Dŵr Cymru
Welsh Water

Enhanced Investment Case: WSH70-PE01 – Minimising Environmental Harm from Storm Overflows

Contents

Executive Summary

This investment will reduce ecological harm by reducing the impact of Storm Overflow (SO) spills on the surrounding environment. This investment is part of a multi-AMP approach which will ensure all SOs that cause ecological impact will be improved so that by 2040 noting beyond very low ecological harm will be caused by our SOs. Furthermore, investment to ensure all SOs meet a satisfactory classification irrespective of impact will be addressed by 2050.

We have structured this document using the enhancement assessment criteria set out in Ofwat's PR24 Final Methodology, Appendix 9 (Setting Expenditure Allowances), Section A1.

The enhancement assessment criteria are divided into four criteria groupings:

- need for enhancement investment (7 sections);
- best option for customers (5 sections);
- cost efficiency (2 sections); and
- customer protection (2 sections)

Need: This enhancement case is driven by regulatory requirements following key legislation which is specified as applicable to us in the regulator's driver papers. This is then translated into the NEP and WINEP by the by Natural Resources Wales and the Environment Agency respectively. We have worked closely with key stakeholders including the Welsh Government and the PR24 Forum who set the strategic steer for Welsh Water in AMP8 by setting out a collaborative approach among government, regulators, water companies and wider stakeholders in Wales. We have targeted 3 priority areas to meet our obligations:

- SO Improvement to Satisfactory performance, including AMP9 programme design work
- SO Impact Assessment and Classification
- SO Enhanced Monitoring Development.

Options: For SO improvement to satisfactory performance, we have assessed options for 13 bands of SOs, considering both Grey Storage and Grey/Green Storage, (using Rainscape[1]). These bands have been created based on the 10th spill volumes for the range of sites, this has then allowed costing and concept solutions to be developed for a range of storage requirements for the SO programme, the banding can be seen in the table below. We have applied our service measure framework for cost benefit analysis on both options and for all except one band of SOs (Band 2), the most cost beneficial solution was the grey storage option.

Band	10th Largest Spill Volume (m^3)
1	0-50
2	50-100
3	100-250
4	250-500
5	500-1000
6	1000-1500
7	1500-2500
8	2500-5000
9	5000-7500
10	7500-10,000
11	10,000-12,500
12	12,500-15,000
23	40,000-42-500

What We Will Deliver: This Enhancement Case will deliver investment at over 100 of our highest impact Storm Overflows to ensure they do not cause environmental harm (as defined by "no" or "very low" impact) and meet the requirements of a satisfactory performing asset as defined by NRW

[1] Rainscape is a combination of surface water removal, infiltration reduction and retrofitting Sustainable drainage systems (SuDS)

guidance[2]. It will also expand our investigations programme to a further 907 assets to meet our statutory requirements to classify the impact at all our SO assets by 2030 and deliver the evidence required for the formation of an enhanced river water quality monitoring programme.

Costing:

	CapEx	OpEx	TotEx
SO Impact Assessment and Classification	£10.969M	£0.000M	£10.969M
SO Improvements	£345.771M	£3.415M	£349.186M
SO Enhanced Monitoring	£4.682M	£1.391M	£6.073M
Total	**£361.422M**	**£4.806M**	**£366.228M**

Customer Protection: This enhancement is covered by regulatory oversight from Natural Resources Wales and the Environment Agency through the drivers in the NEP and WINEP that set out the regulatory obligations based on legislation, guidance, and government policy. These framework directives give strong control, with added protection via our proposed Storm Overflow PC, that will ensure we deliver the required improvements in SOs if the funding is allowed.

Benefits: The investment will enhance environmental protection to the new regulatory requirements by reducing SO impact, in line with the Welsh Government and PR24 Forums strategic steers for Welsh Water and the regulatory drivers set out in the NEP and WINEP. There will also be a significant reduction in in ecological impact and environmental harm over the programme of work to 2040. Our multi-AMP programme will deliver our commitment that all SOs, by 2040, will have 'no' / 'very low' impact on the receiving environment and our AMP8 programme will ensure that 60.98% of SOs will meet this criteria. From the baseline of 52.91% at the end of AMP7.

Supporting documents:

1. PR24 Strategic Steers, PR24 Forum
2. Welsh Water Storm Overflow Investment Plan as issued to the Better River Quality Taskforce, 26th June 2023
3. Customer Views on CSOs: 2023 Update, Blue Marble
4. Welsh Water Storm Overflow Strategy Review, 15th September 2023, Jacobs

[2] *'How to comply with your Environmental Permit. Additional Guidance for: Water Discharge and Groundwater (from point source) Activity Permits (EPR 7.01)'*, NRW.

1. Introduction

1.1 Purpose of this document

In this document, we make the case for investing in the reduction of impact from the operation of Storm Overflows (SOs) on the surrounding environment.

For context, by the term SOs, we mean overflows on the wastewater network, those at pumping stations, overflows from WwTW either direct to the environment or via storm storage tanks, but not overflows designed to operate and are operating in an emergency. We have also included in our programme permitted emergency overflows that we believe are operating as storm overflows and unpermitted storm overflows.

The proposed investment will deliver compliance with regulatory requirements as set out in NEP and WINEP and it delivers on the long-term pathway to no SO causing environmental harm by 2040, an ambition driven by both the PR24 Forum and the BRQT in Wales.

Figure 1 below details where this Enhancement Case fits into the overall WINEP and NEP Enhancement Cases.

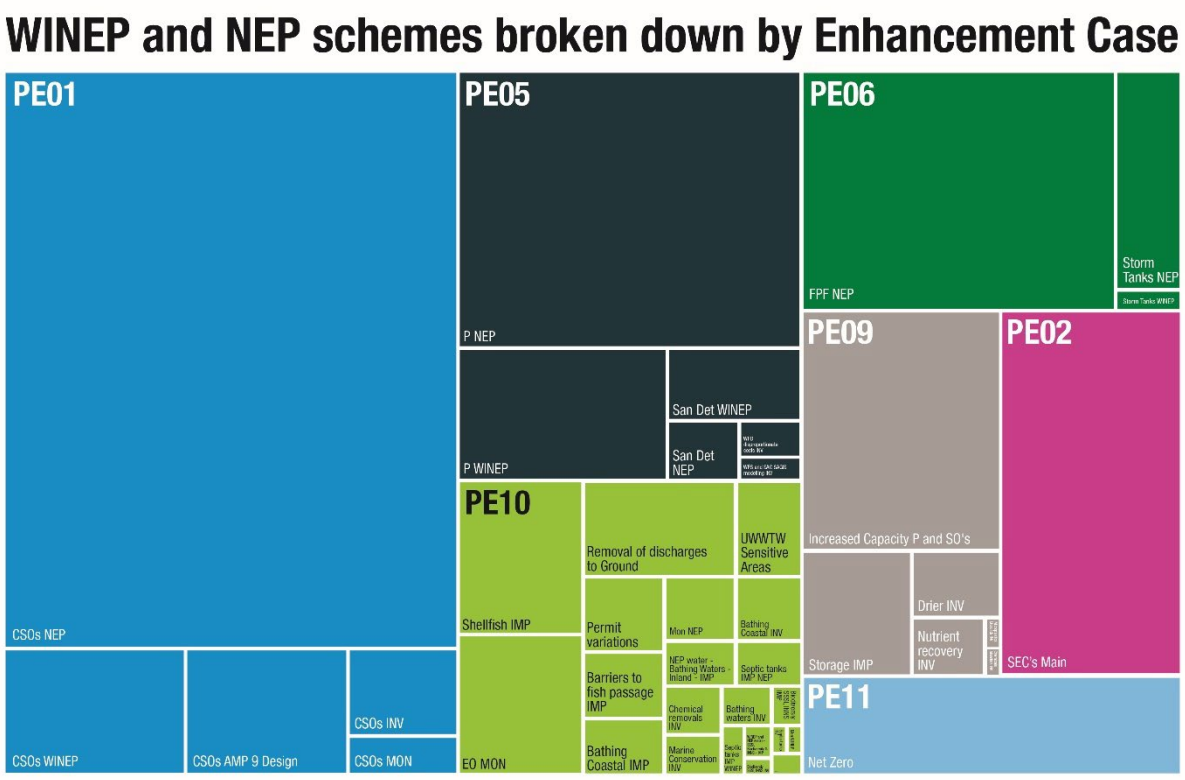


Figure 1: WINEP and NEP schemes broken down by Enhancement Case.

1.2 Structure of this Document

We have structured this investment case using the enhancement assessment criteria set out in Ofwat's PR24 Final Methodology, Appendix 9 (Setting Expenditure Allowances), Section A1.1:

ID from Appendix 9		Abbreviated Assessment Criterion	SO Impact Assessments and Classification	SO Improvements	SO Enhanced Monitoring
A1.1.1 Need for enhancement investment	a	Is there evidence that the proposed investment is required?	Section 3.1.1	Section 4.1.1	Section 5.1.3
	b	Is the scale and timing of the investment fully justified?	Section 3.1.2	Section 0	Section 5.1.2
	c	Does the proposed investment overlap with base activities?	Section 5.1.3	Section 4.1.2	Section 5.1.3
	d	Does the need and/or proposed investment overlap/duplicate with previously funded activities or service levels?	Section 3.1.4	Section 0	Section 5.1.5
	e	Does the need clearly align to a robust long term delivery strategy within a defined core adaptive pathway?	Section 3.1.5	Section 4.1.5	Section 5.1.6
	f	Do customers support the need for investment?	Section 3.1.6	Section 4.1.6	Section 5.1.7
	g	Have steps been taken to control costs, including potential cost savings?	Section 3.1.7	Section 4.1.7	Section 4.1.7
A1.1.2 Best option for customers	a	Have a variety of options with a range of intervention types been explored?	Section 3.2.1	Section 4.2.1	Section 5.2.1
	b	Has a robust cost-benefit appraisal been undertaken to select the proposed option?	Section 0	Section 4.2.2	Section 5.2.2
	c	Has the carbon impact, natural capital and other benefits that the options can deliver been assessed?	Section 3.2.4	Section 4.2.3	Section 5.2.3
	d	Has the impact of the proposed option on the identified need been quantified?			
	e	Have the uncertainties relating to costs and benefit delivery been explored and mitigated?	Section 3.2.5	Section 0	Section 5.2.4
	f	Where forecast third party funding needs to be secured, has the scale been shown to be reliable and appropriate?	Section 3.2.5	Section 4.2.5	Section 5.2.5
	g	Has Direct Procurement for Customers (DPC) delivery been considered?	Please refer to WSH50-IP00 Our Approach to Investment Planning (Section 3.4.1)		
	h	Have customer views informed the selection of the proposed solution?	Please refer to Stepping up to the Challenge: Business Plan 2025-30 (Section 2.2)		
A1.1.3 Cost efficiency	a	Is it clear how the company has arrived at its option costs?	Section 3.3.1	Section 4.3.1	Section 5.3.1
	b	Is there evidence that the cost estimates are efficient?	Section 3.3.2	Section 4.3.2	Section 5.3.2
	c	Does the company provide third party assurance for the robustness of the cost estimates?	Section 3.3.1	Section 4.3.1	Section 5.3.1
	a	Are customers protected if the investment is cancelled, delayed or reduced in scope?	Section 3.4.1	Section 4.4.1	Section 5.4.1

ID from Appendix 9		Abbreviated Assessment Criterion	SO Impact Assessments and Classification	SO Improvements	SO Enhanced Monitoring
A1.1.4 Customer protection	b	Does the protection cover all the benefits proposed to be delivered and funded?	Section 3.4.2	Section 4.4.2	Section 5.4.2
	c	Does the company provide an explanation for how third-party funding or delivery arrangements will work for relevant investments?	Not applicable for this case		

2. Storm Overflows in Wales

Public and government challenges to the acceptability of the operation of SOs has translated into governments in both Wales and England expecting water companies to reduce their reliance on them, as well as carry out additional monitoring to better understand the issues and impact that may arise when they are in operation.

2.1 Better River Quality Taskforce

Environmental policy is a devolved matter and comes under Welsh Government for both Wales and those areas of England that we serve. Policy on required SO improvements is determined by the Welsh Government who have established the Better River Quality Taskforce (BRQT)[3] to evaluate the approach to the management and regulation of overflows in Wales, setting detailed plans to drive change and improvement in 5 key areas and supporting Welsh Government in defining in greater detail targets for storm overflow improvements.

2.2 PR24 Forum

Ofwat guidance for PR24 included the opportunity for the development of a collaborative model in Wales. The Wales Price Review Forum (PR24 Forum) was established to deliver this collaborative approach among government, regulators, water companies and wider stakeholders in Wales.

A key function of the Forum is to develop and adopt positions, endorsed by its members, that reflect joint views on key topics for PR24, Long-Term Delivery Strategies, Business Plans, and priority outcomes for Wales that will need to be achieved over the next 25 years. Ofwat have been actively involved in the PR24 Forum and its adoption of such a collaborative approach and the direction taken in Wales should be well-known and understood.

Positions of the Forum are articulated through communiques released and endorsed by the Forum from time to time. Positions are expected to be robust, evidence-based, informed, and relevant to the development of Business Plans. Water companies in Wales are expected to consider these communiques in the development of their Long-Term Delivery Strategies and Business Plans[4].

The Forum has been meeting over the last 2 years and has now issued Strategic Steers to guide and inform the development of Welsh Water's Long Term Delivery Strategies and PR24 Business Plan.

2.3 Welsh Water Storm Overflow Investment Plan

Welsh Water has built its investment plan to target the maximum reduction of ecological harm from SOs in order to align with the Strategic Steers from Welsh Ministers and the PR24 Forum[5]. BRQT action plan outcomes which were developed jointly by its members, have been incorporated into the PR24 Forum's Strategic Steer.

Welsh policy recognises that Wales is one wettest parts of the UK and that many of our customers are served by combined sewer networks. As a result, we have significantly more SOs per customer than other water companies, particularly those in eastern parts of England. When this is considered in combination with having the highest standard average annual rainfall (SAAR) of all the English and Welsh water and sewerage companies[6] it results in Welsh Water having the highest average annual spill frequency.

Analysis (further information of which can be found in Appendix A) has shown that if Welsh Water's wastewater network was subject to a lower SAARs range, for example that of East Anglia (Cambridge), then the forecast average annual EDM spills would be circa. 13.6. This analysis holds

[3] https://www.gov.wales/wales-better-river-quality-taskforce/terms-reference
[4] Terms of Reference - PR24 (ccw.org.uk)
[5] Issued in August 2023
[6] See PICTURE 6 in our PR24 Business Plan Document

true for both Plymouth rainfall and Newcastle rainfall. The analysis demonstrates that if Wales were subject to lower annual rainfall – like other areas of the UK, it could achieve a sub 20 EDM average without further investment.

However, having a higher annual average spill frequency is not the same as saying our SOs are having a greater impact. 40% of all Welsh water bodies met good ecological status in 2021 and whilst it remains a challenge to improve rivers and coastal waters in Wales, the impact of SOs should be assessed from the perspective of ecological harm.

As a result, our plan aims to deliver the maximum ecological benefit rather than targeting spill numbers with the optimum solution being decided by a cost-benefit assessment, representing the best use of customers money. In addition to eliminating the ecological impact of our SOs we are also required under NRW guidance to "improve" SOs which means achieving a "satisfactory" classification under the Urban Waste Water Treatment (England and Wales) Regulations 1994 (UWWTR) with the chosen solution. The 4 primary drivers which lead to a CSO being classified as unsatisfactory under the NRW guidance are[7]:

- Any operation in dry weather conditions
- Any operation in breach of permit conditions
- Any significant visual or aesthetic impact due to solids or sewage fungus
- Causes or significantly contributes to a deterioration in the biological or chemical status of the receiving water.

By contrast companies operating wholly and mainly in England are subject to a statutory requirement to reduce the adverse impacts of SOs through reductions in average spill frequency as set out in the Environment Act 2021. The act sets targets for achieving an average annual spill frequency of 10 for all storm overflows by 2050 as specified with the intervening milestones on the road to that target set out in Defra's Storm Overflows Discharge Reduction Plan (SODRP).

Based on the current available data, Welsh Water is prioritising its AMP8 investment to tackle SO sites that fall under the category of causing 'severe' harm while considering deliverability in AMP8. This approach is consistent across our investment proposal for SOs in Wales under our NEP submission with NRW and our WINEP submission with the Environment Agency (EA). We have reached an agreement with the EA that our SO investment in England be delivered under the 25YEP_IMP driver and follow the same approach to prioritisation and harm reduction as in Wales[8].

