United Utilities Water

DRAFT Drainage and Wastewater Management Plan 2023

TA8 Programme Optimisation

Document Reference: TA8

June 2022

United Utilities

Water for the North West

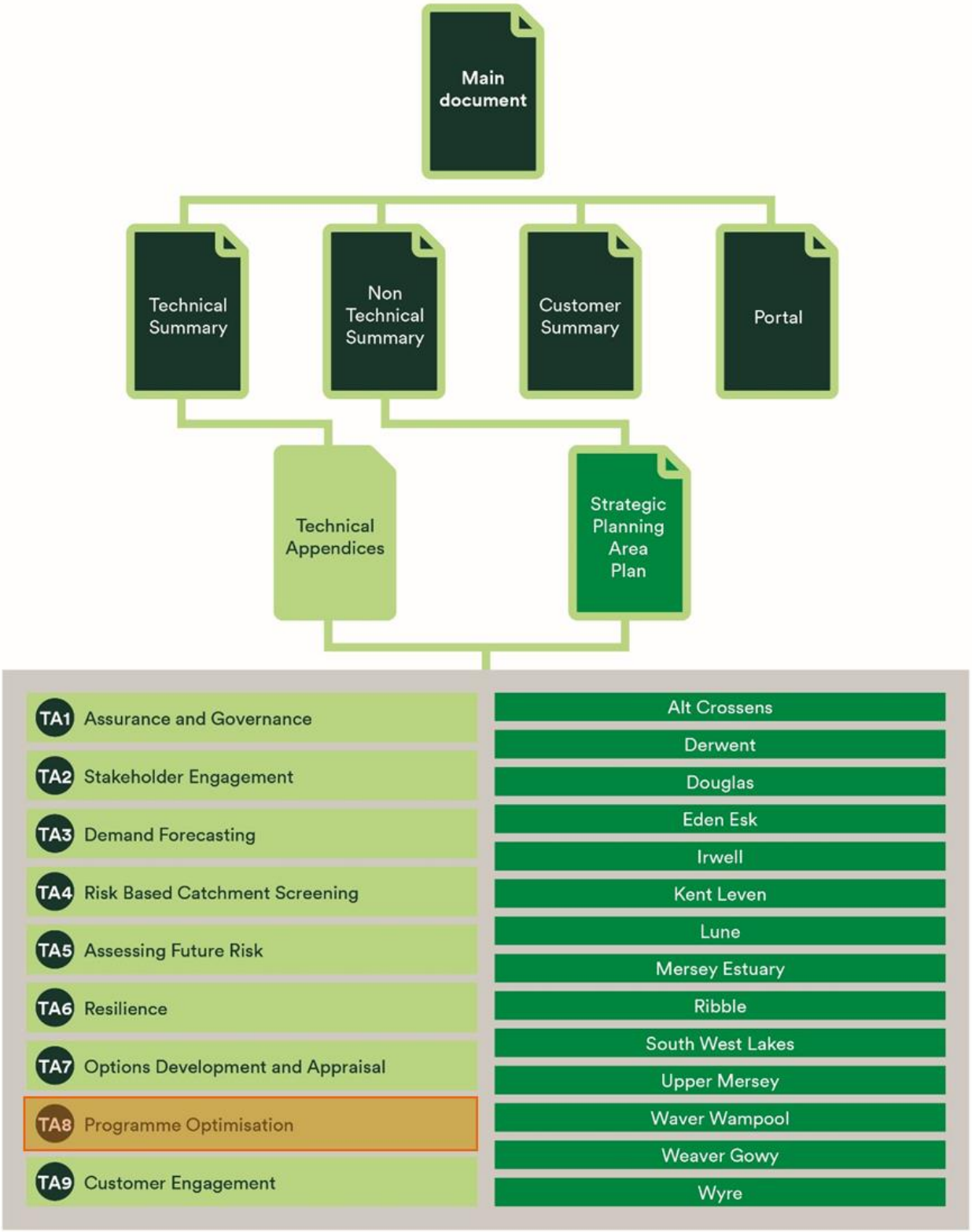
Executive Summary

This report is one of nine Technical Appendix (TA) documents, which accompany the drainage and wastewater management (DMWP) Main Document and provide greater detail on the outputs of the assessments and the mechanisms used to derive the preferred near, medium and long-term plan. The programme optimisation process forms a fundamental part of the DWMP. This TA includes details of:

- United Utilities Water's (UUW) feasible options;
- the approach to measuring cost and benefits;
- how UUW carried out an initial optimisation to determine preferred plans for each strategic planning area;
- how UUW carried out secondary optimisation to determine a regional preferred plan;
- how legal obligations have been accounted for in the preferred plan; and
- a summary of the preferred plan.

This TA is one of a suite of documents that provides information used in the development of the Drainage and Wastewater Management Plan as shown in Figure 1.

Figure 1 DWMP document structure



Acronyms

For a list of acronyms, refer to document C0003.

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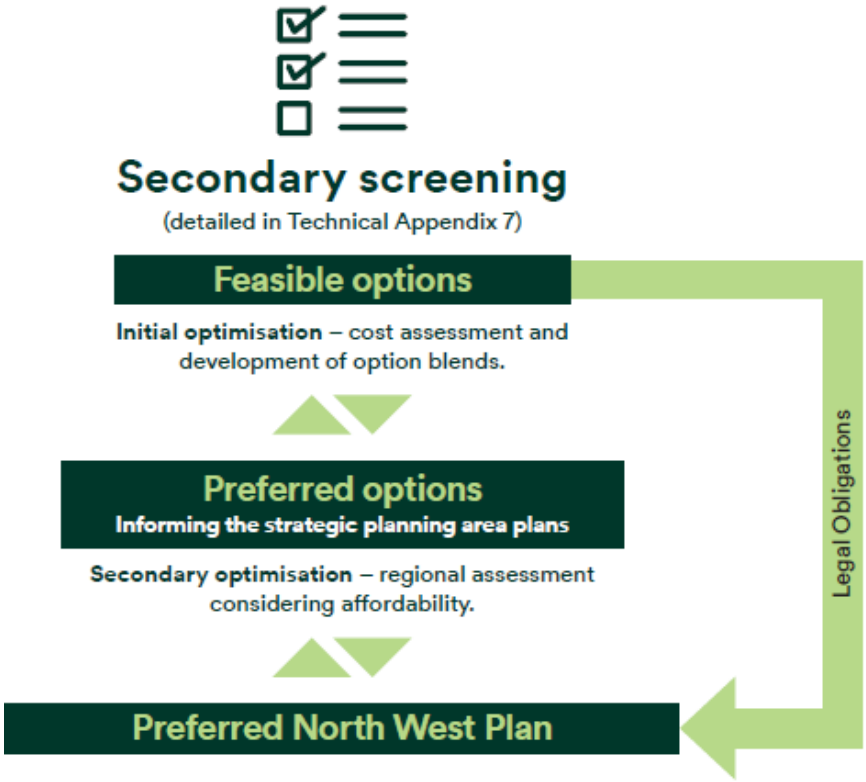
1. Introduction

1.1 Overview

1.1.1 This TA provides an overview of the programme appraisal and decision-making stages of DWMP options development and appraisal. This incorporates activities from the selection of preferred options, derived from the feasible options database, through to the testing of scenarios and selection of preferred options to inform the United Utilities Water (UUW) Drainage and Wastewater Management Plan (DWMP). This appendix is a direct sequel to Technical Appendix 7 – Options Identification and Appraisal (TA7) where the methodology for collating and refining all unconstrained and constrained options is presented.

1.1.2 This appendix details UUW's approach to programme optimisation through its constituent stages: feasible options; initial optimisation; selection of preferred options; secondary optimisation; and selection of the preferred regional programme (Figure 2). The programme optimisation stage of the DWMP process aims to identify the most appropriate options to implement in the plan given the cost, performance, wider benefits and impacts of options. The programme is required to resolve the projected risk using interventions to meet the outlined planning objectives across the North West of England.

Figure 2 Activities undertaken within optimisation, following secondary screening



1.1.3 Options appraisal and programme optimisation activities are critical in developing a preferred programme, these activities have taken into account:

- regional delivery of performance against planning objective targets;
- programme cost and affordability for customers; and
- wider benefits delivered by different programmes based on the interventions selected.

1.1.4 The Programme Optimisation process was broadly split into two phases:

- Phase 1 – the initial optimisation phase; to determine the prioritised initial strategic planning areas (SPA) plans, focused on the selection of preferred options for each Tactical Planning Unit (TPU). Phase 1 involved taking all potential feasible options and selecting solutions, which in combination, facilitated meeting planning objectives in a cost beneficial manner. The initial prioritised SPA plans were collated to create an initial view of the regional plan. The approach to initial optimisation is detailed in section 1.
- Phase 2 – the secondary optimisation phase; interventions were prioritised regionally, considering affordability and customer preference in order to deliver a regional best value plan. During this phase, legal obligation activities were accounted for to ensure legal obligations would be met. The approach to secondary optimisation is detailed in section 1.

1.1.5 Engagement with customers through formal research and engagement with stakeholders through Strategic Planning Groups (SPGs) has informed the development of UUW's values framework and the scenarios tested within phase 1 and 2 of optimisation. This has included: prioritisation of planning objectives; feedback on wider benefit categories; prioritisation of service levels; and triangulation to understand affordability. Details of UUW's customer and stakeholder engagement are outlined in Technical Appendices 2 – Stakeholder Engagement (TA2) and Technical Appendices 9 – Customer Engagement (TA9) respectively.

