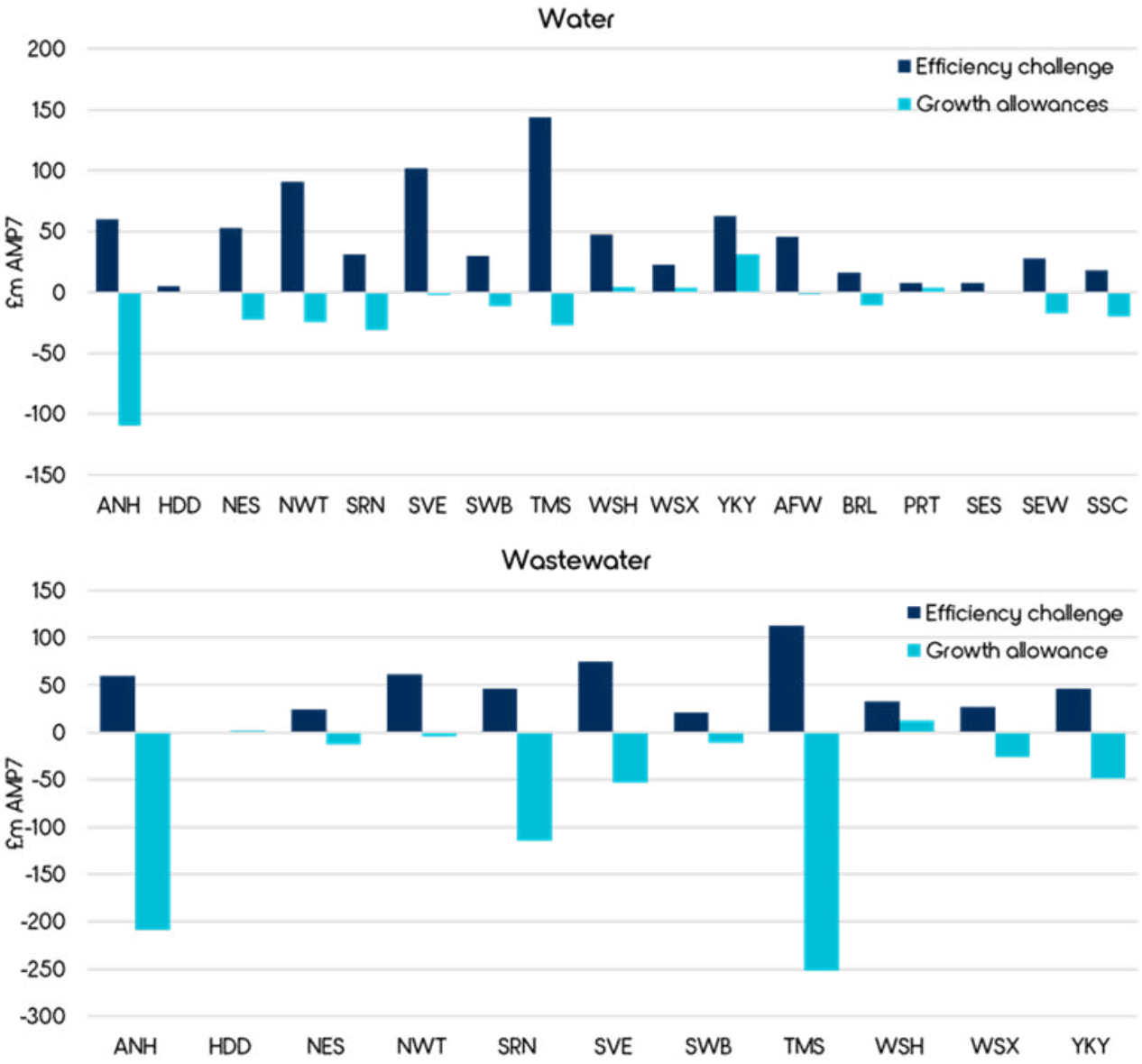
Figure 4 AMP7 new connections



The degree of underfunding is also uneven between companies, with high growth companies such as Anglian most adversely affected. As the scatterplot above (based on Ofwat's DD forecasts) shows, companies in the South East of England are forecast to grow faster than the rest of the sector. These companies have higher than average costs per connection, and are therefore underfunded (relative to the scale of growth they face) by the most.

Finally, while the use of botex+ simultaneously leads to lower growth allowances, it also implies a less stringent upper quartile efficiency challenge in both services (1.4% in wastewater and 4.2% in water). All companies benefit from the diminished botex efficiency challenge, while high growth companies are hit hardest by the lower growth allowances. The majority of the sector, but not Anglian, experiences a net benefit from these changes as shown below. Other companies are unlikely to make representations on botex+ models and growth funding as a result of this.

Figure 5 Efficiency challenge and Growth allowances - water and wastewater



1.2.3 Modelled allowances do not account for complexity drivers

This section presents evidence on complexity drivers of growth costs, for which the botex+ models make no attempt at all to account. It sets out engineering narratives for the drivers of on- and offsite costs in turn, and shows that we are adversely affected relative to the industry average by all of these. Later materials on the 'robustness and efficiency of costs' quantify the impact of these factors on our costs.

Vivid Economics has developed measures of company-level intensity and remoteness using publicly available data from the Land Registry and OpenStreetMapper. Full details of their derivation are provided in the methodological appendix included at the end of this document. These are drivers that we have developed to help Ofwat understand drivers of growth costs.

1.2.4 Onsite costs

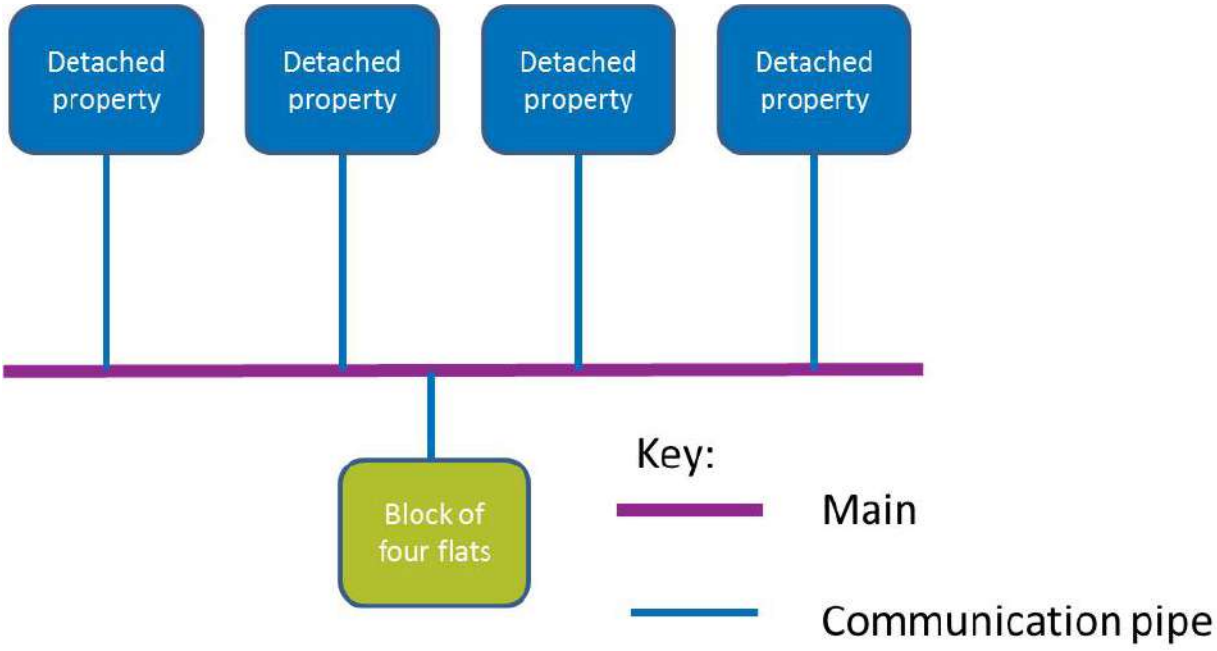
Evidence gathered by Ofwat[2]on the costs of companies' new water supply connection costs highlights three key drivers of onsite costs:

- **the average length of communication pipe**, which tend to be longer for different property types, with the greatest variation between detached properties and flats.
- **development site ground surface types**, with higher costs associated with hard surfaces.
- **self-lay penetration**, though the nature of causation is unclear in this area.

In the absence of any evidence that development site ground surface types varies significantly between companies, this section focuses on exogenous drivers of the average length of communication pipes.

The diagram below demonstrates how the length of communication pipes can very by property type.

Figure 6 Variation in length of communication pipes



Analysis carried out by Vivid Economics of Land Registry data, combined with ONS Local Authority growth projections, shows how the expected profile of connection types varies between companies over the AMP7 period. It shows:

- There is significant variation between companies depending on connection types.
- We have the lowest share of flats and the third highest of detached houses among water companies (see figures below).

As we show in the section below on 'robustness and efficiency of costs' this has a highly material impact on our efficient costs, on the basis that all else being equal, the activity per connection is greater.

2 Ofwat independent comparison of monopoly water companies' new water supply connection costs https://www.ofwat.gov.uk/wp-content/uploads/2017/02/IN-1702-New-connections-benchmarking-costs.pdf

