Dŵr Cymru
Welsh Water

Enhanced Investment Case: WSH64-PE02 – Protecting Multiple Adjoining SSSIs near the SECS Main

Contents

Executive Summary

This investment will improve the resilience of the South East Coastal Strategy (SECS) wastewater rising main and allow us to reduce environmental impact on the sensitive environment through which it passes. The work is part of the National Environment Programme (NEP) agreed with Natural Resources Wales (NRW).

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 (5 sections);
- best option for customers (3 sections);
- cost efficiency (2 sections); and
- customer protection

Need: The SECS main has experienced multiple structural failures with a resultant escape of sewage to the environment. The 32.7km main is situated along the side of the Severn Estuary running through the area known as the Gwent Levels, an iconic, estuarine landscape of international significance. This means that the risk of any failure causing significant pollution, is much greater compared to other rising mains within Wales. Additionally, since original construction, some 12km of the main now sits within an area of land designated as a Site of Special Scientific Interest (SSSI) making the consequence of environmental harm much greater, both in terms of pollution and in terms of enacting reactive repairs without causing further damage. The mitigation measures that were previously considered sufficient to protect the condition of the SSSI are no longer sufficient should the SECS main fail again even if we can keep the impact of the failure highly localised with our mitigation plans. For this reason, NRW have included an obligation to be delivered in the NEP under the W_SSI_NDIMP1 driver.

If we do not act to reduce failure rates in AMP8, we can expect to see:

- increases in mains repairs, more significant structural failures, and greater impacts upon a sensitive environment because of sewage escape.

Options: In developing schemes, we have modelled the costs for several different options, partial replacement, premature termination at a new works outside the SSSI, reactive replacement only, to determine the most cost-effective solution. Our chosen option is to replace the main to prevent further failures.

What We Will Deliver: This Enhancement will deliver replacement of 32.7km of rising main sewer within the Gwent Levels.

Efficient Costing: We will invest £78M (TotEx, post efficiency, 22/23 price base) to replace 32.7km of wastewater rising mains.
The requirement is to work within the SSSI to address the risk posed by existing assets creates uncertainty in the development of a chosen option. We have included contingency funding within the Enhancement Case to mitigate this risk – with a price control deliverable (PCD) designed to return funding to customers if it is not required.

Customer Protection: The proposed work is within the scope of the NEP and will have regulatory oversight from NRW.
In addition, we propose a PCD which will protect the company from uncertainties in the design and delivery process and allow funds to be returned to customers if the work is not delivered, or if costs within the contingency allowances are not required.

Benefits: The investment will ensure that the pollution risk to a sensitive environment is significantly diminished, delivering a resilient asset and supporting our targets to minimise pollution.
Our approach has been independently assessed by Jacobs (Engineering and Costs) and Economic Insight (CBA).

1. Introduction

The aim of this enhancement investment is to improve service quality and resilience in the sewerage network – specifically, to invest to protect a Site of Special Scientific Interest (SSSI), the coverage of which has been expanded since the construction of our sewer network. The work is an agreed output within the NEP.

The Gwent Levels is renowned for the special wildlife it supports, its rich patchwork of different habitats and beautiful landscapes that sweep the Severn Estuary coastline from Cardiff. The drainage ditches within the levels are host to a wide range of aquatic plants, including many rare or scarce species, that in turn support a wide variety of other wildlife. There is a diverse community of insects and other invertebrates, with over 350 species being recorded. Of particular concern and referenced in the condition assessment of this SSSI is the Shrill Carder Bee and Bearded Tit. As well as these features, there are other habitats that contribute to the special wildlife interest. These include green lanes, hedgerows, and flower rich ditch banks.

The area is made up of multiple adjoining SSSIs. A new area through which our pipeline also runs, the Newport Wetlands National Nature Reserve (NNR), was created in 2000 as compensation measures for the loss of the Taf/Ely Estuary SSSI to the Cardiff Bay Barrage. This new site was created after the construction of the main and was designated as a NNR in 2008 with declaration of the SSSI following in 2010. This increased the sensitivity of the area and 14 of the 19 notified features of the NNR were entirely attributed to its creation in 2000.

Since construction of the main, the sewage from the Sedbury, Chepstow, Caldicot and Magor/Undy catchments has been collected and pumped via the SECS rising main for treatment at Nash Wastewater Treatment Works (WwTW). The transfer rising main runs approximately 32.7km along the Southeast coast of Wales. Ten sewage pumping stations (SPS) located at Chepstow North, Chepstow Fairfield, Sedbury, Beachley, Hunger Pill, Mathern, Sudbrook, Caldicot, Magor, and Nash Vacuum inject flow along the pipe route.

At the time of construction, modelling indicated that the towns of Magor, Caldicot, Chepstow and Sedbury accounted for approximately 32,000 out of the total catchment population of 41,500. The remainder of the population was made up of many smaller, outlying villages.

Figure 1: SECS Rising Main Plan

When the pipeline was laid the value of the Gwent Levels habitat was not fully understood. The consequences of failures on the pipeline system are now assessed to be much more significant than at the time the pipe was laid. Any untreated sewage that escapes from the pipeline will be drained into the ditches, which are the most sensitive and valued area of the SSSI. The pipeline has already failed on 25 occasions, including a serious pollution incident in 2018 and two in 2023 (known as a 'high - significant impact' incident on the NRW classification). The levels in which the main are laid have been reclaimed from the sea, are very low lying and subject to significant ground movement due to constant drying and wetting. This increases risk of damage to the integrity of the pipeline.

We are committed to intervening to reduce the likelihood of mains failure along the pipeline to protect these sensitive environments.

The AMP8 enhanced TotEx investment in this project is £78M (post efficiency, post frontier shift and in 2022/23 prices).

Figure 2 shows our full WINEP/NEP programme and how investment, by driver, has been split between our cases for enhanced investment. Boxes are scaled to reflect the relative size of investment.

This enhancement investment case (WSH64-PE02) responds the environmental risk associated with the SECS main described above.

