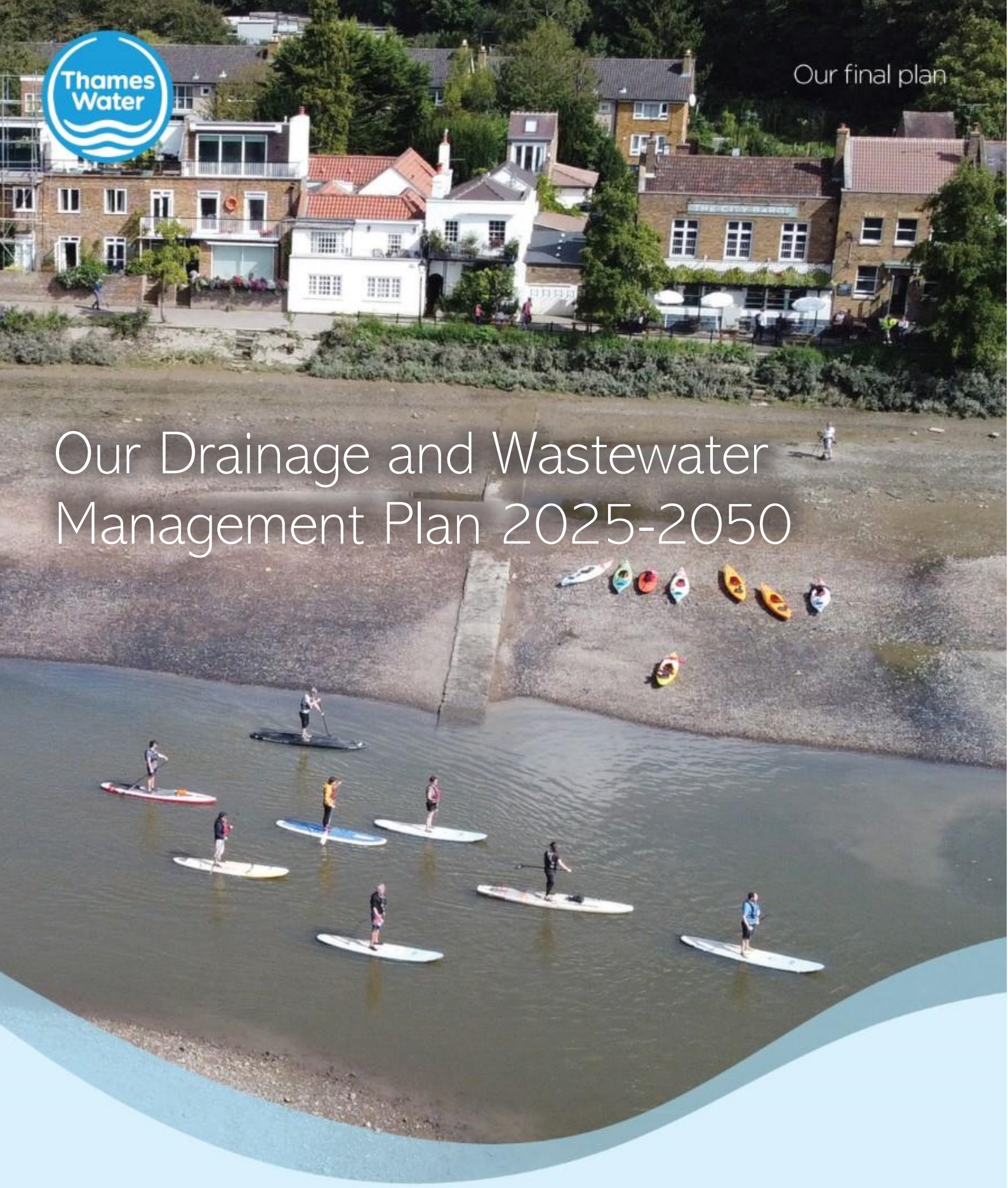

Our final plan

Our Drainage and Wastewater Management Plan 2025-2050

Technical Appendices
Appendix I – Risk and Uncertainty

May 2023

Contents

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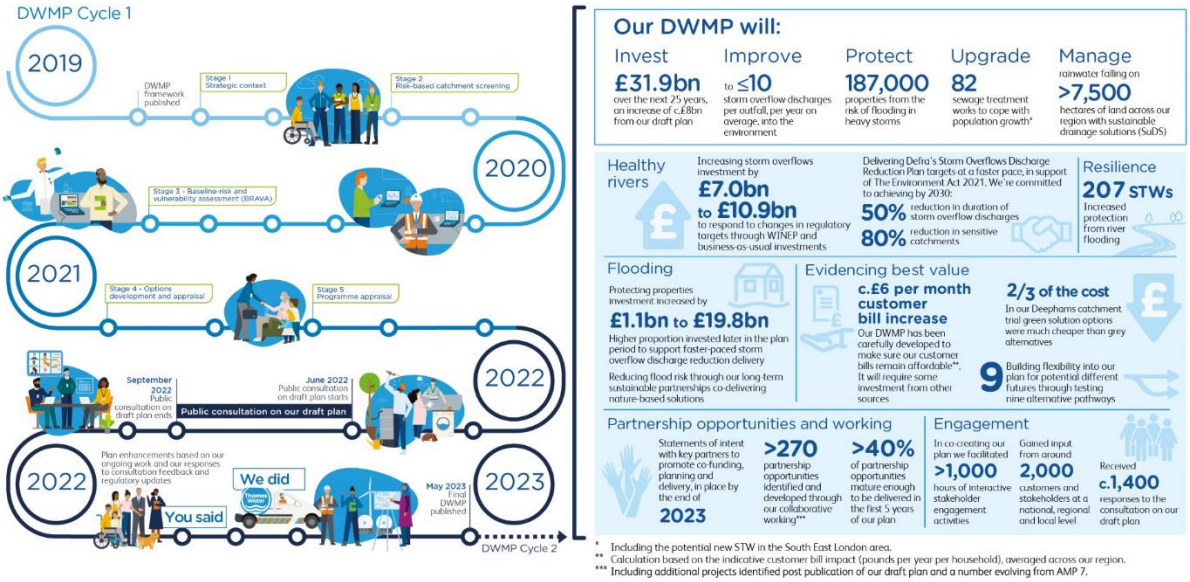
Preface

We're proud to present our first Drainage and Wastewater Management Plan (DWMP) and encouraged by the level of positive feedback we've received. Over the last four years, we've engaged and worked collaboratively with around 2,000 of our customers and stakeholders, to deepen our shared understanding and develop new ways to manage drainage and wastewater across our region. We illustrate our DWMP Cycle 1 and its headlines below.