Figure 7 Flats as a % of total connections for water

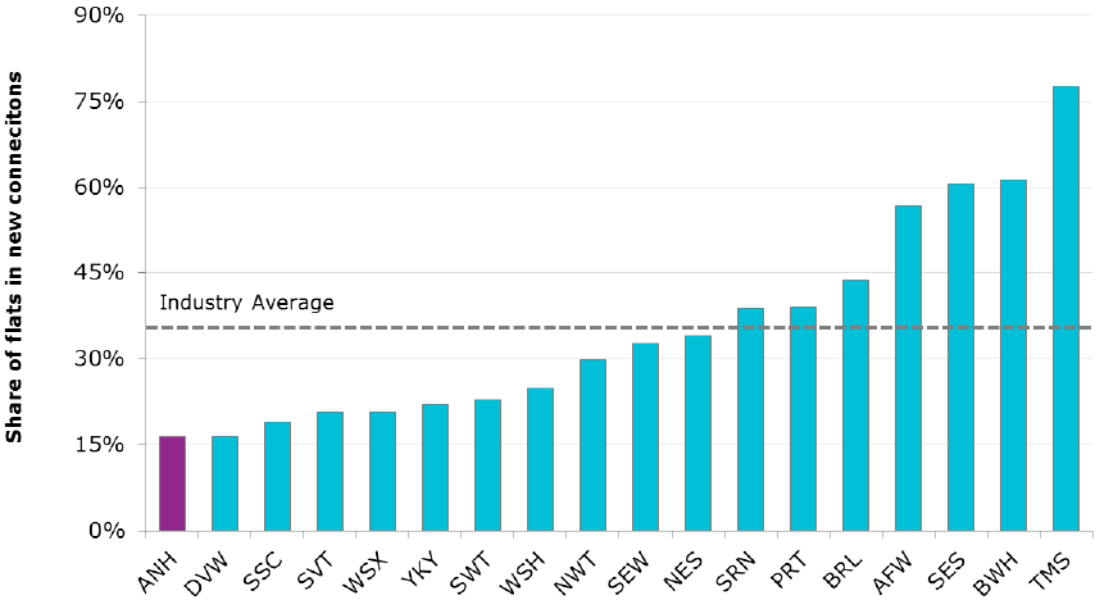


Figure 8 Detached properties as a % of total connections for water

Figure 9 Flats as a % of total connections for wastewater

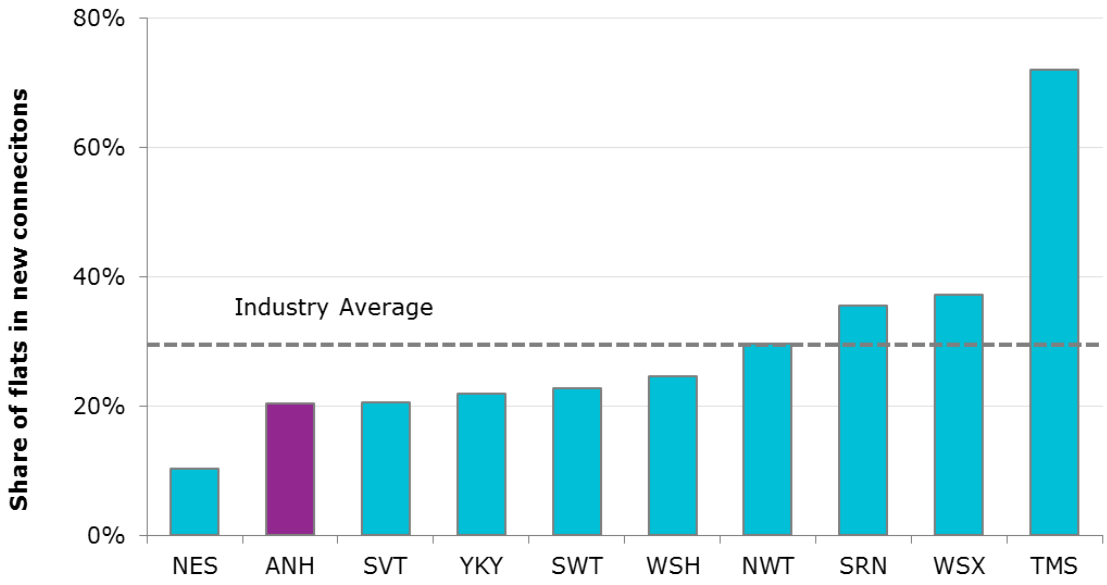
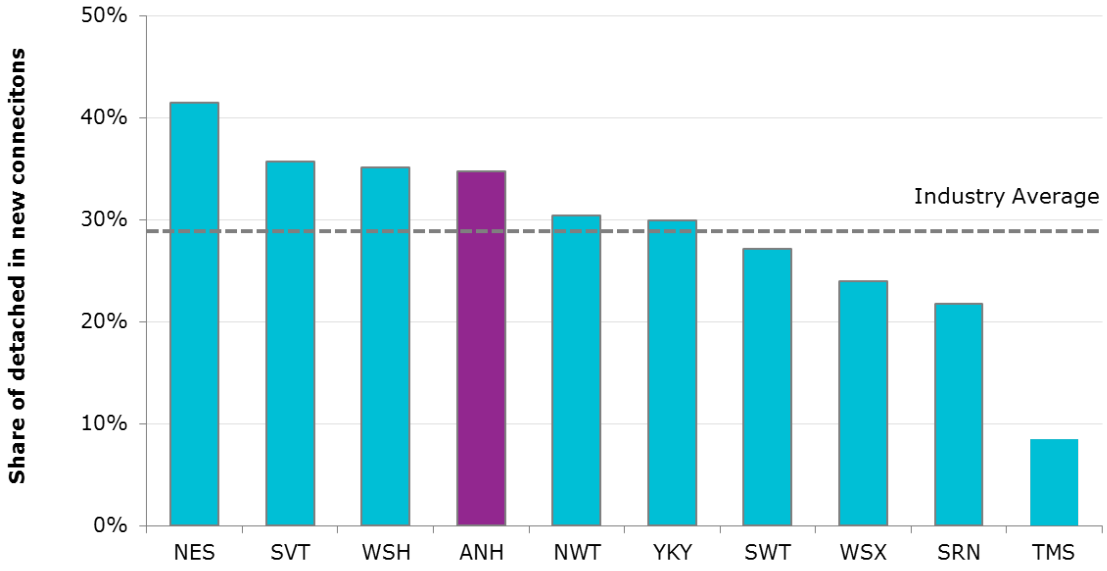


Figure 10 Detached properties as a % of total connections for wastewater



1.2.5 Offsite costs

Offsite reinforcements are required where demands placed on upstream assets by new connections exceed local available capacity either in networks or treatment works. An important scale driver is intensity of local population growth, which is correlated with the number of new connections. This section focuses on complexity drivers that affect the need and overall cost for offsite reinforcement work given a rate of population growth.

Offsite reinforcement for water can include pumping stations, water mains and water treatment works. Water mains and pumping stations need to be able to accommodate enough flow capacity and maintain a given flow rate or pressure to provide an adequate service for customers.

Waste offsite reinforcements can include gravity sewers, rising mains and pumping stations, as well as sewage treatment works. Population growth can cause the capacity of gravity sewers or rising mains to be exceeded or necessitate new consents/upgrades at sewage treatment works to adhere to environmental standards.

The nature and cost of offsite reinforcements can be bespoke to development sites, as the detailed evidence in our business plan shows, but there are two overarching factors that affect the level of activity required across the generality of sites:

- **Extent of local growth relative to existing assets** - localised growth on a large scale relative to the size of existing settlement is more likely to cause the design capacity of assets along the value chain to be exceeded, thus necessitating offsite reinforcements.
- **The location of growth** - offsite reinforcements to accommodate growth more distant from existing assets are likely to involve:
  - greater lengths of new or reinforced water mains (water); more rising mains,
  - more expensive transfers between catchments,
  - or local WTW upgrades (wastewater); and
  - more pumping capacity (both services).

We have termed these factors the 'intensity' and 'remoteness' of growth respectively. To understand the extent to which these vary between companies, and thus cause variation in the need for and cost of offsite reinforcement in AMP7, Vivid Economics has developed measures of company-level intensity and remoteness using publicly available data from the Land Registry and OpenStreetMapper. Full details of their derivation are provided in the methodological appendix included at the end of this document.

To measure the intensity of company growth profiles, Vivid adopted the following approach:

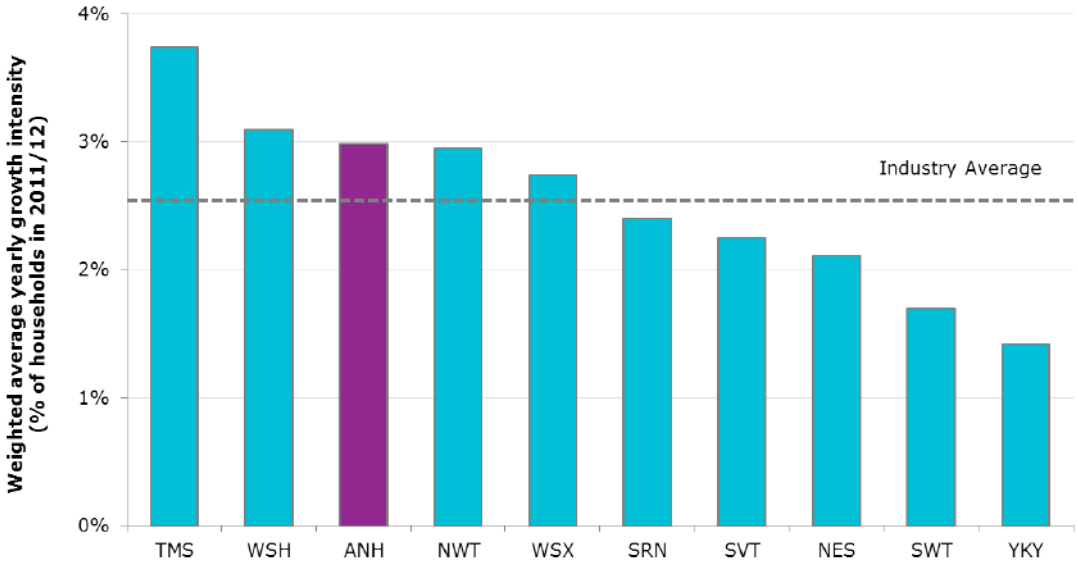
- Calculate the growth in households in each postcode sector for each AMP7 year relative to the number of existing households in 2011 ('growth intensity');
- Allocate postal sectors to each water or waste company;
- Weighting postal sectors by the quantity of growth, compute the average postal sector growth intensity for each company for the AMP7 period.

The results show: first, that there is significant variation in growth intensity between companies, with up to a factor of four among water companies and a factor of more than two among waste companies; and, second, that we have high levels of predicted growth intensity relative to other water and waste companies.

As the section on 'robustness and efficiency of costs' below shows, this is expected to contribute to our materially higher costs than allowed for at DD.

Figure 11 Average yearly growth intensity by company for water

Figure 12 Average yearly growth intensity by company for watewater



The measure of remoteness is calculated as the average distance between growth sites and the nearest town (and, by way of a robustness check, the nearest five towns) to the site, weighted by the level of growth in each post code sector.

Figure 13 Distances to closest towns and cities

Once again, the results show significant variation across the sector and that we are more affected average. Indeed, we have the highest average distance from postcode sectors to both the nearest town (at over 3km) and the highest average distance to the nearest 5 towns (nearly 10km). Wessex and South West also have average distances well above the industry average. By contrast, one-town WOCs (e.g. Bristol) and Thames Water have low average distances, reflecting the density of their catchments, and the fact that growth is more likely to be situated close to existing assets.

