



Water Resources Management Plan 2024

Feasible Demand Management Options Paper

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Background and Introduction

- 19 This paper should be read in conjunction with the following reports as detailed in Figure 1.

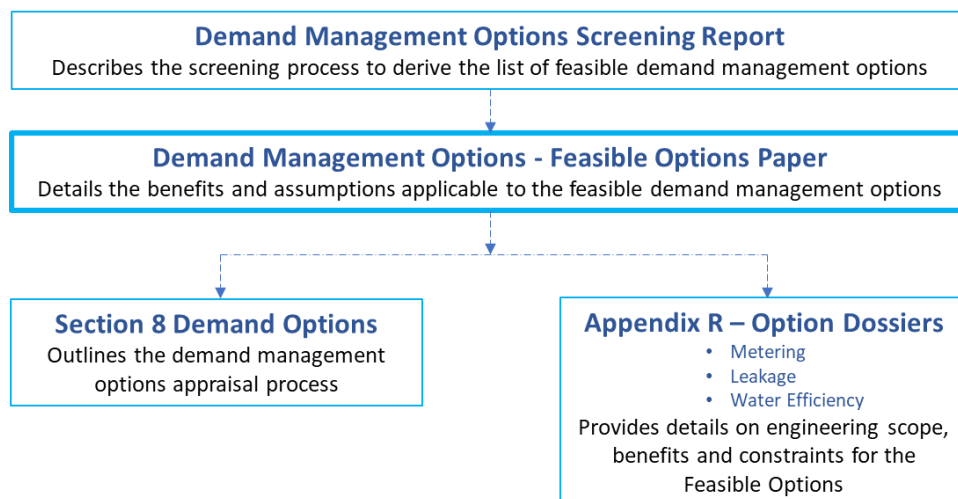


Figure 1: Overview of WRMP24 demand management options reports

The purpose of this paper is to detail the benefits and assumptions applicable to the Feasible Demand Management Options identified by the Demand Management Screening Process.

The Demand Management Options Screening Process, identified a list of Feasible Demand Management Options for inclusion in the Water Resources Management Plan 2024 (WRMP24). They were categorised into three areas: Metering, Water Efficiency, and Leakage.

This paper details the benefits and assumptions associated with these options and forms an appendix to, and should be read in conjunction with, the Demand Management Options Screening Report, September 2022.

Feasible Demand Management Options

- 20 The Feasible Demand Management Options for inclusion in WRMP24 are summarised in Table 1. There are 18 individual interventions in total, categorised into three areas. The black text refers to options included in WRMP19 which have been reassessed for inclusion in WRMP24. The green text highlights new options for WRMP24 which have been identified through further work and discussions with stakeholders.

Leakage	Metering	Water Efficiency
Advanced District Metered Area intervention (DMAi)	Progressive Metering Programme (PMP)	Digital Engagement
Leakage Innovation	Progressive Smart Upgrade Household (HH PSUP)	Household Innovation and Tariffs
Mains Rehabilitation	Bulk Metered Area (BMA)	Smarter Home Visits (SHVs) - (PMP)

Leakage	Metering	Water Efficiency
	Mini Bulk Metered Area (mBMA)	SHVs - Optants
	Progressive Smart Upgrade Non-household (NHH PSUP)	SHVs - Progressive Smart Upgrade Programme (PSUP)
	Metering Innovation – PMP	Wastage Fix
	Metering Innovation – (PSUP)	Green Redeem
		Smarter Business Visits (SBVs)
		Non-Household Continuous Flow Fixes
		Non-Household New Tariff Structure
		Non-Household Retailer Activity

Table 1: Feasible Demand Management Options Summary

Black Text – Options included in WRMP19 and reassessed for inclusion in WRMP24

Green Text – New options for WRMP24

- 21 This paper provides the detail that informs these interventions, further information can be found under the Metering, Water Efficiency and Leakage Reduction Sections of this report.

Metering

Metering interventions

22 The demand management options screening process identified seven feasible metering interventions. The interventions are described in Table 2.

No.	Feasible Intervention	Description
1	PMP	<p>The PMP is a progressive programme where currently unmeasured household customers are compulsorily metered. This programme is applicable to all property types (detached, semi-detached and terrace properties and individual dwellings in Mini Bulk and Bulk properties).</p> <p>For WRMP24 digital meters will be installed which are either AMI or AMR meters (see Section - Non-household – installation of a meter to measure supply to non-domestic customers. Meter technology) for more details on meter technology). The new meters enable water use reduction through customer behavioural change, and identification of wastage and customer side leaks.</p>
2	PSUP - household	The PSUP is a proactive programme to upgrade households with a basic meter to meters with smart or AMI technology. The new smart meters allow for easier identification of customer side leaks.
3	BMA	<p>This programme installs a large smart meter to detect supply pipe leakage to multiple properties. Individual household and non-household properties within the meter area can be unmetered and unmeasured.</p> <ul style="list-style-type: none"> • BMA are typically fitted to blocks of flats where the supply covers more than 25 properties • mBMA are appropriate for single buildings and supplies which cover less than 25 properties
4	mBMA	
5	Metering innovation - PMP	This option investigates and implements innovative technologies and approaches to meter properties currently regarded as unmeterable under the PMP and PSUP interventions.
6	Metering innovation - PSUP	<p>The PMP and PSUP programmes are limited by current deliverability and technological constraints:</p> <ul style="list-style-type: none"> • No Access properties – where the customer is not available or will not provide permission for us to access their property and install a meter (either internally or externally) • Unmeterable properties - properties where it is impractical or a health and safety risk to provide an installation <p>This option aims to reduce the number of no access and unmeterable properties through:</p> <ul style="list-style-type: none"> • No access innovation <ul style="list-style-type: none"> – Compulsory metering of properties when customers vacate or move into a property. – Extending access to customer support, increased meter installation and operating hours and covering a portion of reinstatement works where an external

No.	Feasible Intervention	Description
		meter installation impacts a customers' driveway or garden <ul style="list-style-type: none"> Unmeterable innovation – employing innovative and emerging technological solutions to meter customers who are currently considered unmeterable. Investment in innovation trials through AMP8. The technology and approaches to achieve the ambition for metering innovation is either emerging or is yet to be developed.
7	Progressive Smart Upgrade Programme – non-household (NHH PSUP)	The PSUP NHH is a proactive programme to upgrade non-household properties with a basic meter to meters with smart or AMI technology. The new smart meters allow for easier identification of customer side leaks.

Table 2: Feasible metering intervention descriptions

23 The feasible metering options and the types of benefits associated with each option are shown in Table 3. This table also indicates whether an option was considered at WRMP19.

Option		Customer Side Leakage Reduction	Household Behavioural Use Reduction	Household Wastage Reduction	Non-Household Reduction	WRMP19 or New
1	PMP	Yes	Yes	Yes		WRMP19
2	Progressive Smart Upgrade Programme Household (HH PSUP)	Yes				WRMP19
3	BMA	Yes				WRMP19
4	mBMA	Yes				WRMP19
5	Metering Innovation – PMP	Yes	Yes	Yes		New
6	Metering Innovation – PSUP	Yes				New
7	NHH PSUP	Yes			Yes	New

Table 3: Feasible metering options

Property types and meter sizes

24 The metering interventions are targeted at different property types and in some cases target groups of properties. The types of properties targeted, and the meter installation types associated with them are described in this section.

