IAP Response

Ref B2.2.WSH.OC

Performance Commitment Targets and Deadbands

1 April 2019

Contents

1. Introduction

This document covers our responses to the IAP Actions concerning our Performance Commitment targets, plus two deadbands for compliance measures where the formal target is 100% compliance.

In this response document, a number of important points of general principle are relevant on a number of occasions. In particular, we have concerns across several performance commitments that:

- the level of performance targeted for a company must have sufficient regard to the particular operating circumstances of that company's area;
- Ofwat's approach to calculating the upper quartile, forecast level of service can be too influenced by the results for very small companies – our approach which sets upper quartile with reference to customer numbers is more robust; and
- the very heterogeneous operating environments of companies would be expected to result in markedly differing marginal costs of service improvements. In that case, setting a uniform level of service target risks creating very inefficient outcomes for the customers of some companies, where the marginal cost of seeking to deliver Ofwat's target greatly outweighs the marginal benefit to customers, thereby misdirecting resources which could be better used to deliver other priorities for the customers of that company.

Further information on these and other methodological points is contained in the accompanying response paper B2.1.WSH.OC Performance Commitments IAP Response.

2. WSH.OC.A9 CRI DEADBAND

Summary of response

We do not believe that 1.50 represents a justified and reasonable level for the deadband on this measure. Details of are reasoning are provided below. We have retained our original approach of a deadband equivalent to the 'upper third' level of performance in any given year's outturn CRI results.

2.1. Background

In our original PR19 submission we proposed a deadband equal, for each year, to the 'upper third' level of actual performance of companies in the industry in each given year. This approach, we would argue, is reasonable and appropriate given the fact that the measure is new, and what we think is the inherent volatility of individual companies' performance against the measure.

In its IAP publication, Ofwat has mandated a standard deadband of 1.50 for this measure, calculated as the average of a) the observed upper quartile performance of companies in 2017, and b) the upper quartile of the deadbands proposed by companies.

2.2. Our position on 1.50 as a deadband

While Ofwat states that its approach provides a reasonable balance between allowing for volatility of a new measure and stretching company performance, we would argue that in reality this is not the case. It results in a deadband value that seems likely on current evidence to be unachievable for most companies in most years. This is because:

- Using the deadbands proposed by companies on an equal footing does not take into account that some set much higher penalty rates than others, (it is easier to set a 'tighter' deadband with lower penalty rates).
- Using a single year's performance as the basis for setting an upper quartile absolute measure (rather than relative) for the next 5 years is to ignore the fact that this is a new measure that appears quite volatile and may take a while to 'bed down'. Irrespective of the actual value chosen, picking an absolute measure creates the risk that, after a couple of years, it turns out to be inappropriately high or obviously too low. A relative measure has the obvious advantage that it automatically re-calibrates over time in line with the out-turn performance of the industry.
- The design of the measure means that there are always likely to be a few companies with particularly low (good) scores (and also some with high scores). This is because of the use as a multiplier of the 'proportion of population served' by a WTW suffering a compliance failure. So small companies with a small number of relatively large works will have particularly volatile scores from year to year, depending on whether they have any compliance failures at one of their larger works. Assuming on the balance of probability that in any given year a few of them do not have any of those, (and a few of them do), then these companies will determine a (very low) upper quartile level, leaving the rest of the industry in penalty.

Larger companies with a high number of works, each serving a smaller proportion on average of their total population compared to smaller companies, will not suffer from the same volatility. It will not be possible for them to match the performance of the best performing companies on CRI, unless they can achieve a very low number of failures at all of their many works across their area.

2.3. Conclusion

CRI is a kind of composite measure, very different in its nature to other more traditional performance measures. As such we believe greater consideration needs to be given to the appropriate deadband level that better takes into account the newness of the measure and the volatility. Some kind of rolling measure on a relative basis would seem to merit consideration.

Note: All aspects of ODIs are dealt with in separate doc Ref B2.4.WSH.OC.

3. WSH.OC.A10 SUPPLY INTERRUPTIONS TARGET

Summary of response

We have given careful consideration to the feedback provided by Ofwat in the IAP. However, we do not consider that there is a case for re-visiting our performance targets, and have accordingly left them unchanged. The principal reasons for this decision are as follows:

- we do not accept the validity of Ofwat's upper quartile target of 3.0 minutes by the end of the AMP7 period;
- in order for horizontal benchmarks to be fair and robust, allowances should be made for significant differences in operating environments. The relative lack of network connectivity in our region combined with the sparsity of our population puts us at a significant disadvantage on CML performance; and
- there is no support from customers for significant further reductions in CML. See the evidence set out in our Business Plan (Ref 5.2: PR19 Performance Commitments).

3.1. The Basis for Ofwat's Upper Quartile Target of 3 minutes by 2024/25

We do not accept the validity of the target of 3 minutes for the following reasons.

First, Ofwat's methodology for calculating the upper quartile is to count the number of companies. Since there is considerable size variation across the industry, we think that this measure is potentially misleading, because it is customers that count, not companies. In other words, a fair upper quartile measure would count the number of customers in each company. Otherwise, there is a possibility that the number of customers served by companies that are at the upper quartile or better could be anything from, say, 60% to 6% or less. This issue affects Ofwat's calculation of the upper quartile for CML. Three of the four companies with the lowest targets are small water only companies, and the other is a medium-size WASC, Yorkshire Water. Our calculations show that an upper quartile assessment based on customers rather than companies would be somewhat higher.

Second, and in any event, we do not think that Yorkshire's target of 2.0 minutes by 2024/25 is relevant to the calculation of a reasonable industry benchmark target. Although the target appears "stretching", Yorkshire are proposing a deadband three times higher, at 6.0 minutes, which is a very different proposition to a target of 2.0 with no deadband.

3.2. Our Operating Area is Different and Gives Rise to Relatively High Levels of CML

Put crudely, customers lose their water supply because pipes burst, alternative delivery routes are unavailable, and it takes a period of time to restore service. All water companies are confronted with the challenge of minimising loss of supply in the first place, and finding ways to restore it as quickly as possible.

That challenge is greater for us for several reasons. First, due to the topography of our area and the sparsity of our population we have more bursts per customer than average. This is not because we do not look after our mains: on the contrary, our performance on bursts per

length of main is better than average. It is because we have more mains per customer. The following table presents the relevant evidence for 2017/18.

	Bursts per '000 km	Mains Length '000 km	No of Bursts	Connected Properties ('000)	Mains length per '000 properties	Bursts per 10,000 props
ANH	129.2	38.4	4,964	2,196	17.5	22.6
SRN	133.0	13.9	1,849	1,114	12.5	16.6
NES	162.6	25.9	4,213	2,019	12.8	20.9
SVE	124.2	46.5	5,778	3,612	12.9	16.0
TMS	272.0	31.5	8,557	3,826	8.2	22.4
WSH	**151.5**	**27.6**	**4,181**	**1,434**	**19.3**	**29.2**
NWT	106.5	42.1	4,484	3,313	12.7	13.5
WSX	161.0	11.9	1,922	615	19.4	31.2
YKY	216.0	31.7	6,846	2,305	13.7	29.7
AFW	175.2	16.7	2,923	1,500	11.1	19.5
BRL	179.0	6.8	1,222	536	12.7	22.8
PRT	70.1	3.3	234	320	10.4	7.3
SES	61.5	3.5	214	291	11.9	7.3
SEW	186.2	14.6	2,722	1,013	14.4	26.9
SSC	127.0	8.5	1,078	736	11.5	14.7
HDD	110.4	2.6	290	105	25.0	27.7
SWB	152.0	18.2	2,771	1,044	17.5	26.5
Total	157.8	343.9	54,249	25,980	13.2	20.9

Source: PR19 Business Plans

Our burst rate, at 151 per 1,000km, is 4% better than the industry average, but on a per customer basis the rate is 40% higher than the industry average. This is due to the fact that our length of main per customer is 45% higher than the industry average.

Second, the effect of the higher burst rate is compounded by the relative non-availability of back-up delivery routes in our supply systems. Companies operating in smaller, more densely populated areas have found it economic to link water sources and integrate networks, which has the benefit of greater intrinsic delivery security than we are able to offer. Many of our systems are discreet, single supply source delivery networks, which severely limits the scope for mitigating the effect of bursts on service continuity in those areas. Evidence of the effect of "connectivity" on CML is provided below, for 2016/17 (a comparatively "normal" year) and 2017/18 (the year in which "Storm Emma" had a massive impact on performance.)

Using data at Leakage Control Area (LCA) level, we examined the relationship between a connectivity score – measured as ((Main Length/No Of Valves)*(Main Length/No Of Tees))/No Of LCA Properties then divided into six bands – and CML. The following table presents the results for the two years.

Customer Minutes Lost by Connectivity Band

	Connectivity band (1 = high connectivity)			
Year	1	2	3	4 to 6
2016/17	6.4	11.7	30.9	67.6
2017/18	13.8	29.7	130.6	333.3

As the table shows, in LCAs where we have greater network connectivity (more tees and valves) our CML performance is orders of magnitude better.

