River Basin Catchment Summary

Wye

How to read this document
This document outlines detail relating to the planning areas of our DWMP.

The document has been structured to begin by outlining the information for Strategic Planning Units (Level 2) and then proceeds onto detailing the Tactical Planning Units (Level 3).

The reader is advised to scroll down the document until they find the appropriate section.

1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how we as Dŵr Cymru Welsh Water (DCWW), will manage and improve our assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment.

1.1 Catchment Information

Wye (see Figure 1) consists of 163 wastewater catchments with a total population of 796636. There is a total sewer length of 2500km, where 1149km is associated to the foul system, 483km is associated to the surface water system and 830km is associated to the combined system. There are 163 Wastewater Treatment Works (WwTW), 453 Sewerage Pumping Stations (SPSs), and 417 Combined Storm Overflows (CSOs) across this river basin catchment level.

The main river in the Wye is the River Wye, which stretches from Hereford to Chepstow, covering the Gloucestershire, Herefordshire and Monmouthshire counties.

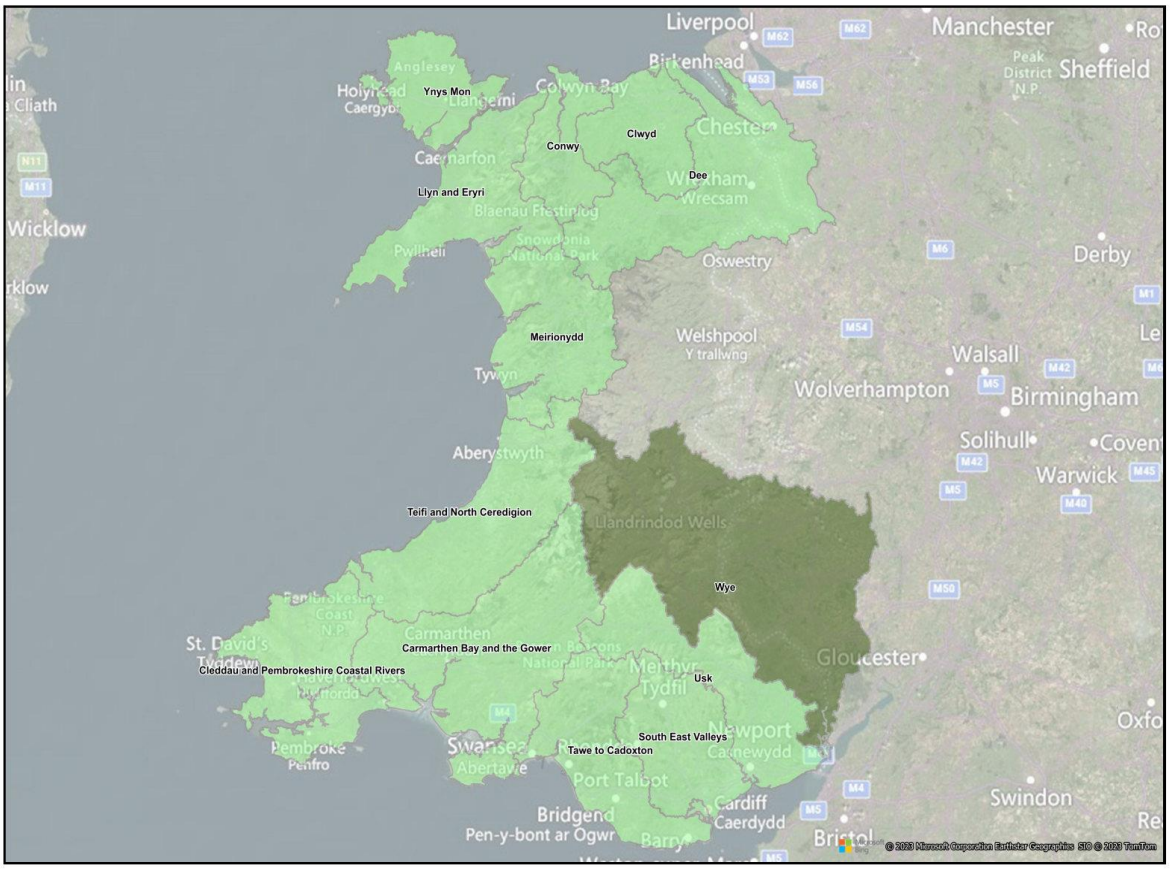


Figure 1 - River basin location detailing associated strategic planning areas

Data is available from https://www.openstreetmap.org/copyright © OpenStreetMap contributors

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans. Table 1 details the main opportunities we have identified but this is not intended to be exhaustive. Note that these stakeholders have their own planning processes and plans which do not necessarily align with those of DCWW.

In collaboration with our stakeholders, we have produced the following documents at the completion of each stage of the DWMP:

• Strategic Context: 'Introduction to the Drainage and Wastewater Management Plan', a Strategic Context document with details of the six national planning objectives and the DWMP action plan. A customer overview of the 'Introduction to the Drainage and Wastewater Management Plan', document which summarises what is included in the DWMP and why and how we created it has also been published.
• Risk Assessment: 'Where we want to work with you', which details our vision for future joint working on current and future risks.

• Options Development: An Options Development document is currently being developed with stakeholders and will be published later in 2023. This document will communicate how we have developed options that apply across all areas.
• Programme Appraisal: We are developing a 'Programme Appraisal' document in conjunction with our Options Development Option which will be published in 2023 and will outline how we take preferred solutions from the Options Development Process and develop a programme of work and timescales to implement them.
• Consultation: We produced this DWMP Plan, along with supporting documents to help stakeholders and customers make informed decisions at the consultation stage. Supporting documents to the DWMP include: a Customer Version DWMP; a DWMP brochure and questionnaire and a non-technical document. These were all published for the public consultation between July and October 2022.
• Following on from the consultation, we have produced a Statement of Response and a customer version Statement of Response to provide our stakeholders and customers with our responses to the items raised as part of the consultation.

Further information on how we are and will continue to engage with stakeholders can be found in the 'How have we engaged with customers and stakeholders?' chapter of the Main Plan.

Plans	Stakeholder Engagement	Responsible Bodies/Primary Stakeholder
Local Management Plans	The main rivers in the Wye catchment are the Ithon, Frome and Wye. The River Wye has many significant tributaries including the Elan, Irfon, Ithon, Lugg and Monnow. The Wye is an internationally important habitat, reflected in its designation as a Site of Specific Scientific Interest (SSSI) and Special Area of Conservation (SAC). Examples of projects in the management catchment consist of: 1. WISE (Wye, Ithon, Severn Ecosystem) Project 2. Lugg Living Landscapes 3. The Herefordshire Wye & Lugg NFM 4. Eradicating Invasive Non Native Species	Natural Resources Wales Environment Agency Local partnerships
Flood Risk Management Plans (FRMP)	FRMPs are managed by Natural Resources Wales (NRW) and the Environment Agency (EA) and three are produced, the Severn, the Dee and the Western Wales. The local flood risk management strategy consists of the following general objectives: 1. Providing an effective and sustained response to flood and coastal erosion events. 2. Establishing effective routine maintenance regime. The FRMP for the Severn River Basin District which covers the Wye catchment can be found on the NRW website.	Welsh Government Water companies Coastal Groups (local authority led) Natural Resources Wales Environment Agency Lead Local Flood Authorities

Shoreline Management Plans (SMP)	Shoreline Management Plans (SMP) SMP 19 covers the Severn Esturary and is lead by Monmmouthshire Council. The overall objective is to prioritise flood risk management measures so that advice is made available and provided to utility companies in order to protect critical infrastructure, development control advices and enable flood warning investment. Further information can be found here in relation to Severn Estuary here : https://www.newport.gov.uk/documents/Planning-Documents/LDP-2011-2026/River-Usk-Strategy---Low-Res.pdf in relation to the 2011 to 2016 River Usk Strategy and SMP2 main document can be found here : https://severnestuarycoastalgroup.org.uk/shoreline-management-plan/smp2-action-plan/	Coastal Groups (local authority led) County Councils Lead Local Flood Authorities
River Basin Management Plan (RBMP)	River Basin Management Plans (RBMP) set out how a combination of organisations and parties work together and set out to improve the catchments water quality and environment. The RBMPs can be found here: https://www.gov.uk/guidance/severn-river-basin-district-river-basin-management-plan-updated-2022	Water companies Coastal Groups (local authority led) Natural Resources Wales Welsh Government Environment Agency DEFRA
Flood and Coastal Erosion Risk Management Programme (FCERM)	There are a total of 6 strategically outlined FCERM schemes planned in the region from 2021 to 2022. This is illustrated in Figure 2.	Coastal Groups (local authority led) Natural Resources Wales Welsh Government Environment Agency DEFRA
Local Development Plans (LDPs)	The latest local development plans have been incorporated into the plan and future iterations of LDPs will be amended into the DWMP in future cycles.	Local Councils
Other Stakeholders and Non-Governmental Organisation (NGOs)	There are a range of other stakeholders of varying interests regarding water in this region including national charities and organisations, as well as other authorities (see right).	The Coal Authority Lead Local Flood Authorities

Table 1 - Stakeholder opportunity partnerships

The 'Where we want to work with you' document, which further explains our stakeholder engagement plan, can be found in the Risk section of the Welsh Water DWMP page: https://www.dwrcymru.com/en/our-services/wastewater/drainage-and-wastewater-management-plan

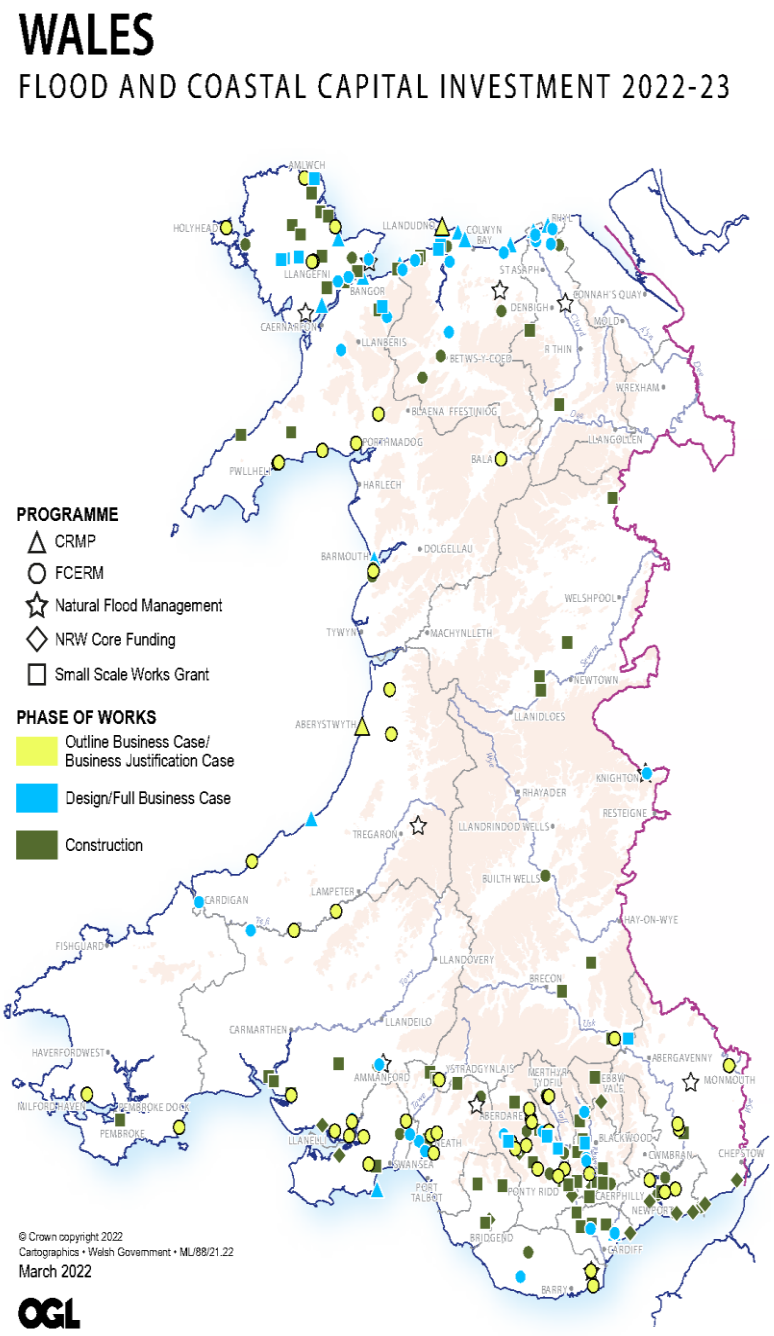


Figure 2 - Flood and Coastal Investment overview

Data is available from: https://gov.wales/flood-and-coastal-erosion-risk-management-programme-2022-2023

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much the population will change by, the degree to which climate change will impact Wales and areas of England which are within our operating region, and how surface water connected to the sewer network may increase the amount and rate at which rainfall drains into our sewers.