2. Feasible option selection

2.1 Approach to feasible option selection

2.1.1 The feasible options were derived from the constrained options list following secondary screening. During the development of feasible options, a large amount of data had already been gathered and analysed, as described in TA7. This data was required to help inform the selection of feasible options, which would be considered in programme appraisal and included:

- costs (capital expenditure (capex), operational expenditure (opex) and replacement where applicable);
- the scale of benefits against all relevant planning objectives;
- environmental and social impacts;
- customer support;
- assessment of uncertainty; and
- dependency and mutual exclusivity information.

2.2 Determining performance benefit

2.2.1 For every option developed within feasible options, performance data was captured. During this process, the benefit provided by options was reviewed against a full breadth of service areas ensuring the benefit provided by each option was fully captured and that options, which promote multiple planning objectives, are understood. The service areas considered for each high-level solution, or option type, is outlined in Table 1.

Table 1 Performance data gathered for each option type

Option type	Planning objective that the benefit has been quantified against								
	Permit compliance	WINEP	Overflows	Pollution	Flooding: internal	Flooding: external	Flooding: Open spaces	Flooding: 1 in 50-year	Collapses
Catchment management initiatives	■	■	■						
Domestic and business customer education				■	■	■	■		
Enhanced operational maintenance				■	■	■	■		
Greywater treatment and reuse								■	
Increase capacity of existing networks			■	■	■	■	■	■	
Increase treatment capacity	■	■							
Intelligent network operation				■	■	■	■		■
Modification of consent/permits	■	■							
Property Level Resilience (PLR)					■				
Sewer maintenance				■	■	■	■		■
Sewer rehab				■	■	■	■		
Surface water source control measures			■		■	■	■	■	
Treatment works rationalisation	■	■							

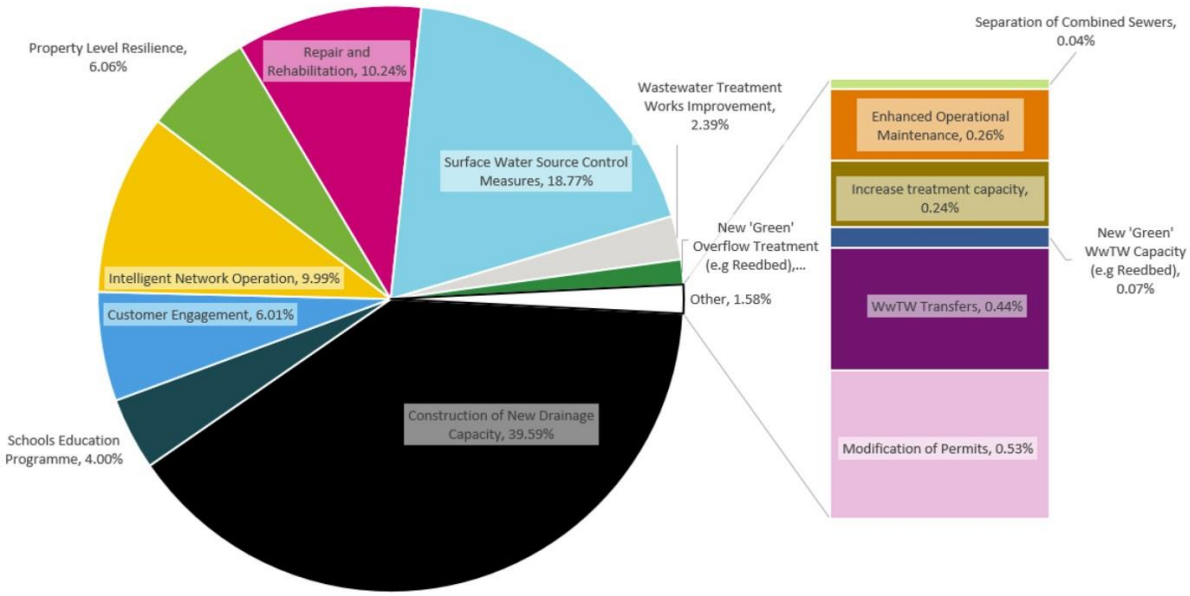
2.2.2 Performance was reviewed in metrics appropriate to each planning objective service area, for example flooding service is measured in annualised flood risk, whereas overflows are measured in number of spills. In order to convert benefit into a comparable figure across all planning objectives, values have been assigned to each planning objective. Where applicable, valuations have been determined from those used in PR19 outcome delivery incentives. Where this information was not available, values were determined based on existing customer values, data and literature.

2.3 Feasible options summary

2.3.1 The outcome of secondary screening concluded in 5,428 options remaining. The options contained a range of all categories. A significant proportion (approximately 40%) of the feasible options relate to construction of new drainage capacity. Sustainable urban drainage systems (SuDS) account for approximately 19% of feasible options. This evidences the need for a blend of traditional hard engineering solutions alongside nature-based solutions in order to tackle the step change in challenges posed by climate change.

2.3.2 Approximately 10% of options focus on customer side management through education programmes and targeted campaigns to reduce rates of blockage and flooding caused as a result of sewer misuse. This supports the need for customers to play a role in the future of drainage management and evidences the need to work collaboratively with partners to manage issues at the root cause.

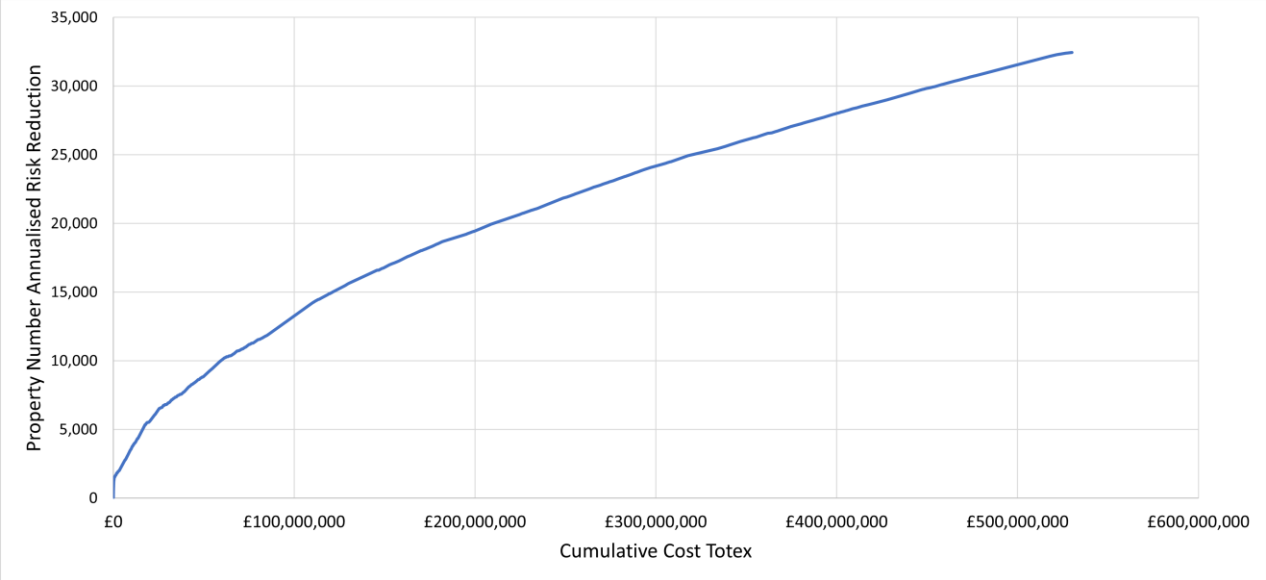
Figure 3 A regional overview of the number of feasible options selected for inclusion in option blends by option type



2.3.3 To determine the level of benefit, which could be delivered through feasible options, analysis was carried out on the costs of delivering different levels of service improvement. During this analysis, options being considered for a planning objective in an area are ordered in descending cost benefit. The example displayed in Figure 4 relates to the '1 in 50-year' flooding risk planning objective. For this objective, expenditure between £0 and £100 million reduces the properties at risk by 14,223, however, spending a further £100 million would decrease properties at risk by only a third of what is achieved in the first £100 million of investment (an additional 5,177 properties). The analysis evidences that there are diminishing benefits to be derived as the cumulative cost of the options increases. This is demonstrated by the case study in Figure 4.

2.3.4 This approach does not take into account the potential for some of the options to contribute benefit across multiple planning objectives and does not take into account potential non-monetary six capitals benefits, which might arise from favouring selection of other options. An external and industry robust decision support tool, Copperleaf Portfolio, was required to enable the development of an integrated, Systems Thinking led view of performance and benefit.

Figure 4 Cumulative cost of options and subsequent monetised benefit provided ordered by ascending cost benefit ratio



3. Calculating cost benefit

3.1 Overview

3.1.1 In order to assess cost benefit of options a cost benefit threshold was used. The cost benefit threshold took into account the initial cost benefit score for the option plus the 'six capitals' factor associated with the option. The cost benefit score was calculated by dividing the whole life benefit value by the whole life cost of the option. Consequently, a cost benefit score greater than one indicated positive benefit for the investment, whereas a cost benefit score below indicated that costs outweighed the benefits secured by an option.

3.2 Values framework

3.2.1 Six capitals assessment

3.2.1.1. In order to value the benefit of each option in UUW's plan, and demonstrate the value of UUW's plan as a whole, UUW are using a number of values metrics. These metrics measure how well options perform against criteria, including cost; performance; and wider benefits across a number of capitals covering natural, social, human, intellectual, financial and manufactured capital. Using these metrics supports the selection of options and underpins UUW's best value plan.