- 25 **Houses** – terraced, detached or semi-detached. Meters can be installed internally or externally. An external meter requires the installation of a standard boundary box. If this is not present, dig work is required in order to install the meter.
- 26 **Individual dwellings in a block of flats** – installation of a meter to measure the supply to individual dwellings in a block of flats – a meter is required for each individual dwelling. Similar to houses, the meters may be installed externally or internally. Meter installation is only possible if each individual dwelling has a single supply pipe and is not possible where any dwellings have shared supplies.
- 27 **Bulks and mini bulks** - installation of a single bulk meter on the supply pipe of a block of flats. This requires the installation of a large chamber outside the property to house the meter which is significantly more labour intensive and therefore expensive than the standard boundary box required for houses. Bulk meters do not measure supply to individual dwellings within the block of flats.
- A BMA is described as:
 - Feeds 25 or more properties
 - Can supply multiple buildings
 - Can have multiple supplies to the BMA
 - Involves longer and/or more complex pipework (>20m of pipe in London, >50m of pipe in Thames Valley)
 - Can include metered and unmeasured and household and non-household properties within the BMA
 - An mBMA is described as:
 - Feeds up to 25 properties
 - Supplies one building only¹
 - Single supply to the mBMA only
 - Simple pipe work feeding multiple dwellings in one building (<20m of pipe in London, <50m of pipe in Thames Valley)
 - Can include metered and unmeasured and household and non-household properties (particularly sites with flats over a business premise) within the mBMA
- 28 **Non-household** – installation of a meter to measure supply to non-domestic customers.

Meter technology

- 29 New basic meters are no longer being installed but are still operational at properties where they have previously been installed. Basic meters are a conventional meter with a register dial. Meter readings are taken by a meter reader gaining physical access to the meter and visually recording the reading. Readings are manually entered into an electronic data capture device on site. Some data capture devices have bar code readers to check record and check the meter serial number. Basic meters do not have any smart connectivity.

Smart meters

- **Advanced Metering Infrastructure (AMI):** commonly referred to as a 'smart meter', AMI meters send automatic reads through a secure wireless network to provide real time water

¹ Exception – Terraced houses of up to 4 properties

consumption data. They can do this when our Local Communication Equipment (LCE)² and wide area network (WAN) communication system is available.

Electronic readings are remotely passed from the meter to our Smart Meter Operations Centre (SMOC) which is responsible for the storage and analysis of our smart meter data.

- **Automatic Meter Reading (AMR):** provide a meter reading during a 'walk by' or 'drive by' reading. These meters are equipped with a short range radio that communicates with a meter reading device. In contrast to 'Basic meters' meter reads can be taken without physical access to the meter.
- AMR meters are referred to as 'smart enabled' as they have the capability to be switched into AMI mode when our WAN communication system becomes available in that location.
- The current WAN covers 95% of London and parts of the Thames Valley. By 2025/26, we aim to have WAN coverage across the Thames Valley, which will enable our PMP meters to be switched for an AMI mode at the start of AMP8. AMR meters will be installed by exception such as in the accommodation of religious or personal customer circumstances.

Meter installations

30 To assess costs and benefits of the feasible metering interventions, the number of meters for installation were modelled. This was done by modelling the quantity of meters in each District Metered Area (DMA) based on property type, internal/external split and survey to fit ratio.

31 Each property to be metered is surveyed to:

- Determine whether it is technically feasible to meter (Section - Feasibility of meter installation – survey to fit ratio)
- Determine the most appropriate meter installation type (Section - Meter technology)
-
- Meter installation location (internal / external split)
- Obtain the required details pertaining to the property

Meter installation location (internal / external split)

32 Meters can be installed internally or externally at a property:

- **External** - a meter is fitted in the pavement at the stop tap position. This has the benefit that the meter will record leakage on the customer's supply pipe aiding quicker leakage repair and the meters are easier to install and read:
 - Where there is an existing sufficient sized standard boundary box a screw in meter can be installed
 - Where there is not a suitable boundary box, one must be excavated
- **Internal** - a meter is fitted at the first stop tap inside the property. This location is used if the property does not have an individual supply

Feasibility of meter installation – survey to fit ratio

33 It is not possible to install meters at all properties. This can be for a variety of reasons, both technical and economic. Typical reasons preventing a meter installation include but are not limited to:

² Local Communication Equipment (LCE): Two-way communication hardware also referred to as a communication smart-point. It is wirelessly installed adjacent to the meter and enables transfer of data from the meter to our systems utilising a wide area network infrastructure.

- More than two water meters per supply are required to calculate the consumption
- It is unreasonably expensive to do so which is defined as where the total cost exceeds a 50% uplift on the standard cost
- The installation would create an unacceptable health and safety risk
- There is a communal hot water supply

No access and unmeterable properties

34 As noted above, it is not always possible to fit a meter at a property. As a result, there are a proportion of properties which are unmeterable under the PMP and PSUP programmes. Similar constraints apply to those who opt to have a meter installed outside of these programmes. There are two key constraints to properties being regarded as unmeterable:

- Properties which cannot be metered due to technical or safety constraints (see Section - Feasibility of meter installation – survey to fit ratio)
- Properties which cannot be metered due to limitations on accessing the property. It may be possible that there are no technical restrictions to metering these properties, however access to them cannot be gained

35 The metering innovation programmes (both PMP metering currently unmetered properties and PSUP for upgrading to smart meters) target resolving properties currently regarded as unmeterable through innovative approaches to resolving technical, safety and access constraints.

Total number of meter installations

36 The number of meters that will be installed in each DMA is calculated as illustrated by Figure 2 to Figure 4:

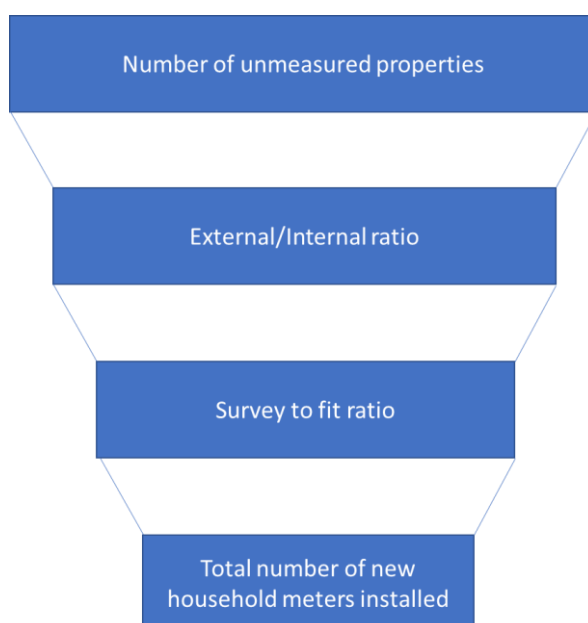


Figure 2: Number of household meters installed – PMP and Optants (for further detail refer to dossiers)

Note: The external/internal ratio and the survey to fit ratio differ by property type (see Section - Meter installations). This method applies to both households and dwellings within blocks of flats.

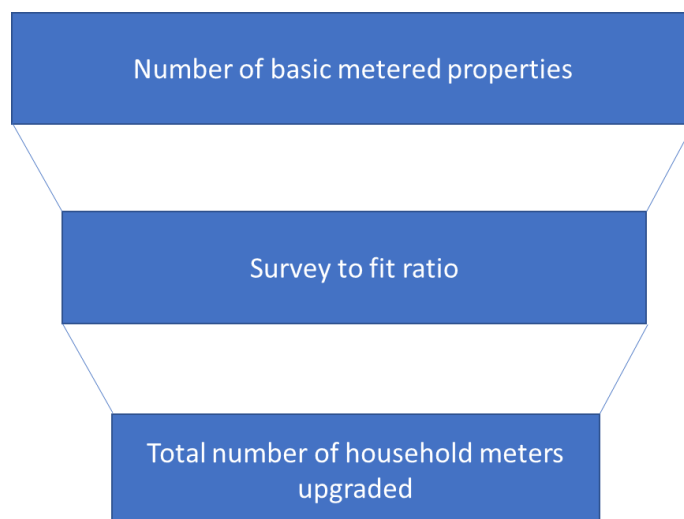


Figure 3: Number of household basic meters upgraded to smart meters – PSUP (for further detail refer to dossiers)

Note: the survey to fit ratio differs by property type (see Section - Meter installations). This method applies to both households and dwellings within blocks of flats. For PSUP, the external/internal ratio is already known as existing basic meters are being upgraded.