Welsh Water's investment strategy for SOs was issued to the BRQT on 4th July 2023[9].

2.4 Alignment with the PR24 Forum Strategic Steer

All elements of our storm overflow investment case have been developed in accordance with the statutory planning framework of the NEP driver guidance for improving SOs[10], the collaborative approach adopted as set out by Ofwat and have implemented the strategic steers provided to us by Welsh Ministers, the PR24 Forum and the direction of the BRQT. It has not been developed within the context of the Drainage & Wastewater Management Plan (DWMP), which companies in England have used to target their investment on reducing spills across the network, as the hydraulic modelling that underpins the DWMP is not appropriate from prioritising on the basis of ecological harm.

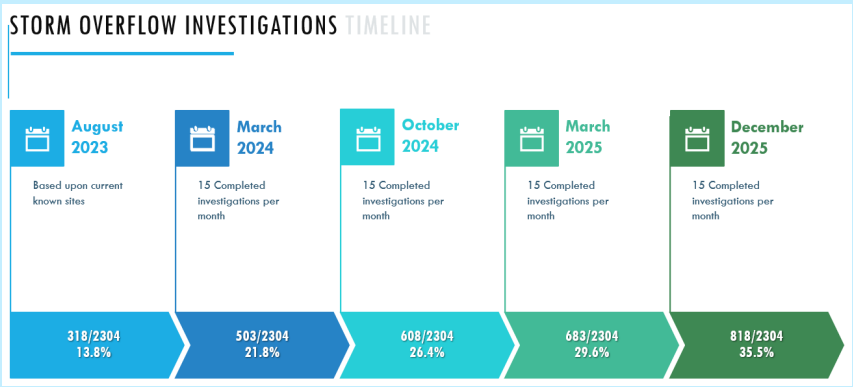
The table in this section describes how we have met the strategic steers from Welsh Ministers and the PR24 Forum and incorporated them into our AMP8 investment programme.

[7] *'How to comply with your Environmental Permit. Additional Guidance for: Water Discharge and Groundwater (from point source) Activity Permits (EPR 7.01)'*, NRW.
[8] The EA's published FAQs confirm that the English SO improvement targets do not apply to the areas of England we serve.
[9] Welsh Water Storm Overflow Investment Plan. 26th June 2023.
[10] NRW PR24 Drivers: Storm Overflows, Urban Waste Water Treatment Regulations 1994, Statutory Obligation.

Table 1: Meeting the PR24 Strategic Direction[11]

Expectation	How has this been met
We expect all Welsh Water assets to be classified against criteria set out in NRW's Storm Overflow classification guidance by 2030.	*We are delivering this under the W_U_INV1 driver with an additional 907 investigations at some of our SOs. SOs currently unpermitted will be classified by the end of this AMP.*
We expect companies to investigate the impact of their assets and where further evidence is required to act, in time to inform planning for PR29.	*We have included for this within our W_U_O_IMP1 investment to support the design and feasibility for our AMP9 programme, to enable a well-informed submission to NRW at PR29. We are also spending £11M (TotEx) under the W_U_O_INV1 Driver so all SOs will be classified, and impact assessed by 2030. Finally, we have allowed a further £6M (TotEx) under the W_U_O_MON1 driver to allow us to collaborate with others in order to enhance monitoring at priority assets and meet the evidence needs of the BRQT action plan.*
The companies Drainage and Wastewater Management Plans (DWMPs) evidence must be used to strategically assess and address these issues in conjunction with work already done (and other statutory plans) to assess high spilling assets. Companies need to act now, ahead of and during PR24 to set out and deliver a clear prioritised pathway to a sustainable and resilient drainage and sewerage network.	The objectives of the NEP Driver are broadly aligned with the objectives of our DWMP. *The conclusions of this 1st cycle as to what needs to be done to provide a resilient drainage system and avoid flooding and pollution are based purely on hydraulic modelling of the sample catchments to assess the capacity of the system. In assessing what needs to be planned for storm overflows the model does not, therefore, reflect the quality of the water in the receiving watercourse, and hence does not allow Storm Overflow investment to be prioritised on the basis of ecological harm, as required by Welsh Government policy. It is not, therefore, possible to derive the AMP8 enhancement programme for Storm Overflows from the DWMP, something that has been required by Ofwat. By the time of the 2nd cycle, we anticipate that we will have completed the assessment of water quality pertaining to each of our SOs discharging into rivers, along with developing a process to assess quality impacts for coastal discharges and this data will be able to be introduced into the models supporting the DWMP allowing it to form the basis of the enhancement investment programme for subsequent AMPs.*
We expect Welsh Water to reduce the use of Storm Overflows (SOs) prioritised on the basis of delivering the maximum improvement to the environment in terms of reducing harm. This also applies to currently unpermitted SOs.	*We have identified a initial prioritised list of 109 SOs, that are classified as "Severe" as per the SOAF impact assessment methodology and our solutions aim to reduce impact from these to "no" or "very low" by the end of AMP8. This will be the first stage of a longer-term programme to eliminate the ecological harm caused by of all our storm overflows by 2040. This is expected to lead to improvements at around 1,071 SOs.*
We expect Welsh Water's performance on SOs to be monitored and incentivised based on reducing ecological harm and not on average spill numbers. Reductions in the numbers of spills are welcome but are not in themselves the priority for action, which should be focused on identifying and addressing SOs causing the greatest impact on the environment.	*The programme in this Enhancement Case outlines the solutions we aim to implement to reduce harms from prioritised SOs that have been classified as "Severe" under the SOAF Programme. A full list of proposed sites is given in Appendix B and we have also outlined this in our proposed bespoke Storm Overflow PC – discussed in Section 4.4*

[11] PR24 Strategic steers final – published August 2023

Expectation	How has this been met
We recognise the significant investment estimated to be required to address the problem of SOs causing ecological harm and recognise the need to take a phased approach in order to manage the impact on customer bills, financing and deliverability.	*We originally hoped to improve all SOs with the greatest impact in AMP8. However, our estimated number of sites, based on our AMP7 SOAF investigations, thought to be having a "severe" impact put the number of sites to be improved at over 400. Consequently, we have applied affordability criteria in recognition that the size of the programme would have been too large and expensive for a single AMP and have thus prioritised our SOs based on "Severe +" which currently supports targeting 109 sites*
We expect Welsh Water to invest to increase the proportion of SOs causing no harm (or 'very low' harm) to the environment to 100% by 2040 at the latest including all currently unpermitted SOs. We expect the company to achieve 60% by 2030, and 80% by 2035.	*To support the BRQT action plan and the PR24 Forum Strategic Steer, Welsh Water has developed an ambitious plan to eliminate the impact at all of its storm overflows by 2040. Further investment may be needed between 2040 and 2050 on SOs that may have no or very low impact but would be considered substandard for example due to the level of screening provided.* *During AMP8 in tackling the priority list of 109 SO's we will have opportunity to try a range of solutions as well as working with the regulator on innovative catchment proposals that will need new regulatory policy, and this will help inform us in terms of refining solution cost and timescales for delivery, enabling a larger programme in subsequent AMPs.* *This will be a long term commitment to investing near £5000M in today's terms and is illustrated below:* 
We expect Welsh Water to work with local authorities to maximise opportunities from the flood risk management programme where projects can directly or indirectly support the SO programme. We expect the company to be an exemplar on surface water management in Wales.	*In development of our SO improvement programme we have worked with key stakeholders to ensure we deliver solutions of most benefit to customers and the environment. Collaboration with stakeholders will vary by scheme where appropriate but may include the following:* · *NRW* · *EA* · *Local Councils* · *Welsh Government* An example of how we have delivered on this, and how we aim to collaborate in the future is our Greener Grangetown. *collaboration with Cardiff Council.*

2.5 Third Party Appraisal of SO investment approach

Our approach for investment in SOs has also been appraised by Jacobs, with a view to commenting on whether the Welsh Water approach to basing investment in SOs on harm to the environment the right approach for Wales.

The appraisal concluded support for the approach and that it provides best values for both customers and the environment. Jacobs noted that there are two areas where our approach can be strengthened: reviewing whether additional criteria can be added to narrow down our number of investigations which we will now discuss with the BRQT and referencing the alignment with our Long-Term Delivery Strategy in our strategy. Jacobs supported a performance commitment that is based on environmental outcomes and noted the unique regulatory and policy differences within Wales would be best for our customers.[12]

Following on from this review, we will ensure the strategy encompasses our adaptive planning approach and remain committed to keeping our strategy live and under review. As we progress through our improvement programme, we will ensure the strategy focus changes from enhancement to maintenance and include how we reassess harm if there is deterioration or change to the outflow from our assets.

[12] Welsh Water storm overflow strategy review, Jacobs, 15th September 2023.

3. SO Impact Assessment and Classification

3.1 Need for Enhancement Investment

3.1.1 Evidence that Enhancement is Needed

Is there evidence that the proposed enhancement investment is required?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.1a

SOs can have an impact on water quality and ecology of a river. Impact is assessed in line with the methodology and impact classification set out in SOAF[13] and NRW guidance[14]. The largest section of the SO improvement programme in AMP8 will be based on these criteria and, subject to approval at Final Determination, investment under these drivers will aim to reduce the impact of any SO improved under these criteria to No/Very Low in one step. Continuing the impact assessments & classifications of all storm overflows is, therefore, critical in delivering best value for our customer in AMP8 and onwards. NRW also require all storm overflows to be classified by 2030, as outlined in their NEP Storm Overflow Driver Paper Outcomes and Ambition[15].

3.1.2 Scale and Timing of Investment

Is the scale and timing of the investment justified?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.1b

We are planning to invest £11M to support SO classification under the W_U_O_INV1 driver for the NEP and also under the 25YEP INV driver as set out by the EA under the WINEP for England.

The requirement is for the investigation to classify a storm overflow in accordance with NRW's storm overflow classification guidance where assessment of the asset has not previously been captured by other programmes. This is also in accordance with the strategic steer from the PR24 Forum to have all Welsh Water assets classified against the NRW criteria by 2030.

Across a total of 2,304 storm discharges, Welsh Water has minimal evidence on the impact to the environment for approximately 907 SOs. The 907 assets requiring SO classification under the W_U_O_INV1 driver for the NEP and under the 25YEP_INV driver under the WINEP for England is a subset of the full, count of 2,304 storm overflow assets. An exercise was undertaken to cross reference and remove from the programme, in line with the NRW Driver Paper, SOAF sites investigated to end of 2025, unpermitted SO (uCSO) sites under investigation) and Trigger Event Notice (TEN) sites (to establish those already improved based on impact). From this was compiled the list of 907 sites that would require investigations to be undertaken to ensure all sites would have a known impact and classification by the end 2030. Any of these sites that are in high priority water bodies are then programmed for completion by 2027 in line with the Strategic Steer.

Table 2: W_U_O_INV1 and 25YEP_INV breakdown for Wales & England

Area	No of Sites
Wales	794
England	113
Total	**907**

To develop the long-term strategy for all storm discharges operated by Welsh Water, a firm and consistent baseline of their impact is needed. Unlike the assessment of nutrients discharged from WwTWs which is carried out through water quality modelling such as SAGIS, the assessment of a SOs impact is considered at a localised level through modelling and is heavily dependent on its

[13] SOAF V1.6 June 2018 pages 11-18.
[14] '*How to comply with your Environmental Permit. Additional Guidance for: Water Discharge and Groundwater (from point source) Activity Permits (EPR 7.01)'*, NRW.
[15] NRW PR24 Drivers: Storm Overflows, Urban Waste Water Treatment Regulations 1994, Statutory Obligation.

representation through a hydraulic model and assessment in line with the Urban Pollution Management manual (UPM). This approach is common to NRW and the EA's regulatory guidance.

In Wales, we have excluded SOs improved in earlier AMP investment programmes and are now covered by TEN permit conditions because these assets had already been found to have had an impact on bathing and shellfish waters during previous investigations. TEN permit conditions require Welsh Water to investigate when these sites breach a permitted spill frequency trigger and report on the reasons for the breach and then develop and issue a maintenance plan setting out the plan to restore performance. This process is funded from our Base Maintenance allowance.

3.1.3 Overlap with Activities to be Delivered through Base

Does the proposed enhancement investment overlap with activities to be delivered through base?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.1c

This enhancement investment does not overlap with any activities funded in the base models.

3.1.4 Overlap with Funding from Previous Price Reviews

Does the need and/or proposed enhancement investment overlap with activities or service levels already funded at previous price reviews?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.1d

We are investing under the W_U_INV1 driver (investigation to classify a storm overflow in accordance with NRW's storm overflow classification guidance where the assessment of the asset has not previously been captured by other programmes) for PR24 in Wales and the 25YEP_INV Driver in England, whereas previously we were investing under the W_U_INV and U_INV drivers at PR19 (investigations in support of schemes to undertake an UWWTR spill frequency reduction investigation and cost benefit appraisal for frequently spilling SOs).

The two driver codes are similar, but requirements are distinct. The AMP7 investigations also only applied to sites that exceeded the SOAF thresholds.[16] The programme for AMP8 extends the investigations undertaken in AMP7 to SOs that have not already been investigated i.e., those that did not meet the spill thresholds. The AMP8 process includes a new classification step against the NRW guidelines[17] and removes the consideration of cost benefit included in the previous driver.

Table 3: Difference between PR19 & PR24 Driver Codes

	AMP7:	AMP8	
Driver Code:	***U_INV***	**W_U_O_INV1 (NEP)**	**25YEP_INV (WINEP)**
Description:	UWWTR spill frequency reduction investigation and Cost Benefit appraisal	Investigation to classify a storm overflow in accordance with NRW's storm overflow classification guidance where assessment of the asset has not previously been captured by other programmes	Investigations into a locally significant environmental issue not eligible under any other driver, but with clear evidence of customer support. – this driver is used to support the direction from Welsh Government

[16] 60 spills in first year of EDM reporting, 50 spills on average over the first 2 years of reporting, 40 spills on average over a 3-year period.
[17] '*How to comply with your Environmental Permit. Additional Guidance for: Water Discharge and Groundwater (from point source) Activity Permits (EPR 7.01)*', NRW.

	AMP7:	AMP8	
Number of Schemes	600 (+ 200 additional impact assessment funded by our non-shareholder model)	794	113
Expenditure	£10.167M	£10.969M	

At PR19 we developed an industry leading programme under the SOAF framework to investigate the impact of over 600 frequently spilling SOs throughout AMP7 and then prioritise investment on sites where the cost benefit of reducing the environmental impact of the SO met the criteria set out in the framework.

This programme is in progress assessing the listed SOs along with around an additional 200 SO impact assessments funded through additional investment made available by board at the end of 2021 from the company's own resources. As of May 2023, we have investigated 253 sites and are targeting completion of over 800 by the end of 2025. The investigation and assessment timeline are shown in figure 2 below.

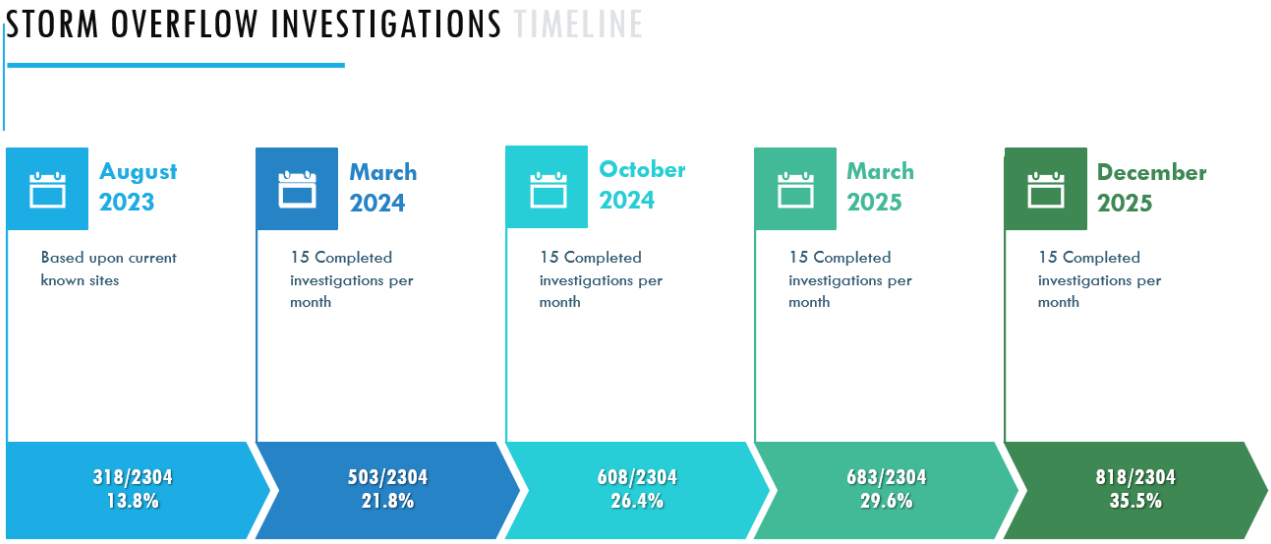


Figure 2: SO Investigations Assessment Timeline

It is worth noting that there is no current harm assessment methodology (equivalent) for estuaries and coastal waters (not in Bathing or Shellfish designated areas). We have worked on developing a methodology for this and will be reviewing the proposal with NRW for implementation in AMP8 to ensure all overflows are classified by 2030.

