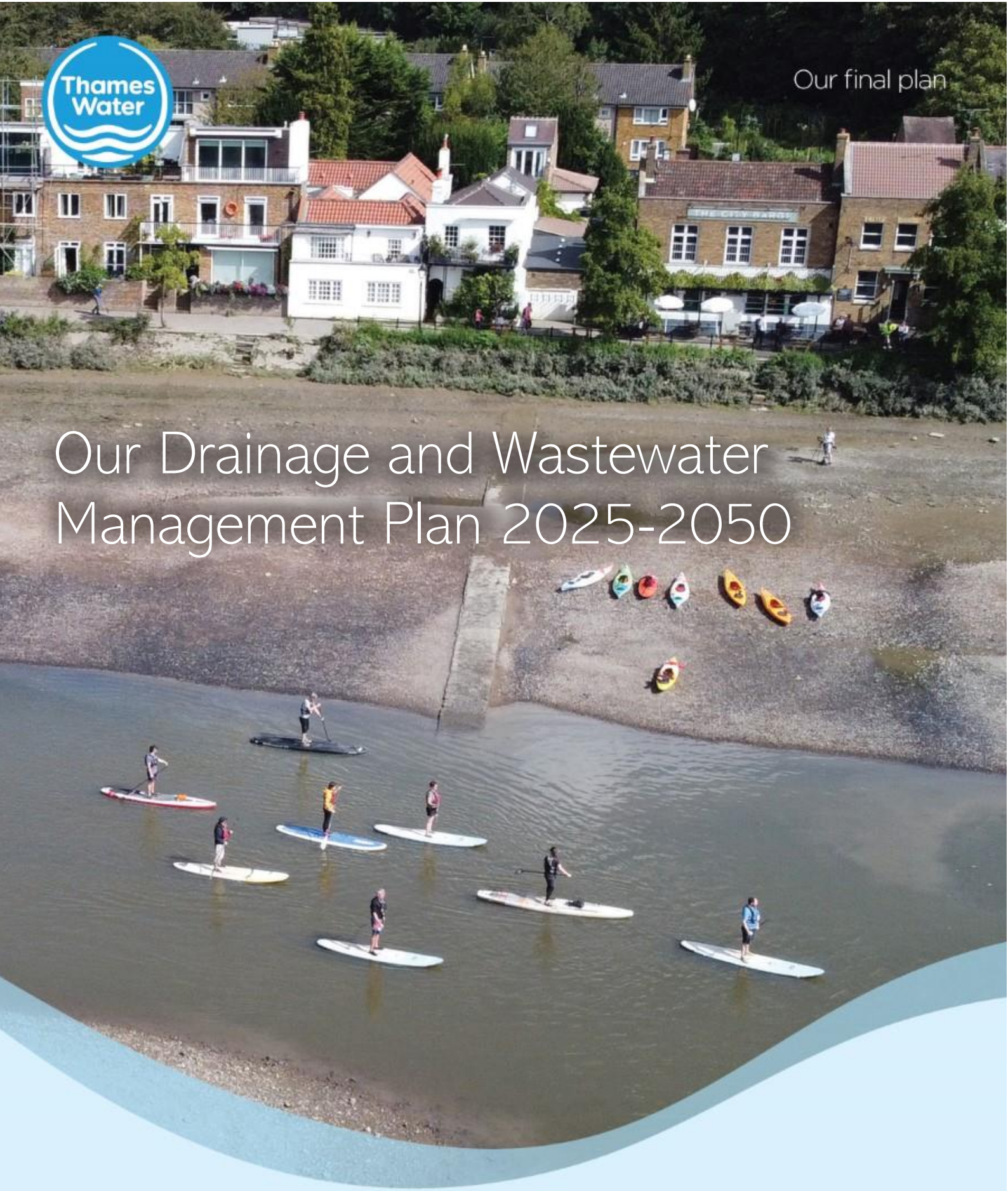


Our final plan

Our Drainage and Wastewater Management Plan 2025-2050

Technical Appendices
Appendix E – Programme Appraisal

May 2023

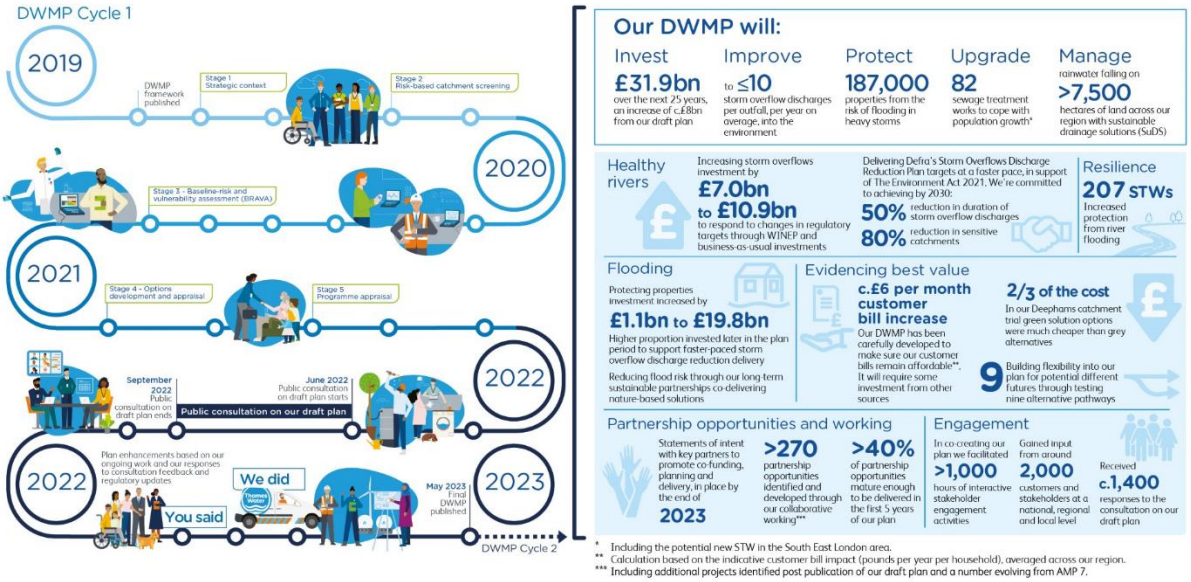
Contents

Figures

Tables

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.



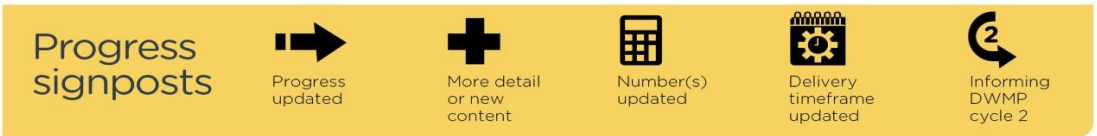
We've progressed and enhanced our DWMP since we published it for public consultation in June 2022. We were pleased to receive lots of positive comments and support on the quality and ambition of our draft plan as well as useful ideas for making our final DWMP even stronger.

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

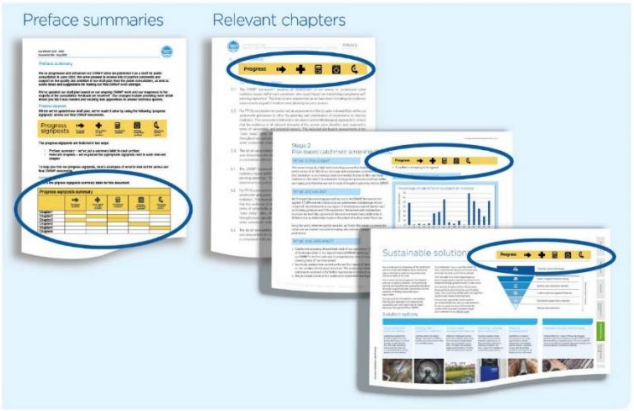
We want to make it easy for you to see what's changed. You can spot all the places we've updated our draft plan with our 'progress signposts' which we've used across our final DWMP documents.



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 E Programme Appraisal	Progress updated	More detail or new content	Number(s) updated	Delivery timeframe updated	Informing DWMP cycle 2
2. Introduction to Programme Appraisal					
3. Engaging with our stakeholders					
4. Our decision-making process					
5. Levels of performance for our DWMP – a recap					
6. Developing draft plans that achieve our planning objectives					
7. Developing final plans that achieve our planning objectives					
8. Our proposed best value DWMP					

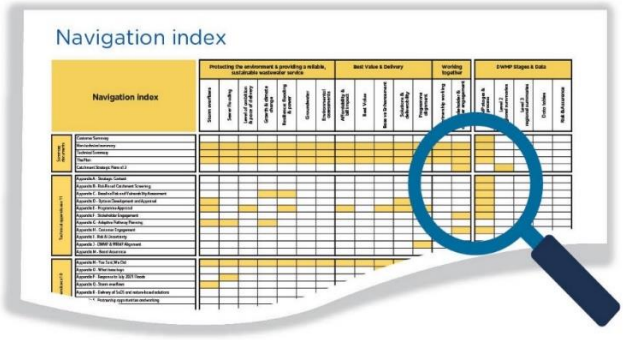
This document specifically includes the following key DWMP content:

- Protecting the environment and providing a reliable, sustainable wastewater service:
  - Storm overflows
  - Sewer flooding
  - Level of ambition & pace of delivery
- Best Value and Delivery:
  - Affordability & bill impact

    - Best Value
    - Solutions & deliverability
    - Programme alignment
- DWMP stages and data:
    - DWMP stages & process
    - Level 2 regional summaries
    - Data tables

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

Introduction to our DWMP

A Drainage and Wastewater Management Plan (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.

Programme appraisal (PA) is the final stage within the DWMP Framework[1]. This PA Technical Appendix outlines how our preferred investment plan has been developed. It describes the value criteria, metrics and target levels of service applied to generate numerous combinations of defined constraints, and the decision support tool (DST) used to develop alternative plans to meet these. It then goes on to describe the process of assessing alternative plans, and their associated programme costs[2] and benefits, to show the outcomes for the company, our customers, the communities we serve and the natural environment in our region. The development of our plan from draft to final, taking into consideration feedback from our consultation, is presented to demonstrate the journey and highlight and justify the changes that have resulted in our final DWMP.

How we balance our plan

Our approach to PA follows the DWMP Framework and aligns with the Government's Guiding Principles[3] and the Ofwat Long Term Delivery Strategy guidance[4], identifying the need for enhancement and a preferred plan that can then be tested against the common reference scenarios set out by Ofwat

The primary objective of the PA stage is to assess alternative plans and identify our preferred long-term investment plan that addresses our DWMP planning objectives. Options developed during the Options Development and Appraisal stage are compared, evaluated and combined, to create different possible investment plans ('package of investments') that achieve our planning objective targets. Cost and benefits associated with each potential plan are appraised, to determine whether they offer 'best value' to our customers, the communities we serve and the natural environment in our region, using the same approach as our Water Resource Management Plan (WRMP).

[1] DWMP_Framework_Report_Main_Report_September_2021.pdf (water.org.uk)
[2] All stated costs in this Technical Appendix comprise construction costs only. Costs are presented at a 2020/21 price base, which aligns with costs submitted in the Ofwat data tables. Costs are subject to rounding; however, totals are correct.
[3] Drainage and wastewater management plans: guiding principles for the water industry - GOV.UK
[4] PR24 and beyond: Final guidance on long-term delivery strategies - Ofwat

In developing our preferred plan with our customers and stakeholders, we have defined 14 value criteria, representing our planning objectives, against which we test the performance of alternative plans:

- Cost
- Reducing internal property sewer flooding risk
- Reducing external property sewer flooding risk
- Reducing surface water runoff
- Resilience (reducing properties at-risk of sewer flooding in a 1:50 year storm)
- Storm overflow discharges
- Sewage treatment works compliance
- Reducing misconnections
- Collaboration
- Carbon
- Asset health
- Environmental impact (positive and negative)
- Natural capital (positive and negative)
- Wellbeing

What you said in our engagement and consultation about plan balancing

We have undertaken research with our customers and stakeholders to understand their views on, and preferences for, the priority weighting for each criterion. You told us that:

- Your highest priority was asset health (sewer collapse); your lowest priority was 'collaboration', which you said should be part of our normal operations
- Environmental performance was important (storm overflow discharge reductions, pollution risk and compliance, sewer flooding risk, and natural capital benefit), as was cost and impact on customers' bills

We published our draft DWMP for consultation on 30 June 2022. The feedback we received from regulators, stakeholders and customers has been used to inform our final DWMP. The response showed 60% of consultees agreed our draft plan was acceptable. However, in developing the best value plan, you wanted:

- More ambitious storm overflow discharge targets to help protect the environment
- Quicker delivery in certain areas. However, you also expressed concerns about the delivery of such an ambitious surface water management plan, particularly in London
- Better visibility of the impact on customer bills – you were concerned about costs and bill impacts
- More ambitious flooding targets – some consultees wanted to increase our flooding target from 1 in 50 years to 1 in 100 years reflecting concerns about recent flooding in London
- Better balancing of risk, ambition and deliverability with cost
- Better alignment of the DWMP with other strategies and delivery plans
- The Programme Appraisal documentation to be more accessible to non-technical stakeholders

We have developed plans that reflect the consultation feedback and allow us to test a range of ambition in delivery. We have not developed the extent or granularity of options to be able to accommodate the desire for a level of service for flooding protection extended to protection from a 1 in 100 return period storm. We recognise this as a key action for development for the next cycle of our DWMP planning and have included pilot studies in the recommendations of our plan to develop the solutions to address this (Technical Appendix P – Response to July 2021 Floods).

Changing context between the draft and final plan

Since the publication and consultation of our draft DWMP, new legislation, the Environment Act[5], and the Government's storm overflow discharge reduction plan (SODRP)[6] have come into force. This requires us to reduce storm overflow discharges to designated bathing waters by 2035, to high priority waterbodies by 2045 and discharges to other water bodies by 2050. As part of our commitment to the Government's storm overflows discharge reduction plan, we have committed to a 50% reduction in our storm overflows by 2030. This has resulted in an increase in the number of storm overflow assets requiring improvement. Our plans explore the implications of implementing different levels of ambition, including bringing forward delivery of all reductions by 2045.

Given the statutory requirement on us, our plans must prioritise delivery of our storm discharge reduction plan over improving flooding resilience. As a result, our final DWMP has less freedom to balance storm overflow discharges and flooding requirements and options to address our flooding ambition are significantly deferred to later AMP periods. Our plan balancing to 2030 focusses on flooding schemes that can be delivered within affordability constraints, informing our PR24 plans.

Recognising feedback on our draft DWMP consultation, our options have been further developed to include:

- Pluvial and fluvial flood resilience options for sewage treatment assets following L1 stakeholder feedback
- Flood risk and mitigation to non-residential properties

Therefore, the suite of options presented for our draft and final plans differ, both in respect of performance and timing targets.

Alternative plans

Over 70 alternative plans have been considered during the development of our DWMP and identification of our preferred plan. We held engagement sessions with our L1 regional stakeholders to explore alternative plans, representing a range of alternative outcomes, to steer and challenge the development and assessment of alternative plans and identification of our preferred plan.

Our final plan builds on those plans consulted on at draft but have been re-shaped and deliver a different and larger suite of options, reflecting the new statutory obligations and feedback from the consultation, as well as exploring delivery of different levels of ambition. The table below summarises the plans and performance targets assessed; the draft DWMP preferred plan is provided for comparison.

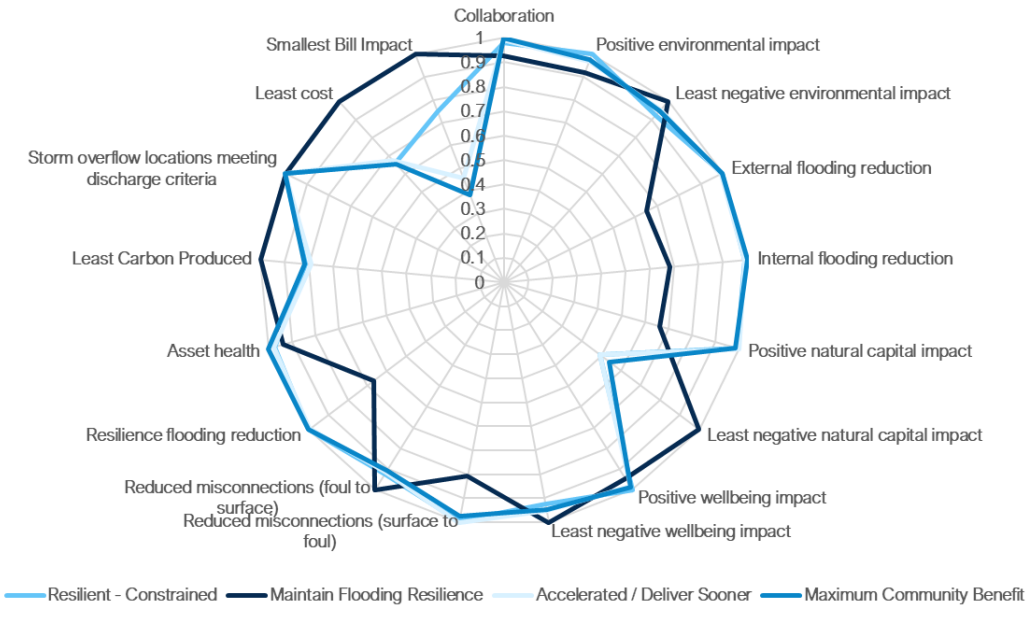
The costs of all plans have increased compared to our draft plan primarily because of new obligations under the Environment Act to address all storm overflows by 2050.

[5] The Environment Act 2021 (Commencement No. 4) Regulations 2022 (legislation.gov.uk)
[6] Storm overflows discharge reduction plan - GOV.UK (www.gov.uk)

Plan	Plan performance objectives			
	Delivery of our storm discharge reduction plan for all high priority sites	Delivery of our storm discharge reduction plan for all sites	Property flooding resilience – 1 in 50 year storm event	Profiling
Maintain flooding resilience	2035	2045	Maintained at 2025 levels	Constrained
Maximum community benefit	2035	2045	2050	Unconstrained
Resilient - constrained	2035	2045	2050	Constrained in near term
Accelerated/deliver sooner	2035	Before/by 2045	Before 2050	Unconstrained
Draft DWMP Preferred Plan	Achieve storm overflow discharge frequency of <10 per year (on average) at all overflows identified in BRAVA		2050	Unconstrained

Table 0-1 Alternative plan performance objectives

A summary, by L1 area, of the relative performance at 2050, of our alternative plan to address our planning objective targets is shown below.



Note 1: Least cost relates to the construction cost of each plan. Smallest bill impact represents the household bill increase of each plan which takes into account the profiling of investment. Carbon is considered as part of the natural capital element
Note 2: The plan with the largest area under the radar plot indicates that plan provides the greatest value across all value criteria. The closer the line is to the outside of the graph, the better the outcome for any particular metric

Figure 0-1 L1 area summary of our alternative plan to address planning objective targets

Our preferred plan

All plans prioritise delivery of our storm overflow reduction plan. However, the plan which we believe provides the better balance of cost, risk, ambition, and deliverability is the 'Resilient – constrained' plan. On balance, this is because:

- It prioritises delivery of our storm overflow discharge reduction plans in advance of the legislative requirements of the Environment Act - at all high priority overflows by 2035, at our two designated Bathing Water sites by 2030, and all overflows by 2045.
- It ensures compliance for our STWs
- It delivers our flooding objectives
- In constraining the timing and scale of delivery of options to meet our plan objectives over the plan, it:
    - Provides the least impact on customer bills
    - Provides time for investigations to reduce risks and uncertainties in our plan
    - Provides time to build capacity and develop innovation to achieve the step change in delivery of an ambitious surface water management plan
- It provides the lowest cost plan to deliver our objectives

Our preferred plan has also been profiled to allow:

- Scaling up for delivery of surface water management from AMP10, providing time for innovation and development of partnerships to deliver the best outcomes
- For further investigations and modelling to reduce uncertainties and improve understanding of surface water interaction to target property risk more effectively

The cost of our final plan, £31.9bn, has increased compared to our draft plan because we have prioritised delivery of the new storm overflow discharge reduction obligations. Beyond storm overflow discharge reductions, our plan balancing to 2030 focuses on property flooding mitigation measures that can be delivered within affordability constraints, informing our PR24 plans, thereby aligning our DWMP and PR24 plans. The costs and outcomes of our preferred plan are summarised below.