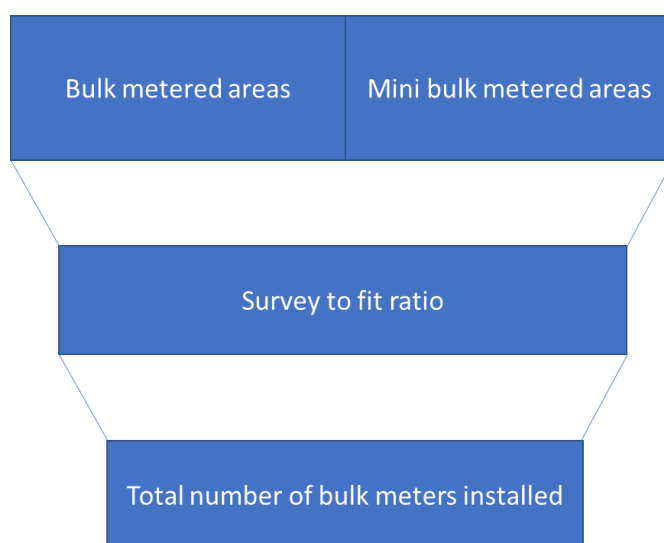


Figure 4: Number of bulk meters installed

Note: This applies to both large blocks of flats and small blocks of flats (see Section - Meter installations for the survey to fit ratio breakdown).

Metering benefits

- 37 Metering (including upgrading existing basic meters to smart meters) provides demand management benefit through:
- Reduction of per capita consumption. This comprises two elements:
 - Customer behavioural change – customers changing their discretionary usage habits to reduce water consumption

- Wastage reduction – identifying and fixing internal wastage within a property, e.g. leaking toilets or taps
- Identification of and reduction of customer supply pipe leakage

38 The assumed benefits are applied to the number of each water efficiency activity to calculate the total benefit expected from metering. The Section - Meter installations summarises the assumptions and data used to calculate the total benefit.

Identification of leakage and wastage

39 When a customer has a smart meter fitted it will identify if there is a continuous flow of water on the property. Continuous flow is where the flow rate does not drop below a minimum consistently for a number of days.

- Continuous flow on an external meter indicates the customer either has a customer side leak on their supply pipe or wastage within their property (i.e. a leaking tap)
- Continuous flow on an internal meter indicates the customer has wastage within their property

40 When a property is identified as having continuous flow, it is labelled as a point of interest (POI) and our leakage teams will visit the property and prove whether there is a supply pipe leak or internal wastage. For WRMP24, it is assumed that a POI is applicable when a property has continuous flow greater than 5 l/hr.

41 To calculate the volume of water attributed to customer side leakage, the number of POI's raised is multiplied by the % POIs confirmed as CSL or wastage by the unit savings associated with fixing the identified supply pipe leak or wastage.

Number of Properties with POIs and CSLs

42 For WRMP24 it is assumed that 3% of properties with external meter installations will have a supply pipe leak. This data has been derived from the PMP and this assumption is applied to all property types.

43 As noted above it is not possible for internal meters to identify a supply pipe leak, though they can help identify wastage within a property.

Customer behaviour change and wastage reduction benefits

44 In WRMP19, we assessed the total customer consumption reduction from PMP using our Metered Consumption Model (MCM)³. This model compared basic meter readings to estimated unmeasured consumption per property to forecast savings from PMP.

45 Unmeasured consumption was estimated using our Domestic Water Use Study (DWUS) which consisted of approximately 1000 properties whose consumption was metered but the customer was not charged on a metered bill. We assumed these customers behaved as unmeasured customers. Measured consumption was based on 8,567 properties with a dumb meter some of these had been fitted since 1990.

46 In WRMP19 our MCM was the best and most robust dataset available to assess the savings from PMP. Although the model could forecast total consumption reduction savings from PMP, it could not split these savings into customer behavioural use changes

³ Cocks, R, February 2017, 'Using Household Consumption Models to Estimate the Impact of Metering', Thames Water.

and wastage. Our WRMP19 model showed an average usage reduction of 17% per property when a meter was fitted.

- 47 In WRMP24, our models have been updated to use smart meter data. Our smart meter data has given us the opportunity to reforecast the savings we expect from PMP and to split these savings between customer behavioural changes and wastage. This reforecast has been done in our Smart Meter Benefits Study⁴.
- 48 **This assessment showed an average usage reduction of 13% per property when a meter was fitted.** Compared with the assumptions made for WRMP19, this is a 4% decrease in the predicted average usage benefit obtained from metering. However, since the beginning of WRMP19, Thames Water has installed and received readings from a greater number and greater variety of property types and across a wider population. This has given a better dataset that more accurately represents the property type and population make up of Thames Water's area.
- 49 Data for our models is available for reduction in per capita consumption (for both customer behavioural change and wastage reduction) at different property type level. Property types are detailed in the Section - Property types and meter sizes.
- 50 Please refer to Section 8 of the WRMP24 for further explanation of the difference between our WRMP19 assessment and WRMP24 assessment.

Identification of and reduction of customer supply pipe leakage benefits

- 51 Data for our models is available for reduction in customer supply leakage at different property type level. Property types are detailed in the Section - Property types and meter sizes.
- 52 The leakage deterioration rate is applied to supply pipe leakage savings to account for the natural rate of rise in leakage resulting from aging assets.

Metering journey and fair billing

- 53 Our PMP is driven by our commitment to fairer and accurate billing as well as conserving water resources.
- 54 In order to minimise the billing impact on customers, we currently implement a 'one year journey' from the time a customer has a meter installed and the time they begin paying on a metered tariff. Within this one year window, customers receive comparative bills which show the cost of water on an unmeasured and measured tariff. This incentivises customers to save water prior to being put on a metered tariff at the end of their one-year journey. The change in customer behaviour is input into the benefit calculations as a one year depreciation towards the final expected level. This is:
- 10% of complete reductions in the year of intervention – it is assumed that customers will modify their behaviour and use less water immediately upon meter installation before any comparative billing is available
 - 100% of complete reductions in the year after the intervention. The one year journey allows customers to see how metering is affecting their potential billing at the end of the

⁴ Artesia Consulting, May 2022, 'Smart Metering Benefits Template_2022-05-18'

first year and it is assumed that all adjustments in behaviour are complete before they are billed as a measured customer

Meter Asset Life

55 The assumed asset life of meters installed is as follows:

- Installations until 2040 – 15 year life
- Installations between 2040 and 2055 – 20 year life
- Installations post 2050 – 25 year life

Water Efficiency

56 The demand management options screening process identified seven feasible water efficiency interventions. The interventions are described in summary in Table 4. A more detailed description of each option is provided in the following sections.

No.	Feasible Intervention	Description
1	Digital Engagement	<p>Digital engagement will allow smart metered customers to have continuous access to their own water consumption data.</p> <p>Customers will be able to view their water consumption and associated costs via a Digital Engagement Portal. The Portal will also provide advice on interpreting the available data, saving water and on identified and fixing potential leakage / wastage issues identified by the data.</p>
2	Household Innovation and Tariffs	<p>Household innovation and Tariffs encompasses our household activity and future tariffs implementation.</p> <p>Household innovation encompasses six potential solutions:</p> <ul style="list-style-type: none"> • AMP8 Water Efficiency Innovation Trials (new) – this is the most critical of the six solutions • Eliminate Wastage (new) • Non-Potable Water Supplies • Water Efficiency on BMAs and mBMAs (new) • Media campaigns • New Water Efficiency Innovation <p>Tariff charging to encourage water conservation can be implemented by reforming water rates, introducing surcharges or establishing penalties to deter high water or wasteful water practices. In WRMP24, we plan to introduce tariffs in 2035, once we have completed our PMP to ensure fairness in billing to customers.</p>
3	SHV – PMP	SHVs are offered to customers who are newly metered through the PMP programme. An SHV includes a free home visit by one of our qualified staff to install water saving devices and provide personalised water saving advice to households.
4	SHV - Optants	SHVs are offered to customers who are newly metered through the optants programme. An SHV includes a free home visit by one of our qualified staff to install water saving devices and provide personalised water saving advice to households.
5	SHV – PSUP	SHVs are offered to customers who are newly metered through the PSUP programme. An SHV includes a free home visit by one of our qualified staff to install water saving devices and provide personalised water saving advice to households
6	Wastage Fix	Wastage Fixes are offered to customers following an SHV if they are found they have a leaking toilet or tap.