We've progressed and enhanced our DWMP since we published it for public consultation in June 2022. We were pleased to receive lots of positive comments and support on the quality and ambition of our draft plan as well as useful ideas for making our final DWMP even stronger.

We've updated our draft plan based on our ongoing DWMP work, regulatory updates and our responses to the consultation feedback wherever possible*. Our updates include providing more detail where you felt it was needed and creating new appendices to answer technical queries. For more details on how we've progressed our final plan and responded to the consultation feedback, please see our Non-technical summary and You said, We did Technical appendix.

* Some public consultation feedback didn't require further action or wasn't relevant to the DWMP process. Other feedback was relevant to future DWMP planning cycles and will be used to inform this work.

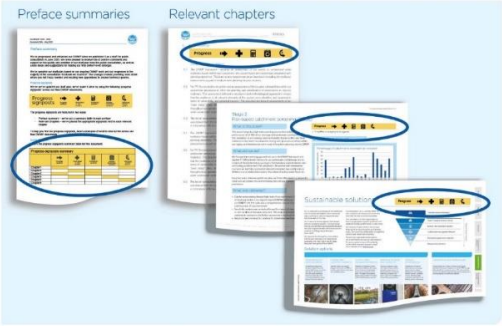
Progress signposts

We want to make it easy for you to see what's changed. You can spot all the places we've updated our draft plan with our 'progress signposts' which we've used across our final DWMP documents.

Here's where they'll be:

- Preface summaries – we've put a summary table in each document's preface (excluding Summary documents and CSPs)
- Relevant chapters – we've placed the appropriate signposts next to each relevant chapter (including Summary document and CSPs)

To help you find our progress signposts, here are examples of what to look out for:



Progress summary table

The progress signposts summary table for the chapters in this document is outlined below. We've used orange cells to indicate where our draft plan has been updated with progress.

Progress signposts summary: Technical Appendix I Risk and Uncertainty	Progress updated	More detail or new content	Number(s) updated	Delivery timeframe updated	Informing DWMP cycle 2
1. Our Drainage and Wastewater Management Plan (DWMP)					
2. Applying uncertainty analysis to our DWMP					
3. Applying uncertainty analysis to our Preferred Plan					
4. Conclusions					

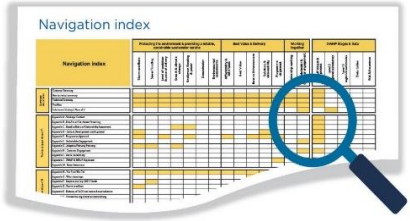
Key DWMP content

This document specifically includes the following key DWMP content:

- DWMP stages and data:
  - Risk & Assurance

Navigating our documents

To help you navigate around our final DWMP document suite and find where key DWMP content features, we've placed a Navigation index at the back of this document.



Executive Summary

A DWMP is a long-term costed plan that is focused on partnership working, which sets out the future risks and pressures for our drainage and wastewater systems. It identifies the actions that are required to make sure we can continue to deliver our services reliably and sustainably, whilst also achieving positive outcomes for our customers, communities, and environment.

Our DWMP provides our best assessment of what the future might hold and produces our best assessment of the solutions we need, to address potential future catchment risks to our drainage and wastewater treatment systems. Acknowledging that there is uncertainty in our predictions, we have tested how sensitive our estimates and forecasts are to variation in the input parameters we have used when deriving our preferred plan.

Our preferred plan prioritises delivery of measures that:

- Reduce storm overflow discharges, providing environmental improvements to meet new obligations under the Environment Act more quickly
- Ensure compliance of our sewage treatment works in response to future growth pressures
- Focus on maximising the benefit from retrofitting surface water management solutions to reduce the risk of sewer flooding.

We have developed adaptive pathways to test our plan and ensure our investment is focussed on no- or low-regret measures to manage future pressures. We have also incorporated site-based adaptive plans for two of our largest sewage treatment works. This is detailed in our Adaptive Planning Technical Appendix[1].

The aim of this Risk and Uncertainty Technical Appendix is to assess how sensitive our preferred plan may be to cost uncertainty in developing our options. We have considered risk and uncertainty to wider, longer-term drivers, such as growth and climate change, separately in developing adaptive pathways. We have also developed a separate appendix covering delivery risks around our ambitious SuDS programme[2]. This technical appendix therefore specifically explores how sensitive our preferred plan is to:

- Cost of the solutions proposed (cost uncertainty)
- The level of design undertaken when developing our solutions (design maturity)
- The complexity of implementing the solutions proposed (solution complexity)

A high-level assessment of the uncertainty arising from our costs, design maturity and anticipated typical project complexity has been undertaken. Our DWMP has a high level of cost uncertainty due to the strategic nature and early stage of concept design of the solutions developed for this first cycle of planning.

We have followed an industry standard approach which recognises this and includes an allowance (optimism bias) for cost uncertainty. In our options assessment this is approximately 33% of the

[1] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-g-adaptive-pathway-planning.pdf
[2] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-r-delivery-of-suds-and-nature-based-solutions.pdf

option cost, due to the strategic nature and early stage of concept design of the solutions developed for this first cycle of planning.