3.1.5 Alignment with the Long Term Delivery Strategy

> ***Is the need clearly identified in the context of a robust long term delivery strategy within a defined core adaptive pathway?***
>
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.1e*

The improvement of SOs is a key long-term ambition of the company, which forms part of Welsh Water's outcomes as agreed with the Wales PR24 Forum. This investment is part of a multi-AMP approach which will ensure all SOs that cause ecological impact will be improved so that by 2040 nothing beyond very low ecological harm will be caused by our SOs. Furthermore, investment to ensure all SOs meet a satisfactory classification irrespective of impact will be addressed by 2050. Further details can be seen in WSH01 Long Term Delivery Strategy.

3.1.6 Evidence of Customer Support

Where appropriate, is there evidence that customers support the need for investment?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.1f

Our approach to customer engagement is set out in Stepping up to the Challenge: Business Plan 2025-30 (Section 2.2).

Via our engagement with stakeholders on our DWMP, customers expressed support for us to invest in Storm Overflows to reach our long-term destination of zero spills (except in exceptional circumstances) and indicated support for us to continue to implement our approach of prioritising schemes by environmental benefit**.**

We have also undertaken independent research via Blue Marble in both 2021 and 2023 to understand customers views on SOs. In the most recent research, once customers were made aware of SOs, reducing the operation of them was seen as a top priority[18].

Customers in this research also indicted that they would prefer measures that assessed the extent to which environmental harm is reduced as a way of monitoring progress on improving SOs.

3.1.7 Management Control of Costs

Is the investment driven by factors outside of management control? Is it clear that steps been taken to control costs and have potential cost savings been accounted for?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.1g

The enhancement investment under W_U_O_INV1 & 25YEP_INV are driven by regulatory requirements of the NRW Driver Paper and the PR24 Strategic Steer to classify the impact of all our assets by 2030.

3.2 Best Option for Customer

In this section, we will describe how we have identified and developed options for addressing the need identified above. We identify investment to classify impacts at over 900 of our SO assets, and two potential approaches have been assessed for best value. There is no third-party funding for this Enhancement Case.

3.2.1 Identification of Solution Options

Has the company considered an appropriate number of options over a range of intervention types to meet the identified need?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.2a

To deliver on the W_U_O_INV1 and 25YEP_INV driver requirements, we intend to continue carrying out investigations to classify storm overflows in accordance with NRW guidance[19]and SOAF[20]. This requirement aligns with that of the PR24 Forum Strategic Steer and NRW driver paper to classify all our storm overflow assets by 2030.

To satisfy the requirements of the drivers set out by NRW and the EA, we have identified 2 key options. These are for model calibration or model verification. The primary difference between the two options is that the latter requires additional flow surveys to be carried out in order to allow for verification of the models and the former does not require this as it is calibrating the existing models.

[18] Customers Views on CSOs: 2023 update, Blue Marble.
[19] '*How to comply with your Environmental Permit. Additional Guidance for: Water Discharge and Groundwater (from point source) Activity Permits (EPR 7.01)'*, NRW.
[20] SOAF V1.6 June 2018 pages 11-18.

To ensure the best value option the decision was made to go with the model calibration as the least cost option. This level of modelling ensures they are fit for use, as specified by UK Water Industry modelling guidance.

There are 794 locations identified which require assessment in Wales. Of these 165 are classed as discharging into high priority waters. A further 113 sites have been identified for investigation in England, under the 25YEP_INV driver in the WINEP.

Investigations are proposed within the catchment which will be done in a typical manner for this asset class, including model calibration and asset surveying. The impact from these investigations will be assessed and assets can then be prioritised for investment.

The investigations include for the following areas:

- Running the model confidence assessment (MCA) tool.
- Collation and analysis of rainfall data.
- Costs for hydraulic surveys and modelling.
- Cost for water quality modelling.

As part of an appraisal of our storm overflow approach by Jacobs[21], they have commented that there may be the opportunity to screen more of our storm overflows for impact to remove those that are likely not to be causing impact through a robust methodology being used by the EA. More detailed impact analysis using UPM will then be undertaken where screening has failed. This will narrow down the number of detailed investigations, but this suggestion needs to be discussed with NRW and the BRWT for approval of an amended process to ensure our obligation has been met.

3.2.2 Assessment and Selection of Solution Options

> ***Is there evidence that the proposed solution represents best value for customers, communities, and the environment over the long term?***
>
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.2b*

The investment under the W_U_O_INV1 & 25YEP_INV drivers is a statutory obligation to meet 2030 targets from NRW and is vital to inform our proposed storm overflow performance commitment to ensure our investment is rightly targeting our most impacting assets. Understanding the impact of our SO performance on the environment is also of importance to our stakeholders. The preferred option provides slightly less certainty but is still viable, and at a significantly lower cost, so offers best balance of value for customers.

3.2.3 Quantification of Benefits

> ***Has the company fully considered the carbon impact, natural capital and other benefits that the options can deliver?***
> ***Has the impact (incremental improvement) of the proposed option on the identified need been quantified, including the impact on performance commitments where applicable?***
>
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.2c and A1.1.2d*

No specific carbon impact has been considered for the W_U_O_INV1 & 25YEP_INV drivers as they are for impact assessment and classification only.

[21] Welsh Water Storm Overflow strategy review, Jacobs, 15th September 2023.

3.2.4 Uncertainties relating to cost and benefit delivery

Have the uncertainties relating to costs and benefit delivery been explored and mitigated? Have flexible, lower risk and modular solutions been assessed – including where forecast option utilisation will be low?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.2e

As discussed previously, we have been delivering an extensive programme of investigations and impact assessments and the programme in AMP8 under the W_U_O_INV1 & 25YEP_INV drivers is a continuation and expansion of this. Therefore, uncertainties to costs and delivery are low.

3.2.5 Third Party Funding

Has the scale of forecast third party funding to be secured (where appropriate) been shown to be reliable and appropriate to the activity and outcomes being proposed?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.2f

No third-party funding is involved with the W_U_O_INV1 & 25YEP_INV drivers as they are for impact assessment and classification only.

3.3 Cost Efficiency

3.3.1 Developing a cost for SO Investigations

Is it clear how the company has arrived at its option costs? Is there supporting evidence on the calculations and key assumptions used and why these are appropriate?

Does the company provide third party assurance for the robustness of the cost estimates?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.3a and A1.1.3c

The cost for investigations has not been subject to third party assurance but a unit cost has been built up for each investigation based on supplier quotes and historical costs of similar types of work and will cover various activities such as running the MCA tool, RADAR data, model build, calibration and simulation, flow surveys and riverine water quality modelling.

3.3.2 Benchmarking our approach

Is there evidence that the cost estimates are efficient (for example using similar scheme outturn data, industry and/or external cost benchmarking)?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.3b

No external cost benchmarking has been employed for the impact and classification studies, but the build-up of costs is based on the actual costs of selected elements of previous similar investigation work and supplier quotations.

3.4 Providing Customer Protection

In this section, we set out protection provided by NRW's NEP and the EA's WINEP requirements.

The two sub-sections below correspond to the three criteria set out in Ofwat's PR24 Final Methodology, Appendix 9 (Setting Expenditure Allowances), Section A.1.1.4. There is no third-party funding for this Enhancement Case.

3.4.1 Proposed Performance Commitment (PC)

Are customers protected (via a price control deliverable or performance commitment) if the investment is cancelled, delayed or reduced in scope?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.4a

This enhancement investment is covered by regulatory oversight from NRW's NEP and the EA's WINEP.

The undertaking of impact assessments is crucial in targeting SO improvements and also to support and refine our proposed SO performance commitment – see Section 4.4.

3.4.2 Extent of Protection

Does the protection cover all the benefits proposed to be delivered and funded (eg primary and wider benefits)?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.4b

The NEP & the WINEP gives a strong control, alongside our proposed SO PC.

4. SO Improvements

4.1 Need for Enhancement Investment

This enhancement expenditure supports multiple actions under W_U_O_IMP1 and 25YEP_IMP SO investment drivers within the NEP and WINEP in line with the existing guidance from NRW and the EA (the EA's driver is also designed to give effect to Welsh Government's environmental policy). NRW's driver sets out the actions needed to meet the requirements of the UWWTR by improving storm overflows classified as 'unsatisfactory' generally by ensuring that they do not cause or significantly contribute to a deterioration in the existing quality of the receiving water based on the new information gained as a result of our AMP7 SOAF investigations and the further evidence we expect to find from our investigations in AMP8. The criteria for classifying storm overflows are provided in NRW's current Storm Overflow Classification guidance[22].

4.1.1 Evidence that Enhancement is Needed

Is there evidence that the proposed enhancement investment is required?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.1a

Assessing SO impact is the first step in understanding how many storm overflows will require improvement and all SOs will have their impact assessed by 2030 with priority given to sites spilling to high priority waters (by end of 2027). We have currently completed ecological impact assessments on 253 frequently spilling SOs[23]. The results for this are shown in the table below. Of importance to note is the finding that spill frequency and duration are not a good indicator of impact for this group of frequently spilling SOs. This is evidenced by there being no correlation between spill frequency, duration and impact.

Table 4: SO Impact by Spill Frequency and Duration

Impact	Sites	Percentage	Average Spills	Average Duration
Severe +	77	30%	83.1	777.6
High/Very High	42	17%	96.7	865.1
Moderate	51	20%	74.3	577.4
Low	23	9%	94.3	835.5
No / Very low	60	24%	83.6	700.3
Total	**253**	**100%**	**86.4**	**751.2**

To obtain an initial estimate of the likely numbers of overflows that will require improvement to reduce impact by 2040 we have extrapolated the above data to all SOs spilling 40 times per year or more on average. Further extrapolation has been made for SOs discharging on a lower frequency basis. This extrapolation has been made using the following assumptions:

- For SOs operating more than 40 times per year on average and which have not had their impact assessed, the percentage with "no" or "very low" ecological impact will be calculated on a pro rata basis of the results for storm overflows which have already been assessed. E.g., 30% of sites with over 40 spills estimated to cause 'Severe+' impact.
- For SOs operating between 10 and 40 times per year and which have not yet been assessed, the percentage with "no" or "very low" ecological impact will be estimated as a slightly higher percentage of such sites. This will be estimated at 40% (as against 24% in the sample) having "no" or "very low" ecological impact and 60% have "low" or greater impact.

[22] How to comply with your environmental permit. Additional guidance for: Water Discharge and Groundwater (from point source) Activity Permits (EPR 7.01) (naturalresources.wales) p36
[23] Assessments carried out to May 2023.

- SOs operating an average of 10 times per year or less will be screened in AMP8 to check minimum dilution of their flows when they do spill (along with other parameters such as gradient). Sites that fail this screening will have a full impact assessment carried out. Based on the studies completed to date, we have estimated that 15% of these sites will fail the dilution screening and, of those 25% will be found to have an impact[24]. This means that 96% of SOs operating an average of 10 times per year or less have "no" or "very low" ecological impact and 4% have "low" or greater impact.

Based on these assumptions the impact of all SOs across the Welsh Water operating area has been estimated and is shown in Table *5* below.

Table 5: Estimated SO ecological impact in 2023.

Impact	Percentage	No of Sites*
Severe +	18%	423
High/Very High	10%	238
Moderate	12%	312
Low	6%	127
No / Very low	54%	1204
Total		2304
**This is the figure for 2021 and includes network and pumping station SOs, WWTW and last in line storm tanks and EOs known to be acting as SOs. The list includes all SOs regardless of their permit status.*		

As a result, we estimate that the long-term investment programme will need to improve 1,100 SOs to have no or very low impact by 2040. We also plan to invest in any remaining sub-standard SOs that have no or very low impact to bring them up to a satisfactory standard in later AMP periods (2040 to 2050).

We expect to continuously update our estimates of the number of sites that require improvement as we complete our SO impact investigations programme, as per the timetable to the end of 2025 shown in Figure *2*. We aim to have completed 503 impact assessments by March 2024 and 608 by October 2024 and so the currently extrapolated numbers in Table 5 will be updated based on the findings of those activities. These updates will help to strengthen our certainty on the SO programmes and also help to refine the position of our proposed SO performance commitment (as discussed in Section 4.4.1).

We have prioritised the order for investment based on the sensitivity of the site and the level of impact we are having. The 109 sites listed on the NEP and WINEP for AMP8 have been identified based on the current impact assessment data available to Welsh Water. These are included in Appendix 3. As further site assessments are completed this list will be refined and any changes to the current named sites discussed with the environmental regulators, but we remain committed to addressing impact from at least 109 of our most impacting SO sites.

4.1.2 Scale and Timing of Investment

Is the scale and timing of the investment justified?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.1b

The AMP8 quality investment programme for SOs will be at least 4 times larger than in AMP7 supported by an increased number of regulatory drivers.

[24] These sites are assumed to have a "moderate" impact for the purposes of investment planning only meaning that investment for these sites will be planned for later AMP investment periods.

The requirements and timing of the investments are set out in the PR24 NEP framework driver guidance[25] which are shown in the table below. These dates are also captured in the latest version of the NEP (v6 July 2023).

Table 6: NEP PR24 Framework requirement

Driver Code	Description	Outcomes & Ambition
W_U_O_IMP1 and 2	***NRW - (Wales)*** To meet the requirements of the UWWTR by improving storm overflows classified as 'unsatisfactory' or 'substandard'	*SO's identified for investment by the end of AMP8 will be improved to eliminate their impact on the water body and meet satisfactory classification under the UWWTR.*
25YEP_IMP and INV	**EA – *(England)*** Investigations and improvements on locally significant environmental measures not eligible under any other driver but with clear evidence of customer support	*Similar to Wales investment to reduce impact to "no" or "very low" over the course of AMP8 to meet satisfactory*
W_U_O_IMP1 – SO AMP9 programme design	Welsh Water will require funding in AMP8 as part of PR24 to enable continuation of the rolling programme of improvements	*For PR29, the aim of the process is to assess the costs and benefits of detailed improvement options to allow to provide NRW and EA with improved certainty for the NEP and WINEP in AMP9*

Thus, for investment in AMP8, the outcome of Welsh Water's SOAF stage 2 programme will be utilized and aligned to ecological harm. As the AMP7 NEP investigation (U_INV2) is approved by NRW throughout the remainder of AMP7, an entry will be added onto the AMP8 NEP tracker under the relevant improvement driver aligned to the priority based on ecological harm and waterbody sensitivity in the relevant delivery timeframe (i.e., any period to 2040).

It is envisaged that prior to draft determination, a large number of AMP7 SOAF investigations will be approved for sign off and will be programmed for investment in line with our prioritisation methodology.

The table in Appendix C gives a breakdown of the 109 sites that are currently named on the NEP. As discussed, this is based on the current data available and focuses on resolving "Severe+" sites whilst applying an affordability criterion. This represents a phased approach to SO improvement, as per the regulatory expectations, and embodies "no-regrets" investment that is part of the broader pipeline of investment through to AMP9, AMP10 and further. We outline this in the section below.

4.1.2.1 Longer Term Storm Overflow Improvement Programme

To support the BRQT SO action plan and the PR24 Forum Strategic Steer, Welsh Water has developed an ambitious plan to eliminate the impact of its storm overflows by 2040. Further investment may be required between 2040 and 2050 on SOs that may have no or very low impact but would be considered substandard. This will be a long-term commitment to investing near £5000M in today's terms and is illustrated in Figure *3* below.