3.2.1.2. The six capitals approach used in this assessment represents a step on UUW's journey to using a six capitals approach to assess and make decisions on best value. The learnings UUW have taken from this assessment have been invaluable as UUW develop UUW's approach to assessing value in the forthcoming investment cycle 2025 - 2030, and continue to embed a six capitals approach across UUW. The material factors assessed in the Water Resources Management Plan (WRMP), DWMP, Water Industry National Environment Programme (WINEP) and the rest of the business plan are aligned, with slight discrepancies in approach arising from differing stakeholder needs and regulatory requirements. A full description of how UUW have assessed value for investment cycle 2025 - 2030 will be included in UUW's business plan submission.

3.2.1.3. Conventionally, six capitals assessment uses site specific information to assess metrics on a granular project level. The approach to assessing six capitals within DWMP has focused on strategic level interventions and is an initial step in the options development process towards a best value assessment.

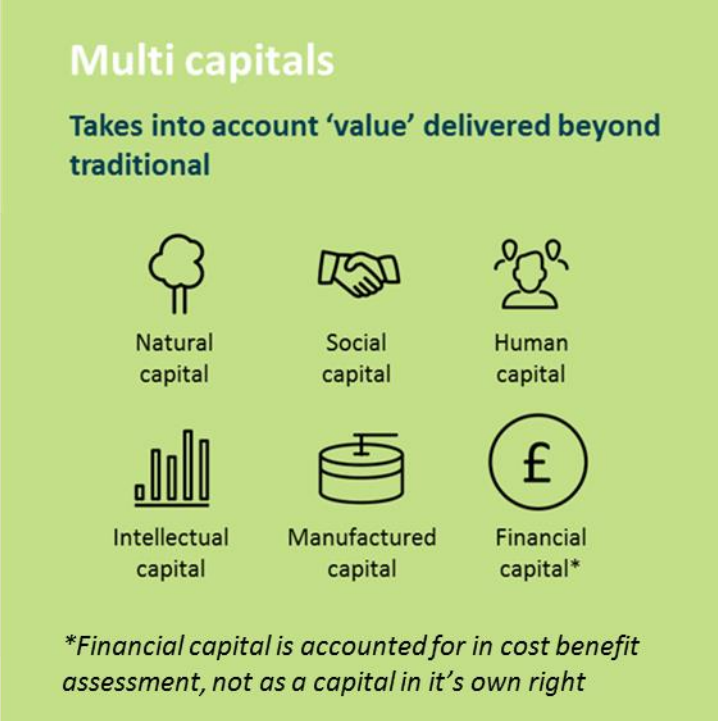
3.2.1.4. Within DWMP a qualitative six capitals measure has been used to support our selection and screening of options. This has ensured that options, which may otherwise be discounted based on traditional cost benefit assessments, are considered further in the process. The outputs of options appraisal have evidenced that 'best value' and 'lowest whole life cost' are not often aligned. Consequently, further customer engagement is being undertaken to understand how customers value the wider benefits delivered by options. This will help to inform further evolution of the approach used for final publication of the DWMP in 2023 and the forthcoming investment cycle 2025 - 2030. The application of the capitals score in decision-making for DWMP is outlined in section 3.3.

3.2.1.5. Table 2 provides a summary of the average score for each options out of a maximum score of 52. The scores at the individual option level range between -17 and 32. These scores have been used alongside the cost-benefit analysis results for each option and each programme produced for the preferred regional plan to better understand risks and benefits of each.

Table 2 Average six capitals score for each Generic Option Management Area

DWMP management area	Average score
Combined and Foul Sewer Systems	-1
Customer Side Management	13
Indirect measures	5
Sludge	0
Surface Water Management	18
Wastewater treatment	3

Figure 5 UUW's Six Capitals Approach



3.3 Cost benefit threshold

3.3.1. Due to the qualitative nature of UUW's six capitals assessment, in order to ensure options were not rejected where there may be significant additional value delivered, a capitals threshold was used to lower the cost benefit score required to be selected within the option blends. The thresholds applied are outlined in Table 3.

Table 3 Cost benefit thresholds used to select feasible options

Benefit cost ratio (BCR)	Six capitals score required to be considered for feasible options
>1.0	All six capitals scores considered
0.75 – 1.0	Neutral or positive (i.e. >0) six capitals scores considered
0.50 – 0.75	Positive (i.e. >1) six capitals scores considered
<0.50	All options rejected from feasible options

3.3.2. Methodologies for determining the cost, performance and six capitals value of options are available in TA7.

4. Phase 1: Initial optimisation

4.1 Overview

4.1.1 This section details the approach to determining the prioritised initial strategic planning areas (SPA) plans and the selection of preferred options for each Tactical Planning Units (TPU).

4.1.2 From an initial review of the feasible options against planning objectives, it was clear that selecting individual options from this list would not necessarily achieve the objectives for a TPU as can be observed in the example tactical planning unit shown in Figure 6. The preferred options for each TPU would need to be comprised of multiple interventions.

4.1.3 Additionally, drainage and water quality issues are complex and often require multiple intervention strategies to ensure robust resolution. In developing options, UUW recognise that a singular solution is not often one that delivers the best outcome for customers, or strategically manages the issues identified. Consequently, we've developed an approach to consider multiple measures to mitigate an issue, these have been termed 'option blends'.

4.1.4 An option blend is a suite of measures developed to mitigate a risk identified through the baseline risk and vulnerability assessment (BRAVA). The blends are made up of multiple option types, combining traditional engineering solutions with working with customers and innovating to better manage UUW's assets and catchments. As option blends are comprised of a range of different option types, all of which contribute towards meeting planning objective targets, this approach enables solutions, which partially contributed towards meeting planning objectives to be considered and encourages a Systems Thinking led approach.

4.1.5 Option blends as place-based strategies deliver multiple benefits:

- prioritise options which get to the root cause of a problem;
- enable inclusion of partial solutions – solutions do not need to be the 'whole' solution;
- secure increased confidence in performance improvement – multiple intervention types – supporting the delivery of more uncertain solutions as part of the whole; and
- allow adaptation of approach in areas of high uncertainty.

4.1.6 The additional benefit of creating option blends is that it creates an additional level of flexibility and mitigates innate uncertainty, supporting UUW's adaptive approach to long-term planning, allowing interventions to be brought in and out depending on whether risks materialise in the future.

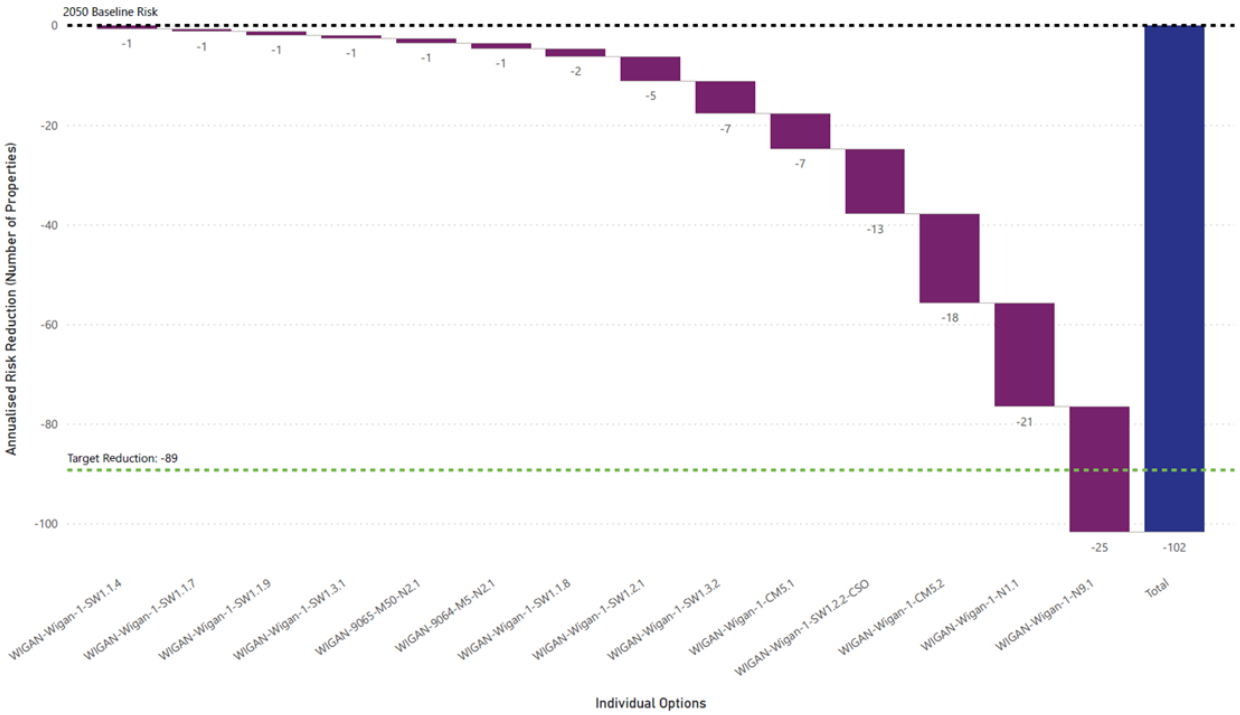
4.1.7 A number of methods were considered for creating preferred option blends, two of these approaches were taken forwards for development and reviewed with customers and stakeholders:

- Most **cost beneficial** options selected to close performance gap selected (outlined in section 4.2); and
- Options selected to close performance gap prioritised using a **solution hierarchy** (outlined in section 4.3).

4.1.8 In both cases, where applicable, a cost benefit threshold was applied to every option, as outlined in section 1.3 and Table 3.

4.1.9 In some cases, options which did not meet the cost benefit thresholds were reconsidered following optimisation to reflect that certain drivers are not subject to cost benefit e.g. permit compliance. In these cases, a risk-based approach has been used to constrain the programme, while ensuring legal obligations are met.