Figure 14 Weighted average minimum distance to 5 nearest towns for water

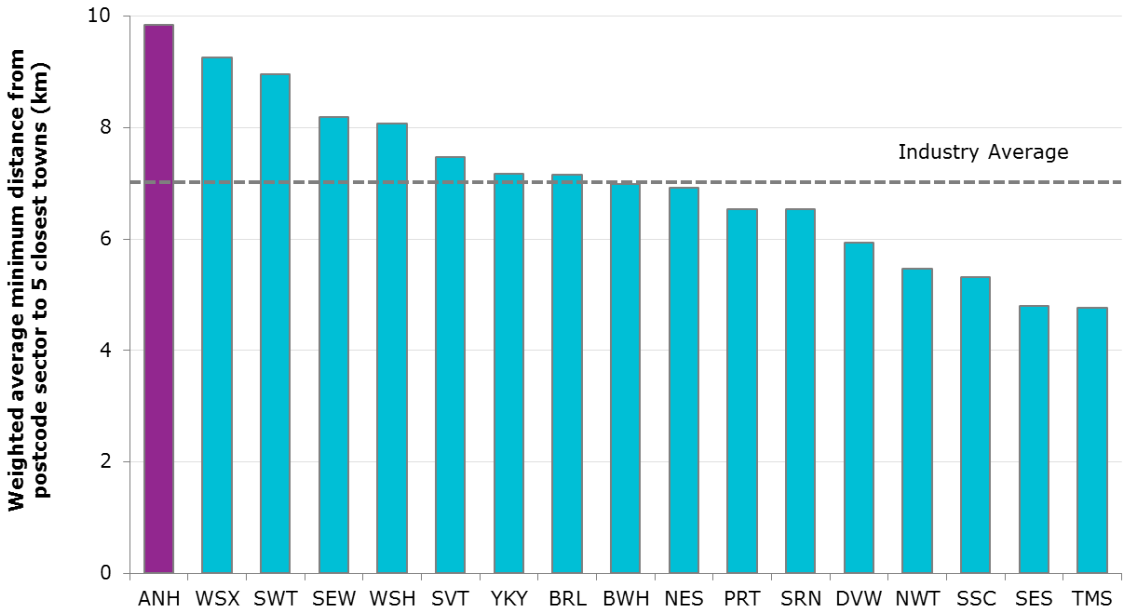
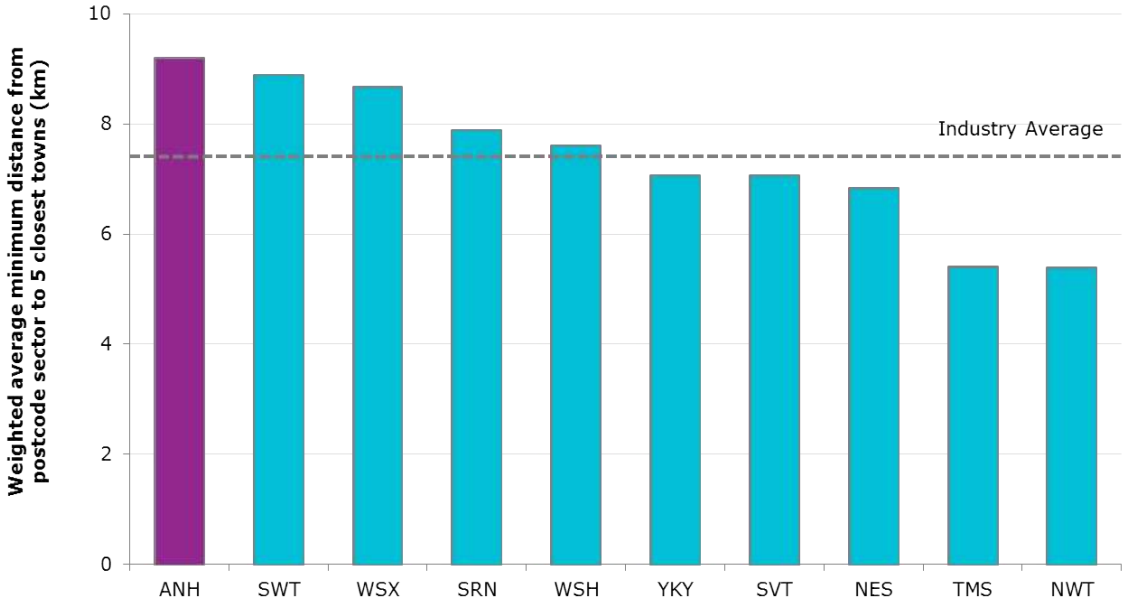


Figure 15 Weighted average minimum distance to 5 nearest towns for wastewater



1.2.6 Uncertainty mechanisms do not address inadequate modelling of scale drivers

The Developer Services Revenue Adjustment (DSRA) mechanism does not correct the fundamental issue of baseline growth being underfunded. It also fails to fully adjust company net totex for differences between outturn and forecast growth, and also fails to reduce customer and company risks around these forecasts.

The DSRA does not cover all aspects of growth expenditure (such as water recycling treatment) or company contributions to network reinforcement or on-site works that are required to maintain the broad balance of charges. This is material for companies where recovery of costs from developers is less than 100%. We recover only 12% of on-site water mains costs. There is limited discretion for us to adapt this due the requirements of charging rule 19 to maintain the broad balance between the generality of customers and developers.

The use of company-specific unit rates for this adjustment is also inconsistent with the Botex Plus approach. Botex Plus funds growth based on company size and make no adjustment for factors which affect company's unit rates. The proposed approach includes company-specific unit rates which reflect each company's operating circumstances. This inconsistency may have unexpected effects on developer services revenue and customer bills, as company unit costs are often in excess of Botex Plus new connection unit rates.

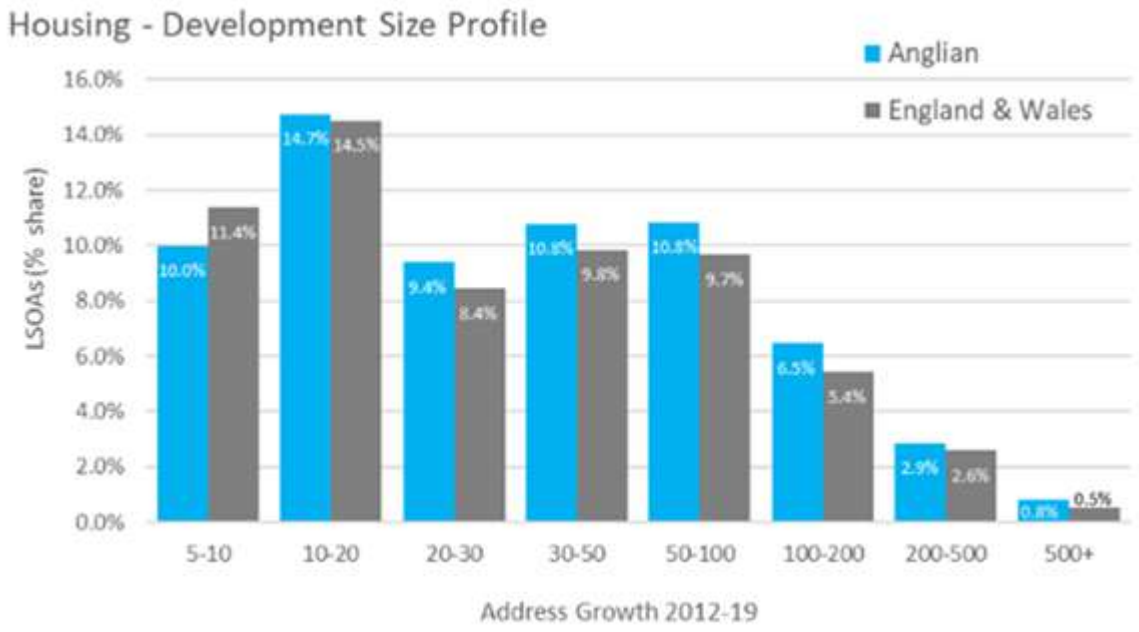
1.2.7 An increase in large sites further raises our efficient AMP7 unit costs relative to historical benchmarks

Larger development sites suffer from greater discontinuities between the timing of expenditure and new connections coming online and appearing in official counts of connections served. It is more efficient on large sites to install on and offsite spending in advance of the realisation of connections. For large sites, where investment can take place one or more AMPs in before connections come online this can wrongly create the appearance of inefficiency if costs are directly compared with connections. We have a higher than average and increasing proportion of large sites relative to the industry average: the resulting inter-AMP profiling of our spending relative to connections, means that our efficient unit costs are higher relative to industry and historical averages.

It might be thought that any such effect for projects starting in AMP7 would be offset by projects which started in AMP5 and where Anglian is now enjoying a “free ride” for connections based on investments in earlier AMPs. While this is logically possible, it is not the case at present given the fall-out of the 2007-08 financial crash and the subsequent sharp reduction in house-building which followed.

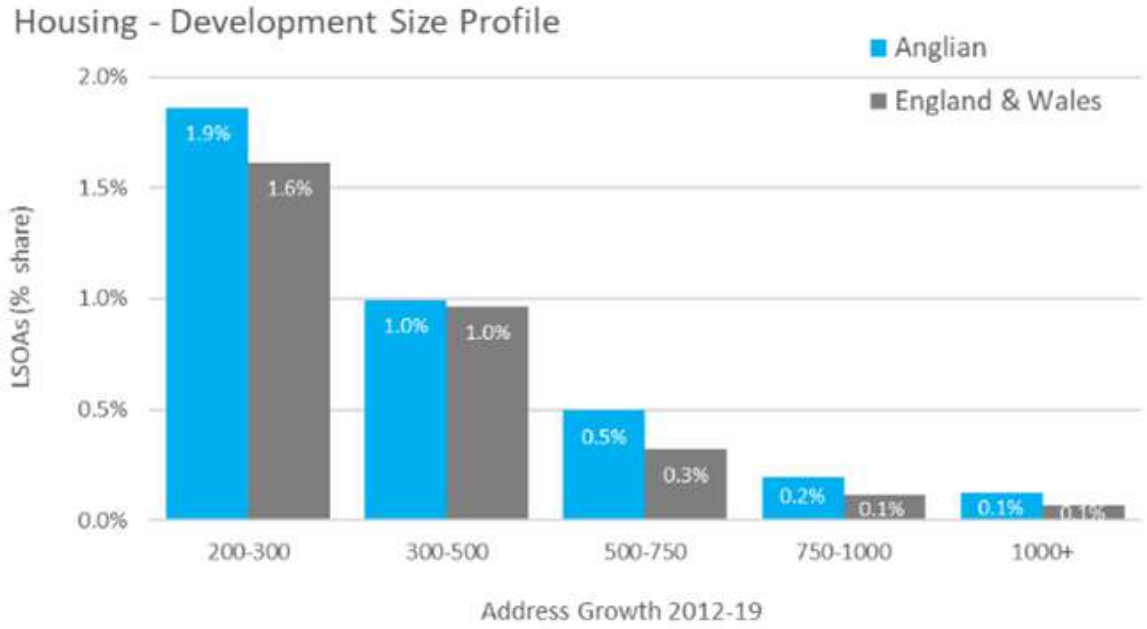
This spending and connection lag is evident from our own historical site specific data, which clearly shows that inter-AMP spending occurs more prominently for large development sites. A report by Edge Analytics clearly shows that, historically, development in our region has taken place on larger sites than the average across England and Wales, with 60% more than average in the largest 500+ house category. This is shown in the figure below for Lower Layer Super Output Areas (LSOAs) comparing Anglian to the average in England and Wales.[3] We provide a case study of the 'East of Kettering' site as an annex to this document. This provides an overview of the type of large urban extensions we are accommodating.