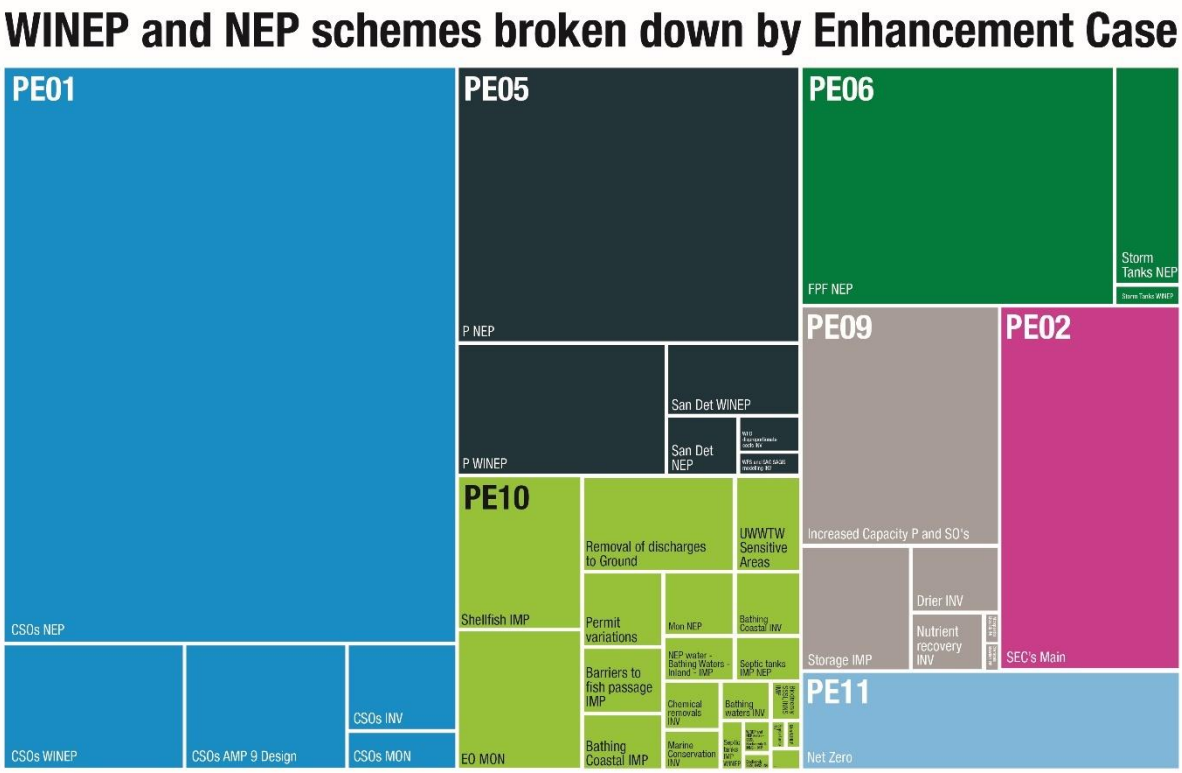

Figure 2: WINEP and NEP schemes broken down by Enhancement Case.

1.1 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	Addressed in
A1.1.1 Need for enhancement investment	a	Is there evidence that the proposed investment is required?	Section 2.1
	b	Is the scale and timing of the investment fully justified?	Section 2.1
	c	Does the proposed investment overlap with base activities?	Section 2.2
	d	Does the need and/or proposed investment overlap/duplicate with previously funded activities or service levels?	Section 2.3
	e	Does the need clearly align to a robust long term delivery strategy within a defined core adaptive pathway?	Section 2.4
	f	Do customers support the need for investment?	Section 2.1
	g	Have steps been taken to control costs, including potential cost savings?	Section 2.5
A1.1.2 Best option for customers	a	Have a variety of options with a range of intervention types been explored?	Section 3.1
	b	Has a robust cost-benefit appraisal been undertaken to select the proposed option?	Section 3.1
	c	Has the carbon impact, natural capital and other benefits that the options can deliver been assessed?	Section 3.2
	d	Has the impact of the proposed option on the identified need been quantified?	Section 3.2
	e	Have the uncertainties relating to costs and benefit delivery been explored and mitigated?	Section 3.3
	f	Where required, has any forecast third party funding been shown to be reliable and appropriate?	Not applicable to this case
	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 4.1
	b	Is there evidence that the cost estimates are efficient?	Section 4.2
	c	Does the company provide third party assurance for the robustness of the cost estimates?	Section 4.1
A1.1.4 Customer protection	a	Are customers protected if the investment is cancelled, delayed or reduced in scope?	Section 5.1
	b	Does the protection cover all the benefits proposed to be delivered and funded?	Section 5.1
	c	Does the company provide an explanation for how third-party funding or delivery arrangements will work for relevant investments?	Not applicable to this case

2. Need for Enhancement Investment

This section sets out the drivers behind the Enhancement Case and describes the context within which it has arisen.

Deterioration on the SECS main has led to structural failures with a resultant escape of sewage to the environment. The 32.7km main is situated within the Gwent Levels, a sensitive environment, meaning that the risk of failure causing significant pollution is much greater compared to other rising mains within Wales. Additionally, since original construction, some 12km of the main now sits within an area of land designated as a SSSI making the consequence of environmental harm much greater, both in terms of pollution and in terms of enacting reactive repairs without causing further damage. The land is crisscrossed with a series of reens, drainage installed to create the landscape in its current form. This means that it is much more of a challenge to contain the flows from any pipe burst from causing an aquatic pollution incident.

The proposed investment aligns with our Long Term Delivery Strategy (LTDS) – responding to the need for long term stewardship and improvement in service.