Urban creep is the term used to explain loss of green spaces. For example, when new driveways or house extensions are built. This often leads to more rainwater entering sewers. Our forecasts, which are based on a UKWIR study, suggest that urban creep will add up to 0.63 metres squared of impermeable area per house per year.

A UKWIR report on urban creep can be found here, Impact of Urban Creep on Sewerage Systems.

Climate change is predicted to increase the intensity of storms by around 15% in this region. This is based on a 2017 UKWIR report, which used a high-resolution climate model for the UK to predict changes in design storm intensities for a high emissions scenario (RCP8.5). In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall is predicted to happen more frequently.

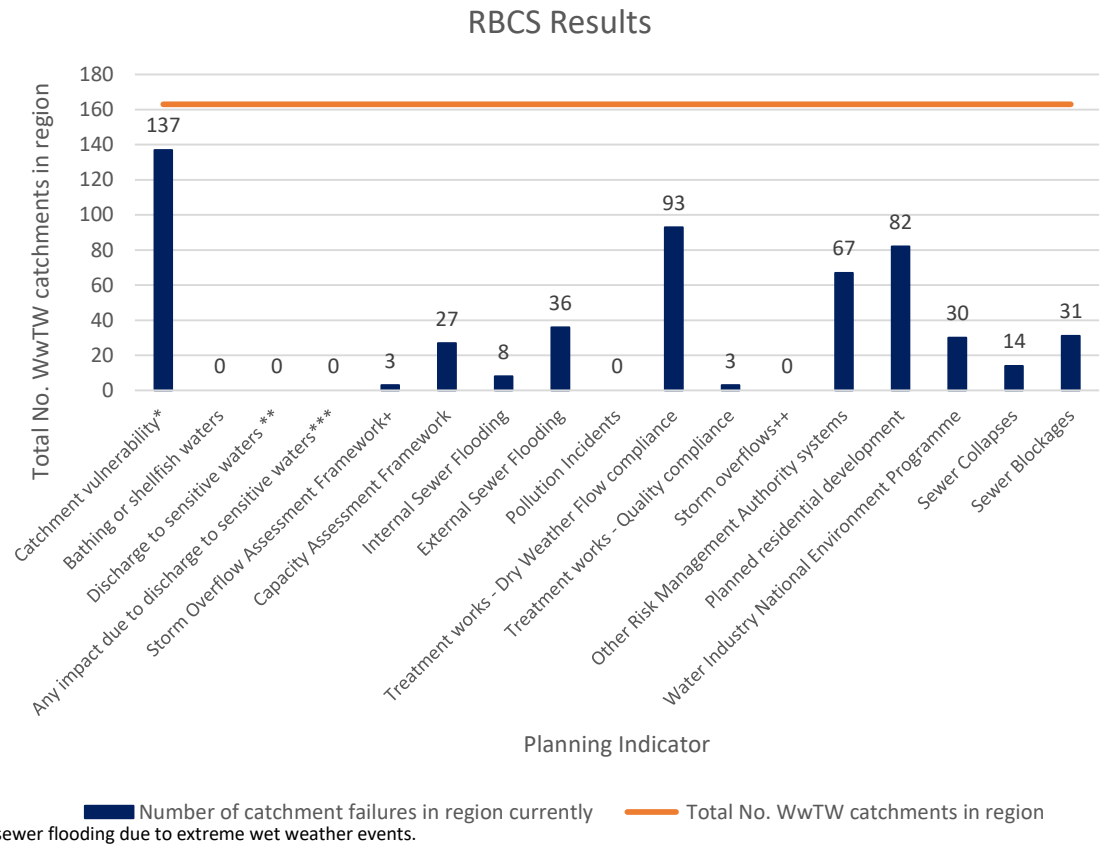
Future predictions of growth in the area have been estimated based on the average between the rate of properties that have been built in the past 10 years and the rate that the local development plan predicts houses should be built. In addition to this, we have accounted for the changes in the existing population by the change in the number of people living in an average property in the area.

Major growth is centred around Cardiff with the transition of population away from the valleys towards the city, combined with the reduction of people per property which leads to an overall reduction in the region. The population in the Wye region is set to decrease to 693700 by 2050, a change of -13% based on our future projections. However, there are major developments in localised areas that will contribute to future pressures on the network, including Monmouth, Fairfield Mabey, Chepstow with 350 units and Wonastow Road, Monmouth with 342 units. For a further breakdown of population change in the L2 region, please see the L3 reports.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. The results are shown in Figure 3. Descriptions of the indicators can be seen in Appendix B. All catchments are passed through to a more detailed risk assessment (BRAVA).

For the Wye region the biggest risks indicated by the RBCS are region vulnerability (based on a vulnerability assessment of flooding due to local characteristics, such as topography) followed by dry weather flow treatment works compliance.



* To sewer flooding due to extreme wet weather events.

** Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.

*** Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.

+ Frequency investigation triggered.

++Overflow risks not covered by other indicators.

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment. Figures 4 and 5 illustrate the outcome of the BRAVA assessment in Wye.

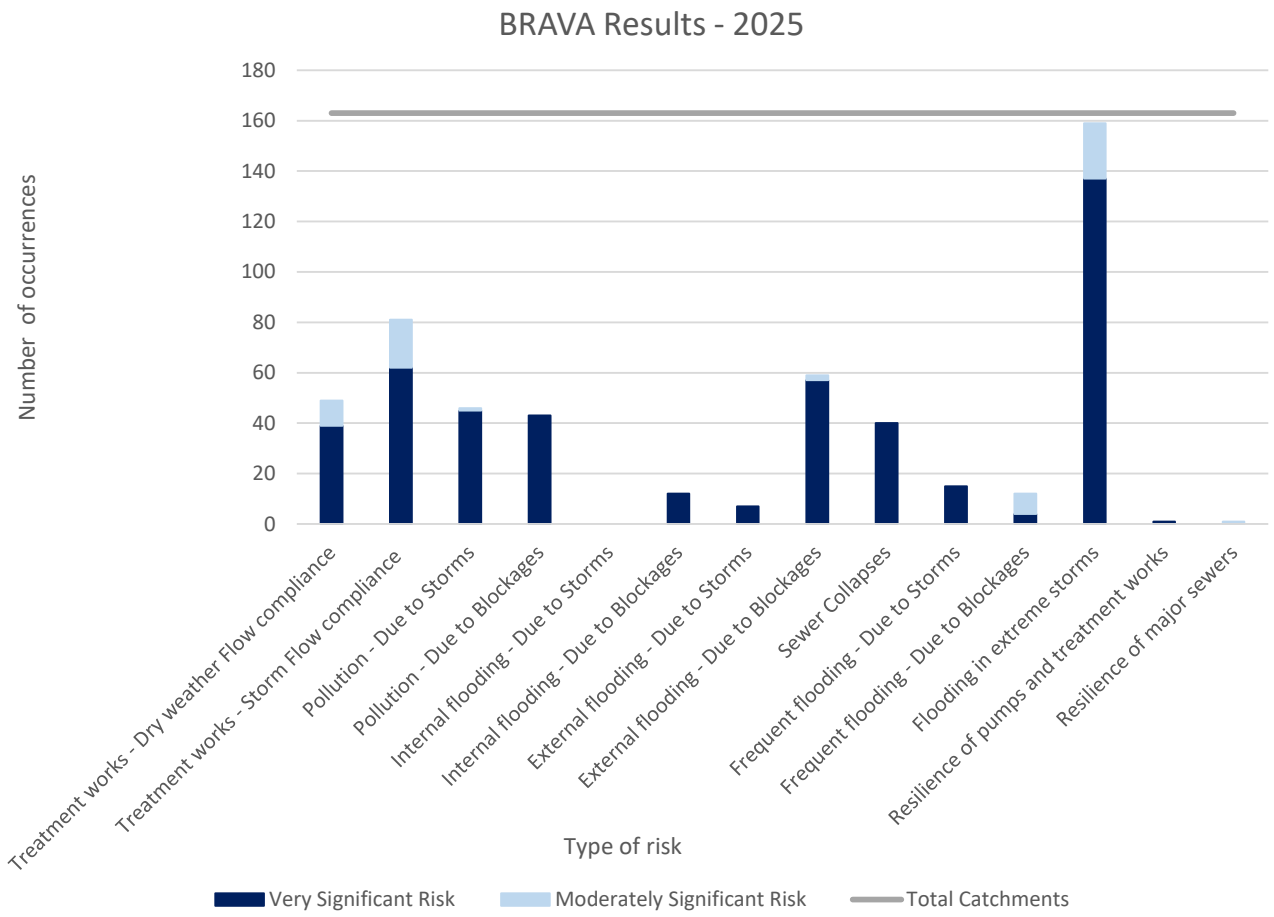


Figure 4 - BRAVA 2025 Summary

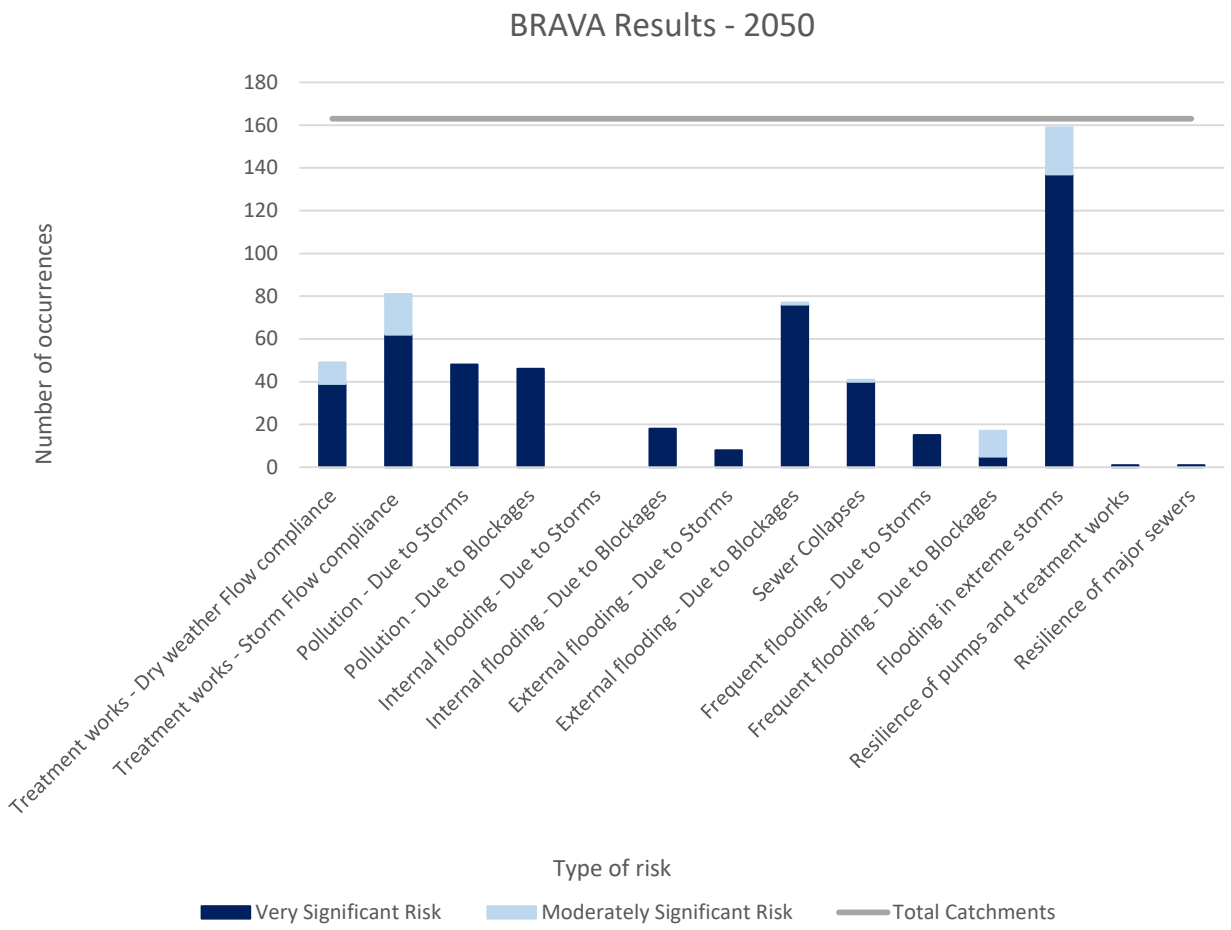


Figure 5 - BRAVA 2050 Summary

In both 2025 and 2050, risk of Flooding in extreme storms is the biggest risk in the Wye region.

Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment.

From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to be in the Extended or Complex category and required a more detailed option assessment.

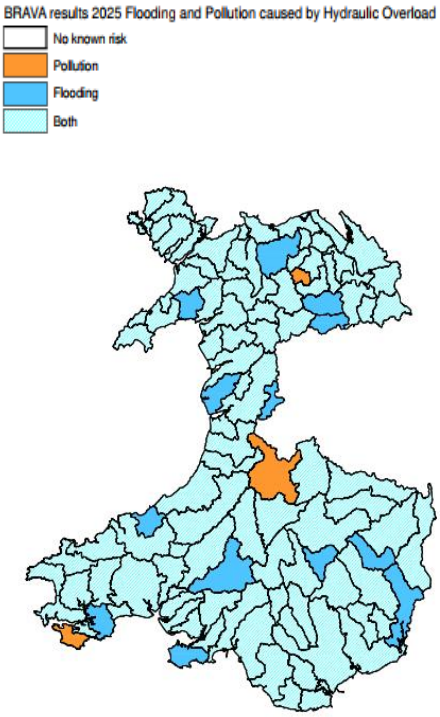


Figure 6 - Associated Strategic Planning Area priority (2025)

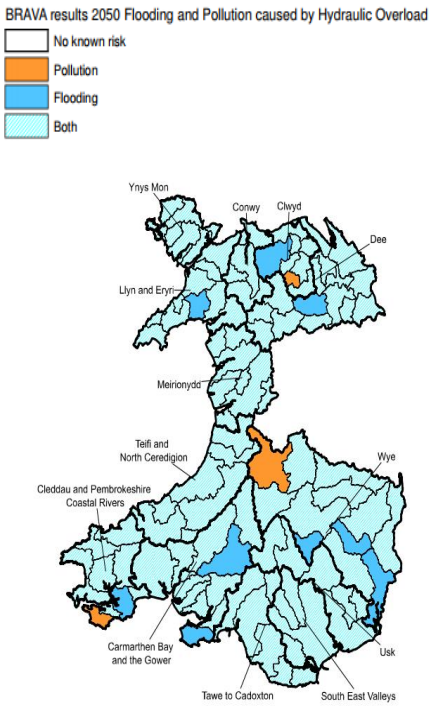


Figure 7 - Associated Strategic Planning Area priority (2050)

3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L2 Area	Total	Good	Moderate	Poor	Bad
Wye	128	33	71	21	3

Table 2 - WFD status'

4.0 Supply Demand

The supply-demand balance is an assessment of overall capacity of the network versus the current consented capacity of the treatment works. The current discharge consent includes the quality parameters which are fundamental to the current discharge consent. The presentation of the supply demand balance is showing the status of catchment in terms of the dry weather components of a network when added together compared to the current discharge consent today and into the future. In areas where this assessment shows a risk that the capacity of the network is greater than the capacity of the current discharge permit then an assessment into the route cause is required. The resultant solution could be a need to alter the discharge permit; upgrade of the treatment work; or an upgrade of stretches to the network.

Table 3 shows the supply-demand assessment for this catchment. Where a region may not have adequate capacity, it is flagged dark blue for further investigation. There may be local incapacity issues at individual treatment works within the catchment.

L2 Area	2025	2030	2035	2040	2045	2050
Wye						

Pass | Close Fail | Close Pass | Fail

Table 3 - Supply Demand Balance

Table 3 shows that for the Wye region the balance between supply and demand is currently acceptable across the region and is projected to remain so through to 2050. However, it should be noted that local issues are present for some of the associated L3 regions. Further detail is provided in the relevant L3 summaries.

5.0 Options

To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment's rainfall in just a few storms. In sewer modelling these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon we have tested various types of schemes, and combinations of schemes, to ensure a robust plan is delivered. Figure 8 shows our Journey Plan. This describes the scheme types that are most likely to be beneficial in this region and the timescales over which solutions types might be implemented which can reduce risks to customers and the environment. We can reduce rainwater entering our sewers from homes (domestic surface water disconnection), businesses or paved areas (commercial and paved surface water disconnection) or from roads (highway area disconnection). Sometimes water gets into sewers through small gaps that can occur in ageing sewers - by replacing or repairing the sewers we can reduce the likelihood of this happening (groundwater infiltration into sewers reduction). Reducing how much water homes and businesses use can also help to reduce the risk to people and the environment (personal water usage reduction or trade flow reduction).

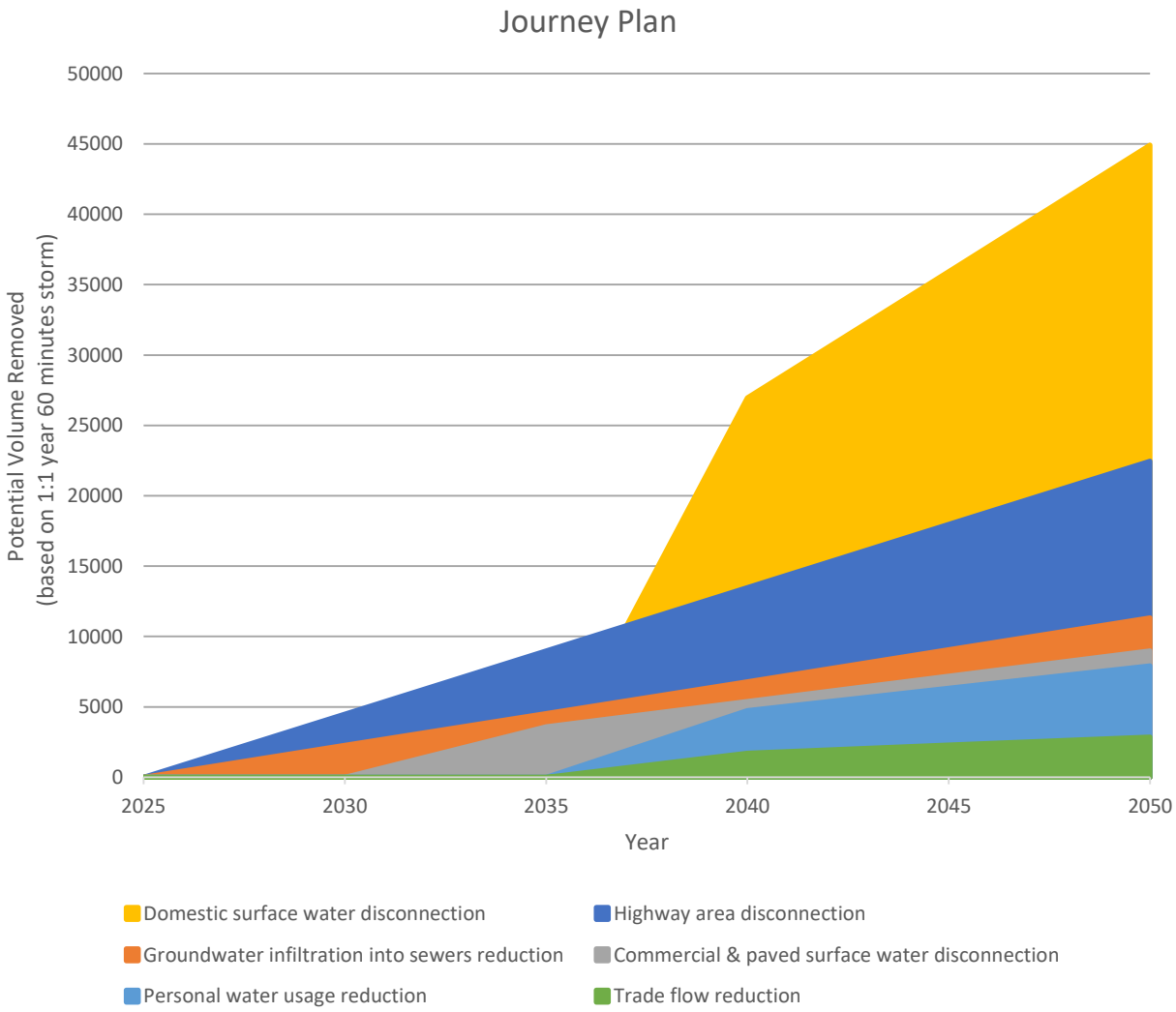


Figure 8 - Journey Plan

The measures within the Journey Plan include all green infrastructure and surface water removal techniques. We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding.

Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence. We use the size of a storm event that has the probability of occurring once every 30 years.

Table 4 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

At the time of publishing, over 200 assessments of the environmental impact of our storm overflows have been completed and by the end of 2025 this should rise to over 750 assessments. These assessments are made at individual assets across the company area. Our approach follows the Storm Overflow Assessment Framework Stage 2 assessments and includes assessment of aesthetic and visual impacts alongside water quality impact (through a combination of invertebrate or water quality modelling). We will provide an update to the area summaries when the output data becomes available.

Table 5 highlights the potential costs in this region from preventing flooding from manholes scenarios. The assessment includes both the size and cost of potential mitigation measures.
Costs in Table 4 are in addition to those in Table 5, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£215,000,000.00	£338,500,000.00
40 spills in a typical year	£74,000,000.00	£66,000,000.00	£62,000,000.00
20 spills in a typical year	£121,000,000.00	£118,000,000.00	£129,000,000.00
10 spills in a typical year	£163,000,000.00	£161,000,000.00	£180,000,000.00
0 spills in a typical year	£460,000,000.00	£473,000,000.00	£508,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	1.26	1.47	1.61

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 4 - Summary of Combined Storm Overflow Option Investment Strategy Costs

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£18,000,000.00	£23,000,000.00	£32,000,000.00
External escapes in gardens	£14,000,000.00	£18,000,000.00	£27,000,000.00
Escapes in highways	£88,000,000.00	£110,000,000.00	£177,000,000.00
All other remaining flooding	-	£145,000,000.00	£562,000,000.00
Total	£120,000,000.00	£296,000,000.00	£798,000,000.00

*Internal escapes - All flooding that results in flooding within a property is stopped

*External escapes in gardens - All flooding within the curtilage of the property is stopped

*Escapes to highways - All flooding from DCWW systems impacting public highways is stopped.

Table 5 - Summary of Flooding Option Investments Strategy Costs

Costs in Table 4 and 5 are strategic indications needed to bring our entire network up to the level of protection required to be resilient for future risk and demands. The range of scenarios provides a choice for understanding and discussion of future direction.

We are beginning to break down the investment indicated in Table 4 and 5 by creating practical schemes ready for delivery. These schemes are designed as traditional engineering solutions, sustainable or green infrastructure, or a combination of both. They have been analysed in terms of their long term benefit, environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the Habitat Directive, as a priority against pollution and flooding events. Appendix A shows the number of solutions within this river basin catchment.

A summary of the options considered within suitability tests can be found in the Main Plan alongside the methodology. More detailed information can be seen in the Level 3 reports.

If you would like to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please contact us at DWMP@dwrcymru.com.

We will continue to work with the Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with the Welsh Government and our regulators.

Appendix A - Schemes in L3 catchment within L2 region

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

Table A1 - Number of schemes in L3 catchment within L2 region

L3 Zones	No. Schemes
R Lugg - conf R Arrow to conf R Wye	0
R Lugg - conf Norton Bk to conf R Arrow	0
R Monnow - conf Afon Honddu to conf R Wye	0
R Wye - Hampton Bishop to conf Kerne Br	0
R Arrow - conf Gilwern Bk to conf R Lugg	0
R Wye - conf R Irfon to Brewardine Br	0
R Wye - conf Walford Bk to Bigsweir Br	0
R Dore - source to conf Worm Bk	0
R Wye - conf Afon Elan to conf R Ithon	0
R Ithon - conf Camddwr Bk to conf R Wye	0
Afon Chwefru - source to conf R Irfon	0
Afon Llynfi - conf Dulas Bk to conf R Wye	0

Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WwTW Q compliance	Historical measure relating to the performance of the treatment works (discharge permit compliance (numeric)).

WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.

DWMP Strategic Planning Area Summary

Afon Chwefru - source to conf R Irfon

1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how we as Dŵr Cymru Welsh Water (DCWW), will manage and improve our assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The Afon Chwefru - source to conf R Irfon planning catchment lies within the Wye catchment (see Figure 1).

The Afon Chwefru - source to conf R Irfon catchment covers an area stretching from Beulah and Builth Road in the north as far as Llanwrtyd-Wells and Tirabad in the south. The geography of the catchment is predominantly forest and rural.

There are several main rivers within the L3 including the River Irfon and River Wye, however the river basin district of this catchment is the Severn. The catchment covers several major urban areas including Beulach, Llanwrtyd-Wells, Llangammarch Wells and Garth.

The largest WwTW is Llanwrtyd Wells which serves a residential population of 639.

This planning catchment consists of 8 wastewater catchments (see Figure 2). There is a combined population of 1727, this is set to decrease to 1600 by 2050, a change of -9%. There is a total sewer length of 21km, with a foul sewer length of 17km, a surface water length of 0km and a combined sewer length of 2km. There are 8 Wastewater Treatment Works (WwTW), 5 Sewerage Pumping Stations (SPSs), and 6 Combined Storm Overflows (CSOs) across this strategic planning area.

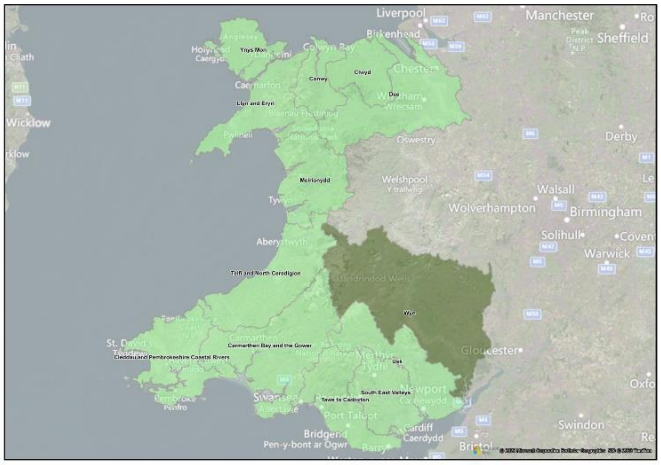


Figure 1 - River basin location detailing the strategic planning area

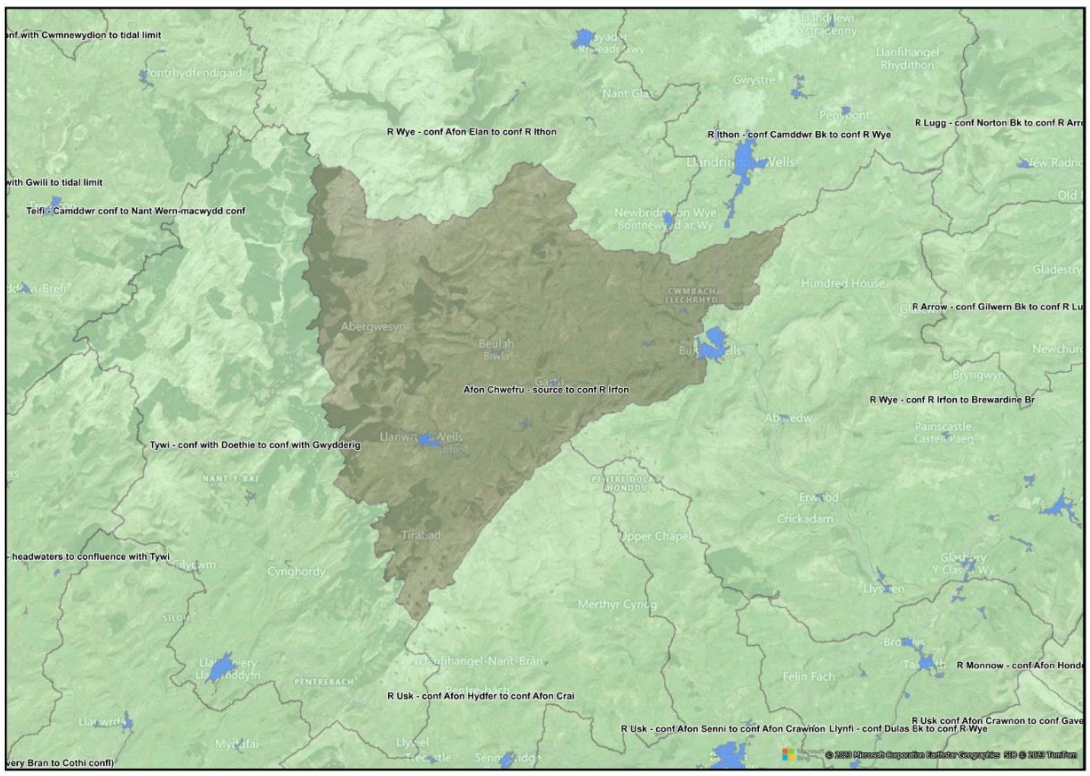


Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans.

Further information on how we are and will continue to engage with stakeholders can be found in the 'How have we engaged with customers and stakeholders?' chapter of the Main Plan.

Stakeholder Engagement Opportunities
Stakeholder engagement meetings have been held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. No multi-agency schemes have been identified at this stage, however engagement has been made to establish alignment with stakeholder plans, policies and to explore the concept of joint working going forward.

Table 1 - Stakeholder opportunity partnerships

The 'Where we want to work with you' document, which further explains our stakeholder engagement plan, can be found in the Risk section of the DCWW DWMP page found here:

Drainage Wastewater Management Plan

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England which are within our operating region, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

Urban creep is the term used to explain loss of green spaces. For example, when new driveways or house extensions are built. This often leads to more rainwater entering sewers. Our forecasts, which are based on a UKWIR study, suggest that urban creep will add up to 0.63 metres squared of impermeable area per house per year.

A UKWIR report on urban creep can be found here, Impact of Urban Creep on Sewerage Systems.
Climate change is predicted to increase the intensity of storms by around 15% in this region. This is based on a 2017 UKWIR report, which used a high-resolution climate model for the UK to predict changes in design storm intensities for a high emissions scenario (RCP8.5). In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the Afon Chwefru - source to conf R Irfon region is set to decrease to 1600 by 2050, a change of -9% based on our future projections. For a further a breakdown of population change in the L3 region please see the L4 report.

There are major developments in localised areas that will contribute to future pressures on the network, with the largest including OS 2664 Caemawr, off Ffos Road with a proposed 47 units, and OS 1451 Meadow View, Station Road, with a proposed 19 units.
The Core Management plan for the River Wye SAC provides an overview of the conservation required on site. The plan details the drive in enhancing the social, economic and natural value of the area, by summarising conservation objectives with regards to maintenance, restoration and future connections between the wider ecology and connecting surroundings. The plan can be found here :

Core Management Plan

Future predictions of growth in the area have been estimated based on the average between the rate of properties that have been built in the past 10 years and the rate that the local development plan predicts houses should be built. In addition to this, we have accounted for the changes in the existing population by the change in the number of people living in an average property in the area.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. The results are shown in Figure 3. Descriptions of the indicators can be seen in Appendix B. All catchments passed through to a more detailed risk assessment (BRAVA).

For this strategic planning area the biggest risks indicated by the RBCS are firstly Catchment vulnerability, followed by Other Risk Management Authority systems.

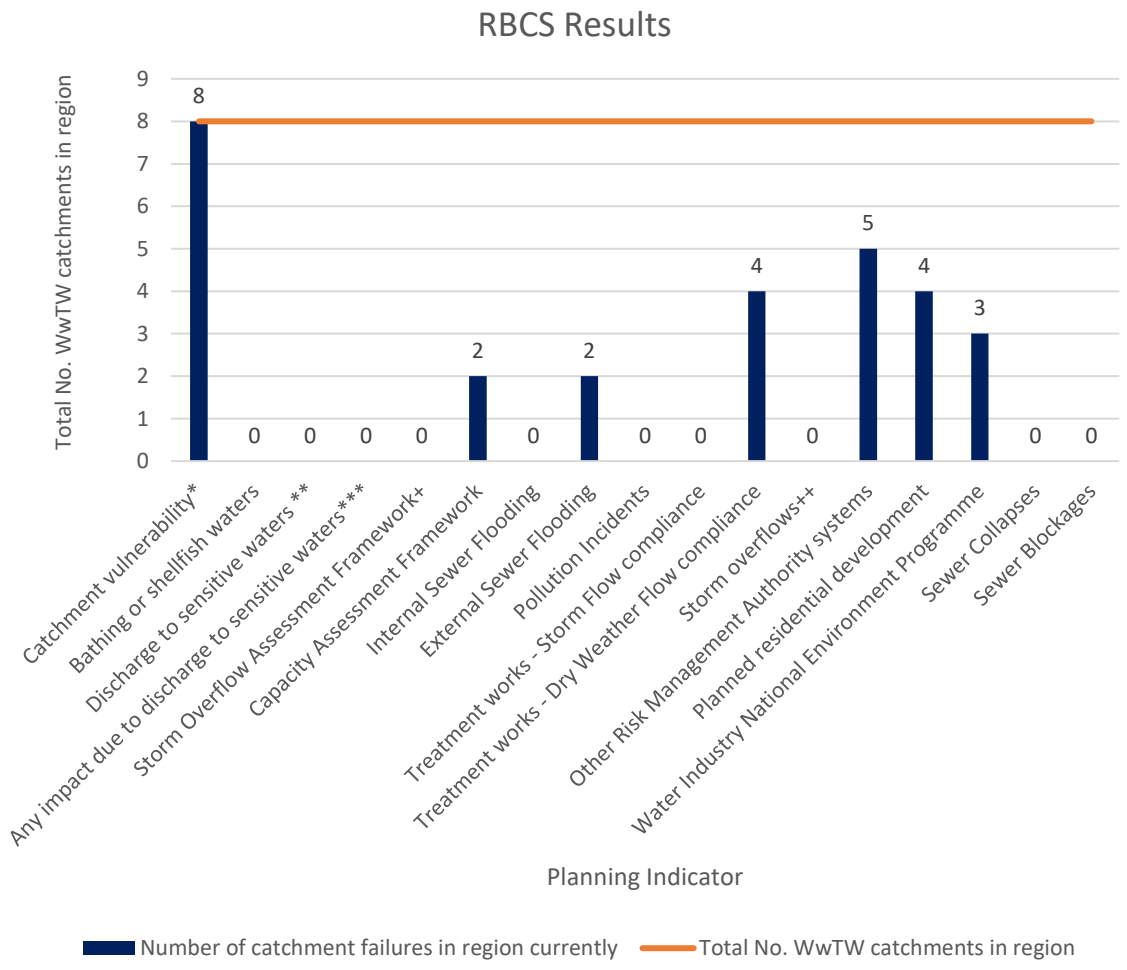


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Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment. Figures 4 and 5 illustrate the outcome of the BRAVA assessment for this strategic planning area.

