Thames Water

Revised Draft Water Resources Management Plan 2019

Technical Appendices

Appendix M: Leakage

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Leakage

This Appendix includes the following:

- An overview of our leakage control approach and areas of focus
- Our leakage performance over recent times and our present difficulties in delivering our leakage targets for this AMP period, and the assumptions in our baseline leakage forecast
- Our future direction of leakage management and how the options selected within this revised draft Water Resource Management Plan 2019 (revised draft WRMP19) support it
- Leakage consistency reporting, our progress to become compliant and how we have incorporated this within our revised draft WRMP19 planning

A. Introduction

M.1 Leakage occurs as a result of the water pipes failing. It goes very much hand in hand with the occurrence of bursts and therefore the level of service that we provide to our customers in relation to the number of interruptions to supply. Additionally, the act of repairing a leak and reinstating the area can result in disruption for our customers and stakeholders.

M.2 Customers and stakeholders have clearly indicated to us that they wish to see leakage further reduced beyond the existing economic level and have recognised that, within the realms of affordability, this will have to be paid for (Appendix T: Our customer priorities and preferences has further information on customer research).

M.3 Our ambition is to strike the right balance between our mutual desire to further reduce leakage, the additional cost of this work and its impact on customers' bills, the need to maintain a robust and efficient water distribution network and the need to manage impacts on traffic congestion and household disruption.

M.4 Our approach to leakage management is holistic and can be considered as to be made up of four types of activity: minimising leak occurrence, understanding where leakage is, locating leaks and repairing leaks. Figure M-1 illustrates the activities under each type.

Figure M-1: Holistic approach to leakage management

	Minimising leak occurrence (consistently)	Understanding where leakage is (quickly and accurately)	Locating leaks (quickly, accurately and efficiently)	Repairing leaks (quickly, efficiently, to quality, with minimal interruption to supply)
Maintaining leakage level	• Pumping regimes • Surge vessels • Variable speed pumps • Managing commercial customer demand • Pressure Management Valve (PRV) and Pressure Management Area (PMA) maintenance work • Network reconfiguratin to meet new customer demand • Mains replacement to offset deterioration	• Network meter verification • Maintain customer meters • Maintain District Metered Area (DMA) meters • Install loggers on new customers • Maintain DMAs and Flow Monitoring Zone (FMZ) bounaries and function sets • Network meter repair and replacement • Maintain commercial loggers	• Reactive and recovery leakage surveys • Run step tests • Correlation survey and sound • Gas detection • Sahara surveys and lekage investigations • Seepage investigations • Maintain waste areas and meters	• Capacity planning, job planning and dispatch • Wastage fixes • Valve maintenance • Traffic management and streetworks • Repairs on visible leaks, active leaks and customer side leaks and fast reinstatements • Special focus on fast repair of visible leaks • Trunk main repairs
Reducing leakage	• New PMA schemes • Network reconfiguration to reduce pressures • Mains replacement to enhance asset	• Improve network metering • Improve DMA operability as part of DMA Enhancement • Sub- divide DMAs as part of DMA Enhancement • Integrate use of smart meters	• Special surveys • Campaigns management and burst sectorisation • Join up acoustic logger data with DMA flows	• Reduce repair times

M.5 With the experience of many years of leakage management, a large effort across a varied range of activities is put into holding leakage at current levels. For example, to maintain present leak recurrence levels we have surge protection in place on the network, to minimise load on the pipes when we turn pumps on and off. In order to prevent the burst rate from increasing we need to continue to maintain these vessels to ensure they continue to function correctly. This work does not reduce leakage, but helps to maintain the present level with the current expenditure.

M.6 Our objective is to not only complete the work we do to maintain current leakage levels but to seek better and more efficient ways to do this. One example of this is in the deployment of noise loggers to find leaks with a reduced leakage detection resource effort.

M.7 Mains replacement (Section C) is important to both maintain leakage levels by offsetting the deterioration of the pipe network and reduce leakage. If we undertake enough activity we can reduce leakage while also improving asset condition and performance.

M.8 The introduction of smart metering (Appendix N: Metering) and capturing data with a frequency of at least one hour allows for more accurate analysis. This allows us to better identify how much water is consumed by our customers and how much is lost through leakage (Section C). This is currently an area of considerable development.