Figure 16 Existing Housing Density Profile - smaller sites



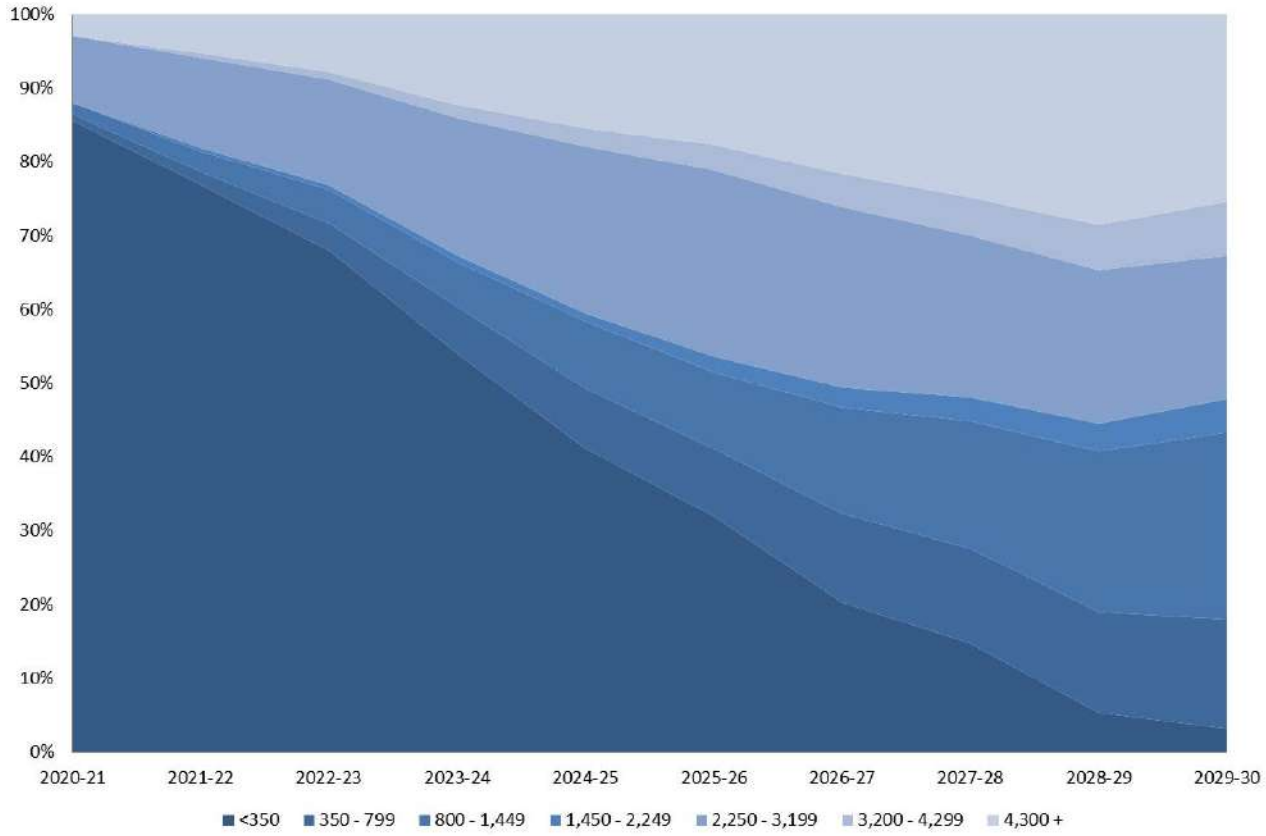
3 A LSOA is a geographic area. LSOAs are defined by the Office Of National Statistics. On average they have a population of ~1,500. Both population and areas of LSOAs are updated regularly.

Figure 17 Existing Housing Density Profile - larger sites



We expect this trend to continue and become more apparent in AMP7. In AMP7 we expect the percentage of connections occurring on development sites greater than 350 plots to increase from 15% to 59% by the end of AMP7. We expect this to continue into AMP8, noting that some large sites in AMP8 are likely to be split into multiple smaller sites. This trend is shown in the figure below, with the development site banding reflecting increasing sizes in required sewer pipe size (from 150mm for a 350 plot site to 600mm for a site with more than 4,300 plots).

Figure 18 Proportion of connections made by development size



Econometric models of offsite costs which use in-year or within AMP costs will miss these trade-offs and conflate (in)efficiency with periods of (more)less intense activity.

1.2.8 Economies of scale are not a significant factor

As with other elements of cost, economies of scale are most relevant at the asset rather than company level. Given the localised nature of growth assets, higher company-wide growth is unlikely to yield significant economies of scale beyond those already identified in the plan.

For onsite costs, schemes are delivered through our partners who already operate at efficient scale. These alliance partners are subject to market testing. Therefore there are no significant uncosted economies of scale from having a larger programme. Indeed, where the programme becomes very large, competition for scarce resources in the supply chain (e.g. appropriately skilled labour) is expected to lead to higher costs.

For offsite costs, as already noted, more intensive growth is more likely to trigger reinforcements. Again, if anything, this is likely to lead to diseconomies of scale.

1.2.9 Robustness of case to properties forecasts

The need for an adjustment made for this expenditure is robust to the choice between ONS and companies' own forecasts.

Even if Ofwat forecasts are used, we have growth that is high relative to its size in both services, as shown in Figures 3, 10 and 11. Forecasts of the property type and remoteness variables developed in this claim are unaffected by differences in properties forecasts, if it is reasonably assumed that the distribution of additional growth matches growth projected by the ONS. The intensity (headroom) metric may be affected by forecasting differences, but is currently projected forward based on the ONS's properties projections, and is therefore likely to be an underestimate.

1.2.10 Response to Ofwat assessment of previous evidence – fail

This section of the document demonstrates the need for adjustment, as Ofwat's models do not capture appropriate drivers of growth costs.

The points raised and evidence provided on 31 May 2019 and elsewhere in this cost adjustment claim are more nuanced than greenfield and brownfield. Our difference compared to the wider industry is to do with the scale, type, intensity and remoteness of our growth. This is exacerbated by Ofwat's botex+ modelling approach systematically underfunding growth. This is explained earlier in this section on the need for adjustment.

1.3 Management control

1.3.1 Is the cost driven by factors beyond the control of Anglian Water?

We have a duty under the Water Industry Act 1991 to serve new customers without causing detriment to the environment. This duty covers the provision of new sewers, adoption of sewers, connection of sewers to our existing network, requisition of "offsite" network reinforcement, Intra Planning Zone (IPZ) mains (linking a site to an existing water main), "onsite" housing estate mains (HEMs) and new connections.

The level of growth and its location is outside of management control, and the evidence above shows why our efficient costs are higher as a result compared to other companies.

1.3.2 Is there persuasive evidence that the company has taken all reasonable steps to control the cost?

For water recycling we have controlled costs by using a three tiered approach involving our InfoNet asset management tool to prioritise the catchments most in need of investment. Once identified, Infoworks ICM hydraulic modelling provided up to eight solution options per catchment, ranging from targeted surface water removal supplemented by localised storage, to wider scale upgrade of existing sewerage infrastructure.

For water, multiple options have been assessed for network reinforcement schemes. Through our experience of working on large development sites we know that some sites will take many years and phases to be completed. As such we have evaluated market build out rates and reflected this in our plans for a phased delivery where possible. This allows us to better understand when off site infrastructure upgrades may be necessary and ensure that we plan and deliver them in the optimal way.

Cost benefit analysis was then used to identify the best value options. In addition to basing our estimates on efficient costs drawn from our AMP6 performance, we have then applied further totex stretch efficiency and productivity challenges to those costs (productivity challenge of 1% pa). Elsewhere in this document we demonstrate the efficiency of our costs.

1.4 Best option for customers

1.4.1 Does the proposal deliver outcomes that reflect customers' priorities, identified through customer engagement? Is there CCG assurance that the company has engaged with customers on the project and this engagement been taken account of?

Our CEF has commended us for the length, breadth, depth, scale and innovative nature of our customer engagement programme for PR19 and notes that our plan is driven by the requirements of our customers.

Customers are concerned that population growth and new development should be sustainable. In the Acceptability testing on our Strategic Direction Statement (SDS), enabling growth was seen as the second most important of the company's four long-term goals. Customers want the company

to plan ahead, influence the planning system, and work with developers to design-in water efficiency for new homes and communities. (Anglian Water Customer Research & Engagement Synthesis report, 2018, v.14, p175).

1.4.2 Did the company consider an appropriate range of options with a robust cost–benefit analysis before concluding that the proposed option should be pursued?

Cost benefit analysis then used to identify the best value options.

Multiple options have been assessed for network reinforcement schemes. Through our experience of working on large development sites we know that some sites will take many years and phases to be completed. As such we have evaluated market build out rates and reflected this in our plans for a phased delivery where possible. This allows us to better understand when off site infrastructure upgrades may be necessary and ensure that we plan and deliver them in the optimal way.

1.4.3 Is there persuasive evidence that the proposed solution represents the best value for customers in the long term, including evidence from customer engagement?

Keeping pace with the scale of change, while working with local authorities to prioritise investment, ensures this proposal represents best value for customers in the long term. In addition, we work closely with Local Planning Authorities to include the building regulations part G2 'optional higher level of water efficiency for new development' within their Local Plans to limit additional demand.

This requires all planning applicants to demonstrate how the 110 litres per person per day standard will be met, rather than the normal requirement of 125 litres per person per day. Local authorities have been very supportive of this approach, with to date over 90 per cent of those within our water area including the standard within an adopted plan, emerging plan or making a commitment to include at the next appropriate stage. Ultimately, reflecting our customer's views to limit demand, our ambition in the long term is for all new housing to be delivered with design standards for 80 litres per person per day.

1.4.4 Has risk been assessed? Have flexible, lower risk solutions been assessed?

Our long term plans for both water (WRMP) and water recycling (WRLTP) are developed to account of risk and have flexible, adaptive elements. These set the backdrop for growth related expenditure. We have described how we have taken a risk based approach to scoping and costing investments earlier in this cost adjustment claim.

Each scheme is individual in nature and all alternative options are considered as part of our Risk Opportunity and Value (ROV) process. Our ROV process considers baseline and residual risk of each alternative considered, scored for both private and societal impact. This enables cost benefit analysis to be carried out on each option to choose the best value, lowest whole life cost solution.

Our proposal for growth delivery ODIs removes volume uncertainty risk for both customers and companies. This is explained further in the 'Focus Area: Growth' chapter of our representation.

1.4.5 Has the impact on natural capital and the environment been considered?

Our investments for growth deliver significant environmental benefits. Our WRMP includes significant demand management activities to offset water abstraction. Our WRLTP includes increased use of natural capital solutions, such as our Ingoldisthorpe wetland treatment site, and sustainable urban drainage (SuDS). Our contribution to natural capital will be captured during AMP7 through our natural capital performance commitment.

1.5 Robustness and Efficiency of Costs

Our business plan costs are robust. They were built from our WRMP and WRLTP, have been rigorously built up over multiple years drawing on site-level evidence, and are subject to appropriately detailed internal and external quality assurance. As discussed elsewhere, Ofwat's models do not account for the variety of factors that influence growth costs.

We have further tested the costs in our business plan using bottom up and econometric analysis using the complexity drivers. The allowances suggested by both the new bottom up and econometric estimates are higher or line with those developed for our business plan. These are summarised in the tables below and explained more fully later in this section. Therefore we remain confident that our business plan costs are robust.

To put the business plan figures in appropriate context, we present two further estimates of the expected impact of relevant cost drivers on our efficient costs:

- Bottom up estimates, drawing on industry-wide and our own data to calculate the expected impact of variation in the complexity factors on our costs. These provide evidence that the level of cost in the business plan is approximately in line with expectations.
- Econometric estimates of cost, using industry-wide data on costs and explanatory variables. These provide further assurance that the level of cost in the business plan is reasonable, when benchmarked against other company cost data.