[25] NRW PR24 Driver – Storm Overflows

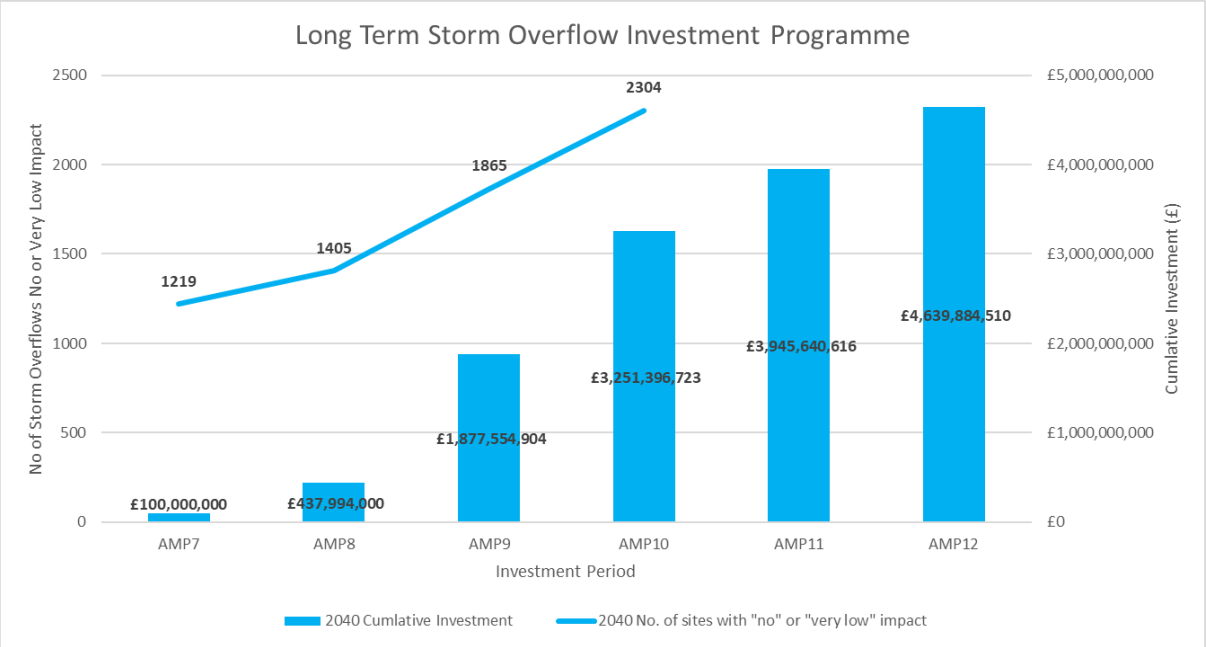


Figure 3: Welsh Water's Longer Term Storm Overflow Cumulative Improvement Programme

The proposed investment profile between 2025 and 2040 shows a significant step change in the number of SOs Welsh Water expects to improve in AMP8 compared with AMP7 and then a further acceleration in AMP9 and 10. There are a number of reasons for proposing this investment profile:

- It reflects the fact that there is significant investment planned for AMP8 to meet other environmental needs particularly in relation to reductions in phosphorus discharged to SAC and WFD improvements (also outlined in the PR24 Forum Strategic Steer) whilst maintaining the balance between affordable customer bills and the pace of environmental improvement. A greater proportion of the environmental investment programme is expected to be focused on SO investment in AMPs 9 and 10 before dropping again in AMP11 and 12.

- This proposed AMP8 plan will be as large or larger in real terms as any programme we have delivered historically, and it will take our supply chain time to build up the capability and capacity to deliver our programme.

- The strategic steers are clear that we should seek opportunities to collaborate and coinvest with others and that we should be seeking to use nature based and sustainable solutions wherever possible. We know from experience that this is possible, but that true mutual collaboration takes time to develop (for example the award winning Greener Grangetown initiative in collaboration with Cardiff Council took 6 years to complete from its inception) and agree with stakeholders and regulators alike.

4.1.2.2 SO AMP9 Programme Design

The SO programme for AMP9 will be significantly larger than AMP8 as the drive to improved environmental performance gathers pace. Consequently, the work within AMP8 for feasibility and design will carry forward into AMP9. This investment supports W_U_O_IMP1 under the NEP framework directive with guidance from NRW.

Based on the anticipated AMP8 storm overflow impact assessment and classification programme outlined in Section 3, it is estimated that up to 326 SO designs will need to be undertaken in AMP8 to ensure our increased programme through AMP9 and 10 remains deliverable. The design process outlined in Figure *4* below, will also allow us to assess the options and costs of improvement for

identified SOs, so as to develop an enhanced submission at PR29 for the NEP and WINEP submission to provide greater certainty to NRW and EA.

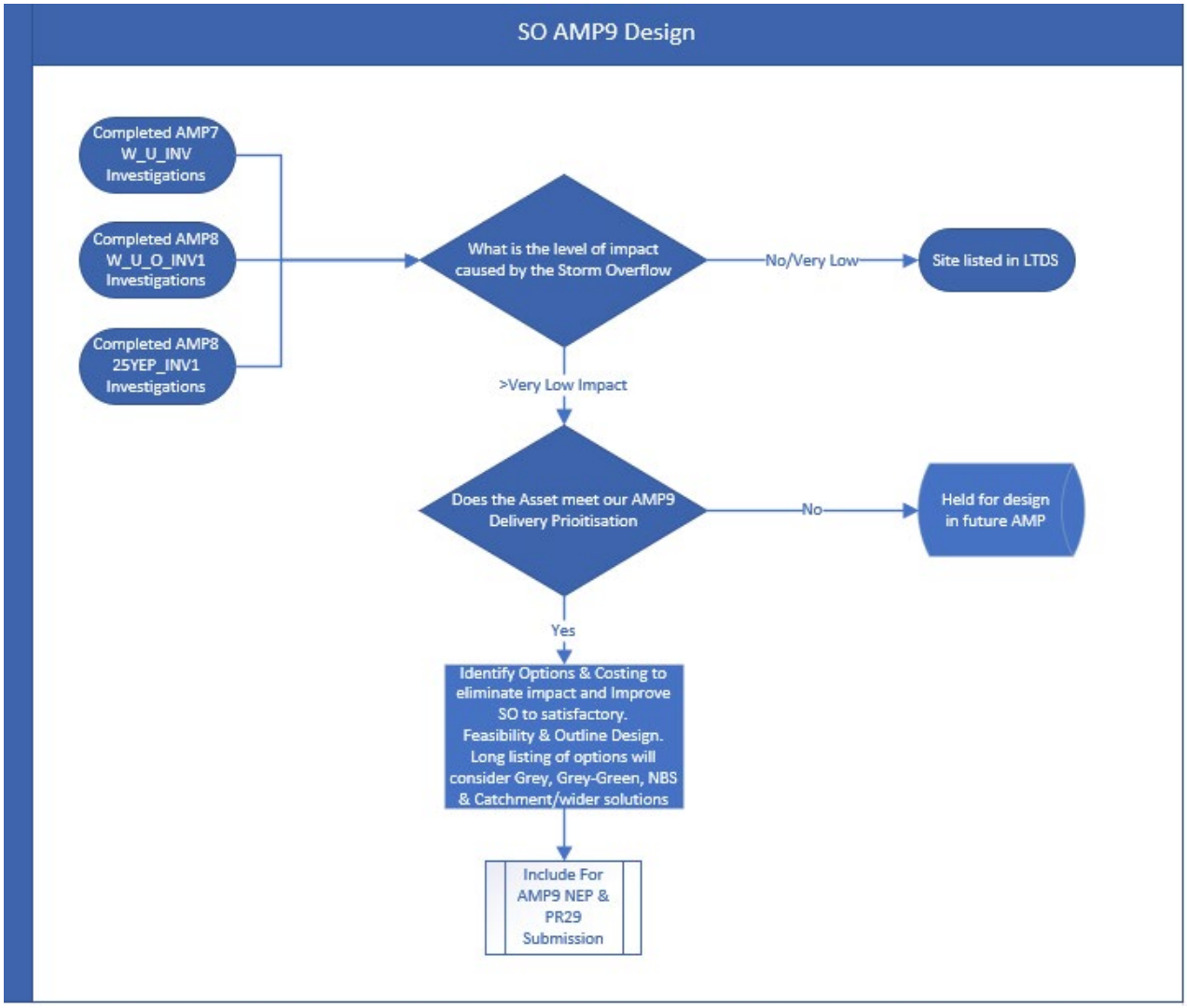


Figure 4: SO AMP9 Design

The sites that have been provisionally listed in the NEP for AMP9 are the candidate sites that will be prioritised for design. This will support our phased long-term approach to improving SOs to 2040, An example of how we aim to progress designs for AMP9 is listed below for the Tredegar catchment Case Study.

Tredegar Catchment Case Study

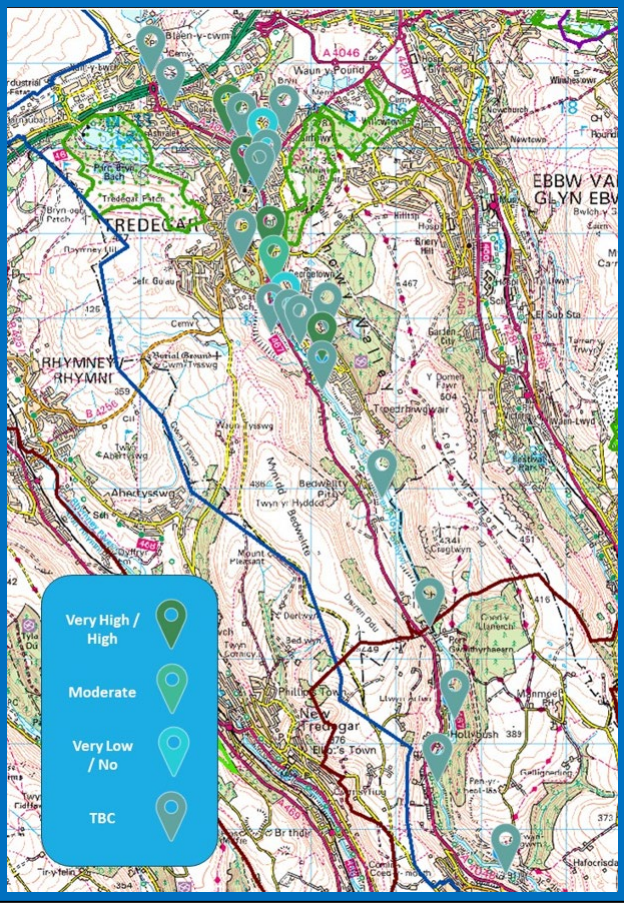
Introduction

Three SO's were identified through the SOAF programme as having an impact and as such requiring solution development to bring them up to a satisfactory status. Following the initial feasibility investigations into these 3 assets it was established that suitable stand alone solutions were not available, as such a concept study was set up to investigate catchment solutions.

This study was extended to a total of 21 CSOs, including an additional 18 CSOs in the catchment down to 32067 – Port Gwaith CSO.

Following the initial study scope for the detailed catchment study was further extended to a total of 25 CSOs, including an additional 4 CSOs down to 71571 – Argoed Cwm Road CSO. This detailed catchment study is building upon the original SOAF investigations and the concept catchment solution.

The main driver for the investigation is to understand the performance of all the local SO assets and the impact of their spills on the receiving watercourse. Originally, only a skeletal model of the network existed which did not fully represent catchment extents, had poor representation of catchment assets and only localised model updates for single SOAF sites and FHO outputs that had been completed in recent times. Spill comparison to EDM shows a range of under/over prediction at many of the SOs, and there was under representation of catchment drain-down and DWF inputs. As such, significant model upgrades have been required to improve confidence in the model for RCA, to allow better optioneering and more accurate water quality assessments and to comply with current WELSH WATER modelling specification.



Catchment Overview

Tredegar lies at the upstream extents of the Cardiff WwTW sewer catchment and is located on the banks of the River Sirhowy that drains any spills from our SOs. The Tredegar catchment is a typical south Wales valleys catchment. It is a steep sided valley with densely populated urban areas running alongside the river and many properties dating from the 19th century. As a result of its age and topography the sewer network is largely combined with the main trunk sewer running within / alongside the river for large parts of the catchment. The catchment investigation identified that some, but not all, of our CSOs are having a severe impact on the receiving water body.

Catchment Solution

The previous SOAF investigations recommended an outline preferred solution as a Tunnel solution to pick up spill flows from existing SOs and transfer them to a nature-based solution at the bottom end of Tredegar town to treat spills, as summarised below. The aim of the study is to improve the modelling tool for the Tredegar catchment to validate the solution and investigate other solutions / improvements in the catchment, primarily to improve River Health of the River Sirhowy. The result of the study was to propose a solution so all SOs in the Tredegar catchment, including a number with a lesser impact than severe.

Tredegar Catchment Case Study

Outline Solution

The preferred solution from the original study includes the decommissioning of 19 SOs, passing all flow forward to a new trunk sewer extending along the valley to a new SO where current PFF is pumped up to a new reedbed / wetland treatment area. In AMP8 we will be trialing a reedbed wetland solution in full scale at a site in South East Wales and the evidence gathering period of 3 years will allow NRW to develop their policy around the use of this type of solution for SOs. It will also mean that we will be delivering solutions on SOs with a less than Severe impact because we believe that will be the better value solution for customers compared to dealing with sites in a piecemeal fashion.

AMP9 Programme Design

We have listed the SOs in Tredegar for delivery on our AMP9 NEP, with investment deferred from AMP8 so as to enable us to undertake design through AMP8 for a whole catchment solution that delivers best value for customers. It will also align with the timescale for NRW to use the Welsh Water trial site for evidence gathering and policy development using wetlands a solution to SO discharges and as a surrogate for reduction in volume discharged. This is an example of how we intend to maximise the multi capital value of our investment through low carbon, nature-based solutions delivered through partnership approaches where possible and provide NRW with greater certainty in the AMP9 submission.

By not deferring investment in the high spilling Tredegar SOs to AMP9 would almost certainly lead Welsh Water to focus on grey infrastructure and high carbon approaches which does not meet the direction of Welsh Ministers and the PR24 Forum.

4.1.3 Overlap with Activities to be Delivered through Base

> ***Does the proposed enhancement investment overlap with activities to be delivered through base?***
>
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.1c*

Funding for maintaining compliance with existing permit requirements[26] is taken from Welsh Water's base allowance and not from the NEP or enhancement programme. As in AMP7, there will be maintenance investment[27] to ensure that SOs meet their permit requirements.

The larger Base Maintenance programmes are (but not limited to):

- In AMP8 approximately £31M has been allowed to restore performance at SO's that have previously been improved to limit the average number of annual discharges (usually near bathing or shellfish waters) but which have breached their agreed trigger points. 80 SOs have met these trigger points since 2015. 20 had already been resolved from base before the start of AMP7 with a further 18 for delivery in AMP7. In AMP8 we expect to deliver maintenance from Base allowance on a further 28 SOs, or 66 in total, and begin investigations on SOs that breach the spill trigger targets in the coming years. Some sites require complex and detailed catchment investigations to establish the root cause and identify

[26] Water Discharge and Groundwater (from point source) Activity Permits (EPR 7.01) (naturalresources.wales)

[27] Some SOs are expected to require a mix of quality and maintenance investment to ensure the meet their current permit requirements and are further enhanced to ensure they contribute to local water quality objectives.

the best value solutions meaning that improvement programmes can last more than one AMP investment period.

- Strategic investigations in the Afan catchment have identified c£41M to be invested on a number of SOs based on a detailed study.
- Approximately £70M in base maintenance investment to restore flow pass forward at WWTWs and ensure storm tanks do not operate sooner than they should.
- Separately we will be undertaking maintenance investment on our pumping stations and sewer networks to ensure we deliver our pollution, flooding and compliance performance.

The process of determining the level of improvement needed to ensure a SO can be enhanced to the point that it will have *no* or *very low* impact means that a bespoke average spill frequency tailored to meet the ecological requirements of the receiving water body will be determined using UPM modelling for each site.

Having delivered those improvements, a mechanism is required to ensure this performance can be maintained for the long term in the face of growth, urban creep, network changes or climate change. Initially this can be achieved by including a "Trigger Event Notice" permit condition for each improved SO. These regulatory conditions would require Welsh Water to report when an improved SO exceeds a certain threshold set at a level that is unlikely to be exceeded under normal local weather patterns[28]. If the trigger is breached Welsh Water would report occurrence to NRW or the EA, investigate why it occurred and then restore the required performance at that site. This will be from base maintenance as we currently do with previously improved Bathing Water and Shellfish water sites.

One effect of the improvement programme will be a significant increase in the number of SO permits with TEN conditions that will have to be maintained. We will also be maintaining SOs before they are enhanced to ensure they do not deteriorate before they are improved as well as those assessed as having no impact without investment. This will increase base maintenance costs across the board.

Finally, the effect of changing weather patterns due on river and stream flows patterns means that in future they may not have the capacity to accept the same spill frequency without being negatively impacted. The mechanism for tracking and reporting this will probably include consideration of average modelled spill dilution with the detailed process to be developed in partnership with members of the BRQT.