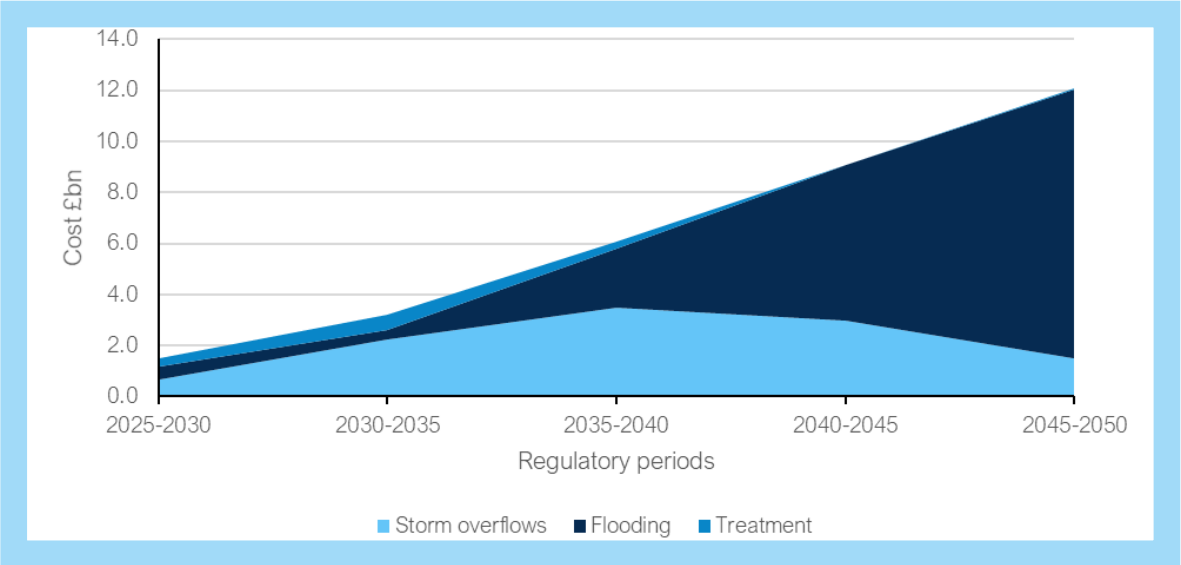


Figure 0-2 Final DWMP Preferred Plan Cost (London and Thames Valley Home Counties)

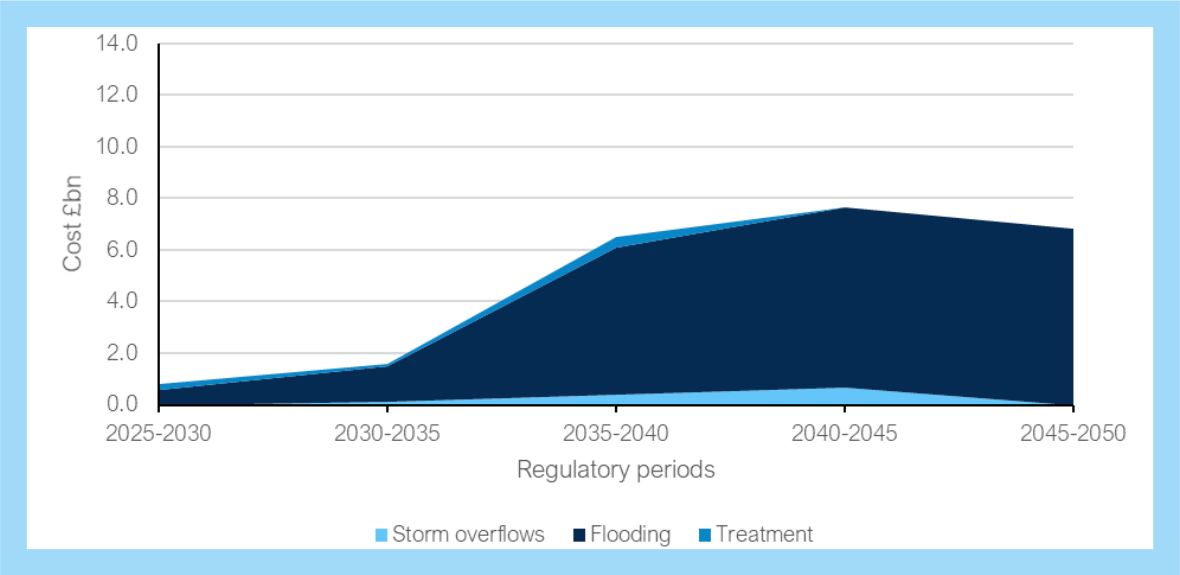


Figure 0-3 Draft DWMP Preferred Plan Cost (London and Thames Valley Home Counties)

	Indicative customer bill impact (£ per year per household (£s)					
Plan	AMP8	AMP9	AMP10	AMP11	AMP12	Average Impact
Resilient - Constrained	7.36	24.61	55.27	104.29	165.57	71.42
Max Community Benefit	7.36	106.40	193.29	203.89	192.66	140.72
Maintain Flooding Resilience	7.36	23.50	45.46	78.31	115.41	54.01
Accelerated/Deliver Sooner	7.36	73.17	144.38	179.07	186.20	118.04

Table 0-2 Indicative customer bill impact per AMP

Note 1: refer to section 4 'Understanding customer bill impact' for bill impact derivation approach

Recommendations for DWMP cycle 2

Our recommendations for cycle 2 focus on two key aspects of delivery of the PA stage:

- PA Stakeholder panel: whilst the engagement in developing the plan has been excellent, we recommend setting up a specialised PA engagement forum for cycle 2 to ensure all aspects of PA are better exposed to stakeholder challenge. This approach has worked well in developing our Water Resource Management Plan (WRMP) over several planning cycles, helping key stakeholders to engage on the process, improve understanding of the approach and the outcomes
- Options development: the concept level of options design has been a constraint for PA in terms of scale, variety/choice, cost and more particularly benefit appraisal. There are wider aspects to this point; clearly better information and modelling will inform options design and will help PA appraising costs and benefits of different options to develop a more robust plan

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 storm overflow discharges), being resilient to the risks of sewer 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 overflow discharges, and 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 to deliver our services reliably and sustainably, whilst 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 iteration of a long-term plan for our drainage and wastewater business following a consistent industrywide framework.

1.7 Our DWMP creates a roadmap for how we adapt our wastewater service to cope with future challenges based on:

- The national DWMP Framework[1] 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
- Guiding principles issued by Government[3]; and,
- The framework for development of Long-Term Delivery Strategies for PR24 issued by Ofwat[4]

2 Introduction to Programme Appraisal (PA)

Progress

Purpose

2.1 Programme appraisal (PA) is the final stage within the DWMP Framework[1]. The previous stage - options development and appraisal (ODA) - identified and assessed possible options to address the risks identified during the initial baseline risk and vulnerability assessment (BRAVA) stage (Figure 2-1). Once feasible options had been selected in the ODA stage, these were further developed to a conceptual design level. This development of conceptual design options provided a consistent platform for comparing the function, cost, and environmental and social performance of each option.

2.2 The strategic context, risk-based catchment screening (RBCS), BRAVA and ODA stages are the critical pre-plan appraisal steps which define the nature and complexity of the issues (risks) to be addressed, and the potential options to address these. These pre-optioneering steps are covered elsewhere in separate Technical Appendices.

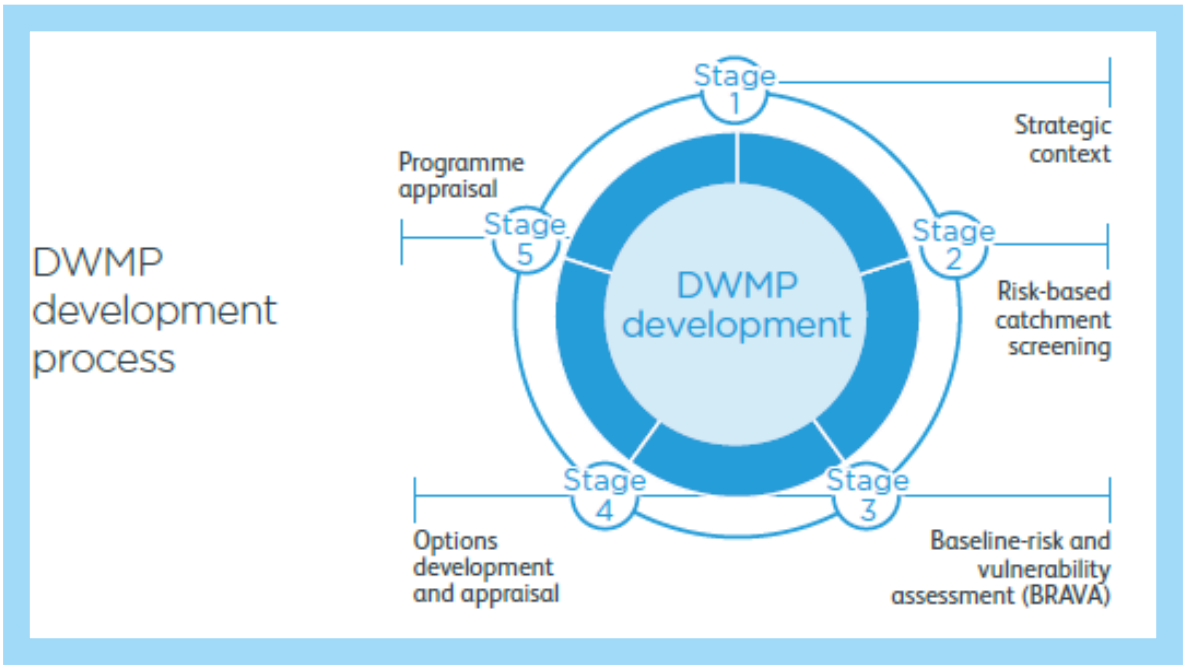


Figure 2-1 Position of the PA stage within the DWMP development process

2.3 The DWMP framework does not provide a detailed definition of the PA stage, recognising that companies may wish to use their own in-house investment planning tools developed from price review planning.

2.4 Since the publication of the framework, new regulatory guidance on developing a Long-Term Delivery Strategy (LTDS) has been published by Ofwat[4], setting out an additional step in the planning process to develop adaptive pathways in response to alternative future scenarios. This is described in a separate Technical Appendix (Appendix G – Adaptive Planning).

2.5 The framework, the Government's Guiding Principles[3] and the Long Term Delivery Strategy[4] guidance do, however, set out some general requirements that the plan shall demonstrate:

- A programme of measures that align with the company's overall planning objectives and commitments made to customers in respect of the level of service intended to be provided to them and the environment
- The development of a least cost plan
- Development of an optimised plan that provides 'best value' to customers and the environment in achieving those planning objectives in the longer term
- The development of an adaptive pathways approach to indicate how plans may change in response to future scenarios and sources of uncertainty
- An allowance for trade-offs between different L2 regions and value criteria, including cost profiling and affordability constraints
- Engagement and positioning with stakeholders, including the regulator with respect to levels of service, environmental performance and resilience (now and in the future), the choices (including trade-offs) to be made and implications for the magnitude of investment required
- That partnership working and scheme co-creation has been embedded within the processes whereby interventions have been identified
- Effective engagement with customers in identifying and prioritising planning objectives, and the associated risks and interventions development to mitigate them
- An expectation that companies would undertake a Strategic Environmental Assessment (SEA) on the preferred plan

2.6 These requirements have been tested with customers and stakeholders through our approach to develop the plan and subsequent consultation on our draft plan. Engagement with, and feedback on, the development of our approach has been positive, supporting the development of planning objectives and refinement of the alternative plans to be assessed.

The Long-Term Delivery Strategy and Programme Appraisal

2.7 Following publication of the industry's Framework for Drainage and Wastewater Planning[1], and as part of its preparations for the next regulatory planning cycle (PR24), Ofwat published its Long-Term Delivery Strategy (LTDS)[4]. The LTDS brings together outputs from all our strategic planning frameworks into one consistent and holistic long-term strategy. Our DWMP is one of several strategic plans that inform the development of our LTDS.

2.8 Ofwat's LTDS guidance provides a framework for considering how alternative scenarios of the future may impact on our planning, and the development of adaptive pathways to deliver different levels of infrastructure enhancements in response to those scenarios. Key steps in the development of long-term delivery strategies include:

- Demonstrating the need for enhancement, activities and pathways to deliver planned outcomes
- Using scenario planning and a best value framework to demonstrate how PR24 measures and the timing of investments are appropriate to an uncertain future
- Prioritising no- or low-regret activities, demonstrating the benefits of planned investment against future uncertainties and risks; and where decisions have been taken to defer investment until the benefits are more certain

2.9 The LTDS is based on the development of a number of pathways:

- A pathway aligned to the "most likely" scenario or set of scenarios. Key to this is testing against a set of common reference scenarios set out by Ofwat.
- A "core pathway" comprising low-regret investment to meet all short-term (2025-30) requirements.
- Alternative pathways linked to clear triggers, reflecting decisions than may be required to manage future uncertainties and risks

2.10 Our approach to programme appraisal aligns with the LTDS guidance, identifying the need for enhancement and a preferred plan that can then be tested against the common reference scenarios set out by Ofwat as illustrated in Figure 2-2.

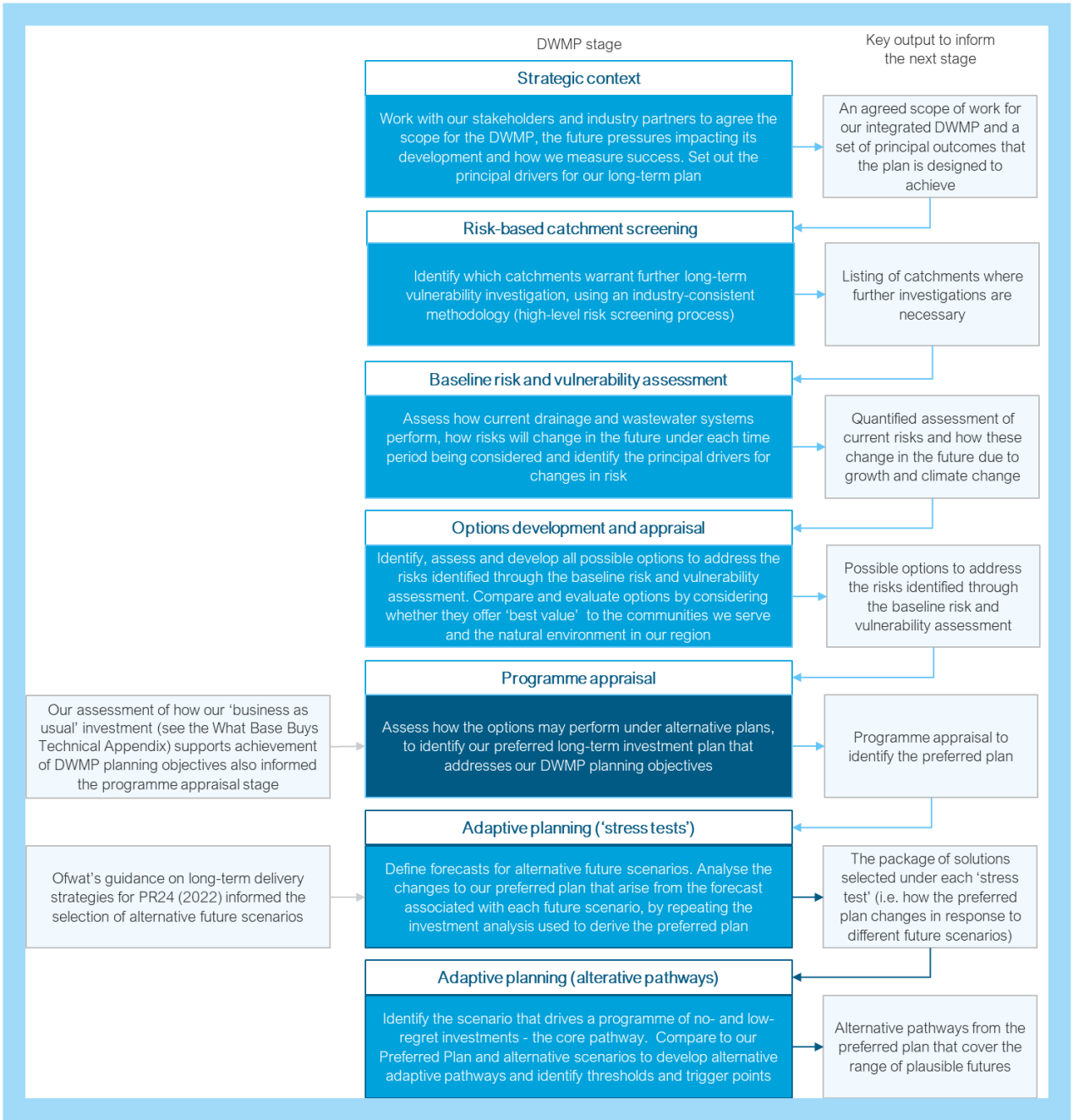


Figure 2-2 DWMP delivery steps

Developing our Preferred Plan

2.11 The primary objective of the PA stage is to assess and identify our preferred long-term investment plan that addresses our DWMP planning objectives. Options developed during the ODA stage are compared, evaluated and combined, to create different possible investment plans ('package of investments') that achieve our planning objective targets. Cost and benefits associated with each potential plan are appraised, to identify the least cost and alternative plans, to determine which provides 'best value' to our customers, the communities we serve and the natural environment in our region.

2.12 In developing our plan, we have focused on short-term (2025-2030), medium-term (2030-2035) and long-term (2035-2050) planning horizons. These planning horizons have been used to inform the development of our PR24 business plan (2025-2030) and our long-term delivery strategy, placing that plan within the longer-term strategic context.

2.13 We have developed and presented a range of possible draft plans in response to regional stakeholder requests, driven by the parallel consultations on industry issues such as guidance on storm overflow performance targets. This resulted in our draft DWMP which was subject to public consultation during 2022.

2.14 We have then updated our plan based our responses to new regulatory obligations on the reduction of storm overflow discharges and the consultation feedback which is reflected in this document. 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.

2.15 We have tested the components of our preferred plan identified through this Programme Appraisal stage against the Ofwat common reference scenarios to identify and develop alternative adaptive pathways. As different parts of our preferred plan respond differently to future scenarios, we separately analysed the following components of our preferred plan:

- Reducing storm overflow discharges
- Protecting properties from sewer flooding
- Addressing sewage treatment works compliance risks

2.16 We then changed our preferred plan forecast to represent each of the common reference scenarios to be tested and to develop an adaptive plan. This is reported separately as Technical Appendix G – Adaptive Planning.

Main principles of a best value programme appraisal framework

2.17 A best value plan is defined within the regulatory guidelines for water resources planning and is described as one that, "*considers factors alongside economic cost and seeks to achieve an outcome that increases the overall benefit to customers, the wider environment and society*".[7] We have utilised this approach in developing our DWMP.

2.18 A best value approach therefore differs from a cost-benefit analysis in that it considers a broader range of factors, rather than just cost and monetised benefit. Some wider benefit factors cannot be easily monetised, for example natural capital, biodiversity enhancement and wellbeing, hence the best value assessment is based on a benefit scoring system. The selection of a best value plan takes into consideration many competing factors, opinions

[7] Water resources planning guideline - GOV.UK

and influences (for example, encompassing technical, environmental, social and economic aspects).

2.19 For a balanced plan to be devised at the PA stage, a comprehensive assessment framework has been developed. This uses best value factors or 'value criteria', representing the DWMP planning objectives, to assess the performance of each option, with additional criteria representing broader environmental impact.

2.20 Figure 2-3 below shows the steps we have taken in deriving a best value plan, in accordance with the Water Resource Management Plan (WRMP) guidelines.[7] Each step is discussed in further detail in the following sections. Note that the last two steps are iterative reflecting development of the draft and final plans in response to feedback to consultation on the draft plan.

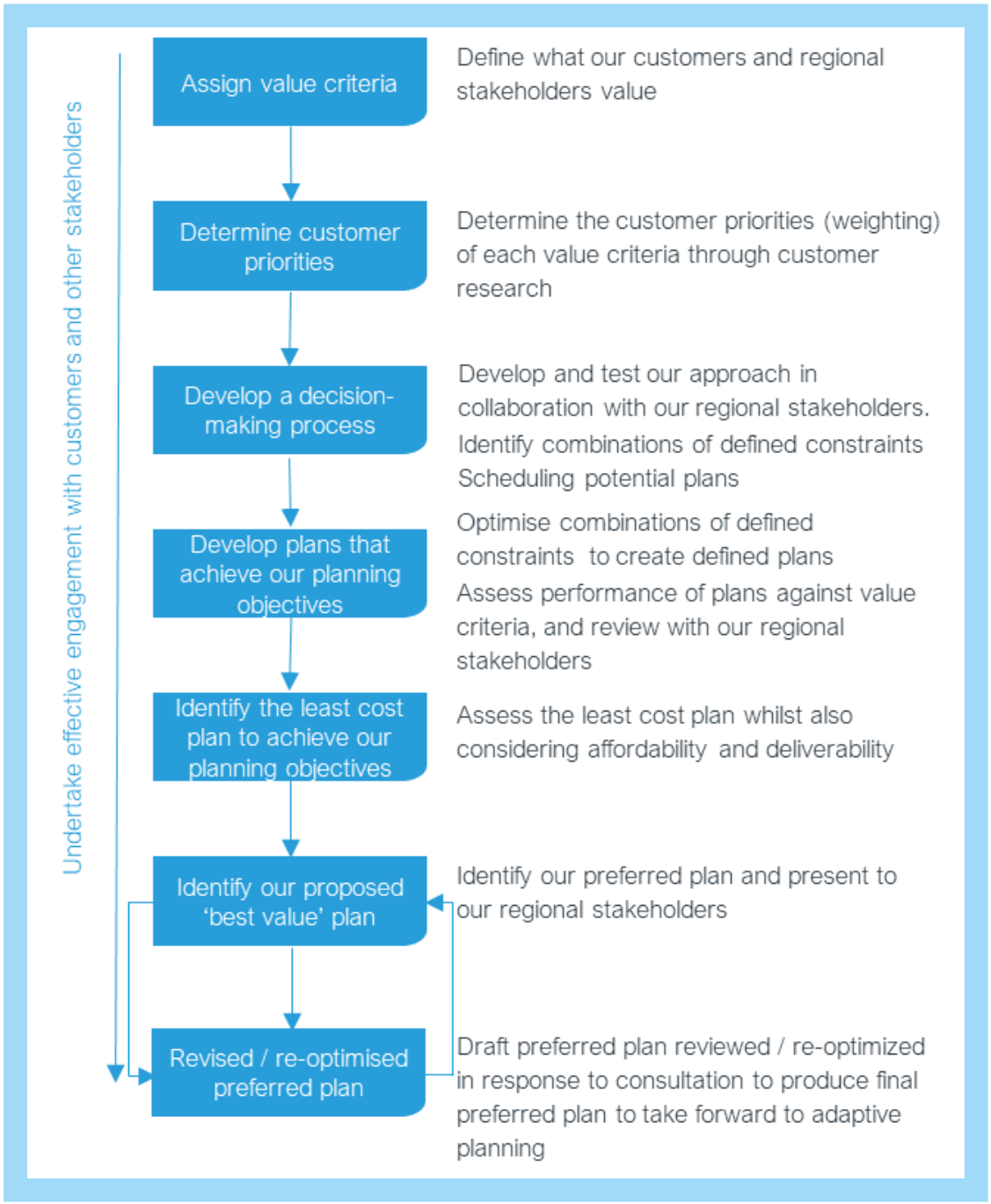


Figure 2-3 The steps we've taken when developing a best value plan

3 Engaging with our stakeholders

Progress 

3.1 Our stakeholder engagement prior to PA has been with three groups:

- L1 – Thames Water region-wide forum
- L2 – 13 sub-regional areas associated with our existing Thames Regional Flood and Coastal Committee (TRFCC) forums plus catchment partnerships
- L3 – local interest groups and customers

3.2 The L1 strategic forum and L3 customers have been engaged in the development of the PA stage of DWMP; L3 stakeholders informing development of weightings of multiple value criteria and the L1 forum contributing to strategic plan balancing.

3.3 The engagement of L1 stakeholders in plan balancing has come from our experiences from WRMP, where PA is best achieved with an experienced stakeholder group that has a region-wide focus on key issues.