Figure 6 Case study: interventions required to meet a planning objective target in a tactical planning unit



Demonstrating a location where single interventions are unable to wholly meet the planning objective target, instead in this location a combination of 14 options are recommended to meet the objective.

4.2 Approach 'A' to creating best value option blend: lowest whole life cost

4.2.1 This section outlines approach 'A' to creating option blends: prioritising the most cost beneficial options to close the forecast performance gaps to deliver a **lowest whole life cost** plan.

4.2.2 Within the first approach to developing option blends, cost benefit alone was used to prioritise solutions selected. Using this approach, the most cost beneficial options were prioritised for inclusion in the preferred option blends.

4.2.3 In this approach, for example, regardless of its position in the hierarchy an option with a cost benefit score of 3.12 will be prioritised over an option with a score of 1.01. Using the lowest cost benefit approach, no consideration is made for customer preference as in the options hierarchy approach. In general, this approach delivers a blend, which has a lower whole life cost but with fewer wider six capital benefits.

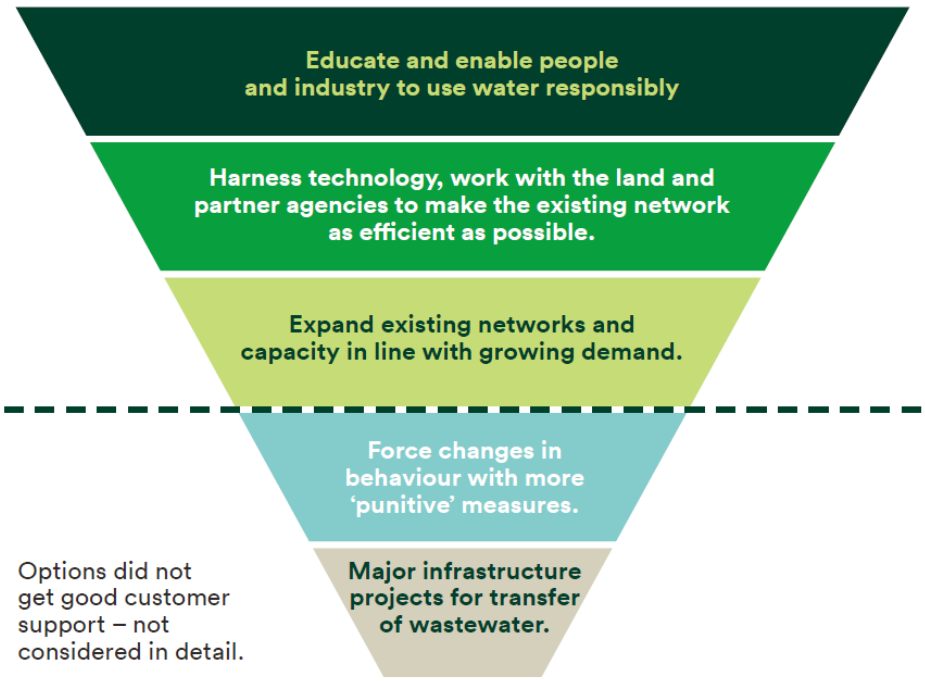
4.3 Approach 'B' to creating best value option blend: option hierarchy

4.3.1 This section outlines approach 'B' to creating option blends: prioritising using a solution hierarchy to close the forecast performance gaps.

4.3.2 Through engaging with customers, UUW understand that the options most supported by customers do not necessarily deliver the full amount of risk reduction to meet the long-term planning objectives. Customer engagement on options for resolving drainage and wastewater risks identified a pattern of preference, which emerged for meeting long-term challenges.

4.3.3 As outlined in Figure 7, customers in the North West show strong support for approaches, which supported communities and industry to help tackle issues discussed, as well as measures, which supported partnerships, utilised new technology and drove efficiencies with existing assets. Conversely, feedback around measures considered as 'forced' behaviour change and major infrastructure projects were met with more caution and should be considered as a last resort. For further information, UUW's customer engagement approach is described fully in TA9.

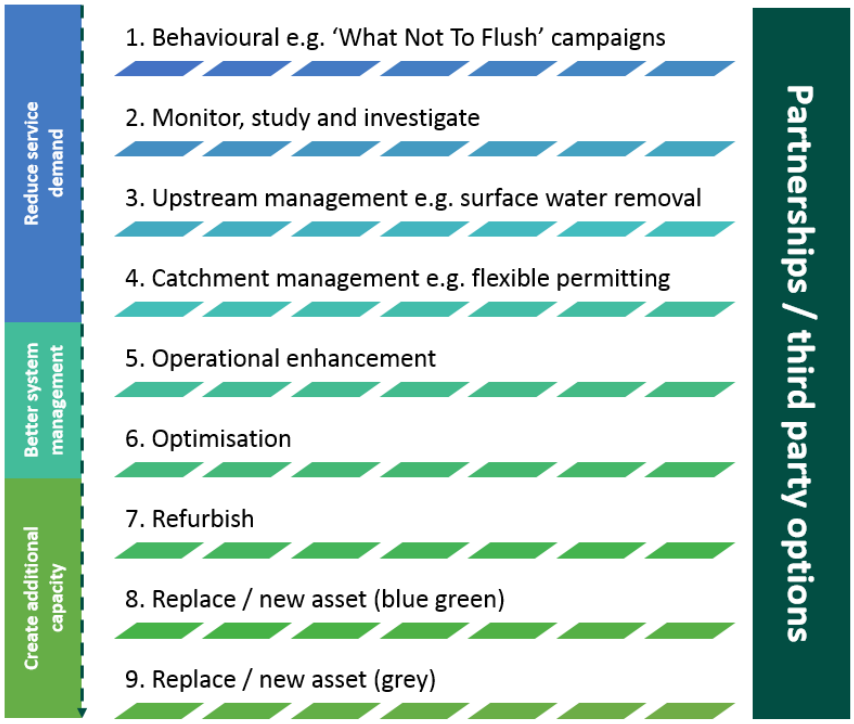
Figure 7 Priorities identified through engagement with customers on potential approaches to managing drainage and wastewater risks



4.3.4 Using the findings of the customer engagement, a hierarchy for prioritising solutions was developed. The hierarchy, Figure 8, was used to determine the prioritisation of option types to be included in the preferred option blends. Using this approach, options which address a planning objective performance gap that are higher up the hierarchy will be selected over those lower down.

4.3.5 Options selected were still required to meet the feasible option cost benefit thresholds as outlined in section 1.3 but, for example, customer side management options (hierarchy position 1) with a cost benefit of 1.01 are prioritised over new asset (hierarchy position 8) with a cost benefit of 3.12. This was optimised by, a decision support tool was used to calculate this allowing the optimal blend to be determined against all planning objectives.

Figure 8 DWMP Options Hierarchy

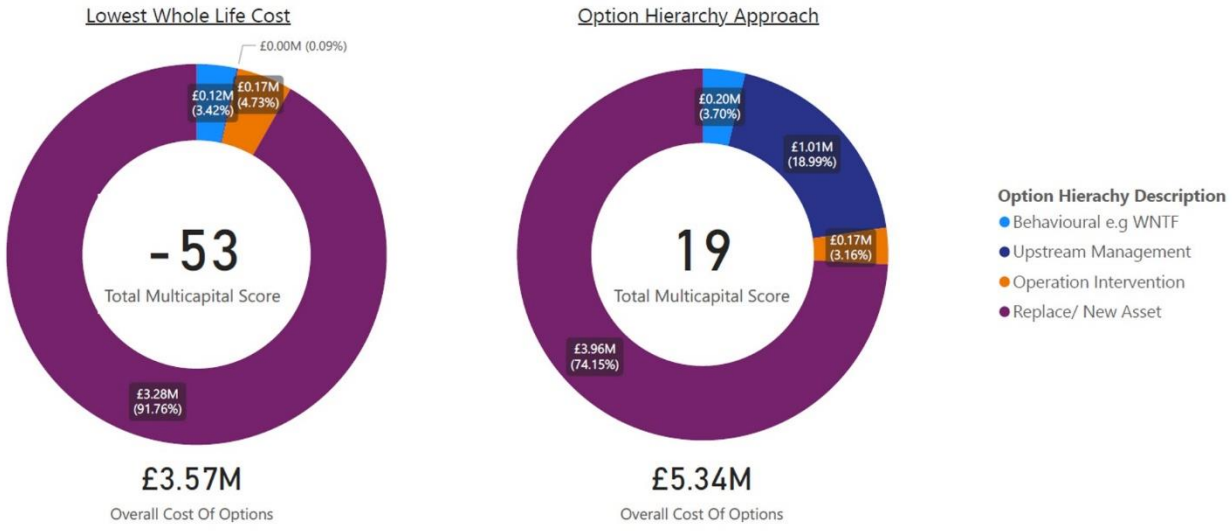


4.4 Worked example

4.4.1 In Figure 9, a comparison of the proposed proportionate expenditure on different option categories in an example tactical planning unit is presented for approach 'A' (lowest whole life cost) and approach 'B' (option hierarchy). These charts are based on outputs from the decision support tool (detailed in section 5).

4.4.2 In the lowest whole life cost scenario, the percentage investment in new assets is greater than the option hierarchy approach (92% to 74%). The options hierarchy approach includes upstream management for 19% of the assigned expenditure, which is not selected using the lowest whole life cost approach. The options hierarchy approach provides a greater six capitals score (greater total benefit for social, intellectual, natural, human and manufactured environments). The sum benefit against the planning objectives for the two approaches presented below is very similar, but as a result of the preference towards demand reduction using the options hierarchy approach the overall cost of options is higher.