The tables below show like-for-like comparisons between the costs in our business plan and estimates generated by the econometric and bottom-up methodologies. The first table shows the econometric results. The econometric estimation uses 3 year smoothed average drivers and costs to align with previous Ofwat modelling and treats company data consistently, so includes reallocation of low pressure and flooding as per the IAP data tables. Hence the relevant comparison for the econometric cost estimates is with the smoothed, IAP Business Plan costs including reallocations.

Table 4 Comparison of IAP Response costs and econometrics

Service	IAP Response costs, with reallocations smoothed (£m)	Econometric modelling with intensity and remoteness drivers (£m)
Water	297.6	314.6
Water recycling	384.8	395.4

The table below provides a comparison between our DD Representation costs and the bottom up estimates.

Table 5 Comparison of DD Response costs and bottom up estimates

Service	DD Response costs (£m)	Bottom up approach (£m)
Water - onsite (line 7 and 9 table App28)	168.9	179.6
Water - offsite (line 6 table App28)	55.84	58.2
Water recycling - offsite (network reinforcement line 23 table App28 and water recycling treatment capacity lines A26 and B72)	355.2	380.1

As noted above, these comparisons give us confidence that our costs are efficient.

1.5.1 Business plan costs

We have previously presented evidence to support the robustness of costs in our business plan as part of the business cases for enhancement expenditure for Housing growth (water), New development and growth (wastewater) and Growth at water recycling centres (wastewater). These formed stand alone enhancement business cases in our water and wastewater data table commentary for our September 2018 business plan and IAP Response.

All costs have been derived using our cost estimation system. The costs used are based on historic costs supplemented by information from our industry leading cost library of completed projects. Where we have developed costs for types of interventions that we have not previously delivered, we have gathered external data to develop new and updated cost models. This means that efficiencies already achieved form the baseline for our future cost estimates. We have then applied our 1% pa productivity challenge and efficiency assumptions, as applied to all of our costs in our business plan. These assumptions are explained in the Cost Assessment chapter of our September 2018 Business Plan. In addition, each alternative has been through a quality assurance process.

We have taken a risk based approach to scoping reinforcement and treatment investments.

Water housing growth

The forecast expenditure needed for Housing and Estate Mains (HEMS), Intra-Planning Zones (IPZ) and new connections has been determined against a baseline of achieved out turn unit rates per dwelling based on AMP6 costs. Thus, efficiencies already achieved form the baseline for our future costs estimates, as described in the Efficiency & Innovation chapter of our Plan. A HEMs/IPZ scheme is designed and costed based on a developer's layout, however these are not available for forecasting future housing costs. We are therefore relying on historic averaging of all development sites. This is reasonable as we do not expect a large overall change in the current market make-up of development sites (e.g. layout), although the scale and volume of connections will increase.

Network reinforcement costs are based on cost base models. These are all validated based on historic costs. The requirement for network reinforcement has been determined using hydraulic modeling. Using spatial data from Local Planning Authorities, we have been able to forecast potential locations for critical development sites and model sites to the nearest water main. This high-level modelling provided an initial understanding of the risk versus cost. Prioritising the highest risk sites, we have undertaken detailed modeling to provide a business case for those sites where network reinforcement will be necessary to supply water to a new development or to protect existing customers from an unacceptable deterioration in service.

We have benchmarked our costs for on-site infrastructure using published water company charges and a representative sample of development sites in our region. This found that for the types of development typical in our region, we are currently 11% more efficient than the lower quartile for cost (i.e. best performing quartile). This benchmarking is described later in this document.

Water recycling new development and growth

Wherever possible, costs have been estimated based upon the most recent unit costs available in our well populated cost library. Thus the efficiencies that are embedded in these costs as a result of innovation over previous years and AMPs are included in our proposed investment.

All of our 1,000+ catchments were screened via our InfoNet asset management tool to identify upgrade requirements from the nearest potential connection point. The results were considered alongside predictive detriment analysis to identify the highest risk catchments. A detailed review of the growth data was then completed in the promoted catchments to improve confidence. The tool was then re-run for these priority catchments using the revised data, promoting those at highest risk to the final stage of a hydraulic modelling assessment. The final assessment, considered a strategic approach to catchment growth, assessed future growth scenarios (with and without climate change) against the existing sewer networks. This provides greater confidence in the capacity deficit alongside a range of modelled solutions.

Monitoring key indicators for growth (such as flow and growth intelligence) will enable us to continuously deliver solutions at the optimal time for maximum efficiency. As we promote investment in growth strategies, we will also strive to integrate solutions with existing flood risk and maintenance requirements within the catchment to gain further delivery efficiencies and reduce impact of construction on our customers.

Where possible, we will deliver any built solutions using a modular approach rather than design and construction, to reduce costs.

Water recycling treatment

Similar to water recycling we will deliver any built solutions using a modular approach rather than design and construction where possible. By 'designing once and building many' it is possible to greatly increase productivity and efficiency whilst reducing embodied carbon and time on site, therefore reducing cost. Further cost efficiencies from this approach are possible from the reduced costs of design, commissioning (and decommissioning) and procurement.

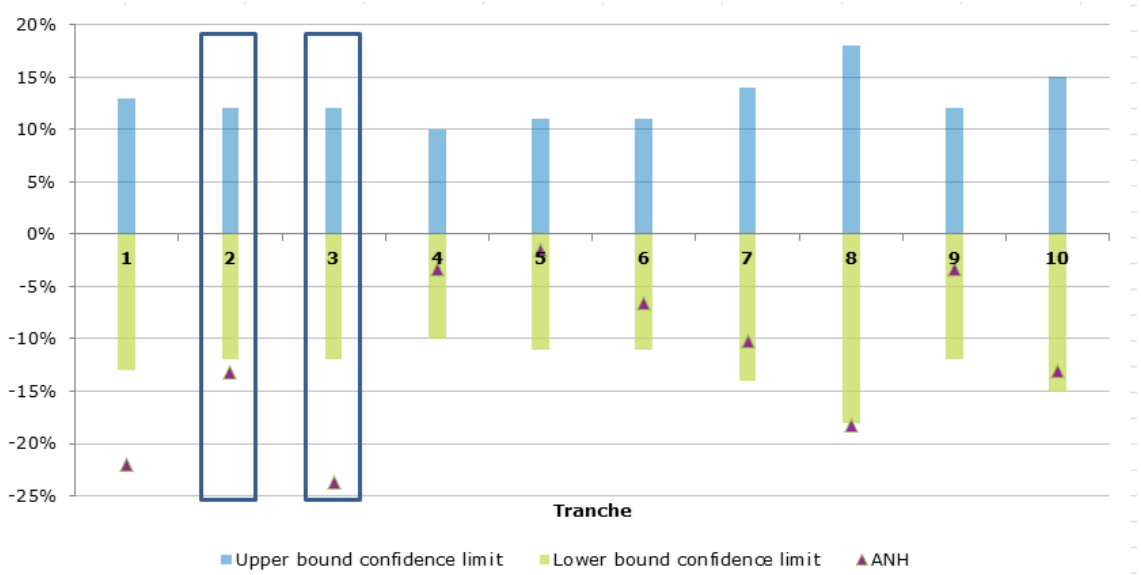
New approaches such as this help to ensure that future growth in our region is affordable in the future.

Ahead of submitting our September business plan, our costs were externally reviewed and benchmarked by Mott MacDonald against other water companies' costs for PR19, and have been shown to be efficient. The tranches that are relevant to enhancements growth are two and three (shown in the table and figure below). For both sets of costs associated with growth at treatment centres we are more efficient and outside of the confidence range.

Table 6 Benchmarked costs

Programme	Tranche ref	Enhancement business case reference	AW cost (£m)	Industry average (£m)	Delta between AW and Industry (%)	Confidence range
WRC capacity enhancement	2	Growth at Water Recysling Centres	34.2	39.3	-13%	+/-12%
WRC DWF programme	3	Growth at Water Recycling Centres	28.0	36.7	-24%	+/-12%

Figure 19 Benchmarked costs



1.5.2 Bottom up costs

In this section, we explain how we develop estimates of the expected impact of complexity drivers on our costs, using site-level data. The purpose of this was to provide evidence for further triangulation as part of this DD Representation. Relationships observed in this site level data can be extrapolated to produce bottom up estimates of enhancement costs given our characteristics.

- Use our site data to understand how complexity factors affect costs
- Use forecasts of complexity factors to project cost impacts forward and derive unit costs
- Apply those unit costs to the number of potential connections that could require reinforcement to create an estimate for total enhancement costs.

We follow this approach for on- and offsite water costs, and for offsite wastewater costs. The majority of on-site costs for waste are incurred by developers rather than companies. Developers lay on-site waste assets which are adopted by us.

Water onsite – connections

Consistent with the narrative presented in the 'need for adjustment' section, historical costs from our development sites shows that flats require significantly shorter communications pipes per plot than detached plots. This makes flats far cheaper to connect than detached plots. In AMP6 data from SAP billing system shows the following average lengths for different plot types:

- Flats: 0.8m per plot
- Detached: 7.4m per plot

Based on historical trends (more details on methodology available in Annex 1), only 16% of our new connections will be flats compared to an industry average of 35%. Our own published connection charges have detached connections (assumed to be the average cost between 4m and 9m connections) as being 36% more expensive than flats (assumed to be the average cost of a 2m connections). Using the unit rates quoted in Ofwat's independent review of water connection costs, this difference grows to 51%.

Using our own published connection charges and weighting appropriately based on the share of plots which are flats and houses produces an average unit cost of £967 per new connection. Note that this is significantly less than the average unit cost based on Ofwat's rates from its review of water connection costs, which would be £1,077.

Using this average cost per connection of £967 (based on our charges rather than the higher unit costs published by Ofwat), the cost of delivering 108,448 connections[4] would be expected to be £105m. This is more than the corresponding figure in our business plan which is £78m (excluding fees for self-lay providers) and illustrates the efficiency of our proposed costs.

Water onsite – mains

As part of our DD Representation we have compared our published costs for new developments to the published costs of other water companies. A sample of 105 Anglian schemes were costed, being a representative sample of the different sizes of developments we currently experience. We used the published costs of 10 companies. These are: Severn Trent, Bristol, South West, Northumbrian Water, Essex & Suffolk Water, Yorkshire, Affinity, Portsmouth, United Utilities and Thames. While this uses current charging information, our costs for AMP7 include the application of our 1% pa productivity challenge and efficiency assumptions, as explained in the cost assessment chapter of our September 2018 business plan.

This analysis was subject to internal quality assurance. We have published our analysis as an appendix to this document so that it can be scrutinised and traced back to source.