2.1 Evidence that Enhancement is Needed Now

> ***Is there evidence that the proposed enhancement investment is required?***
> ***Is the scale and timing justified?***
> ***Where appropriate, is there evidence that customers support the need for investment?***
> *– Ofwat's final methodology for PR24, Appendix 9, A1.1.1a, A1.1.1b and A1.1.1f*

The area is made up of multiple adjoining SSSIs. A new area through which our pipeline also runs, the Newport Wetlands SSSI, was designated in 2010 as compensation for the Cardiff Barrage after the construction of the main which increased our understanding of the sensitivity of the area.

Since installation, the SECS main has deteriorated, we have also observed ageing of the assets at Nash WWTW inlet works. This deterioration has led to 13 pollution failures (and a further 12 failures were not assigned a pollution category) recorded since June 2013, which includes three 'high – significant' impact (Cat 2) pollution events, two 'low impact' (category 3) and 8 'events (category 4) – details are provided in Appendix A.

NRW have made clear in written responses to us that our approach to bursts, however well managed, poses an unacceptable risk to the condition of the SSSI. Stating that:

"Given that the pipe is expected to deteriorate further as time progresses and the sensitive location and environmental risks which I have highlighted above, we feel that a start date for civil engineering on the ground as late as AMP8 is unacceptable."

The recent Strategic Steers from Welsh Government placed particular emphasis on the nature emergency facing Wales and has made it clear that Welsh Water is expected to do more to support a thriving biodiversity in areas like this. There is a specific target to increase the percentage of protected areas, like the Gwent Levels, which are meeting favorable condition.

Taking these factors into account, this need has been included in the NEP (July 2023, version 6) programme under driver W_SSSI_NDIMP1 to implement "actions to secure no deterioration of and / or contribute to maintenance of a SSSI and its features to meet / sustain Favourable Condition".

The change in designation of the land around the main (increased consequence), combined with its high rate of failure, mandate intervention to reduce the risk of environmental damage. The need to act has been agreed with NRW.

We have begun to develop detailed design options to further enable our response.

2.1.1 Evidence of Customer Support

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

We have also worked to understand the views of stakeholders in the Gwent Levels. The quotations below are taken from the Futurescapes Gwent Levels booklet published by the Royal Society for the Protection of Birds (RSPB)

"The Gwent Levels must be managed sustainably to retain its unique character and promote the importance of this distinctive landscape to both the history and future of Wales".

RSPB

Our response to managing the SECS main has been developed within the context of these clear environmental messages.

2.2 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

Our approach for separating base from enhancement investment is set out in WSH50-IP00 Our Approach to Investment Planning (Section 3.4.2).

The ongoing maintenance of the SECS main is included in our Base allowance. This includes responding to failures and making repairs where required.

2.3 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

Since the installation of the SECS main, we have not requested specific funding for this asset and have managed it within our base allowance.

The proposed enhancement is a material standalone investment which has not previously been in a funded programme of work.

2.4 Alignment with the Long Term Delivery Strategy (LTDS)

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

Welsh Water have long term outputs in the areas of supporting and enhancing biodiversity and to reduce pollution events and serious pollution events. The PR24 Forum has given a strategic steer to

support the Welsh national targets for at least 30% improvement of protected sites and habitats by 2030, 30% improvement of the condition of SSSI, Special Areas of Conservation (SAC) and sites designated under the RAMSAR convention, and 10% improvement of woodland from unfavourable to favourable condition by 2030. Preventing deterioration in the Gwent Levels SSSI forms part of our response to this direction and our overall support for continuing to build improving SSSI status across Wales after 2030.

In addition, our serious pollution events target is set to be 0 from AMP8 onwards and the wider performance commitment for Category 1-3 pollution events is expected to reduce to 7 per 10,000km of sewer by 2050. Works associated with the SECS main, as outlined in this Enhancement Case, will directly contribute towards Welsh Water's long-term ambitions.

Further details can be seen in WSH01 Long Term Delivery Strategy.

2.5 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 change in designation of the land through which the pipe runs was not foreseen at the time of its construction, the designation was expanded in 2010. This change in our understanding of the environment through which the pipeline runs and the associated increase to the consequence of failure has altered the risk assessment for the pipeline.

In response we have put mitigation plans in place to reduce the risk of a burst, carry out a rapid repair and manage the impact of a spill. This work has helped to ensure that the effect of any burst has been prevented from spreading widely within the system of ditches and drains, and that any impacts are cleaned up. We hold strategic spares and ensure that our operators are trained specifically for pollution response.

In addition, we are conducting inspection and maintenance activities along the pipeline.

These actions have, to date, provided mitigation to the consequences of failures. NRW have however classified bursts as Category 2 pollution events in recent years irrespective of our mitigation measures and with the sensitivity of the site, we run the risk, every time the main fails, that our response will not be quick enough to prevent environmental damage.

NRW's assessment of the condition of the SSSIs through which the SECS main passes list numerous species that are of importance and for which the sites are designated. Of particular concern are the Shrill Carder Bee and Bearded Tit which are both in unfavourable condition and particularly vulnerable to pollution that would occur if there were further failures.

The mitigation measures that were previously considered sufficient to protect the condition of the SSSI are no longer adequate to protect these particularly vulnerable designated species should the SECS main fail again, even if we can keep the impact of the failure highly localised with our mitigation plans.

3. Best Option for Customer

In this section we will describe how we have developed options for addressing the need identified above.

We have worked closely with NRW to consider how we can best respond to this risk. We have considered a range of issues using our standard TotEx hierarchy approach and evaluated how risk reduction can be achieved whilst maintaining affordability for customers. We have applied cost benefit assessment modelling to evaluate viable options. As there are complexities in quantifying the likelihood and scale of failures/pollution incidents we have taken a conservative approach to valuation. There are also uncertainties within the development of solutions related to the complexity of working within the SSSI, whether to remove existing assets or install a new pipeline.

3.1 Identification, Assessment and Selection of Solution Options

> ***Has the company considered an appropriate number of options over a range of intervention types to meet the identified need?***
> ***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, A1.1.2a and A1.1.2b*

Our approach to options appraisal is set out in the investment chapter. It includes working through a TotEx hierarchy from do nothing and OpEx only solutions to full replacement of the asset.