Figure 9 Example comparison of options by cost, selected using both blend approaches in a TPU



4.5 Selection of preferred option blend approach

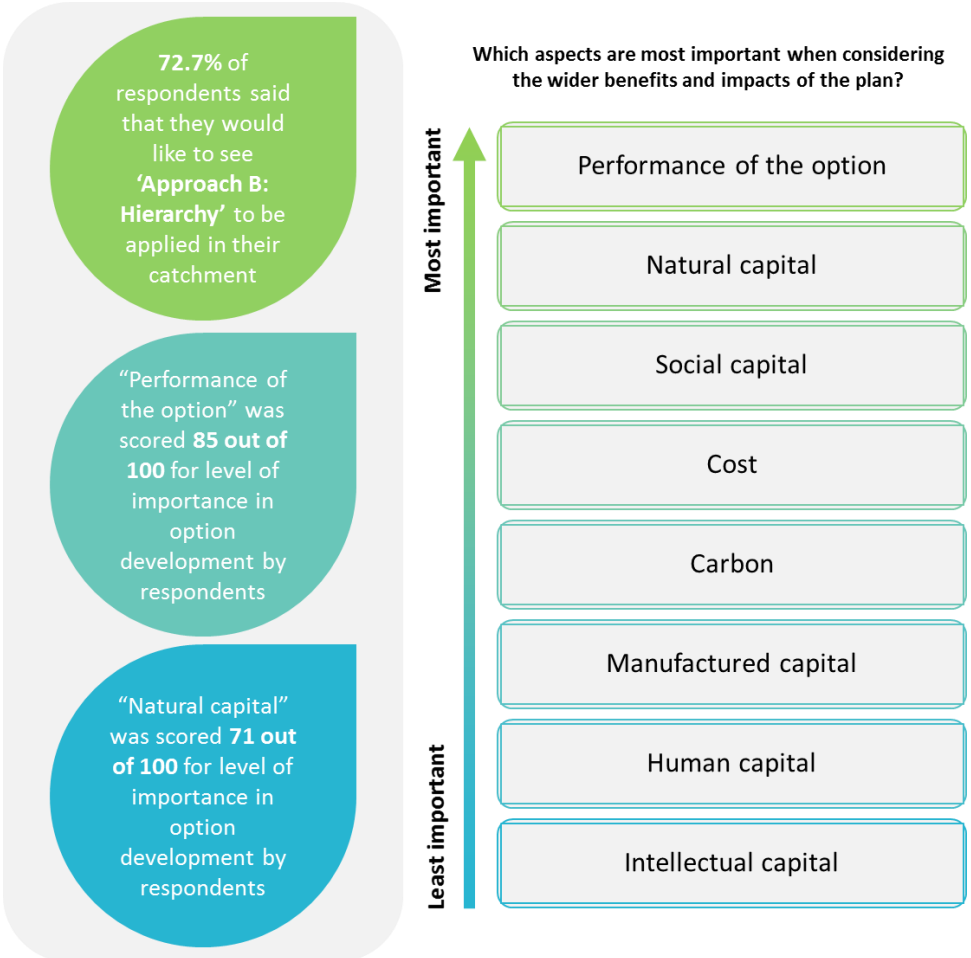
4.5.1 A sub group of UUW's Customer Challenge Group (CCG), 'Your Voice Environmental and Social Capital Sub Group', and UUW's strategic planning groups have been consulted on the best way to select the preferred option blends. The two approaches described in 4.2 and 4.3 were shared with the groups for feedback and endorsement.

4.5.2 The engagement was delivered through a presentation to UUW's CCG 'Your Voice Environmental and Social Capital Sub Group' and feedback was unanimously in support of using the Options Hierarchy approach.

4.5.3 An information brief and survey was sent to members of UUW's strategic planning groups to gain feedback. This outlined the two approaches, the process for selecting preferred options and two worked examples to demonstrate the impact of choosing each approach in both cost, benefit and solution types. Following this engagement:

- 73% of respondents supported the options hierarchy approach;
- the remaining 27% of respondents selected 'other' as their preferred approach;
- the lowest whole life cost approach was not selected by any respondent; and
- respondents ranked performance of the option, natural capital and social capital as the three most important aspects when considering the wider benefits and impacts of the plan (Figure 10).

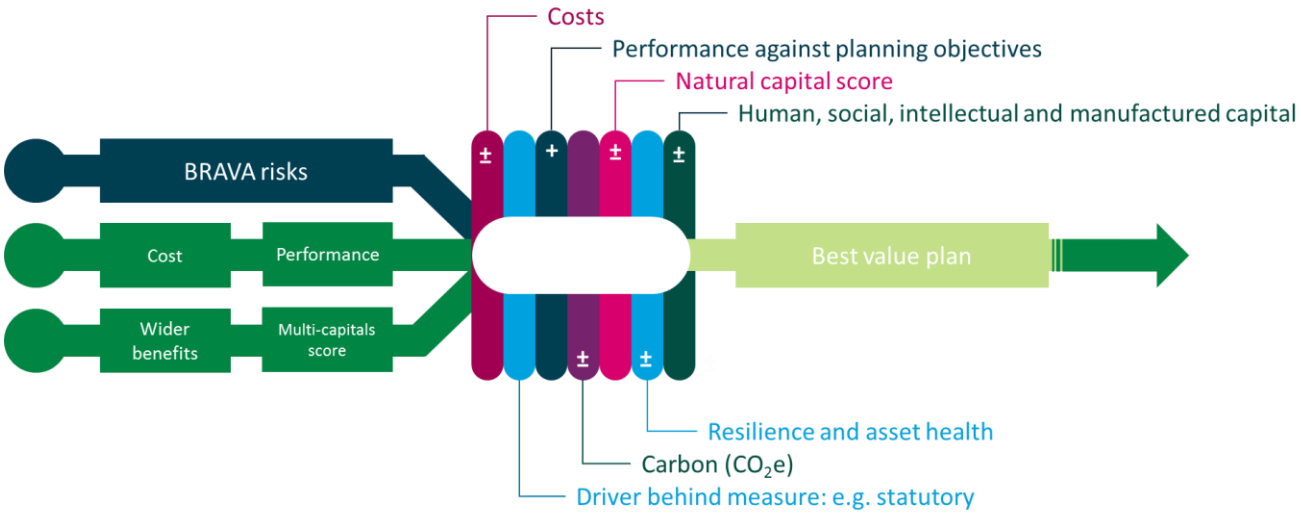
Figure 10 Stakeholder feedback on the process for selecting preferred options



4.6 Decision support approach for 'initial optimisation'

4.6.1 UUW have worked with the supply chain to use an innovative decision support tool, Copperleaf Portfolio, to optimise the plan. The tool uses algorithms to apply various constraints and prioritise different outcomes. To develop an optimised programme, the tool aims to meet the planning objective targets by using the inputted 'feasible' options. A number of scenarios were tested, for each a different set of rules and constraints was applied to select the best combination of options to meet the planning objectives. Wider benefits delivered by options are considered and reported for each scenario to inform decision-making. The tool considers need and risk over time and proposes an appropriate approach to investment over the period of the plan.

Figure 11 Optimisation Process



4.6.2 A value framework was configured to enable the optimisation tool to run, consider and compare different financial and outcome scenarios. This framework incorporated risk reduction values for each planning objective to allow for monetisation of service provision. In addition, non-monetised benefit was considered for UUW's six capitals assessment in the form of a 'six capitals score'. A number of scenarios were tested in both phase 1 and phase 2 of the optimisation process.

4.6.3 The output of phase 1 of optimisation is the prioritised plan for each SPA. As outlined in 'Appendix D – Options Development and Appraisal' of the Water UK document 'A Framework for the production of Drainage and Wastewater Management Plans' (2018), the prioritised SPA plan should not be seen as a delivery vehicle but as an input into the wider regional assessment required to derive an overall plan to achieve a planning objectives given affordability for customers. The regional plan derived through the DWMP will feed into the business plan for 2025–2030, translation of the DWMP for business plan activities means that wider affordability constraints will have to be considered taking into account wider needs such as maintenance need and investment across water and bioresources price controls.

4.6.4 Optimisation options have also been categorised depending on:

- whether the driver is mandated by regulatory drivers (e.g. WINEP);
- whether the option provides partnership opportunities; and
- whether the option delivers benefit against multiple planning objectives.

4.6.5 Analysis of the feasible options determined that over 85% of the options screened through to this stage delivered benefit against more than one planning objective. This highlights the interconnected nature of drainage and wastewater management and the necessity of integrated planning within the DWMP.

5. Phase 2: Secondary optimisation

5.1 Overview

5.1.1 Within secondary optimisation, the same decision support tool, Copperleaf Portfolio, was used to optimise the preferred options. During this phase, interventions were prioritised regionally, considering affordability and customer preference in order to deliver a regional best value plan.

5.1.2 In order to drive the best performance possible, at a regional level, offsetting of performance was allowed for a number of planning objectives including internal flooding, external flooding, open spaces flooding, pollution etc. Offsetting refers to the process in which the decision support tool is able to deliver over performance in some areas and select fewer options in other areas, which could lead to underperformance in some sub-areas. The purpose of offsetting is to try and achieve the best overall regional outcomes in an affordable manner.

5.1.3 A range of scenarios were considered to reflect the current uncertainty around certain outcomes, particularly overflows and investment driven by WINEP where was unclear whether a cost benefit assessment would apply.

5.1.4 Key scenarios run that will be discussed in this document include:

- scenario 1: Best value approach where only feasible options are considered; and
- scenario 2: Lowest whole life cost where only feasible options are considered.

5.1.5 Using the applicable rules, the decision support tool determined what the best combination of interventions is for the region for each scenario. The resulting costs and benefits of each programme vary according to the outputs of the decision support tool. However, there are some clear activities that appear in all scenarios and these are the 'no regrets' activities that will be the focus of investment cycle 2025-2030.