We do not have the same granular data for other companies' networks. However, we are able to look at connectivity at a more aggregate level. The following table examines the average size of water resource zones across the industry in terms of properties. Our average is comfortably the lowest, at less than 30% of the average for the industry as a whole. Ofwat will be aware that for water resource management planning purposes "zones" have a specific definition that captures "connectivity" between sources and properties. Thus, for example, in the Yorkshire area, which is much more densely populated than Wales, a failure in a trunk main delivering water from one treatment works need not lead to a loss of supply for the properties that usually receive water from that source, because of the scope for "re-zoning". Similarly Wessex, the other company with a high rate of bursts per customer, has only a single water resource zone. As we understand it, this reflects a very significant resilience enhancement scheme funded in AMP6 to create a new ring-main to join up their previous separate supply grids.

	Connected Properties ('000s)	Water Resource Zones	Properties per zone ('000s)
ANH	2,196	28	78.4
SRN	1,114	14	79.6
NES	2,019	7	288.4
SVT/HDD	3,717	15	247.8
TMS	3,826	6	637.7
WSH	**1,434**	**24**	**59.7**
NWT	3,313	6	552.2
WSX	615	1	615.4
YKY	2,305	2	1,152.7
AFW	1,500	8	187.5
BRL	536	1	536.1
PRT	320	1	319.8
SES	291	1	291.4
SEW	1,013	8	126.6
SSC	736	2	367.9
HDD	105	4	261.1
SWB	1,044	28	78.4
Total/Av	**25,980**	**128**	**203.0**

Source: PR19 Business Plans

We should stress that the lack of connectivity in our area is not due to a reluctance to link zones where this makes economic sense. On the contrary, in the course of preparing our periodic water resource management plans we look at all practicable options to address zone deficits, including potential inter-zonal transfers. In general, these types of options are constrained by the geographic and topographical features of our region. For example, a scheme that would effectively link the South Meirionydd and Tywyn zones was looked at for the purposes of the 2014 plan, but was found to be 7 times more expensive than the preferred AMP6 supply side option.

However, other schemes to provide connectivity between zones have been developed and promoted within our plans where they have been shown to be economically justifiable. In AMP 7 we are planning to make permanent a temporary link that was put in place between the Lleyn Harlech and Barmouth zones during the 2018 drought. We also have plans that would lead to a merger between our Vowchurch and Hereford zones (though these are currently being challenged by Ofwat). However, notwithstanding these limited examples of inter-connection that are planned or have taken place in our region in recent years our systems remain relatively fragmented, so the probability of a mains burst leading to a loss of supply for customers is commensurately higher than in other areas of England and Wales.

4. WSH.OC.A12 POLLUTION INCIDENTS

Whilst we support the use of horizontal benchmarking between companies for pollution incidents, we do not accept the validity of the simplistic measure adopted by Ofwat, and specifically the use of length of sewer alone to "normalise" between companies. Pollution can occur at sewage treatment works, combined sewer overflows, rising mains, pumping stations, storm tanks and surface water outfalls, as well as from sewers. Further, the prevalence of such assets varies considerably between companies across the industry. It is therefore unfair to use the simple per-sewer-length measure for horizontal benchmarking, because it will be disadvantageous for some and advantageous for others.

This problem can be overcome by using a multi-asset approach to the measurement of performance. Our report (see Appendix) sets out a methodology for achieving this. We have discussed this material with Natural Resources Wales (NRW), and they have indicated that they will be writing to Ofwat expressing support for this alternative approach.

In any event, we do not accept Ofwat's derivation of "upper quartile". The methodology involves counting the number of companies, but since there is considerable size variation across the industry, we think that this measure is potentially misleading, because it is customers that matter, not companies. In other words, a fair upper quartile measure would reflect the number of customers in each company.

As a separate matter, new internal information is now available on the basis of which we have made revisions to the targets presented in our September 2018 Business Plan. Having commenced implementation of some of the initiatives that we had planned for AMP7, we are in a position to be more confident regarding their effect on our pollution performance. The following table presents the changes, expressed using Ofwat's measure of incidents per 10,000 km of sewer:

	2019/20	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**
Business Plan Forecast	29	28	27	26	25	24
Revised Projection	26	25	24	23	22	21

On the basis of our updated forecasts, we estimate that our projected performance is at or better than industry upper quartile (whether calculated using our preferred approach or Ofwat's), when assessed on a multi-asset basis as set out above, and can therefore be regarded as "stretching" without any further adjustments.

5. WSH.OC.A16 PER CAPITA CONSUMPTION

Summary of response

In view of further information available on the efficacy of our Project Cartref trials, we have revised our targeted reduction from 4% to 6%.

We do not accept Ofwat's assessment of PCC targets as a "performance commitment" as such, including the implicit assertion that "stretch" a valid objective, for the following reasons:

- For PCC, unlike most other performance measures, it is not unambiguously the case that movement in one direction or another is always 'a good thing'. Water in Wales is a precious and valuable resource, and we firmly support its efficient use. But it does not follow that incremental reductions in PCC are always in customers' interests, nor that increases are invariably to be frowned upon. For example, customers in Wales are encouraged to reduce their use of single-use plastic, including bottled water, and to make more use of tap water.
- in any event, we reject the validity of 'like-for-like' cross-industry comparisons. In the first instance, there are differences in measurement and reporting between companies. Even if a common basis were used, there are large variations across England and Wales in terms of water resource constraints and future supply-demand challenges. The demand management costs that might be justified as part of an optimisation exercise involving PCC reductions in one region may make little or no sense in another. This would mean charging customers more to pay for measures to force them to use less for no purpose. While our reported PCC figures are slightly higher than the average for the rest of the industry, we consider that they are at an appropriate level for our region, striking a fair balance between the interests of customers and the environment.

That said, independent of the IAP process, we have made changes to our PCC forecasts to take account of new information. As described in B2.a8.WSH.CE.A1 Project Cartref Investment Case, the pilot activities for Project Cartref have indicated that further reductions in PCC will be achievable as the project is rolled-out over the AMP7 period.

Accordingly, instead of the 4% reduction in PCC we had targeted in our Business Plan, we have now increased this to 6%. The revised targets for PCC on a three-year rolling average and year on year basis are therefore as follows:

	2020/21	2021/22	2022/23	2023/24	2024/25
Business Plan Forecast (3 year rolling average)	145	144	142	141	139
Revised Projection (3 year rolling average)	144	143	142	140	138
Revised Projection (year on year)	143	141	140	138	136

It remains our long term goal to reduce PCC to 100 l/h/d by 2050. As we move through AMP7 we will re-evaluate this target in the light of the new experience we (and other companies) have gained. In particular, since significant further reductions in PCC may require

widespread adoption of certain types of fittings by households, as well as necessitating potentially significant changes in cultural attitudes to water and personal behaviours, we will want to collect evidence as to whether that is what our customers want. Whilst we are fully committed to the long term importance of maximising the efficient use of water, there are important differences between our circumstances and those of some of the companies in England, especially those located in the comparatively dry and densely populated South East, so we will want to be certain that our strategy reflects priorities in Wales.

6. WSH.OC.A19 SEWER FLOODING (INTERNAL)

Summary of response

In view of further information on our performance in 2018-19 we are making a change to our targets. However, following careful review of the information contained in the IAP, we are not accepting Ofwat's calculated upper quartile values, for the reasons set out below.

At the time that we were preparing our Business Plan during the summer of 2018 Ofwat's internal sewer flooding measure was still comparatively new, and subject to a degree of uncertainty, especially around those parts of the new definition that differed from the old one, namely the inclusion of flooding of lean-to structures and "unsubstantiated claims".

Some nine months on, we have a better understanding of what the new measure means in practice. As a consequence, we are better placed to make forecasts of performance and have revised our figures accordingly, as set out below.

	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
Business Plan targets	300	294	288	283	280	273
Revised targets	280	274	268	263	260	253
Revised targets (per 10,000 connections)	1.91	1.86	1.81	1.77	1.72	1.67

Note that these targets are contingent on the associated enhancement funding which is subject to a separate challenge by Ofwat.

We have carefully considered Ofwat's view that we should go further, which would entail a significant additional reduction in our targets of more than 20% on average. However, we have decided not to adjust our targets further in line with Ofwat's proposals for the following reasons:

- we do not think that a uniform "upper quartile" target for the industry is appropriate for this measure, because operating circumstances and customer priorities vary. A particular source of disadvantage for us is the fact that flooding due to severe weather events is now included in the measure, and such events are more common in our area than in most of England. We note that, though we are unable to demonstrate this because we do not have the breakdown of other companies' flooding totals, this is something that Ofwat is in a position to collate;
- in any event, we do not accept Ofwat's derivation of "upper quartile". The methodology involves counting the number of companies, but since there is considerable size variation across the industry, we think that this measure is potentially misleading because it is customers that matter, not companies. In other words, a fair upper quartile measure would count the number of customers in each company; and

- we do not have customer support for making further reductions, which can only be achieved at high marginal cost, as set out in our Business Plan (Ref 5.2: PR19 Performance Commitments). The additional cost of seeking to achieve Ofwat's proposed uniform service level in our particular circumstances would not be good value for money for our customers and would risk diverting resources away from higher priorities that they have.