3.4 We held four engagement sessions with our strategic forum to receive steer and challenge. Focussed sessions on catchments in London and outside of London were held separately, as the needs and solutions are different and the scale of the challenge in London could dominate in combined forums. The PA stage is complex and detailed, so we have worked hard to develop accessible and less technical formats for stakeholders who are not necessarily familiar with the outputs of mathematical optimisers for investment planning.

3.5 Despite the challenges, we received clear feedback from the strategic forum on our draft plans, which is discussed further in section 6.

3.6 The approach developed for our draft preferred plan and agreed with stakeholders has been carried forward to the final plan. In developing our final plan, we have revised our assessments of storm overflow discharges to ensure our final plan meets the new statutory obligations on us from the Environment Act 2021[5] and directions from Government[6]. As a result, our plan now prioritises delivery of reductions in storm overflow discharges to sensitive watercourses by 2030 and delivers further reductions at other sites by 2045. Our plan balancing to 2030 focusses on flooding schemes that can be delivered within affordability constraints, informing our PR24 plans, thereby aligning our DWMP and PR24 plans.

3.7 For cycle 2 we are considering whether we need to set up an additional specialised PA engagement forum to ensure all levels of detail can be better exposed to stakeholder challenge. This approach has worked well in developing our WRMP over several planning cycles, helping to engage key stakeholders to engage on the process, improve understanding of the approach and the outcomes.

Defining what our customers and regional stakeholders value

3.8 Twelve DWMP planning objectives, shown in Figure 3-1, were developed and agreed with regional stakeholders at the strategic context stage. Early and effective consultation and agreement of planning objectives is vital as these are used as performance criteria through BRAVA, ODA and programme appraisal stages. It is important that the planning objectives are applied consistently throughout the plan process; as a result, they are not reviewed after the strategic context stage as this would lead to each stage being reworked. However, we expect to review them again on commencement of cycle 2 of the DWMP.

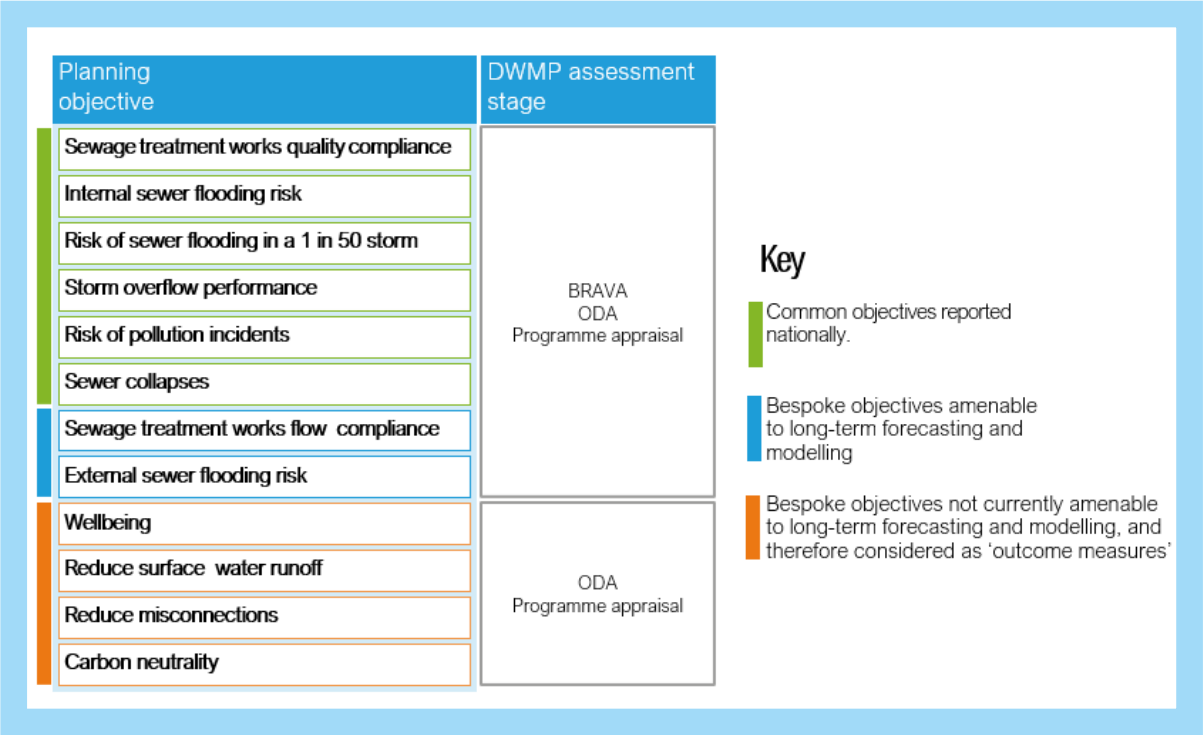


Figure 3-1 The twelve DWMP planning objectives set by regional stakeholders as part of the strategic context stage

3.9 Our planning objectives form the basis of 'value criteria' that have been used in PA, as defined in Table 3-1.

Value criteria	Planning objective
Cost (construction, operation and replacement/maintenance)	
Number of properties at-risk of internal flooding (1 in 30 year storm event)	Internal sewer flooding risk
Resilience to flooding in a 1 in 50 year return period storm event	Risk of sewer flooding in a 1 in 50 storm
Number of properties at-risk of external flooding (1 in 30 year storm event)	External sewer flooding risk
Storm overflow performance (storm overflow discharges reduction)	Storm overflow performance Risk of pollution incidents
Sewage treatment works compliance	Sewage treatment works flow and quality compliance
Environmental and social performance (positive and negative)	

Value criteria	Planning objective
Environmental performance – natural capital value (positive and negative)	
Reducing misconnections (foul to surface and surface to foul)	Reduce misconnections
Reducing surface water runoff (hectarage removed)	Reduce surface water runoff
Carbon	Carbon neutrality
Wellbeing	Wellbeing
Collaboration	
Asset heath	Sewer collapse

Table 3-1 Value criteria

3.10 Our value criteria have been considered under the key themes of affordability, environment, property flooding, collaboration and wellbeing. Their performance measures, type of objective and application are included in Appendix A - Value criteria.

Customer priorities for a best value plan

3.11 Having defined the value criteria to be used to balance the plan, we undertook research to understand our customers views on the priority weighting of each criterion.

3.12 This was achieved by undertaking an online survey of our customers, across a mixture of age groups, socio-economic backgrounds and locations across our region. This provided quantitative evidence on our customers' view on their prioritisation, to support the production of an overall 'best value' plan.

3.13 The outcome of our research is presented in Figure 3-2. Further detail is provided in Technical Appendix H: Customer Engagement:

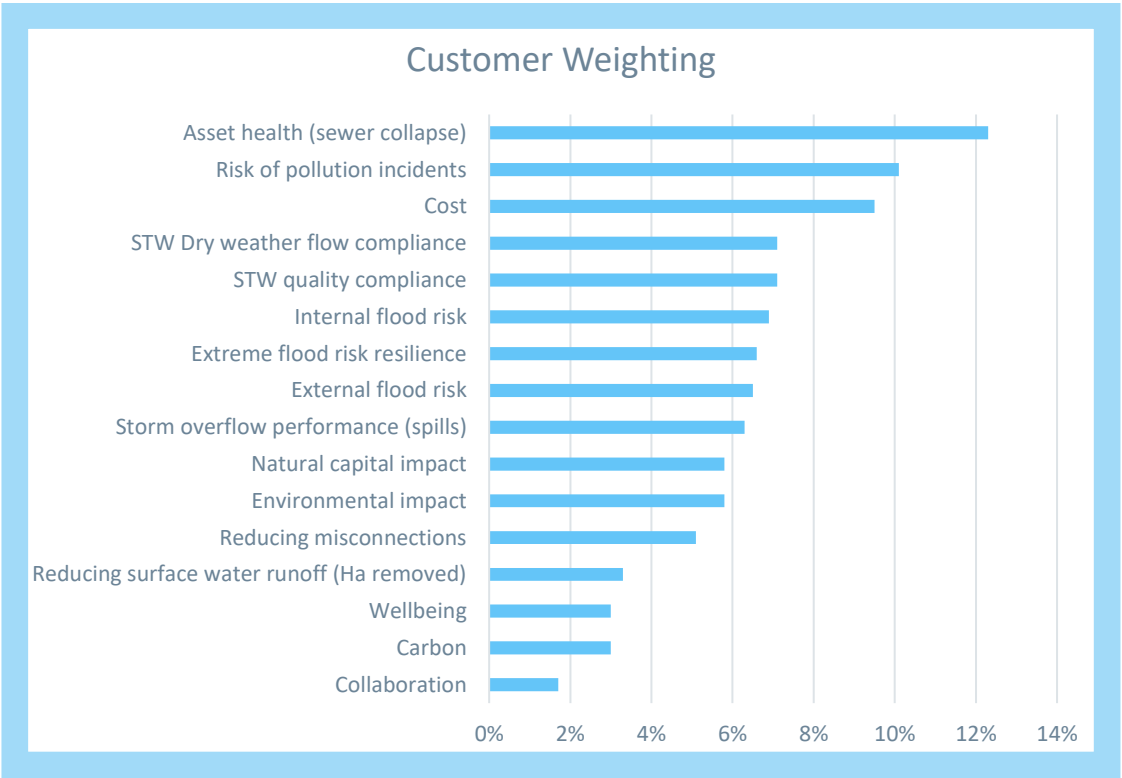


Figure 3-2 Value criteria weightings

3.14 The customer preference weightings indicated that trade-offs were going to be required, most notably between costs and environmental protection. The key findings from the research were:

- Highest priority was placed on asset health (sewer collapse)
- Environmental factors were strongly represented through risk of pollution and also more detailed criteria such as STW compliance, flood risk, storm overflow discharges and natural capital
- A high priority was assigned to 'cost', which directly links to the affordability of customers' wastewater bill
- There was a distinguishable margin between cost and next highest priorities
- Lowest priority was assigned to 'collaboration' (working with other organisations that are responsible for drainage, aiming to reduce overall costs where improving the wastewater system can also benefit these organisations). In exploring this further with customers, it became evident that they felt collaboration should be part of our normal operations and therefore implicit in the approach to delivering the DWMP

3.15 The value criteria weightings derived from the research were used as direct inputs to the PA process in assessing possible plans.

3.16 We appreciate that customer weightings can change over time, and we expect to undertake new customer surveys for cycle 2, as indeed we would for other strategic plans in developing our long-term delivery strategy.

Consultation on our draft plan

3.17 In addition to our engagement with customers and stakeholders described here to frame the objectives for the plan, we also undertook a formal public consultation involving our regulators, stakeholders and customers for feedback on our draft DWMP which was published in June 2022. We also undertook customer research with our household (residential) and non-household (commercial) customers. Feedback from the consultation phase is described in section 6.

4 Our decision-making process

4.1 The following sections describe each of the key steps in our decision-making process, commencing with development of the approach and concluding with selection of our preferred plan. Our decision-making process is summarised in Figure 4-1.

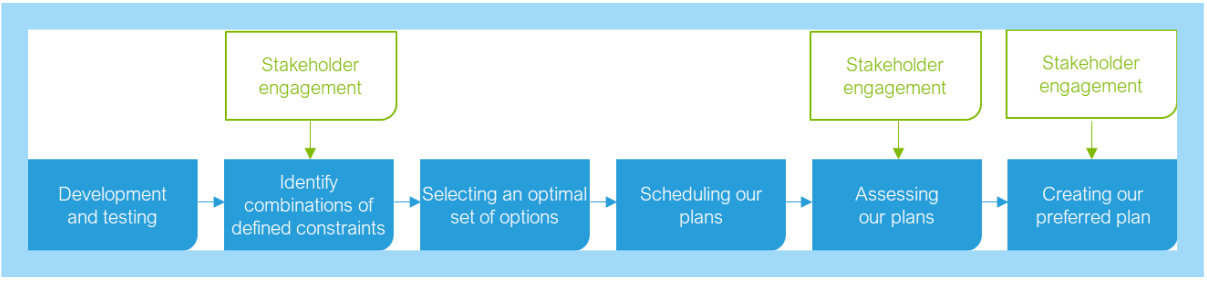


Figure 4-1 Our PA decision making process

Development and testing of a decision support tool

4.2 We commenced work on our PA methodology in June 2021 with a three-month development period. We considered appropriate tools and techniques to derive our plan before undertaking a testing phase to trial and refine our approach.

4.3 A decision support tool (DST) was developed to allow us to optimise our plan based on our value criteria and constraints. We adapted a DST that followed a structure with a successful track record of use in WRMP investment planning. A schematic of our DST methodology is shown in Figure 4-2.

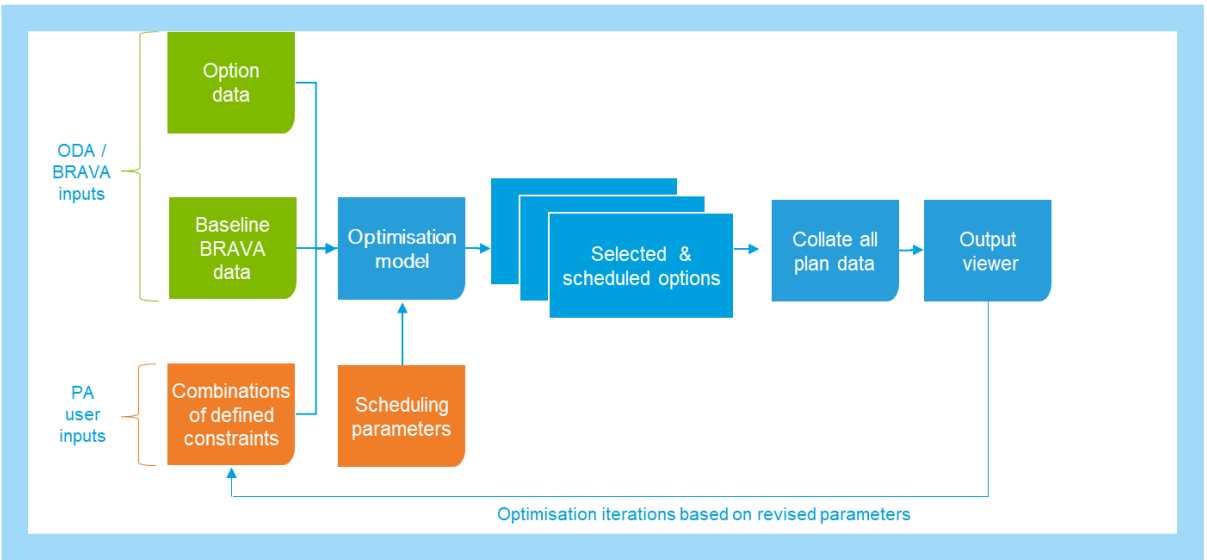


Figure 4-2 DST methodology schematic

4.4 The DST optimisation model has been developed using a common programming language (called 'Python') to provide outputs in a spreadsheet compatible format. The DST uses a mixed integer solver known as a CBC (COIN-OR Branch-and-Cut). Mixed integer solvers have been widely used in the development of WRMPs, to select optimal sets of options that deliver against required targets.

4.5 The DST inputs comprise data from ODA, baseline BRAVA data and combinations of defined constraints. The ODA information includes costs (annuitised plus financing costs) and benefits (for example properties no longer at-risk of flooding, storm overflow discharges alleviated and wellbeing).

4.6 The DST has an input dashboard where optimisation constraints are entered, for example timescales to achieve performance targets, or whether we must have an option for all catchments, value criteria and weighting.

4.7 Different combinations of defined constraints, including priority and timing of investment, can be traded-off to identify the plan which delivers the best outcomes for customers, communities and the environment.

Identifying constraints and alternative plans

4.8 In developing our plan, we have assessed a range of alternative plans with various combinations of defined constraints applied to our value criteria.

4.9 Constraints are parameters that place a restriction on the criterion being considered, for example, we want to reduce the number of properties impacted by foul flooding to X (i.e. setting a target), or set a maximum cost limit of Y over successive 5 year investment periods so that the potential bill impacts can be assessed and managed, or apply spend limits in certain time periods to address deliverability concerns.

4.10 Plans are created from the different combinations of specific defined constraints/outcome targets. Examples of possible plans are shown in Table 4-1. The specific plans for our region are discussed further in section 6.

Example plan	Description
Have no storm overflow discharges as our highest priority target	Select options that deliver a 'no storm overflow discharges' target, ahead of options that deliver other performance targets within the combinations of defined constraints
Choose the most environmentally friendly plan	Maximise the environmental benefits the plan delivers
Choose the least cost plan	Achieve performance targets at lowest overall cost

Table 4-1 Example plans

4.11 Stakeholder reviews of the plans provide check and challenge points when defining the targets and constraints within the potential plans. Section 6 provides further detail of how we initially defined a long list of combinations of defined constraints to consider, and then refined and prioritised the list through discussions with our L1 region-wide stakeholders.

Selection of options to meet plan targets

4.12 The optimisation approach applied within the DST falls into two broad approaches, dependent on the type of constraint(s) applied within the plans:

- Criteria (score) based optimisation
- Cost-based optimisation

4.13 A criteria (score) based optimisation approach is used when constraints are applied within the plan that require consideration of our customer preference weightings. The example of

'choosing the most environmentally friendly plan' (i.e. maximising the environmental benefits the plan delivers), would require this approach.

4.14 For criteria (score) based optimisation, the DST applies the customer preference weightings to the specific value criteria referenced within the plan. For each option, the input parameters are converted, using the weightings, to a normalised score of between 0 and 100, with a score of 100 representing the highest possible score. The DST then sums the scores relating to each value criteria referenced within the plan and uses this summed value to rank different options. These ranked options are then used within the DST to maximise the value criteria scores within each plan.

4.15 Cost-based optimisation is used when the constraints applied within the plan do not require consideration of our customer preference weightings of value criteria. The example of 'having no storm overflow discharges as our highest priority target' would require this approach.

4.16 For cost-based optimisation, the DST optimises options selection based on the most cost-effective group of options to meet the targets within each plan.

4.17 In each case, the DST optimises the least cost selection of options that deliver the outcomes and performance defined for each plan.

4.18 In other words, the DST identifies the least cost approach to deliver the performance objectives defined for each plan. We can then compare the costs and performance outcomes of each plan within the value framework defined with stakeholders to identify or develop the 'Best-Value' plan and understand where trade-offs may be necessary.

Scheduling our plans

4.19 Our plan includes a number of time-based constraints that schedule options across the 25-year programme. These constraints act to:

- Ensure that we do not compromise meeting compliance dates for sewage treatment works upgrades, or
- Achieve a performance target by a certain date. For example, time-based constraints are used to ensure we address high priority storm overflow discharges earlier in our plans

4.20 Scheduling also enables us to explore alternative investment profiles that define how quickly options may be implemented and the potential impact on customer bills.

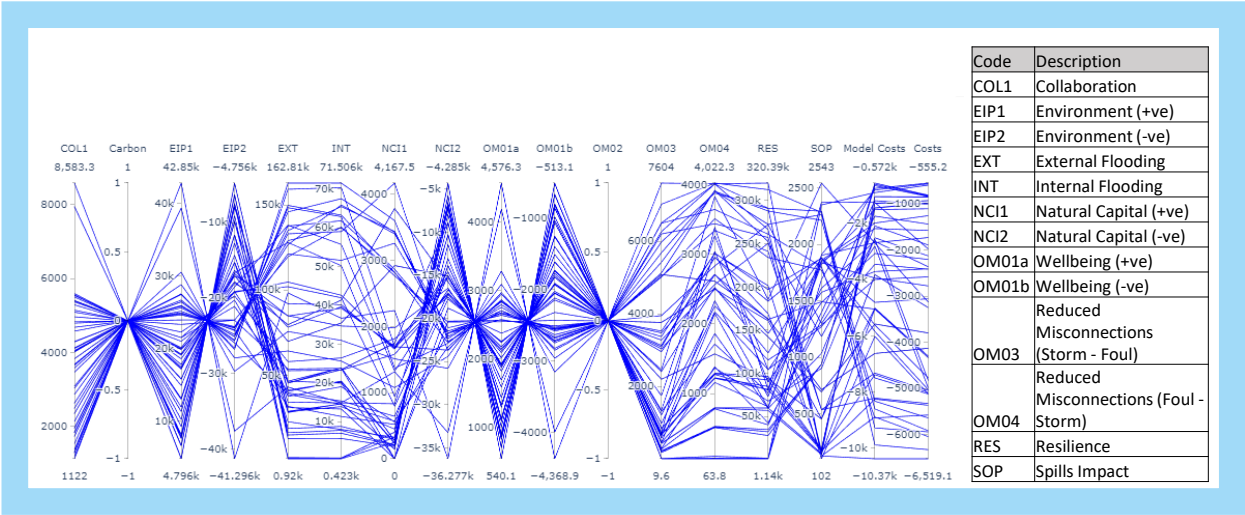
Assessing our plans

4.21 Comparing results from multiple plans across multiple planning objectives and targets can be challenging.

4.22 Performance of a plan is evaluated against value criteria to create an overall 'value' score, which is assessed for every plan. Normalising considers the maximum and minimum value criteria scores achieved by a plan, which are then multiplied by the associated customer preference weightings. This allows us to compare portfolio performance for each value criteria and the weighted scores across all value criteria. This ensures the value criteria are assessed consistently and reflect customer preference weightings.

4.23 Our DST generates a parallel axis plot as a high-level tool to visualise different combinations of defined constraints across multiple value criteria, allowing us to explore the differences between plan outcomes and identify if and where trade-offs between different outcomes may need to be made.

4.24 The parallel axis plot comprises a vertical axis for each value criteria, with associated scale. Each plan can then be plotted to show the relative benefits of one to another. This is shown in Figure 4-3.



Code	Description
COL1	Collaboration
EIP1	Environment (+ve)
EIP2	Environment (-ve)
EXT	External Flooding
INT	Internal Flooding
NCI1	Natural Capital (+ve)
NCI2	Natural Capital (-ve)
OM01a	Wellbeing (+ve)
OM01b	Wellbeing (-ve)
OM03	Reduced Misconnections (Storm - Foul)
OM04	Reduced Misconnections (Foul - Storm)
RES	Resilience
SOP	Spills Impact

Figure 4-3 Illustrative parallel axis plot of different plans

4.25 We also use radar plots to provide a comparison of our different plans (see
4.26 Figure 4-4 for an illustrative plot; note the different coloured lines represent different plans).