5.1.6 Following triangulation of customer research to understand customer affordability, the best value approach where only feasible options are considered was selected as the most appropriate in the absence of further guidance on WINEP and overflows.

5.1.7 This preferred approach scenario projects an overall expenditure of £1,016 million over the next 25 years. Consideration has been given to the phasing of this investment, taking into account when issues arise as well as financing and deliverability. When these factors are applied within the decision support tool, the preferred plan expenditure is shown in Table 4.

Table 4 Preferred Plan Summary

	Investment cycle 2025 - 2030	Investment cycle 2030 - 2035	Investment cycle 2035 - 2040	Investment cycle 2040 - 2045	Investment cycle 2045 - 2050
Total Expenditure (£m)	264	175	57	190	329

5.1.8 This scenario does not include base maintenance to maintain current levels of service (as stable service was assumed in modelling) or all anticipated WINEP investment due to lack of finalised guidance at the point of selecting the preferred plan. Costs associated with this will be provided in more detail for investment cycle 2025 - 2030.

5.2 Affordability

5.2.1 While it is important to drive long-term performance improvement, it is important to recognise that this needs to be delivered in a way that is affordable to customers. In order to ensure robustness, a number of pieces of research, which have been undertaken over the previous 18 months fed into UUW's affordability assessment.

5.2.2 Our customer research, both as part of DWMP planning and wider on going UUW customer engagement, has demonstrated that bill affordability is a critical priority for customers. Customers' focus on affordability has increased in recent months as wider cost of living factors, such as rising energy and fuel costs, have become more prominent. When UUW service priorities have been tested with customers, affordability is highlighted as a key priority (Table 5). Additionally, between 2020 and 2021 we have seen an increase in the number of customers who express concern about meeting water bills (Table 5). As demonstrated in Table 6, regular water service priorities research undertaken in 2016 found that affordability was ranked as the sixth most important priority out of 11. In 2021, the same research found affordability had increased to the third most important out of 11 priorities. Furthermore, between the two pieces of research a higher proportion of customers agreed that affordability should be a priority for UUW, rising from 64% of customers agreeing in 2016 to 77% in 2021.

Table 5 Engagement with customers to understand concern about meeting water bills – September 2021

	% of customers		
	April 2020	**March 2021**	**September 2021**
Concern about meeting water bills	21%	21%	33%

Table 6 Customer feedback on the priority 'working hard to keep the cost of water as affordable as possible'

'Working hard to keep the cost of water as affordable as possible'	**2016 survey results**	**2021 survey results**
Rank of priority (out of 11 priorities tested)	6	3
% of customers agreeing this issue is a priority	64%	77%

5.2.3 Additionally, we have regularly sought to understand customers' views on overall bill changes, including as part of our research into customers' priorities. This package of research has consistently indicated that the majority of customers are likely to be supportive of relatively small bill increases (c.1%–2% on current bills) in exchange for service improvement in areas of customer priority. However, there are early indications that bill increases larger than this are more likely to be challenged by many customers. This suggests that, at minimum, gaining support for larger bill increase will require clear demonstration of the benefits of investment.

5.2.4 The draft DWMP will signal a larger than historic bill impact, however, uncertainty around investment requirements have, up until now prevented us from developing a clear articulation for customers of service improvements associated with the potential bill increases. As a result, we do not at this stage have a robust understanding of customers' informed views on affordability impacts of this plan. Therefore, as part of the Draft DWMP consultation we will conduct further research with customers, engaging to better understand views on this draft plan, including planned service improvement, investment priorities and associated bill changes.

5.3 Service levels

5.3.1 In addition to understanding programme affordability, customer research has also provided insight into customer priorities for wastewater service levels. November 2021 research exploring prioritisation of services across water and wastewater highlighted protecting the environment and utilising sustainable solutions as high priorities (Table 7). Priorities relating to the DWMP are highlighted green.

Table 7 Ranked priorities of service levels determined by November 2021 research into customer priorities, a low number indicates a high rank (i.e. 1 is high)

Rank	Priority
1	Safe water to drink
=2	Protecting the environment
=2	Meeting future challenges through sustainable solutions
=2	Supporting customers with low incomes/in vulnerable circumstances
3	Reliable supply of water now and in the future
=4	Reducing leakage
=4	Reducing flooding
=5	Limiting the odour, flies and noise caused by United Utilities Water operations
=5	Avoiding disruption to travel
=5	A better digital experience

5.3.2 The relatively high priority given to the environment is consistent with the outcome of our State of the Nation research, which showed that the top two concerns were the environment and climate change. The results from the priorities research gives a value showing the proportional importance of each priority. The scores relevant to wastewater are outlined in Table 8.

Table 8 Proportional importance of wastewater priorities, a high score is positive

Priority	Score
Play our part in protecting the environment (e.g. reducing carbon footprint)	6
Meet future challenges through investing in sustainable solutions	5
Preventing pollution to the environment	4
Removing and treating wastewater in a way that protects the environment	4
Reduce wastewater flooding	1
Reduce wastewater blockages	1

5.3.3 Customer feedback on service levels has informed prioritisation of planning objectives within the decision support tool. Consequently, for planning objectives driving environmental performance including WINEP, overflows and permit compliance UUW have included a ‘must deliver’ rule into the optimisation process.

5.3.4 Meeting future challenges by investing in sustainable solutions was also highlighted as a high priority. This priority does not align directly to one of UUW’s planning objectives but rather an approach to options development, this is reflected in UUW’s options hierarchy. Risk management at source is prioritised (reducing service demand), followed by options to optimise the system and finally creation of additional capacity. The options, which are prioritised earlier within the options hierarchy, have lower carbon and are generally scalable and offer low regrets options supporting adaptation to future uncertainty.

5.4 Considering alternative plans

5.4.1 A preferred and alternative approach selecting options in the decision support tool were considered. These consisted of a best value and lowest whole life cost scenario.

5.4.2 Best Value

5.4.2.1. The best value approach follows the hierarchy approach detailed in TA7, which, as outlined in section 4.3, was developed based on customer research and endorsed as a best value approach by the Your Voice environmental sub group. Options from the list were selected using this hierarchy.

Figure 12 Option Category Hierarchy

5.4.3 Lowest whole life cost

5.4.3.1. As described in section 4.2, the lowest whole life cost approach, the decision support tool selects the lowest whole life cost option from the available option list. The multi-capital benefits of options were considered in the creation of this option list with a lower screening threshold for secondary screening for options with additional benefits.

5.4.4 Chosen scenario

5.4.4.1. High level comparison of these two approaches (Table 9) shows differences in overall expenditure and the types of investment selected. A wide scale monitoring programme would be required whichever scenario to enable the delivery of an adaptive approach.

5.4.4.2. While the best value approach is more expensive overall, it also offers greater opportunity for six-capital benefits (27,667 six capitals score for best value approach compared to 20,639 six capitals score for lowest whole life cost approach) and broadly similar performance improvements.

5.4.4.3. The two approaches were tested with stakeholders, as detailed in Section 4.5 and ultimately the best value approach based on the option hierarchy was selected.

Table 9 Best Value vs. Lowest Whole Life Cost (WLC) Projected Investment

Option Hierarchy	Scenario 1 Best Value		Scenario 2 Lowest WLC	
	Cost (£m)	Six capitals score	Cost (£m)	Six capitals score
Behavioural	81.2	16368	46.3	4719
Upstream Management	290.5	14158	277.9	13775
Catchment Management	15.6	174	15.8	168
Operational Interventions	151.0	2837	151.0	2937
Refurbishment	161.0	117	169.0	455
Replace/New Asset (blue green)	17.4	1967	12.0	1940
Replace/New Asset (conventional)	299.2	-7954	157.3	-3460
Total	1016.0	27667	829.3	20434

6. Determining our preferred plan

6.1 Overview

6.1.1 UUW have generated a number of scenarios based on different prioritisation, considering different levels of service provision and timing, as well as risk appetite. Delivery of the preferred plan sets out a pathway and direction of travel to meet UUW's long-term planning objectives. It must, however, be continually reviewed as part of an adaptive approach given the levels of uncertainty regarding exogenous factors such as climate change and policy changes.

6.1.2 Other factors, which must be considered when selecting the preferred plan include:

- **Impact on customer bills:** as outlined in section 5.2 affordability of bills is of increasing concern for customers, UUW's best value plan must consider value delivered collectively with affordability rather than as separate entities.
- **Intergenerational equity:** UUW recognise the need to ensure investment is in low-regrets interventions and investment is only made where there is high confidence in the need for that investment, however, UUW must also consider the risk of unnecessarily deferred investment causing a bow wave of investment need for future generations. Sustainable investment decisions taking into account long-term needs and balancing spend across investment cycles is key to preventing intergenerational inequality to ensure services in the future meet the needs of the future.
- **Need for flexibility/adaptation:** The DWMP process innately supports an adaptive planning approach with five year cyclical reviews, which will allow us to monitor delivery of interventions; track uncertainty in exogenous factors such as climate change and growth; and update UUW's approach to ensure UUW are using the best available data and tools.

6.1.3 We are setting out our plan through three core components reflecting three different levels of certainty:

(1) legal obligations – must do activities that are mandated by legislation or are required to maintain compliance with discharge permits;

(2) performance improvements – optimised outputs of the non-mandated aspects of the plan e.g. to meet internal flooding planning objective; and

(3) future requirements – investment associated with uncertain regulatory guidance e.g. objectives around overflows.

6.1.4 A central view of the investment associated with each of the core components listed above are summarised in Table 10 and detailed in Sections 6.2-6.3. Our current core plan is focused on the areas where we have greatest certainty, with a risk-based approach being taken for those areas of greater uncertainty, which are inherently higher risk.