7. WSH.OC.A29 TREATMENT WORKS COMPLIANCE DEADBAND

We have carefully considered Ofwat's feedback, reviewed up-to-date evidence, and concluded that we will adjust our deadband to 99% for each year of AMP7.

8. WSH.OC.A31 ACCEPTABILITY OF WATER

Summary of response

We have carefully re-considered our AMP7 targets in the light of the IAP feedback and other updated evidence. We have decided to leave the targets for Acceptability of Water unchanged from our Business Plan proposals, for the reasons set out below.

The achievement of improvements in Acceptability of Water is particularly difficult for us as compared with the rest of the industry because of our geology, topography, and history, factors which are outside our control. Specifically, the interaction between the high natural concentrations of manganese in our raw water and the prevalence of cast iron pipes in our network, all against the backdrop of steady reductions in demand associated with long term industrial decline since the 1970s, has created conditions under which discolouration incidents are comparatively frequent;

That said, we are targeting a 28% reduction in customer contacts between 2017/18 and the end of AMP7 which we consider to be very stretching given that all of the 'easy wins' on this measure have already been achieved in the early part of AMP6. We also note that it compares favourably with other companies' plans for AMP7; and

Although discolouration does raise some modest concerns for customers, the support for significant investment to achieve further improvements in this measure is limited. Further, cost benefit analysis supports a level of performance in the range of 2.0 – 2.4 contacts per 1,000 population, well above the average for the rest of the industry. Until and unless we have evidence that our customers do want us to go further, and would consider the additional cost involved to be good value for money, we do not see a case for targeting even more stretching targets by the end of the AMP7 period.

8.1. The Principal Cause of Discolouration

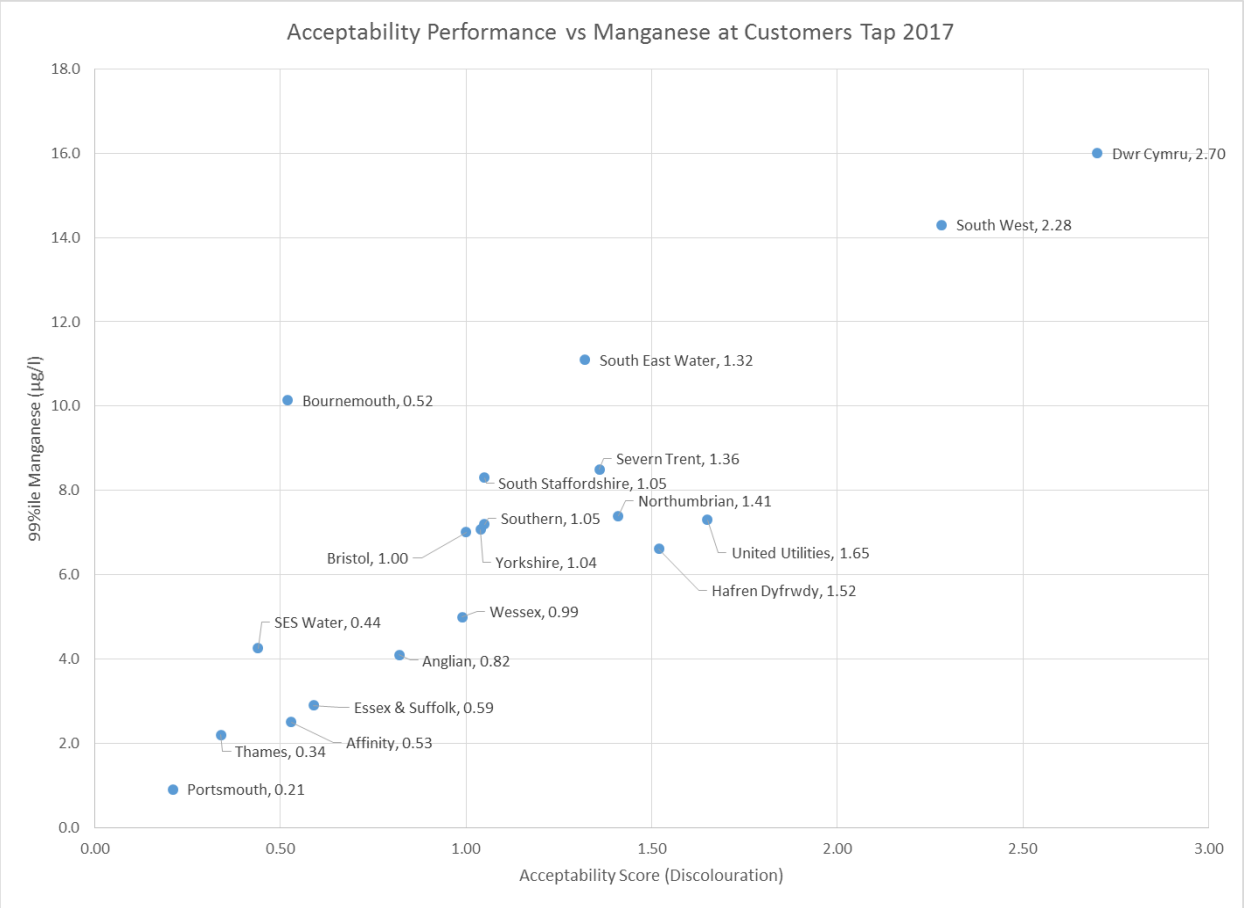
Manganese occurs naturally in raw water in particular locations. This is oxidised in the water treatment process and is present in small concentrations in the final water output from treatment works. The internal corrosion of mains that are cast iron also creates deposits in our mains. As water flows through pipes at a slow speed a bio-film can form on the inside of the pipes. This is harmless and transparent so does not cause a problem in itself if undisturbed.

However, if there is a high level of manganese and iron in the water then this can react and stick to the bio-film. If the water is hard (as is typically the case for groundwater sources in the South East of England) then the calcium carbonate can form a protective barrier, preventing particles from sticking to the film.

Originally pipes were designed to operate at sufficient velocity that they would self-clean. However, over time, in many locations, demand has dropped and we now have pipes that are oversized for the volumes that they deliver so that the water is not running at the velocity that was originally assumed. This allows the film and particles to build up. Sudden changes in velocity, triggered by a valve operation, 3rd party usage or a burst main can disturb the particles which then flow through to customers' taps. The problem is exacerbated in unlined cast iron mains as the internal corrosion adds to the discolouration.

Evidence on the Relationship Between Manganese in Water and Customer Contacts

The following chart shows that there is a very strong correlation across the industry between the residual concentrations of manganese in drinking water and customer contacts.