4.1.4 Overlap with Funding from Previous Price Reviews

Does the need and/or proposed enhancement investment overlap with activities or service levels already funded at previous price reviews?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.1d

Historic (primarily during AMP3 and 4) investment on other SOs, where they were identified for improvement, has focused on meeting basic regulatory requirements for screening (depending on the amenity classification and spill frequency of the receiving water body) and retaining Formula A flows. However, in this AMP period we go beyond what was funded historically to consider the impact of our SOs on the receiving water body using the impact assessment methodology agreed in the 2018 SOAF framework. Consequently, there is no overlap been this improvement programme and historical enhancement investment prior to AMP7.

We are investing in eliminating harm under the W_U_O_IMP1 driver for PR24 in Wales and the 25YEP_IMP Driver in England, whereas in AMP7 we were investing under the W_U_IMP4 and U_IMP4 Drivers under which the cost benefit of the improvement was also considered and only applied to sites exceeding the SOAF spills thresholds[29]. The two driver codes are similar but are distinct and the programme for AMP8 represents that which was over and above in AMP7 as

[28] Trigger Event Notice permit conditions are already used for SOs improved to limit spills for bathing or shellfish water.
[29] 60 spills in first year of EDM reporting, 50 spills on average over the first 2 years of reporting, 40 spills on average over a 3-year period.

described above. It should also be noted that the regulatory tests of environmental acceptability that the investment was focused on for PR19 and in AMP7 were much less demanding than has been required for AMP8 and onwards. These differences are summarised below in Table 7. Importantly our NEP drivers and PR24 Forum strategic steers require us to go beyond the original SOAF approach under which only those sites where the improvement was found to be cost beneficial would be improved. Consequently, all SOs found to have an impact greater than "no" or "very low" impact will be improved in a programme that will stretch out to 2040.

As prescribed in the Strategic Steers from the PR24 Forum, our focus is on the elimination of ecological harm rather than a frequency spill reduction. However, our programme will result in reductions in average spill as a by-product of eliminating impact.

Table 7: Difference between PR19 & PR24 Driver Codes

	AMP7:	AMP8:		
Driver Code:	***U_IMP4***	**W_U_O_IMP1 (NEP)**	**25YEP_IMP (WINEP)**	**W_U_O_IMP1 AMP9 Programme Design**
Description:	UWWTR spill frequency reduction scheme.	Action to implement improvements to overflows classified as Unsatisfactory – *(based on ecological harm and impact – not directly associated with spill reduction)*		Early AMP9 programme design to ensure the SO impact reduction programme can meet the increased investment planned for PR29.
Number of Schemes	15	100	9	326
Capex Expenditure	£32M (at FD19)	£323M		£23M

4.1.5 Alignment with the Long-Term Delivery Strategy

Is the need clearly identified in the context of a robust long term delivery strategy within a defined core adaptive pathway?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.1e

The improvement of SOs is a key long-term ambition of the company which forms part of the company's outcomes as agreed with the Wales PR24 Forum. Our target is that by 2040 nothing beyond very low ecological harm will be caused by SO spills and by 2050 all storm overflows should meet satisfactory classification irrespective of impact. Further details can be seen in WSH01 Long Term Delivery Strategy.

4.1.6 Evidence of Customer Support

Where appropriate, is there evidence that customers support the need for investment?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.1f

Our approach to customer engagement is set out in Stepping up to the Challenge: Business Plan 2025-30 (Section 2.2).

Via our engagement with stakeholders on our DWMP, customers expressed support for us to invest in Storm Overflows to reach our long-term destination of zero spills (except in exceptional circumstances and indicated support for us to continue to implement our approach of prioritising schemes by environmental benefit.

We have also undertaken independent research via Blue Marble in both 2021 and 2023 to understand customers views on SOs. In the most recent research, once customers were made aware of SOs, reducing the operations of them was seen as a top priority[30].

Customers in this research also indicted that they would prefer measures that assessed the reduction in environmental harm as a way of monitoring progress on improving SOs.

4.1.7 Management Control of Costs

> ***Is the investment driven by factors outside of management control? Is it clear that steps been taken to control costs and have potential cost savings been accounted for?***
>
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.1g*

As discussed previously in Section 45.1.3, the enhancement investment under W_U_O_IMP1 & 25YEP_IMP is driven by regulatory changes and the PR24 Strategic Steer to improve our most impacting SOs to satisfactory status.

4.2 Best Option for Customer

In this section, we will describe how we have developed options for addressing the need identified above. We identify investment to address ecological harm at over 100 of our highest impacting SO assets discharging to our most sensitive waters, and all options have been assessed using our Service Measure Framework.

4.2.1 Identification of Solution Options

> ***Has the company considered an appropriate number of options over a range of intervention types to meet the identified need?***
>
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.2a*

Optioneering and cost estimating to reduce harm is far more complex than to target a set spill number reduction. The finalised agreed list of SOs will need to consider bespoke optioneering and best value solutions to reduce harm at the specific location. This will require the outputs of continuing AMP7 SOAF studies and the further investigations and classifications in AMP8 discussed in Section 3 above. In order to purely to develop a business case for AMP8, we have considered the best value concept from a number of potential options to provide storage, or effective storage equivalent, to the 10th spill volume from our current modelled data, as well as ensuring that any screening of the storm overflow meets British standard BS EN 752:2017. For Business Planning purposes, concept solution costing is based upon the 10th spill Volumes which come from hydraulic modelling developed using 10-year time series rainfall (TSR) typically using the previous 10 years. This ensures there is no significant visual or aesthetic impact due to solids or sewage fungus. This is as a surrogate for the detailed analysis that will be required during the detailed design phase to ensure we have eliminated any environmental impact, which could require the achievement of significantly less than 10 spills per annum or may not require to achieve the full 10 spills on an individual site by site basis.

As sites progress into detailed design, UPM modelling will be undertaken to confirm the actual average spill frequency and volume needed to deliver the expected reduction in environmental harm with adjustments made where required to ensure the impact reduction is met as well as meeting the requirements of "Satisfactory" overflow as defined by NRW[31]. Bespoke design and optioneering will take place to identify the best value solution that meets the harm reduction criteria.

4.2.1.1 Longlisting

[30] Customers Views on CSOs: 2023 update, Blue Marble.

[31] '*How to comply with your Environmental Permit. Additional Guidance for: Water Discharge and Groundwater (from point source) Activity Permits (EPR 7.01)*', NRW.

For the purposes of our PR24 plan, we have undertaken detailed optioneering for 13 different sizes of SO scheme, using information from 155 locations investigated as part of our AMP7 SOAF programme. This work has then been extrapolated to populate the programme across the cohort of SOs.

- 155 locations have been modelled to date allowing the scale and costs of the works to be established at these locations.
- To project this forward to the whole cohort, the 155 schemes have been divided into 13 'Bands' based on their modelled 10th spill volume: ranging from under 50 m^3 to an upper band of 40,500 to 42,500 m^3.

4.2.1.2 Shortlisting

For the 13 bands, two concepts have been further developed based on experience of being the best value during our AMP5 and 6 delivery of Rainscape[32] solutions and AMP7 delivery of our SOAF programme solutions for previously designed and completed schemes based on the 10th spill volumes following a longlisting, shortlisting and risk and cost benefit analysis process.

- 'Grey' Option – a conventional stormwater storage system comprising on-line or off-line storage, flow control, mechanically raked screens and stormwater return flows.
- 'Green/Grey' Option – based on Welsh Water's previous experience these options provide for 30% of the spill reduction being achieved using 'Rainscape'[33] type solutions. The remaining 70% will be constructed using 'grey' construction.

As discussed in Section 4.2.1 above, these are unlikely to be the only solutions that will be employed to reduce the harm impact and each site will require bespoke optioneering to find the best value solution to achieve the required spill reduction. There are likely to be a combination of solution types that give best value at specific locations. We would favour "green" or "catchment" solutions as much as possible where it represents best value against our multi-capitals value framework. However, it is important to note that NRW have not yet defined a policy on the acceptability of green or catchment type solutions and we continue to work with them to assess our wetlands pilot scheme to help inform policy.

Final Solutions will be developed based upon Storm Overflow Assessment Framework (SOAF, 2018). Consequently, the process to be followed will be one of assessing the impact of the SO, prioritising investment at the site based on a combination of the severity of impact / sensitivity of the receiving water body and finally investing to deliver the improvements required to meet no or very low ecological impact.

To ensure that the improvement delivered is long term, the improvements for each site will be based on the expectation that water quality upstream of the discharge meets good or high ecological status (GES) irrespective of the actual status of the water. In this way, once subsequent improvements are made the water body will be able to meet GES without further intervention at the improved asset which avoids the risk that investment is limited simply because of the impact of other contributors upstream of the site to be improved.

For Business Planning purposes, concept solution costing is based upon the 10th spill Volumes which come from hydraulic modelling developed using 10-year time series rainfall (TSR) typically using the previous 10 years.

4.2.1.3 SO AMP9 Programme Design

The requirements under the W_U_O_IMP1 and 25YEP_IMP drivers are to eliminate SO harm on receiving water bodies and, in so doing, - ensure they also meet satisfactory classification under the UWWTR. Our long-term programme as outlined in Section 4.1.3.1. shows a significant increase from AMP8 in sites to be improved. In order to meet this rolling programme, we must begin designing of

[32] Rainscape is a combination of surface water removal, infiltration reduction and retrofitting Sustainable drainage systems (SuDS)
[33] Ibid.

our AMP9 programme sites in AMP8. We have not applied a long listing and short-listing exercise for the cost of this design work as we have for our harm reduction programme as the only viable option is implementing design work in AMP8 through modelling and surveying activities, with the idea of generating engineering options for AMP9.

Based on the anticipated scale of the AMP9 SO programme it is anticipated that up to 326 SO designs will be delivered in AMP8 with the remaining sites designed in early AMP9, the funding for which will be included in PR29.

The design of SO solutions will need to include (but not limited to):

- Flow Surveys
- Asset Surveys
- Desktop Study
- Other surveying
- Modelling
- Water Quality Analysis to ensure solutions meet “no” / “very low” impact criteria.
- Benefit analysis/costing and solution plan
- Documentation creation
- Handover & audit packs

The costs have been based on quotes received from suppliers and is estimated at approximately £0.065M per site.

4.2.2 Assessment and Selection of Solution Options

> ***Is there evidence that the proposed solution represents best value for customers, communities, and the environment over the long term?***
> *– Ofwat’s final methodology for PR24, Appendix 9, A1.1.2b*

As noted above, we have not yet selected the specific option for [the majority of] the SO harm reduction schemes in AMP8. Our approach to cost benefit appraisal and its role in decision making is set out in WSH50-IP00 Our Approach to Investment Planning (Section 4.3).

To carry out cost benefit of scheme options we have assessed benefit using the Welsh Water multi capitals framework. This framework contains multiple criteria that schemes can be scored against, the below table highlights the different criteria that are relevant to this case and indicates the valuation applicable per unit. The benefits and values for different bands can be seen later in the document in tables 9-12:

Table 8: SMF applicable to SO Harm Reduction

Category	Service Measure Driver	Rationale	Service Measure Framework Value
Environment	Land-use	Total area (ha)	-£0.001M
Environment	Pollution Incidents (Land, Aquatic)	Number of incidents	£0.173M
General	Customer Contacts (others)	Nr of complaints	£0.001M
Waste-Water	Network / Storm Storage Consent Compliance	Per failure	£0.001M
Environment	Environmental Impact	km/yr	-£0.082M
Environment	Greenhouse Gas Emissions	Embodied GHG (tCO2e)*	£323
Environment	Greenhouse Gas Emissions	Operational GHG emissions (Other) (tCO2e)*	£323
***derived from UCD Costing sheet**			

The tables (9-12) below have been completed using data from our cost benefit analysis to illustrate the value generated by the proposed investment (note all monetary values are expressed in 2022/23 prices and are prior to portfolio adjustments for corporate overheads and efficiency challenge. Welsh Water ref: SMF version 5). Four examples are used to illustrate the approach. All options with the greatest NPV and quickest payback have been selected. Bands 1, 7 and 12 all have the 'Grey' option as the best value option using our multi-capitals SMF, whilst Band 2 is the only one where the Green/Grey option is the most cost effective. Where this is no material difference in NPV and payback, Welsh Water would always have a preference towards green type solutions.

A full list of the Cost Benefit (using the Welsh Water Multi Capitals framework), alongside the anticipated AMP8 Delivery Costs are given in Appendix B.

Third-party technical assurance of cost–benefit appraisal has been completed by Economic Insight who have confirmed that our approach is robust and in line with Ofwat expectations. Full details are given in WSH50-IP00 Our Approach to Investment Planning (Sections 4.3 and 6).

Table 9: Band 1, online tank sewer Grey (S1) and Green/Grey Comparison (S2)

Solution Option	Option Name	CAPEX	Present Value Whole Life Costs (WLC)	Present Value Whole Life Benefits (WLB)	Benefit/ Cost Ratio	Net Present Value (=WLB - WLC)
Option S1	Grey Only	£1.006M	£1.197M	£4.077M	**3.405**	£2.879M
Option S2	70% Grey/30% Green	£1.057M	£1.247M	£4.069M	**3.264**	£2.822M

Table 10: Band 2, offline stormwater tanks, example of small tank, Grey (S1) and Green/Grey Comparison (S2)

Solution Option	Option Name	CAPEX	Present Value Whole Life Costs (WLC)	Present Value Whole Life Benefits (WLB)	Benefit/ Cost Ratio	Net Present Value (=WLB - WLC)
Option S1	Grey Only	£1.704M	£1.988M	£4.052M	**2.038**	£2.064M
Option S2	70% Grey/30% Green	£1.339M	£1.525M	£4.054M	**2.658**	£2.529M

Table 11: Band 7, offline stormwater tanks, example of medium tank, Grey (S1) and Green/Grey Comparison (S2)

Solution Option	Option Name	CAPEX	Present Value Whole Life Costs (WLC)	Present Value Whole Life Benefits (WLB)	Benefit/ Cost Ratio	Net Present Value (=WLB - WLC)
Option S1	Grey Only	£4.85M	£5.318M	£3.772M	**0.709**	-£1.546M
Option S2	70% Grey/30% Green	£11.916M	£12.342M	£3.142M	**0.255**	-£9.200M

Table 12: Band 12, Band 7, large offline stormwater tanks, Grey (S1) and Green/Grey Comparison (S2)

Solution Option	Option Name	CAPEX	Present Value Whole Life Costs (WLC)	Present Value Whole Life Benefits (WLB)	Benefit/ Cost Ratio	Net Present Value (=WLB - WLC)
Option S1	Grey Only	£24.031M	£25.337M	£2.294M	**0.091**	-£23.043M
Option S2	70% Grey/30% Green	£77.52M	£78.449M	-£2.647M	**-0.034**	-£81.096M

4.2.3 Quantification of Benefits

Has the company fully considered the carbon impact, natural capital and other benefits that the options can deliver?
Has the impact (incremental improvement) of the proposed option on the identified need been quantified, including the impact on performance commitments where applicable?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.2c and A1.1.2d

The long-term objective of Welsh Water's investment plan is to improve the performance of SOs, rather than achieve a specified average spill frequency. Our approach of addressing harm, therefore, means that, in cases of low and very low impact, there will not be the need to build significant storage with high associated carbon costs. We know from our work in Llanelli that in high rainfall in high spilling catchments, the size of the storage to contain flows is very large and in some cases this storage will not be emptied before the next rainfall event. Therefore, we believe our approach will be lower in carbon cost than following a pure spill reduction approach.

From our analysis the proposed option will make the following impacts:

- Improvement of SOs at 109 sites across Wales & England by improving the performance from unsatisfactory to satisfactory as per the NRW classification guidance and in doing so reducing their impact to "no" or "very low".
- Introduction of a Bespoke Storm Overflow PC – as discussed in Section 4.4.1 – which measures the percentage of SOs with "no" or "very low" ecological impact. Our long-term programme of improvements is shown in Figure 5 with the programme for AMP8 shown in Table 13 below.