M.9 Pressure management continues to be important to us (Section C). With over 1,000 pressure reducing valves (PRVs) already in the ground, a great deal of work is involved in maintaining these assets and the associated pressure management areas (PMAs) to ensure that they operate as designed and we “retain” the leakage benefit. A large number of our PRVs have

been upgraded to “closed loop control”. This means that they continuously adjust as demand changes to ensure we continuously achieve the target pressure at the critical locations in the PMA.

M.10 In the last couple of years we have been developing our approach to leakage detection (Section C). This is moving us on from the traditional approach where, in response to the district meter area (DMA) flow increasing, we complete detection and repair of leaks to return the DMA flow back to the historic level. This is still important, but we are now looking at these historic levels in each DMA and challenging ourselves to drive leakage lower. This can result in finding customer demand we did not know about, correcting our understanding of our pipe network, or finding a long standing leak on a customer supply pipe which couldn’t be detected with conventional leak detection techniques. In fact, during this asset management plan (AMP) period we have had very good success with installing meters on private mains networks, of which we have a high number in London, and working with our customers to locate and repair leaks on their pipework.

M.11 We have also looked at innovation to improve our ability to locate leaks. Some are still in development, such as the use of satellites and drones. Others, such as the deployment of permanent noise loggers, we feel present far more promise in the shorter term.

M.12 Trunk mains leakage reduction is an area of particular focus this AMP period (Section B). We have rolled out the Netconn tool which allows flow balances throughout the system to be undertaken from Abstraction, Distribution Input, to Flow Monitoring Zones and DMAs, and ultimately customer demand. This allows us to identify and investigate anomalies. These can often be due to metering issues and lead to repair or replacement of meters. However, we are also identifying increasing numbers of leaks on our trunk mains network through this process.

M.13 Our network is complex, with continuous property development requiring connection, especially in London. This is most clearly seen with the building of large skyscrapers such as The Shard, and the large strategic schemes such as Crossrail and High Speed 2 (HS2). Less noticeable is the continual demolition and rebuilding of smaller properties. By developing new processes and systems to improve our tracking of the development of our region, this has proven an opportunity to keep aware of increasing water demand, and thereby improve our management of leakage.

B. Recent leakage performance

M.14 Leakage reduction is a key element of our plan to manage the balance between supply and demand. Total leakage has been reduced by 30% since the peak in 2003/04 to 654 Ml/d at the end of AMP5.

M.15 In AMP4 (2005-2010) considerable leakage reductions were achieved through mains rehabilitation and pressure management. During this period we undertook a large mains rehabilitation programme to improve asset condition, with an average of over 400km of mains replaced each year. This was supported by a programme of new pressure management schemes and a proactive plan to detect and repair leakage on our trunk mains network. Find and fix activity continued to manage leakage recurrence.

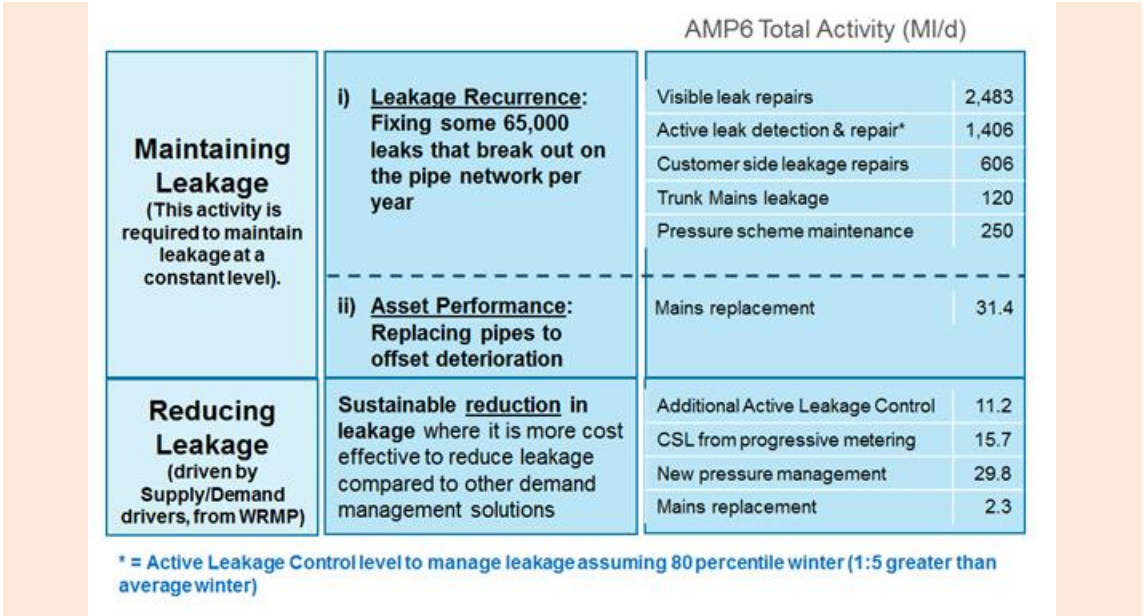
M.16 In AMP5 (2010-2015) the target was to maintain leakage over the AMP period. Mains replacement funding was reduced to maintain asset condition and leakage was reduced by 2% over the AMP period. We continued to deliver new pressure management schemes, albeit on a smaller scale given that the largest schemes had already been delivered, and work continued on trunk mains leakage and find and fix activity to manage leakage recurrence.