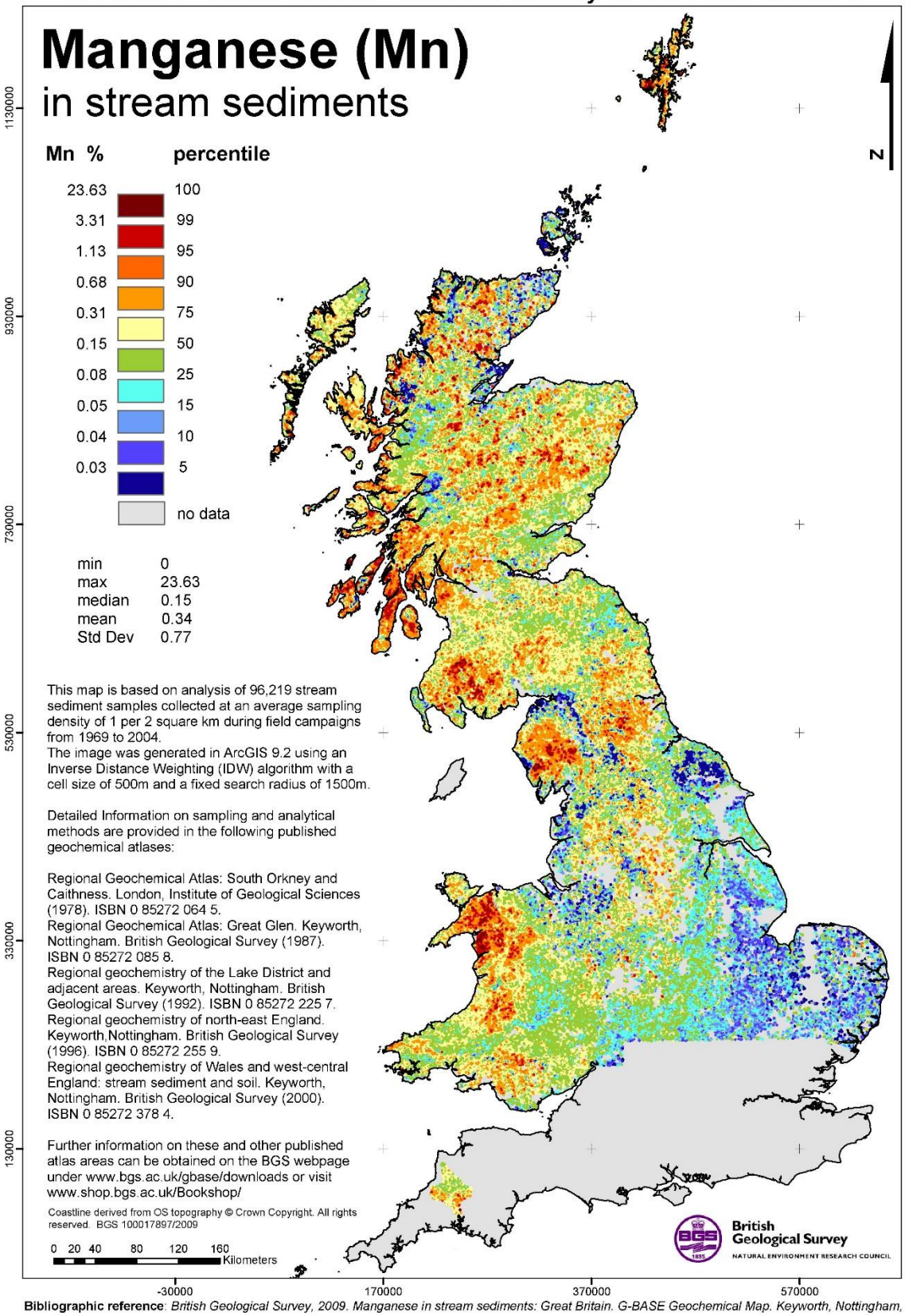


The Uneven Prevalence of Manganese across England and Wales

Unfortunately water companies are not required to collect and publish data on concentrations of manganese in raw water, so we are not able to demonstrate that high levels of manganese in drinking water are primarily caused by high levels in the source water (water treatment typically removes over 95% of manganese in order to achieve compliance with manganese standards, but a small proportion remains in the water that is distributed to customers).

However, the British Geological Survey publishes information on manganese concentrations in streams. The following map illustrates the general observation made above, namely that manganese concentrations tend to be higher in Wales and certain parts of the north of England, and lower in the South and East of England.

G-BASE - Geochemical Baseline Survey of the Environment



Bibliographic reference: *British Geological Survey, 2009. Manganese in stream sediments: Great Britain. G-BASE Geochemical Map. Keyworth, Nottingham, UK.*

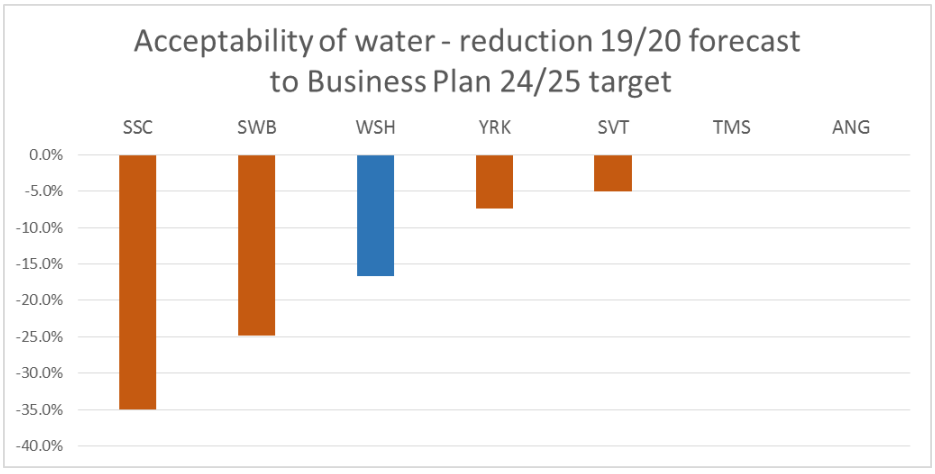
8.2. Why Can't Manganese Be Completely Removed in Water Treatment?

Manganese exists in two main forms in the environment, the most prevalent is the particulate manganese dioxide MnO2 but under anaerobic conditions, such as at the bottom of an impounding reservoir, this form can be reduced to the soluble Mn2+ form. Further, this form can then react to form complex compounds with dissolved organic carbon compounds such as the humic and fulvic acids prevalent in our upland waters. While the particulate form can be relatively simple to remove as part of a standard coagulation and filtration process, the soluble form required oxidation by chlorine at an elevated pH and further filtration. These processes are not an absolute barrier and should be considered to be circa 99.9 % removal for the first and 90% for the second process. This second process is less efficient due to the rate of oxidation, the impact of the complexation with organic compounds and the effectiveness of a single stage sand filter following oxidation. In summary, complete removal of manganese is not possible using the treatment processes available to water companies, so trace concentrations will always be present in the distribution system (see "Speciation of Manganese in Drinking Water", a report produced in 2014 for the Drinking Water Inspectorate, especially chapter 4).

8.3. Why we consider that our targets are already stretching

As explained in our Business Plan (see Ref 5.2: PR19 Performance Commitments), we have already achieved significant improvements in this measure through implementation of operational practices. This has helped us to reduce the rate of contacts per 1,000 population from 3.53 in 2014/15 to 2.79 in 2017/18.

Comparison with other companies' plans for AMP7 shows that our rate of improvement is competitive with the rest of the industry. The following chart shows rate of improvement that we propose, compared alongside the other companies that use a comparable measure for acceptability of water.



In addition, although we continue to look for new operational initiatives that could improve performance further, we have already been employing all of the existing mitigating actions available to water companies during the AMP6 period, including mains flushing programmes, mains conditioning (PODDS), trickle caps and operations training centres. We have therefore concluded that significant further gains will require considerable expenditure

under the auspices of our Zonal Study programme, as set out in detail in our Network Quality Legal Obligations investment case Ref B2.16.CE.A1]. The evidence from early implementation of this approach shows that very considerable reductions can be made in the rate of customer contacts (as well as other service benefits). For example, the Whitbourne zone was one of our worst performing areas in terms of discolouration. It was characterised by large lengths of iron water mains coupled with relatively low rural population as well as a large number of customers being supplied at the ends of the network. Although the age of water mains in this area were not particularly old, it was clear that iron deposits that had formed from the internal corrosion of the water mains was having an impact on our customers. Water in this area is moderately aggressive using the Langelier index which will contribute towards the corrosion of unlined iron mains.

Following the completion of the zonal study interventions in this zone in 2016 the number of contacts received for discolouration has reduced from 218 in 2014 to just 28 in 2018, as set out in the following table.

	2012	2013	2014	2015	2016	2017	2018
Discolouration Contacts	209	165	218	154	140	83	28
Rate/1000 customers	13.74	10.85	14.33	10.12	9.20	5.46	1.84

9. WSH.OC.A32 EXTERNAL SEWER FLOODING

Summary of response

We have carefully considered the IAP feedback, but have decided to make no changes to our Business Plan forecasts for the reasons set out below:

- We reduced total external flooding incidents (within and outside of property curtilages) by 31% between 2012/13 and 2017/18. The question of whether there is "stretch" in our AMP7 projections has to be viewed against this backdrop;
- as we explained in our Business Plan (see Ref 5.2: PR19 Performance Commitments) our customer research shows that although external flooding causes some concern, it is not seen as a very significant issue. Further, cost benefit analysis does not support a reduction in performance below 3,700 incidents at this time. It would therefore not be in customers' interests to target a much bigger reduction in AMP7;
- we think cross-company comparisons have to be treated with some caution at this stage, because this is a new measure with historically quite differing reporting methods being used by companies. It will take some time and a process of independent horizontal audit before we arrive at robust and consistent reporting data across the sector, which should be available to inform decisions for AMP8.

Pollution Incident Report

Dŵr Cymru
Welsh Water

Comparative Measurement of Pollution Incidents

March 2019

dwrcymru.com

Contents

Executive Summary

This report details an alternative method of assessing the relative performance of pollution incidents to be considered by the EA, NRW and Ofwat. We are concerned that the current methodology for pollution incidents is too simplistic and risks giving a misleading picture. The current approach evaluates performance from all assets relative to the length of sewer but does not take into account the number of other water company assets which also give rise to pollution incidents.

For instance, sewage treatment works, combined sewer overflows, rising mains, pumping stations, storm tanks and surface water outfalls also contribute to pollution incidents. The number of these assets vary considerably across the industry due to differences in companies' operating environments. These assets account for a significant proportion of incidents, with 48% of the pollution incidents caused by other assets and the remaining 52% from foul sewers.

Our proposed method extends on the current approach to take into account the performance of all assets which contribute to pollution incidents. The performance of each asset is evaluated by examining the number of pollution incidents from a given asset relative to the number of those assets.

If the number of all assets are considered in the assessment, the overall picture would look very different as the following table shows. The table shows the difference in the performance score under the current approach and our proposed approach. Positive values indicate that the company's performance has improved when accounting for all of their assets. A negative value indicates that the current approach favours these companies due to their relatively small number of assets.

	Difference in Performance Score (%)
South West	47%
Dŵr Cymru	23%
Anglian	10%
Southern	1%
Wessex	(1%)
Yorkshire	(4%)
Northumbrian	(6%)
Severn Trent	(7%)
Thames	(18%)
United Utilities	(19%)

There is a strong correlation between the rank of the relative number of assets and the difference in the performance score. When all assets are not taken into account this can results in an unfavourable performance assessments for companies' with a relatively large number of assets and a favourable performance assessment for companies with a small number of assets.

The current approach of reporting pollution incidents has significantly improved the performance level in the industry. However as the performance continues to improve and converge, the proposed approach adds in an additional level of detail to account for differences in the operating characteristics in the industry.