6.1.5 We have tested a range of scenarios and combinations of these three investment components. The extent to which each of these components are included can alter costs significantly; in particular for those areas associated with uncertain regulatory guidance. This includes investment on overflows and to meet certain environmental drivers where guidance has not yet been finalised. The understanding of investment driven by emerging legislation will continue to evolve over the duration of the plan and better inform future DWMPs.

6.1.6 Due to the high degree of uncertainty associated with key elements of the plan, it is key that we use an adaptive approach to manage this risk as it emerges. Therefore, there is greater certainty in proposed investment in the short term than the long term.

6.1.7 Further details of the preferred plan can be found in the Draft DWMP Main Document (DP1).

Table 10 Preferred Plan for 2025-2050 summary

Component	Area	Price base assumption (Financial Year, FY)	Cost £m (2025–2050)
Legal obligations	Permit compliance	FY21	709
Legal obligations	WINEP	FY21	1,898
Performance improvements	Optimised activity	FY21	1,016
	Total: Legal obligations + Performance improvements		**3,623**
Future requirements	Overflows (Ecology)	FY21	1,039
Future requirements	Overflows (10 spills)	FY21	15,387
Future requirements	Overflows (Bathing Waters)	FY21	1,417
Future requirements	Overflows (screening)	FY21	455
	Total: Legal obligations + Performance improvements + Future requirements		**21,920**

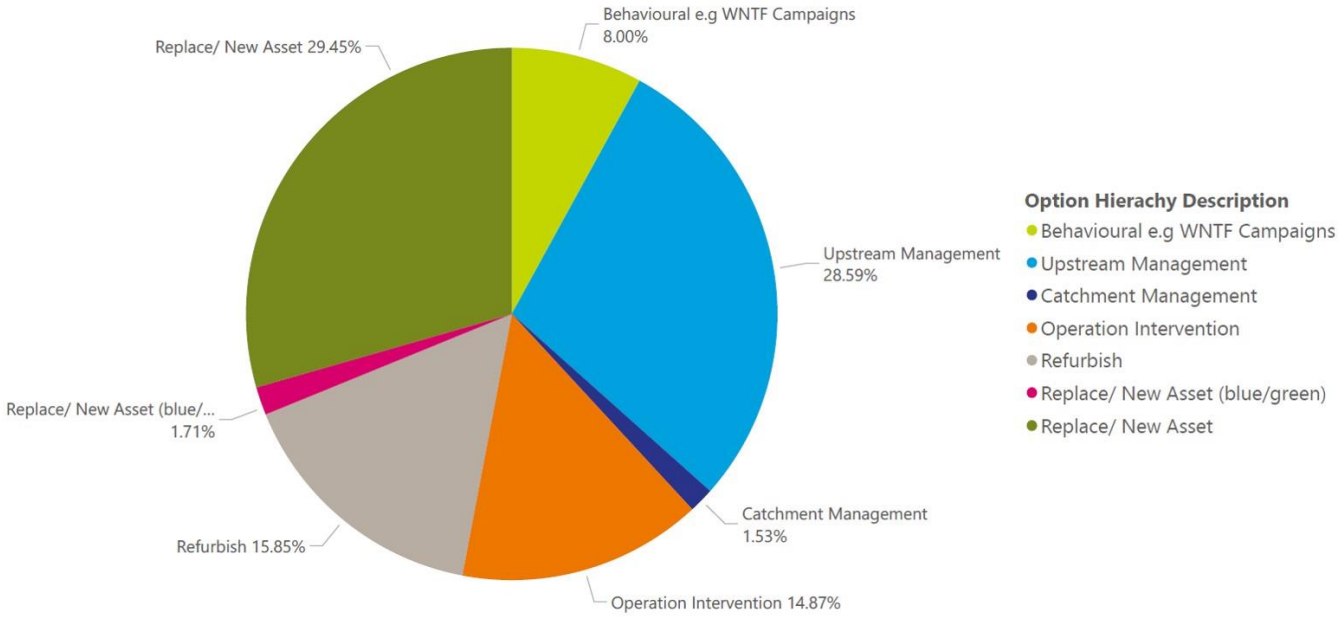
6.2 Optimised activities to deliver performance improvements

6.2.1 Overview of activities

6.2.1.1 Following the best value approach, the optimiser was used to select the best combination of options to meet the long-term planning objectives across the region. A wide variety of different option types were selected (Figure 13). This was carried out before the publication of the overflow consultation.

6.2.1.2 Within the optimised outputs to deliver performance improvements, significant investment of £1,016 million is forecast to be required over the 25-year period (2025–2050). The investment is distributed between a range of option types and across the 14 SPAs. Full detail of investment per SPA can be found in the SPA Plans (SPA_01 to SPA_14).

Figure 13 Regional view of optimised activities by option hierarchy



6.2.1.3 At a regional level, new assets and upstream management (e.g. SuDS) make up the largest proportion of investment (Figure 13). This is generally in the form of storage options, which are implemented to manage remaining capacity gaps in the sewer system caused by climate change and sustainable drainage options to manage rainwater entering the sewer system and SuDS options gained significant support from customers, owing to perceived additional benefits and getting to the 'root cause' of a problem. UUW are focused on delivering a rainwater management strategy recognising the challenge posed by climate change to the heavily combined systems in the North West.

6.2.1.4 Additional significant investment is found in operational interventions and refurbishment of existing assets. This investment includes activities to utilise innovative dynamic network management technologies and manage the wastewater and drainage systems using remote monitoring and artificial intelligence. Refurbishment options align to customer priorities to use existing assets and maximise asset life.

6.2.1.5 Approximately £20 million is forecast to be invested in catchment management, aligned to UUW's catchment systems thinking strategy.

6.3 Legal obligations

6.3.1 Overview

6.3.1.1 While certain areas of this plan are discretionary, and we have been able to optimise proposed investment as described in section 5.4.4, UUW is committed to several legal obligations in order to meet a selection of environmental and water quality-based drivers. These are derived from the Water Industry National Environment Programme (WINEP), Storm Overflow Assessment Framework (SOAF), and Water Framework Directive (WFD).

6.3.1.2 It is not appropriate to include engineering options for all investment drivers. Achieving permit compliance or complying with environmental drivers set out in the WINEP are legal requirements. Therefore, a cost benefit screened approach is not necessarily appropriate. This means that these activities must be considered independently from the decision support tool optimisation runs as using a cost benefit screen may not fully capture the activities required to mitigate risk.

6.3.1.3 Two areas of investment fall into this category:

(1) Permit Compliance; and

(2) WINEP.

6.3.1.4 In total, £2,607 million of investment has been identified to meet these mandatory activities between 2025–2050. This is associated with known regulatory requirements. Future needs driven by new and yet unknown legislation has not been included. For example, no investment has been identified to remove micro plastics or emerging chemical contaminants. As such, the detail set out in this section is likely to change significantly before final DWMP publication in March 2023 and in future iterations of the plan as new requirements are identified.

6.3.1.5 Legal obligations have been included for 357 TPUs. These have been identified through the BRAVA or by following the WINEP driver guidance issued by the Environment Agency. In the majority of these TPUs, the investment identified is fairly small. However, significant potential expenditure has been identified through this process for a number of TPUs (Figure 14). It is anticipated that the Upper Mersey SPA, which covers a significant area of Manchester will be an area of significant investment.

Figure 14 Map detailing areas where significant legal obligation investment has been identified

6.3.2 Permit compliance

6.3.2.1 To understand the potential scale of programme which would be required to meet permit compliance a risk-based approach was used. The outputs of BRAVA modelling was used to identify sites with the greatest vulnerability and a prioritised programme developed based upon this. This has involved assessing sites with investment need for:

- end of pipe compliance risk, which identifies long-term investment need in 76 TPUs; and
- dry weather flow (DWF) compliance risk, which identifies long-term investment need in 95 TPUs.

6.3.2.2 Taking into account wastewater treatment works already selected during programme optimisation, this results in 81 unique new sites to be included alongside the optimised plan.

6.3.2.3 Holistic solutions for these sites have been developed, which also include any investment to meet WINEP drivers. When costs are proportioned out between permit compliance and WINEP we are forecasting a programme of £709 million over 25 years to meet permit compliance.

6.3.2.4 A number of significant TPUs have been identified through this approach including some of our largest TPUs. Sites such as these have a number of drivers and alignment of delivery will be key in ensuring an efficient and holistic solution.

6.3.2.5 All the sites identified as part of this programme will need careful monitoring to understand the growth rate and point where capacity is exceeded in light of what is likely to be a significant programme of surface water management upstream. This programme of work is likely to be under continual review as part of an adaptive plan. Decisions on this type of investment have historically been subject to decision and prioritisation through the periodic review processes and managed flexibly to incorporate changes in growth location and size as part of the overall plan.

6.3.3 Water Industry National Environment Programme (WINEP)

6.3.3.1 The WINEP is the programme of work water companies in England are required to do to meet their obligations from environmental legislation and UK government policy.

6.3.3.2 The development of the WINEP with the Environment Agency to inform investment cycle 2025 - 2030 and beyond is currently underway. While this is currently under development there are some areas which have been identified as likely candidates for investment predominantly in investment cycle 2025 - 2030 and investment cycle 2030 - 2035.

6.3.3.3 In the DWMP, we have accounted for the following unconfirmed schemes, some of which have historically been considered but found to be non-cost beneficial and, therefore, categorised as ‘red’ schemes through the WINEP, others where sufficient guidance has been received, that gives confidence that solutions will be required, have been included in the proposed activities (Table 11). The drivers included in this plan are currently classified as ‘core’. The schemes included are likely to change between draft and final as the understanding of the WINEP requirements are finalised.