M.17 In AMP6 (2015-2020) our Water Resources Management Plan 2014 (WRMP14) set out an ambitious plan to reduce leakage by a further 9% (59 Ml/d) over the five year period, driven by the supply demand position in London. We set out to deliver this reduction through a combination of mains replacement, introduction of new pressure management schemes, reduction in customer side leakage identified through the installation of customer meters, and further find and fix activity made possible through better understanding of leakage using new smart meters. This was underpinned by ongoing find and fix and trunk mains activity.

M.18 Although replacing the oldest and leakiest pipes in our network is the best way to make long-term sustainable reductions in leakage, detecting and repairing leaks still forms a key part of our leakage strategy to offset leakage recurrence levels. Currently we detect and repair some 65,000 leaks per annum, with an estimated leakage benefit value in excess of 400 Ml/d per year.

M.19 Figure M-2 shows the key components of the revised delivery plan for AMP6. As well as detecting leaks and repairing them, we are also completing the repair of visible leaks and leaks on trunk mains and maintaining our pressure management schemes. If the pressure management schemes were allowed to deteriorate we would see leakage rise as a result. In total, the work required to maintain leakage (i.e. offset the natural increase in leakage) is estimated to be greater than 900 Ml/d[1].

Figure M-2: Key components of AMP6 delivery plan



[1] This is based on our P80 position. i.e. the probably of experiencing a bad winter.

M.20 Approximately one quarter of leakage is estimated to be from leaks on customers' own supply pipes and we continue to offer our domestic customers a free leak repair and pipe relay service.

M.21 At the start of AMP6 we formed a new partnership alliance (called the Infrastructure Alliance) to encourage better, smarter and more collaborative working. This has proved more complex than expected to implement and embed. These issues, along with the desire to always keep customers in supply throughout the leak repair process whilst working within traffic management restrictions, have hampered our ability to detect and repair leaks quickly and efficiently. In 2016/17 we missed our leakage target for the first time in 11 years. Leakage was ahead of target in three water resource zones (WRZs), but was behind target in the other three WRZs, most notably London.

M.22 We have put a detailed recovery plan together which covers the final three years of AMP6. As part of the leakage recovery plan, we have committed additional funding on activities including further leakage detection and repair, including the use of more advanced technologies, further pressure management and optimisation, and more investment into improving understanding and accounting for water use, which is drawing heavily on the increasing numbers of smart meters being installed. This is all supported by improved governance and clearer accountability. The revised leakage forecast is illustrated in Table M-1.

Table M-1: AMP6 Leakage performance – actuals and forecast

Activity	Unit	2015/16 Actual	2016/17 Actual	2017/18 Actual	2018/19 Forecast	2019/20 Forecast
Reported leakage level (AR Table 10)[2]	Ml/d	642	677	694	672	606

M.23 Due to missing the target in 2016/17 with leakage increasing over the year and each future year's target being more challenging, this recovery plan does not see us meeting our WRMP14 leakage targets fully until 2019/20. However, this plan will ensure we are back on track for AMP7, and it forms a key part of the base plan for the draft WRMP19.