We have good management practices already in place to respond to and mitigate the impacts of mains failures, working with NRW on contingency plans and rapid deployment of appropriate spares and repairs. However, the high potential consequences of failure mean that this is not an acceptable option given the vulnerability of some of the species for which the Gwent Levels were designated.

The condition of the SECS main is assessed to be poor, we have already observed multiple structural failures and as such we have excluded options designed to slow or reduce deterioration.

We are therefore focusing on options which can restore structural integrity to the pipeline and asset replacement. Within this category we have considered replacing sections of the pipeline, full scale replacement and rerouting of the pipeline outside of the SSSI. These options look to address likelihood of failure and reduce the consequences of failure.

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). This includes a cost benefit analysis (CBA) tool, which comprises of a detailed analysis of benefit to costs for all proposed options. The proposed solutions include quantification of risk and benefit over the long term via service measure framework (SMF) values, including valuation of the following criteria including natural; social; human and intellectual capital.

A review of the existing needs recorded in our corporate systems has been undertaken to produce a pre-risk position. These include:

- Rising main bursts
- Structural failure of the discharge chamber at Nash WWTW
- Odour issues at the Blackbird Road Air Valve

Some of the key impact categories are:

- Deterioration of several of the Gwent Levels designated SSSIs and reduction in their conservation status
- Pollution
- Legal compliance
- Staff productivity
- Customer complaints
- Other cost of failure

Long listing

We completed a process of long listing which considered 15 different options. These were focused on replacing different sections of the pipeline and different treatment options in a range of combinations.

The Summary and Scheme Selection table is included below. This analysis was undertaken in a previous version of our cost benefit assessment tool, that tool was fit for purpose but has not produced values which flow through into the shortlist analysis presented in 2 below.

None of the options identified had a benefit/cost ratio of over 1, due to the high costs of working in the SSSI and limitations in how we were able to represent pollution impacts on the SSSI.

Table 1 Summary and Scheme Selection table (SMF v4.9)

Solution Option	Option Name	Benefit/Cost Ratio
Enhance existing resources or add new resources. **Option 1A**	SECS Main at-risk section replacement (8,626 meters) no repeat CapEx[1]	0.151
Enhance existing resources or add new resources. Option 1B	SECS Main complete pipe replacement (31,759 meters) no repeat CapEx	0.139
Enhance existing resources or add new resources. Option 1C	SECS Main complete replacement (31,759 meters) + repeat CapEx	0.128
Enhance existing resources or add new resources. Option 2A	One Works @ Magor SPS + at risk section replacement (4,476 meters) no repeat CapEx	0.135
Enhance existing resources or add new resources. Option 2B	One Works @ Magor SPS + complete pipe replacement (17,759 meters)	0.138
Enhance existing resources or add new resources. Option 2C	One Works @ Magor SPS + complete pipe replacement (17,759 meters) + repeat CapEx	0.134

[1] Repeat capex refers to the need to replace certain short life assets within the span of the CBA. For example, batteries in telemetry equipment might be replaced after 5-10 years. Considering repeat capex allows us to evaluate the relative NPV of options involving different combinations of long and short life assets on a comparable footing.

Solution Option	Option Name	Benefit/Cost Ratio
Enhance existing resources or add new resources. Option 3A	Two Works (Magor, Caldicot) @2No SPS + at risk section replacement (1,487 meters)	0.128
Enhance existing resources or add new resources. Option 3B	Two Works (Magor, Caldicot) @2No SPS + complete replacement (11,600 meters)	0.129
Enhance existing resources or add new resources. Option 3C	Two Works (Magor, Caldicot) 2No SPS + complete replacement (11,600 meters) + repeat CapEx	0.127
Enhance existing resources or add new resources. Option 4A	Three Works (Magor, Caldicot, Hunger Pill WwTW) @2No SPS + at risk section replacement (1,018 meters)	0.126
Enhance existing resources or add new resources. Option 4B	Three Works (Magor, Caldicot, Hunger Pill WwTW) @3No SPS + complete replacement (4,551 meters)	0.126
Enhance existing resources or add new resources. Option 4C	Three Works (Magor, Caldicot, Hunger Pill WwTW) @3No SPS + complete replacement (4,551 meters) + repeat CapEx	0.125
Maintain the effective risk controls already in place. **Option 5**	Provision of Nutriox dosing only	0.088
Enhance existing resources or add new resources. Option 6	One Works located in Magor – upstream pipework remaining	0.145

Shortlisting and cost benefit assessment

Having completed the long listing process, we have identified two options for further review and full CBA using our SMF tool. Although the two options progressed are not the most cost beneficial across all options assessed in the longlist, the higher cost benefit options do not reduce the risk of future pollution incidents sufficiently to justify significant investment in the asset or fully address the obligation in the NEP, so were dismissed as not viable solutions. The options taken forward directly address the condition of the rising main, allowing it to be abandoned and replaced with a new asset whilst limiting the scale of activity to manage costs.

The scheme is a mandatory requirement within the NEP and as such we are not seeking to understand whether the scheme is cost beneficial but rather to use the analysis to help us better understand the relative costs and benefits of different options.

Option 1 'SECS Main Complete Replacement'. The installation of a new asset would significantly reduce the likelihood of asset failure. This would include selection of pipe material better suited to the conditions in the Gwent Levels.

Option 2 'New WwTW at Magor and replacement of at-risk sections of SECS Main' would remove sections of the main within the SSSI, however there would still be a residual risk of the main bursting in those sections where it has not been replaced (outside of the SSSI, but still within the Gwent Levels).

Table 2 below shows our analysis for these two options within our CBA tool. 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.

Option 1 is significantly cheaper than Option 2 and has a greater benefit value. The benefit to cost ratio for Option 1 outweighs Option 2 although neither scheme has a ratio above 1 (see discussion below).

Table 2: Benefit to cost ratio analysis of the SECS Main without contingency.