No.	Feasible Intervention	Description
7	Green Redeem	Green Redeem is a scheme whereby customers are incentivised through non-financial offers to be more efficient with their water consumption.
8	Smarter Business Visits	<p>An SBV includes a free visit by one of our qualified staff to install water saving devices and provide personalised water saving advice to non-households. The data can further be used to identify businesses with continuous flows and use this to help notify Retailers and business customers of potential customer side leakage (CSL) of external leaks or internal wastage.</p> <p>Although we are no longer a retailer to business customers following the introduction of the non-household market in April 2017, non-household customers still make up a significant proportion of demand in our supply area.</p>
9	Non-Household Continuous Flow Fixes	Where businesses have been identified as having a continuous flow a fix is offered. Continuous flow is defined as where the flow rate does not drop to 0 l/hr every hour for 14 days. Continuous flow on an external meter indicates the customer either has leakage or wastage within their property.
10	Non-Household New Tariff Structure	<p>Water usage tariffs in the non-household sector are envisioned to be brought in from AMP10 and onwards. These tariffs would look to implement higher cost rates for overuse of water in the commercial sector, in order to drive down demand. As with HH tariffs, charge rates and usage requirements for each rate are yet to be determined.</p> <p>The Retailer-Wholesaler Group (RWG) is currently working to simplify NHH tariffs. It is recognised that different NHH tariff structures and approaches to pricing may be required as a core demand reduction option longer-term.</p>
11	Non-Household Retailer Activity	<p>We will be communicating with non-household water retailers to further reduce business use by incentivising change and enabling greater demand reduction delivery using smart meter data.</p> <p>This will likely be a combination of Thames-Retailer initiatives and on-site water efficiency delivery to install water savings devices and fix continuous flows, and a retailer-led water efficiency or continuous flow fix scheme, using our smart meter and analysis. Our Digital Data Service, plus bespoke water efficiency programme effort, would be aimed to provide Retailers with evidence of continuous flow and demand reduction opportunity, which would enable the Retailer to undertake their own engagement and/or water efficiency programme with business customers.</p>

Table 4: Feasible water efficiency intervention descriptions

57 The feasible metering options and the types of benefits associated with each option are shown in Table 5. This table also indicates whether an option was considered at WRMP19.

Option		Customer Side Leakage Reduction	Household Behavioural Use Reduction	Household Wastage Reduction	Non-Household Reduction	WRMP19 or New
1	Digital Engagement		Yes	Yes		New
2	Household Innovation and Tariffs		Yes	Yes		WRMP19
3	SHV – PMP		Yes			WRMP19
4	SHV - Optants		Yes			WRMP19
5	SHV – PSUP		Yes			WRMP19
6	Wastage Fix			Yes		WRMP19
7	Green Redeem		Yes			WRMP19
8	SBVs				Yes	WRMP19
9	Non-Household Continuous Flow Fixes				Yes	New
10	Non-Household New Tariff Structure				Yes	New
11	Non-Household Retailer Activity				Yes	New

Table 5: Feasible water efficiency intervention descriptions

Digital Engagement

58 Digital engagement will allow smart metered customers to have continuous access to their own water consumption data. At present household consumption data is provided to customers (where available) on request:

- Smart meter customers can request their historic and/or ongoing consumption data through our Providing Digital Media Data service
- Basic meter customers can request to see their historic meter readings

59 Digital Engagement will substantially improve on this system in two ways.

Digital Engagement Portal

60 We will create a digital engagement portal to enable customers to log on and access their smart meter data at their convenience. This will enable customers to easily track their

water consumption and cost each day, enabling them to identify areas where they can save water and on their bill.

61 It is envisaged that the portal will ultimately evolve to be similar to the gas and electric industry where customers can quickly see their consumption through the day. This may be from either:

- Logging on to the online portal
- Viewing their in-home display

Digital Engagement Advice

62 To assist customers with the interpretation of their smart meter data, Digital Engagement will also provide data assessment and advice. This will be an option which can be selected as part of the portal.

63 From being able to track both their water consumption and cost throughout each day, customers will then be able to identify areas where they could save water or money on their bills.

64 Digital engagement advice on the portal will:

- Identify which proportion of consumption may be a leak or internal wastage issue
- Identify peak periods of behavioural usage and recommend water saving tips
- Provide context of a customers' consumption impact on the environment and provide context for the environmental benefits for water saved
- Provide advice to find and fix leakage or wastage issues within the home
- Encourage customers to maintain their previous water savings by highlighting any subsequent increase
- Alert customers when they are entering the 'high use' category of consumption

Household Innovation and Tariffs

65 Household innovation and Tariffs encompasses a range of six activities:

- AMP8 Water Efficiency Innovation Trials – this is the most critical of the six solutions
- Eliminate Wastage
- Non-Potable Water Supplies
- Water Efficiency on BMAs and mBMAs
- Media campaigns
- New Water Efficiency Innovation

AMP8 Water Efficiency Innovation Trials (new for WRMP24)

66 The technology and approach to reduce household consumption through innovation is either emerging or yet to be developed. In AMP8, we will invest in trials of both emerging approaches and technology to test and demonstrate the most cost efficient and viable innovative solutions available to achieve long term, sustainable reductions in household consumption.

Eliminate Wastage (new for WRMP24)

67 This solution is to find innovative ways to understand and approach these customers to repair their wastage issues where they persist after smart metering, smart home visits, wastage fixes and digital engagement. This solution is key to reach our ambition to eliminate wastage by removing the majority of wastage from household properties.

Non-Potable Water Supplies

- 68 In WRMP24, we have considered schemes which are a combination of rainwater harvesting, stormwater harvesting and greywater recycling (see Appendix O for more detail on this water efficiency measure).

Water Efficiency on BMAs and mBMAs (new for WRMP24)

- 69 This solution involves conducting an SHV and, where required, a wastage repair on dwellings within revenue and non-revenue BMAs. This solution will specifically focus on those dwellings without a meter. This is a new option for WRMP24 regarding revenue BMAs.

Media campaigns

- 70 In WRMP19 intensive area based media campaigns (campaigns designed to raise awareness about water resources and water efficiency solutions in specific locations throughout our supply area) were designed with overarching messages that congratulated specific areas for saving water.
- 71 In WRMP24, we will revisit these campaigns to provide more focus to link water savings with environmental value and protection in the local area and include the promotion of local activities to help save water. Media campaigns in the shorter term will raise awareness of all Water Efficiency activity and assist to increase the take up of our specific water saving initiatives.

New Water Efficiency Innovation

- 72 Although we have an indication of the types of future household innovation, there are solutions that are yet to be conceptualised. Our new water efficiency innovation category includes these solutions and make an allowance in our plan for solutions that will be discovered and developed in the future.

Tariffs

- 73 Tariff charging to encourage water conservation can be implemented by reforming water rates, introducing surcharges or establishing penalties to deter high water or wasteful water practices. In WRMP24, we plan to introduce tariffs in 2035, once we have completed our PMP to ensure fairness in billing to customers.

Smarter Home Visits and Wastage Fixes

- 74 SHVs are offered to customers who are newly metered through the PMP, PSUP, or Optant programmes. Each metering type customer represents an individual feasible water efficiency option at WRMP24:
- SHV – PMP – an SHV is offered to those who are newly meter on the PMP (see Metering Feasible Options)
 - SHV - optant – an SHV is offered to those who are newly metered after opting to have a meter installed
 - SHV – PSUP – an SHV is offered to those who are newly meter on the PSUP (see Metering Feasible Options)

- 75 Where appropriate, all SHV customers are offered Wastage Fixes where they are appropriate following the SHV. The four feasible options are therefore considered together in this section.
- 76 An SHV includes a free home visit by one of our qualified staff to install water saving devices and provide personalised water saving advice to households. It includes an App which our advisors use to produce a tailored water savings report for every customer. This report helps customers to quantify their potential water, energy, and money savings from changing their water use behaviour in the home. SHVs are the most intensive and face-to-face communication we have with our customers about water use.
- 77 Wastage Fixes are offered to customers following an SHV if they are found they have a leaking toilet or tap.
- 78 In WRMP19, we also offered SHVs to unmeasured and basic metered properties. In WRMP24 the volume of unmeasured properties has drastically reduced as we approach the conclusion of our PMP and complete the majority of our PSUP installations in AMP8. Water Efficiency activity on the unmeasured and basic metered properties that remain is covered by Digital Engagement.