4.27 The radar plot provides a visual comparison of multiple plans, with the best unweighted performance value for each criterion from any of the potential plans being scored at 100%. The performance of each value criteria in any specific plan is compared to this best/highest scoring result.

Note: Carbon is considered as part of the natural capital element.
The radar plots each metric from lowest at the centre to highest at the boundary; the closer the line is to the outside of the graph, the better the outcome for any particular metric.

Figure 4-4 Illustrative radar plot of different plans

4.28 The radar plot shows performance of each metric from lowest at the centre to highest at the boundary; the closer the line is to the outside of the graph, the better the outcome for any particular metric. The plan with the largest area under the radar plot indicates that plan provides the greatest value across all value criteria. We can then consider where a plan scores poorly and determine if the reasons for those low scores are acceptable.

4.29 We can also compare the results from multiple plans through the generation of a cost-overall score for all metrics curves to demonstrate the relative performance of different plans. These help to identify those plans that deliver the best value for a given cost (known as the 'Pareto front' shown as a dashed line in Figure 4-5 below).

Figure 4-5 Illustrative DST plan cost-overall score curve

Understanding customer bill impact

4.30 An indicative assessment of impact on customer bills has been estimated based on a simple and transparent approach set out in the Ofwat LTDS[4] to provide an indicative future bill impact over the 25-year plan period of the DWMP.

4.31 Indicative future bill impacts from enhancement expenditure in the DWMP have been estimated for each combination of defined constraints using the following approach as set out by Ofwat:

- Enhancement expenditure is split into capital and operating expenditure
- Capital enhancement expenditure is added to a new enhancement Regulatory Capital Value (RCV)
- The return on the new enhancement RCV is based on the PR19 allowed return on capital or subsequent updates provided by Ofwat for PR24 (as appropriate)
- The new enhancement RCV is run-off (depreciated) based on the asset life of the enhancement expenditure
- A notional allowance for corporation tax funding has been approximated as follows:

$$Corporation\ tax\ funding = Return\ on\ new\ enhancement\ RCV \times \left(\frac{\%\ return\ on\ equity \times (1 - notional\ gearing)}{\%\ allowed\ return}\right) \times \left(\frac{1}{(1 - statutory\ tax\ rate)} - 1\right)$$

- The total wholesale long-term revenue requirement is based on operating enhancement expenditure plus return on new enhancement RCV plus new enhancement RCV run-off, plus corporation tax funding
- The total long-term revenue requirement reflects the wholesale long term revenue requirement plus an allowance (10%) for retail margin
- The total long-term revenue requirement is split into revenue recovered from household and non-household customers
- The indicative bill impact per year reflects the total long-term revenue requirement recovered from household customers (only) divided by the number of household customers.

4.32 The bill impact values quoted in Table 7-1 and Table 7-3 relate to the impact per customer in each of our two discrete geographical areas, inside and outside of London, respectively.

4.33 It is important to emphasise that this calculation provides an indicative bill impact and does not consider any treatment of inflation or other factors that would be used within the regulatory framework for determining wastewater charges. It also assumes an average asset life of 80 years and that all investment is in new assets, with no replacement or maintenance costs of existing assets netted off against the capital sum. We have also excluded any allowance for revenue raised through our infrastructure charges to developers. The indicative bill impact is expressed in "real" 2020-21 terms.

4.34 However, the approach provides insight into the effect of profiling timing and size of investment within our combinations of defined constraints. For example, a plan focusing on the early delivery of benefits, with more upfront investment, will have a greater average bill impact compared to a plan which aims to achieve the same benefits over a longer time-period and therefore attempts to balance deliverability and affordability in the near-term AMP periods.

Assessment of alternative plans

4.35 The approaches described above demonstrate how we can then compare and assess alternative plans based on key factors including:

- Performance against our planning objectives
- Stakeholder feedback and priorities
- Affordability
- Deliverability

4.36 We have considered a 'long list' of alternative plans, screening out those plans which fall below the Pareto front as these are, by definition, less efficient/effective. This allows us to focus on fewer, more efficient, plans which sit on the Pareto front, and to explore different speeds of delivery. We have then identified sensible 'bookend' alternative plans (at extremes of the Pareto curve) to provide meaningful comparison of alternative plans for our catchments inside and outside of London respectively. This has allowed us to focus our efforts on identifying and developing alternative plans that provide a balance of best value (using our performance criteria), cost and deliverability.

4.37 It is important to recognise that each plan has been optimised to give the least cost programme of options implementation within the parameters applied. This includes scheduling (timing of implementation) of options where pace of delivery is explored.

Deriving and testing a best value plan

4.38 Our best value plan can then be derived through an iterative testing process based around a suite of alternative plans focused on affordability, deliverability and performance.

4.39 Our best value plan also must align our DWMP and PR24 AMP8 planning and comply with other drivers such as our storm overflow discharge performance which is now a regulatory requirement under the Environment Act.

4.40 Our approaches for deriving and testing our best value plans for our catchments inside London and in the Thames Valley and Home Counties are discussed in sections 6 and 7.

Creating our preferred plan

4.41 The steps outlined above culminate in the identification and selection of a preferred plan from a range of alternative plans that then forms the basis for engagement and review by both internal and regional stakeholders. Further iteration of the plan may then be undertaken to develop the preferred plan presented for consultation on our draft DWMP, and to refined and updated it to create our final plan, reflecting consultation feedback.

4.42 Sensitivity analysis will then be undertaken to check that the plan is robust to change. This will consider sensitivity to risks and uncertainties associated with our preferred plan, as detailed in the Risk and Uncertainty Technical Appendix.

4.43 The preferred plan also provides key inputs to the assessment and development of adaptive pathways reflecting the impact of changes to our core targets associated with future scenarios such as climate change, growth and demand. Our approach is discussed in detail in the Adaptive Planning Technical Appendix.

4.44 The PA approach conforms to the DWMP framework[1], guidance principles[3] and the long-term delivery strategy[4] in that it demonstrates:

- A programme of measures that align with the company's overall planning objectives and commitments made to customers in respect of the level of service intended to be provided to them and the environment
- A structured and auditable approach
- The development of a least cost plan
- An allowance for trade-offs between different L2 regions and value criteria, including cost profiling constraints and affordability constraints
- Engagement and positioning with stakeholders, including the regulator with respect to levels of service, environmental performance, and resilience (now and in the future), the choices (including trade-offs) to be made and implications for the magnitude of investment required
- Enabling of alternative plans and value criteria to clearly show options mandated by regulatory drivers; potential for options to be co-created using the 'collaboration' value criteria; and assessment of the plan benefits against the value criteria
- Development of an optimised plan that provides 'best value' to customers and the environment in achieving those planning objectives in the longer term
- That partnership working and scheme co-creation has been embedded within the processes whereby interventions have been identified
- Effective engagement with customers in identifying and prioritising planning objectives, and the associated risks and interventions development to mitigate them

5 Levels of performance for our DWMP – a recap

5.1 Our ambitious levels of service were set at the ODA stage of our DWMP. During the public consultation new legislation, the Environment Act[5], and the Government's storm overflows discharge reduction plan (SODRP)[6] were passed relating to performance targets for storm overflow discharges which we have reflected in revised targets. These are summarised in Table 5-1.

Planning objective	Thames Valley and Home Counties	London
	2050	2050
Internal sewer flooding risk	100% reduction[1],[2]	No greater than 1.5% of properties at-risk per zone
External sewer flooding risk	100% reduction[1],[2]	No greater than 3% of properties at-risk per zone
Risk of sewer flooding in a 1 in 50 storm	100% reduction[1],[3]	No greater than 7.6% of properties at-risk per zone
Storm overflow performance	Compliance with the Environment Act and the SODRP. Specifically, <=10 discharges in a typical year (as a proxy for no environmental harm), with <=3 discharges in a typical year for discharges to designated bathing water sites. Prioritises delivery of reductions in storm overflow discharges to sensitive watercourses by 2035 and delivers reductions at other sites by 2045	
Sewage treatment works quality compliance	100%	
Sewage treatment works flow compliance	100%	

1. Reduction from baseline (2025 level of performance).
2. Achieving the target for 'risk of flooding in a 1 in 50 storm' will also achieve internal and external flooding targets.
3. Stop property flooding up to a 1 in 50 year storm event

Table 5-1 ODA planning objective targets

5.2 The new statutory requirement has resulted in an increase in the number of storm overflow assets requiring improvement in line with the SODRP and WINEP commitments. Further details of our storm overflow discharge reduction plan can be found in Appendix Q Storm Overflows.

5.3 In addition, following feedback on our draft DWMP consultation, our options have been further developed to:

- Inform and align with our PR24 AMP8 business plans
- Include pluvial and fluvial flood resilience options for sewage treatment assets following L1 stakeholder feedback
- Include flood risk and mitigation for non-residential properties

5.4 As a result, the suite of options assessed for our Final DWMP differs to that consulted on in our Draft DWMP.

5.5 Our catchments inside and outside of London have different levels of service for sewer flooding. This reflects the scale of the challenge of eradicating flood risk in London due to the density of properties, prevalence of basement dwellings, and the combined nature of the network in central London. Further details are provided in Appendix D Option Development and Appraisal.

6 Learning from our draft plan optimisation

Progress 

6.1 This section summarises our approach and the development of plans that were published for public consultation as part of our draft DWMP. The development and refinement of the preferred and alternative plans following our consultation to inform our final preferred plan is presented in section 7.

Identifying a long list of plans

6.2 Over 70 possible plans were identified to achieve various combinations of our planning objective targets. Examples covering the range of alternative plans assessed are shown in Table 6-1.

Objective = maintain current performance whilst keeping bills flat	Objective = meet our planning objective targets	Objective = maximise value criteria benefits regardless of cost
Maximise current performance Keep bills flat up to 2030 Keep bills flat up to 2035 Keep bills flat up to 2050	Storm overflow spill frequency < 20 by 2050 Storm overflow spill frequency <10 by 2050 Storm overflow spill frequency <10 by 2050 in high priority catchments Storm overflow spill frequency <10 by 2035 in high priority catchments Zero storm overflows by 2050 Storm overflow spill frequency < 10 by 2050 plus enhanced flooding targets Zero storm overflows by 2050 plus enhanced flooding targets	Reduction in flooding risk Resilience to 1 in 50 event Reduction in surface water runoff Minimise carbon Environment score Natural capital score Collaboration Maximise overall value criteria score Maximise weighted value criteria scores

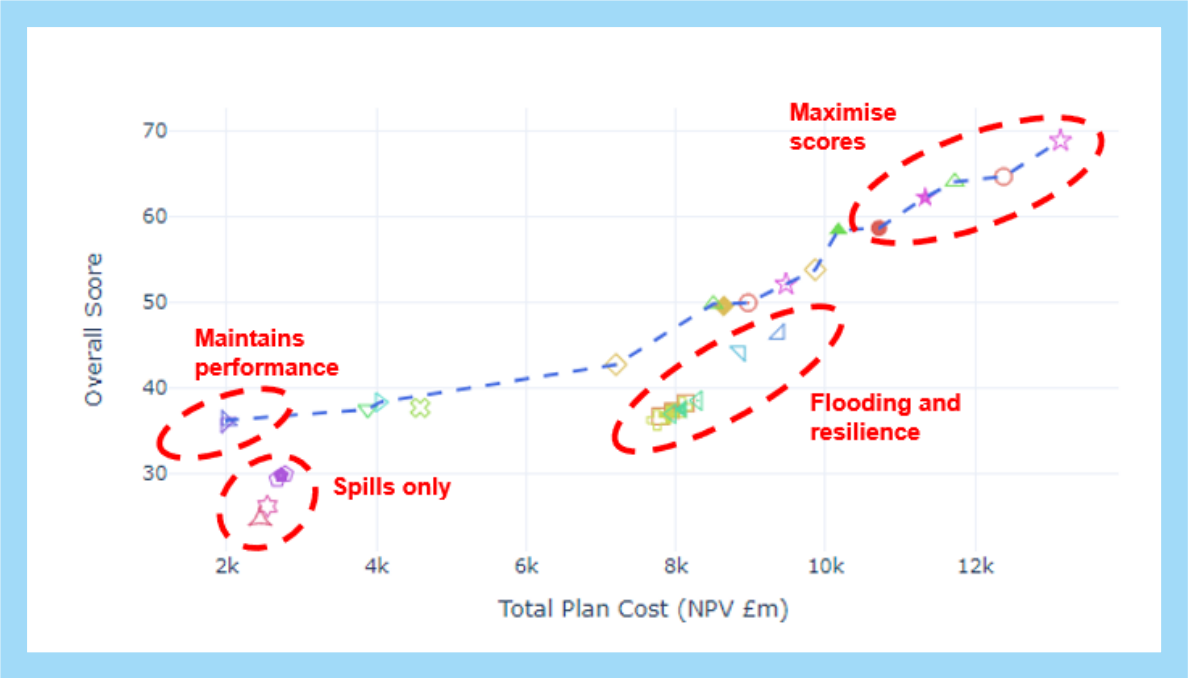
Table 6-1 Example combinations of defined constraints to meet different objectives

6.3 The plan objectives were further refined and prioritised through engagement and discussions with our L1 region-wide stakeholders as summarised in Table 6-2. Stakeholders were ambitious and wanted to see step changes in performance over the 25-year planning period. Whilst there was general agreement on the scale of long-term aspirations, we had to be realistic on what we could achieve in the first cycle. For example, stakeholders in London, following the July 2021 storms, wanted to see a level of service for flooding extended to protection from a 1 in 100 return period storm. We have not developed the extent or granularity of options to accommodate this as a robust region-wide cycle 1 output; however, we have recognised that pilot studies will be needed to develop the solutions to address this in the next cycle. Further details are provided in Technical Appendix P Response to July 2021 Floods.

New combinations of defined constraints	Top priority combinations of defined constraints	Low priority combinations of defined constraints
Unconstrained. Ensure we meet our legal obligations and 100% quality compliance at STWs (as well as single digit storm overflow discharges) **Unconstrained**. Ensure we meet higher level of service on sewer flooding – i.e. a 1 in 100 year storm event [Note that options have not been developed during ODA for this level of service so has not been considered as part of PA) **Semi-constrained**. Meet good environmental outcome with no bill volatility. Have support for vulnerable customers who struggle to pay	Flooding benefits (reduction in risk to property) Resilience to a 1 in 50 year storm event Reduction in surface water runoff Minimise carbon Environment score Natural capital score No adverse impact from storm overflow discharges Flow compliance	Maintain current performance Keep bills flat up to 2030 Keep bills flat up to 2035 Keep bills flat up to 2050 Storm overflow spill frequency of < 20 per year (on average) by 2050 Zero storm overflows by 2050

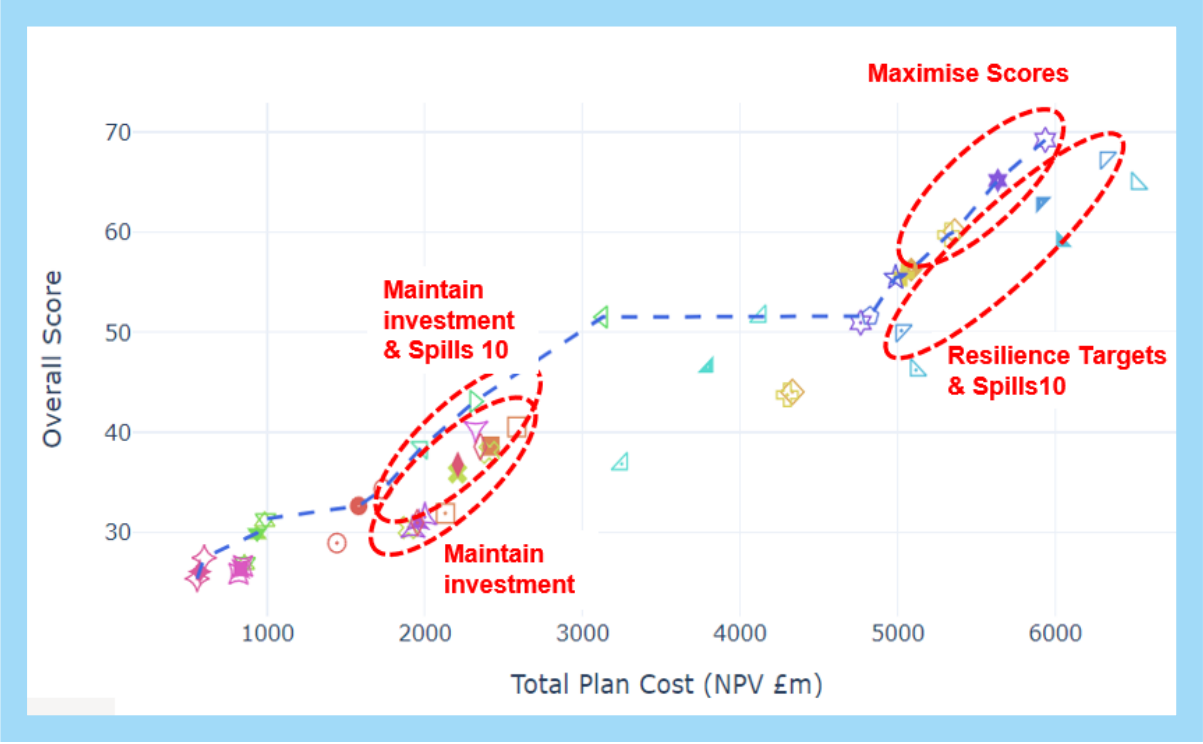
Table 6-2 Stakeholder feedback on combinations of defined constraints at draft DWMP

6.4 Different combinations of defined constraints were assessed on their successful delivery of outcomes, overall cost and relative metric performance as described in Section 4. Overall performance score was assessed across a Pareto front to determine which plans provided the best value for a given cost. Examples using the Pareto front for London and for Thames Valley are presented in Figure 6-1 and Figure 6-2 respectively.



Note: NPV (Net Present Value) represents the present value of the plan cash flow

Figure 6-1 Cost-benefit curve at draft DWMP – London



Note: NPV (Net Present Value) represents the present value of the plan cash flow

Figure 6-2 Cost-benefit curve at draft DWMP – Thames Valley Home Counties

Refining our bookend plans

6.5 Following the refinement of performance objectives and initial plan testing, we identified a range of plans that delivered the ambition expressed within our stakeholder feedback; we have called these 'bookend' combinations of defined constraints. Our bookend plans defined the range in outcomes as listed below:

- Maintain flooding: maintain property flooding performance at 2025 levels for the next 25 years, mitigating internal and external flooding at 8,000 internal and 6,000 properties respectively per AMP
- No harm from storm overflow discharges: <=10 annual storm overflow discharge frequency by 2045 at all overflows identified in the BRAVA stage
- Maximum benefit: optimise across all value criteria to achieve the maximum benefit score for least cost
- Resilient system:
    - Achieve a storm overflow discharge frequency of <10 per year (on average) at all overflows identified in the BRAVA stage
    - Meet 1 in 50 year storm return event flooding targets by 2050
    - Deliver a feasible level of surface water management within the initial 10 year period of the plan

Selecting a best value draft plan

6.6 The range of plans together with our bookend plans were presented for discussion and challenge with L1 stakeholders with the aim of identifying the best performing plans.

6.7 The resilient plan was also profiled to understand both the effect on cost and the scope to provide time:

- To understand and improve delivery capability
- For further investigations and modelling to reduce uncertainties and improve understanding of surface water interaction to target property risk more effectively
- To scale up for delivery of surface water management from AMP10, innovation and development of partnerships to deliver the best outcomes

6.8 Three versions of the resilient plan were explored: go fast, go even and go steady, reflecting different pace of investment. The go steady resilient plan was recommended to stakeholders as the plan which delivered the best balance of cost, performance and time to address key plan uncertainties and deliverability.

6.9 The feedback from the L1 strategic forum was positive and recommended further consideration of how we could work more collaboratively with our partners to address the required resourcing and surface water management delivery challenges.

6.10 A full assessment of alternative plans was presented in our draft DWMP. Following our assessment of the draft plans and in balancing our ambitions, our stakeholder and customer desires, our value criteria and affordability, we selected the resilient plan in its go steady version as our preferred draft plan for our catchments both inside and outside London. This:

- Comprised a large-scale retrofit of sustainable drainage solutions, a three-fold increase in the length of sewer lining, alongside new and upsized sewers, and attenuation storage

- Focuses on removing unwanted flow such as groundwater infiltration and misconnections from our foul sewer systems
- Achieved a storm overflow spill frequency target of <10 per year (on average) by 2045 at all overflows requiring options to address issues identified in the BRAVA stage
- Removed the predicted risk of flooding in a 1 in 50 year storm event to 155,000 properties in our catchments in London and to all properties in our catchments outside London (50% of properties by 2030, 75% by 2035 and 100% by 2050)
- Provided a long-term adaptive plan for STW compliance

6.11 A summary of the key metrics for the draft DWMP preferred plans for the catchments within and outside of London is presented in Table 6-3 below.

	Draft Plan - London	Draft Plan - TVHC
Indicative construction cost (Capex) (£ million)	15,446	7,922
Indicative customer bill impact (£ per year per household)[1]	56.2	27.95
Storm overflow discharge reduction (in a typical year)	2,422	97,391
Resilience (no. of at-risk properties benefitting up to a 1 in 50 storm event)	155,018	20,651
Internal flooding (no. of at-risk properties benefitting up to a 1 in 30 storm event)	65,331	4,382
External flooding (no. of at-risk properties benefitting up to a 1 in 30 storm event)	71,356	10,498

1 – Indicative average annual bill impact over the 25 years of the plan (£/household) as described in Section 4

Table 6-3 Key outcomes at draft DWMP

Consultation feedback on our draft plan

6.12 We undertook a formal public consultation involving our regulators, stakeholders and customers to collect feedback on our draft DWMP. We published our draft DWMP for public consultation on Thursday 30 June 2022 and the consultation closed on Monday 26 September 2022. Alongside this we also undertook customer research using an online survey to collect additional feedback from our household (residential) and non-household (commercial) customers. Details of each part of our consultation are provided in Technical Appendix N - Consultation Response - You Said We Did.

6.13 The consultation response showed general support for our draft preferred plan. More than 60% of our customers agreed that our plan was acceptable, see Figure 6-3 and Figure 6-4.