Table 11 WINEP schemes included in draft plan

Driver	Justification for inclusion	Number of TPUs	Number of drivers
Septic Tank Improvements	New UWWTD driver guidance to treat all septic tanks to 40 BOD and 60 suspended solids received	59	59
Habitats Directive Improvements (or prevention of deterioration)	Identified through habitats investigation outputs (draft)	48	48
MON3 and MON4 flow compliance monitoring requirements	Updated guidance on flow monitoring received February 2022	267	305
No Deterioration	Identified through revised river models (to be updated for investment cycle 2025 - 2030)	25	25
Population thresholds	Identified through risk analysis of growth increase and Urban Waste Water Treatment Directive guidance	3	3
Water Framework Directive (continuous discharge)	Previously identified for improvements but historically non-cost beneficial to treat to limits identified (RED WINEP)	28	29

6.3.3.4 Taking into account the wastewater treatment works already selected during programme optimisation, this results in 226 unique new sites to be added at an additional cost of £1,898 million.

6.4 Future requirements – Areas of uncertain expenditure

6.4.1 There are a number of evolving policy areas which could result in significant expenditure for wastewater. This section outlines the uncertain investment associated with future requirements, which has been considered within the draft DWMP.

6.4.2 A number of these will be driven by the recent Environment Act and the outcome of the Government's Storm Overflow Discharge Reduction Plan consultation. There are also ongoing discussions with the Environment Agency with regards to the development of the WINEP, which will continue up until the publication of the WINEP in March 2023.

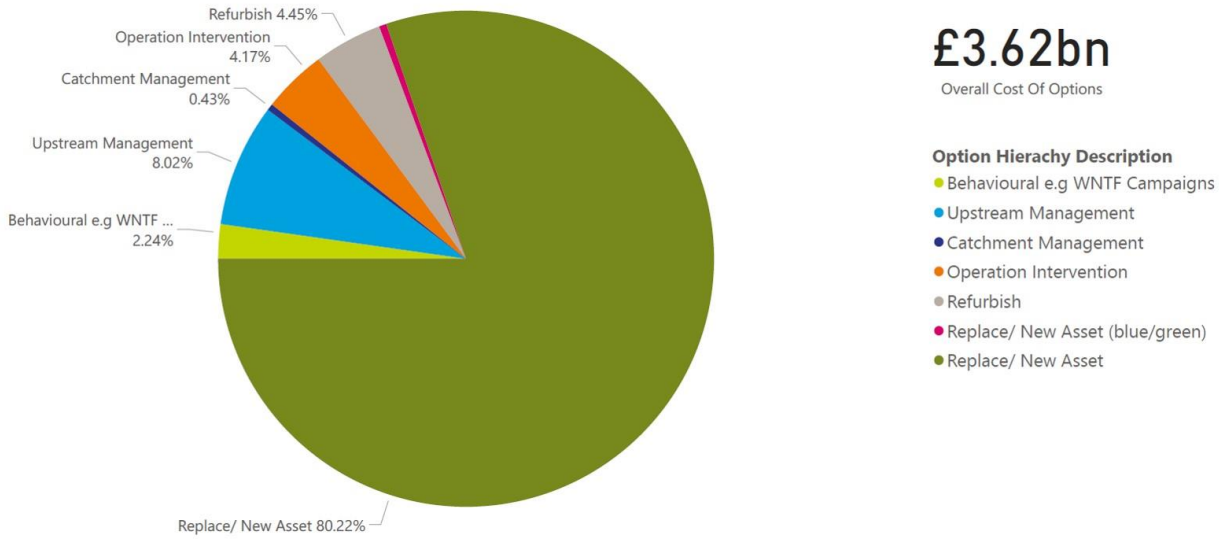
6.4.3 Further details on how we have considered the future requirements can be found in the UUW DWMP Main Document including the proposed phasing of investment required in order to meet the objectives set out in the Government's Storm Overflow Discharge Reduction Plan consultation.

6.5 A summary of our preferred plan

6.5.1 Overview

6.5.1.1 The preferred plan that is set out in this section is based on legal obligations and optimised activities to deliver performance improvements. This totals £3,623 million of investment over the 25-year period 2025–2050 (Figure 15).

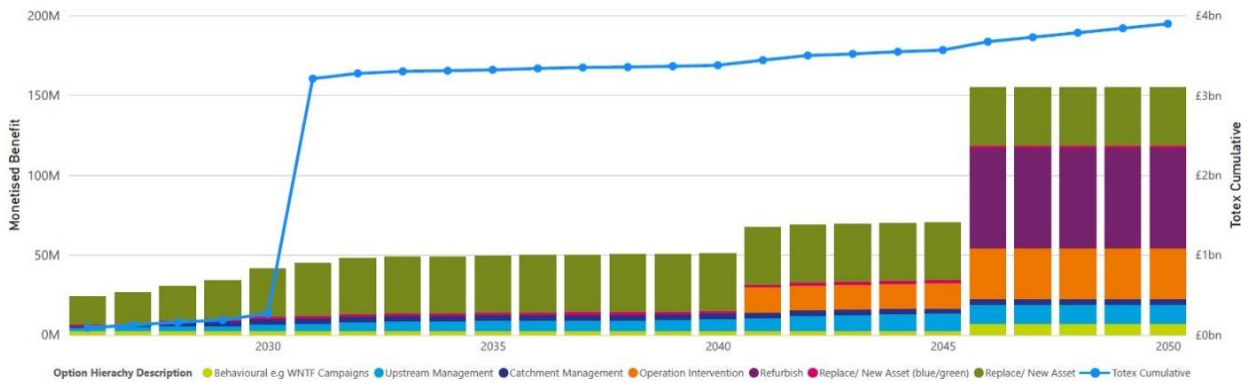
Figure 15 Proposed breakdown of investment by option hierarchy of likely legal oblications and optimised activities to meet planning objectives



6.5.1.2 Figure 15 demonstrates the split of investment by option hierarchy. Due to the scale of change needed, the biggest investment that will be required is in new assets. This is predominantly due to the scale of investment required to meet legal obligations set out in the WINEP. Benefits throughout the 25-year period are aligned to the investment as demonstrated in Figure 16.

6.5.1.3 Operational interventions and refurbishment options bring more significant benefit later in the planning period (2040 onwards). Benefit delivered by upstream management, catchment and behavioural option types remains fairly constant with benefit incrementally increasing as additional investment is made in these option types. Figure 16 highlights a step change in investment required in investment cycle 2030 - 2035 , this is aligned to delivery of legal obligations associated with WINEP and overflows, followed by a more stable expenditure trajectory.

Figure 16 Benefit per investment cycle provided by option types and cumulative cost (totex)



6.5.2 Delivering against planning objectives

6.5.2.1 The preferred plan includes a range of interventions to ensure delivery of the planning objectives (Figure 17). This is done by mitigating the long-term risks identified through the BRAVA. These risks vary from drainage area to drainage area.

Figure 17 How activities in the plan ensure achievement against planning objectives

Planning objective	We will collect, treat and recycle wastewater in compliance with our permits, now and in the future, to protect the natural environment	We will protect, restore and improve the natural environment of the North West through our actions	We will sustainably reduce the risk of sewer flooding in the North West
Metric	Wastewater Quality Compliance Pollution Incidents	Storm Overflow Performance Environmental Obligations (WINEP)	Internal Flooding External Flooding Flooding of Open Spaces Sewer Collapses Risk of 1:50 Year Storm
Addressed by	Legal Obligations: Permit Compliance Performance Improvements	Legal Obligations: WINEP	Performance Improvements

6.5.2.2 The preferred plan delivers against progress towards our planning objectives with four of our six key metrics forecast to be met: internal flooding, flooding open spaces, 1 in 50-year flooding and sewer collapses (Table 12). Potential over achievement is forecast for these targets, resulting from the integrated nature of drainage – options to resolve risk in one performance area often have numerous secondary benefits to other parts of the system.

6.5.2.3 Two of our objectives, external flooding and pollution, have proved challenging to meet in a cost effective manner. These objectives are impacted by both hydraulic risk and by 'other causes' of capacity constraints, including sewer misuse, blockages and collapses.

6.5.2.4 Successful delivery of planning objectives will also depend on partnership working, innovation and legislative change. Key legislative changes which will support improvement include the implementation of Schedule 3 of the Flood and Water Management Act; reviewing the role of highway drainage as a rainwater drainage system; eliminating the use of wet wipes; and supporting public action to reduce the misuse of drains and sustainable drainage. As part of UUW's adaptive approach, we will continue to monitor the progress of these areas and adjust the plan accordingly.

6.5.2.5 We consider that there are good reasons to expect that innovation, legislative changes and future improvements in forecasting should be capable of substantially closing the gap in these planning objectives by 2050.

Table 12 Potential risk reduction associated with the delivery of the optimised plan

Planning objective	Regional % reduction in risk achieved through optimised activities
Internal flooding	68%
External flooding	39%
Pollution	88%
Open space flooding	56%
Sewer collapses	72%
1 in 50-year flooding	4%

6.5.2.6 To ensure wastewater treatment compliance into the future, the plan has identified significant potential expenditure for a small number of wastewater treatment works due to likely future permit changes and growth. The expenditure profiled is based on best assessments of likely regulatory requirements, however, short and long-term uncertainty around the WINEP will necessitate changes between draft and final DWMP.

6.5.2.7 Similarly, storm overflows performance still requires finalisation of the Defra Storm Overflow Discharge Reduction Plan requirements before we can optimise this within our overall plan. The analysis we have carried out has indicated expenditure in this area could be significant and continued engagement on the matter with both regulators and customers will be paramount in agreeing the approach.

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