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	SECS Main Complete Replacement	£59.243M	£61.953M	£23.495M	0.379	-£38.458M
Option S2	New works at Magor and at-risk replacement of SECS Main	£84.307M	£95.277M	£13.734M	0.144	-£81.543M

Table 3 shows the same analysis with an additional contingency factor added to the costing for Option 1, this is valued at £25.064M. Again, all monetary values are expressed in 2022/23 prices and are prior to portfolio adjustments for corporate overheads and efficiency challenge. This brings costs in Option 1 into line with those in Option 2. This figure post efficiency and frontier shift is a cost of £22.626M.

The additional contingency is required because of the complexity of replacing the main in the sensitive SSSI and the potential escalation of costs due to unforeseen risks (for example, route diversion, compensatory work, additional licences, and delays due to restricted access). The contingency is unknown but is set such that if forecast costs escalate during the detailed design to a point where Option 2 would be more cost beneficial, we would change the solution to Option 2.

Table 3: Benefit to cost ratio analysis of the SECS Main with contingency.

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	SECS Main Complete Replacement	£84.307M	£84.450M	£23.495M	0.278	-£60.955M
Option S2	New works at Magor and at-risk replacement of SECS Main	£84.307M	£95.277M	£13.734M	0.144	-£81.543M

Option 1 with additional contingency is still the preferred option as it offers best value if the unforeseen risks do not materialise (see discussion in uncertainty below).

A PCD is proposed to protect customers if the contingency is not required. We are continuing to progress design and engagement work to reduce this risk and will be able to refine the approach ahead of Final Determination.

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 (Section 6).

3.2 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*

Our Service Measure Framework (SMF) provides a significant improvement in our ability to quantify benefits arising from investment. The tool is described in the WSH50-IP00 Our Approach to Investment Planning (Section 4.3).

We have provided an excerpt from our SMF below, which quantifies the benefits of Option 1 the selected scheme.

Table 4 Benefit from AMP8 Spend

Scenario	Benefits from AMP8 Spend across relevant categories (%)							
	Health & Safety	Pollution Incidents	Flooding - External	Legal Compliance	Customer Contacts	Environmental Impact	Traffic and Transport Disruption	Total
Preferred –	0.10%	**63.28%**	10.99%	0.89%	0.08%	**22.96%**	1.71%	100%

Our CBA work has assigned benefits to several categories within our SMF, with the largest benefit relating to the reduction in pollution incidents with the reduction in environmental impact providing the next largest benefit.

For this Enhancement Case, the SMF does not fully capture the benefits of avoiding a pollution incident within the unique environment of the Gwent Levels. The Gwent Levels are a SSSI in an unfavourable condition and are made up of interconnected waterways and ditches which have the potential to spread pollution over a wide area. Furthermore, we have been conservative in our assessment of the frequency of future failures leading to a serious pollution event assumed in the model meaning that the benefits of intervention are likely to be understated.

The need to invest at this location is not reliant on an NPV positive CBA but rather on the requirements set out within the NEP.

This investment has the potential to impact on two common performance commitments.

- Total pollution incidents, and
- Serious pollution incidents

Through our cost benefit assessment activity, we have quantified the expected change in annual pollution incidents.

SECS Main pollution incidents avoided per year (once constructed in the last year of the AMP)

- 1.7 category-3 failures
- 0.7 category-1 failures

With this investment it is assumed on the basis it will reduce to zero over the reasonable life of the asset.

Whilst the concern driving the need is serious pollution incidents, we have set out clear targets across our operating area that we should not incur any serious incidents. As such, the work at this location will reduce the likelihood of serious pollution occurring in any year but will not impact on the target which has been set (0).

3.3 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*

The approach to addressing the need – laying of sewer pipe or construction of treatment facilities – are well understood. However, the environment within which this work is to be delivered adds significant uncertainty to the costing process.

The planned work is designed to reduce the likelihood of harm to the SSSI and the surrounding Gwent Levels. To achieve this change, we will need to deliver engineering activity within the levels which itself will create a risk to the environment which we are seeking to protect. A diversion outside of the levels will require significant costs and will not fully avoid intervention within the levels to make safe and 're-plumb' existing assets.

The chosen option assumes the delivery of a pipeline route following the approximate line of the existing main. This option has been discussed with NRW and other stakeholders and is believed to be viable, if suitable working arrangements can be agreed. However, there remains a material risk that this option is not deliverable or that significant diversion from the planned route may be required. If the costs escalate significantly Option 2 may become the preferred solution providing that a suitable permit can be obtained. Given the effluent would be discharging into the protected Severn Estuary it would require not only tight sanitary determinands, but also likely tight nutrient limits.

We have therefore included a contingency figure of £23M (post efficiency) in this Enhancement Case (in addition to the contingency for known risks). This figure for unforeseen risks has been set to equal the differences in costs between options 1 and 2. It will allow Welsh Water to deliver a more complex version of Option 1 or revert to Option 2.

We will provide a specific measure within the proposed PCD to allow this funding to be returned to customers if it is not triggered.

Table 5: Options considered for the SECS Main scheme.

Option	Description	Risks associated with costing this option or valuing its benefits	Mitigation [of the Risk associated with costing]
Conventional Solution	'Do nothing' requires the existing pipeline to be maintained with reactive maintenance/repairs for emergency situations	Cost uncertainty due to the potential for bursts, which would involve the replacement of the rising main itself but could also lead to pollution fines, especially if we cannot prevent deterioration of the SSSI due to the impact of our asset's performance on its conservation status.	As this is a do-nothing option, mitigation of the risk has not been included, this is represented by the large 'post-solution' risk score where Welsh Water would be carrying significant risk if this option was to be selected.
Option 1	SECS Main Complete Replacement	The cost uncertainty is elevated due to: - further requirements from NRW to be confirmed for working within the designated SSSI and measures required to offset any disturbance caused by the replacement works. - potential for rising main bursts during construction which could lead to pollution fines and enforcement measures, especially if they happen in SSSI area. - land acquisition or compensation if a new main cannot be installed within the current easement.	A risk allowance for replacing the rising main in SSSI area has been included. In addition, a £23M (post efficiency) contingency is proposed in case this option is not viable or requires material alteration. This figure will be updated as we progress design and engagement.
Option 2	New WwTW at Magor and replacement of at-risk sections of SECS Main	New WwTW surrounded by SSSI. Risk of flooding/ground water due to proximity to the sea Planning permission required for the new WwTW. Land purchase may be required for the new WWTW.	We have costed this uncertainty within the project.