Table 7 Summary of published costs analysis

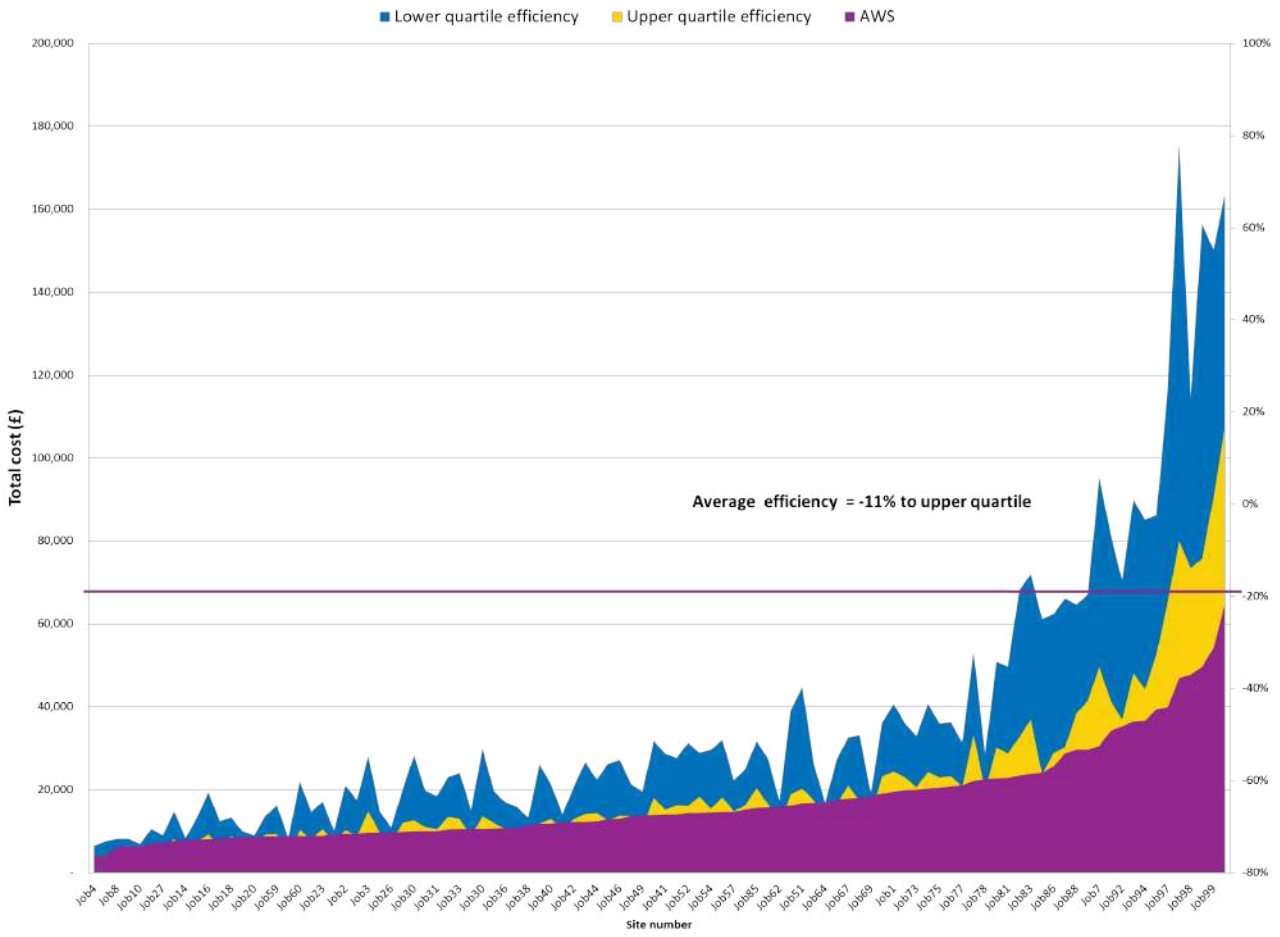
	1-50	51-100	101-500
Number of sites analysed	81	10	14
Number of sites per segment (forecast for a horizon of 15 years)	4,555	385	446
Proportion of sites analysed per segment	83%	7%	8%

4 This represents 59% of the total 183,810 new connections forecast for AMP7. The remainder will be delivered by Self-lay Providers.

Our analysis, presented in the figure below, shows across the entire sample that we are 11% more efficient than the upper quartile for cost efficiency (i.e. highest performing). We are very similar to the upper quartile for smaller sites and as sites get larger we become more efficient. This demonstrates that when other company unit charges are applied to our types of developments, we are efficient.

This suggests that a company operating at upper quartile levels of efficiency would deliver our programme for £83m as compared to £75m in our business plan. The figure below shows our costs for each site in magenta, the upper quartile on cost (i.e. least cost) in gold and lowest quartile in blue (using the left hand y axis). The horizontal line shows our relative efficiency to the upper quartile, using the right hand y axis.

Figure 20 AW charges vs industry benchmark for typical Anglian development sites



Water offsite

Data on distribution zones (DZs) used to develop our WRMP and business plan shows a clear positive relationship between a requirement for offsite water reinforcement in AMP7 and the intensity of local growth.[5] The DZs which have been identified with a strong need for water reinforcement have a growth intensity of 10.5% in total over AMP7 (growth over AMP7 divided by existing connections), compared to 7.7% across DZs on average. At the postcode level, the average intensity of growth in Anglian's water service area is 17% in total over AMP7. If we assume, conservatively, that new connections trigger upgrades only where the level of growth intensity is greater than average by the same factors shown above, this suggests offsite reinforcement is required whenever local intensity is greater than 23%.

5 This is based on data provided by Edge Analytics, mapped to our DZs.

Analysis of intensity of growth projected in AMP7,[6] shows that around 17% of new water connections in our region will take place in post code sectors where the intensity of growth is greater than the 23% benchmark. Using unit costs of offsite reinforcement of £1,896[7] from our externally assured cost models (based on dividing the total connection increases in AMP7 in DZs with water offsite investments by the business plan costs of those investments), and assuming, conservatively, that only those new connections in areas of growth intensity greater than the 23% benchmark are affected, offsite costs would be expected to be £58.2m in AMP7 which is in line with the £58.1m figure in our business plan.

Water recycling offsite

As with the analysis of water offsite costs, AMP7 growth intensity is significantly higher in wastewater catchments with offsite reinforcement than those without. This breaks down as follows:

- **Network reinforcement**: 15 catchments chosen for reinforcement, all with population equivalent (PE) capacity of 10,000+. The average growth intensity is 8.2% in total over AMP7 in reinforced catchments as compared to 6.8% in catchments of a similar size on average.
- **Water recycling centre upgrades**: 42 catchments with PE of 500+ chosen for enhancements to deliver greater capacity (other catchments also allocated expenditure for non-capacity increasing studies and investigations etc). The average growth intensity in upgraded catchments is 8.6% in total over AMP7 as compared to 6.5% in catchments of a similar size on average.

Working at the postcode level, we assume, conservatively, that new connections trigger offsite upgrades only where the level of local growth intensity is greater than average by the same factors shown above. Given an average postcode level growth intensity of 15% in total over AMP7, this means network reinforcements are assumed triggered where intensity is greater than 18% and water recycling centre upgrades when intensity exceeds 20%.

Roughly 21% of our new connections fall in postcode sectors above the 'trigger point' for waste infrastructure reinforcement, and 16% for water recycling centre upgrades. Applying the average unit costs from our externally assured cost models (see previously for benchmarking of our water recycling centre costs compared to industry average), this analysis suggests total required costs of £380m for waste offsite investment compared to £355m proposed in the business plan. The unit cost data below is based on data included in our business plan from C55, our investment optimisation system.

- Network reinforcement:
  - Unit cost = £3,909
  - Share of total connections in areas with growth intensity of 18% or higher = 21%
  - New connections in 'high intensity' growth areas = 43,800
- Water recycling centre upgrades:
  - Unit cost = £6,089
  - Share of total connections in areas with growth intensity of 20% or higher = 16.2%
  - New connections in 'high intensity' growth areas = 34,276

1.6 Econometric modelling

A final estimate of the effect of scale and complexity variables on our efficient costs is based on econometric modelling. In the absence of site-level data from other companies, it uses company-level data on costs and drivers to understand efficient costs. This is aligned with Ofwat's approach to cost assessment in many other enhancement areas.

The models presented here use simple specifications that capture the relationship between costs and drivers set out in this claim:

- Linear specification is used, which is justified on the basis that there are no significant economies of scale (see the section on 'need for adjustment' for further details).

6 Using postcode level Land Registry data; see description in the section on 'Need for adjustment' and the methodological annex.
7 Based on data included in our business plan from C55, our investment optimisation tool.

- Onsite and offsite costs are modelled jointly. Despite the fact that costs have distinct drivers, the lack of consistent and quality assured disaggregated data precludes modelling at this level.
- Connection type and remoteness are not used in the same models as a strong correlation between remoteness and property type leads to instability in small samples.
- Both growth intensity and mean distance from the nearest 5 towns are demeaned from the industry average in the models for easier to make interpretation of coefficients easier.

The results are aligned with expectations, with intensity and remoteness factors having coefficients with the right sign, and models showing reasonable fit. The tables below present summaries of the results.

- In the water joint model, all variables have the correct sign and overall model fit is acceptable. Remoteness and connections are highly significant, but intensity is not significant. The latter is not surprising given offsite costs are a smaller component of overall growth costs for water than for waste.
- In the waste joint model all variables are highly significant with the correct sign.

Table 8 Water joint modelling

Variables	Coeff (P-value)
New connections smoothed	1.11 (0.01)
(% Growth Intensity) * (New Connections)	16.6 (0.36)
(Mean Distance) * (New Connections)	0.16 (0.00)
Constant	3.18 (0.43)
Dependent Variable = Water total totex smoothed	
R^2 = 0.75	

Table 9 Waste joint modelling

Variables	Coeff (P-value)
New connections smoothed	0.90 (0.00)
(% Growth Intensity) * (New Connections)	66.9 (0.00)
(Mean Distance) * (New Connections)	0.23 (0.00)
Constant	14.9 (0.07)
Dependent Variable = Waste total totex smoothed	
R^2 = 0.76	

This simple modelling exercise supports the claim that the intensity and remoteness of growth are key drivers of efficient enhancement growth costs. Our predicted costs in these models are similar to what is proposed in our business plan.

- Water: £315m (predicted) vs £298m (smoothed BP costs)
- Waste: £395m (predicted) vs £385m (smoothed BP costs)

1.6.1 Is there high quality third party assurance for the robustness of the cost estimates?

Our approach to Growth in our business plan was been audited by our external assurance provider (Jacobs), who have confirmed to our Board that there are no material concerns. *"We found that Anglian's business planning methodologies and its tools for identifying needs and solutions, estimating costs and benefits and optimising expenditure were robust from a technical perspective and based upon sound risk-based principles using reliable asset-specific data". (Jacobs, Anglian Water PR19 Technical Assurance Executive Summary, 13 August 2018').*

This has informed our Board's support for the assurance statement in the September 2018 Plan.

1.7 Customer Protection

1.7.1 Are customers protected if the investment is cancelled, delayed or reduced in scope? Are the customer benefits that relate to the claim linked to outcomes and to a suitable incentive in the company's business plan?

We propose to protect both customers and companies through additional growth delivery ODIs. Our proposed expansion to this mechanism is described in the 'Focus Area: Growth' chapter of our draft determination representation. These proposed mechanisms are supported by the totex cost sharing mechanism and DSRA.

Customers are also protected through D-MeX. Insufficient investment to support growth will result in delays to connections, resulting in penalties through D-MeX and lower bills for customers.