M.24 Table M-1 reflects our forecast at the time of developing our revised draft WRMP19 (February 2018). Since that time, we have had the 'freeze thaw' event of winter 2018 and the heatwave in the summer of 2018. Consequently, our current forecast for 2018/19 has increased to 694 Ml/d from 672Ml/d but our forecast for 2019/20 remains the same at 606 Ml/d.

M.25 For further information on the leakage performance in each year by WRZ please refer to our Annual Reviews to the Environment Agency.

[2] These are based on the current AR17 'ODI consistent' leakage reporting assumptions and do not include an up-lift for the Leakage Consistency (Shadow Reporting) impact.

Leakage performance in London

M.26 While the London water supply area only accounts for 55% of the company's water mains, it has 77% of our customers, 79% of our water into supply and 79% of our leakage. Our performance is therefore dominated by leakage in the capital.

M.27 The London supply area is heavily urbanised, covering the whole of central London and supplying 7.73 million people. In contrast, the next largest city in the UK is Birmingham with just 1.1 million people.

M.28 Locating leaks is heavily reliant on acoustic methods and leakage detection in London is already carried out at night when other noises, such as that from traffic, are at a minimum. However, even at night, the 24 hour nature of London and the continuous background noise from, for example air conditioning units, makes leakage detection difficult.

M.29 This is further exacerbated by the heavy London clay soil. The soil not only moves much more than other soils as it wets and dries through the seasons, and attacks the pipe material with its highly corrosive properties, but it also restricts the flow of water from leaks, thus minimising the sound that it makes and also the likelihood that it will become visible on the surface.

M.30 Despite the difficulty in finding leaks in London, given the condition of the infrastructure, and the intensive leakage detection activity, the number of leaks found still exceeds those found by other companies. This is reflective both of the age of the mains, with about 40% over 100 years old, and of the challenging environment in which we work.

M.31 In 2016/17 leakage in London was reported as 524 Ml/d against the WRMP14 target of 498 Ml/d. Although we have demonstrated in the small WRZ of Guildford that we can turn around performance, with leakage levels reduced by 28% between 2013/14 and 2015/16, the size and complexity of London makes this more challenging.

M.32 With leakage increasing during 2016/17, the focus for 2017/18 was about stabilising performance and re-organising the delivery model with our detection and repair service providers. Performance was also affected by the sharp freeze thaw event in March 18. As a result, leakage in London was reported as 535 Ml/d against the WRMP14 target of 488 Ml/d.

M.33 We are continuing to invest time and effort into improving our understanding of where leakage is, assisted by the smart meters that are being installed, not only in new domestic installations but also on commercial properties where we replace the meters.

M.34 We are also investing in permanent noise loggers, with approximately 26,000 now installed, most in London in the areas of highest leakage and some of the busiest streets. These should allow us to identify leaks more efficiently.

Trunk mains leakage control activity

M.35 Leakage on our Transfer and Principal mains (usually categorised as trunk mains) is often the most difficult leakage to detect and accounts for approximately 18% of our reported leakage figure annually. The measurement of trunk main leakage is difficult because of the relatively small losses in relation to the large flows passing through the trunk mains. Identification and detection of trunk main leaks is challenging due to the limitations of existing technology, the

low propagation of noise along these large diameter pipes along with longer distances between fittings, and accuracy of measurement. This can often generate a large volume of work for relatively little return.

M.36 Trunk main leakage is detected primarily by either Hydrophone surveys or noise logging, although these techniques are being supplemented by the increasing network coverage of real time monitoring units, additional insertion points and a programme of innovation. Hydrophone surveys are used to detect leakage by inserting a probe into the main through an existing insertion point (tapping). The hydrophone has a small 'parachute' in-front of it which picks up the flow of the main and drags the probe along allowing a survey to pin point leaks and provide an estimate of the leak size. The average length of trunk main surveyed in AMP6 is 386m due to restriction in access points, network configuration and operating regimes.

M.37 Where insertion points are not available, noise loggers are deployed at positions either side of a suspected leak or at a set distance apart on a main that needs to be checked. They are deployed externally on valves or hydrants and so do not require an insertion point. The final leak location is usually confirmed by technicians through the use of more traditional techniques such as ground microphones or listening sticks.