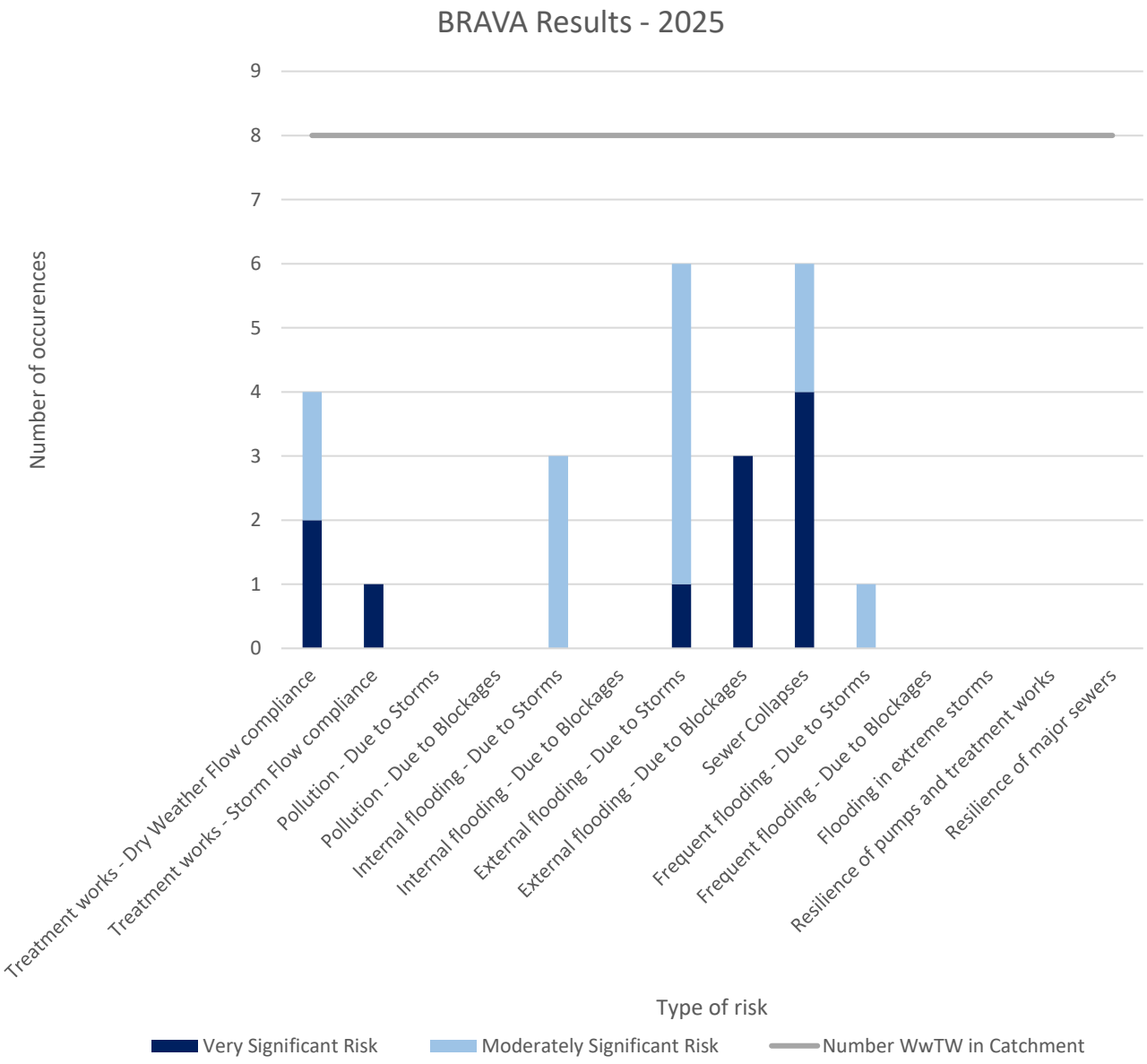


Figure 4 - BRAVA 2025 Summary

In 2025, Sewer Collapses followed by External flooding - Due to Blockages and External flooding - Due to Storms are the biggest risks in this strategic planning area.

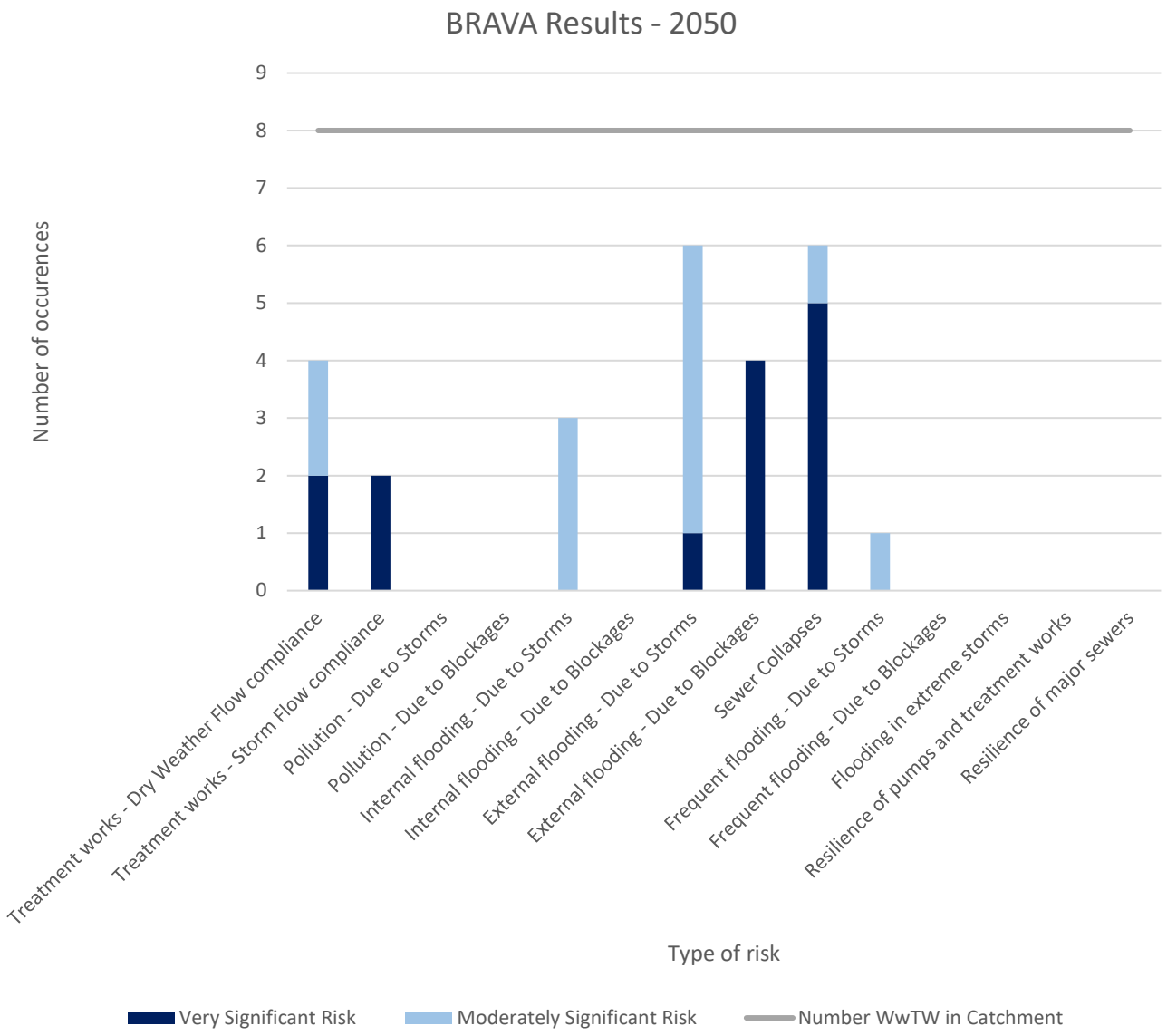
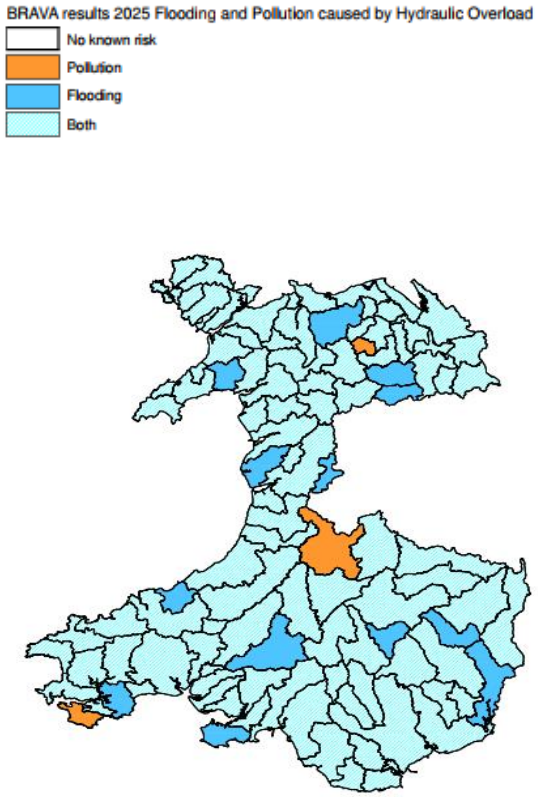


Figure 5 - BRAVA 2050 Summary

In 2050, Sewer Collapses followed by External flooding - Due to Blockages are the biggest risks in this strategic planning area.

Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment.

From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to require a standard option assessment methodology.



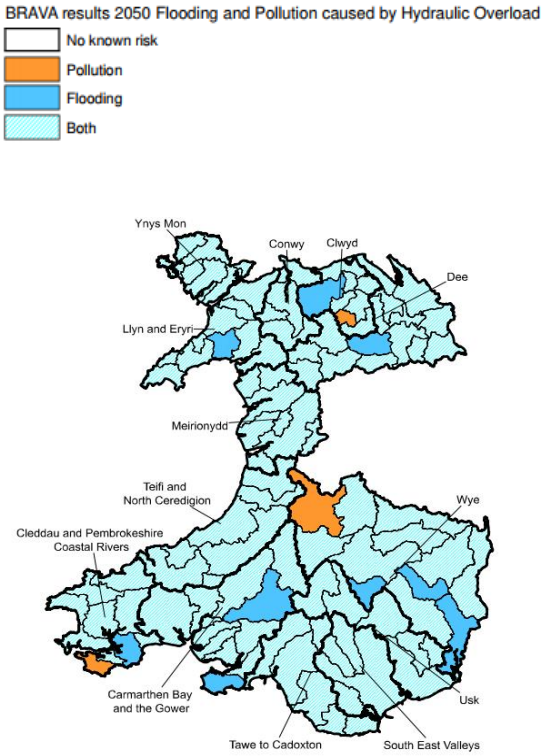


Figure 6 - Associated Strategic Planning Area priority (2025)

Figure 7 - Associated Strategic Planning Area priority (2050)

3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
Afon Chwefru - source to conf R Irfon	11	3	7	1	0

Table 2 - WFD status'

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

The wet weather assessment takes pass forward flow (PFF) consent values, where available, as an indication of WwTW capacity, and estimates the amount of incoming flow the treatment works is able to treat across a year. It uses the same estimates as the DWF assessment for current flow, but also includes an estimate as to how much rainfall the WwTW might be able to deal with in the future, by including growth, climate change and creep. Climate change is expected to change the periodicity and amount of rain across a "typical" year. Creep, the gradual misconnection of storm sewers to the foul sewer network, is also expected to have an impact on the amount of flow a WwTW receives during storms. This gives us an approximation of where we might expect problems to arise in the future during wet weather due to growth, creep, and climate change. Areas with the greatest estimated wet weather treatment shortfall are shown in the darkest blue.

L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key
Afon Chwefru - source to conf R Irfon	Headroom							Pass / Close Pass / Close fail / Fail
	Wet weather capacity							>90% / 80%-90% / 70%-80% / <70%

Table 3 - Supply Demand Balance

Table 3 shows that for the Afon Chwefru - source to conf R Irfon catchment the balance between supply and demand currently passes the assessment criteria avaliable, for headroom only, and will continue to pass through to 2050. It should be noted that local issues are present in the Beulah and Cilmery L4 catchments. Further detail is provided in the relevant L4 summaries.

5.0 Options

To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment's rainfall in just a few storms. In sewer modelling, these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon we have tested various types of schemes, and combinations of schemes, to ensure a robust plan is delivered. Table 4 shows different ways that we can reduce the risks to customers and the environment. We can stop rainwater entering our sewers from homes (domestic surface water disconnection), businesses or paved areas (commercial and paved surface water disconnection) or from roads (highway area disconnection). Sometimes water gets into sewers through small gaps that can occur in ageing sewers - by replacing or repairing the sewers we can reduce the likelihood of this happening (groundwater infiltration into sewers reduction). Reducing how much water homes and businesses use can also help to reduce the risk to people and the environment (personal water usage reduction or trade flow reduction).

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers.	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures.	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 4 - Scheme types

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a Journey Plan, see Figure 8. The Journey Plan provides an indicative overview of the most effective option types against a timeline indicating when they might be applied.