1.8 Affordability

1.8.1 Has the impact on affordability been considered?

The timing of investments involves trade-offs in cost and risk between current and future customers. We must reconcile the need to keep bills affordable with the need to plan for future challenges. While we believe our growth forecasts are robust, they can be dependent on macro-economic factors so our long term strategies are adaptive to change and respond to the key indicators we monitor. We have selected the most cost beneficial option and have phased investment across AMP7 and AMP8 where possible. Monitoring key indicators for growth (such as flow and growth intelligence) will enable us to deliver solutions at the optimal time. The cost benefit analysis that has been undertaken on each option allows the best value, lowest whole life cost solution to be identified that has the least impact on bills both in the short and long term.

Our proposal meets the needs of the housing growth forecasts in the region. Customers acknowledge that the combination of increasing demand and decreasing supply creates challenges. Customers are very concerned about population growth and new development; enabling sustainable growth is generally seen as the second most important of the company's four long-term goals. Customers therefore want the company to plan ahead, influencing the planning system and work in partnership with developers.

There was broad support from customers for the package of service and cost proposed as part of our business plan. We have a comprehensive package of support available for customers struggling to pay.

The proposed ODIs will ensure that if growth is lower than forecast, customer bills will be reduced in line with the reduced scale of investment.

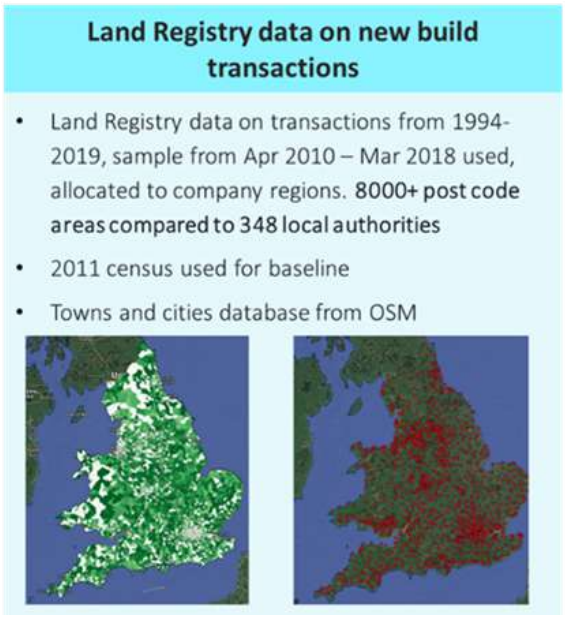
1.8.2 For large investment schemes in particular, is there persuasive evidence that the investment does not raise bills higher than what is affordable?

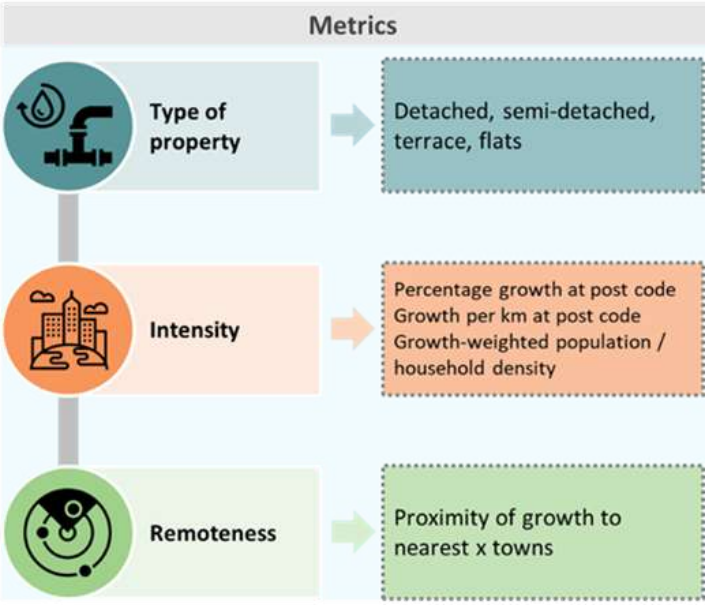
The costs of this investment are partly but not wholly offset by the additional revenue we expect to generate from new customers and grants and contributions from developers. The proposed ODIs will ensure that if growth is lower than forecast, customer bills will be reduced in line with the reduced scale of investment.

1.9 Assurance & Board Assurance

Our approach to Housing Growth in our September Plan was audited by our external assurance provider (Jacobs), who have confirmed to our Board that there are no material concerns. Our proposed investments and expenditure in this area have not changed materially since submission of the September plan. *"We found that Anglian's business planning methodologies and its tools for identifying needs and solutions, estimating costs and benefits and optimising expenditure were robust from a technical perspective and based upon sound risk-based principles using reliable asset-specific data". (Jacobs 'Anglian Water PR19 Technical Assurance Executive Summary, 13 August 2018').* This has informed our Board's support for the assurance statement in our September 2018 Plan.

2 ANNEX 1 - METHODOLOGY





All new drivers and metrics were based on publicly available data and analysed with open source software. The key sources used for this analysis were:

- Land registry data on new dwellings sold by type by postcode sector
- Census 2011 data on the number of existing households per postcode sector
- ONS LA household projection data
- Locations of towns and cities from OpenStreetMapper

All analysis was done at the postcode sector level and aggregated up to company-level metrics by allocating each postcode sector to the relevant LA and then matching the LAs to the various companies.

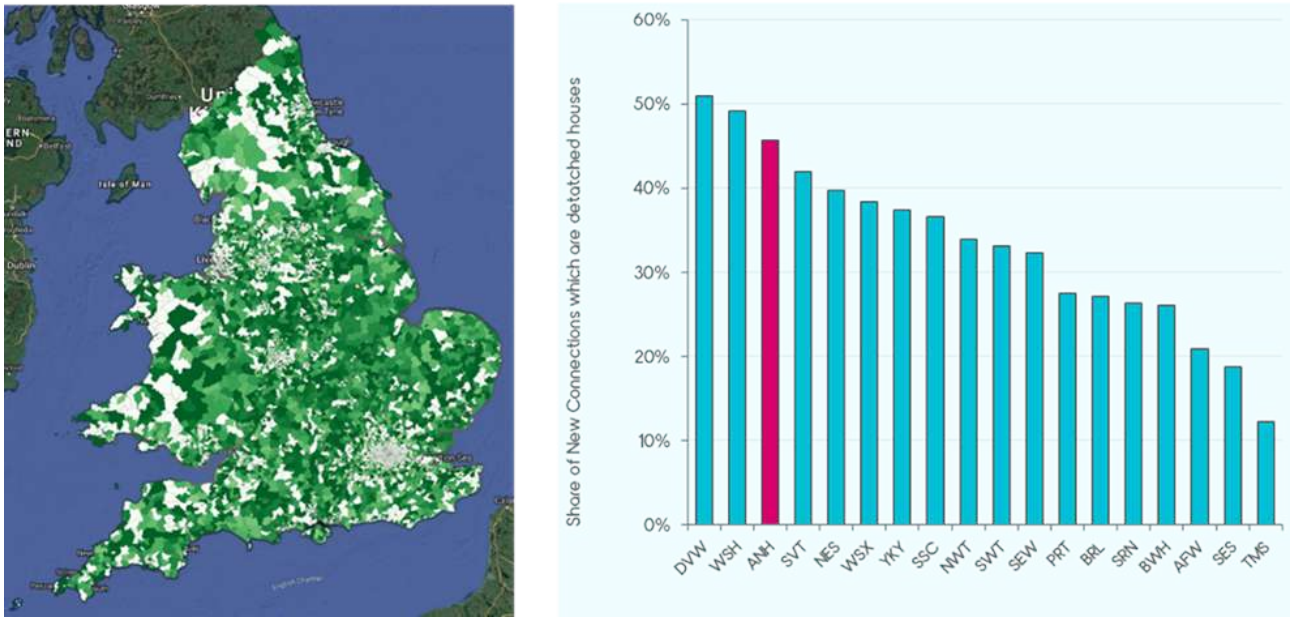
Future ONA LA forecasts for new connections are provided at the LA level – it was assumed that the relative shares of growth for each postcode sector within each LA is the same as the historical average (20101- 2018) to allow the projected LA level growth to be distributed amongst the postal sectors. Each metric followed a roughly uniform process which is laid out in more detail below:

2.0.1 Types of Connections

- Land registry data was used to calculate, for each postal sector, the number of new build properties sold over 2011 – 2018 and the relative shares of detached and flats
- Each postal sector was assigned to its relevant LA
- Each postal sector's share of total new build property sales within its given LA was calculated
- New future connections from ONS projections were distributed to postal sectors based on their historical share of total new sales in the LA
- New connections allocated to each postcode sector were split into flats and detached based on the postcode sector's historical ratios of sale shares
- A weighted average (based on postal sector new property sale share of total LA sales) was calculated for the shares of detached and flats for postcode sectors within each LA – this created an appropriately weighted figure for the sales of different property types at the LA level
- Company level metrics were derived by applying another weighted average, looking at the sale shares of detached/flats in each relevant LA where a company operates, and weighting by each LA's share of total company new build property sales.

An illustration of the postcode sector level data and the results for the historical data (2011 – 2018) are below:

Figure 21 New connections by postcode sector level



2.0.2 Growth Intensity

- Land registry data was used to calculate, for each postal sector, the number of new build properties sold over 2011 – 2018
- Each postal sector was assigned to its relevant LA
- Each postal sector's share of total new build property sales within its given LA was calculated
- New future connections from ONS projections were distributed to postal sectors based on their historical share of total new sales in the LA
- The number of new future connections allocated to each postcode sector was divided by the number of existing households in 2011 from census data to create a 'growth intensity' value for each postcode sector
- A weighted average (based on postal sector new property sale share of total LA sales) was calculated for the growth intensity for postcode sectors within each LA – this generates an appropriately weighted figure for the growth intensity at the LA level
- Company level intensity metrics were derived by applying another weighted average, looking at the total new house sale shares in each relevant LA where a company operates, and weighting by each LA's share of total company new build property sales.