The report concludes that when determining the threshold values and upper quartile targets for the EPA and PR19 price review, the EA, NRW and Ofwat should consider evaluating performance against all assets.

1. Introduction

Environmental performance is reported in the Environmental Performance Assessment (EPA) published by the Environment Agency (EA) and Natural Resources Wales (NRW). The EPA reports the number of pollution incidents per 10,000km of sewers.

Pollution incidents are caused by a failure at one of a number of different assets, including sewage treatment works, CSOs, pumping stations, rising mains, storm tanks, surface water outfalls and foul sewers. The current approach only takes into account the different length of sewers across companies. However nearly 50% of our pollution incidents are cause from other assets which are not currently considered in the assessment of performance.

The objective of this report is to examine the importance of accounting for all types of assets and to propose an alternative approach to comparing performance.

This report is split into six sections

- Section 2 provides an overview of the current framework
- Section 3 examines the importance of accounting for all assets
- Section 4 outlines an alternative modelling approach
- Section 5 evaluates the performance level
- Section 6 concludes the report

2. Current comparative approach to pollution incidents

The number of pollution incidents is reported in the Environmental Performance Assessment (EPA) published by Natural Resources Wales (NRW) and the Environment Agency (EA). The EPA was introduced in 2011 as a tool to compare the performance between water companies and across years. The EPA includes six environmental indicators, one of which is pollution incidents.

The EPA reports the number of pollution incidents per 10,000km of sewers. The number of pollution incidents is normalised by the length of sewer to facilitate a meaningful comparison of the performance of different companies, taking into account the different size of the network across the industry.

The EA and NRW assess the performance of water companies by banding each company into one of three categories; Green, Amber and Red. Each company is rated based on their performance relative to threshold values set by the EA and NRW. The thresholds are based on previous performance and expectations of future performance. For example in 2017 performance was banded as Green if performance is equal to or less than 25 incidents per 10,000km of sewer.

The EA and NRW collect data on the number of pollution incidents against the type of asset that has caused the incident. The number of pollution incidents are recorded against the following assets; foul sewers, CSOs, rising mains, surface water outfalls, pumping stations, sewage treatment works, storm tanks and other assets. The table below shows the breakdown of pollution incidents per asset for 2017.

Table 1: Number of pollution Incidents

	Foul Sewers	CSOs	Rising Mains	Surface Water Outfalls	Pumping Stations	Sewage Treatment Works	Storm Tank	Other	Total
Anglian	85	9	20	6	70	33	0	0	223
Dŵr Cymru	56	18	8	0	11	9	0	0	102
Northumbrian	24	13	4	1	6	3	0	0	51
Southern	52	4	17	1	35	14	0	0	123
Severn Trent	152	28	27	1	45	31	1	0	285
South West	73	12	11	3	32	36	0	0	167
Thames	221	4	17	11	19	31	0	0	303
United Utilities	48	20	8	7	32	54	2	0	171
Wessex	38	12	7	0	6	15	3	2	83
Yorkshire	92	21	22	3	43	46	0	0	227

Current performance is evaluated by comparing the total number of pollution incidents (from all assets) relative to the length of sewers. The table below reports the 2017 industry performance per 10,000km of sewers reported by the NRW and EA[1].

Table 2: Number of pollution incidents per length of sewer

	Total Number of Incidents	Length of Sewer (km)	Pollution Incidents per 10,000km of sewer
Northumbrian	51	30,026	17.0
United Utilities	171	77,339	22.1
Wessex	83	34,944	23.8
Thames	303	108,980	27.8
Dŵr Cymru	102	36,260	28.1
Anglian	223	76,437	29.2
Severn Trent	285	94,027	30.3
Southern	123	39,541	31.1
Yorkshire	227	52,263	43.4
South West	167	17,440	95.8

As well as being reported in the EPA, pollution incidents are one of Ofwat's 14 common performance commitments for the 2019 price review. Ofwat also compares the performance of water companies to set performance commitments for 2020/21- 2024/25. Ofwat has outlined its expectations that companies should be targeting upper quartile level of performance.

[11] Note that the performance is slightly different to that reported by the EA and NRW as the length of sewers has been updated to reflect the value in the 2018 APR. The NRW and EA keep the length of sewers the same over the period to ensure changes in relative performance is only driven by changes in incidents. The 2018 APR has been used here to allow for updated number of other assets to be included in the analysis.

The following section highlights the importance of accounting for differences in the companies' operating areas when applying comparative benchmarking to set targets for performance improvements. .

3. Accounting for all assets

Pollution incidents arise as a result of a failure of an asset. The assets included within the EA's pollution definition are: sewage treatment works, foul sewers, combined sewer overflows (CSOs), rising mains, pumping stations, storm tanks and surface water outfalls. Foul sewers account for 52% of the pollution incidents and the other assets account for 48% of all incidents in 2017. Although the other assets account for nearly 50% of incidents, the current methodology does not reflect the number of these assets in the relative assessment of performance.

This section illustrates the importance of accounting for the number of different types of assets that cause pollution incidents. Firstly a simple illustration is provided to demonstrate the risk that the true picture of performance can be distorted when only one asset is taken into account. Secondly this section highlights the importance by examining the differences in the number of assets across the industry.

The impact of only accounting for one type of asset can be demonstrated through a simple illustration. Table 3 provides data for two companies, A and B. The companies have the same number of pollution incidents and the same length of sewers. The current approach of reporting the number of incidents per 10,000km shows that the two companies' have the same performance score.

Table 3: Company A and B Pollution Incidents

	Company A	Company B
Pollution Incidents from Sewers	30	30
Pollution Incidents from STWs	30	30
Total Incidents	**60**	**60**

Length of Sewers	30,000	30,000
Incidents per 10,000km	20	20

The current approach looks at the incidents caused by all assets relative to the length of sewers. The performance of the sewage treatment works can be examined by comparing the number of incidents caused by sewage treatment works relative to the number of sewage treatment works. The performance of foul sewers can be examined by comparing the number of incidents from foul sewers relative to the length of sewer. The table below shows the performance of foul sewers and sewage treatment works (STWs) separately.

Table 4: Company A and B Performance per Asset

	Company A	Company B
Pollution Incidents from Sewers	30	30
Length of Sewers	30,000	30,000
Incidents from Sewers per 10,000km	***10***	***10***

Pollution Incidents from STWs	30	30
Number of STWs	50	100
Incidents from STWs per 1,000 STW	***0.6***	***0.3***

The performance for foul sewers is the same as both companies have the same number of incidents and the same length of sewer. Company A and B have the same number of incidents from sewage treatment works, however Company A has more sewage treatment works. Therefore the performance per sewage treatment works for Company A is better than Company B.

This simple illustration highlights the risk that the relatively simplistic approach of only considering one type of asset in the normalisation of incidents can result in a misleading picture of performance. The current approach would report that the performance of Company A and B as the same. However when accounting for the number of sewage treatment works as well as length of sewers the performance differs substantially. These two different views of performance can have important implications on the targets that companies are set.

The impact of only taking into account one type of asset depends on the heterogeneity of the industry's asset stock is. If companies have large differences in the number of assets per length of sewer, then only accounting for one type of asset will have a significant impact.

The differences in the companies' assets are examined in Table 5. The table compares the number of combined sewer overflows, pumping stations, sewage treatment works, length of rising mains and length of surface water mains relative to the length of mains. Data for the number of assets are reported in companies' 2017-18 annual performance report.

Table 5: Number of Assets per length of sewers

	Combined Sewer Overflows (Nr per 1,000km of mains)	Pumping Stations (Nr per 1,000km of mains)	Sewage Treatment Works (Nr per 1,000km of mains)	Rising Mains (km per 1,000km of mains)	Surface Water Only Mains (km per 1,000km of mains)
Anglian	35	81	15	59	150
Dŵr Cymru	77	66	23	35	93
Northumbrian	60	31	14	14	148
Southern	26	84	9	38	129
Severn Trent	43	48	11	25	181
South West	92	71	37	35	162
Thames	6	64	3	18	214
United Utilities	37	34	7	13	136
Wessex	41	60	11	35	132
Yorkshire	55	48	12	24	143

The table highlights that the number of assets per 1,000km of sewers varies significantly across the industry. The number of CSOs per 1,000km of sewer varies from 6 to 77. The number of sewage treatment works per 1,000km of sewers ranges from 3 to 37. The table also shows that several companies have consistently higher number of assets across all of the different types of assets, for example South West Water and Welsh Water. On the other hand several companies have consistently lower number of assets relative to the length of sewers, for example United Utilities and Thames. An alternative approach to comparing performance that takes into account these differences in the number of assets across the industry is outlined in the next section.

4. Modelling Approach

This section outlines an approach that allows a comparison of the performance across the industry that takes into account the performance of each type of asset. The four key steps are outlined below. Each step is outlined further in the next four sections.

Step 1: Calculate the performance of each asset type

- The asset performance for each company is calculated by dividing the number of pollution incidents from the given asset by the number of assets (or the length of sewer)

Step 2: Calculate the asset based performance score for each company

- The asset based performance calculates the number of incidents a company would incur if it had achieved each other company's performance for each asset type. The number of incidents will differ between companies according to the number of assets in each company's operating area.