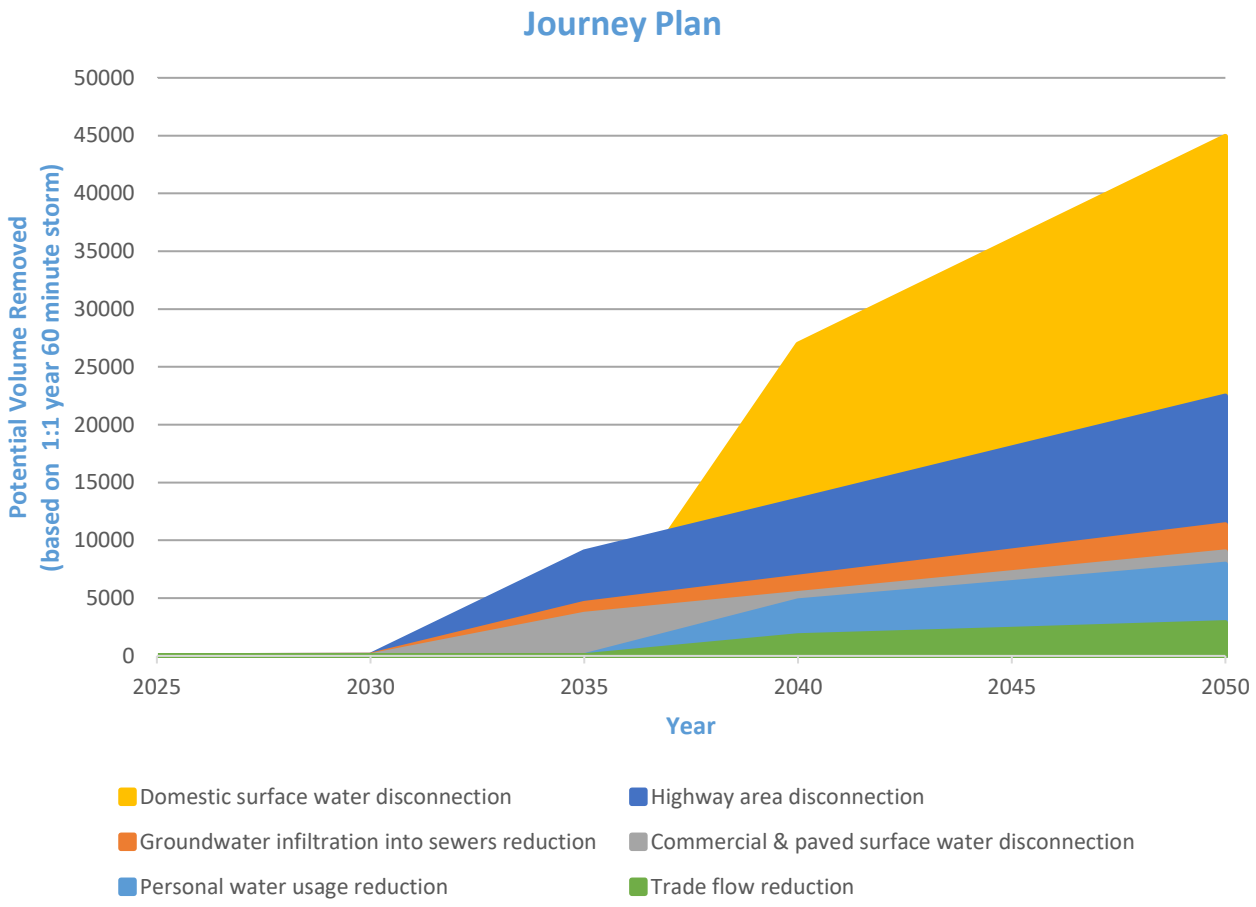


Figure 8 - Journey Plan

The measures within the Journey Plan include all green infrastructure and surface water removal techniques. We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence. We use the size of a storm event that has the probability of occurring once every 30 years.

Table 5 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

Table 6 highlights the potential costs in this region from preventing flooding from manholes scenarios. The assessment includes both the size and cost of potential mitigation measures.
Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£21,000,000.00	£29,000,000.00
40 spills in a typical year	£8,000,000.00	£8,000,000.00	£8,000,000.00
20 spills in a typical year	£10,000,000.00	£10,000,000.00	£10,000,000.00
10 spills in a typical year	£12,000,000.00	£12,000,000.00	£13,000,000.00
0 spills in a typical year	£21,000,000.00	£22,000,000.00	£23,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	80.00	127.00	138.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£0.00	£0.00	£0.00
External escapes in gardens	£700,000.00	£800,000.00	£1,200,000.00
Escapes in highways	£2,000,000.00	£2,300,000.00	£3,600,000.00
All other remaining flooding	-	£0.00	£0.00
Total	£2,700,000.00	£3,100,000.00	£4,800,000.00

*Internal escapes - All flooding that results in flooding within a property is stopped

*External escapes in gardens - All flooding within the curtilage of the property is stopped

*Escapes to highways - All flooding from DCWW systems impacting public highways is stopped.

Table 6 - Summary of Flooding Option Investments Strategy Costs

We have developed solutions which aim to provide a resilient sewerage network when tested against a range of future legislative scenarios. The solutions developed highlight the level of investment required to bring the entire network up to the level of protection required to be resilient to future demands. We have derived costs for a range of potential legislative future scenarios to ensure the cost impact of choices made is recognised.

We are beginning to break down the investment indicated in Table 5 and 6 by creating practical schemes ready for delivery. These schemes are designed as traditional engineering solutions, sustainable or green infrastructure, or a combination of both. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the Habitat Directive, as a priority against drainage and network failure which result in pollution events and flooding. The solutions developed highlight the level of investment required to bring our network to the level of protection required to mitigate against these risks. Appendix A shows the number of solutions within this tactical planning unit (Level 3).

For more information on the methodology developed to carry out the assessments see the DWMP Main Plan.

If you would like to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please contact us at DWMP@dwrcymru.com.

We will continue to work with the Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Appendix A - Schemes in L4 catchment within L3 catchment

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

Table A1 - Number of schemes in L4 catchment within L3 catchment

L4 Catchments	No. Schemes
LLANWRTYD WELLS SWK	0
LLANGAMMARCH WELLS SWK	0
Cefn Gorwydd STW New	0
TIRABAD SWK	0
GARTH (NR BUILTH WELLS) SWK	0
BUILTH ROAD (NR BUILTH WELLS) STW	0
BEULAH (NR LLANWRTYD WELLS) STW	0
CILMERY (NR BUILTH WELLS) SWK	0

Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WwTW O compliance	Historical measure relating to the performance of the treatment works (discharge permit

WwTW Q compliance	of the treatment works (discharge permit compliance (numeric)).
WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.

DWMP Strategic Planning Area Summary

Afon Llynfi - conf Dulas Bk to conf R Wye

1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how we as Dŵr Cymru Welsh Water (DCWW), will manage and improve our assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The Afon Llynfi - conf Dulas Bk to conf R Wye planning catchment lies within the Wye catchment (see Figure 1).

The Afon Llynfi - conf Dulas Bk to conf R Wye catchment covers an area stretching from Felindre and Bronllys in the north as far as Llanfihangel Tal-y-llyn and Llangord to the south. The geography of the catchment is predominantly rural.
Within the L3 catchment is the Afon Llynfi, with the river basin district of this catchment being the Severn. The catchment covers populous areas including the town of Talgarth and villages of Llangors and Felindre.
The largest WwTW is Talgarth which serves a residential population of 2,192.

This planning catchment consists of 4 wastewater catchments (see Figure 2). There is a combined population of 3282, this is set to decrease to 3000 by 2050, a change of -9%. There is a total sewer length of 35km, with a foul sewer length of 24km, a surface water length of 2.78km and a combined sewer length of 7km. There are 4 Wastewater Treatment Works (WwTW), 5 Sewerage Pumping Stations (SPSs), and 9 Combined Storm Overflows (CSOs) across this strategic planning area.

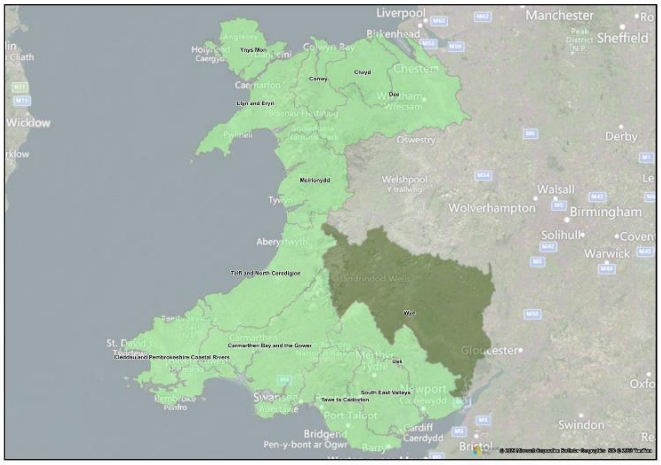


Figure 1 - River basin location detailing the strategic planning area

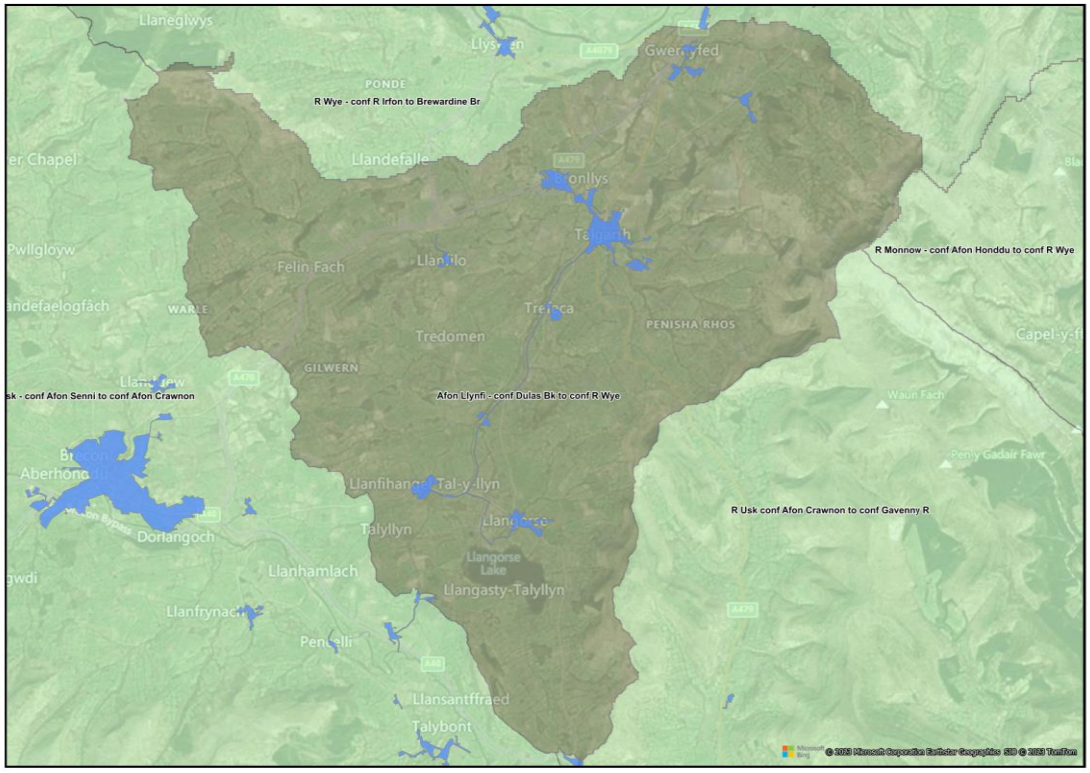


Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans.

Further information on how we are and will continue to engage with stakeholders can be found in the 'How have we engaged with customers and stakeholders?' chapter of the Main Plan.

Stakeholder Engagement Opportunities
Stakeholder engagement meetings have been held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. No multi-agency schemes have been identified at this stage, however engagement has been made to establish alignment with stakeholder plans, policies and to explore the concept of joint working going forward.

Table 1 - Stakeholder opportunity partnerships

The 'Where we want to work with you' document, which further explains our stakeholder engagement plan, can be found in the Risk section of the DCWW DWMP page found here:

Drainage Wastewater Management Plan

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England which are within our operating region, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

Urban creep is the term used to explain loss of green spaces. For example, when new driveways or house extensions are built. This often leads to more rainwater entering sewers. Our forecasts, which are based on a UKWIR study, suggest that urban creep will add up to 0.63 metres squared of impermeable area per house per year.

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There are major developments in localised areas that will contribute to future pressures on the network, the largest include Former Mid Wales Hospital, with a proposed 93 units, followed by Land between/adj Bronllys CP School, Neuadd Terrace, with a proposed 36 units.