The level of cost uncertainty is typical of strategic plans similar to the DWMP in their first cycle of planning. We will improve our cost certainty by following our business-as-usual process of developing schemes from strategic planning into delivery.

We have then looked at how much this might change, assuming the same option scope, with a more mature design in future. This suggests that the additional cost uncertainty of our plan is of the order of 0 to -5%, or +£0 to -£1.0bn of our overall £31.9bn DWMP construction cost.

However, as this method of assessment is applicable to individual projects rather than long-term investment programmes it is considered that it underestimates the uncertainty. In the absence of an appropriate tool to determine this further, our expert opinion is that the cost uncertainty of the plan is of the order of +10% to -10%, or +£3.2bn to -£3.2bn, of our overall £31.9bn DWMP construction cost.

There are further elements of uncertainty that we cannot robustly quantify at this time. These include the interaction that surface water systems have with the foul network. We therefore have a development programme to include enhancement of our understanding by improving our mapping and modelling for these, and some other, elements. This will reduce uncertainty (and potentially cost) as well as increase confidence in the development of our plans for future DWMP cycles.

1 Our Drainage and Wastewater Management Plan (DWMP)

Our DWMP vision

1.1 Working in partnership to co-create a 25-year plan for drainage and wastewater that sustainably benefits communities and the natural environment in our region.

Our DWMP aim

1.2 To identify future catchment risks to our drainage and wastewater treatment systems and develop sustainable, efficient solutions to address them.

What we're trying to achieve

1.3 Protection of our environment, looking after the health of our rivers (aiming for zero harm from spills), being resilient to the risks of flooding and generating wider benefits to the communities we serve. DWMP outcomes for:

- Customers and communities – fair charges, improved health and wellbeing, increased amenity, and a resilient service
- Drainage and wastewater services – reduce sewer flooding and achieve 100% Sewage Treatment Works (STW) compliance
- The environment – increase biodiversity, zero harm from storm discharges, environmental net gain

Description of the plan

1.4 A DWMP is a long-term costed plan that is focused on partnership working, which sets out the future risks and pressures for our drainage and wastewater systems. It identifies the actions that are required to make sure we can continue delivering our services reliably and sustainably, while also achieving positive outcomes for our customers, communities, and environment.

1.5 Our long-term, collaborative plan aims to ensure a resilient and sustainable wastewater service for the next 25 years and beyond.

Framework

1.6 This is the first time we've produced a long-term plan for our wastewater business. Based on the national DWMP framework[3] that was developed jointly by regulators and industry bodies including Ofwat, Defra, the Environment Agency, Water UK, Welsh Government, Natural Resources Wales, Consumer Council for Water, Association of Directors of Environment, Economy, Planning and Transport and Blueprint for Water, the DWMP creates a roadmap for how we adapt our wastewater service to cope with future challenges.

[3] https://www.water.org.uk/wp-content/uploads/2021/10/Working_Together_an_overview_of_Drainage_and_Wastewater_Management_Plans.pdf

2 Applying uncertainty analysis to our DWMP

Progress

Addressing uncertainty

2.1 Uncertainty analysis is considered within the programme appraisal (PA) or fourth stage of the DWMP; the key stages of which are shown below in Figure 2 1.

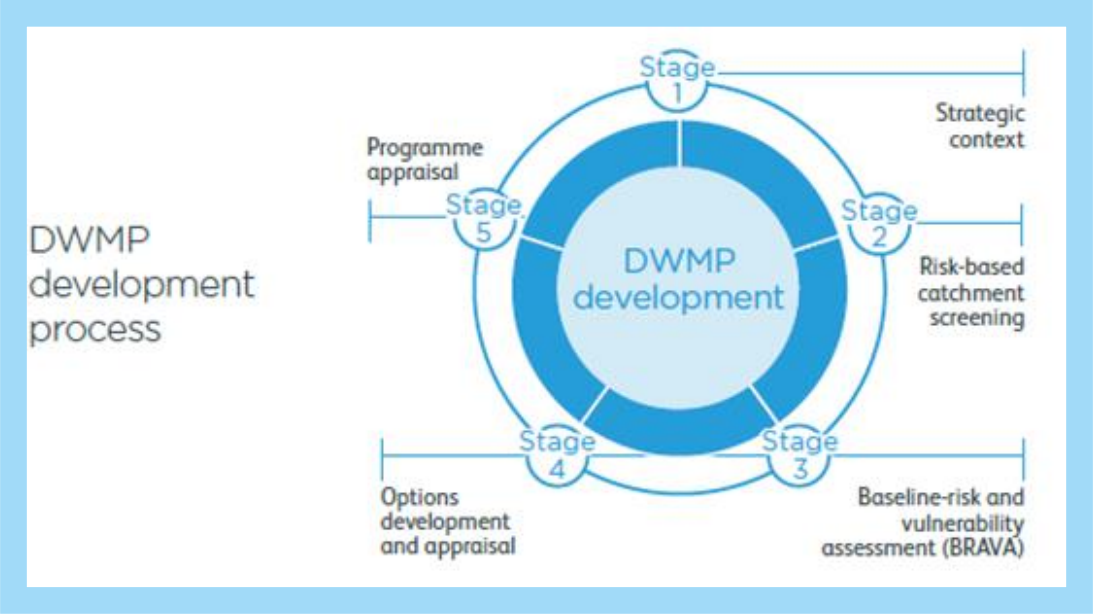


Figure 2-1 Key stages in the DWMP development process

2.2 Our preferred plan focuses on maximising the retrofit of sustainable drainage solutions in our London catchments, and in our catchments outside of London, removing unwanted flow such as groundwater and surface water runoff through misconnections.

2.3 We cannot accurately predict what the future may hold, but we can use current tools and forecasts to produce our best estimate of how we anticipate our wastewater systems will be affected by future scenarios including population growth and climate change. We can also estimate the scale and quantum of solutions we need to address these future risks. Acknowledging that there is uncertainty in our forecasts, we can test how sensitive our estimates and forecasts are to changes in the input parameters we have used.