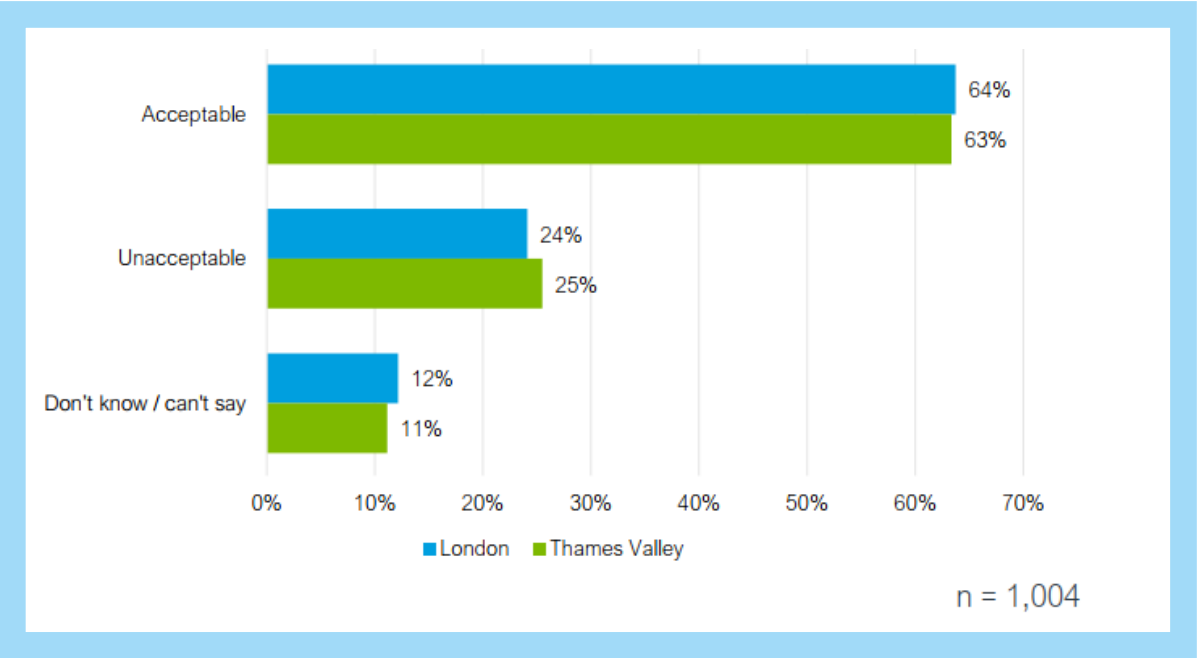


Figure 6-3 Overall, how acceptable is the plan for improving the wastewater system in the region and its impact on customer bills? (Customer survey question to household customers)

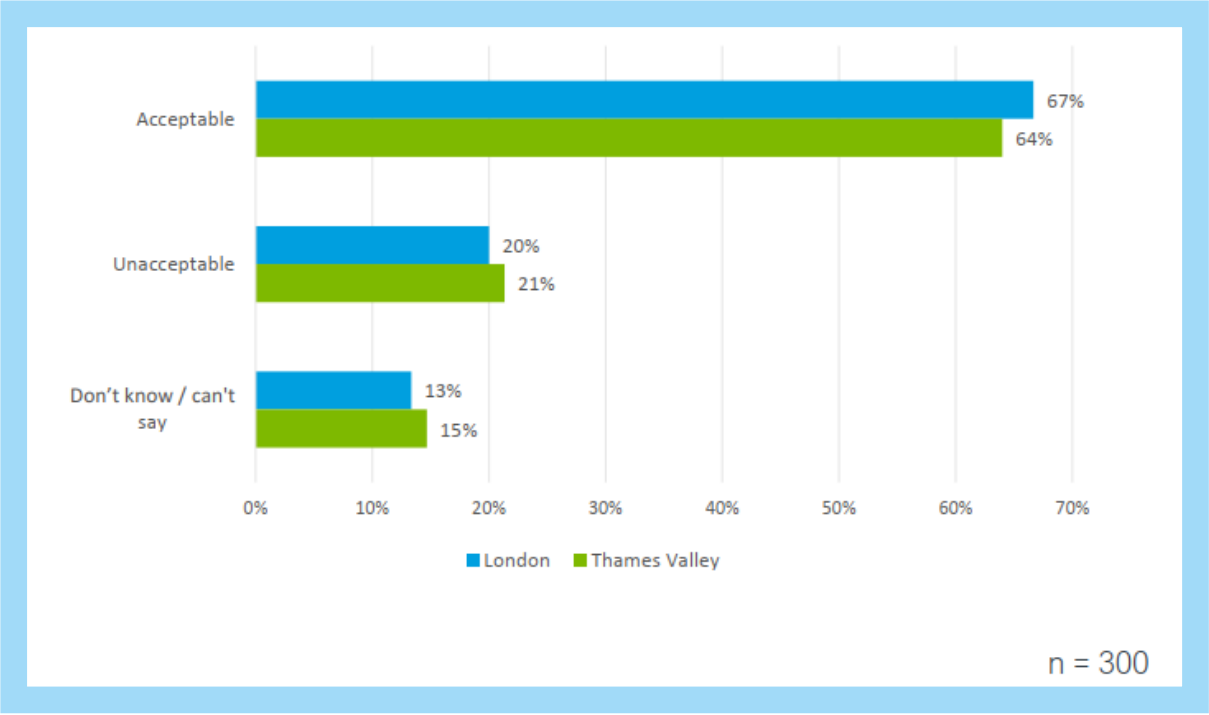


Figure 6-4 Overall, how acceptable is the plan for improving the wastewater system in the region and its impact on customer bills? (Customer survey question to non-household customers)

6.14 The consultation responses also identified where there was less support for our plan; in particular, challenge on:

- Our targets – customers wanted amendments or some new plans to be added, particularly addressing more stringent storm overflow performance
- Our programme – customers wanted quicker delivery in certain areas but also expressed concerns about such an ambitious surface water management plan
- Cost – customers were worried about the impact on bills and the visibility of this. Whilst 64% of those consulted thought the plan and its impact on customer bills was acceptable,

53% also stated that they did not believe our draft plan achieved the right balance between affordability, deliverability and ambition and wanted us to be more ambitious
- Accessibility - customers wanted us to make the Programme Appraisal documentation more accessible to non-technical stakeholders

6.15 On programme appraisal, Ofwat wanted us to provide:
- More clarity of different plans in our decision making; comparing our preferred plan with the least cost plan and other alternative plans to demonstrate how we achieve best value in our final DWMP
- More visibility of the costs, including expenditure timeline, to indicate the impact on customer bills from the preferred and alternative plans
- A range of alternative plans showing a breakdown of the likely impact on affordability and customer bills
- Demonstrate how the responses to our consultation have influenced the final DWMP

6.16 Feedback specific to our London plan identified concerns over the deliverability of the extent of surface water management envisaged, although there were firm views that some of the barriers outlined may not be insurmountable through more effective collaboration and co-funding with other organisations.

6.17 Feedback on our Thames Valley and Home Counties plan identified concerns over a lack of ambition on reducing storm overflow discharges in the short term, low investment in surface water management and a lack of consideration of rural land management measures.

6.18 The feedback from the public consultation, together with new legislation, has been used to inform our final DWMP. Based on the specific feedback from our public consultation we identified the following aspects to consider in developing the best value plan for our final DWMP:
- More ambitious storm overflow discharge targets to help protect the environment
- Increased balancing of risk, ambition and deliverability
- Increased alignment of DWMP to other strategies and delivery plans
- Earlier planned implementation

6.19 In addition, the options assessed through our alternative plans have been further developed to include:
- Pluvial and fluvial flood resilience options for sewage treatment assets following L1 stakeholder feedback
- Flood risk and mitigation to non-residential properties

6.20 The PA stage has not considered the potential impact of better information on our plan. This will be addressed as part of our cycle 2 planning.

6.21 We have also enhanced our reporting in this Technical Appendix to make the document more accessible and to further demonstrate how we have:
- Assessed our alternative plans for our catchments, including potential customer bill impacts (see paragraph 4.30)
- Evidenced our reasons for discounting alternative plans
- Selected the best value for our catchments

7 Developing final plans that achieve our planning objectives

7.1 This section details our approach and development of final plans following public consultation and learning from our draft plan as discussed in section 6.

7.2 Development of our final plan builds on the approach developed with stakeholders in identifying our draft preferred plan and feedback following public consultation on the draft DWMP. This includes the impact of new statutory obligations on storm overflow discharge reduction and further development of our options as discussed in section 3 and section 5.

7.3 Given the new statutory obligations on storm overflow discharges, the focus has shifted to prioritise delivery of reductions in storm overflow discharges over improving flooding resilience in the immediate term. They explore the implications of implementing different levels of ambition from delivering reductions at all sites by 2035 to reductions at sites discharging to high priority watercourses by 2035, discharges to designated bathing waters by 2035, and further reductions at other sites by 2045.

7.4 As a result, our final DWMP has less freedom to balance storm overflow discharges and flooding requirements and options to address our flooding ambition are significantly deferred.

7.5 As a consequence, the suite of options presented for our draft and final plans differs, both in respect of performance targets (e.g. for storm overflows) and associated timings.

7.6 Our plan balancing to 2030 focusses on flooding schemes that can be delivered within deliverability constraints and affordability, informing our PR24 plans. This means that in our final plans, our short-term schedule of options for AMP8 are constrained but ensures short-term alignment and deliverability of our DWMP and PR24 plans.

7.7 We have continued to explore how the pace of delivery can be varied to reduce impact on customers' bills.

Developing our final plans

7.8 At the draft plan stage, we identified and appraised the following plans and outcomes, as described in Section 6:

- Maintain flooding: maintaining property flooding performance at 2025 levels for the next 25 years, mitigating internal and external flooding at 8,000 internal and 6,000 properties respectively per AMP
- No harm from storm overflow discharges: <=10 annual storm overflow discharge frequency by 2045 at all overflows identified in the BRAVA stage
- Maximum benefit: optimise across all value criteria to achieve the maximum benefit score for least cost
- Resilient system:
    - Achieving a storm overflow discharge frequency of <10 per year (on average) at all overflows identified in the BRAVA stage

- Meeting 1 in 50 year storm return event flooding targets by 2050
- Delivering a feasible level of surface water management within the initial 10 year period of the plan

7.9 All plans considered in developing the final preferred plan now prioritise delivery of reductions in storm overflow discharges. They build on the plans set out at draft but deliver a different and larger suite of options and explore different levels of ambition in storm overflow reductions from:

- Delivering reductions at all sites by 2035, to
- Reductions at sites discharging to high priority watercourses by 2035, discharges to designated bathing waters by 2035, and further reductions at other sites by 2045.

7.10 As a result, our plans have been re-shaped and now include one plan, Maintain flooding resilience, to provide a baseline, business as usual position (plus new storm overflow reductions) against which other plans are compared. The plans assessed for our final DWMP include:

- Maintain flooding resilience: this plan is similar to that at draft in maintaining flooding performance but now prioritises delivery of our storm discharge reduction programme to meet legislative requirements and represents the minimum investment to achieve our current performance levels and legislative requirements:
  - Delivery of our storm discharge reduction plan for all high priority sites by 2035 and all sites by 2045
  - Maintain property flooding performance at 2025 levels for the next 25 years, mitigating flooding in a 1 in 50 storm event for 10,000 properties in AMP9, 20,000 in AMP10 and 25,000 in each of AMP11 and AMP12

  The maintain plan has been assessed despite it being a low priority to stakeholders as it provides a clear reference point against which more ambitious plans can be assessed.

- Resilient - constrained: this plan prioritises delivery of our storm discharge reduction programme to meet legislative requirements and imposes a constrained/steady pace of investment on flooding performance in AMP8 and AMP9 to manage impact on customers' bills and deliverability (following the approach to flooding developed for the (preferred) resilient plan consulted on at draft DWMP):
  - Delivery of our storm discharge reduction plan for high priority sites by 2035 and all sites by 2045
  - Meet 1 in 50 year storm return event flooding targets by 2050
  - Constrained within the initial 10-year period to deliver feasible surface water management in AMP8 and similar profile in AMP9

- Accelerated/deliver sooner: this plan prioritises delivery of our storm discharge reduction programme to meet legislative requirements by 2035 and delivery of our flooding targets sooner than the Resilient – constrained plan:
  - Delivery of our storm discharge reduction plan for all sites by or before 2045
  - This uses an accelerated 'go faster' spend profile to deliver our storm overflow reduction and 1 in 50 year storm return even flooding targets sooner

- **Maximum community benefit**: this plan prioritises delivery of our storm discharge reduction programme to meet legislative requirements and, as with the Maximum benefit plan at draft, selects those options that meet our DWMP planning objectives which also create the most benefit to communities and the environment:
    - Delivery of our storm discharge reduction plan for all high priority sites by 2035 and all sites by 2045
    - Meet 1 in 50 year storm return event flooding targets by 2050
    - Optimise our plan across all value criteria to achieve the maximum benefit score for least cost
    - The plan has an unconstrained spend profile so the DST will deliver the most efficient plan that achieves the fastest delivery of plan outcomes

7.11 As noted in section 5, the very different characteristics of our catchments inside and outside of London means that we have different levels of service for sewer flooding. This reflects the scale of the challenge of eradicating flood risk in London, in particular, due to the density of properties, prevalence of basement dwellings, and the combined nature of the network in central London.

7.12 Prioritising delivery of our storm overflows reduction programme in accordance with new legislative requirements means that our alternative plans for our final DWMP have less freedom to balance storm overflow discharges and flooding requirements. We have, therefore, identified plans that allowed us to test a range of pace, ambition and impact on customers' bills.

7.13 Additional spend in AMP8 is also constrained as a result and all plans prioritise selection of options that will deliver known flooding benefits within AMP8. This provides alignment with PR24.

Assessing alternative final plans for our catchments in London

7.14 In addition to prioritising delivery of our storm overflows reduction programme, in developing plans for our catchments in London we have drawn on feedback from our public consultation; in particular, concerns regarding the deliverability of our surface water management targets.

7.15 The performance of each of the four alternative plans compared to the preferred plan at draft stage is given in Table 7-1, Table 7-2, Figure 7-1, Figure 7-2, Figure 7-3, Figure 7-4 and Figure 7-5.

	Maintain Flooding Resilience	Maximum Community Benefit	Resilient - Constrained	Accelerated /Deliver Sooner	Draft Plan
Indicative construction cost (Capex) (£ million)	15,774	23,119	22,922	23,397	15,446
Indicative customer bill impact (£ per year per household)[1]	58.58	140.52	74.83	129.36	56.20
Resilience (no. of at-risk properties benefitting up to a 1 in 50 storm event)	116,968	165,377	164,706	166,698	155,018
Internal flooding (no. of at-risk properties benefitting up to a 1 in 30 storm event)	47,429	67,410	66,559	67,775	65,331
External flooding (no. of at-risk properties benefitting up to a 1 in 30 storm event)	53,231	76,841	76,527	77,633	71,356

1 – Indicative average annual bill impact over the 25 years of the plan (£/household) as described in Section 4.30

Table 7-1 Comparison of alternative plans at final DWMP (London catchments)

Plan	Indicative customer bill impact (£ per year per household)[1]					
	AMP8	AMP9	AMP10	AMP11	AMP12	Average Impact
Resilient - Constrained	3.55	19.92	55.80	113.23	181.66	74.83
Max Community Benefit	3.55	94.63	191.05	211.82	201.56	140.52
Maintain Flooding Resilience	3.55	19.71	47.42	88.83	133.41	58.58
Accelerated/Deliver Sooner	3.55	78.81	160.91	198.89	204.63	129.36

1 – Indicative average annual bill impact over the 25 years of the plan (£/household) as described in Section 4.30.

Table 7-2 Indicative customer bill impact (£ per year per household)(London catchments)

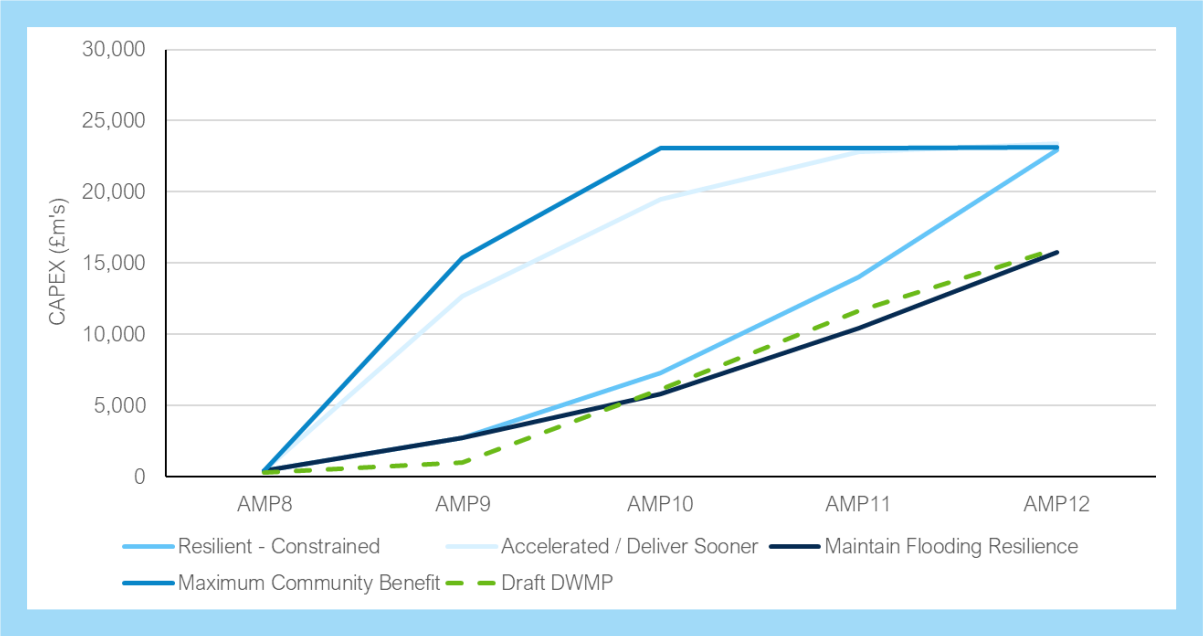


Figure 7-1 Comparison of Capex spend profile for alternative plans at final DWMP (London catchments)

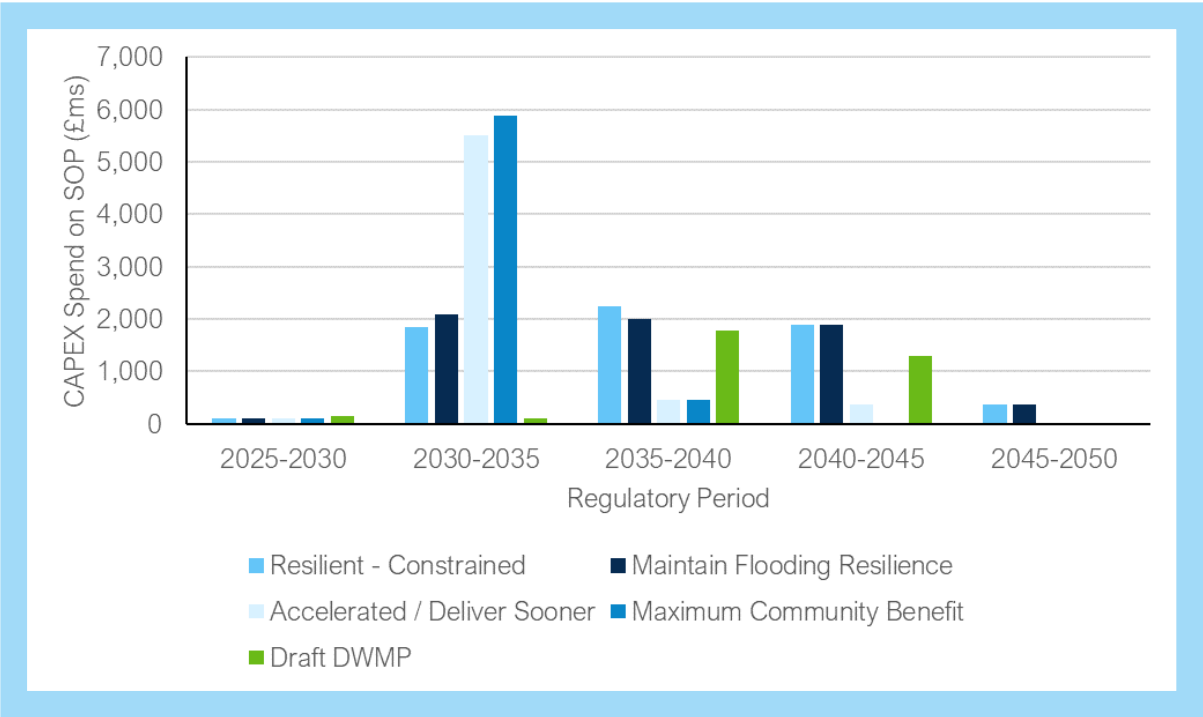


Figure 7-2 Comparison of Capex spend profile on storm overflow discharges for alternative plans at final DWMP (London catchments)

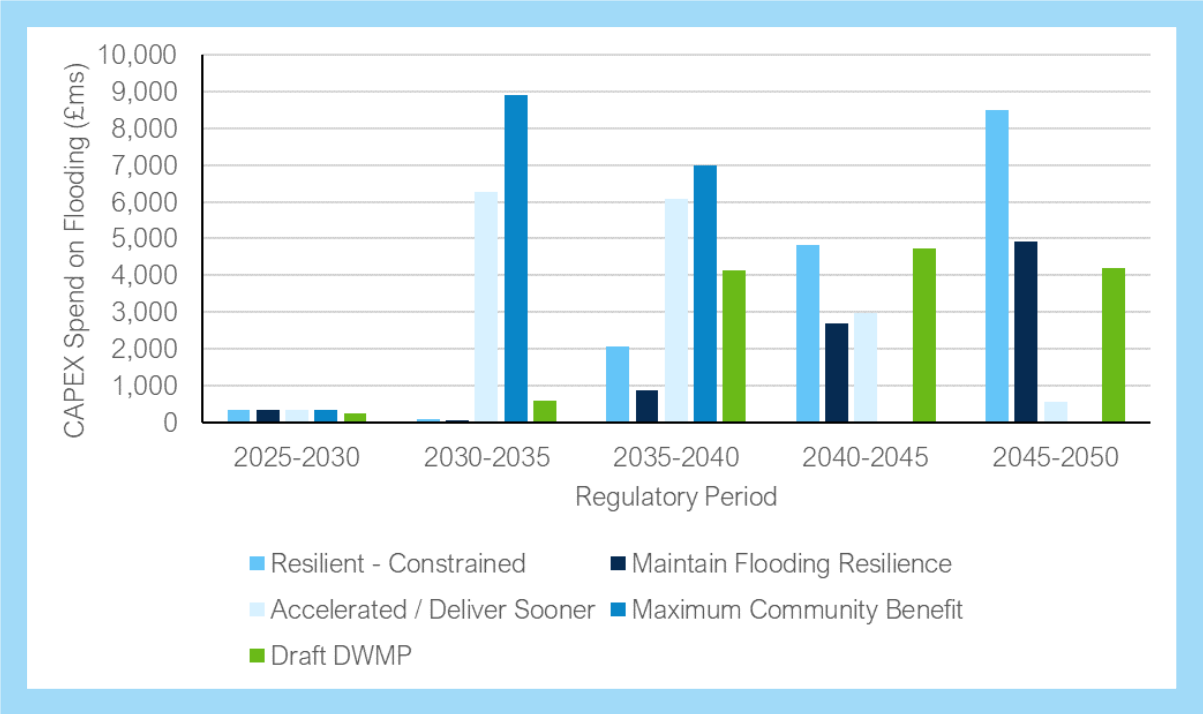


Figure 7-3 Comparison of Capex spend profile on properties protected from 1 in 50 Flooding events (Resilience) for alternative plans at final DWMP (London catchments)