Step 3: Calculate the UQ performance level for each company

- Given the asset based performance scores an upper quartile performance level for each company is calculated.

Step 4: Evaluate Performance

- Performance is evaluated by comparing the actual number of incidents to the upper quartile level of incidents

The EA and NRW outline that pollution incidents can be caused from seven types of assets. The proposed approach allows for the performance of each type of asset to be examined separately and then aggregated to provide an overall company assessment. For the performance of a given asset to be considered separately, asset data is required. The performance of six key assets are considered in the proposed approach. The table outlines which assets have been included separately. If an assets performance has not been assessed separately, the pollution incidents have been allocated to another asset type to ensure that they are still included within the assessment of pollution incidents.

Table 6: Assets included in the assessment

	Incorporate Separately	Asset Data	Comment
Sewage Treatment Works (STWs)	Yes	Number of STWs	
Combined Sewer Overflow (CSO)	Yes	Number of CSOs	
Sewage Pumping Station (SPS)	Yes	Number of SPSs	
Foul Sewers	Yes	Length of Sewers	
Rising Mains	Yes	Length of Rising Mains	
Surface Water Outfalls	Yes	Length of surface water mains	
Storm Tanks	No- Included in STWs		Asset data is not available for the number of storm tanks. The incidents have been included in sewage treatment works.
Other	No- Included in Foul Sewers		Other assets account for a small proportion of incidents. These have been included in foul sewers as foul sewers make up the largest proportion of incidents therefore the inclusion will have a limited impact.

4.1 Step 1: Performance of each asset by company

The first step is to calculate the performance of each asset. The performance is calculated by comparing the number of pollution incidents from a given asset type to the number of assets (or length of sewers). For example:

- Performance of CSOs= Pollution Incidents caused by CSOs / Number of CSOs
- Performance of STWs = Pollution Incidents caused by STWs / Number of STWs
- Performance of foul sewers= Pollution Incidents caused by foul sewers / Length of foul sewers

The table below reports the calculation of the performance score for sewage treatment works (STWs) by company. The first column reports the number of incidents from STWs and the second column reports the number of STWs. The final column reports the performance per 1,000 STWs. This calculation is repeated for each of the six types of assets, the full details are in appendix 1.

Table 7: Performance scores for STWs

	Incidents from STWs	Number of STWs	Performance per 1,000 STWs
Northumbrian	3	413	7.3
Dŵr Cymru	9	835	10.8
Anglian	33	1129	29.2
Severn Trent	31	1010	30.7
Wessex	15	401	37.4
Southern	14	365	38.4
South West	36	651	55.3
Yorkshire	46	611	75.3
Thames	31	353	87.8
United Utilities	54	568	95.1

4.2 Step 2: Asset Based Performance levels

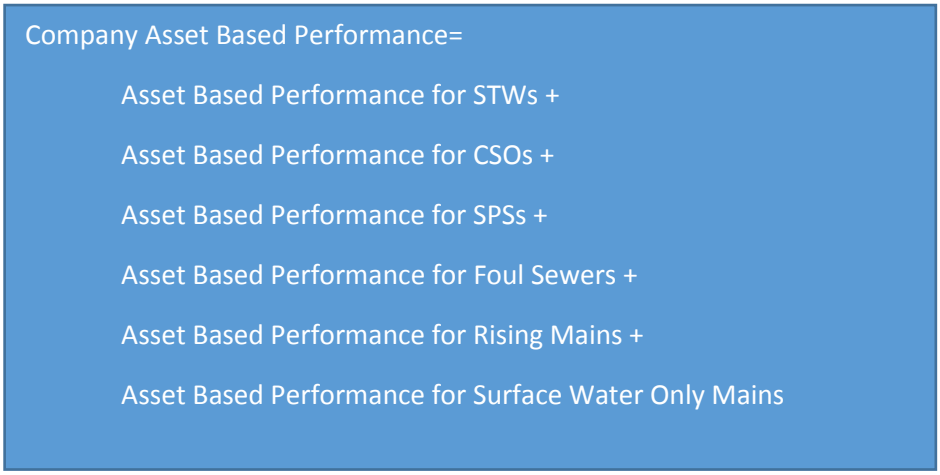
The second step is to calculate the asset based performance level for each company and each asset type. As the approach examines the performance of multiple assets, a simple ratio cannot be used for the overall assessment of the companies' performance. To allow for multiple assets to be included an 'asset based performance' measure is calculated.

The 'asset based performance' calculates the number of pollution incidents that a company, given its configuration of assets, would expect to incur for a given level of performance for each asset type.

The asset based performance can be demonstrated through a simple example. If we consider two companies, Company A and Company B. Company A has 6 sewage treatment works and Company B has 12 Sewage treatment works. If the average number of pollution incidents per sewage treatment works is 0.5, to achieve the average number of incidents Company A would have 3 incidents whereas Company B would have 6 incidents.

The 'asset based performance' is calculated for each company by multiplying the performance of each company for each asset (as calculated in Step 1) by each companies' number of assets. The company asset based performance is the sum of the asset base performance for each asset as outlined in Figure 1.

Figure 1: Calculation of Company Asset Based Performance



The 'asset based performance for STWs for Dŵr Cymru and Southern are calculated in table 8. The table reports the performance per asset as calculated in step 1. The table then reports the number of sewage treatment works operated by Dŵr Cymru and Southern. The final column reports the asset based performance for Dŵr Cymru for sewage treatment works. This is calculated by multiplying the performance for each company by Dŵr Cymru's and Southern's number of works.

The asset based performance calculates the number of pollution incidents Dŵr Cymru and Southern Water would incur if it had another company's performance given its asset base. For example if both companies were to target the industry leading performance, given their number of works Dŵr Cymru would need to reduce the number of pollution incidents from sewage treatment works to 6 whereas Southern would need to reduce the number of incidents to 3. The number of incidents for Southern Water is lower as it has a smaller number of sewage treatment works.

Table 8: Asset Based Performance for Dŵr Cymru and Southern Water for Sewage Treatment Works

	Performance per 1,000 STWs	Dŵr Cymru Nr of STWs	DCWW Asset Based Performance STWs	Performance per 1,000 CSOs	Southern Nr of STWs	SRN Asset Based Performance STWs
Northumbrian	7.3	835	6	7.3	365	3
Dŵr Cymru	10.8	835	9	10.8	365	4
Anglian	29.2	835	24	29.2	365	11
Severn Trent	34.7	835	26	34.7	365	12
Southern	38.4	835	31	38.4	365	14
Wessex	44.9	835	32	44.9	365	16
South West	55.3	835	46	55.3	365	20
Yorkshire	75.3	835	63	75.3	365	28
Thames	87.8	835	73	87.8	365	32
United Utilities	98.6	835	79	98.6	365	36

The asset based performance is calculated for each asset for each company. Table 9 shows the calculation of the total asset based performance for Dŵr Cymru. The final column reports the number of incidents Dŵr Cymru would incur if it had each companies' level of performance. Full details for all companies are included in Appendix 2.

Table 9- Asset Base Performance for Dŵr Cymru

	Fouls Sewers	CSOs	Rising Mains	Surface Water	SPS	STWs	Total
NEW	29	20	12	1	15	6	83
DCWW	56	18	8	0	11	9	102
ANG	40	10	6	2	27	24	109
WSX	39	23	7	0	7	37	114
SRN	48	11	14	1	25	32	131
SVT	59	19	14	0	24	26	143
UUW	23	20	10	2	29	82	166
TMS	74	16	11	2	7	73	182
YRK	64	21	22	1	42	63	212
SWT	152	21	23	4	62	46	308

4.3 Step 3: Relative Performance

The current approach examines the performance of companies by comparing the normalised number of pollution incidents. As the proposed measure includes multiple types of assets, a simple ratio, as currently used cannot be applied. To enable the level of performance to be compared the actual performance of the company is compared to the upper quartile level of performance. The use of an upper quartile assessment is consistent with Ofwat's approach to assessing performance for pollution incidents in the 2019 price review. The benchmark can be altered, for example performance could be compared to the industry average.

The upper quartile level of performance is calculated on the asset based performance of all of the assets. The upper quartile is calculated on all of the assets instead of each asset type individually to avoid the calculation of infeasible frontiers.

The upper quartile can be calculated using the upper quartile of customers or the upper quartile of companies. As outlined in our 2020-25 business plan, our preferred approach is to calculate the upper quartile based on the number of customers. Whilst this is our preferred approach both are presented here for completeness.

4.3.1 Upper Quartile of Customers

This section outlines the calculation of the performance level of the upper quartile of customers. This measure examines the level of performance that is experienced by at least 25% of customers. This is calculated by firstly ranking the performance level from the highest level of performance to the lowest. The upper quartile performance is the level of performance that is received by at least 25% of customers.

The calculation of the upper quartile for the asset based performance is outlined in table 10. The table reports the total asset based performance score for Dŵr Cymru based on each companies'

performance, ranked by the lowest number of incidents to the highest. The upper quartile performance is the level of performance received by at least 25% of customers, which is highlighted.