2.4 Defra's Guiding Principles[4] focus primarily on the assessment of long-term risks through the BRAVA[5] process, but clearly point to the DWMP supporting an informed debate about the acceptability of different levels of risk.

2.5 The DWMP planning process sets out a framework within which we, and our stakeholders, can explore future uncertainties, particularly with respect to climate change and population growth, and how they impact our long-term plans and decision making. The framework

[4] https://www.gov.uk/government/publications/drainage-and-wastewater-management-plans-guiding-principles-for-the-water-industry/guiding-principles-for-drainage-and-wastewater-management-plans
[5] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-c-baseline-risk-and-vulnerability-assessment-and-problem-characterisation.pdf

highlights the assessment of uncertainties particularly in relation to complex solutions and where significant future uncertainties are identified. It considers the benefits of implementing different solution types (or sizes of the same solution) over time to address capacity constraints as and when they are projected to materialise.

2.6 Our assessment of risk and uncertainty also informs the development of programme level adaptive pathways. These provide a range of delivery trajectories that account for future uncertainty associated with external parameters, such as climate change and growth, which are used to produce our forecasts of the future. For example, growth may be less than we have considered which would delay the need for treatment works upgrades being required. Technical Appendix G[6] considers adaptive pathway planning for our preferred plan.

- The aim of this Risk and Uncertainty Technical Appendix is to assess how sensitive our preferred plan may be to uncertainty due to:
- Cost of the solutions proposed (cost uncertainty)
- The level of design undertaken when developing our solutions (design maturity)
- The complexity of implementing the solutions proposed (solution complexity)

2.7 These three key risk factors are discussed in the following sub-sections.

Cost uncertainty

2.8 Our options development and appraisal (ODA) process has generated costs using our Engineering Estimation System (EES). Our EES holds actual costs from delivered projects as well as market cost estimates for key elements of our options. These provide our base costs, built up from our primary quantities.

2.9 All costs are presented to a 2020-21 price base as specified by Ofwat.

2.10 Cost and design uncertainty are related. Cost uncertainty decreases as the solution definition increases. Figure 2-2 is a demonstration of the four steps in cost uncertainty assessment and a graphical representation of how the cost accuracy improves (and uncertainty decreases) based on the design maturity.

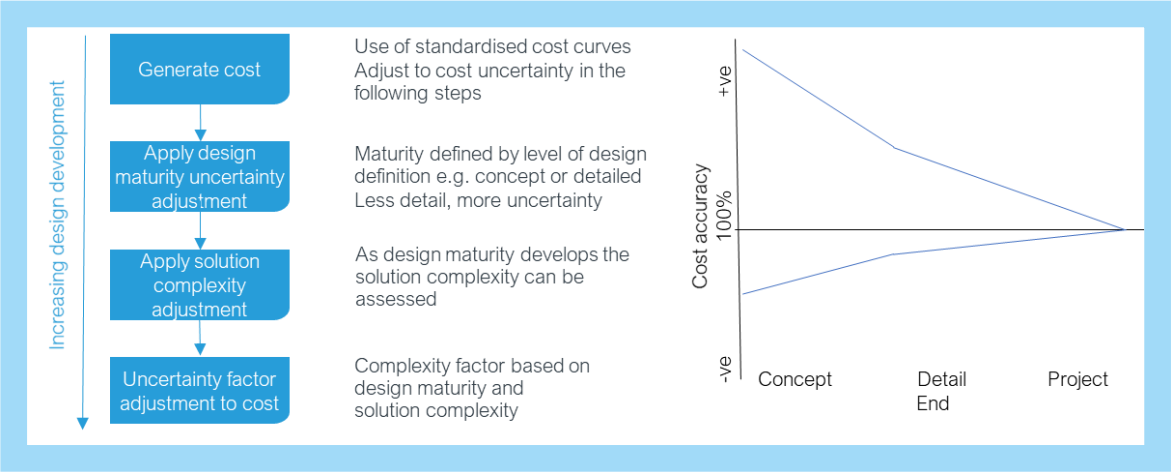


Figure 2-2 Cost uncertainty assessment

[6] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-g-adaptive-pathway-planning.pdf

2.11 Furthermore, as our DWMP is a long-term strategic plan, which informs our short-term delivery plan, our process is inherently less certain.

2.12 As this is the first cycle of DWMP planning, we have also had to utilise costing approaches applicable to the strategic scale of our plan. Our DWMP will be repeated in future cycles and this iterative process will result in the cost approaches becoming more mature and improving in accuracy.

Design maturity

2.13 Design maturity reflects the level of development that has been undertaken for our solutions. This could be a conceptual design, typically arising from a high-level feasibility study, outline design, or a fully developed detailed design ready for construction.

2.14 Our DWMP solutions have been developed at a conceptual level of design, reflecting the strategic nature of the plan at this first cycle. As a result, whilst we have a good understanding of the engineering required to deliver the solutions, at this stage of planning, they will have a low level of design maturity.

2.15 We consider two levels of design maturity in our business-as-usual project delivery process:

1. 'Level 1' develops options to a conceptual level of design and may typically have a high level of cost uncertainty because the specific location, scale and scope are less developed
2. At 'Level 2', planning and scope of individual schemes will be supported by better information, such as need for land acquisition or additional power supply, and therefore greater confidence in the design development. This better information is considered through a solution complexity assessment which is discussed in the next section

2.16 The different levels of design are also reflected in an 'uncertainty factor' that is applied as a percentage to base costs.

2.17 Different factors are applied depending on the scale of cost. Generally, our approach applies a lower factor for more expensive scheme costs (>£30 million), and solutions in the network and at treatment works also attract difference factors.