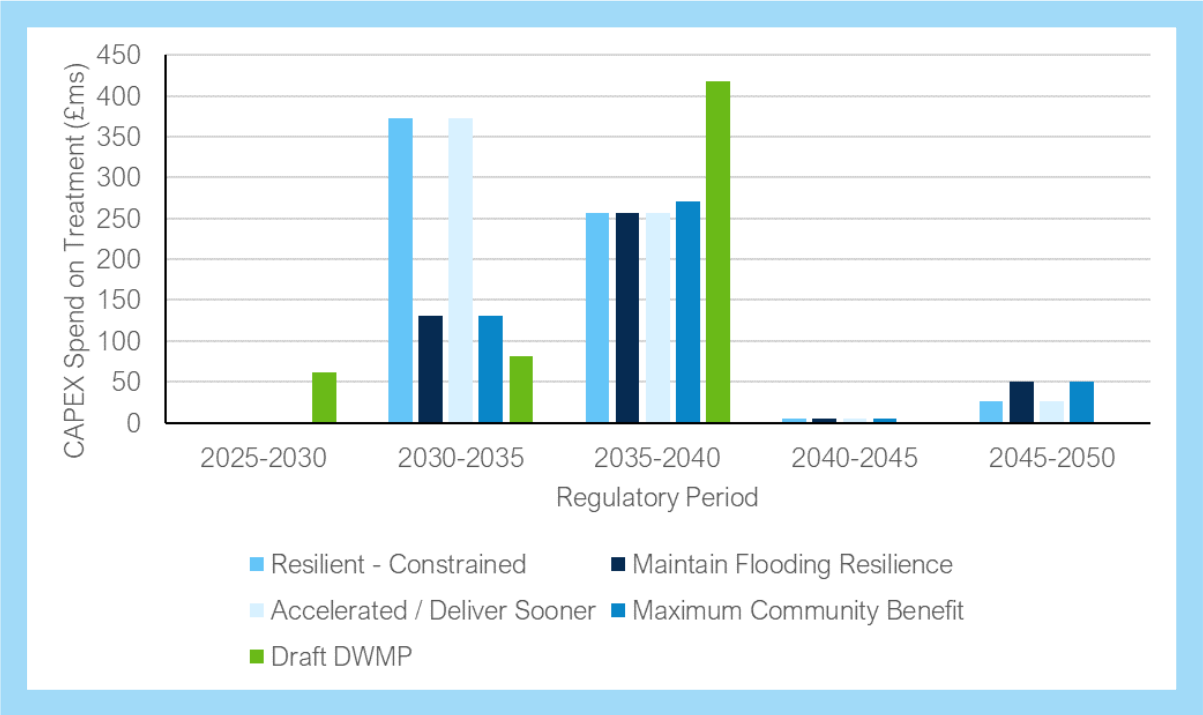


Figure 7-4 Comparison of CAPEX spend profile on STW compliance for alternative plans at final DWMP (London catchments)

Note 1: Least cost relates to the construction cost of each plan. Smallest bill impact represents the household bill increase of each plan which takes into account the profiling of investment. Carbon is considered as part of the natural capital element

Figure 7-5 Comparison of alternative plan results (London) – relative plan performance at final DWMP comparing benefits delivered by 2050

7.16 Table 7-1, Table 7-2, Figure 7-1, Figure 7-2, Figure 7-3, and Figure 7-4 indicate that:

- The costs of all plans have increased compared to our draft plan primarily as a result of new obligations under the Environment Act to address all storm overflows by 2050 (see Section 5). This means that our final maintain plan has a similar cost to the preferred plan set out at draft
- The 'Resilient - constrained', 'Accelerated' and 'Maximum community benefit' plans are the best performing, in delivering against our targets. These plans all have roughly the same construction cost (Capex).
- The 'Maintain flooding resilience' plan is approximately two-thirds of the Capex of other plans and delivers proportionately less benefit. It does not deliver the step change in performance required against our flooding planning objectives
- The indicative customer bill impact of the 'Resilient - constrained' plan is almost half that of the 'Maximum community benefit' and 'Accelerated' plans as the scale of delivery is reduced in the medium-term (to 2035)
- The indicative bill impact of the 'Maintain flooding resilience' plan is equivalent to approximately 80% of that of the 'Resilient - constrained' plan
- Excluding 'Maintain flooding resilience', the differences between alternative plans are driven by the pace of delivery of both storm overflow discharge reduction and flood resilience plans. The 'Maximum community benefit' and 'Accelerated' plans have a significant increase in number of storm overflow sites resolved in AMP9 and, hence, higher construction capex costs and bill impact compared to the 'Resilient - constrained' plan
- The 'Resilient – constrained' plan performs well on our primary planning objectives when compared to our 'Accelerated' and 'Maximum community benefit' plans. However, it performs less well on other factors due to the scale and relative timing of investment, and

hence the positive impacts of, for example environmental impact, wellbeing and collaboration, are realised later with the 'Resilient – constrained' plan

- Figure 7-5 provides a comparative assessment of benefits delivered by each plan by 2050. As a simple guide, the plan with the largest area under the radar plot delivers the best balance of value criteria and so the best value plan. As noted above, this shows that the 'Resilient - constrained', 'Maximum community benefit' and 'Accelerated' plans all deliver very similar performance across all 14 value criteria by 2050. However, the 'Resilient - constrained' plan shows a lower bill impact reflecting the profiling of investment. The 'Maintain flooding resilience' plan provides a similar level of performance to the 'Resilient - constrained' plan but fails to deliver the step change in flooding outcomes of other plans
- The similarity in performance between the 'Accelerated' and the 'Resilient - constrained' plans reflects the profiling of investment; the storm overflow reduction plans are the same but the 'Resilient - constrained' plan defers implementation of flooding options to later in the plan. The profile of the 'Resilient – constrained' plan delivers the same outcomes over the plan period but at lower cost, and lower bill impact to customers. However, in doing so, the benefits are also realised late in the plan period. Counterbalancing this, profiling provides time to address deliverability challenges and reduce uncertainties which may allow us in future cycles to identify how the plan can deliver more effectively

Identifying the best value final plan for our catchments in London

7.17 All the plans considered prioritise delivery of our storm discharge reduction plan and a small core of options that deliver flooding benefits within AMP8. The legislative requirements to address the Government's storm discharge reduction plan means that we have limited scope when developing our final DWMP to balance storm overflow discharges and flooding options in the short-term. However, all plans, other than the 'Maintain Flooding Resilience' meet our long-term ambition for the DWMP, but at different pace.

7.18 In assessing which plan provides best value we have considered the performance of each plan in terms of the deliverability and speed of delivery of that plan, and the need to manage impact on customers' bills:

- Deliverability – the industry challenges in delivering the scale of our surface water management delivery plan in the short to medium term are significant and has been recognised in the consultation feedback. We have yet to deliver more than 20 ha in a single AMP, so our AMP8 target of 150 ha may be considered a significant stretch. Our long-term targets are also well in excess of this. To meet our planning objectives, our plans aim to deliver approximately 7,000 ha. However, we recognise that we will need time to develop capacity and improve delivery over the 25-year plan period and so have to be realistic about what may be achievable in the short to medium term. Our 'Resilient – constrained' plan addresses this point and is based on a constrained pace of delivery particularly in AMP8 and AMP9 and then a steady pace beyond that to allow us to explore the impact on costs in view of the potential benefits of time to explore and innovate our delivery approaches
- Affordability – the customer bill impact of 'doing more' (Maximum community benefit) and 'doing more sooner' (Accelerated) is significantly more than the 'Resilient - constrained' plan, whilst still achieving the same or very similar outcomes over the longer term. Constraining plan costs in the short to medium term to manage bill impacts means that

investment is focussed primarily on delivering new obligations to reduce storm discharges to sensitive waterbodies and treatment works compliance. Schemes to address our flooding ambition are therefore significantly deferred; AMP8 and AMP9 flooding schemes are limited to priority flooding risks

7.19 In addition to managing customer bill impacts, our Resilient-constrained plan in constraining plan costs in the short to medium term will also provide benefit in terms of indirectly providing time to:

- Develop capacity and the innovation required to meet the scale of delivery envisaged, and potentially increase pace
- Provide the monitoring and modelling required to reduce the uncertainties in our assessment and provide a better understanding of properties at-risk of flooding and the scale and timing of options to address those risks
- Develop a better understanding of the scale of opportunity to develop green options and potential collaborations to ensure we deliver the best possible outcomes for our customers, communities and the environment

7.20 In contrast, accelerating investment, as in our 'Maximum community benefit' and 'Accelerated' plans, means that we will be scaling solutions to meet all the risks and uncertainties implicit in our plan. This risks schemes potentially being overdesigned, providing more capacity than might be required in future.

7.21 In assessing these trade-offs, we have taken into consideration the feedback received to our consultation on the draft plan; in particular,

- Our programme – you wanted quicker delivery in certain areas, particularly delivering more ambitious storm overflow discharge reduction targets to help protect the environment
- Reducing the impact on customer bills
- Better balancing of risk, ambition and deliverability; in particular, addressing the risks of delivering an ambitious surface water management plan

7.22 All of our plans prioritise delivery of our storm overflow reduction plan. However, the plan which we believe provides the better balance of cost, risk, ambition and deliverability is the 'Resilient – constrained' plan. On balance, this is because:

- It prioritises delivery of our storm overflow reduction plans
- In constraining the timing and scale of delivery of options to meet our plan objectives over the plan, it:
    - Provides the least impact on customer bills
    - Provides time for investigations to reduce risks and uncertainties in our plan
    - Provides time to build capacity and develop innovation to achieve the step change in delivery of an ambitious surface water management plan
- It provides the lowest cost plan to deliver our objectives

7.23 In conclusion, balancing our ambitions, our stakeholder and customer desires, our value criteria and affordability, we believe the 'Resilient – constrained' plan represents the best value and should be our preferred plan for our catchments inside London. This builds on the plan consulted upon for the draft DWMP and includes new storm overflow targets that are now also defined in statute.

7.24 Our final DWMP preferred plan:

- Achieves a storm overflow spill frequency target of <=10 per year (on average) at all high priority overflows by 2035 and all overflows by 2045. This is delivering these improvements significantly in advance of the legislative requirements of the Environment Act.
- Comprises a large-scale retrofit of sustainable drainage solutions, a three-fold increase in the length of sewer lining, alongside new and upsized sewers and attenuation storage
- Removes the predicted risk of flooding to 164,700 residential and non-residential properties in a 1 in 50 year storm event
- Provides a long-term adaptive plan for STW compliance

7.25 The preferred plan has also been profiled to allow:

- Scaling up for delivery of surface water management from AMP10, providing time for innovation and development of partnerships to deliver the best outcomes
- For further investigations and modelling to reduce uncertainties and improve understanding of surface water interaction to target property risk more effectively

7.26 Figure 7-6 shows the investment by AMP period for our preferred plan. It emphasises the priority given to delivery of our storm overflow reduction plans, particularly in the short to medium term, and to compliance and growth at our treatment works. The effect of this, in combination with a plan that constrains the pace of delivery and a steady cost, is to defer investment in flooding resilience options. As can be seen from the figure, the volume of flooding resilience options increases significantly over the medium to longer term. However, as there remains significant risk and uncertainty in the assessed risks and therefore, scale and timing of options required, this provides time in the short to medium term for investment in monitoring and modelling to provide better understanding and confidence in what future solutions will be required.

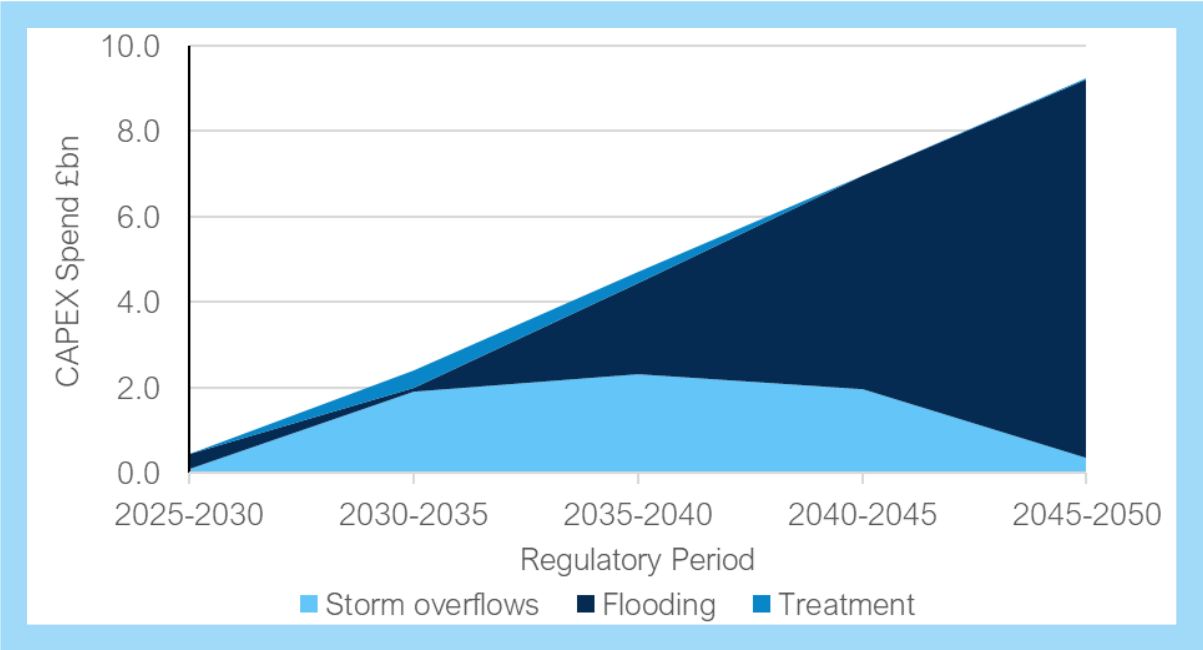


Figure 7-6 CAPEX spend (£bn) on flooding, storm overflows and treatment solutions in each AMP period for the final plan for catchments in London.

7.27 Figure 7-7 presents the investment by AMP period for our draft plan to provide comparison and helps to illustrate how our 'Resilient – constrained' plan has developed from the draft DWMP. As discussed, the greater storm overflow investment shifts some of the flooding investment into later AMP periods. This helps explain how the majority of the bill impact is driven by SODRP obligations. In the draft plan the spend is more focused on the later AMP periods which applies a greater discounted cost and therefore smaller bill impact. As the SODRP obligations are required in the early AMP periods in our final plan, this has a greater impact on bills.

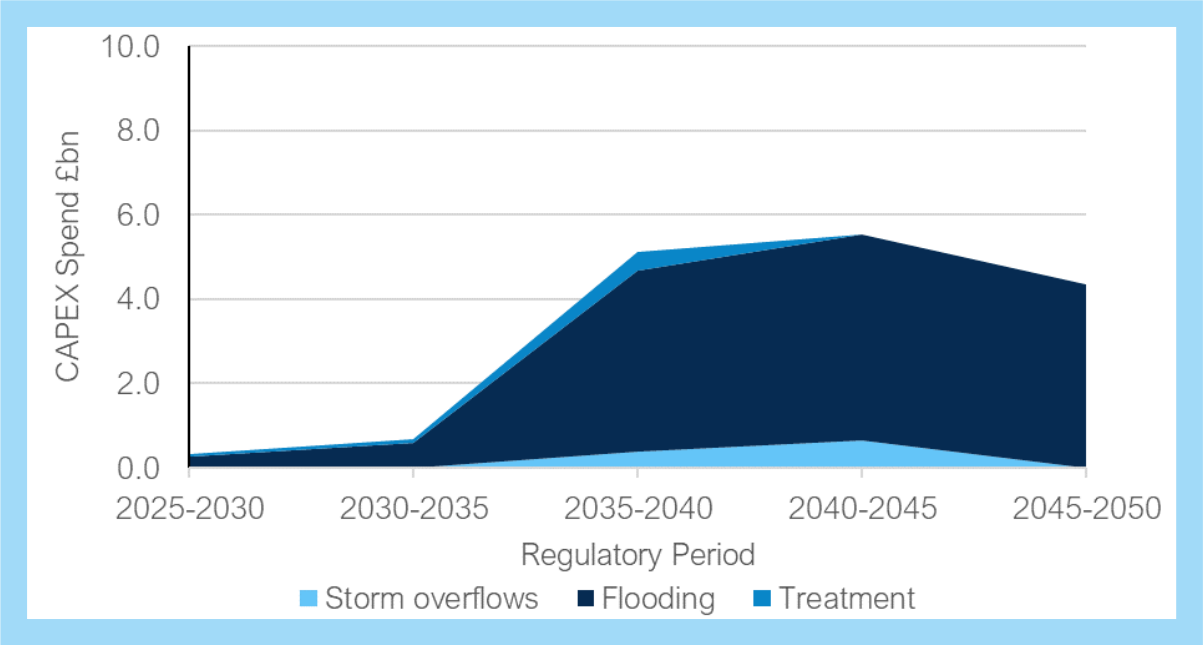


Figure 7-7 CAPEX spend (£bn) on flooding, storm overflows and treatment solutions in each AMP period for the draft DWMP plan for catchments in London.

Assessing alternative final plans for our Thames Valley and Home Counties catchments

7.28 In addition to prioritising delivery of new statutory storm overflow discharge reduction targets, our approach to developing plans for our Thames Valley and Home Counties catchments has focused on removing unwanted flow from groundwater infiltration and misconnections into our foul sewer systems and flooding reduction targets across the region.

7.29 We have developed plans that reflect feedback from public consultation regarding increasing investment in surface water management with greater consideration of rural land management measures. We have also explored a range of ambition to allow these alternative plans to be compared and assessed.

7.30 The performance of the four alternative plans is summarised in Table 7-3 and Table 7-4. The performance metrics from the draft plan are included for comparison.

	Maintain Flooding Resilience	Maximum Community Benefit	Resilient - Constrained	Accelerated/Deliver Sooner	Draft Plan
Indicative construction cost (Capex) (£ million)	5,505	10,307	9,020	8,985	7,922
Indicative customer bill impact (£ per year per household)[1]	45.35	141.08	64.96	96.63	52.86
Resilience (no. of at-risk properties benefitting up to a 1 in 50 storm event)	8,101	22,313	22,313	22,313	20,651
Internal flooding (no. of at-risk properties benefitting up to a 1 in 30 storm event)	1,892	4,982	4,941	4,915	4,382
External flooding (no. of at-risk properties benefitting up to a 1 in 30 storm event)	4,292	11,682	11,602	11,547	10,498

1 – Indicative average annual bill impact over the 25 years of the plan (£/household) as described in Section 4.30.

Table 7-3 Comparison of alternative plans at final DWMP (Thames Valley and Home Counties catchments)

Plan	Indicative customer bill impact (£ per year per household)[1]					
	AMP8	AMP9	AMP10	AMP11	AMP12	Average Impact
Resilient - Constrained	14.55	33.47	54.27	87.38	135.13	64.96
Max Community Benefit	14.55	128.62	197.51	188.89	175.83	141.08
Maintain Flooding Resilience	14.55	30.65	41.76	58.42	81.35	45.35
Accelerated/Deliver Sooner	14.55	62.53	113.12	141.58	151.36	96.63

1 – Indicative average annual bill impact over the 25 years of the plan (£/household) as described in Section 4.30.