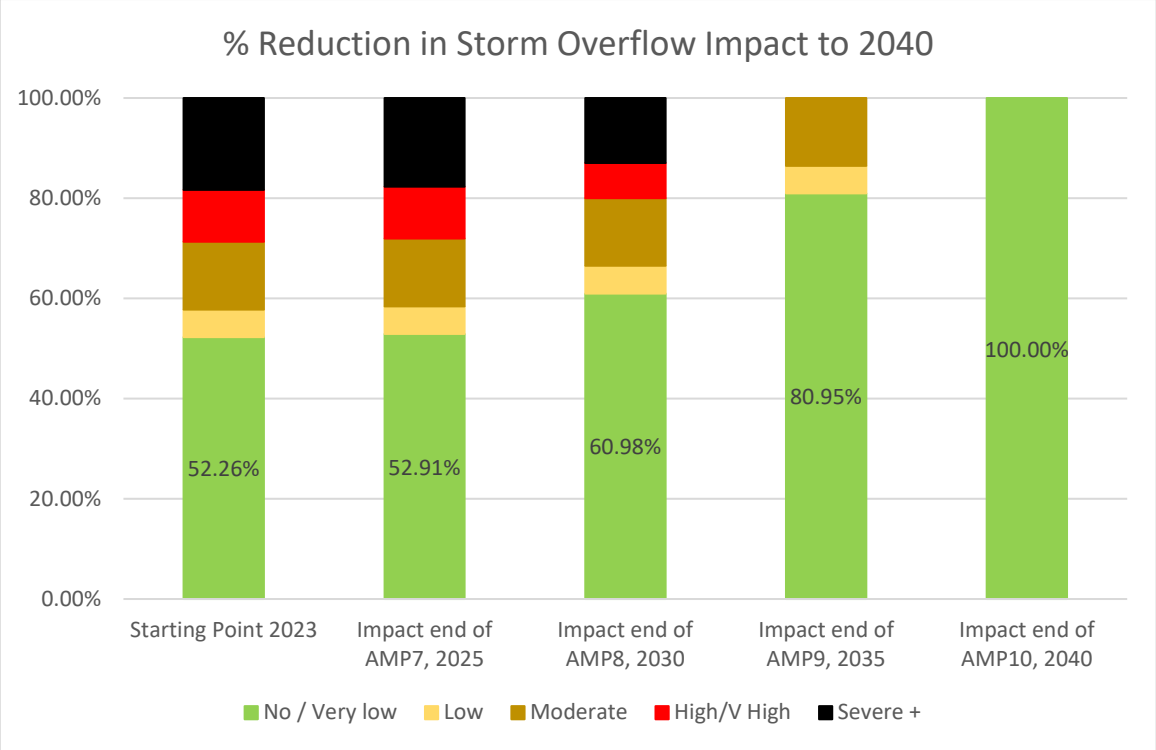


Figure 5: Long Term Investment Programme to Reduce the Impact of SO's to "No" or "Very Low".

Table 13: AMP8 Investment Programme impact improvements (Welsh Water proposed performance commitment)

Reporting Year	22-23	23-24	24-25	25-26	26-27	27-28	28-29	29-30
% of SOs with "no" or "very low" impact	52.26%	52.26%	52.91%	52.91%	53.34%	55.86%	58.42%	60.98%
No. of SOs with "no" or "very low" impact	1204	1204	1219	1219	1229	1287	1346	1405

Over the term of the AMP the reduction is made up of the 109 improvement schemes from this enhancement case plus the contribution from other investment, including increased storm tank capacity and increases to permitted forward passed flow (FPF) schemes.

4.2.4 Uncertainties relating to cost and benefit delivery.

> ***Have the uncertainties relating to costs and benefit delivery been explored and mitigated? Have flexible, lower risk and modular solutions been assessed – including where forecast option utilisation will be low?***
>
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.2e*

Our methodology is set out in WSH50-IP00 Our Approach to Investment Planning (Section 4.3). This includes commentary on our approach to optioneering, costing and cost benefit analysis.

We have highlighted areas in which the calculation of costs or benefits are unusual or uncertain and how we have mitigated for this in our evaluation. Innovation and new approaches such as nature-based work may be more uncertain than conventional grey engineering approaches.

Welsh Water has developed its PR24 investment plan for storm discharges from a sample set of 253 completed SOAF stage 2 investigations. However, as the impact assessment programme for high priority waters will only be completed for the end of 2027 and the full investigation programme for all SOs by the end AMP8, it is expected that the numbers of SOs that meet the criteria for each impact group shown in Figure *5* andTable *13* above will increase. This means that the named sites shown in the SO programme may have to be altered to allow sites having a greater impact to be scheduled for earlier investment according to the criteria set out above.

As discussed previously, companies in England are targeting spill number reductions to meet a defined average annual spill frequency across the entirety of the asset base whereas in Wales we are focusing our interventions on the improvement of SOs and the elimination of harm. Therefore, the approach to optioneering has had to be different and our methodology using a banded system as a representative baseline is appropriate for the challenge in Wales.

These represent a solution, for a given size of SO, that we know can deliver a 10th spill volume reduction (as a proxy for achieving satisfactory status) using either Grey or Grey-Green solutions.

We acknowledge there are uncertainties with this approach, and we are putting mitigations in place and these are as discussed in the Table below:

Table 14:Difference to Approach to Optioneering with Uncertainties & Mitigation

	Wales	England	Uncertainty & mitigation
Needs Identification	We can utilise our DWMP to assess hydraulic capacity. However, the NRW drivers are based on the environmental impact of the SO – divided into three main components (as per SOAF): • Aesthetic impact • Invertebrate (biological) impact • Water quality impact All of which are unable to be effectively modelled through our DWMP and instead are completed through the 2018 SOAF impact assessment (which can take up to 24 months to complete)	Companies can use their DWMP modelling to identify sites, based on hydraulic modelling to anticipate the required volume of spill reduction to achieve the DEFRA SODRP as set out by the EA. Can identify a more definitive list of schemes without need for impact assessments	We are conducting a high priority waters investigation programme, and this is due to complete by the end of 2027. All will have a Stage 2 SOAF assessment undertaken and will fully quantify the mitigation required to convert the SO from unsatisfactory to satisfactory and in so doing will eliminate their impact.
Development of Options - Approach	In order to prepare the PR24 submission we have modelled 105 SOs, allowing the 10th average spill volumes to be used as the criteria for the bands. We have initially assumed that modelling to the 10th spill is an appropriate proxy for harm reduction i.e reducing to 10 spills will resolve a SO to satisfactory, on average, in most cases	Companies develop their options to achieve a reduction to no more than 10 spills at high priority (using DWMP modelling or appropriate alternatives)	The Stage 2 SOAF will fully quantify the required spill volume to eliminate harm – for some SOs identified it may require a reduction of more than 10 or for some it may allow to spill greater than 10 without any ecological impact

	Wales	England	Uncertainty & mitigation
Development of Options Grey	We have produced for each band a conventional stormwater storage system comprising on-line or off-line storage, flow control, mechanically raked screens and stormwater return flows.	X	For PR24, these interventions are well understood, and cost confidences is high. This represents a costed solution from our unit cost database (UCD) that we know can deliver a likely "satisfactory" outcome for a given size SO Benefits can be systematically quantified through hydraulic modelling giving strong confidence. Previously constructed schemes at Welsh Water have shown that 16% more storage is required to deliver the 10th spill and therefore this has been allowed for in the concept design. This factor has been used to provide the design volume for the online or offline storage requirements.
Development of Options – Grey-Green	We have produced for each band an option that replaces 30% of the Grey solution with "Rainscape[34]"	X	For PR24, these interventions are less well understood, and cost confidence is lower. On previously constructed schemes where 'Rainscape'[35] has been used an average of 30% storage reduction has been possible This represents a costed UCD solution that we know can deliver a likely "satisfactory" outcome for a given size SO, using our assessment on what has been feasible to deliver using Rainscape[36]
Change Control	Initial programme drafted using AMP7 SOAF Programme and each has individual line in the NEP/WINEP	X	In order to maintain proper transparency and governance of this process an initial programme of SO's to be improved has been included in the NEP and WINEP and changes to this list will be subject to change protocol and agreement with NRW/EA before they proceed. Changes of specific sites will be agreed within similar size bands or average costs to manage the programme to the agree number of sites and value.

[34] Rainscape is a combination of surface water removal, infiltration reduction and retrofitting Sustainable drainage systems (SuDS)
[35] ibid
[36] ibid.

As mentioned in the table above, the solutions included in this Enhancement Case represent an appropriate solution that we know that we can deliver for each particular band of asset but does not necessarily equate to the final solution we will deliver at each individual SO. The money we have included for AMP9 Programme Design aims to develop this approach even further for PR29. We will progress our AMP8 SO assessment to a more developed design position to ensure for AMP9 we have a greater range and suite of options and case studies to develop a more certain PR29 NEP submission and will mitigate against uncertainties as acknowledged at PR24.

4.2.5 Third Party Funding

Has the scale of forecast third party funding to be secured (where appropriate) been shown to be reliable and appropriate to the activity and outcomes being proposed?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.2f

No third-party funding is involved in any of the projects included in this Enhancement Case. Welsh Water has established a team to work with Local Authorities and stakeholders with an interest in reducing surface water draining to the combined sewer network. Some projects may be possible to deliver jointly in AMP8 but a combination of differences in need (typically Local Authorities are interested in protecting their communities from 1:100 year floods and not events that trigger the operation of SOs), funding availability to them and the time it takes time to develop such plans means that we do not anticipate widespread co-investment in AMP8 but expect that to change for AMP9.

4.3 Cost Efficiency

4.3.1 Developing a cost for SO Improvements

Is it clear how the company has arrived at its option costs? Is there supporting evidence on the calculations and key assumptions used and why these are appropriate?

Does the company provide third party assurance for the robustness of the cost estimates?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.3a and A1.1.3c

Our approach to was to develop a standardised scope of works for size bands of SOs. This enabled us to use our preferred method for costing using Unit Cost Database (UCD) Cost & Carbon Estimating Tool (C&CET), as described in Section 5 Costing Methodology of the in 'Overview: How we have developed our investment plan'. The costed size bands were then applied to the SO schemes identified within the programme.

Corporate Costing Approach

We have used data from our Unit Cost Database (UCD) Cost & Carbon Estimating Tool (C&CET) tool to build up costs in our investment model. The UCD C&CET holds our cost modelling data, which have been developed from historical project actual costs. This provides us with the best data to forecast spend based on the costs we experience in our own network. This approach along with our governance process is identified in our 'Overview: How we have developed our investment plan'.

To adhere to our costing methodology of using Like-for-like (top down) to cost our business plan, set out in 'Overview: How we have developed our investment plan, we have taken the UCD models version 17 (used in the PR24 Business Plan) and incorporated these into the AIM system. This approach has provided an optimised and costed programme for this investment.

Along with our overall costing strategy being reviewed and assured by Jacobs, we have also employed third party consultants to review single Enhancement Cases to provide confidence that the estimates within them are robust, efficient and deliverable. Please refer to WSH50-IP00 Our Approach to Investment Planning (Section 6).

4.3.2 Benchmarking our approach

Is there evidence that the cost estimates are efficient (for example using similar scheme outturn data, industry and/or external cost benchmarking)?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.3b

To support the costing of this investment case we engaged independent Consultants to undertake a benchmarking exercise of the business plan to ensure that we can deliver the outcomes for the expenditure set out and demonstrate our efficiency within the water industry. In this instance the benchmarking work provided review and challenge of the costs put forward. Any costs which were derived from the UCD have also been through the internal assurance process that determines their accuracy and relative efficiency.

The benchmark report identified that our pre-efficiency costing was better than the industry average but not upper quartile. Our applied efficiencies proposed for our business plan, aims to move us towards upper quartile.

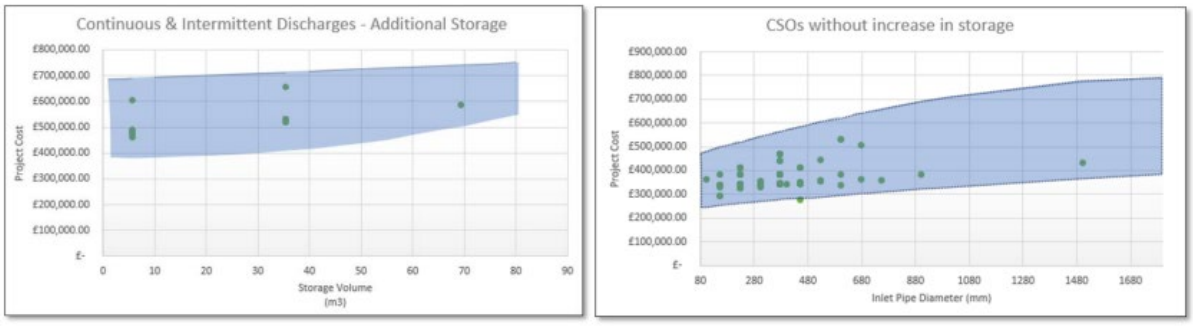


Figure 6 - Abstract from Benchmark Report carried out by Aqua Consultants

4.4 Providing Customer Protection

In this section, we set out the template for the proposed performance commitment and the protection provided by NRW's NEP requirements. This is designed to provide strong controls in terms of work delivered against funding allowed if the proposed reduction in ecological harm is not delivered.

The two sub-sections below correspond to the three criteria set out in Ofwat's PR24 Final Methodology, Appendix 9 (Setting Expenditure Allowances), Section A.1.1.4. There is no third-party funding for this Enhancement Case.

4.4.1 Proposed Performance Commitment (PC)

Are customers protected (via a price control deliverable or performance commitment) if the investment is cancelled, delayed or reduced in scope?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.4a

This enhancement investment is covered by regulatory oversight from NRW and the EA via the NEP and WINEP and controlled through the proposed SO performance commitment as discussed in this section.

In line with the direction from the BRQT, a detailed alternative to Ofwat's SO average spill frequency performance metric has been proposed for AMP8 which focuses on reducing the ecological harm of storm overflows as quickly as possible whilst balancing customer affordability. This is defined by the percentage of all SOs including those on the wastewater network, those at pumping stations, emergency overflows which we believe to be operating as storm overflows, any unpermitted storm

overflows and WwTW storm tank overflows, with ‘low’ or ‘very low’ ecological impact. This will be calculated as a percentage to two decimal places as follows:

$$= \frac{\text{Total no. of storm overflows with no or very low ecological impact}}{\text{Total no. storm overflows}}$$

The detailed definition of this metric is available in Welsh Water’s proposals to Ofwat including assumptions made and would allow us to provide Welsh Government and Regulators with a measure demonstrating progress towards meeting Welsh Government’s policy.

As part of an appraisal of our storm overflow approach by Jacobs[37], a review was undertaken of our proposed storm overflow performance metric for PR24. The rationale was broadly supported and pointed out that there is a reputation risk whereby Welsh Water Performance against the common PC would be different to English companies due to very valid regulatory and policy reasons. The review also noted that for Welsh Water customers, a performance commitment that is based on environmental outcomes will provide best value to customers but that the current OFWAT regulatory guidance does not currently support this.

4.4.2 Extent of Protection

> ***Does the protection cover all the benefits proposed to be delivered and funded (eg primary and wider benefits)?***
>
> *– Ofwat’s final methodology for PR24, Appendix 9, A1.1.4b*

The NEP/WINEP gives a strong control, with added protection via the Storm Overflows PC.

[37] Welsh Water Storm Overflow strategy review, Jacobs, 15th September 2023.

5. SO Enhanced Monitoring

This section will set out the framework behind this enhancement driver for the development of an enhanced monitoring programme for SO assets, which will be developed in conjunction with the BRQT.

5.1 Need for Enhancement Investment

5.1.1 Evidence that Enhancement is Needed

Is there evidence that the proposed enhancement investment is required?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.1a

This investment supports the W_U_O_MON1 for a suitable pre and post intervention monitoring trial under the NEP framework directive with guidance from Natural Resources Wales (NRW) and the Environment Agency (EA).

The Better River Quality Taskforce is developing an action plan led by NRW aiming to establish what evidence is needed to review the benefit of improvements to storm overflows and to support assessments of their impact in priority waters through improved monitoring by regulators, eNGOs, citizen scientists and Welsh Water. For us, it will include development of a strategic enhanced monitoring programme at priority assets and in key water body locations in collaboration with regulators and stakeholders. This will involve suitable pre and post intervention monitoring as a trial in AMP8 as well as developing innovative catchment monitoring programmes. The specific sites will be identified in the future with collaborations between Welsh Water, NRW, stakeholders such as Afonydd Cymru and the Taskforce to meet the needs of this driver.

5.1.2 Scale and Timing of Investment

Is the scale and timing of the investment justified?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.1b

The Better River Quality Taskforce lead the development of a monitoring programme for storm overflows and this driver supports the delivery of the strategic evidence needs to inform the strategy for PR29 onwards. Monitoring is likely to be a combination of reviewing impact of delivery of AMP7 schemes and early AMP8 schemes, and a catchment wide monitoring of a single river to fill gaps in data.