2.18 For our DWMP we have applied the 'uncertainty factor' at the level usually applied at 'Level 1' to reflect the strategic nature of our plan.

2.19 We also recognise that in many cases other third-party assets affect surface water entering the wastewater system (such as land drainage, highway drainage). In many cases we have a limited understanding of the origin and nature of this flow. Furthermore, we do not have all surface water sewers mapped and modelled. This means that the location and timing of solutions in our preferred plan is uncertain. We have incorporated this uncertainty in the design maturity of the solutions in our plan. To reduce the uncertainty in our knowledge and performance of our systems, during the next cycle of DWMPs we will improve our understanding and modelling of groundwater infiltration and surface water interconnections.

Solution complexity

2.20 Solution complexity considers the influence of a range of factors affecting the scope and deliverability of options. This may include the level of understanding of the technology

proposed, deliverability, land, dependencies with other schemes, research and innovation or partnership working.

2.21 Whilst these factors are usually identified at 'Level 1', the level of design development is often insufficient to quantify (or mitigate) them fully.

2.22 At 'Level 2', the enhanced level of design has a subjective assessment of a range of ten solution complexities: They are:

- Power upgrade - the need for additional energy to operate the new assets
- Site access - the ability to safely get staff, plant, and equipment for construction to the site
- Planning permission - if planning permission is required for the solution
- Working areas and enabling works – the availability of sufficient space and an appropriate environment in which to construct the new assets
- Service diversions – the presence of third-party utility services that affect the construction and may need to be moved, or require the design to change to accommodate them
- Temporary plant – the provisions needed to maintain the current level of service during construction
- Disconnection, demolition – the need to disconnect or demolish assets to make land available for construction
- Land acquisition – the need to purchase additional land on which to construct the new assets
- Ground conditions – the ability of the ground and geology for construction or are the need to design and build structures to support the assets we require
- SCADA or electrical interfaces – the need for any interfaces with our control systems or updated required to those systems due to the new assets that we are building

2.23 Our solutions for the DWMP are developed to 'Level 1' with a cost factor to account for the uncertainty inherent at Level 1.

Other uncertainties

2.24 A key uncertainty factor that permeates our entire plan is the deliverability of surface water management solutions (including sustainable drainage systems (SuDS)). The uncertainty reflects the ambitious scale of intervention proposed and the inherent risks in delivering such a vast programme of retrofit SuDS. We have written a dedicated technical appendix for this which we believe will provide a springboard to collaborate with partners to mainstream green engineering delivery at the scale our plan proposes. It is therefore excluded from this document. Please refer to the Delivery of SuDS and Nature Based Solutions Technical Appendix7.

2.25 We have also tested our preferred plan against the impact of common reference scenarios, a set of benign and adverse scenarios covering three material drivers of uncertainty (climate change, technology and demand), as detailed in the Ofwat final guidance on Long Term Delivery Strategies (LTDS)[8], within Technical Appendix G on Adaptive Pathways[9]. Potential

[7] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-r-delivery-of-suds-and-nature-based-solutions.pdf
[8] https://www.ofwat.gov.uk/publication/pr24-and-beyond-final-guidance-on-long-term-delivery-strategies/
[9] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-g-adaptive-pathway-planning.pdf

alternative plans arising from changes to our current performance targets are also considered in our Next Steps section of The Plan[10].

[10] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/the-plan.pdf

3 Applying uncertainty analysis to our final DWMP

3.1 The sensitivities assessed through development of options, design maturity and solution complexity are amalgamated into an 'uncertainty factor' for each of our network and treatment solutions. We have applied this factor to the base costs developed for each solution.

3.2 This is a mature methodology embedded in our business-as-usual project delivery process. The methodology assesses high-level risks, based on asset types, and is refined during the design process, to generate uncertainty factor values to be applied to our EES costs.

3.3 The range of our uncertainty factor values we apply to our EES costs at 'Level 1' are shown in Table 3-1. This reflects industry standard practice and government guidance on costing and optimism bias.

Design stage	Description		Network solutions	Treatment solutions
Level 1	High level scheme cost uncertainty applied by asset type	Low	0%	0%
		High	+32.9%	+40.7%

Table 3-1 Assessment of uncertainty factor (Level 1)

3.4 As noted in section 2, our DWMP solutions have been developed to 'Level 1' level of design and have inherent uncertainty in the option definition. Therefore, due to the strategic nature and conceptual design of the solutions they include the high 'uncertainty factor' allowance of +32.9% for network solutions and +40.7% for treatment solutions. This is included in the cost data presented throughout our DWMP.

3.5 Applying this to our £31.9bn DWMP construction cost indicates an overall range of uncertainty of between -33% and 0% (-£10.6 to £0bn). This represents an expected industry range design uncertainty at this stage of solution definition for strategic plans.

3.6 Given our costs (including uncertainty) we have then looked at outturn cost implications. We have completed an assessment of the ten solution complexity factors that would be considered at 'Level 2' using our business-as-usual project delivery process subjective framework as summarised in Table 3-2. The selection of 'yes', 'no' or 'maybe' has been made based on the typical type of solution included in our DWMP.

Solution complexity	Network solutions (Yes/No/Maybe)	Treatment solutions (Yes/No/Maybe)
Power upgrade	Maybe	Maybe
Site access	Maybe	Maybe
Planning permission	Yes	Yes
Working areas/conditions/enabling works	Yes	Yes
Service diversions	Yes	Yes

Solution complexity	Network solutions (Yes/No/Maybe)	Treatment solutions (Yes/No/Maybe)
Temp process plant	Maybe	Yes
Disconnect, demolition of asset disposal	Yes	Yes
Land acquisition	Maybe	Maybe
Ground condition issues	Yes	Yes
SCADA or electrical interface issues	No	Yes

Table 3-2 Assessment of solution complexity for a 'typical' DWMP type solution

3.7 The simple 'yes', 'no' or 'maybe' represents an industry standard approach to risk assessment at this level. The selection of 'yes', 'no' or 'maybe' for each factor determines a standard percentage adjustment that is then summed over the ten factors to give a low and high range of the uncertainty factor. Table 3-3 summarises the range of uncertainty factor ranges for typical solutions that align to those used in our DWMP based on the subjective assessment in Table 3-2.