Table 7-4 Indicative customer bill impact (£ per year per household) (Thames Valley and Home Counties catchments)

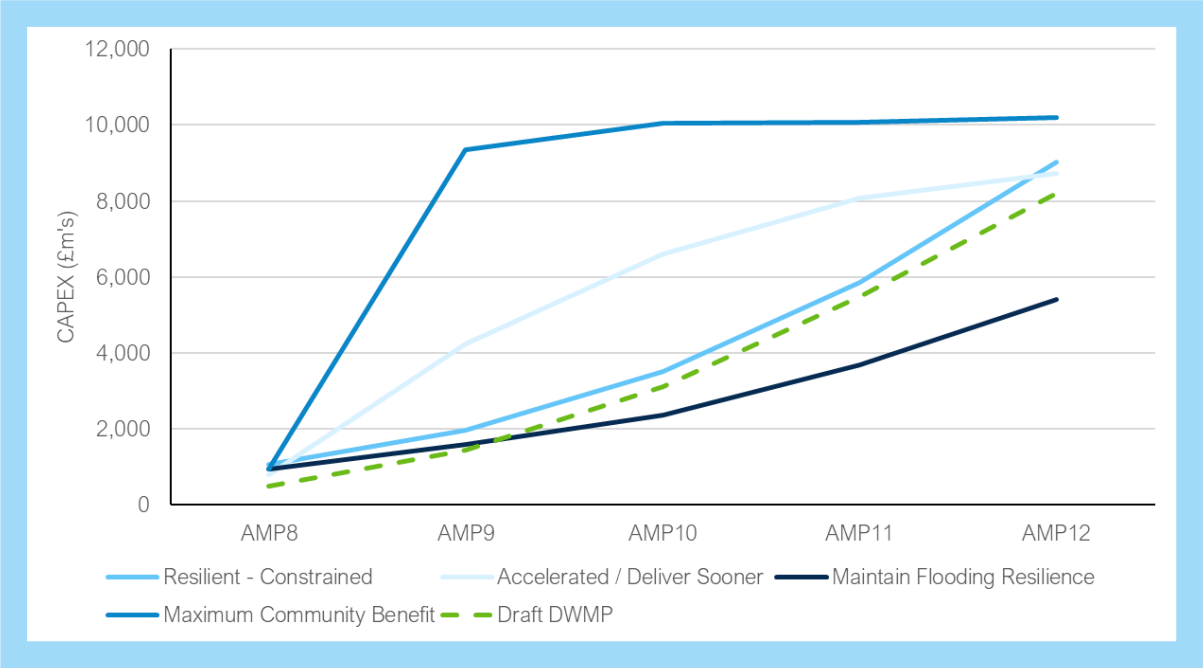


Figure 7-8 Comparison of Capex spend profile for alternative plans at final DWMP (Thames Valley and Home Counties catchments)

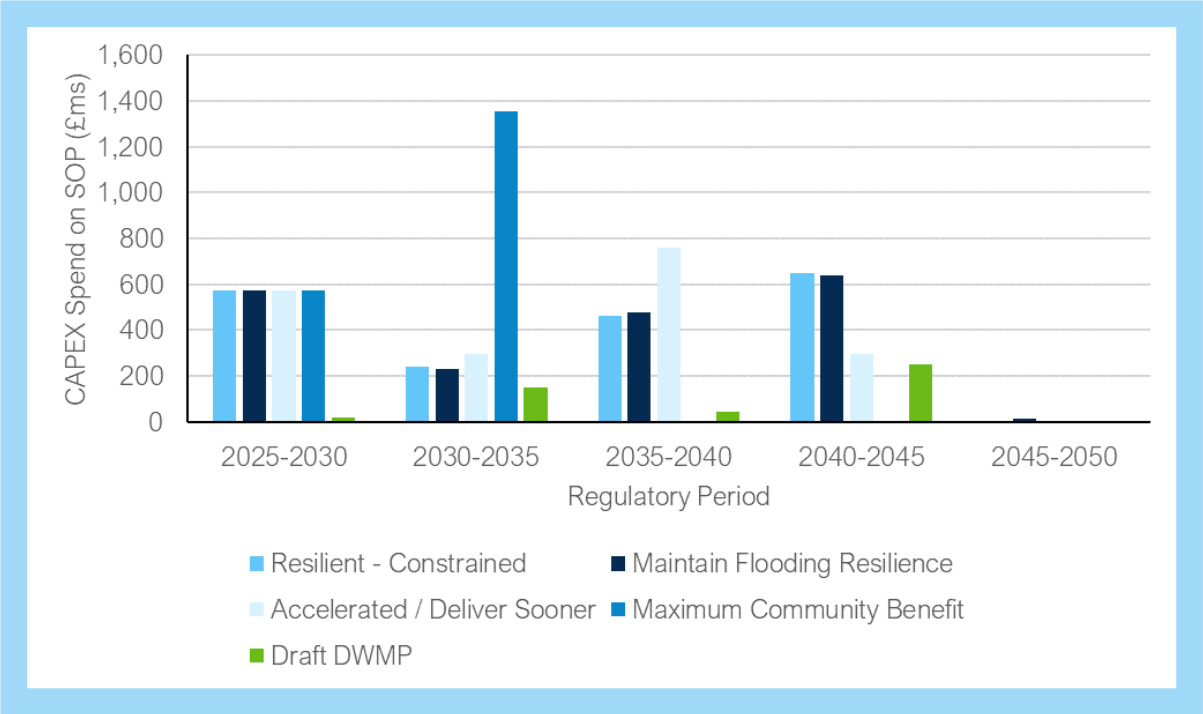


Figure 7-9 Comparison of Capex spend profile on storm overflow discharges for alternative plans at final DWMP (Thames Valley and Home Counties)

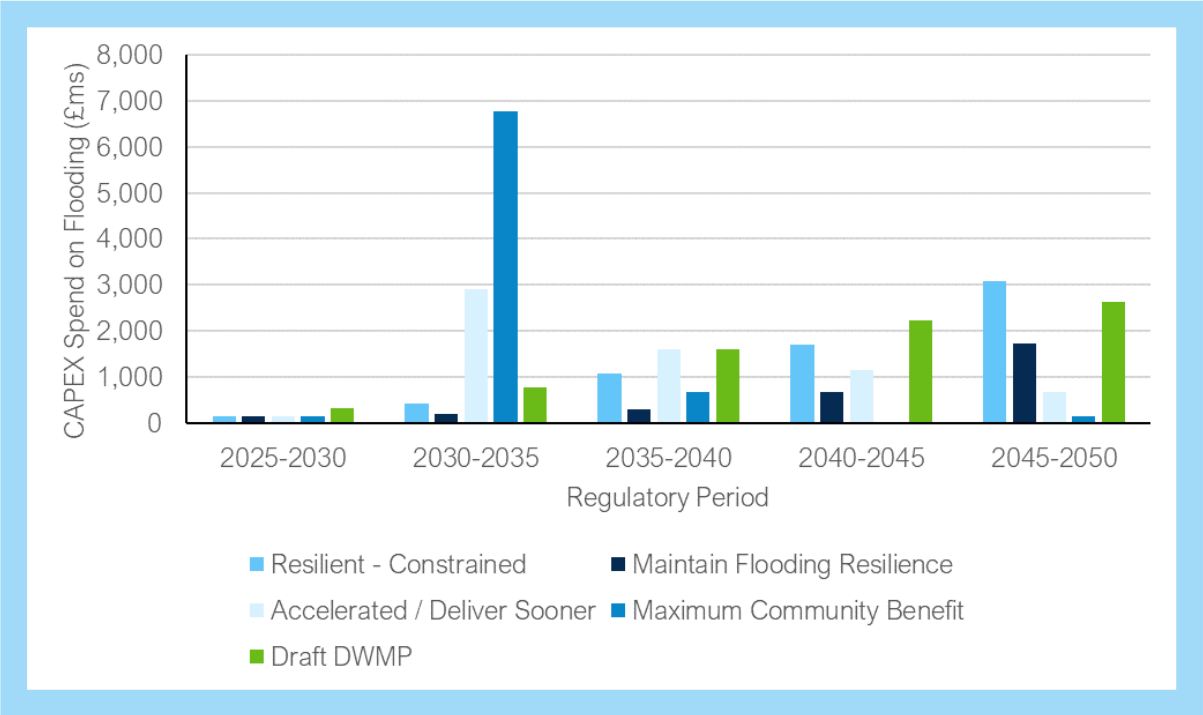


Figure 7-10 Comparison of Capex spend profile on properties protected from 1 in 50 Flooding events (Resilience) for alternative plans at final DWMP (Thames Valley and Home Counties)

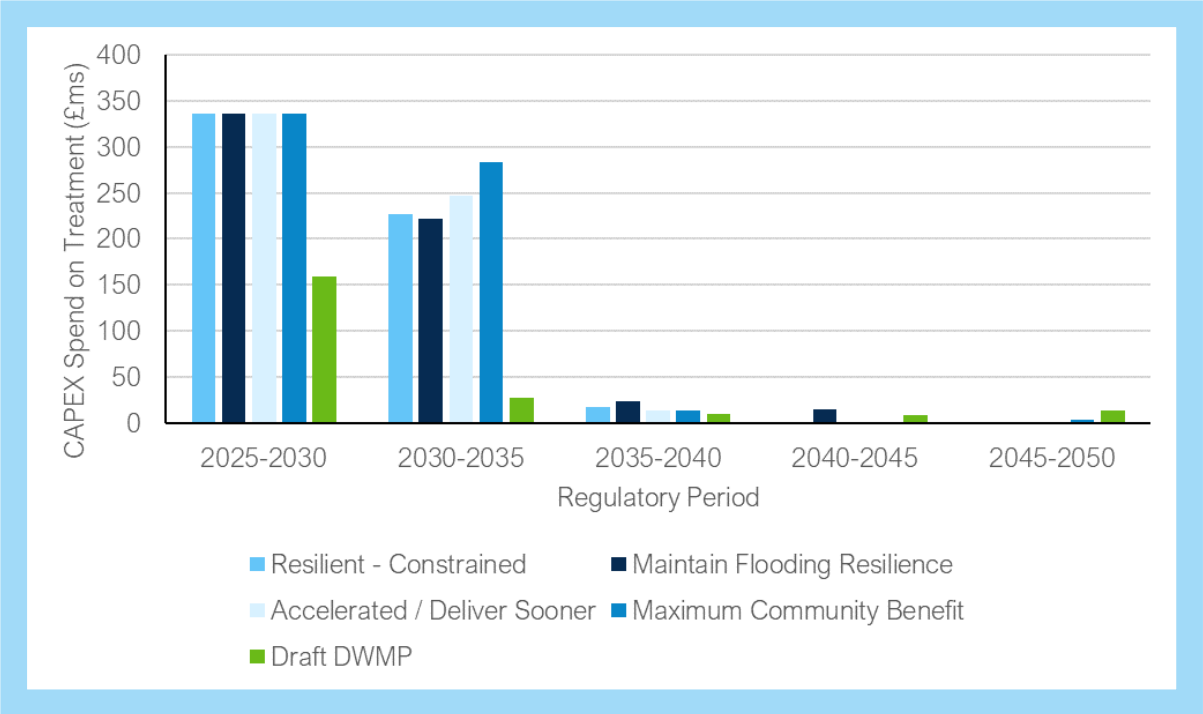
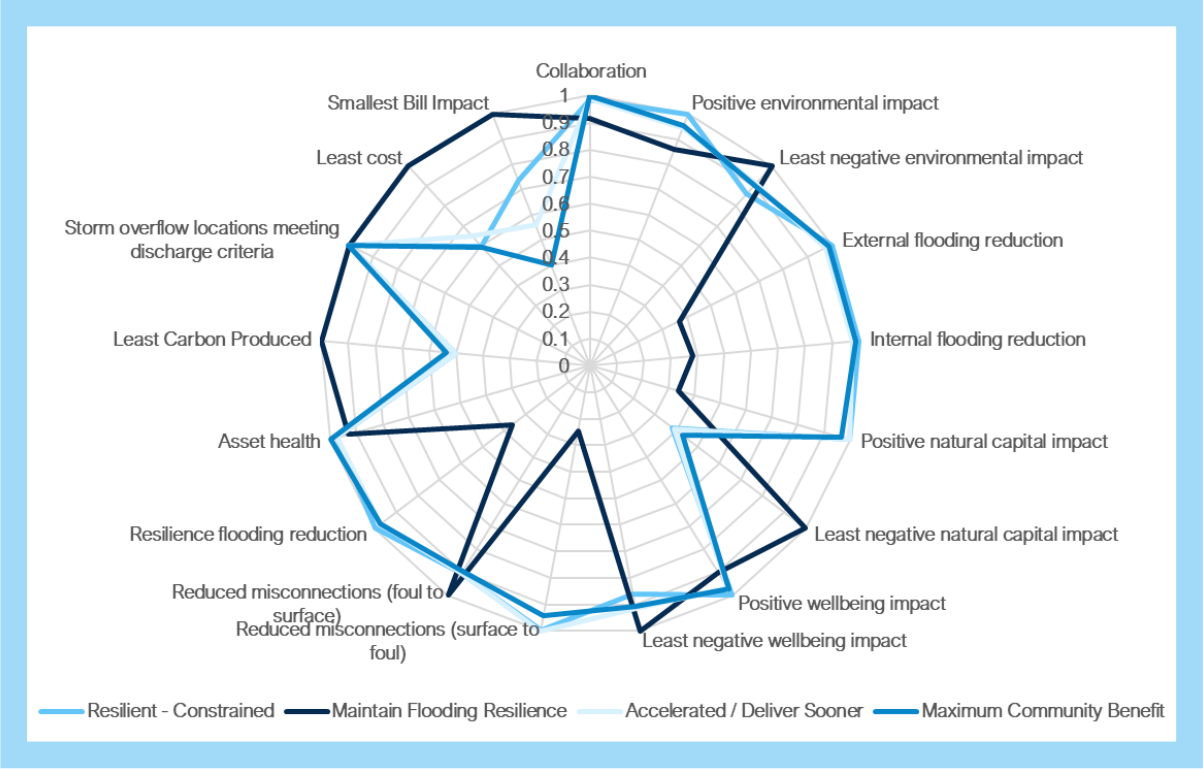


Figure 7-11 Comparison of CAPEX spend profile on STW compliance for alternative plans at final DWMP (Thames Valley and Home Counties)



Note 1: Least cost relates to the construction cost of each plan. Smallest bill impact represents the household bill increase of each plan which takes into account the profiling of investment. Carbon is considered as part of the natural capital element.

Figure 7-12 Comparison of alternative plan results (Thames Valley and Home Counties) – relative plan performance at final DWMP comparing benefits delivered by 2050.

7.31 Table 7-3, Table 7-4, Figure 7-8, Figure 7-9, Figure 7-10, Figure 7-11 and Figure 7-12 indicate that:

- The costs of all plans have increased compared to our draft plan primarily because of new obligations under the Environment Act to address all storm overflows by 2050 (see Section 5)
- The 'Resilient – constrained',' Accelerated' and 'Maximum community benefit' plans are the best performing and each meets our flooding planning objectives
- The 'Maintain flooding resilience' plan appears better performing in factors such as carbon, cost, least negative environment impact but this is because it is delivering far fewer options in only maintaining flooding performance at 2025 levels
- The 'Resilient – constrained',' Accelerated' and 'Maximum community benefit' plans all have similar construction cost (Capex). The 'Maintain flooding resilience' plan cost is equivalent to approximately 55% of this value and delivers proportionately less benefit. It does not deliver the step change in performance required against our flooding planning objectives
- The indicative customer bill impact of the 'Resilient – constrained' plan is just over half that of the 'Maximum community benefits plan and 75% of the 'Accelerated' plan. This reflects the reduced pace and scale of delivery of the 'Resilient – constrained' plan in the short to medium-term (to 2035)
- By contrast, the indicative customer bill impact of the 'Maintain flooding resilience' plan is equivalent to approximately 75% of the 'Resilient – constrained' plan
- The pace of delivery of both storm overflow reduction and flooding resilience plans varies between plans, although all plans deliver our obligations to reduce storm overflows to sensitive (high priority) watercourses by 2035. The 'Accelerated' plan addresses all storm overflow sites in AMP9 (by 2035) and, therefore, has a corresponding increase in construction cost and bill impacts compared to the 'Resilient – constrained' plan. The 'Maximum community benefits' plan delivers storm overflows in two phases (all high priority sites by 2035 and all sites by 2045) but has an unconstrained spend profile which achieves the most efficient way to deliver the plan outcomes fastest
- The cost of the 'Resilient – constrained' plan is similar to the preferred plan set out in our draft DWMP as the options selected in our catchments outside of London remain broadly similar between draft and final plans, as discussed in section 5
- The 'Resilient – constrained' plan performs as well, or similarly, across all metrics when compared to the 'Maximum community benefits' and 'Accelerated' plans
- Figure 7-12 shows that the 'Resilient - constrained', 'Maximum community benefit' and 'Accelerated' plans all deliver very similar performance across all 14 value criteria by 2050. We have explored this further to consider performance across the whole plan period rather than only by 2050. Looking in more detail at the options selected between plans, the main reason for this relates to the profiling of investment in the 'Resilient - constrained' plan. Essentially, because we have the same storm overflow reduction plans but are implementing additional flooding options later in the plan, the long-term effect of the options currently selected on wider benefits is limited in the 'Resilient - constrained' plan. This clearly points to the need for further work in cycle 2 to explore how we can develop and improve our options, particularly in terms of wider environmental benefits
- Environmental, natural capital and wellbeing outcomes are high for the 'Resilient – constrained' plan. For some metrics 'Resilient – constrained' outperforms 'Maximum

community benefit' plan as the scale of delivery is marginally reduced, hence the negative impacts are marginally reduced

Identifying the best value final plan for our Thames Valley and Home Counties catchments

7.32 All the plans considered prioritise delivery of our storm discharge reduction plan and a small core of options that deliver flooding benefits within AMP8. The legislative requirements to address the Government's storm discharge reduction plan means that we have limited scope when developing our final DWMP to balance storm overflow discharges and flooding options.

7.33 In assessing which plan provides best value we have considered the performance of each plan in terms of the depth of understanding of our surface water networks and speed of delivery of that plan, and the need to manage impact on customers' bills:

- Lack of understanding of our surface water networks and third-party surface water drainage systems – our sewer networks in Thames Valley and Home Counties have primarily been constructed to operate as separate systems, conveying only foul flow or surface water flow. In practice, many foul networks currently operate as 'combined' systems, conveying foul flow and surface water runoff. The latter enters our systems through a variety of mechanisms including groundwater infiltration and property misconnections. It is important that we undertake further investigations and modelling to reduce uncertainties and improve our understanding of surface water interaction to target property risk more effectively
- Affordability – the customer bill impact of 'doing more' (Maximum community benefit) and 'doing more sooner' (Accelerated) is significantly more than the 'Resilient – constrained' plan, whilst still achieving the same or very similar outcomes. Constraining plan costs in the short to medium term to manage bill impacts means that investment is focussed primarily on delivering new obligations to reduce storm discharges to sensitive waterbodies and treatment works compliance. Schemes to address our flooding ambition are therefore significantly deferred; AMP8 and AMP9 flooding schemes are limited to priority flooding risks

7.34 In addition to managing customer bill impacts, constraining plan costs in the short to medium term will also benefit in terms of indirectly providing time to:

- Provide the monitoring and modelling required to reduce the uncertainties in our assessment and provide a better understanding of surface water interaction to target property risk more effectively
- Develop a better understanding of the scale and timing of options to address the risks identified and potential collaborations to ensure we deliver the best possible outcomes for our customers, communities and the environment in the medium to longer term

7.35 In contrast, accelerating investment means that we will be scaling solutions to meet all the risks and uncertainties implicit in our plan. This risks schemes potentially being overdesigned, providing more capacity than might be required in future.

7.37 In assessing these trade-offs, we have taken into consideration the feedback received to our consultation on the draft plan; in particular,

- Our programme – you wanted quicker delivery in certain areas and delivery of more ambitious storm overflow discharge reduction targets to help protect the environment
- Reducing the impact on customer bills
- Better balancing of risk, ambition and deliverability; in particular, addressing the risks of delivering an ambitious surface water management plan

7.38 All our plans prioritise delivery of our storm overflow reduction plan. However, the plan which we believe provides the better balance of cost, risk, ambition and deliverability is the 'Resilient - constrained plan'. On balance, this is because:

- It prioritises delivery of our storm overflow reduction plans
- In constraining the timing and scale of delivery of options to meet our plan objectives over the plan, it
    - Provides the least impact on customer bills
    - Provides time for investigations to reduce risks and uncertainties in our plan; in particular, improving our understanding of surface water interactions with our networks and associated flood risk to target property risk more effectively
    - Provides time to build capacity and develop innovation in partnership schemes, catchment and rural land management
- It provides the lowest cost plan to deliver our objectives

7.39 In conclusion, balancing our ambitions, our stakeholder and customer desires, our value criteria and affordability, we believe the 'Resilient – constrained' plan represents the best value and should be our preferred plan for our Thames Valley and Home Counties catchments.

7.40 Our final DWMP preferred plan:

- Achieves a storm overflow spill frequency target of <=10 per year (on average) at all overflows in line with SODRP and Environment Act targets. This will be achieved sooner than the legislative deadline, by 2045, with all high priority sites achieved by 2035
- In addition, storm overflows discharging near our two designated Bathing Water sites will meet the more stringent target of three discharges or less per year (on average) by 2030
- Ensures compliance for our STWs
- Focuses on removing unwanted flow such as groundwater infiltration and misconnections from our foul sewer systems. At the same time, these measures will also reduce exfiltration from sewers, reducing any potential effects on groundwater quality.
- Removes the risk of flooding to all properties in a 1 in 50 year storm event (15% of properties by 2035 and 100% by 2050)

7.41 Figure 7-13 and Figure 7-14 present the investment by AMP period for our draft and final plans for the DWMP. The profile of both plans is similar however the final plan includes a greater composition of storm overflow and treatment compliance spend. This is particularly prevalent in the early AMPs and is reflected in the greater CAPEX cost and bill impact of the plans.

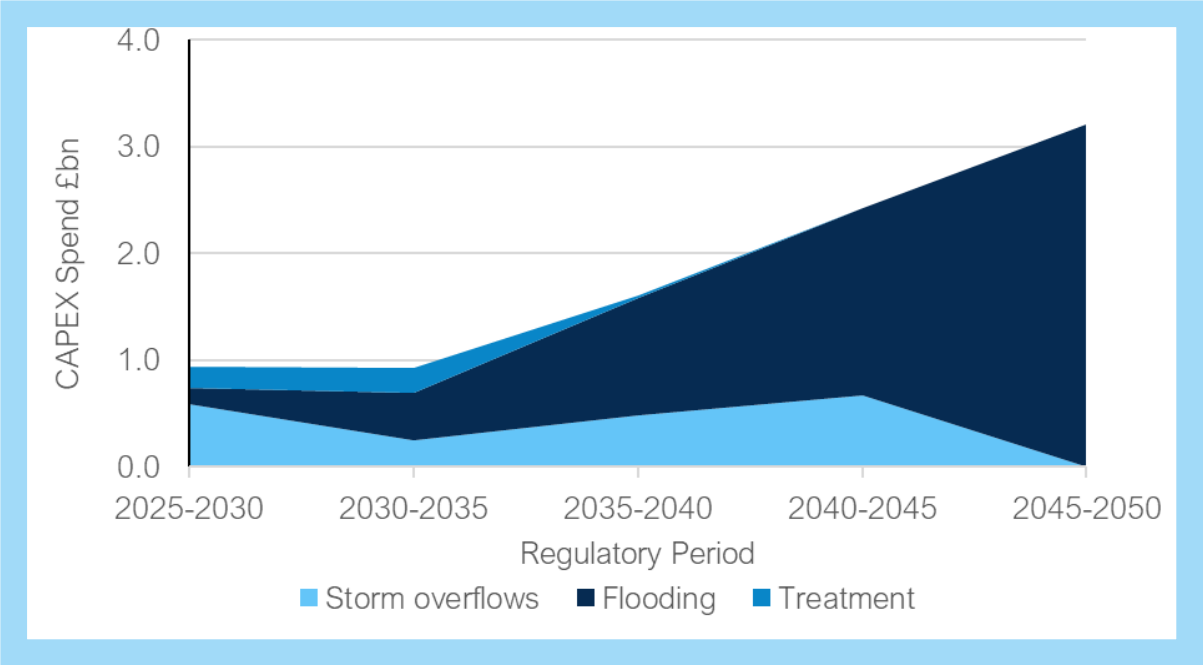


Figure 7-13 CAPEX spend (£bn) on flooding, storm overflows and treatment solutions in each AMP period for the final plan for catchments outside of London.