5.1.3 Overlaps with Activities to be Delivered from Base

Does the proposed enhancement investment overlap with activities to be delivered through base?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.1c

This enhancement investment does not overlap with any activities funded in the base models.

5.1.4 Overlap with Funding from Previous Price Reviews

Does the need and/or proposed enhancement investment overlap with activities or service levels already funded at previous price reviews?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.1d

The W_U_O_MON1 enhanced monitoring driver is a new driver at PR24 and does not relate to any previous NEP activities in previous AMPs. The Better River Quality Taskforce will lead the development of a monitoring programme to meet strategic evidence needs. The investment is likely to include enhanced monitoring at priority assets and in key water body locations for both pre and

post interventions in collaboration with regulators and stakeholders. It will also include the development of innovative catchment monitoring programmes.

5.1.5 Alignment with the Long Term Delivery Strategy

Is the need clearly identified in the context of a robust long term delivery strategy within a defined core adaptive pathway?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.1e

The improvement of SOs is a key long-term ambition of the company which forms part of the company's outcomes as agreed with the Wales PR24 Forum. Our target is that by 2040 nothing beyond very low ecological harm will be caused by SO spills and by 2050 all storm overflows should meet satisfactory classification irrespective of impact. Further details can be seen in WSH01 Long Term Delivery Strategy.

5.1.6 Evidence of Customer Support

Where appropriate, is there evidence that customers support the need for investment?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.1f

Our approach to customer engagement is set out in Stepping up to the Challenge: Business Plan 2025-30 (Section 2.2). We have not consulted customers specifically on the SO enhanced monitoring programme but understand that improving river water quality consistently ranks highly in customer priorities.

5.1.7 Management Control of Costs

Is the investment driven by factors outside of management control? Is it clear that steps been taken to control costs and have potential cost savings been accounted for?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.1g

The enhancement investment under these W_U_MON1 is driven by regulatory requirements outlined in the NRW Driver Paper for PR24, supported by the requirements of the BRQT.

5.2 Best Option for Customer

In this section, we will describe how we have developed options for this enhanced monitoring programme and how we will work with the BRQT to develop a well-informed, evidence-based monitoring programme for the AMP9 onwards.

5.2.1 Identification of Solution Options

Has the company considered an appropriate number of options over a range of intervention types to meet the identified need?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.2a

To gather greater evidence on the impact of storm overflows on our rivers, the Better River Quality Taskforce (BRQT) is developing an evidence action plan which involves a strategic enhanced monitoring programme at priority assets. This includes suitable pre and post intervention monitoring as a trial in AMP8 under the W_U_O_MON1 driver and wider monitoring parameters for other substances of concern. It is important to recognise that the requirements for this NRW driver are distinctly different to the Environment Act 2021 driver in England to provide upstream and downstream overflow monitoring of all water company discharges.

The exact sites and parameters to be monitored will be identified following discussions with NRW and the Taskforce and the outcome of the monitoring activity will be to better inform future viable interventions. It is likely that this will take the form of sampling and analysis with some element of continuous monitoring at a few key locations. It is most likely that the programme will be undertaken in close collaboration with NRW and other expert resources (such as academics and some of our highly competent eNGOs).

Along with other members of the BRQT, we are also looking at the development of a Wales wide platform where water quality impact data, including that generated by Welsh Water and others, can be shared and updated to ensure transparency of information. This will be implemented during AMP8 and should allow continual assessment of progress on improving rivers and identifying gaps in data to enable all those that gather data to optimise their limited resources to gather the most valuable information.

However, to provide a basis for our programme Welsh Water has developed a cost based on installing a typical land-based, continuous monitoring kiosk unit which would contain instruments for monitoring parameters such as turbidity, ammonia, pH, dissolved oxygen and temperature at a number of sites.

When sampling and monitoring locations have been confirmed with NRW and the BRQT the detailed programme will be developed but subject to the price limit included in the programme.

5.2.2 Assessment and Selection of Solution Options

Is there evidence that the proposed solution represents best value for customers, communities, and the environment over the long term?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.2b

The preferred solution is also the least cost because only one option was viable at the short-listing stage. The monitoring programme under the W_U_MON1 driver will deliver the evidence needs for the development of a wider programme in subsequent AMP periods. Therefore, the investment represents a no-regrets approach to help inform the direction of investment in monitoring of our assets in conjunction with the BRWQT.

5.2.3 Quantification of Benefits

Has the company fully considered the carbon impact, natural capital and other benefits that the options can deliver?
Has the impact (incremental improvement) of the proposed option on the identified need been quantified, including the impact on performance commitments where applicable?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.2c and A1.1.2d

This was not considered suitable for the W_U_MON1 driver as this is focused on the development of an enhanced monitoring programme in conjunction with the BRQT.

5.2.4 Uncertainties relating to cost and benefit delivery.

Have the uncertainties relating to costs and benefit delivery been explored and mitigated? Have flexible, lower risk and modular solutions been assessed – including where forecast option utilisation will be low?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.2e

As discussed previously, the specific sites will be identified in the future with collaborations between Welsh Water, NRW, stakeholders such as Afonydd Cymru and the Taskforce to meet the needs of this driver.

5.2.5 Third Party Funding

Has the scale of forecast third party funding to be secured (where appropriate) been shown to be reliable and appropriate to the activity and outcomes being proposed?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.2f

No third-party funding is currently proposed under the W_U_MON1 driver.

5.3 Cost Efficiency

5.3.1 Developing a cost for SO Enhanced Monitoring

Is it clear how the company has arrived at its option costs? Is there supporting evidence on the calculations and key assumptions used and why these are appropriate?

Does the company provide third party assurance for the robustness of the cost estimates?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.3a and A1.1.3c

Our approach to was to develop a standardised scope of works for a typical monitoring unit. The exact sites where monitoring will be undertaken will be identified at a later date following discussions with NRW and the Taskforce, however at present the funding sought would allow for monitoring at 14 sites. We are requesting funding for £6.073M (TotEx, 2022/23 prices, post efficiency)

As we work through this programme with the BRQT, we will review opportunities through innovation, to improve the cost and process effectiveness of the monitoring programme.

5.3.2 Benchmarking our approach

Is there evidence that the cost estimates are efficient (for example using similar scheme outturn data, industry and/or external cost benchmarking)?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.3b

This was not considered suitable for the W_U_MON1 driver as this is focused on the development of an enhanced monitoring programme in conjunction with the BRQT

5.4 Providing Customer Protection

In this section, we set out protection provided by NRW's NEP requirements.

The two sub-sections below correspond to the three criteria set out in Ofwat's PR24 Final Methodology, Appendix 9 (Setting Expenditure Allowances), Section A.1.1.4. There is no third-party funding for this Enhancement Case.

5.4.1 Proposed Performance Commitment (PC)

Are customers protected (via a price control deliverable or performance commitment) if the investment is cancelled, delayed or reduced in scope?
– Ofwat's final methodology for PR24, Appendix 9, A1.1.4a

This enhancement investment is covered by regulatory oversight from NRW and the BRQT.

5.4.2 Extent of Protection

Does the protection cover all the benefits proposed to be delivered and funded (eg primary and wider benefits)?

– Ofwat's final methodology for PR24, Appendix 9, A1.1.4b

Yes, the NEP/WINEP gives a strong control, alongside the BRQT who are instigating the development of the monitoring programme.

Appendices

Appendix A

SO Sites Currently Proposed in the WINEP and NEP

The below work was undertaken by Arup on behalf of Welsh Water as part of the SOAF programme.

Summary

In 2021, across England and Wales, Welsh Water's Storm Overflow (SO) spills as counted by the Event Duration Monitoring (EDM) equipment were amongst the highest across all water companies (Figure 7). Wales also has the highest Standard Average Annual Rainfall (SAAR) range, excluding Scotland which has a higher upper bound. Analysis has shown that if Welsh Water's wastewater network was subject to a lower SAARs range, for example that of East Anglia, then the forecast average annual SO spills would be circa.13.6. This analysis holds true for two other areas of the UK where rainfall SAAR used (Newcastle and Plymouth). This demonstrates that if Wales were subject to lower annual rainfall similar to other areas of the UK it could achieve a sub 20 EDM average without further investment.

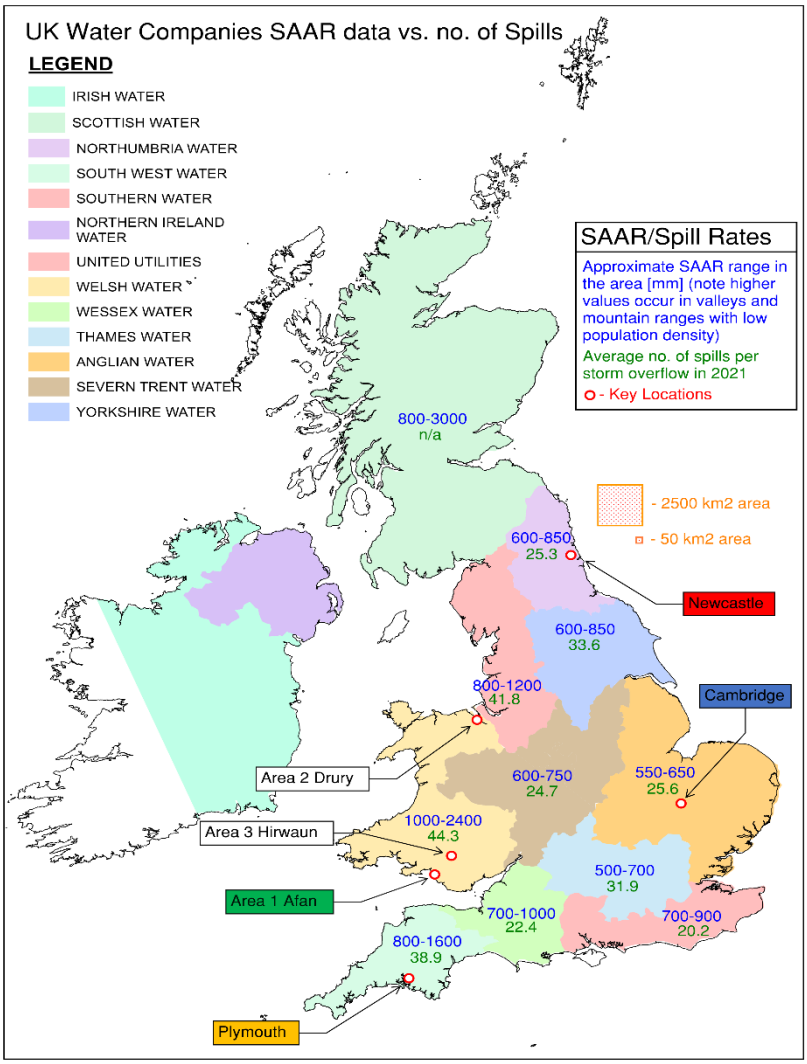


Figure 7: UK water companies SAAR data vs average number of spills per storm overflow in 2021.

Background

Storm Overflows are subject to increasing pressure as a result of population growth, climate change and impermeable urban expansion. Welsh Water are addressing the issue through EDM monitoring to gain understanding of their operation, and their Storm Overflow Assessment Framework (SOAF) programme to prioritise and confirm investment requirements. In 2021 Welsh Water reported their annual average SO spills (44.3) to NRW and the EA. Relative to other water companies, this average is amongst the highest (Figure 7).

Wales is subject to one of the UK's highest annual average rainfall rates, with only Scotland exceeding Wales's upper bound (Figure 7). Due to urbanisation, SO spills are largely driven by rainfall runoff and therefore catchments with higher rainfall will on average have higher average SO spills. The analysis described in this note investigates this relationship and aims to understand how Welsh Water's wastewater network would perform if subject to lower rainfall rates, similar to the rest of the UK.

Afan Catchment Case Study

To investigate the influence of rainfall on network performance, an existing verified network model was run with rainfall inputs from various locations across the UK. Specifically, a network model for the Afan catchment was chosen as the area's 10-year accumulative rainfall (12309mm) is within the approximate SAAR range for Wales (10000-24000mm), thus providing a representative example for the study. The Afan wastewater network is also representative of Welsh Water's overall network, in terms of number of assets and their condition.

Rainfall from three other locations was chosen, Newcastle in the North, Cambridge in the East and Plymouth in the South. This not only provides a good geographical coverage but also a range of recorded rainfall totals across the UK, e.g., Cambridge has the lowest average SAAR range and Newcastle has the median.

The sensitivity of network performance to rainfall was determined by comparing the 10-year average spill counts, 10-year average spill volumes and the 10th spill volume for assets in an individual year.

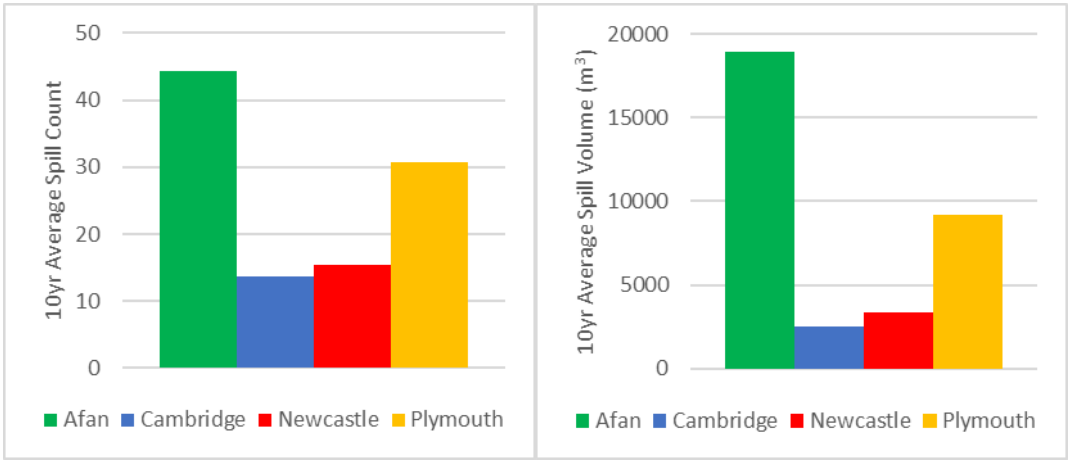


Figure 8: 10-year average spill count and volumes

Table 15: 10yr average spill counts and volumes for the top spilling Afan assets with various rainfall datasets.

Catchment Rainfall	10yr Average Spill Count	10yr Average Spill Volume (m^3)
Afan	44.3	18944
Cambridge	13.6 **(31% of Afan)**	2541 **(13% of Afan)**
Newcastle	15.4 **(35% of Afan)**	3376 **(18% of Afan)**
Plymouth	30.8 **(70% of Afan)**	9230 **(49% of Afan)**

Figure *9* shows the modelled 10-year average spill count and 10-year average spill volume for the various rainfall datasets. For spill count, the results show that with Afan's local current rainfall, Afan assets have an average spill count of 44.3. This aligns with Welsh Water's overall average EDM spill count which is further evidence Afan is a representative catchment.

However, this average could be reduced to 13.6 or 15.4 if the catchment was subject to rainfall comparable to that of Cambridge or Newcastle.

Figure *10* shows the modelled total 10th spill volume of the top five highest spilling assets in Afan for an individual year, for the same four rainfall locations. 2018 was the individual year chosen as it was one of the wettest years in Cambridge, Newcastle and Plymouth but only the third wettest year in Wales (Afan). The results support those of the 10-year average spill count and volume by showing a significantly higher total 10th spill volume when Afan rainfall is used compared to those from drier areas of the UK. If a storage solution was to be specified to reduce the assets to 10 spills per year, the disparity in cost is significant. Using a flat rate £3000/m^3, it would cost an average of £4M per asset if Afan's own rainfall was used, however only £1M if Cambridge's rainfall was substituted.

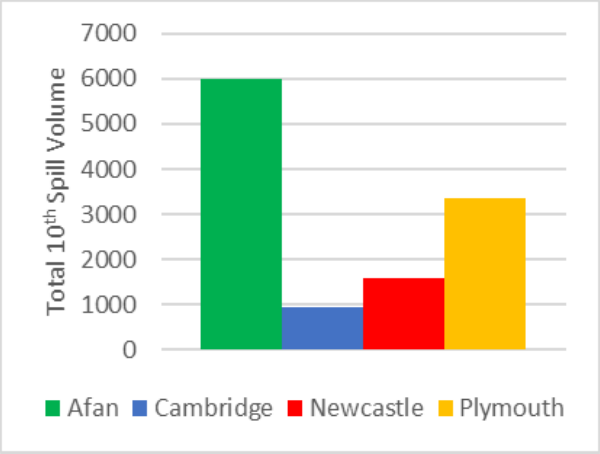


Figure 9: Total 10th Spill Volume across different areas

Table 16: 10-year average spill counts and volumes for the top spilling Afan assets with various rainfall datasets.