Design stage	Description		Network solutions		Treatment solutions	
			Cost <£30m	Cost >£30m	Cost <£30m	Cost >£30m
Level 1	High level scheme cost uncertainty applied by asset type	Low	0%	0%	0%	0%
		High	+32.9%	+32.9%	+40.7%	+40.7%
Level 2	Range of ten complexities are subjectivity assessed. Maxima range from low (no complexity) to high (highly complex) in addition to SG1	Low	-32.9%	-32.9%	-40.7%	-40.7%
		High	+32.1%	-1.9%	+24.3%	-9.7%
		Typical	+6.1%	-10.4%	+15.8%	-13.2%

Note: Level 2 'Low' and 'High' relate to all 'no' and 'yes' answers respectively to project complexity. 'Typical' relates to the output from our assessment in Table 3-2 for a 'typical' DWMP type solution

Table 3-3 Assessment of uncertainty factor (Level 2)

3.8 We have applied the outputs of Table 3-2 to our 'Level 1' costs for schemes within each size category in our DWMP to estimate the typical range of uncertainty for large (>£30m) and small (<£30m) schemes across our programme. This has been applied separately to network and treatment solutions and is summarised in Table 3-4 and Table 3-5.

	Preferred plan total construction cost £m		Typical project complexity % adjustment		Uncertainty adjusted plan construction cost £m
	Solution cost <£30m	Solution cost >£30m	Solution cost <£30m	Solution cost >£30m	
Network solutions	10,411.2	20,245.9	6.1%	-10.4%	29,186.4
Treatment solutions	542.4	743.2	15.8%	-13.2%	1,273.3
Total		**31,942.6**			**30,459.7**

Table 3-4 Applying 'typical uncertainty factors' to our DWMP – Highest Level 1 uncertainty

	AMP8	AMP9	AMP10	AMP11	AMP12	Total
Preferred plan £m	1,494	3,215	6,096	9,062	12,075	31,943
Uncertainty adjusted plan £m	1,569	3,310	5,962	8,555	11,063	30,460
Variance from preferred plan £m	+75	+96	-134	-507	-1,012	-1,483
Variance from preferred plan %	+5%	+3%	-2%	-6%	-8%	-5%

Table 3-5 Impact of 'uncertainty factors' on our DWMP AMP spend – Highest Level 1 uncertainty

3.9 Our assessment of potential uncertainty in outturn costs based on assumptions for a more mature design and typical solution complexity, at a programme level, therefore indicates an additional uncertainty of between 0% to -5%, or +£0 to -£1.0bn of our overall £31.9bn DWMP construction cost.

3.10 In the short term there is a positive deviation, indicating a greater likelihood of our preferred plan base costs being exceeded. This is a function more of the solutions proposed in the short term being below the £30m construction cost threshold.

3.11 The methodology that we applied, and outlines above is generally used for individual projects as they pass through our governance processes into delivery. It is not a useful for a long-term comprehensive programme of intervention as is a DWMP. We have engaged with colleagues who address cost uncertainty in the WRMP to understand if there is anything similar that they already use and have not found anything.

3.12 In the absence of an appropriate tool to assess 25-year process cost uncertainty, we have challenged our internal cost estimation team who have recommended that, in their expert opinion the cost uncertainty of this DWMP is of the order of +10% to -10%, or +£3.2bn to -£3.2bn, of our overall £31.9bn plan.

4 Conclusions

4.1 A high-level assessment of the uncertainty arising from our costs, design maturity and anticipated typical project complexity has been undertaken. Our DWMP has a high level of cost uncertainty due to the strategic nature and early stage of concept design of the solutions developed for this first cycle of planning.

4.2 We have followed an industry standard approach which recognises this and includes an allowance (optimism bias) for cost uncertainty. In our options assessment this is approximately 33% of the option cost, due to the strategic nature and early stage of concept design of the solutions developed for this first cycle of planning.

4.3 The level of cost uncertainty is typical of strategic plans similar to the DWMP in their first cycle of planning. We will improve our cost certainty by following our business-as-usual process of developing schemes from strategic planning into delivery.

4.4 We have then looked at how much this might change, assuming the same option scope, with a more mature design in future. This suggests that the cost uncertainty of our plan is of the order of 0 to -5%, or +£0 to -£1.0bn of our overall £31.9bn DWMP construction cost.

4.5 This method of assessment is applicable to individual projects rather than long-term investment programmes it is considered that it underestimates uncertainty. In the absence of an appropriate tool to determine this further, our expert opinion is that the cost uncertainty of the plan is of the order of +10% to -10%, or +£3.2bn to -£3.2bn, of our overall £31.9bn DWMP construction cost.

4.6 As part of our cycle 2 planning, we will develop an approach that is considered more appropriate for assessing programme level cost uncertainty for long-term investment plans. This will increase confidence in our uncertainty assessments in future.

4.7 There are further elements of uncertainty that we cannot robustly quantify at this time. These include the interaction that surface water systems have with the foul network. We therefore have a development programme to include enhancement of our understanding by improving our mapping and modelling for these, and some other, elements. This will reduce uncertainty (and potentially cost) as well as increase confidence in the development of our plans for future DWMP cycles.