Table 10: Dŵr Cymru Upper Quartile Customers Proposed Approach

	Dŵr Cymru Asset Base Pollution Incidents	Population (,000)	Cumulative Percent
Northumbrian	83.2	2,629.8	4%
Dŵr Cymru	102	3,257.4	10%
Anglian	108.7	6,273.6	21%
Wessex	114.4	2,803.5	26%
Southern	130.9	4,634.4	33%
Severn Trent	143.2	9,004.4	49%
United Utilities	165.7	7,560.0	62%
Thames	182.3	15,524.1	88%
Yorkshire	212.4	5,148.8	97%
South West	307.9	1,706.5	100%

The upper quartile level of performance for the current approach of normalising the number of incidents by the length of sewer is calculated using the same approach. In this case the asset based performance incidents is calculated just using the length of sewers. Table 11 reports the calculation of the upper quartile for Dŵr Cymru for the number of pollution incidents per 10,000km of sewers.

Table 11: Dŵr Cymru Upper Quartile Customers Current Approach

	Dŵr Cymru Asset Base Performance incidents km of sewer Only	Population (,000)	Cumulative Percent
Northumbrian	61.6	2,629.8	4%
United Utilities	80.2	7,560.0	17%
Wessex	86.1	2,803.5	22%
Thames	100.8	15,524.1	49%
Dŵr Cymru	102.0	3,257.4	54%
Anglian	105.8	6,273.6	65%
Severn Trent	109.9	9,004.4	80%
Southern	112.8	4,634.4	88%
Yorkshire	157.5	5,148.8	97%
South West	347.2	1,706.5	100%

The upper quartile number of pollution incidents for each company is reported in Table 12 for both the current approach and the proposed approach. An initial view highlights that the upper quartile level of incidents vary between the two measures. The difference between the two measures is explore further in section 5.

Table 12: Industry UQ Asset Based Performance

	UQ Asset Based Performance- Current Approach	UQ Asset Based Performance- Proposed Approach
Anglian	182	223
Dŵr Cymru	86	114
Northumbrian	71	71
Southern	110	105
Severn Trent	223	218
South West	48	69
Thames	241	222
United Utilities	215	162
Wessex	83	87
Yorkshire	124	125

4.3.2 Upper quartile of companies

This section outlines the calculation of the upper quartile based on the number of companies. The upper quartile of companies is calculated by examining the performance of the upper quartile company, this is performance between the 3rd and 4th company.

The upper quartile number of pollution incidents for each company is reported in Table 13 for both the current approach and the proposed approach. An initial view highlights that the upper quartile level of incidents varies between the two measures. The difference between the two measures is explore further in section 5.

Table 13: Upper Quartile Companies Asset Based Performance

	UQ Asset Based Performance- Current Approach	UQ Asset Based Performance- Proposed Approach
Anglian	189	209
Dŵr Cymru	90	110
Northumbrian	74	70
Southern	98	98
Severn Trent	233	218
South West	43	64
Thames	270	221
United Utilities	192	155
Wessex	87	85
Yorkshire	129	124

5. Step 4: Evaluation of Performance

The final step is to examine the relative performance of the industry. The 'performance score' is calculated by comparing the upper quartile target level of incidents and the actual number of incidents. The upper quartile is calculated based on the upper quartile of customers. The performance score is calculated as:

$$Performance\ Score = \left(\frac{UQ\ Number\ of\ Incidents}{Actual\ Number\ of\ Incidents}\right) * 100$$

A score of less than 100% indicates that the number of pollution incidents is greater than the upper quartile performance level. A company with a score below than 100% needs to reduce the number of incidents to achieve the upper quartile level of performance. A score greater than 100% indicates that the company's performance level is better than the upper quartile performance level.

The performance score for the proposed approach is reported in Table 14. The results show the level of performance for each company, for example Dŵr Cymru's performance under the proposed approach has a performance score of 112% which indicates that the number of incidents is better than the upper quartile. Yorkshire Water has a performance score of 55%, indicating that the current number of incidents needs to be reduced by 45% to achieve upper quartile.

Table 14: Industry Performance Score- Proposed Approach

	Actual Incidents 2017	UQ Incidents Proposed Approach	Pollution Incidents Performance Score (%)
Northumbrian	51	71	140%
Dŵr Cymru	102	114	112%
Wessex	83	87	105%
Anglian	223	223	100%
United Utilities	171	162	95%
Southern	123	105	85%
Severn Trent	285	218	76%
Thames	303	222	73%
Yorkshire	227	125	55%
South West	167	69	41%

The performance score for the current approach is calculated in Table 15. The score is calculated by comparing the actual number of incidents to the UQ number of incidents calculated in section 4.3.1.

Table 15: Industry Performance Score- Current Approach

	Actual 2017 Incidents	UQ Incidents Current Approach	Pollution Incidents Asset Score (%)
Northumbrian	51	71	140%
United Utilities	171	215	126%
Wessex	83	83	100%
Southern	123	110	89%
Dŵr Cymru	102	86	84%
Anglian	223	182	81%
Thames	303	241	80%
Severn Trent	285	223	78%
Yorkshire	227	124	55%
South West	167	48	29%

5.2. Comparison of approaches

The proposed approach extends on the current approach of normalising the number of incidents by the length of sewers by including the number of 'other' assets. When the number of other assets are included the performance scores between the companies are expected to vary relative to the number of these assets. The performance score for companies with a large number of other assets relative to the length of sewers are expected to increase as the assets are taken into account. On the other hand the performance score of companies' with a small number of assets are expected to fall. This section compares the performance score of the current approach and proposed approach.

The performance score for the current and proposed approach are reported in Table 16 alongside the percentage change. A positive value for the percentage change indicates that the performance score has improved when the number of all assets are taken into account. The performance score has improved for South West Water, Dŵr Cymru and Anglian. Section 3 highlights that these companies have the largest number of assets relative to the length of mains. On the other hand United Utilities, Thames and Southern's performance score has deteriorated when accounting for all of the assets as they have a relatively small number of assets.

Whilst this report considers the upper quartile of customers the results hold when examining the upper quartile of companies. Appendix 3 outlines the results using the upper quartile of companies.

Overall the results indicate that the current approach favours those companies with a small number of assets and the current approach is unfavourable for those companies with a large number of assets. The results indicate that there is a significant risk that the current approach will not provide a true reflection of performance in the industry.

Table 16: Comparison of Performance Score

	Performance Score (%)- Current Approach	Performance Score (%)- Proposed Approach	Percentage Change in Performance Score
South West	29%	41%	41%
Dŵr Cymru	84%	112%	33%
Anglian	81%	100%	23%
Wessex	100%	105%	5%
Yorkshire	55%	55%	1%
Northumbrian	140%	140%	0%
Severn Trent	78%	76%	(3%)
Southern	89%	85%	(5%)
Thames	80%	73%	(8%)
United Utilities	126%	95%	(24%)

6. Conclusion

This report provides an alternative approach for measuring the relative performance of pollution incidents. The proposed approach extends upon the current approach of normalising pollution incidents by the length of sewer by considering the performance relative to a wider range of assets.

The report highlights that there is a risk that the current approach may not provide a true reflection of the current performance of water companies. The current approach is favourable to those companies with a relatively small number of assets and is unfavourable to those with a relatively large number of assets.

There is a risk that if the current approach does not reflect the true level of performance this can result in targets for pollution incidents that are not optimal. The current approach could result in targets that are too lax for companies with a small asset base. On the other hand companies with a large asset base could be set targets that are too tight, which could result in inefficient investment decisions.

The proposed approach is more complex than the current relatively simplistic approach, however we believe that this additional degree of complexity is required. The current approach has been effective in reducing the number of incidents across the industry since its introduction in 2011. However we believe that the additional degree of complexity is required as the industry performance has converged and the number of incidents are significantly lower. Ofwat's move to upper quartile performance targets in the 2019 price review also requires company specific operating characteristics to be taken into account to ensure the targets are reflective of company's individual circumstances.

Overall we recommend that when the relative performance of water and sewerage companies is evaluated for setting threshold of upper quartile levels, the performance of all assets should be taken into account.

Appendix 1- Asset Performance

This section calculates the asset performance for each asset.