Green Redeem

- 79 Green Redeem is a scheme whereby customers are incentivised through non-financial offers to be more efficient with their water consumption.
- 80 It works by incentivising customers to use less water through awarding points that can be exchanged for money off vouchers, charity donations, prize draw entries and days out. We provide water reduction targets for customers based on their current usage and award points that may differ depending on whether they can reach their water saving target, whether they sustain the reduction in water usage and whether they exceed their target.

Smarter Business Visits

- 81 An SBV includes a free visit by one of our qualified staff to install water saving devices and provide personalised water saving advice to non-households.
- 82 Although we are no longer a retailer to business customers following the introduction of the non-household market in April 2017, non-household customers make up a significant proportion of demand in our supply area.
- 83 Each business type is identified by their Standard Industrial Classification (SIC) code to ensure the majority of business types can be allocated to one of the segments. The business type designations are:
- Agriculture
 - Business and Social Welfare
 - Chemical and Metal Goods Manufacturing
 - Defence
 - Education
 - Health
 - Hotels and Catering
 - Miscellaneous Manufacturing
 - Miscellaneous Administration

- Public Administration
- Retail
- Transport, Construction and Other

- 84 The benefits associated with SBVs are detailed in the Section - Water Efficiency Benefits.
- 85 The rate of smarter business through AMP8 will be as per WRMP24, with this rate also being maintained through AMP9. From AMP10 onwards SBV activity will reduce and will specifically target high usage/continuous flow locations evidenced by Smart Meter data.

Non-Household Continuous Flow Fixes

- 86 Continuous flows are typically evidence of a leak. Continuous flow is defined as where the flow rate does not drop to 0 l/hr every hour for 14 days. Continuous flow on an external meter indicates the customer either has leakage or wastage within their property.
- 87 With the rollout of our smart meters on non-households, we are able to use smart meter data to identify continuous flow and use this to help notify Retailers and business customers of potential customer side leakage (CSL) of external leaks or internal wastage. This has been piloted in AMP7 and initial results are very promising.
- 88 Continuous flow targeting can be performed, distinct from SBVs and metering, in order to prioritise those properties that are identified as having continuous flow of water. For this option, we have envisioned that a dedicated element of our SBV team would be added to prioritise the identification and reduction of continuous flow elements, and we will also be notifying and encouraging businesses to self fix any CSL.

Non-Household New Tariff Structure

- 89 In the NHH sector, water usage tariffs are envisioned to be brought in from AMP10 and onwards. These tariffs would look to implement higher cost rates for overuse of water in the commercial sector, in order to drive down demand. As with household tariffs, charge rates and usage requirements for each rate are yet to be determined.
- 90 The Retailer-Wholesaler Group (RWG) is currently working to simplify NHH tariffs. It is recognised that different NHH tariff structures and approaches to pricing may be required as a core demand reduction option longer-term. We will continue to work with the RWG on NHH tariff improvement, as well as investigate innovative NHH tariff options and pilot opportunities.

Non-Household Retailer Activity

- 91 PR24 will see the introduction of a new performance commitment on Business Demand Reduction.
- 92 Wholesalers will now need to take a lead role on NHH demand reduction delivery. The actual water efficiency interventions could be either wholesaler-led or in collaboration with Retailers. Our AMP7 NHH water efficiency activity is already delivering both of these activity types and has informed our proposed AMP8 work streams and demand reduction volumes.

93 Thames will be communicating with NHH water retailers to further reduce business use by incentivising change and enabling greater demand reduction delivery using smart meter data. This will likely be a combination of:

- Combined Thames-Retailer engagement and on-site water efficiency delivery to install water savings devices and fix continuous flows. These initiatives could be a mix of Thames and/or joint branded offers to business customers.
- A retailer-led water efficiency or continuous flow fix scheme, using our smart meter and analysis. Our Digital Data Service, plus bespoke water efficiency programme effort, would be aimed to provide Retailers with evidence of continuous flow and demand reduction opportunity, which would enable the Retailer to undertake their own engagement and/or water efficiency programme with business customers.

Scale of Water Efficiency

94 To assess the benefit and cost of the feasible water efficiency interventions, the number of water efficiency visits must be modelled. This is done by modelling the number of visits in each WRZ based on intervention type, intervention uptake rate and extent of metering.

Water efficiency intervention uptake rate

95 Water Efficiency Intervention Uptake Rates are based on the Water Efficiency Programme Uptake throughout AMP7. Table 6 summarises the rates applied to each intervention.

Feasible Intervention	Uptake Rate
Digital Engagement	<p>It is assumed that 75% of PSUP customers will engage with digital engagement and make cost savings due to them already having a meter and paying on a metered tariff.</p> <p>It is assumed that 25% of PMP unmeterable properties will engage with digital engagement in AMP8. This is assumed at a conservative level to ensure no double counting with the assumption that innovation in technology will allow some unmeterable properties to become metered in AMP10. It is further assumed that 50% of the remaining will engage in AMP9; this is considered an ambitious target.</p>
Housing Innovation and Tariffs	<p>Household innovation is dependent upon innovative solutions, many of which are emergent and not yet defined.</p> <p>The introduction of Tariffs is dependent upon sufficient smart metering penetration.</p>
SHV	<p>An uptake rate of 21.67% among high use customers (those who use more than 500l/d) who are offered an SHV is assumed. This value is based on the mean of:</p> <ul style="list-style-type: none"> • recently available uptake rate data of 13.33% • an aspirational uptake rate of 30%. <p>Whilst the uptake rate of high users is consistent across the three customer streams who are offered SHVs, the distribution of high and normal (usage of less than 500l/d) customers varies between PMP, Optants and PSUP:</p> <ul style="list-style-type: none"> • Progressive Smart Metering programme – high user proportion assumed to be 29.39%

Feasible Intervention	Uptake Rate
	<ul style="list-style-type: none"> • Metering optants - high user proportion assumed to be 10.73% • PSUP – high user proportion assumed to be 20.40%
Wastage Fix	<p>It is assumed that 10% of SHVs will identify a wastage repair. Of these wastage repairs it is assumed that:</p> <ul style="list-style-type: none"> • 72% are from toilets • 14% are from taps <p>The Wastage Fix programme specially targets toilet and tap fixes.</p>
Green Redeem	<p>It is assumed that 22% of Smarter Homes Visits will result in a Green Redeem sign up.</p>
SBV	<p>SBVs are offered both through lettering and groundwork contact with the businesses. The assumed rate of uptake is 10% resulting from both engagement methods. This figure is based on our lettering in AMP7 to 9,854 businesses.</p>
Non-Household Continuous Flow Targeting	<p>Continuous flow targeting can be performed, distinct from SBVs and metering, in order to prioritise those properties that are identified as having continuous flow of water. For this option, we have envisioned that a dedicated element of our SBV team would be added to prioritise the identification and reduction of continuous flow elements, and we will also be notifying and encouraging businesses to self-fix any CSL.</p>
Non-Household Tariffs	<p>The Retailer-Wholesaler Group (RWG) is currently working to simplify NHH tariffs. It is recognised that different NHH tariff structures and approaches to pricing may be required as a core demand reduction option longer-term. We will continue to work with the RWG on NHH tariff improvement, as well as investigate innovative NHH tariff options and pilot opportunities.</p>
Non-Household Retailer Activity	<p>We will be communicating with NHH water retailers to further reduce business use by incentivising change and enabling greater demand reduction delivery using smart meter data.</p>

Table 6: Water Efficiency Uptake Rates

- 96 In WRMP19, we also offered SHVs to unmeasured and basic metered properties. In WRMP24 the volume of unmeasured properties has drastically reduced as we approach the conclusion of our PMP and complete the majority of our PSUP installs in AMP8. Water Efficiency activity on the unmeasured and basic metered properties that remain is covered by Digital Engagement.
- 97 For Green Redeem, the direct sign-up rate is based on the percentage of sign-ups from SHVs during July 2021. The actual range is between 22-40%, however 22% is used as a more conservative figure.
- 98 Water Efficiency Intervention Uptake Rates are based on the Water Efficiency Programme Uptake during the first two years of AMP7.