Glossary

Term	Description
1 in 30-year storm	A storm that has a 1 in 30 chance (3.33% probability) of being equalled or exceeded in any given year. This does not mean that a 30-year flood will happen regularly every 30 years, or only once in 30 years.
1 in 50-year storm	A storm that has a 1 in 50 chance (2% probability) of being equalled or exceeded in any given year. This does not mean that a 50-year flood will happen regularly every 50 years, or only once in 50 years.
Asset Management Plan (AMP)	A five-year planning cycle used by English and Welsh water industry regulators to set allowable price increases for privately owned water companies and for the assessment of performance indicators such as water quality and customer service.
Baseline Risk and Vulnerability Assessment (BRAVA)	Following Risk Based Catchment Screening (RBCS), more detailed risk assessments on those catchments where we believed there was an adverse risk to performance over time. We modelled their performance to 2020 (baseline), 2030, 2035 and 2050.
Business Plan	Business Plans are produced by water companies every 5 years. They set out their investment programme to ensure delivery of water and wastewater services to customers. These plans are drawn up through consultation with the regulators, stakeholders and customers and submitted to Ofwat for detailed scrutiny and review.
Catchment Strategic Plans (CSPs)	Summary reports to promote system thinking across large wastewater catchments. These provide early sight of our final plans enabling co-authoring opportunities for our stakeholders. Each document outlines the challenges that the catchment will face in the future and the long-term plans to address these issues.
Combined sewer	A sewer designed to receive both wastewater and surface water from domestic and industrial sources to a treatment works in a single pipe.
Customer Challenge Group (CCG)	An independent body that challenges both our current performance and our engagement with customers on building our future plans.
Cycle 1 and Cycle 2 DWMP	Our current DWMP is referred to as Cycle 1, it covers a planning period of 2025-2050. Our next plan will be published in five years' time and is referred to as our Cycle 2 DWMP, it will cover a planning period of 2030-2055.
Department for Environment, Food and Rural Affairs (Defra)	UK government department responsible for safeguarding the natural environment, food and farming industry, and the rural economy.
Drainage and Wastewater Management Plan (DWMP)	A Drainage and Wastewater Management Plan (DWMP) is '*a long-term strategic plan that sets out how wastewater systems, and the drainage networks that impact them, are to be extended, improved and maintained to ensure they are robust and resilient to future pressures*'. The planning period is 25 years, from 2025 to 2050. DWMP is iterated every five years; the first known as 'Cycle 1', published as a final plan in May 2023.
dDWMP	The draft version of the Drainage and Wastewater Management Plan, published in June 2022.
fDWMP	The final version of the Drainage and Wastewater Management Plan, to be published in May 2023.
Dry Weather Flow (DWF)	Dry Weather Flow is the average daily flow to a Sewage Treatment Works (STW) during a period without rain.

Environment Agency (EA)	UK government agency whose principal aim is to protect and enhance the environment in England and Wales.
EA Pollution Categories 1 to 3	Category 1 incidents have a serious, extensive or persistent impact on the environment, people or property. Category 2 incidents have a lesser, yet significant, impact. Category 3 incidents have a minor or minimal impact on the environment, people or property with only a limited or localised effect on water quality. Further Ofwat guidance available here: WatCoPerfEPAmethodology v3-Nov-2017-Final.pdf (ofwat.gov.uk)
Event Duration Monitoring (EDM)	Event duration monitoring (EDM) measures the frequency and duration of storm discharges to the environment from storm overflows.
External hydraulic sewer flooding	External flooding occurs within the curtilage of a property due to hydraulic sewer overload. Further Ofwat guidance available here: Reporting-guidance-sewer-flooding.pdf (ofwat.gov.uk)
Foul sewer	A foul sewer is designed to carry domestic or commercial wastewater to a sewage works for treatment. Typically, it takes wastewater from sources including toilets, baths, showers, kitchen sinks, washing machines and dishwashers from residential and commercial premises.
Grey infrastructure	New sewers, sewer upsizing and attenuation storage to provide additional capacity in the wastewater networks. Also covers new pumping stations, rising mains and/or civil structures at STWs.
Green infrastructure	Sustainable surface water management solutions, including sustainable drainage systems (SuDS), that are designed to mimic naturally draining surfaces. Typically applied to surface water or combined sewerage systems, but can also be applied to land, highway or other forms of surface drainage.
Historic England (HE)	A non-departmental public body of the government whose aim is to protect the historical environment of England by preserving and listing historic buildings, ancient monuments.
Hydraulic overload	Hydraulic overload occurs when a sewer or sewerage system is unable to cope with the receiving flow.
Internal hydraulic sewer flooding	Flooding which enters a building or passes below a suspended floor caused by flow from a sewer. Further Ofwat guidance available here: Reporting-guidance-sewer-flooding.pdf (ofwat.gov.uk)
L2 Area (Strategic Planning Area)	An aggregation of level 3 catchments (tactical planning units) into larger level 2 strategic planning areas. The level 2 strategic planning areas allow us to describe strategic drivers for change (relevant at the level 2 strategic planning area scale) as well as facilitating a more strategic level of planning above the detailed catchment assessments.
L3 Catchment (Tactical Planning Unit)	Geographical area in which a wastewater network drains to a single STW. Stakeholders may be specifically associated with this area. Includes for surface water sewerage that may exist which serves the wastewater geographical area but drains to a water course.
Lead Local Flood Authorities (LLFAs)	LLFAs are Risk Management Authorities as defined by the Flood and Water Management Act 2010. They have statutory duties with respect to flood risk management, investigating flooding and the compilation of surface water management plans.