Sewage Treatment Works (STWs)

	Incidents from STWs	Number of STWs	Performance per 1,000 STWs
Northumbrian	3	413	7.3
Dŵr Cymru	9	835	10.8
Anglian	33	1129	29.2
Severn Trent	32	1010	31.7
Southern	14	365	38.4
Wessex	18	401	44.9
South West	36	651	55.3
Yorkshire	46	611	75.3
Thames	31	353	87.8
United Utilities	56	568	98.6

Sewage Pumping Stations (SPS)

	Incidents from SPS	Number of SPSs	Performance per 1,000 SPSs
Thames	19	6958	2.7
Wessex	6	2100	2.9
Dŵr Cymru	11	2402	4.6
Northumbrian	6	945	6.3
Severn Trent	45	4468	10.1
Southern	35	3321	10.5
Anglian	70	6221	11.3
United Utilities	32	2646	12.1
Yorkshire	43	2488	17.3
South West	32	1231	26.0

Surface Water

	Incidents from Surface Water Outfalls	Length of surface water mains (km)	Performance per 1,000 km of surface water mains
Dŵr Cymru	0	3371	0.0
Wessex	0	4605	0.0
Severn Trent	1	16986	0.1
Southern	1	5106	0.2
Northumbrian	1	4452	0.2
Yorkshire	3	7484	0.4
Thames	11	23284	0.5
Anglian	6	11465	0.5
United Utilities	7	10534	0.7
South West	3	2832	1.1

Rising Mains

	Incidents from Rising Mains	Length of Rising Mains (km)	Performance per 1,000 km of rising mains
Anglian	20	4495	4.4
Wessex	7	1208	5.8
Dŵr Cymru	8	1273	6.3
United Utilities	8	1038	7.7
Thames	17	2011	8.5
Northumbrian	4	430	9.3
Severn Trent	27	2392	11.3
Southern	17	1503	11.3
Yorkshire	22	1255	17.5
South West	11	610	18.0

CSOs

	Incidents from CSOs	Number of CSOs	Performance per 1,000 CSO
Anglian	9	2639	3.4
Southern	4	1030	3.9
Thames	4	678	5.9
Dŵr Cymru	18	2795	6.4
Severn Trent	28	4037	6.9
United Utilities	20	2829	7.1
Northumbrian	13	1791	7.3
Yorkshire	21	2863	7.3
South West	12	1601	7.5
Wessex	12	1444	8.3

Foul Sewers

	Incidents from Foul Sewers	Length of Sewers (km)	Performance per 1,000 km of sewer
United Utilities	48	77,339	0.6
Northumbrian	24	30,026	0.8
Wessex	38	34,944	1.1
Anglian	85	76,437	1.1
Southern	52	39,541	1.3
Dŵr Cymru	56	36,260	1.5
Severn Trent	152	94,027	1.6
Yorkshire	92	52,263	1.8
Thames	221	108,980	2.0
South West	73	17,440	4.2

Appendix 2- Asset Based Performance

This section shows the breakdown of the asset based performance for each company.

Asset Based Performance- Anglian

	Foul Sewers	CSOs	Rising Mains	Surface Water	SPS	STWs	Total
Northumbrian	61	19	42	3	39	8	172
Wessex	83	22	26	0	18	51	200
Dŵr Cymru	118	17	28	0	28	12	204
Anglian	85	9	20	6	70	33	223
Southern	101	10	51	2	66	43	273
Severn Trent	124	18	51	1	63	36	292
United Utilities	47	19	35	8	75	111	295
Thames	155	16	38	5	17	99	330
Yorkshire	135	19	79	5	108	85	430
South West	320	20	81	12	162	62	657

Asset Based Performance- Northumbrian

	Foul Sewers	CSOs	Rising Mains	Surface Water	SPS	STWs	Total
Northumbrian	24	13	4	1	6	3	51
Anglian	33	6	2	2	11	12	66
Dŵr Cymru	46	12	3	0	4	4	69
Wessex	33	15	2	0	3	19	71
Southern	39	7	5	1	10	16	78
Severn Trent	49	12	5	0	10	13	89
United Utilities	19	13	3	3	11	41	90
Thames	61	11	4	2	3	36	116
Yorkshire	53	13	8	2	16	31	123
South West	126	13	8	5	25	23	199

Asset Based Performance- Southern

	Foul Sewers	CSOs	Rising Mains	Surface Water	SPS	STWs	Total
Northumbrian	32	7	14	1	21	3	78
Wessex	43	9	9	0	9	16	86
Dŵr Cymru	61	7	9	0	15	4	96
Anglian	44	4	7	3	37	11	105
United Utilities	25	7	12	3	40	36	123
Southern	52	4	17	1	35	14	123
Severn Trent	64	7	17	0	33	12	133
Thames	80	6	13	2	9	32	142
Yorkshire	70	8	26	2	57	27	190
South West	166	8	27	5	86	20	312

Asset Based Performance- Severn Trent

	Foul Sewers	CSOs	Rising Mains	Surface Water	SPS	STWs	Total
Northumbrian	75	29	22	4	28	7	166
Wessex	102	34	14	0	13	45	208
Dŵr Cymru	145	26	15	0	20	11	218
Anglian	105	14	11	9	50	30	218
Southern	124	16	27	3	47	39	256
United Utilities	58	29	18	11	54	100	270
Severn Trent	152	28	27	1	45	32	285
Thames	191	24	20	8	12	89	344
Yorkshire	166	30	42	7	77	76	397
South West	394	30	43	18	116	56	657

Asset Based Performance- South West

	Foul Sewers	CSOs	Rising Mains	Surface Water	SPS	STWs	Total
Northumbrian	14	12	6	1	8	5	44
Dŵr Cymru	27	10	4	0	6	7	54
Anglian	19	5	3	1	14	19	62
Wessex	19	13	4	0	4	29	69
Southern	23	6	7	1	13	25	75
Severn Trent	28	11	7	0	12	21	79
United Utilities	11	11	5	2	15	64	108
Thames	35	9	5	1	3	57	112
Yorkshire	31	12	11	1	21	49	125
South West	73	12	11	3	32	36	167

Asset Based Performance- Thames

	Foul Sewers	CSOs	Rising Mains	Surface Water	SPS	STWs	Total
Northumbrian	87	5	19	5	44	3	163
Wessex	119	6	12	0	20	16	172
Dŵr Cymru	168	4	13	0	32	4	221
United Utilities	68	5	16	15	84	35	222
Anglian	121	2	9	12	78	10	233
Southern	143	3	23	5	73	14	260
Severn Trent	176	5	23	1	70	11	286
Thames	221	4	17	11	19	31	303
Yorkshire	192	5	35	9	120	27	388
South West	456	5	36	25	181	20	723

Asset Based Performance- United Utilities

	Foul Sewers	CSOs	Rising Mains	Surface Water	SPS	STWs	Total
Northumbrian	62	21	10	2	17	4	115
Wessex	84	24	6	0	8	25	147
Anglian	86	10	5	6	30	17	152
Dŵr Cymru	119	18	7	0	12	6	162
United Utilities	48	20	8	7	32	56	171
Southern	102	11	12	2	28	22	176
Severn Trent	125	20	12	1	27	18	202
Thames	157	17	9	5	7	50	244
Yorkshire	136	21	18	4	46	43	268
South West	324	21	19	11	69	31	475

Asset Based Performance- Wessex

	Foul Sewers	CSOs	Rising Mains	Surface Water	SPS	STWs	Total
Northumbrian	28	10	11	1	13	3	67
Wessex	38	12	7	0	6	18	81
Dŵr Cymru	54	9	8	0	10	4	85
Anglian	39	5	5	2	24	12	87
Southern	46	6	14	1	22	15	104
United Utilities	22	10	9	3	25	40	109
Severn Trent	56	10	14	0	21	13	114
Thames	71	9	10	2	6	35	133
Yorkshire	62	11	21	2	36	30	162
South West	146	11	22	5	55	22	261

Asset Based Performance- Yorkshire

	Foul Sewers	CSOs	Rising Mains	Surface Water	SPS	STWs	Total
Northumbrian	42	21	12	2	16	4	96
Wessex	57	24	7	0	7	27	122
Anglian	58	10	6	4	28	18	123
Dŵr Cymru	81	18	8	0	11	7	125
Southern	69	11	14	1	26	23	145
United Utilities	32	20	10	5	30	60	158
Severn Trent	84	20	14	0	25	19	163
Thames	106	17	11	4	7	54	197
Yorkshire	92	21	22	3	43	46	227
South West	219	21	23	8	65	34	369

Asset Based Performance- Dŵr Cymru

	Fouls Sewers	CSOs	Rising Mains	Surface Water	SPS	STWs	Total
NEW	29	20	12	1	15	6	83
DCWW	56	18	8	0	11	9	102
ANG	40	10	6	2	27	24	109
WSX	39	23	7	0	7	37	114
SRN	48	11	14	1	25	32	131
SVT	59	19	14	0	24	26	143
UUW	23	20	10	2	29	82	166
TMS	74	16	11	2	7	73	182
YRK	64	21	22	1	42	63	212
SWT	152	21	23	4	62	46	308

Appendix 3- Upper Quartile of Companies

The table shows the upper quartile (UQ) number of incidents based on our proposed approach based on the upper quartile of companies.

	Actual Incidents 2017	UQ Incidents Proposed Approach	Pollution Incidents Performance Score (%)
Northumbrian	51	70	137%
Dŵr Cymru	102	110	108%
Wessex	83	85	103%
Anglian	223	209	94%
United Utilities	171	155	90%
Southern	123	98	80%
Severn Trent	285	218	76%
Thames	303	221	73%
Yorkshire	227	124	54%
South West	167	64	38%

The table below shows the change in the performance score from the current approach to our proposed asset based approach based on the upper quartile of companies.

	Performance Score (%)- Current Approach	Performance Score (%)- Proposed Approach	Percentage Change in Performance Score
South West	26%	38%	47%
Dŵr Cymru	88%	108%	23%
Anglian	85%	94%	10%
Southern	80%	80%	1%
Wessex	104%	103%	(1%)
Yorkshire	57%	54%	(4%)
Northumbrian	146%	137%	(6%)
Severn Trent	82%	76%	(7%)
Thames	89%	73%	(18%)
United Utilities	112%	90%	(19%)