4. Costing Efficiency

In this section we give specific details on our approach to costing and benchmarking. Our overarching approach to developing efficient costs is set out in WSH50-IP00 Our Approach to Investment Planning (Section 7).

4.1 Developing a cost for replacement

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

This scheme has been costed using a like-for-like (top down) approach, as described in Section 5 Costing Methodology of 'Overview: How we have developed our investment plan' document.

We used our Unit Cost Database (UCD) Cost & Carbon Estimating Tool (C&CET), which holds cost models for process and component assets, to cost the developed scope of works for each of the proposed options.

Our pipeline costing approach includes multiple options including open cut, and directional drilling, pipe abandonment, and Nutriox dosing at the three Pumping Stations: Hunger Pill, Caldicot and Magor. Several chambers were identified but not priced, as these were already included in the pipeline costing.

Much of the scope is for items of work which have been constructed throughout previous AMPs, and therefore we have a rich source of historical cost data. For these items of work, we have developed cost models based on the most important cost drivers, e.g., the most influential driver to cost for a tank is volume. This costing approach forms the direct works and site-specific costs. We apply construction indirect costs and project oncosts based on the work stream, in this instance this is Wastewater Non-Infrastructure, which applies modelled percentages to the cost of the direct works and site specifics.

The scope is aligned to our Work Breakdown Structure (WBS), which was developed to support our data capture process of historical project cost against delivered assets, into a scope input sheet. Within this, sizing of the assets based on the relevant yardstick, which is dictated by the WBS, is provided following calculation in the previous engineering stages. Our costs models are developed in line with our WBS and this allows us to input this information into the C&CET and generate a project estimate. WBS details the inclusions and exclusions of works under each cost model and the limitations of the model, so we can ensure all project costs are captured and there is also no over costing.

The key assumption made for the preferred solution are that it will be a like-for-like replacement of the existing pipeline and that the replacement pipeline would largely follow the existing route. This dictates the surface type we will be laying pipes in that influences the cost. We also assumed that directional drilling crossings will still be possible although we are at the upper value on the pipe diameter.

There are however significant risks identified within this project which, as the project develops through the project life cycle, will be mitigated or become scope items. As such we have made allowance within the estimate for these, such as additional temporary works for dewatering 2km of construction site through a SSSI wetland section of the new main, post scheme monitoring, and environmental mitigation measures. These have been costed bottom-up as these as these are uncommon activities. These have been included within our C&CET model which allows this to be included within our UCD governance process. These identified (known) risks account for around £7M (pre-efficiency) of the costs in Option 1.

Whilst the preferred option is to replace the existing pipeline, there are significant risks requiring mitigation measures to make this a viable option above those identified in the risk register (unknown or unquantified risks). Fundamentally the cheaper option will require us to undertake more works

within the Gwent Levels and therefore we believe that there is a high risk we may need to rework the proposed route or adopt Option 2. We have therefore added a contingency amount to the preferred option cost which would allow us to deliver the required work through a more complex route or by switching to Option 2. This contingency value is the difference between the two options (an efficiency has subsequently been applied to the figure).

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) for more information regarding the review and assurance undertaken.

4.2 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 establish whether our costs are efficient, we engaged an independent consultant to carry out a benchmark of the costing work for each option considered in shortlisting. The results are shown in Figure 3.