Catchment Rainfall	2018 Total 10th Spill Volume (m^3)	Solution Cost (£3000/m^3 Flat rate)	Solution Cost per Asset
Afan	6013	£18M	£4M
Cambridge	929 (15% of Afan)	£3M	£1M
Newcastle	1592 (26% of Afan)	£5M	£1M

Catchment Rainfall	2018 Total 10th Spill Volume (m^3)	Solution Cost (£3000/m^3 Flat rate)	Solution Cost per Asset
Plymouth	3352 (56% of Afan)	£10M	£2M

SOAF Scheme Case Study

A second assessment was carried out using two smaller hydraulic models, Hirwaun in South Wales and Drury Lane in North Wales. These hydraulic models are currently being used in two live schemes to develop a solution to reduce each model's SO to 10 spills per annum.

Two scenarios were run for each model – a baseline and a preferred solution. For each scenario, the catchment's local rainfall was used alongside the rainfall from Cambridge (East Anglia). Figure *11* shows the sensitivity of spill count and spill volume to changes in rainfall. With the Cambridge rainfall, spill count is predicted to be 24% and 11% of the original Hirwaun and Drury Lane results respectively, while spill volume is predicted to be 37% and 71%.

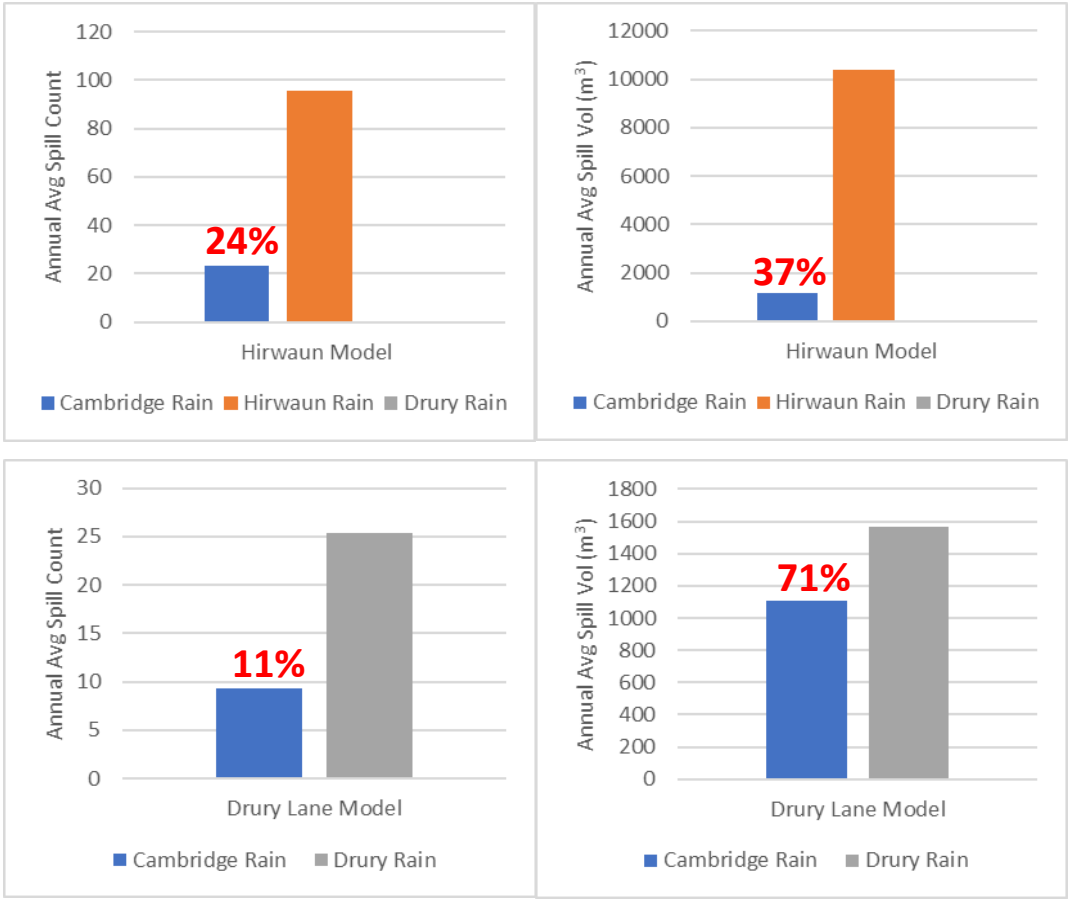


Figure 10: Drury and Hirwaun modelled annual spill count and volume with varying rainfall

Figure 11 shows the current solution and cost developed for each scheme when the model is subject to local catchment rainfall. Both these solutions are currently being developed in detailed design. Figure 11 also indicates the equivalent solution that would have been required if each hydraulic model was subject to the rainfall from Cambridge. There would have been a £1M saving in the Hirwaun scheme, and a no build solution would have been possible in Drury Lane – saving Welsh Water £5M.

Table 17: Drury and Hirwaun solution and cost with varying rainfall

Rainfall	Hirwaun Solution	Drury Lane Solution
Local	1.72 RainScape, SO mods & 400m^3 Storage **£3M**	1.945 RainScape 300m^3 Storage **£5M**
Cambridge	1.72 RainScape, SO mods & 75m^3 Storage **£2M**	Less than 10 spills on average per year **No Solution**

Conclusions

Both case studies demonstrated that Welsh Water's wastewater network performance, in terms of SO spills and volume, would significantly improve if subject to lower annual rainfall rates – similar to those found in other parts of the UK. The Afan case study showed that the average annual EDM spills, of 44.3, could be reduced to <20 per year if Afan was subject to average rainfall rates of between 550-850mm per year. These rainfall rates are found across the whole of central/east England.

The SOAF case study showed that Welsh Water could save 'pounds in ground' if Wales was subject to lower rainfall. It is recommended that the results of this analysis are used to inform discussions with regulators with regards to any future SO spill targets as it concludes that the respective rainfall each water company, plays a significant part in defining that target.

Appendix B

Cost Benefit Solutions for Bands 1-13

Table 18: Cost Benefit Bands 1 to 4 (using Welsh Water Multi Capitals framework)

Cost	Preferred Solution	Least Cost Solution	Preferred Solution	Least Cost Solution	Preferred Solution	Least Cost Solution	Preferred Solution	Least Cost Solution
Band	Band 1 - 0 to 50 m3 10th Largest Spill		Band 2 - 50 to 100 m3 10th Largest Spill		Band 3 - 100 to 250 m3 10th Largest Spill		Band 4 - 250 to 500 m3 10th Largest Spill	
Option	Option 1	Option 1	Option 2	Option 2	Option 1	Option 1	Option 1	Option 1
CAPEX	£1.006M	£1.006M	£1.339M	£1.339M	£2.165M	£2.165M	£2.217M	£2.217M
Present Value Whole Life Costs (WLC)	£1.197M	£1.197M	£1.525M	£1.525M	£2.461M	£2.461M	£2.628M	£2.628M
Present Value Whole Life Benefits (WLB)	£4.077M	£4.077M	£4.054M	£4.054M	£4.051M	£4.051M	£4.00M	£4.00M
Benefit/ Cost Ratio	**3.405**	**3.405**	**2.658**	**2.658**	**1.646**	**1.646**	**1.522**	**1.522**
Net Present Value (=WLB - WLC)	£2.879M	£2.879M	£2.529M	£2.529M	£1.59M	£1.59M	£1.373M	£1.373M

Table 19: Cost Benefit Bands 5 to 8 (using Welsh Water Multi Capitals framework)

Cost	Preferred Solution	Least Cost Solution	Preferred Solution	Least Cost Solution	Preferred Solution	Least Cost Solution	Preferred Solution	Least Cost Solution
Band	Band 5 - 500 to 1000 m3 10th Largest Spill		Band 6 - 1000 to 1500 m3 10th Largest Spill		Band 7 - 1500 to 2500 m3 10th Largest Spill		Band 8 - 2500 to 5000 m3 10th Largest Spill	
Option	Option 1	Option 1	Option 1	Option 1	Option 1	Option 1	Option 1	Option 1
CAPEX	£2.684M	£2.684M	£3.624M	£3.624M	£4.85M	£4.85M	£8.037M	£8.037M
Present Value Whole Life Costs (WLC)	£3.104M	£3.104M	£4.08M	£4.08M	£5.318M	£5.318M	£8.645M	£8.645M
Present Value Whole Life Benefits (WLB)	£3.96M	£3.96M	£3.876M	£3.876M	£3.772M	£3.772M	£3.541M	£3.541M
Benefit/ Cost Ratio	**1.276**	**1.276**	**0.95**	**0.95**	**0.709**	**0.709**	**0.41**	**0.41**
Net Present Value (=WLB - WLC)	£0.855M	£0.855M	-£0.204M	-£0.204M	-£1.546M	-£1.546M	-£5.104M	-£5.104M

Table 20: Cost Benefit Bands 9 to 12 (using Welsh Water Multi Capitals framework)

Cost	Preferred Solution	Least Cost Solution	Preferred Solution	Least Cost Solution	Preferred Solution	Least Cost Solution	Preferred Solution	Least Cost Solution
Band	Band 9 - 5000 to 75000 m3 10th Largest Spill		Band 10 - 7500 to 10000 m3 10th Largest Spill		Band 11 - 10000 to 12500 m3 10th Largest Spill		Band 12 - 12500 to 15000 m3 10th Largest Spill	
Option	Option 1	Option 1	Option 1	Option 1	Option 1	Option 1	Option 1	Option 1
CAPEX	£10.544M	£10.544M	£16.133M	£16.133M	£18.78M	£18.78M	£24.031M	£24.031M
Present Value Whole Life Costs (WLC)	£11.208M	£11.208M	£17.101M	£17.101M	£19.842M	£19.842M	£25.337M	£25.337M
Present Value Whole Life Benefits (WLB)	£3.334M	£3.334M	£2.917M	£2.917M	£7.715M	£7.715M	£2.294M	£2.294M
Benefit/ Cost Ratio	**0.297**	**0.297**	**0.171**	**0.171**	**0.137**	**0.137**	**0.091**	**0.091**
Net Present Value (=WLB - WLC)	-£7.874M	-£7.874M	-£14.184M	-£14.184M	-£17.127M	-£17.127M	-£23.043M	-£23.043M

Table 21: Cost Benefit Band 23 (using Welsh Water Multi Capitals framework)

Cost	Preferred Solution	Least Cost Solution
Band	Band 23 - 40000 to 42500 m3 10th Largest Spill	
Option	Option 1	Option 1
CAPEX	£65.924M	£65.924M
Present Value Whole Life Costs (WLC)	£69.887M	£69.887M
Present Value Whole Life Benefits (WLB)	-£1.418M	-£1.418M
Benefit/ Cost Ratio	**-0.020**	**-0.020**
Net Present Value (=WLB - WLC)	-£71.306M	-£71.306M

Appendix C

SO Sites Currently Proposed in the WINEP and NEP

Rock Park Close SO, Llandrindod Wells	Trecynon Mill St 46/47 Tanks Meirion St	Llanychaer WwTW	Cefneithin - Blaenhirwaun	Llan Penmachno WwTW
Ffostrasol WwTW	Ferndale Highfield Industrial Estate	Haverfordwest No 1-Fred Rees	Tom Jones Nursery SO	Waunfawr SWK
Rear of William St SO, Ystrad	Blake Street (rear of) Maerdy	Verwig WwTW	Pontyberem No2 SPS	Penisarwaun SWK
25 Cricklewood Close SO Bridgend	Penpedairheol Oaks End Close D/S F/Brdg	Farmers Road SO	Pontamman Pipe Crossing	Cwm Penmachno
Mill Street Castle Meadows	Bargoed Old Colliery Washery	Rhydlewis	Garnant - Amman Smalls	Rhosybol Gorslwyd PS
Brecon - East STW Dorlangoch	Sennybridge Army Camp SO, Sennybridge	Blaengynfi Tunnel Terracr MH 245A SWO 8	Brynmaman Footbridge SO, Cwmgarw Rd	Caernarfon Nantlle SPS
Underwood SPS	St Albans School SO, Pontypool	Pontrhydfendgaid SPS	Meadow's Road SO Cwmgwili	The Eagles SO, Llanwchllyn
Newbridge on Wye WwTW	Rhymney Abertysswg U/S Troed-Rhiw-Fuwch	Salem WwTW	Heol Y Deri SO	Maes Gwyndy SO
Brecon Main Pumping Station SPS	Tylorstown Pontygwaith Bridge	Neath Abbey	Inco Works Clydach	Llanarmon-yn-Ial STW
Tredegar Railway View Opposite No 13	Swffryd SO, Crumlin	Cross Hands	Adj 1 The Grove, Trebanos	Corwen WwTW
Trecastle SWK	Huxley Green SO, Newport	Lletty Brongu (Nr Maesteg)	Bryndulais Farm SO	Glyn Ceiriog y Gammer
Tredegar North End of Edward Terrace	Pandy WwTW	Lampeter - No. 3, University	Nant-y-Cafan Dulais Valley	Afon Eitha SO
Rock & Fountain Playing Fields	Trelyn Lane SO, Fleur-De-Lis	Quarry Place SO	Ffestiniog STW	Ruabon SPS
Trosnant Street Pontypool	Crichton St SO Treorchy	Haverfordwest No 6 Fenton	Ceinws Esgairgeiliog	Heol Penyfelin Nant
Pontllanfraith Old Tram Road	Cuckoo Mill SPS	Parc y-Dai No1 SO, Drefach	Capel Curig WwTW	Charles Street SO, Blaenavon
Cwmavon Rising Sun Bridge SO	Clarbeston Road No 1	Cymmer	Waterloo Port SO	James St Pontardawe
Gelligaled Park Tyntyla Road SO Ystrad	Clarbeston Road	Eglwyswrw	Caernarfon Hen Gastell No5	Bromyard Sherford Street SO
Cowbridge Llanblethian STW Storm Tanks	Puncheston WwTW	Cwmgwili	Llangefni WwTW	Bromyard New Road SPS
Berea Close SO Blaina	Dinas Cross SPS	Rhos/Llangeler (Capel Seilo) SPS SO	Llanfaglan STW Storm	7 unnamed 'Severe Impact' SOs for the WINEP
The Strand Builth Wells	St Nicholas WwTW	Dilwyn Arms Pontardawe	Llanllyfni Glan Aber	
Legar SO, Crickhowell	Marloes Works Inlet	Hebron Rd Clydach SO	Caernarfon Nantlle No 5 Nra	

Appendix D

The table below shows the total enhancement costs in Amp8 for this enhancement case, mapped to the lines in the data tables.

- Investigations, other (WINEP/NEP) - survey, monitoring or simple modelling wastewater capex (CWW3b.106)
- Storage schemes to reduce spill frequency at CSOs etc - grey solution; (WINEP/NEP) (CWW3b.022)
- Storage to reduce spill frequency at CSOs etc - green solution; (WINEP/NEP) wastewater capex (CWW3b.025)
- Storage schemes to reduce spill frequency at CSOs etc – grey solution; (WINEP/NEP) wastewater opex (CWW3b.023)
- Storage to reduce spill frequency at CSOs etc - green solution; (WINEP/NEP) wastewater opex (CWW3b.026)
- Continuous river water quality monitoring (WINEP/NEP) wastewater capex (CWW3b.007)
- Continuous river water quality monitoring (WINEP/NEP) wastewater capex (CWW3b.008)

Table 22: Allocation of Costs in the Data Tables

Driver Ref	Year in AMP8					
	1	2	3	4	5	Grand Total
CWW3b.7 - CapEx	£2.368M	£2.314M	£0.000M	£0.000M	£0.000M	£4.682M
CWW3b.8 - Opex	£0.155M	£0.309M	£0.309M	£0.309M	£0.309M	£1.391M
CWW3b.22 - Capex	£36.524M	£66.676M	£95.975M	£81.607M	£52.777M	£333.559M
CWW3b.23 - Opex	£0.110M	£0.330M	£0.661M	£0.936M	£1.102M	£3.139M
CWW3b.25 - Capex	£1.252M	£2.442M	£3.598M	£3.030M	£1.890M	£12.212M
CWW3b.26 - Opex	£0.010	£0.028M	£0.059M	£0.082M	£0.097M	£0.276M
CWW3b.106 - Capex	£1.679M	£4.377M	£2.152M	£1.631M	£1.130M	£10.969M
Total	£42.098M	£76.476M	£102.754M	£87.5953M	£57.305M	£366.228M