Total Number of Water Efficiency Visits

- 99 The number of water efficiency visits and wastage repairs that can be conducted in each DMA is calculated as indicated in Figure 5 to Figure 7.

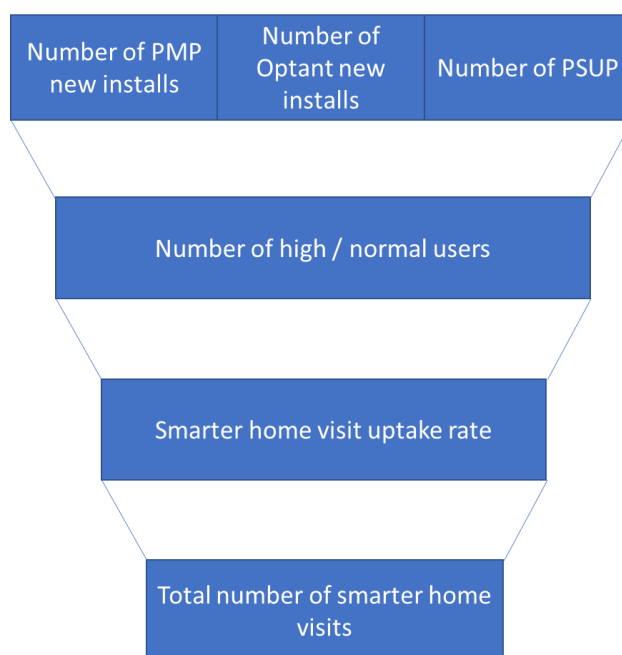


Figure 5: Total number of Smarter Home Visits

Note: the uptake rate of SHVs varies among PMP, Optants and PSUP (see Section - Water efficiency intervention uptake rate for more details).

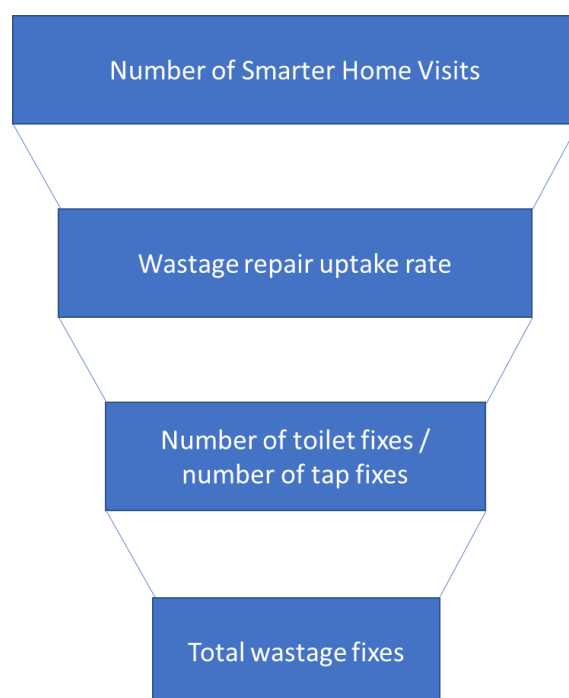


Figure 6 Total number of household Wastage Fixes

Note: See Section - Water Efficiency Benefits for the breakdown of repairs resulting from SHVs and associated Wastage Fixes.

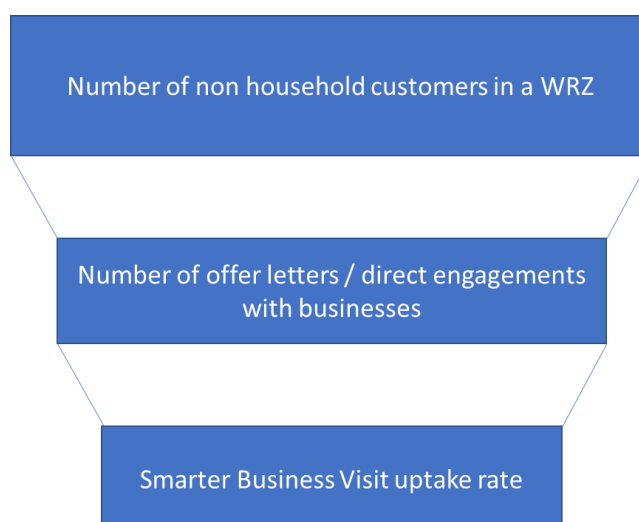


Figure 7: Total number of Smarter Business Visits

Note: See Section - Water efficiency intervention uptake rate for more details on the uptake rate of SBVs

Water Efficiency Benefits

100 Water efficiency provides demand management benefit through usage and wastage reduction. The leakage savings provided through metering (for the combined metering and water efficiency interventions) are attributed to the metering benefit (see Section - Metering). Table 7 summarises the benefits associated with each intervention.

Feasible Intervention	Benefit
Digital Engagement	See details in Section - Digital Engagement below.
Household Innovation and Tariffs	The benefits of this option are modelled in the form of household consumption reduction. The benefits of household innovation and tariffs have been presented as a single option.
SHV	<p>For all three streams of customers offered SHVs (PMP, Optants and PSUP) the assumed resulting savings from customer behavioural change are:</p> <ul style="list-style-type: none"> • High users are assumed to save 70.5 l/p/d • Normal users are assumed to save 39.4 l/p/d – however normal users from metering optants are not targeted for SHVs <p>The savings associated with wastage fixes resulting from SHVs are detailed below.</p>
Wastage Fix	<p>The assumed reduction in wastage associated from fixes resulting from SHVs is:</p> <ul style="list-style-type: none"> • Toilet repair - 234 litres per day • Tap repair – 136 litres per day
Green Redeem	A 3% usage reduction is assumed
SBV	2,724 l/p/d – this is based on the average savings achieved from over 10,000 SBVs up to July 2021.
Non-Household Continuous Flow Targeting	Benefits for continuous flow have been estimated with expert judgement. See below for more details

Feasible Intervention	Benefit
Non-Household Tariffs	Benefits for tariffs have been estimated with expert judgement.
Non-Household Retailer Activity	Benefits for retailer activity have been estimated with expert judgement.

Table 7: Water Efficiency Benefits by Intervention

Digital Engagement

- 101 We have assumed that with Digital Engagement, customers will reduce their behavioural use and therefore their overall consumption following PSUP. We have based these savings on Anglian Water's smart meter study which showed PSUP result in 3% reduction in measured consumption. Without access to the detail of this study, we have been conservative and applied two thirds of this value, or 2% reduction to basic meter measured consumption. This assumes customers will still make the wastage savings but also greatly reduce their behaviour driven use in response to Digital Engagement.
- 102 Digital Engagement is critical to engage a wider proportion of our customers in the long term in a cost efficient and effective manner. It is a key option for meeting ambitions for per capita consumption (PCC) reduction and wastage reduction.
- 103 Digital Engagement will build upon the benefits provided by smart metering (PMP, PSUP and those customers who have opted to have a meter installed.) The access to continuous water consumption data is an improvement on what is currently available for customers.
- 104 The consumption data and advice provided through the digital engagement portal will enable easier identification of the which parts of consumption may be from leakage or internal wastage. The advice will further enable customers to find and fix leakage and wastage issues which their usage data suggests may exist.
- 105 The details of each of these options are described below.
- 106 The granularity of the data will also help customers to better understand peak usage periods and adjust their behaviour to save water. It will also alert customers when consumption is increasing, encouraging them to maintain existing savings and if their water usage is entering the "high use" category.