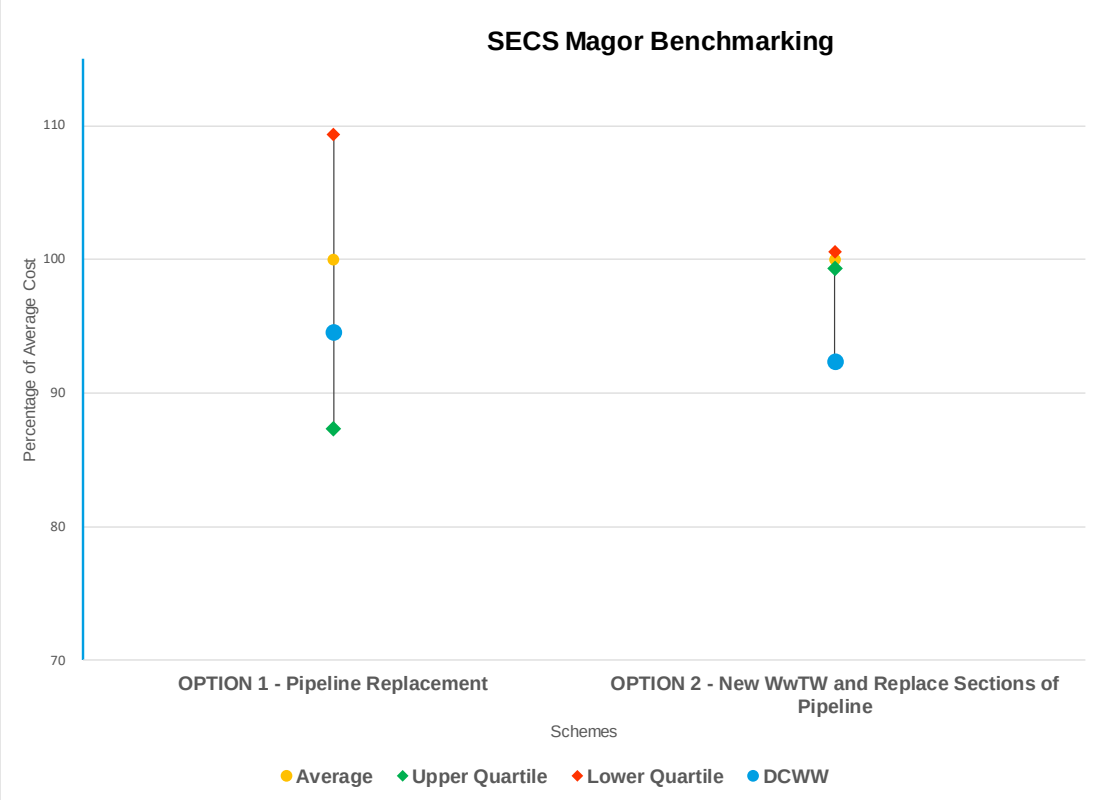

Figure 3 - Benchmarking outcome of our Pre-efficiency costing of both options

Our consultant's report found that our costing of Option 1 (pre-efficiency) was within the second quartile, demonstrating a level of cost efficiency. This analysis was conducted pre-efficiency, without the contingency factor described in 4.1 above.

Our costing of Option 2 (pre-efficiency) was significantly more efficient than the benchmark range for similar schemes. **Error! Reference source not found.** shows the percentage difference from the b enchmark average of our pre-efficiency costing and the upper and lower quartile costing.

The figures for the chosen option are presented in more detail in the table below (pre-efficiency, 2021/22 price base).

Table 6: Extract from Benchmark report on the NRW sample

Project	Welsh Water Pre efficiency	Upper Quartile	Average	Lower Quartile
Option 1	£54.460M	£50.280M	£57.600M	£62.980M

The benchmarking analysis has been delivered on the assumed route and proposed design for the pipeline. The contingency figure has not been included in the benchmark as this covers a multitude of potential site-specific variations to the proposed work which are not included in the schemes which have been used for comparison.

The benchmarking work provides insight that has been used to inform our thinking on the application of efficiency for this project. We have adjusted our proposed cost (and contingency) figures by applying an efficiency to the chosen option of 9.7%.

The benchmarking exercise shows that our approach is ambitious in terms of cost efficiency.

5. Providing Customer Protection

This scheme will have regulatory oversight from Natural Resources Wales (NRW) and part of the NEP.

In addition, we propose that a PCD is applied to provide strong controls in terms of work delivered against funding allowed – specifically with regards to the contingency allowance.

The below corresponds to the three criteria set out in A.1.1.4 of Ofwat Final methodology Appendix 9 (Setting Expenditure Allowances).

There is no third-party funding for this Enhancement Case.

5.1 Proposed Price Control Deliverable (PCD)

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

The work set out in this investment case has oversight from NRW as it is included in the NEP. A scheme to remove the risk posed by the failing main must be delivered to protect a sensitive environment from pollution. The NEP has a well-established mechanism for oversight, reporting and control.

However, given the size of the project and the current uncertainty within the cost estimation linked to the unique characteristic of the scheme we propose that a PCD should also be applied to cover the contingency allowance which has been included in the project. The proposed structure for the PCD is set out below.

We acknowledge that this mechanism does not follow the usual structure for a PCD, and that oversight from NRW already exists. We do however believe that given the scale of contingency within the project cost it is appropriate to provide additional protection to customers. We will work with Ofwat to refine the details of our proposed work and finalise an appropriate mechanism of control.

Customer Facing Description of Enhancement Case	**Protecting Multiple Adjoining SSSIs near the SECS Main**
Short Description of Enhancement Case / PCD Area	**SECS Main**
PCD Number	**PCD9**
Summary of deliverable	**NEP Output delivered**
Description	The SECS rising main transports sewage for treatment at Nash wastewater treatment works (WwTW). The main runs for 32.7km through the Gwent Levels with 10 pumping stations located along the route. Since its construction our national understanding of the sensitivity of this environment has increased, with further sections of the pipeline route being designated as SSSI. Due to the condition of the main there have been several failures leading to pollution incidents. Operational mitigation plans have been put in place to reduce the consequences of future failures, but investment is required to create a step reduction in pollution risk to this sensitive environment. The need to invest is supported by NRW in the NEP.

	Given the complex nature of the environment in which work will be delivered, to address this risk, we are proposing two potential options. The first is a pipeline route, the second a pipeline and treatment option. The pipeline only solution is preferred and is lower cost than the pipeline/treatment option but because of uncertainty in delivery it has been assigned a £22.626M contingency. This brings both options to the same forecast cost. Option 1: 'SECS Main Complete Replacement' – 32.7km of main pipeline with total cost of £77.556M including £22.626M of contingency (TotEx, post-efficiency); or Option 2: 'New WwTW at Magor and replacement of part of the SECS Main' – 3.7km of main pipeline replaced, 13.4km abandoned, with total cost of £77.556M (TotEx, post-efficiency)
Measurement and Reporting	We will measure the delivery of this scheme in two ways: Firstly, delivery against the NEP requirement overseen by NRW. This requirement has an agreed reporting and tracking structure for oversight by NRW. The requirement to draw on the £22.626M contingency fund. This will be reported on an annual basis to Ofwat with a 'true-up' at the end of the AMP. We will report on an open book basis.
Conditions on scheme	NA
Assurance	The company will agree appropriate assurances arrangements with Ofwat as part of Final Determination.
Price control deliverable payment rate	The company will repay to customers any funding from the £22.626M contingency allowances which has not been required to enable construction. The company is presenting three scenarios for the PCD mechanism. Scenario 1: If the company undertakes the preferred Option 1 in relation to the replacement of the 'SECS Main Complete Replacement' it will repay a sum equal to the contingency value. This is estimated to be £22.626M (the "Contingency Sum"). Scenario 2: If the company undertakes the preferred Option 1 but is required by NRW to alter its route or change the methods of construction assumed a portion of the Contingency Sum will be used to fund these risks, with any unused funding returned to customers. Scenario 3: If the company undertakes reserve Option 2 in relation to the construction of a 'New WwTW at Magor and replacement of part of the SECS Main' no Contingency Sum will be repayable.