The Core Management plan for the River Wye SAC provides an overview of the conservation required on site. The plan details the drive in enhancing the social, economic and natural value of the area, by summarising conservation objectives with regards to maintenance, restoration and future connections between the wider ecology and connecting surroundings. The plan can be found here :

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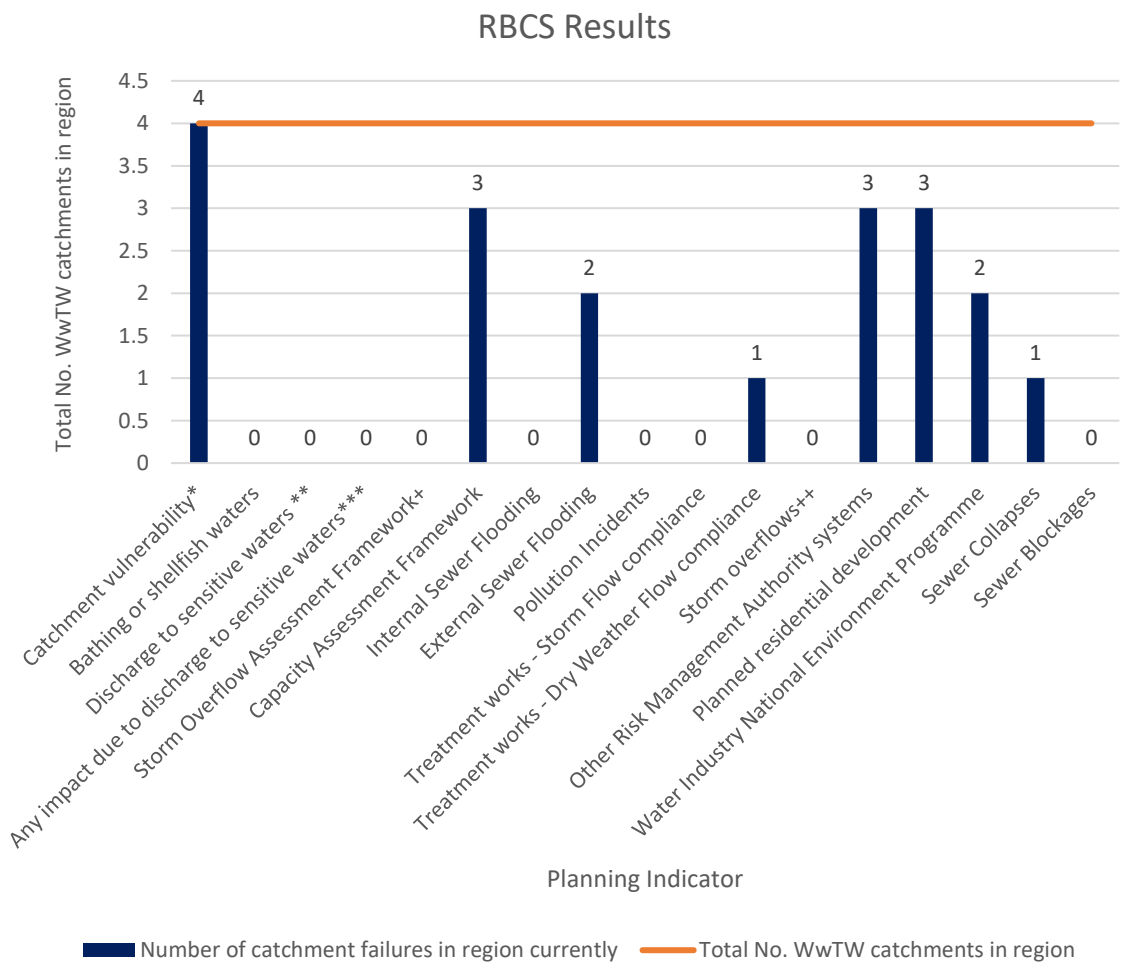

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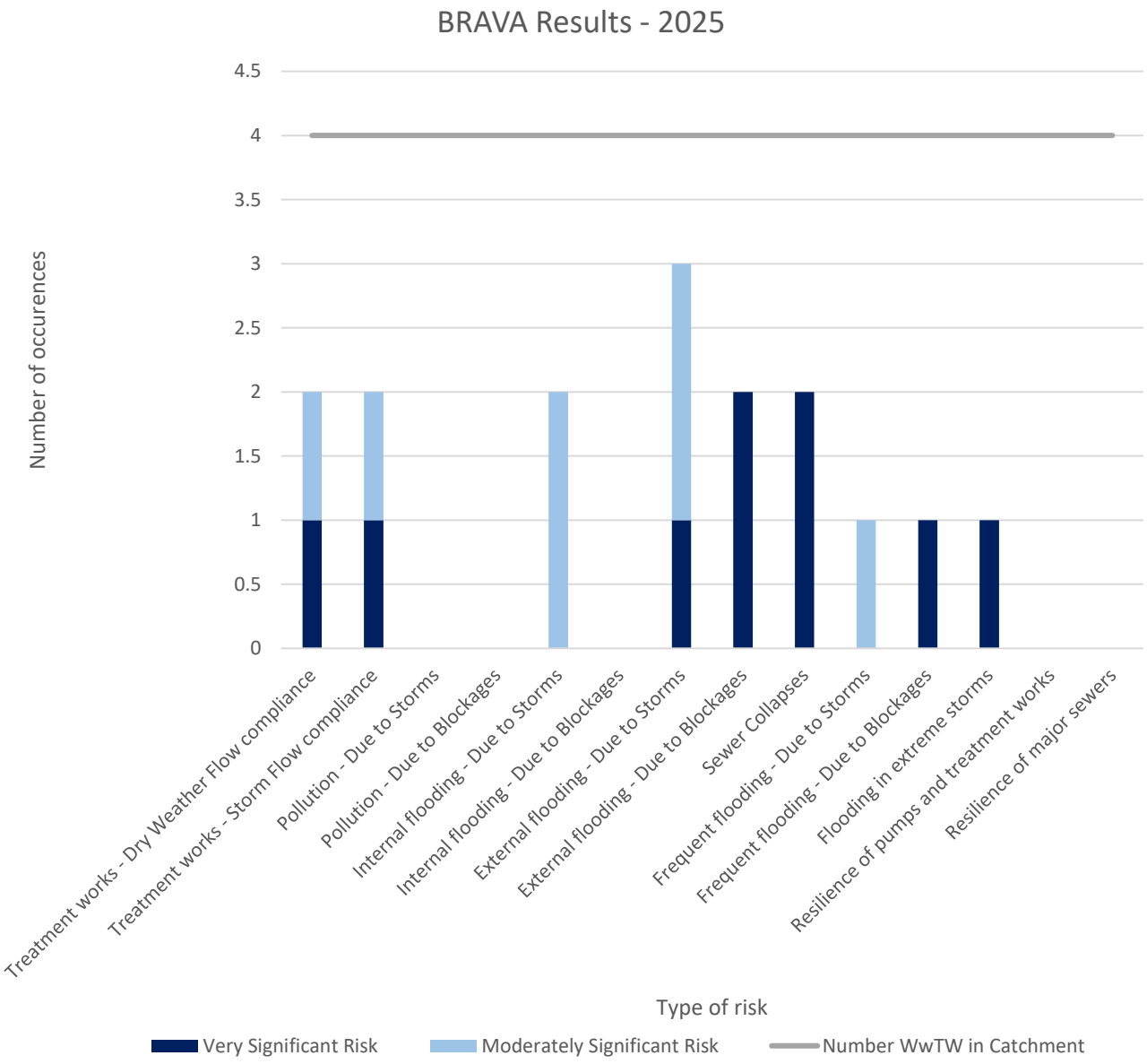

Figure 4 - BRAVA 2025 Summary

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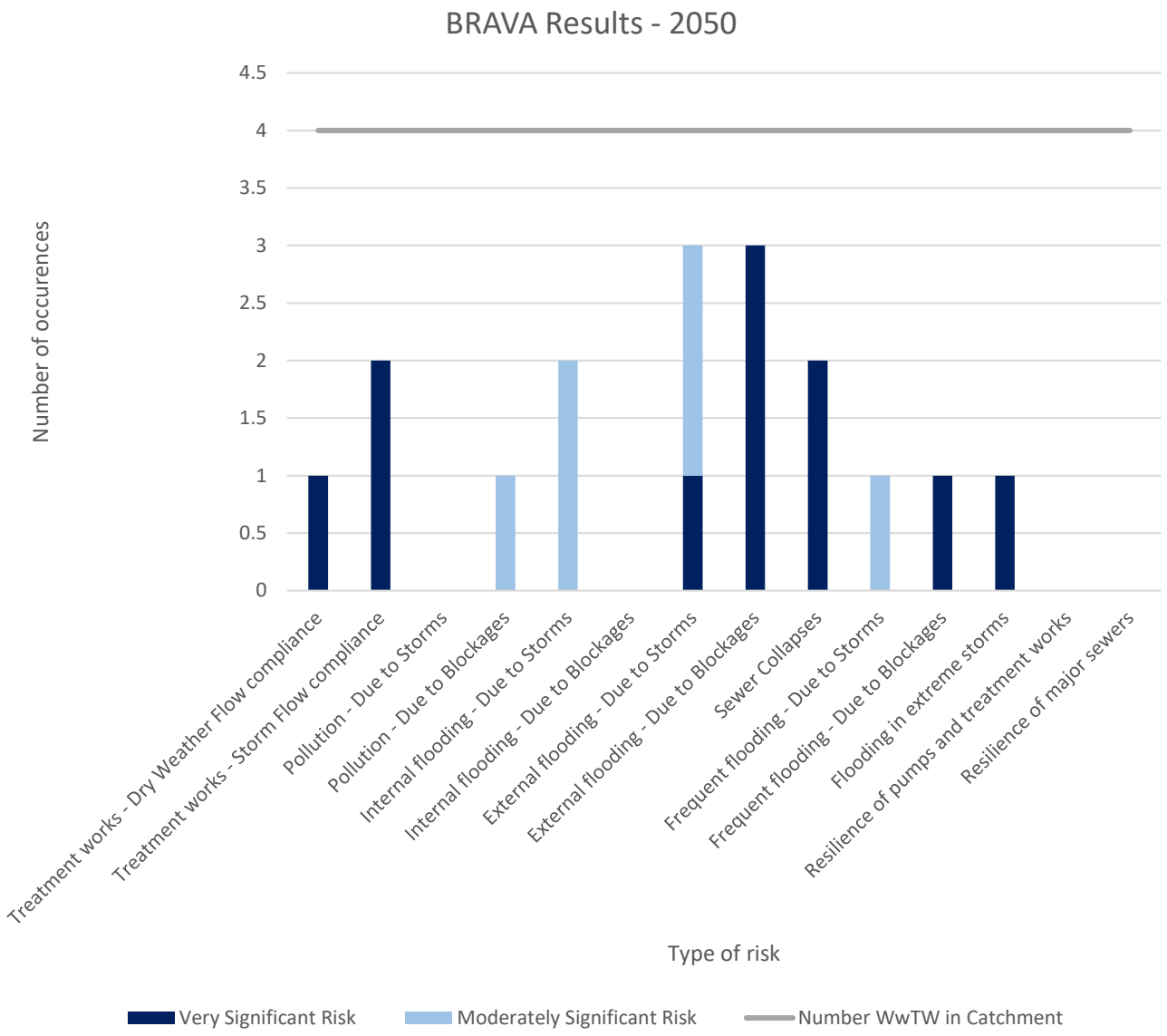

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In 2050, External flooding - Due to Blockages followed by Sewer Collapses are the biggest risks in this strategic planning area.

Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment.