2.0.3 Remoteness

- Land registry data was used to calculate, for each postal sector, the number of new build properties sold over 2011 – 2018
- The centre point of each postal sector was defined, and the distance to the closest major settlement and the mean distance to the closest 5 major settlements from the centre point was calculated for each postcode sector
- Each postcode sector was assigned to its relevant LA
- Each postal sector's share of total new build property sales within its given LA was calculated
- New future connections from ONS projections were distributed to postal sectors based on their historical share of total new sales in the LA
- A weighted average (based on postal sector new property sale share of total LA sales) was calculated for the 'remoteness' (minimum distance metrics) for postcode sectors within each LA – this generates an appropriately growth weighted figure for the remoteness at the LA level

- Company level intensity metrics were derived by applying another weighted average, looking at the total new house sale shares in each relevant LA where a company operates, and weighting by each LA's share of total company new build property sales.
- The figure below provides an illustration of how the minimum distance was calculated for the postcode sectors:

Figure 22 Minimum distances calculation for postcode sectors

3 CASE STUDY: EAST OF KETTERING

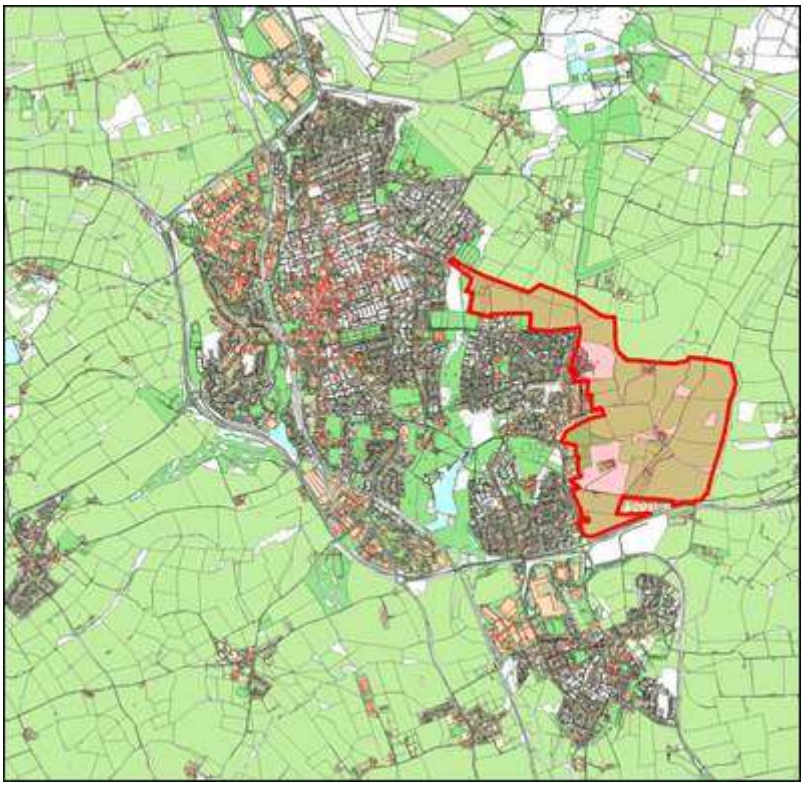
3.1 Overview

The East of Kettering development is a typical Urban Extension that consists of 5,500 homes, shops, schools, restaurants, hotel, leisure and takeaway facilities. Effectively it is a town within a town. This is a typical Land Developer led site that we are increasingly seeing in our towns and villages.

The site is split into two phases, split roughly 50/50 down the centre. The site is located at the edge of Kettering and it is expected to be completed by mid 2030s (late AMP 9 or early AMP 10). On completion, the site will have increased the size of Kettering by almost 25%.

The site gained planning permission in 2010 but the first house was not constructed until 2017. We work directly with land and house developers and build intelligence that provides the "need-date" of a site and we do not work to the planning permission. As such we finished the majority of our offsite infrastructure in 2017 within weeks of the first home being occupied. As is the case with complex infrastructure deliverables, we started our design in 2015 and before construction started on the site. This is always a risk as waiting for the developer to be onsite would result in the infrastructure not being provided in time.

Figure 23 East of Kettering site boundary



3.2 Water

The existing water distribution network adjacent to the development does not have sufficient capacity to supply the whole of the development, and the nearest point of capacity is the Beanfield to Hannington trunk main which is 6.7km from the development. To supply the development will require the existing network to be reinforced along the length from the trunk main to the development and the strategy is to phase the off-site works as the need of the development grows.

There are three phases for the offsite work.

3.2.1 Phase 1

After a total of 750 dwellings have been constructed it will be necessary to lay the first phase of the off-site works which would be 2.9km of 500mm HPPE main north of Kettering. 2.9km of 450mmID reinforcement main has an estimated budget cost of £1,915,912.79

3.2.2 Phase 2

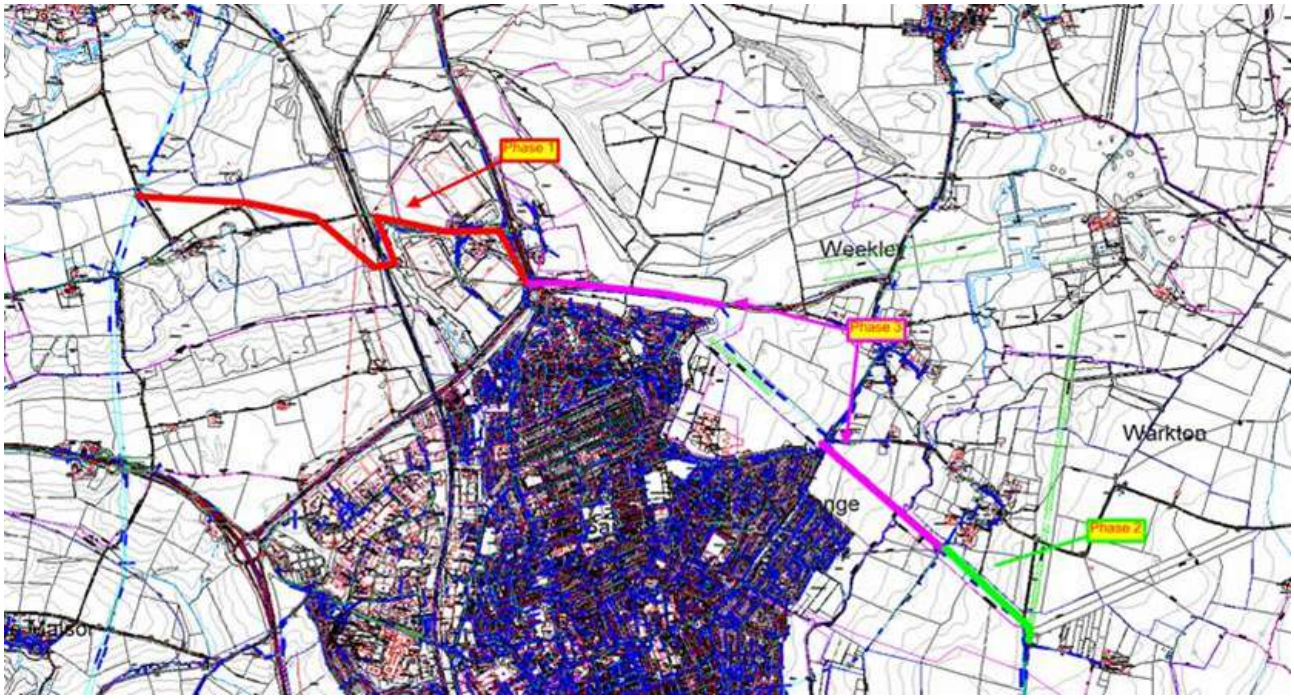
After a total of 1,200 dwellings have been constructed it will be necessary to lay approximately 820m of 355mm HPPE reinforcement main along fields and Warkton Lane and this point there would be second feed into the developments on-site mains. 820m of 300mmID reinforcement main has an estimated budget cost of £269,263.69

3.2.3 Phase 3

After a total of 3,000 dwellings have been constructed the rest of the off-site works would be required which is 2,062m of 355mm HPPE main across fields and along the A43 verge. 2,062m of 300mmID reinforcement main has an estimated budget cost of £1,136,358.49.

Total scheme cost £3,321,534.97

Figure 24 East of Kettering - water plan



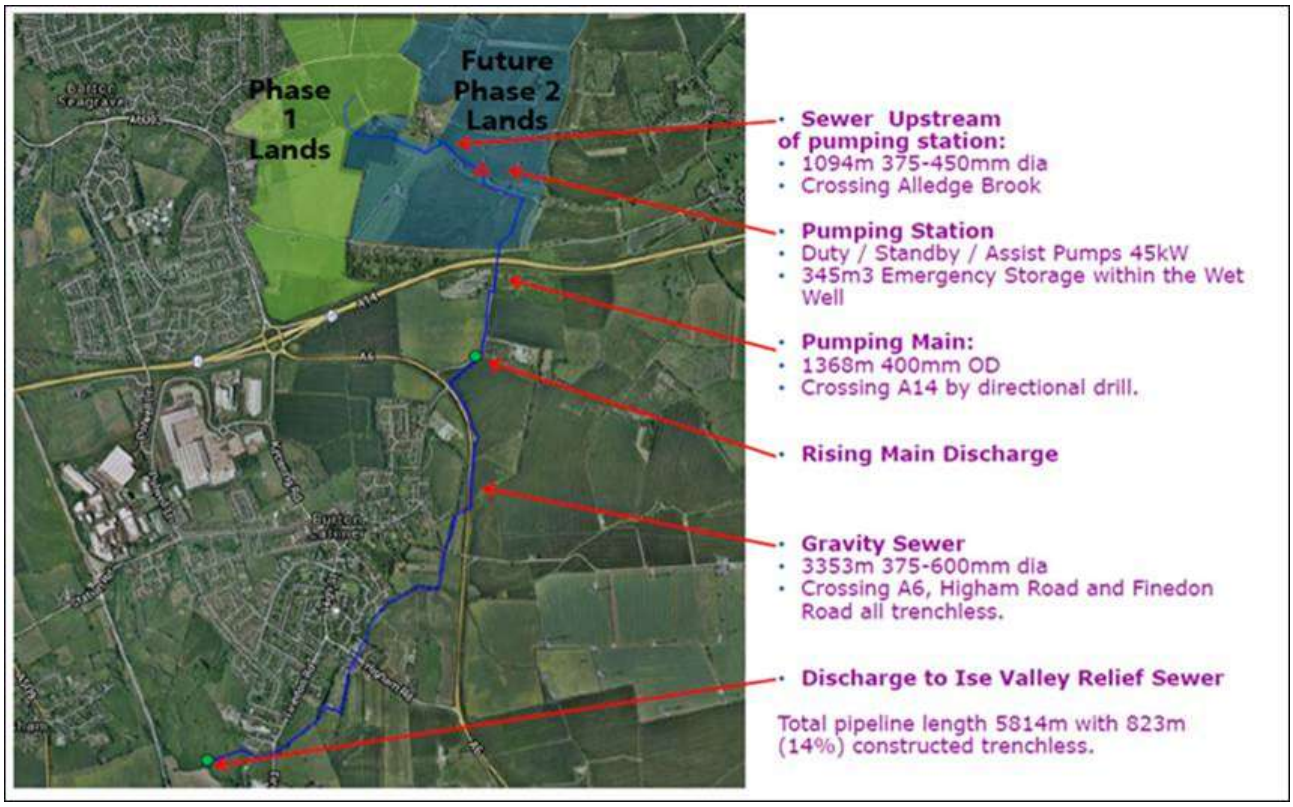
3.3 Water recycling

East of Kettering is located 8km (as crow flies) from Broadholme Water Recycling Centre and the local network has limited capacity for only a handful of houses. A new 6 km Rising Main was needed to take the flows from the site to a large enough sewer that would not result in flooding. There was no opportunity to split the delivery into phases. As can be seen in the below figure, we could not simply part construct the sewer as we needed to build the whole section. This has resulted in a new sewer being constructed at the full price but for a development that will take 18 years to be completed. This is typical for all large development sites that are located in small towns or rural areas.

We originally estimated that the cost would be £8m. Through close working with the developer and their onsite design, routing sections with shallower sewers and combined with improvements in trenchless technology we were able to make savings of over £1m. As part of the design we also

ensured that the sewer was routed through the future Phase 2 of the development site and using a larger diameter sewer we enabled the second future phase and thereby eliminated the need for a second 6km Rising Main.

Figure 25 East of Kettering - water recycling plan



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