	£22.626M contingency returned
Scenario 1: Option 1 fully delivered as per planned route	Yes
Scenario 2: Option 1 fully delivered but with changes to the planned route and construction method	A portion of the contingency returned based on an open book assessment of costs
Scenario 3: Option 2 delivered	No

Under the open book contracting, widely used in parts of the public sector, cost control is not through identifying a fixed price, but through frequent and transparent reporting of costs, to ensure that actual costs are in line with projections.

We have profiled the contingency in the table below, based on the profile of the proposed investment offset by 1 year, and will report on an annual basis. Any required adjustment will be made at the end of the period.

	Year 1	Year 2	Year 3	Year 4	Year 5
% of Contingency allowed		5%	21%	42%	32%

The calculation of any funding returned to customers will consider the initial profile of spend and the time value of money.

Impact performance in relation to performance commitments	The company has performance commitments in relation to protecting and enhancing biodiversity, reducing serious pollution events, and more general pollution events. SECS Main Pollution Avoided per year (once constructed in last year of AMP). • 1.7 Category 3 failures • 0.7 Category 1 failures A reduction in bursts following completion of works associated with the SECS main will directly result in protecting biodiversity in our area and reduce risk of failures against our pollution performance measures.

Oversight from NRW will cover full delivery of the scheme. The PCD will protect customers form the uncertainty within the delivery mechanism.

The benefit of avoiding pollution incidents will be covered by the performance commitment for serious pollution incidents and improving biodiversity net benefit.

6. Appendices

Appendix A

Table 7- Record of SECS Main Failures since April 2013

Date	WIRS Ref	Location	Root Cause	Primary Cause	WIRS Confirmed Category (Water)
06/06/2013	-	AREA of BLACKBIRD ROAD	Other	Other Flood	-
19/09/2013	-	BLACKBIRD RD, CALDICOT, NP26 5RF	Not Assigned	Other Flood	-
18/10/2013	-	BLACKBIRD RD, CALDICOT, NP26 5RF	Fracture	Other Flood	-
24/11/2014	1296900	Blackbird Road, Caldicot, NP26	Rising Main	Collapse	Category 4
09/03/2015	-	BROOKFIELD, GOLDCLIFF, NEWPORT	Not Assigned	Other Flood	-
11/01/2016	1402120	13 Black Rock Road, Caldicot, NP26 5TW	Foul Sewer	Collapse	Category 4
28/12/2017	-	13, BLACK ROCK RD, PORTSKEWETT, CALDICOT	Partial Collapse	Other Flood	-
28/12/2017	1706650	Southbrook Farm, Sudbrook, Caldicott NP26 5SR	Rising Main	Collapse	Category 4
04/01/2018	1800068	Magor SPS, Caldicott NP263EE	Rising Main	Collapse	Event
09/01/2018	1800142	Portskewett, Caldicott NP26 5SW	Rising Main	Collapse	Event
28/01/2018	-	13, BLACK ROCK RD, PORTSKEWETT, CALDICOT	Partial Collapse	Serious External Flood (SEF)	-
12/04/2018	1801984	SECS Main, South of Magor SPS, Magor NP26 3EE	Rising Main	Collapse	High - Significant
25/01/2019	1900581	Nash WwTW, Nash Road West, Newport NP18 2BZ	Rising Main	Collapse	Low
30/07/2019	1905036	Mabey Bridge Site, Chepstow, NP16 5PF	Rising Main	Collapse	Event
22/03/2020	2002104	SECS, Near Sea Wall, Magor NP26 3EE	Rising Main	Collapse	Low
26/03/2020	1793274	Beachley Road, Tutshill, NP16 7DL	Foul Sewer	Blockage	Event
15/04/2020	2002611	Mill Farm, Magor, Newport NP26 3EE	Rising Main	Collapse	Event
11/05/2021	-	RED HOUSE FARM, GOLDCLIFF, NEWPORT	Not assigned	Routine Inspection identified failure	-
29/07/2021	-	THE MEADOWS, CHAPEL RD, GOLDCLIFF, NEWPORT	Not assigned	Routine Inspection identified failure	-
04/01/2022	-	25, TAFF RD, CALDICOT	Not assigned	Manhole Failure	-
24/01/2023	2300636	The Causeway, Magor	Rising Main	Burst Rising Main	High - Significant
03/02/2022	-	Location 333.808, 184.029	Partial Collapse	Routine Inspection identified failure	-
20/03/2023	2302053	Magor Pill, Caldicolt	Rising Main	Collapse	High - Significant
09/04/2023	-	10, BLACKBIRD RD, CALDICOT	Unknown	Other Flood	-
13/06/2023	-	27, BRIDGE ST, CHEPSTOW	N/A	Routine Inspection identified failure	-

From 2017 there was a change in NRW pollution categorisations; High - Major, High - Significant, Low & Event (broadly comparable to the previous CAT1-4).

Appendix B

The table below shows the total enhancement costs in Amp 8 for this Enhancement Case. The Ofwat drivers this Enhancement Case maps to are:

- Catchment management - habitat restoration; (WINEP/NEP) wastewater CapEx, OpEx and Totex (CWW3b.85 to CWW3b.87)

Other habitat restoration drivers in the NEP and WINEP also contribute to these drivers.

Driver Ref	Year in AMP8					
	Year 1	Year 2	Year 3	Year 4	Year 5	Grand Total
CWW3b.85 CapEx	£3.853M	£15.658M	£32.253M	£24.344M	£0.000M	£76.108M
CWW3b.86 OpEx	£0.000M	£0.126M	£0.336M	£0.493M	£0.493M	£1.448M
CWW3b.87 TotEx total	£3.853M	£15.784M	£32.589M	£24.837M	£0.493M	£77.556M

Table 8 - Total TotEx in AMP8 Plan in 2022/23 prices (post efficiency)

What We Will Deliver: This Enhancement will deliver replacement of 32.7km of rising main sewer within the Gwent Levels.