M.38 For high risk trunk mains, identified via an industry-leading Trunk Mains Risk Model, we install real-time monitoring. These units record and transmit flow, pressure and noise data to the 24 hour control room. The units alarm if a failure occurs and can also provide predictive data that gives early warnings that a failure may be about to occur. This information is vital to operational teams to expedite event response procedures. Replacement or relining of trunk mains occurs at locations where there is either a proven history of poor performance, or there is information that a main is in poor condition. Risk rankings from the Trunk Main Risk Model are used to support the investment case for replacement. Where full rehabilitation of a trunk main is not appropriate, we develop contingency plans which may specify the need for regular checks of key assets required to isolate the main or the need to install survey points to monitor for signs of leakage that could develop into a substantial failure.

M.39 Our business's trunk main strategy focuses on addressing the level of risk associated with these assets. The reduction in trunk main leakage is a secondary benefit to the delivery of the strategy and the leak programme addresses leak recurrence on these assets. By locating and repairing trunk main leaks, we remove a possible catastrophic failure point from our trunk main network. We have a large on-going leakage management programme focused on our trunk mains to ensure that leakage on these mains does not increase.

M.40 To improve our capability in this area we have been expanding the use of the NetConn tool within our Netbase leakage management system. This allows balances to be carried out across discrete Trunk Main Areas or TMAs. Where the balances indicate areas of interest, these can be followed up with leakage detection (through the specialist surveys outlined above), metering investigations, or even the installation of further meters to add to the balances being undertaken. We have set up a dedicated team focusing on the creation, validation and monitoring of TMAs and will have created over 300 TMAs in AMP6, of which 85 will have been fully validated. This activity is critical in the understanding of our trunk main assets and the targeting of leakage and Unaccounted for Water.

C. Our future direction of leakage management

M.41 Over the last five years, the environment in which we manage our water network has changed significantly. This includes: focussing on always keeping the customer in supply; the needs of Highway Authorities and Councils as they respond to the challenge of keeping London and surrounding cities and towns moving whilst undertaking major infrastructure projects such as the cycle super highway, Crossrail and HS2; and increasing congestion, both from traffic on the road and pedestrians on foot. As a result our focus is on more intelligent decision making to maximise the value of each intervention on the network (e.g. targeting the largest leaks).

M.42 In order to deliver this we have set the following priorities:

- better data (improved quality and speed, with continual improvement from the field)
- better analysis (real time and dynamic to identify and diagnose the issue, and even predict, through better joining of datasets)
- reduced field activity through better targeting
- well skilled field teams having the right information and using the right tools
- ongoing optimisation of pumping regimes and network reconfiguration to meet growing customer demand whilst managing network pressures
- network assets being adequately maintained to meet service requirements and system health diagnostics that ensure assets are replaced at the end of their usable life

M.43 The options selected within the revised draft WRMP19 for demand management complement this approach.

M.44 Section 8: Appraisal of demand options outlines our approach to the identification and appraisal of demand management options considered in our plan. Section 8 details the demand management options to reduce leakage: Metering and repair of Customer Side Leakage (CSL), Mains Rehabilitation, Pressure Management and DMA Enhancement. These options have been screened to determine their eligibility in the final demand management feasible options list in the Demand Management Options Screening Report[3].

M.45 In comparison with WRMP14, the feasible demand management options that reduce leakage differ in the draft WRMP19:

- Enhanced Active Leakage Control (ALC) + 10% and 20% has been removed
- DMA Enhancement and Enhancement Plus have been added

M.46 In WRMP14, Enhanced ALC + 10% and 20% referred to enhanced levels of 'Find and Fix' activity over and on top of that already being undertaken to achieve a further 10% and 20% reduction in leakage. This option has not been included in draft WRMP19 because there is considered to be limited scope to make significant further leakage reductions with current methods of leakage detection and repair alone. That is, as leakage is reduced further, much greater time is required to detect multiple, smaller leaks in a DMA and there is a high risk of not delivering. In the absence of other work (i.e. Network Reconfiguration), the cost of additional leakage detection as an individual demand management option becomes

[3] Thames Water, 2017, 'Demand Management Options Screening Report', March 2017.

prohibitive. Consequently, the additional cost and risk of not delivering is considered unacceptable and therefore these options were not included in draft WRMP19 but rather, were replaced by DMA Enhancement which provides leakage reduction through thorough data analysis to diagnose the best form of intensive leakage investigation. This often includes installing more meters to increase the understanding of where the unaccounted for water is.