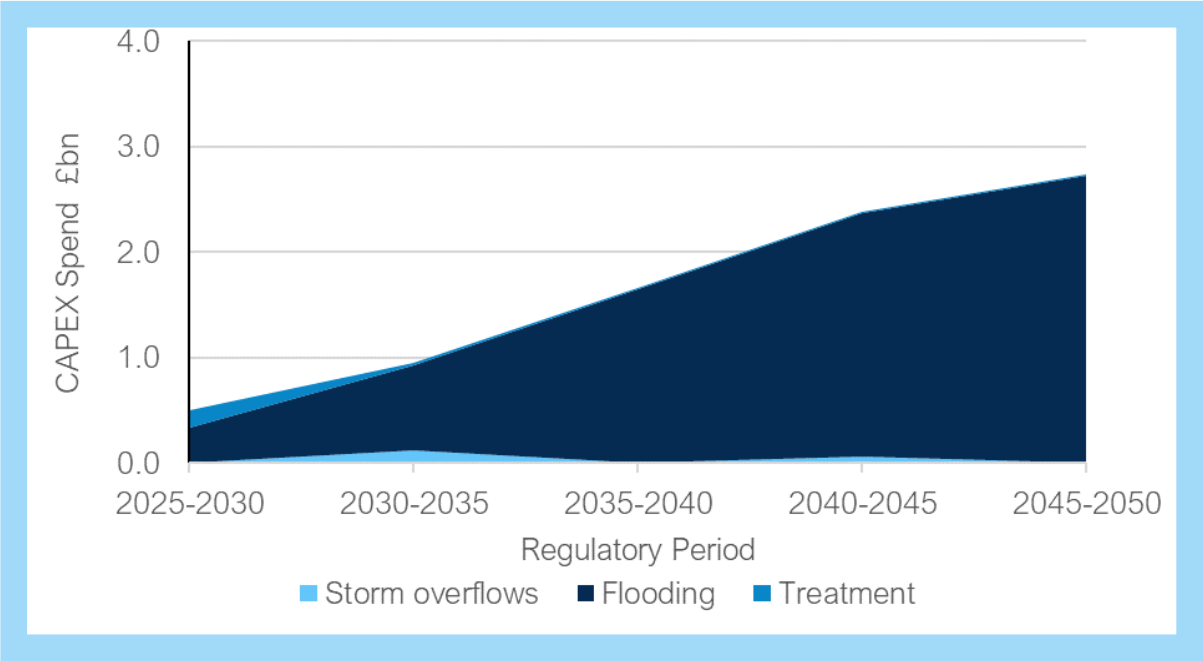


Figure 7-14 CAPEX spend (£bn) on flooding, storm overflows and treatment solutions in each AMP period for the draft plan for catchments outside of London.

8 Our proposed best value DWMP

8.1 Our £31.9bn 'Resilient - constrained' plan provides the best value in terms of overall balance of cost, outcomes, impact on customers' bills and meeting our environmental obligations for our London, Thames Valley and Home Counties catchments and has been selected as our preferred plan. This is a development from our 'resilient' plan presented and generally supported at public consultation on our draft DWMP. The plan meets our planning objective targets, exceeds the storm overflow discharge reduction timescales required by the Environment Act, whilst allowing the industry to develop the capacity to deliver widescale surface water management retrofit, in the most affordable manner for our customers.

8.2 The cost of our final plan has increased compared to our draft plan because we have prioritised delivery of the new storm overflow discharge reduction targets. As a result, our final DWMP has less freedom to balance storm overflow discharge reductions and flooding requirements, and options to address our flooding ambition are significantly deferred to manage impact on customers' bills. Beyond storm overflow discharge reductions, our plan balancing to 2030 focusses on flooding schemes and flood resilience measures that can be delivered within affordability constraints, informing our PR24 plans, thereby aligning our DWMP and PR24 plans.

8.3 This section sets out our plan at a regional L1 scale. Our DWMP is built up at three geographical levels: catchments that are served by our STWs (L3), Thames Regional Flood and Coastal Committee (TFRCC) sub-committee areas (L2) and Thames Water's wastewater operating region (L1). Our London catchments are further split into risk zones at a sub-catchment level (L4). Figure 8-1 shows our L1 operating region boundary and the L2 TRFCC sub-committee areas that are referenced in our plan.

8.4 All stated costs in this Technical Appendix comprise construction costs only. Costs are presented at a 2020/21 price base, which aligns with costs submitted in the Ofwat data tables. Costs are subject to rounding; however, totals are correct.

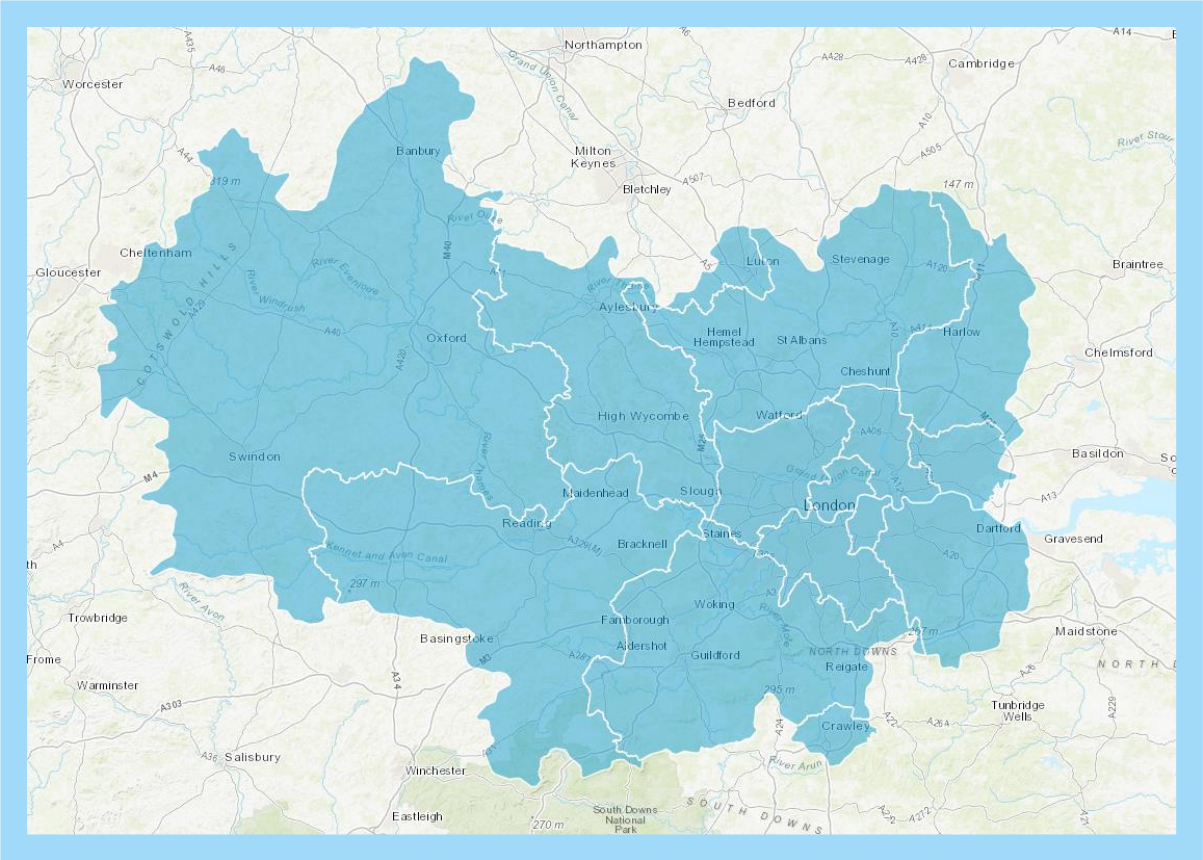


Figure 8-1 Level 2 Thames Regional Flood and Coastal Committee (TRFCC) areas[8]

Main outputs – L1

8.5 The following tables show the overall construction costs, performance outcomes and profiling for our preferred plan at L1 level. Table 8-1 and Table 8-2 show the construction costs and performance outcomes profiles respectively over the 25-year period.

Cost (£m)	AMP8	AMP9	AMP10	AMP11	AMP12	Total
London	439	2,314	4,547	6,723	8,898	22,922
Thames Valley and Home Counties	1,055	900	1,549	2,339	3,177	9,020
Total (L1)	1,494	3,215	6,096	9,062	12,075	31,943

Table 8-1 L1 – Preferred plan construction costs by AMP

[8] Extract from our DWMP Portal: Drainage and Wastewater Management Plan (arcgis.com)

Objective	AMP8	AMP9	AMP10	AMP11	AMP12	Total
Resilience (no.)	2,472	16,502	15,737	26,180	126,128	187,019
Internal flooding (no.)	1,227	6,107	6,066	9,441	48,658	71,500
External flooding (no.)	960	7,595	7,170	11,883	60,522	88,129
Storm overflow discharge reduction[2] (no.)	10,657	1,098	322	423	520	13,020

1: Resilience/Internal flooding/External flooding – number of properties with reduced risk (no.)
2: Storm overflow discharge reduction – number of discharges removed in a typical year (no.). AMP12 count reflects further investment at previously addressed sites to account for forecast growth and climate change impact.

Table 8-2 L1 – Preferred plan outcomes by AMP

8.6 Table 8-3 shows the total cost, split into the primary drivers:

- Storm overflow discharge reduction – reducing the discharge frequency from our storm overflows, delivering our reduction plan for high priority sites by 2035 and all sites by 2045
- Flooding – reducing the number of properties at-risk from internal , external flooding, and in a 1 in 50 year event
- STW Treatment compliance – investment to enhance treatment capacity to meet growth needs

Cost (£m)	Storm overflow discharge	Flooding	Treatment	Total
London	8,820	13,440	662	22,922
Thames Valley and Home Counties	2,077	6,357	586	9,020
Total (L1)	10,897	19,797	1,249	31,943

Table 8-3 L1 – Preferred plan construction costs by primary driver type

8.7 Table 8-4 shows the total cost, split by the following solution types:

- Infiltration reduction – sewer lining and manhole sealing to prevent ingress of groundwater into our foul sewer systems. The proposed interventions will also benefit exfiltration from sewers and impacts on groundwater quality.
- Grey infrastructure (networks) – new sewers, sewer upsizing and attenuation storage to provide additional capacity in the wastewater networks
- Green infrastructure (networks) – sustainable drainage solutions to reduce or remove rainfall runoff entering the wastewater networks
- Individual property protection – local solutions such as individual property pumps and flood boards
- Sewage treatment enhancements to meet flow and quality compliance

Cost (£m)	Infiltration reduction	Grey infrastructure (networks)	Green infrastructure (networks)	Individual property protection	Treatment
London	875	11,901	9,426	56	662
Thames Valley and Home Counties	1,131	5,902	1,217	149	623
Total (L1)	2,007	17,803	10,642	205	1,286

Note – grey infrastructure includes additional storage at an existing STW site, treatment includes flood protection and storm overflow additional treatment.

Table 8-4 L1 – Preferred plan construction costs by solution type

8.8 Table 8-5 provides a summary by L1 area of the key types of activities and their quantities. This demonstrates the scope of the options selected in our preferred plan to address our planning objective targets.

	Surface water manage-ment (ha)	Network enhancements (upsize/new sewers) (km)	Storm attenuation (m^3)	Sewer lining (m)	Individual property protection (no.)	Treatment works upgrade (no.)
London	6,914	953,436	5,269,721	656,373	352	7
Thames Valley and Home Counties	685	33,206	2,802,311	1,196,154	1,360	75
Total (L1)	7,598	986,642	8,072,032	1,852,526	1,712	82

Table 8-5 L1 – Preferred plan principal quantities by solution type

8.9 Table 8-6 shows the indicative customer bill impact, by AMP, for our area plans and overall region.

Resilient – Constrained Plan	Indicative customer bill impact (£s)					
	AMP 8	AMP 9	AMP10	AMP11	AMP12	Average Impact
London	3.55	19.92	55.80	113.23	181.66	74.83
Thames Valley Home Counties	14.55	33.47	54.27	87.38	135.13	64.96
L1 region	7.36	24.61	55.27	104.29	165.57	71.42

1 – Indicative average annual bill impact over the 25 years of the plan (£/household) as described in Section 4.30.

Table 8-6 Indicative customer bill impact (£ per year per household)

8.10 Figure 8-2 provides a summary by L1 area of the relative performance measures arising from the options selected in our preferred plan to address our planning objective targets.

Note 1: Least cost relates to the construction cost of each plan. Smallest bill impact represents the household bill increase of each plan which takes into account the profiling of investment. Carbon is considered as part of the natural capital element.
Note 2: The plan with the largest area under the radar plot indicates that plan provides the greatest value across all value criteria. The closer the line is to the outside of the graph, the better the outcome for any particular metric.

Figure 8-2 L1 Relative performance of our preferred plan at 2050 ('Resilient – constrained')

8.11 Figure 8-2 demonstrates that:

- Our preferred plan performs as well, or similarly, across all metrics when compared to the 'Maximum community benefit' plan
- Environmental, natural capital and wellbeing relative outcomes are high or comparable for our preferred plan compared to the other plans
- Negative impacts on the environment and natural capital appear worse but are generally related to construction activities only and reflect the additional scale of our preferred plan relative to the maintain and maximise score plans

8.12 Details of the performance outcome measure arising from our preferred plan for each L2 region, together with associated cost and solution type, can be found in Appendix B of this document and each respective L2 Catchment Strategy Plan.

Recommendations for DWMP cycle 2

8.13 Our recommendations for cycle 2 focus on two key aspects of delivery of the PA stage:

- PA Stakeholder panel: whilst the engagement in developing the plan has been excellent, we recommend setting up a specialised PA engagement forum for cycle 2 to ensure all aspects of PA are better exposed to stakeholder challenge. This approach has worked well in developing our WRMP over several planning cycles, helping key stakeholders to engage on the process, improve understanding of the approach and the outcomes

- Options development: the concept level of options design has been a constraint for PA in terms of scale, variety/choice, cost and more particularly benefit appraisal. There are wider aspects to this point; clearly better information and modelling will inform options design and will help PA appraising costs and benefits of different options to develop a more robust plan

Appendix A - Value criteria

Alignment to key themes, performance measures, types of objectives and application

Theme	Value criteria	Performance measure/metric	Type of criteria (objective/outcome)	Applies to (infra/non-infra/both)	Hard constraint?	Objective direction
Affordability	Cost	Cost		Both	No	Minimise
Environment	Sewage treatment works compliance	Modelled compliance against current permits	Objective (common)	Non-infra	Yes	n/a
	Sewage treatment works compliance	Modelled compliance against daily DWF permit limit	Objective (bespoke)	Non-infra	Yes	n/a
	Storm overflow performance	Annual average frequency of discharge	Objective (common)	Infra	No	Maximise
	Carbon		Outcome	Both	No	Minimise
	Positive Environmental Impact	Score	Outcome	Both	No	Maximise
	Negative Environmental Impact	Score	Outcome	Both	No	Maximise
	Natural Capital indicator	Score	Outcome	Both	No	Maximise

Theme	Value criteria	Performance measure/metric	Type of criteria (objective/outcome)	Applies to (infra/non-infra/both)	Hard constraint?	Objective direction
Property flooding	Internal sewer flooding	Modelled risk in a 1 in 30 year rainfall event	Objective (common)	Infra	No	Maximise
	External sewer flooding	Modelled risk in a 1 in 30 year rainfall event	Objective (common)	Infra	No	Maximise
	Resilience	Modelled risk in a 1 in 50 year rainfall event	Objective (common)	Infra	No	Maximise
	Reduce surface water runoff	Ha removed	Outcome	Infra	No	Maximise
	Reduce misconnection (storm to foul)	Yes/No	Outcome	Infra	No	Maximise
	Reduce misconnection (foul to storm)	Yes/No	Outcome	Infra	No	Maximise
Collaboration	Collaboration	Score	Outcome	Both	No	Maximise
Wellbeing	Wellbeing	Score	Outcome	Both	No	Maximise

Appendix B - Preferred plan outputs at L2 level

The following tables show the overall construction costs, performance outcomes and profiling for our preferred plan at L2 level.

Cost (£m)	Infiltration reduction	Grey infrastructure (networks)	Green infrastructure (networks)	Individual property protection	Treatment
Central Bedfordshire, Buckinghamshire, Slough, Luton	116	752	134	14	108
Essex and Thurrock	18	298	55	3	24
Hertfordshire	160	704	201	11	43
Oxfordshire, Swindon, Wiltshire, Gloucestershire, Warwickshire	549	1,178	257	36	237
Surrey	24	1,742	312	26	33
West Berkshire, Reading, Wokingham, Bracknell Forest, Windsor and Maidenhead, Hampshire, West Sussex	265	1,228	258	47	172
Lee Valley (Beckton STW and Deephams STW)	0	2,690	2,254	4	324
South West London (Beddington STW and Hogsmill STW	45	4,076	1,191	0	65
South East London (Crossness STW and Long Reach STW)	581	2,056	2,915	2	179
North West London (Mogden STW)	0	2,807	2,755	51	93
North East London (Riverside STW)	250	261	112	0	2
Region-wide		12	198	12	7
Total	**2,007**	**17,803**	**10,642**	**205**	**1,286**

Table B1-1 L2 – Preferred plan construction costs by solution type

Cost (£m)	AMP8	AMP9	AMP10	AMP11	AMP12	Total
Central Bedfordshire, Buckinghamshire, Slough, Luton	179	117	95	286	445	1,123
Essex and Thurrock	57	24	43	209	64	398
Hertfordshire	52	78	176	283	530	1,119
Oxfordshire, Swindon, Wiltshire, Gloucestershire, Warwickshire	444	321	674	350	469	2,257
Surrey	93	142	205	725	972	2,136
West Berkshire, Reading, Wokingham, Bracknell Forest, Windsor and Maidenhead, Hampshire, West Sussex	223	218	349	483	697	1,971
Lee Valley (Beckton STW and Deephams STW)	109	1,248	898	1,319	1,697	5,271
South West London (Beddington STW and Hogsmill STW	8	175	687	1,713	2,794	5,376
South East London (Crossness STW and Long Reach STW)	58	384	1,194	1,508	2,590	5,733
North West London (Mogden STW)	36	503	1,529	2,003	1,636	5,706
North East London (Riverside STW)	8	4	245	184	182	624
Non-specific	228	0	0	0	0	b
Total	**1,494**	**3,215**	**6,096**	**9,062**	**12,075**	**31,943**

1 - These are approximate figures as they are subject to nominal rounding.

Table B1-2 L2 – Preferred plan construction costs by AMP

Catchments	Objective	AMP8	AMP9	AMP10	AMP11	AMP12	Total
London	Resilience (no.)	1,406	15,001	15,003	22,977	110,319	**164,706**
	Internal flooding (no.)	927	5,925	5,965	8,752	44,990	**66,559**
	External flooding (no.)	360	6,957	6,759	10,261	52,189	**76,527**
	Storm overflow discharge reduction (no.)	3,845	97	-965	-998	-160	**1,820**
Thames Valley and Home Counties	Resilience (no.)	1,066	1,501	734	3,203	15,809	**22,313**
	Internal flooding (no.)	300	182	101	689	3,668	**4,941**
	External flooding (no.)	600	637	411	1,621	8,333	**11,602**
	Storm overflow discharge reduction (no.)	6,811	1,002	1,287	1,421	680	**11,201**
Totals (L1)	**Resilience (no.)**	**2,472**	**16,502**	**15,737**	**26,180**	**126,128**	**187,019**
	Internal flooding (no.)	**1.227**	**6,107**	**6,066**	**9,441**	**48,658**	**71,500**
	External flooding (no.)	**960**	**7,595**	**7,170**	**11,883**	**60,522**	**88,129**
	Storm overflow discharge reduction (no.)	10,657	1,098	322	423	520	**13,020**

1 - Resilience/Internal flooding/External flooding – number of properties with reduced risk (no.)
2 – Storm overflow discharge reduction – – number of discharges removed in a typical year (no.). AMP12 count reflects further investment at previously addressed sites to account for forecast growth and climate change impact. Negative value indicates deterioration due to growth and climate change

3 - These are approximate figures as they are subject to nominal rounding

Table B1-3 Regional – Preferred plan outcomes by AMP

	Surface water management (ha)	Network enhancements (upsize/new sewers) (km)	Storm attenuation (m^3)	Sewer lining (km)	Individual property protection (no.)	Treatment works upgrade (no.)
Central Bedfordshire, Buckinghamshire, Slough, Luton	Not defined[1]			107	125	6
Essex and Thurrock				17	27	5
Hertfordshire				125	95	5
Oxfordshire, Swindon, Wiltshire, Gloucestershire, Warwickshire				588	376	32
Surrey				23	226	7
West Berkshire, Reading, Wokingham, Bracknell Forest, Windsor and Maidenhead, Hampshire, West Sussex				337	411	20
Lee Valley (Beckton STW and Deephams STW)	1,717	165	1,552,798	0	31	1
South West London (Beddington STW and Hogsmill STW	514	607	530,297	32	0	2
South East London (Crossness STW and Long Reach STW)	2,718	159	978,850	423	11	2
North West London (Mogden STW)	1,885	67	2,008,204	0	310	1
North East London (Riverside STW)	79	1,611	199,572	201	0	1
Total	**6,914[1]**	**1,028[1]**	**8,072,032[1]**	**1,852**	**1,712**	**82**

1 – These numbers apply to London catchments only, as the 'Reference solution' approach was adopted for Thames Valley and Home Counties catchments as set out in Technical Appendix D - ODA

Table B1-4 L2 – Preferred plan activity quantities for network options

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[9].
fDWMP	The final version of the Drainage and Wastewater Management Plan, to be published in May 2023.

[9] https://www.thameswater.co.uk/about-us/regulation/drainage-and-wastewater-management

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[10]. 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

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

	through a designated outfall to a water course, land area or alternative drainage system.
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.