Long-Term Delivery Strategy (LTDS)	A requirement by Ofwat on water companies, to ensure that short term expenditure meets long term objectives for customers, communities, and the environment. These will be submitted as part of the Price Review.
Misconnections	Misconnections are where either surface water drainage or foul water is connected to the wrong system e.g., surface water to foul only or foul to surface water systems.
Natural capital accounting	The process of calculating the total stocks and flows of natural resources in a given system, either in terms of monetary value or in physical terms.
Natural England (NE)	A non-departmental public body sponsored by the Department for Environment, Food and Rural Affairs to protect the natural environment in England, helping to protect England's nature and landscapes.
Non-governmental organisation (NGO)	An organisation that operates independently of any government, typically one whose purpose is to address a social or political issue.
Options Development and Appraisal (ODA)	A method to focus the level of planning effort, i.e., proportionate to the risks identified, with a view to providing a measure of consistency across the industry.
Ofwat	The regulatory body responsible for economic regulation of the privatised water and wastewater industry in England and Wales.
PR24	Every five years, water companies set out their plans for what they'll deliver and how much they'll charge customers[11]. Their plans over the next five years should include how they will: • Provide a safe and clean water supply • Provide efficient sewerage pumping and treatment services • Control leaks • Install meters • Maintain pipes and sewers • Maintain and improve environmental standards This process is known as the price review, and the next one will be in 2024, when Ofwat will make its final decisions. We call this PR24.
Risk-Based Catchments Screening (RBCS)	A first-pass screening exercise of catchment vulnerability against 17 different risk indicators. To understand which catchments are low risk catchments and those that are likely to be at risk in the future if not supported by our long-term plan.
Risk Management Authorities (RMAs)	Authorities responsible for Flood Risk as defined in the Flood and Water Management At 2010. These include, Lead Local Flood Authorities, Highway Authorities, Local Planning Authorities, Natural England and the Environment Agency.
Sewage Treatment Works (STW)	A sewage treatment works receives and treats wastewater to a standard legally agreed with the Environment Agency, before it is released back into the environment.
Specific, Measurable, Achievable, Relevant, and Time-Bound (SMART)	A framework for setting effective targets.
Storm overflow discharges	Storm overflows are used to manage excess flows, which typically occur as a result of heavy rainfall. Excess flow that may otherwise have caused flooding is released through a designated outfall to a water course, land area or alternative drainage system.

[11] https://www.ccwater.org.uk/priorities/price-review/

Strategic Environmental Assessment (SEA)	A systematic decision support process to ensure that environmental and other sustainability aspects are considered effectively in policy, plan and programme making.
Surface water sewer	A surface water sewer collects rainwater from domestic and commercial roofs, driveways, patios etc to a local watercourse or suitable surface water drainage system.
Sustainable Drainage systems (SuDS)	Drainage solutions that provide an alternative to the direct channelling of surface water through networks of pipes and sewers to nearby watercourses. SuDS aim to reduce surface water flooding, improve water quality, and enhance the amenity and biodiversity value of the environment. SuDS achieve this by lowering flow rates, increasing water storage capacity and reducing the transport of pollution to the water environment.
Thames Regional Flood and Coastal Committee (TRFCC) area	The TRFCC area was established by the Environment Agency under the Flood and Water Management Act 2010 that brings together members representing the Constituent Authority. Featured TRFCCs are listed here on our DWMP portal: Drainage and Wastewater Management Plan (arcgis.com)
Water Industry National Environmental Programme (WINEP)	The framework under which Defra and the EA require environmental improvements to be delivered by water companies. Guidance is released by regulators, which water companies interpret for their geographical area, and resubmit the outputs back to regulators for endorsement.

Navigating our DWMP

We've developed a comprehensive document suite to share our final DWMP. This includes five summary documents that contain increasing levels of detail. To help you to navigate around our document suite and to find key DWMP content, we provide a Navigation index below and on our DWMP webpage. The orange cells refer to where key DWMP content can be found across our final document suite.

Navigation index		Protecting the environment and providing a reliable, sustainable wastewater service							Best value and delivery					Working together		DWMP stages and data				
		Storm overflows	Sewer flooding	Level of ambition & pace of delivery	Growth & climate change	Resilience: flooding & power	Groundwater	Environmental assessments	Affordability & bill impact	Best Value	Base vs Enhancement	Solutions & deliverability	Programme alignment	Partnership working	Stakeholder & customer engagement	DWMP stages & process	Level 2 regional summaries	Level 3 regional summaries	Data tables	Risk & Assurance
Summary documents	Customer summary	■	■											■	■	■				
	Non-technical summary	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				
	Technical summary	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				
	The Plan	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				
	Catchment Strategic Plans x13	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■		
Technical appendices x11	Appendix A - Strategic context												■			■				
	Appendix B - Risk-Based catchment screening															■				
	Appendix C - Baseline risk and Vulnerability assessment				■	■										■				
	Appendix D - Options development and appraisal	■										■				■				
	Appendix E - Programme appraisal	■		■		■			■	■	■	■	■			■				
	Appendix F - Stakeholder engagement														■	■				
	Appendix G - Adaptive pathway planning	■	■		■															
	Appendix H – Customer engagement Part A – Draft DWMP														■	■				
	Appendix I - Risk and uncertainty											■								■
	Appendix J - DWMP and WRMP alignment												■							
	Appendix M - Assurance																			■
New technical appendices x9	Appendix N - You Said, We Did (YSWD)	■	■	■	■	■	■	■	■	■	■	■	■	■	■					
	Appendix O - What base buys										■									
	Appendix P - Response to July 2021 Floods		■	■	■	■			■			■	■	■	■					
	Appendix Q - Storm overflows	■		■	■				■				■							
	Appendix R - Delivery of SuDS and nature-based solutions	■	■	■	■	■			■	■		■	■	■	■					
	Appendix S - Partnership opportunities and working			■								■		■	■					
	Appendix T - Groundwater quality						■													
	Appendix U - Resilience		■		■	■							■	■	■					
	Appendix V – Customer engagement Part B – Consultation Survey Report														■					
Environmental assessments	Appendix K - Strategic environmental assessment (SEA)							■												
	Appendix L - Habitats regulations assessment (HRA)							■												
Portals and data	Customer portal	■	■							■		■		■	■	■	■	■		
	Practitioner portal	■	■											■	■		■	■		
	Data tables			■							■								■	
	Data tables commentary																		■	

We welcome your views on our DWMP. Please share them with us by emailing: DWMP@thameswater.co.uk.

This document reflects our DWMP 2025-2050 as published in May 2023.