M.47 Sections 8-E and 8.H details the benefits, delivery methods and constraints associated with Mains Rehabilitation, Pressure Management and DMA Enhancement to achieve a reduction in leakage. This information is used in the Integrated Demand Model (IDM) to calculate the total benefit expected from these interventions.

M.48 IDM is the optimisation modelling process we use to develop cost efficient demand management programmes. The IDM model optimises the demand management options by appraising each option individually and assessing the costs and benefits of options that can be promoted in combination. It also involves looking at the optimised combination of demand management options for each DMA and assessing the deliverability constraints.

M.49 Section 8-D details the information used in IDM to calculate the total benefit expected from metering. Metering is the only feasible demand option that delivers both a leakage and consumption (customer water use and plumbing losses) reduction. However, metering and the repair of CSL also have additional benefits associated with our understanding of leakage on our own pipes and our understanding of customer demand within a DMA.

Metering, CSL repair and DMA Water Balance

M.50 The increase in customer metering will allow better understanding of leakage, both on the customer side, and on our own pipes. The inclusion of bulk meters (large and small) give us the opportunity to much better understand customer demand, and therefore permit more accurate assessments of leakage on our pipe network. The smart metering technology will greatly speed up the capture of data, with data available to the leakage engineers within 24 hours. Combined with our existing district metering system of some 1,640 DMAs with near real-time flow data captured through telemetry, this will allow for accurate and fast water balances at a local level.

M.51 A trial of this approach started in December 2016. Four DMAs have been carefully selected as they each represent different consumption types. In these four DMAs all existing revenue meters are being exchanged for smart meters, and all properties are being metered. Where it is found to not be possible to individually meter the dwellings, e.g. due to complex plumbing arrangements within the building itself, every supply pipe into a building will be metered with a smart meter (using bulk non-revenue meters). By metering every property in the DMAs we will be able to assess the relative benefits of greater and greater levels of metering. This will allow us to understand the relative benefits from replacing existing dumb meters with smart meters to the benefits of installing more bulk meters.

M.52 At the time of writing all meters have been installed and we are working through the data capture snagging list.

M.53 This is being supported by systems infrastructure with the installation of a new Meter Data Management System in December 2017. This is being interfaced with our leakage management systems to ensure the full benefits of our smart metering system are realised.

M.54 We are also investing heavily in permanent noise logging. We believe this, combined with the smart metering technology and our existing district metering system will give us the capability to manage leakage recurrence more efficiently and drive leakage below current levels. The first generation of these noise loggers indicates the presence of a leak in a localised area, though this still requires localising by a leakage detection technician. These loggers are now being enhanced to correlate between surrounding noise loggers to more accurately identify the location of a leak. To supplement this, DMA Enhancement and DMA Enhancement plus has been selected as a cost effective option to provide the necessary data and system improvements needed to support the plan.

M.55 We are also continuing to trial new and emerging leak detection technologies to ensure we use the most effective innovations on the market. This is demonstrated by our recent trials of satellite, aircraft and drone technologies.

M.56 Satellite leakage detection uses thermal and infrared imaging signatures from satellites to identify areas where the ground temperature is significantly different to the surrounding area to indicate the potential location of a leak.

M.57 Aircraft and drone technology is similar to satellite leak detection, in that it uses thermal and infrared imaging techniques to identify the possible location of a leak, but with the difference that it can be targeted to a specific main, in real time. This approach is primarily being tested on trunk mains.

D. Leakage consistency reporting

M.58 In July 2017 Ofwat introduced the requirement to report leakage following the newly defined guidance developed by UKWIR[4]. This new guidance was to ensure more consistency in reporting of leakage between water companies across England and Wales. This reporting is to be in the form of shadow reporting for the remainder of AMP6, 2016/17 to 2019/20, with the requirement that leakage performance commitments will be set on the new reporting methodology for AMP7. The first submission of our leakage levels using the new methodology was required in August 2017 for the 2016/17 reporting year.