Household Innovation and Tariffs

- 107 The benefits of household innovation and tariffs have been presented as a single option. Compared to other water efficiency options, less detail is available on the individual solutions which make up this option. This is expected due to many of the options being innovative and new.
- 108 As innovative solutions are trialled, the benefits that they produce will become clearer.
- 109 Tariff charging to encourage water conservation can be implemented by reforming water rates, introducing surcharges or establishing penalties to deter high water or wasteful water practices. In WRMP24, we plan to introduce tariffs in 2035, once our PMP is complete to ensure fairness in billing to customers.

Smarter Home Visits

- 110 The average benefit following an SHV to current measured household properties is based on the statistical analysis, conducted by Thames Water's Decision Support Modelling

Team. For existing metered customers who received an SHV, the reduction in consumption was determined by comparing metered consumption before and after an SHV.

- 111 The average benefit following an SHV to a metered high use (more than 500 l/d) property has been shown to be 70.51 litres per day. For normal use properties (less than 500 l/d) the figure is 37.94 litres per day. These figures are based upon the best available recent data.

Wastage Fixes

- 112 The Wastage Fix solution avoids double counting with the wastage savings attributed to Metering due to the degree of wastage picked up by metering compared with the wastage detected by Water Efficiency. That is, the volume of water lost due to a leaky toilet/tap may not prompt a metered customer to call out a plumber based on their meter readings alone. Consequently, metering captures significant wastage volumes on a proportion of metered properties and often a 'leaky toilet/tap' may be overlooked. However, following the water efficiency wastage campaign, the volume of water lost by each leaky toilet/tap can be captured and repaired.
- 113 The percentage of Smart Home Visits which have wastage fixes is assumed at 10% and is based on available data for the year 2021/2022.
- 114 The split of wastage repairs between toilets and taps repairs has been updated based on recently available data, as have the savings associated with the repairs.

Green Redeem

- 115 Behavioural change - overall reduction in water usage due to incentive of rewards via the scheme – this is assumed to be a 3% reduction.

Smarter Business Visit

- For WRMP24 it has been assumed that the average saving resulting from an SBV is 2,724 litres per day. This is based on the average savings achieved from over 10,000 SBVs up to July 2021. In comparison with WRMP19, the benefits from SBVs have doubled. In WRMP19, we assumed each SBV saved 1,316 litres per day. This was based on the average savings from SBVs of 350 businesses up to 2017. In the five years since, we have increased our SBVs to over 10,000 and found that the average saving from business is significantly higher. Due to the substantial increase in the sample size used for this analysis we are confident in the reliability and deliverability of our WRMP24 saving.

Continuous Flow Targeting

- 116 Benefits for continuous flow have been estimated with expert judgement. Further potential for continuous flow fixes can be realised after AMP9, as further metering data is available to us for targeting. Potential will likely trial off in later AMPs as get closer to the full potential of the option.

Tariffs

- 117 Benefits for tariffs have been estimated with expert judgement. The option is expected to be carried out starting from AMP10, with savings expected to increase until AMP12.

Retailer Activity

- 118 Benefits for retailer activity have been estimated with expert judgement. Savings from this option are expected to increase over time, beginning to plateau by AMP12.

Water Efficiency benefits decay

For household interventions

- 119 The life of all water efficiency options has been assumed to be 7 years based on the manufacturer warranty for devices installed. After 2030, this will increase to 10 years based on the assumption that the government will require an improvement in technological reliability as they promote water efficiency.
- 120 Up until 2030, it is assumed that customers will maintain their savings/fix their own toilets in 65% of cases. This is assumed to then increase to 90% beyond 2030 due to Digital Engagement & Government campaigns.

For non-household interventions

- 121 The life of all water efficiency options has been assumed to be 7 years based on the manufacturer warranty for devices installed. After 2025, this will increase to 10 years based on the assumption that the government will require an improvement in technological reliability as they promote water efficiency. All commercial fittings should also last longer than 3 years.
- 122 It is assumed that 75% of non-household properties will pay to maintain they own savings up till 2030. After 2030 this increases to 90% of non-household properties.

Leakage Reduction

- 123 The demand management options screening process identified three feasible leakage reduction interventions. The interventions are described in summary in Table 8. A more detailed description of each option is provided in the following sections.

No.	Feasible Intervention	Description
1	Advanced District Meter Area Intervention (Advanced DMAi)	Advanced DMAi employs capital and operational activity to better understand water demand and pinpoint leaks within a DMA.
2	Leakage Innovation	Leakage Innovation includes activities that provide a new and cost efficient way to reduce leakage on our distribution mains network. Leakage Innovation is designed to be more cost efficient than Mains Rehabilitation.
3	Mains Rehabilitation	Water mains rehabilitation is a traditional and long term sustainable option to reduce leakage from our distribution mains network.

Table 8: Feasible leakage reduction intervention descriptions

- 124 The feasible leakage reduction options and the types of benefits associated with each option are shown in Table 9. This table also indicates whether an option was considered at WRMP19.

Option		Leakage Reduction	Household Behavioural Use Reduction	Household Wastage Reduction	Non-Household Reduction	WRMP19 or New
1	Advanced District Meter Area Intervention (Advanced DMAi)	Yes				New
2	Leakage Innovation	Yes				New
3	Mains Rehabilitation	Yes				WRMP19

Table 9: Feasible leakage reduction options

Advanced District Meter Area Intervention

- 125 Advanced District Meter Area Intervention (Advanced DMAi) is a new option for WRMP24. It has evolved from our experience in implementing DMA Enhancement from WRMP19 and Enhanced Active Leakage Control from WRMP14. Several feasible leakage demand management options from WRMP19 now fall under the remit of Advanced DMAi. Where this is the case, it is noted below.
- 126 Advanced DMAi employs capital and operational activity to better understand water demand and pinpoint leaks within a DMA. The Advanced DMAi process is summarised in Figure 8.

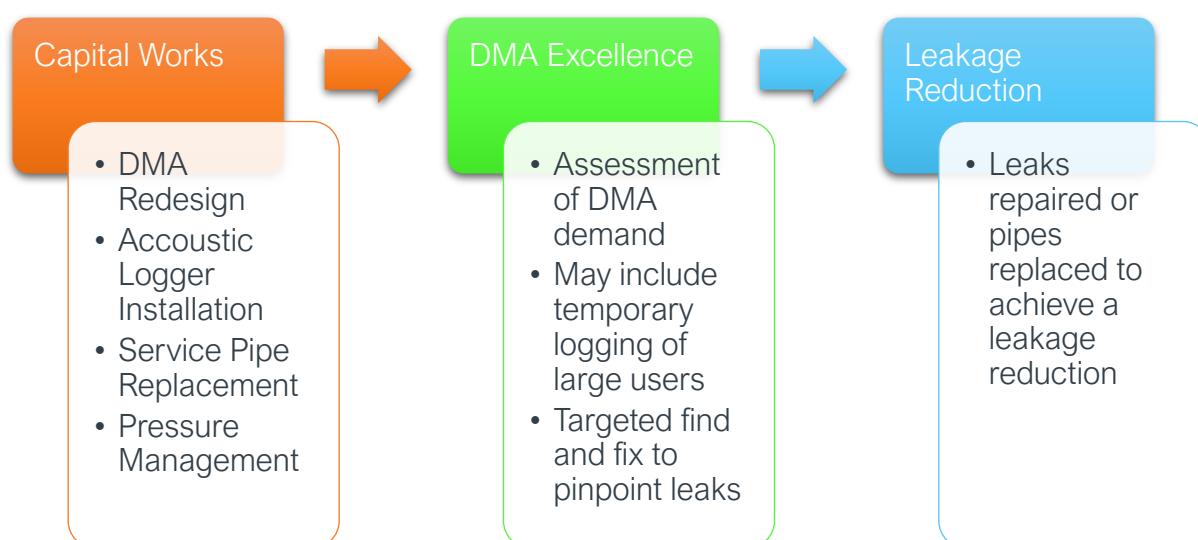


Figure 8: Advanced District Meter Area Intervention (Advanced DMAi) process illustration

Capital Works Component

DMA Redesign

127 DMA Redesign is a core component of Advanced DMAi and involves DMA splitting and reconfiguration. It is required because some existing DMAs are particularly large and/or do not have configurations that make it efficient to detect and pinpoint leaks. Other DMAs are 'unavailable' for leakage detection due to inherent network configuration issues. For example, a broken district meter located on a major London bus lane may not be accessed for many years due to the substantial traffic management required. As a result, the affected DMAs would not be available for leakage detection and leaks may run undetected.