M.59 Ofwat has accepted that companies may not be immediately compliant with the new reporting guidance and requirements. Therefore, as part of the submission, a RAG status has been applied to each section of the guidance. Companies are required to report their compliance against the guidance and, where the company is not fully compliant, provide a short commentary explaining why this is the case and what the company is planning to do to become compliant, along with indicative timescales.

[4] UKWIR: Consistency of Reporting Performance Measures, UKWIR Report Ref No. 17/RG/04/5

Impact on reporting leakage for AR17 base year for draft WRMP19

M.60 Annual average leakage for 2016/17 using our existing reporting methodology (for reporting against our AMP6 leakage performance commitment) was calculated as 677.15 Ml/d (ODI equivalent for Annual Return). However, at the time of completing our Annual Review 2017 we reported a leakage figure of 664.6 Ml/d. This is the actual figure which included methodology improvements at the time.

M.61 At the time of providing the base leakage value for the draft WRMP19 in May 2017 we estimated the impact of moving to the new reporting guidelines (i.e. 'shadow' reporting) as increasing our leakage level by 40 Ml/d, giving a value of 704.6 Ml/d. This was before the new reporting requirements had been confirmed and the changes in methodology had been worked through in detail.

M.62 Between June and August 2017 work was undertaken to move our leakage reporting methodology to be as compliant as possible for the August submission. This work incorporated all changes to the reporting methodology believed to have a material impact on our reported leakage figures. Applying the new shadow reporting methodology back to the 2016/17 year gave a value of 715.75 Ml/d, an increase of 11 Ml/d beyond the value that had been built into the draft WRMP19 baseline forecast. Then, applying the new shadow reporting methodology and the DYAA uplift, gave a value of 741.2 Ml/d for 2016/17.

M.63 For 2016/17 leakage reporting there were 16 compliance measures that were reported on, each with a number of sub-measures. We reported to Ofwat that we were green (fully compliant) on eight measures, and amber (partially compliant but unlikely to have a material impact on reported figures) on the other eight. Red would indicate elements that either had not yet been implemented, or for which the data had significant weaknesses and there is likely to be material impact on reported figures as a result. None of the compliance measures were reported as red.

M.64 The shadow reporting measure and the RAG statuses have been fully endorsed by our Auditor, KPMG, as part of their deep dive audits.

M.65 In March 2018 Ofwat issued updated guidelines to use for shadow reporting. Applying these new guidelines, the company annual average leakage was reported as 720.81 Ml/d for 2017/18. This is 35.16 Ml/d higher than the standard reporting included in our Annual Return 18.

M.66 However, the new guidance from Ofwat was issued after our cut-off date for data inclusion in the PR19 submission. Therefore, for the revised draft WRMP19, we have used the most up to date base year leakage position available at the time. This was the 2016/17 leakage position of 741.2 Ml/d which incorporated the shadow reporting methodology (as at August 2017) and the DYAA uplift for 2016/17.

Activities and timescales required to become fully compliant

M.67 In the March 18 Ofwat guidance there are 16 components which are further divided into 76 elements, each requiring a compliance RAG status. For our 2017/18 shadow reporting we

reported 13 components as green and 3 amber, with 63 elements green and 13 amber. None are reported as red.

M.68 Table M-2 summarises the compliance against each of the 16 components and associated elements, along with an estimate of the work required to become fully compliant.