128 DMA Redesign allows for reconfiguring DMAs regarded as having "poor" health towards good "health". The redesign aims to resolve long standing network issues and ensure key assets are more readily accessible for maintenance and repair when required. This will ensure DMAs will remain available and operable for leakage detection and repair. The three factors determining the health of a DMA (as illustrated by Figure 9) are:

- The number of district meters within the DMA. More meters increase the risk of a DMA becoming unavailable for monitoring purposes if a meter fails. Meters allow for calculation of inflows and outflows to a DMA. A DMA becoming unavailable makes understanding the mass balance difficult. Fewer inflows/ outflows and by extension district meters in a DMA contributes to good DMA health
- The number of properties within the DMA. The more properties in the DMA, the harder it becomes to pinpoint leaks because there are more connections. Limiting the number of properties within a DMA contributes to good DMA health
- The length of pipe network within the DMA. The greater the length of pipework the harder it becomes to pinpoint leaks. Limiting the length of pipework within a DMA contributes to good DMA health

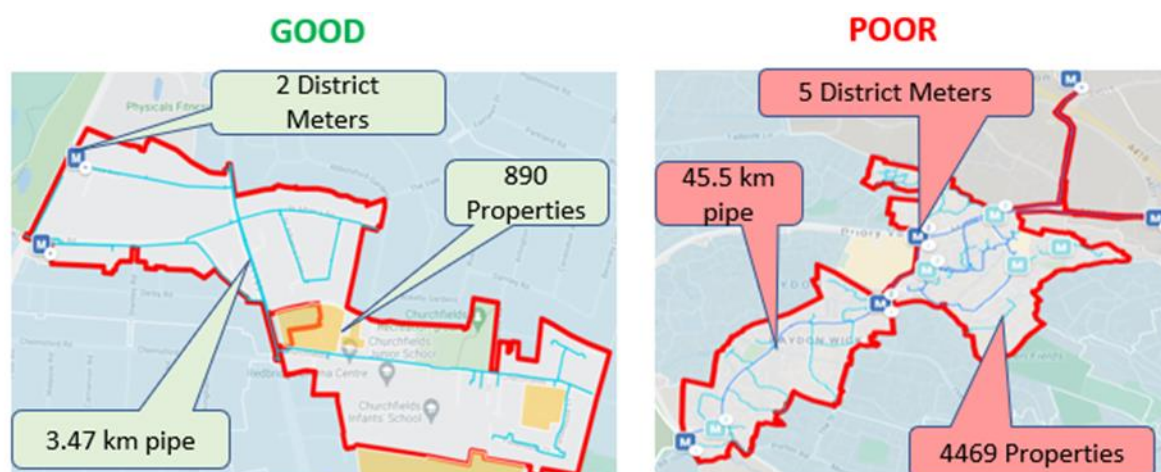


Figure 9: Illustration of DMA design

Other Capital Works

129 The capital works component of Advanced DMAi also includes:

- Acoustic logger installation
- Service pipe replacement
- Pressure management: install new pressure management schemes within individual DMAs at sub-DMA level

Acoustic logger installations

130 The installation of acoustic loggers enables better leakage detection.

Service pipe replacement

131 The replacement of service pipes connecting our water distribution mains with customer properties.

Pressure management

132 Pressure Management refers to the reduction of excess pressure and better management of pressure fluctuations within the water mains network to reduce the rate of leakage. To achieve this, Pressure Reducing Valves are installed within a DMA to reduce pressure within the area to a targeted level.

133 Pressure management was a feasible leakage demand management option at WRMP19. At WRMP24 it is now part of the wider Advanced DMAi option. The suitability of a DMA for a pressure management scheme will be assessed as part of this option.

Operational Works Component – DMA Excellence

134 DMA Excellence is the operational component of work which follows from the capital component of DMA Redesign. It involves a detailed assessment of demand within a DMA that considers:

- Assets
- Properties
- Customer water demand (this may include temporary logging of large customers)

135 Following this assessment, leaks are pinpointed using both traditional and innovative find and fix techniques. At WRMP19 this was referred to as “DMA Enhancement”.

Leakage Reduction Component

- 136 The final stage of Advanced DMAi is to fix the leaks identified to realise the leakage reduction.

Advanced District Meter Area Intervention Costs and Benefits

- 137 It has been assumed that Advanced DMAi is 65% capex and 35% opex costs. This is based on our activity during AMP7.
- 138 It is assumed that 1/3 of leakage reduction achieved in an AMP period will reoccur within 15 years of the associated leakage fixes. This is based on the expected life of pressure management interventions, which are a subcomponent of Advanced DMAi intervention.
- 139 The cost of resolution of leakage reoccurrence is assumed to be 25% of the original cost. This is based upon the cost of recurrence during AMP7. Further investment will then be needed within 40 years. This is in line with what is expected for supply pipe repairs (i.e. leakage on supply pipework within a customer's property boundary).

Leakage Innovation

- 140 Leakage Innovation includes activities that provide a new and cost efficient way to reduce leakage on our distribution mains network. Leakage Innovation is designed to be more cost efficient than Mains Rehabilitation. Leakage Innovation includes activities that we are currently aware of and those that will be developed in the future.
- 141 Activities in leakage innovation include (but are not limited to):
- Adoption of keyhole repair techniques
 - Advanced technologies for precise and accurate leak location – acoustics
 - Advanced technologies for precise and accurate leakage location – tracer gases
 - New quality or design of joints so they are leak free – product development
 - Using technologies for repairing pipes from the inside
 - Enhanced detection equipment or innovation in detection
 - Enhanced repair methods or innovation in repair methods
- 142 An important part of developing technologies and approaches to leakage reduction and repair that are currently emerging or not sufficiently developed is investment in trials of the technology and approached throughout AMP8. This investment is crucial to test and demonstrate the most cost effective innovative solutions available prior to their full implementation in later AMPs.

Leakage Innovation Costs and Benefits

- 143 Leakage innovation is designed to be more cost efficient than Mains Rehabilitation. It has been costed at 50% of the ml/d cost of Mains Rehabilitation. Long term innovation is costed at 50% of the MI/d cost of median Main Rehabilitation (the cost of Main Rehabilitation in AMP11). This is based on the assumed efficiency that will be achieved through leakage innovation approached compared with traditional mains rehabilitation.

Mains Rehabilitation

- 144 Water mains rehabilitation is a traditional and long term sustainable option to reduce leakage from our distribution mains network. We are responsible for over 31,000km of

water mains across London and Thames Valley. A lot of London's water mains are between 100 and 150 years old and although the original cast iron mains have served customers well, the increase in road traffic, corrosive soil conditions and ground movement mean they are more likely to leak or burst. We are therefore investing heavily in replacing the original mains.

Length of Mains Rehabilitation

- 145 To date, the approach to mains rehabilitation has been based on results combining national research, Thames Water experience over the last 20 years, experience gathered from other water companies and discussions with manufacturers.
- 146 However, since 2011, an approach to target pipe condition as well as performance has been investigated to ensure mains replacement is targeted to deliver sustainable benefits. This means mains replacement targeting is being done at street and 'superstring' level. Superstrings are pipes connected to each other of the same age, material and diameter. By analysing the performance of each pipe, those pipes within a DMA that are performing the worst can be targeted.
- 147 The distribution of mains replacement at pipe level is first modelled in the Distribution Mains Model. The output of this model Provides us with the costs and benefits for mains rehabilitation.

Mains Rehabilitation Costs and benefits

- 148 The benefits of mains replacement are derived at DMA level based upon leakage reduction.
- 149 The costs of mains replacement are derived at DMA level based upon:
- Size and length of main to be replaced and the split of techniques (open cut, slip lining, pipe bursting and directional drilling)
 - For London, costs are based on costed schemes, borough/cost zone cost models where provided or 4 zone cost models. In Thames Valley, costs are based on inner city and outer city cost models

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