Table M-2: Activities required to become compliant with consistency guidelines

Measure	RAG Status	Reasons for non-compliance	Plans for compliance	When will we be fully compliant
1. Coverage	G			
2. Availability	A	The average zonal availability for the report year 2016/17 was 79% of continuous monitored areas. Target availability is 90%.	Work is ongoing to assess how to improve the reliability of the zonal metering. This will also include converting those meters that are reporting an instantaneous flow at the end of the 15 minute period, to an average flowrate across the 15 minute period. A feasibility study is being undertaken to identify the solution to improve the availability of zones. As this is yet to report, it is presently unclear what the cost and timescales of any solution might be.	Depending on the outcome of the feasibility study we aim to be compliant by the end of AMP6. We are likely to need significant investment to be able to become compliant but, as the nature of the solution is yet to be defined, we can't estimate how much money will be needed.
3. Properties	G			
4. Night flow period and analysis	A	The night flow period and analysis is mostly compliant. Two areas have been identified as needing more work: The filling of data gaps that last for greater than 6 months presently uses the last available night flow value; The validation process is manual and relies on expert knowledge and judgement. A formal operability test needs to be introduced.	The infilling of data where the period of lost data is greater than 6 months will be reviewed to confirm the best estimates are being used. As Thames Water reports using large FMZs instead of DMAs, the UKWIR guidance of using the zone in which the DMA resides cannot be followed. Systems are being developed to allow the FMZ Operability to be calculated and applied. Although this will be ready for AR18, further work is also required to ensure appropriate data is being used in the calculation.	By 2018/19. This will be developed within Netbase in order to become compliant by the end of March 2019 but a permanent solution will need to be developed for AMP7. External resource has been allocated to another project, delaying other deliverables.
5. Household night use	A	The household night use allowance period needs to be changed from 3:30-4:30 to 3:00-4:00 to make it consistent with the night flow period. We also want to extend the number of properties in the measured sample by making use of the newly installed smart meters.	A project needs to be undertaken to analyse the newly available smart meter data and then appropriately extrapolate to the rest of the properties in the company. Work is already underway to install full smart metering in 4 carefully selected DMAs to provide an appropriate sample.	AR19 This should be deliverable within the current smart DMA project.

Measure	RAG Status	Reasons for non-compliance	Plans for compliance	When will we be fully compliant
6. Non-household night use	A	Specific night use needs to be included in the night flow calculation for the continuously logged commercial customers.	NHH night use allowances have been moved to the fixed hour 3-4am. Processes are being set up to allow the continuously logged customer night use to be directly used in the leakage calculation each day.	AR18 This will be an extension to the present commercial night use project.
7. Hour to day conversion	A	35 of the 234 Flow Monitoring Zones (12% of properties) do not have continuous pressure logging at critical locations to allow zone specific hour to day factors to be calculated. Hour to day factors are derived from the regional average for these zones.	Work is underway to identify the sites for the installation of new critical pressure point loggers. Once installed data will need to be collected for the report year.	AR19 to AR20 This will benefit both leakage and Supply Interruptions 3 measures as both require additional critical pressure logger data.
8. Annual distribution leakage	G			
9. Trunk main leakage	A	Trunk Mains leakage is 5.2% of total leakage, against the target of 5.0%. Although our present estimate of trunk mains leakage is based on company specific data (sample measurements extrapolated to total length), and length is updated each year, the sample measurement data was last updated in 2003.	Flow balances have now been set up across all trunk main areas and data anomalies are now under investigation. Due to the complexity of some of these anomalies, they will take time to resolve.	By the end of AMP6. There is a team already working to resolve this.
10. Service reservoir losses	G			
11. Distribution Input	G			
12. Water delivered measured	A	For non-household there is a need to fully understand the Customer Management Operating System (CMOS) data to ensure billing rebates are dealt with correctly.	For non-household properties work is underway to better understand billing and rebates information within CMOS.	AR18 for CMOS
		Similarly, rebates for CSL on household need to be better quantified.	For household, a new billing system is being implemented (due to go live by December 2018) where clear billing processes are being defined. Need to ensure that CSL rebate flags are built in to the design.	AR19-AR20 for household, due to timescales of delivery of new billing system.
13. Water delivered unmeasured	G			

Measure	RAG Status	Reasons for non-compliance	Plans for compliance	When will we be fully compliant
14. Company own water use	A	Some of the smallest supplies to Water Treatment Works and Sewage Treatment Works are not metered. The total volume is estimated to be 8.8 Ml/d.	The supplies have been identified. Site surveys now need to be undertaken to understand possible metering arrangements and costs. Operational constraints make work complex to plan to ensure continuity of supply whilst work is undertaken.	AR20
15. Other water use	G			
16. Water balance and MLE	G			

M.69 We will continue to improve our leakage reporting methodology to ensure compliance by 2019/20. However, this means we will not know our actual leakage starting position for 2020 onwards until then. It is therefore assumed that leakage targets set out in this draft WRMP19 are leakage "reductions" that will be applied to the new starting position, once known. This is consistent with the need to balance supply and demand where the "reduction" in leakage is important, rather than the absolute value.

M.70 Our management of security of supply has taken this into account to ensure this does not cause a deficit at the start of the next period. This has been achieved through the inclusion of headroom and one further option from April 1st 2020, being the Didcot RWE npower abstraction licence.