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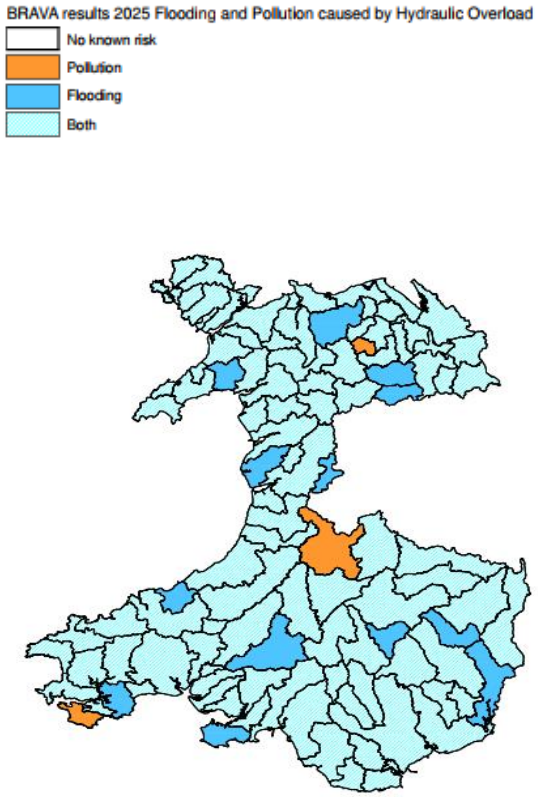

Figure 6 - Associated Strategic Planning Area priority (2025)

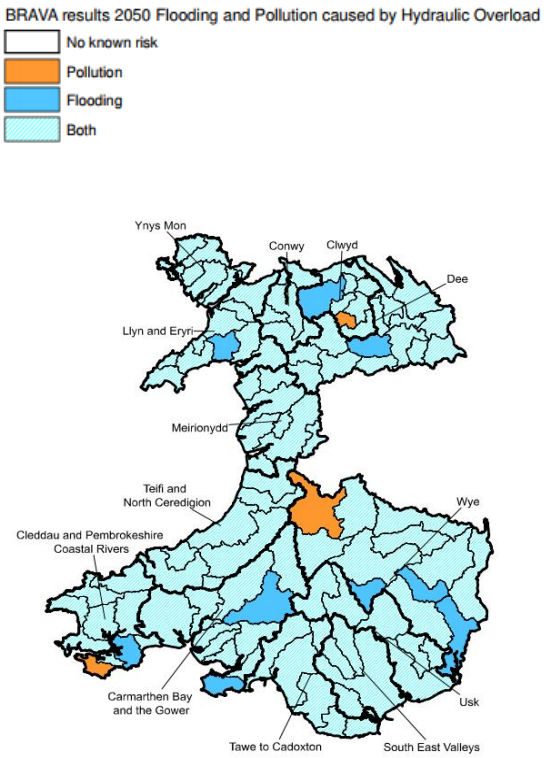

Figure 7 - Associated Strategic Planning Area priority (2050)

3.3 Water Framework Directive

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Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
Afon Llynfi - conf Dulas Bk to conf R Wye	5	1	3	1	0

Table 2 - WFD status'

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

The wet weather assessment takes pass forward flow (PFF) consent values, where available, as an indication of WwTW capacity, and estimates the amount of incoming flow the treatment works is able to treat across a year. It uses the same estimates as the DWF assessment for current flow, but also includes an estimate as to how much rainfall the WwTW might be able to deal with in the future, by including growth, climate change and creep. Climate change is expected to change the periodicity and amount of rain across a "typical" year. Creep, the gradual misconnection of storm sewers to the foul sewer network, is also expected to have an impact on the amount of flow a WwTW receives during storms. This gives us an approximation of where we might expect problems to arise in the future during wet weather due to growth, creep, and climate change. Areas with the greatest estimated wet weather treatment shortfall are shown in the darkest blue.

L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key
Afon Llynfi - conf Dulas Bk to conf R Wye	Headroom							Pass / Close Pass / Close fail / Fail
	Wet weather capacity							>90% / 80%-90% / 70%-80% / <70%

Table 3 - Supply Demand Balance

Table 3 shows that for the Afon Llynfi - conf Dulas Bk to conf R Wye catchment the balance between supply and demand currently passes the assessment criteria avaliable, for headroom only, and will continue to pass through to 2050. It should be noted that local issues are present in the Velindre L4 catchment. Further detail is provided in the relevant L4 summary.

5.0 Options

To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment's rainfall in just a few storms. In sewer modelling, these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.

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Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
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Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers.	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures.	Medium term
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Table 4 - Scheme types

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a Journey Plan, see Figure 8. The Journey Plan provides an indicative overview of the most effective option types against a timeline indicating when they might be applied.

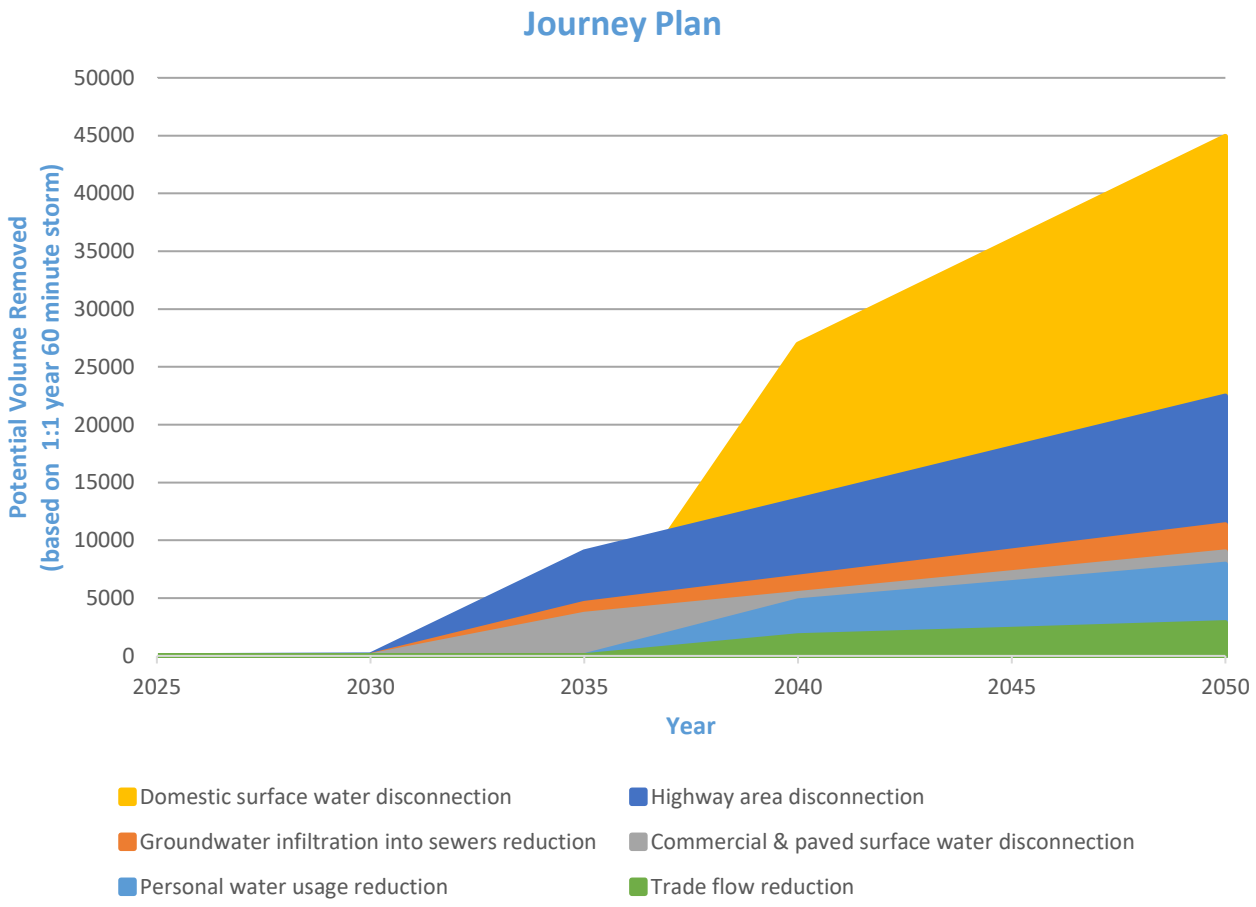


Figure 8 - Journey Plan

The measures within the Journey Plan include all green infrastructure and surface water removal techniques. We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence. We use the size of a storm event that has the probability of occurring once every 30 years.

Table 5 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

Table 6 highlights the potential costs in this region from preventing flooding from manholes scenarios. The assessment includes both the size and cost of potential mitigation measures.
Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£21,000,000.00	£34,000,000.00
40 spills in a typical year	£3,000,000.00	£3,000,000.00	£3,000,000.00
20 spills in a typical year	£7,000,000.00	£7,000,000.00	£7,000,000.00
10 spills in a typical year	£10,000,000.00	£10,000,000.00	£12,000,000.00
0 spills in a typical year	£21,000,000.00	£22,000,000.00	£27,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	26.00	28.00	31.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£0.00	£0.00	£0.00
External escapes in gardens	£0.00	£0.00	£0.00
Escapes in highways	£2,000,000.00	£2,400,000.00	£3,700,000.00
All other remaining flooding	-	£0.00	£0.00
Total	£2,000,000.00	£2,400,000.00	£3,700,000.00

*Internal escapes - All flooding that results in flooding within a property is stopped

*External escapes in gardens - All flooding within the curtilage of the property is stopped

*Escapes to highways - All flooding from DCWW systems impacting public highways is stopped.

Table 6 - Summary of Flooding Option Investments Strategy Costs

We have developed solutions which aim to provide a resilient sewerage network when tested against a range of future legislative scenarios. The solutions developed highlight the level of investment required to bring the entire network up to the level of protection required to be resilient to future demands. We have derived costs for a range of potential legislative future scenarios to ensure the cost impact of choices made is recognised.

We are beginning to break down the investment indicated in Table 5 and 6 by creating practical schemes ready for delivery. These schemes are designed as traditional engineering solutions, sustainable or green infrastructure, or a combination of both. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the Habitat Directive, as a priority against drainage and network failure which result in pollution events and flooding. The solutions developed highlight the level of investment required to bring our network to the level of protection required to mitigate against these risks. Appendix A shows the number of solutions within this tactical planning unit (Level 3).

For more information on the methodology developed to carry out the assessments see the DWMP Main Plan.

If you would like to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please contact us at DWMP@dwrcymru.com.

We will continue to work with the Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Appendix A - Schemes in L4 catchment within L3 catchment

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

Table A1 - Number of schemes in L4 catchment within L3 catchment

L4 Catchments	No. Schemes
THREE COCKS ABERLLYNFI SWK	0
LLANFILO SWK	0
VELINDRE SWK	0
TALGARTH SWK	0

Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WwTW O compliance	Historical measure relating to the performance of the treatment works (discharge permit

WwTW Q compliance	of the treatment works (discharge permit compliance (numeric)).
WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.

DWMP Strategic Planning Area Summary

R Arrow - conf Gilwern Bk to conf R Lugg

1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how we as Dŵr Cymru Welsh Water (DCWW), will manage and improve our assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The R Arrow - conf Gilwern Bk to conf R Lugg planning catchment lies within the Wye catchment (see Figure 1).

The R Arrow - conf Gilwern Bk to conf R Lugg catchment covers an area stretching from Titley in the north as far as Weobley in the South. The geography of the catchment is predominantly rural.
The river within the L3 is the river Arrow, with the river basin district of this catchment being the Severn. The catchment covers several populous areas including the towns of Kington, Weobley and the village of Pembridge.
The largest WwTW is Leominster Barons Cross which serves a residential population of 1,300.

This planning catchment consists of 7 wastewater catchments (see Figure 2). There is a combined population of 5162, this is set to increase to 5800 by 2050, a change of 12%. There is a total sewer length of 38km, with a foul sewer length of 18km, a surface water length of 2.07km and a combined sewer length of 16km. There are 7 Wastewater Treatment Works (WwTW), 6 Sewerage Pumping Stations (SPSs), and 8 Combined Storm Overflows (CSOs) across this strategic planning area.

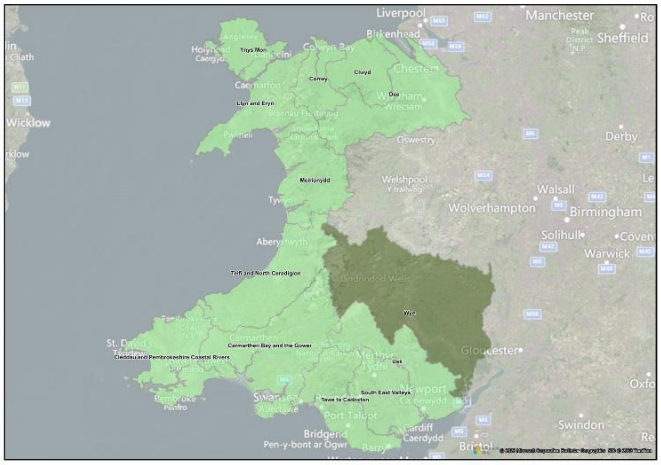


Figure 1 - River basin location detailing the strategic planning area

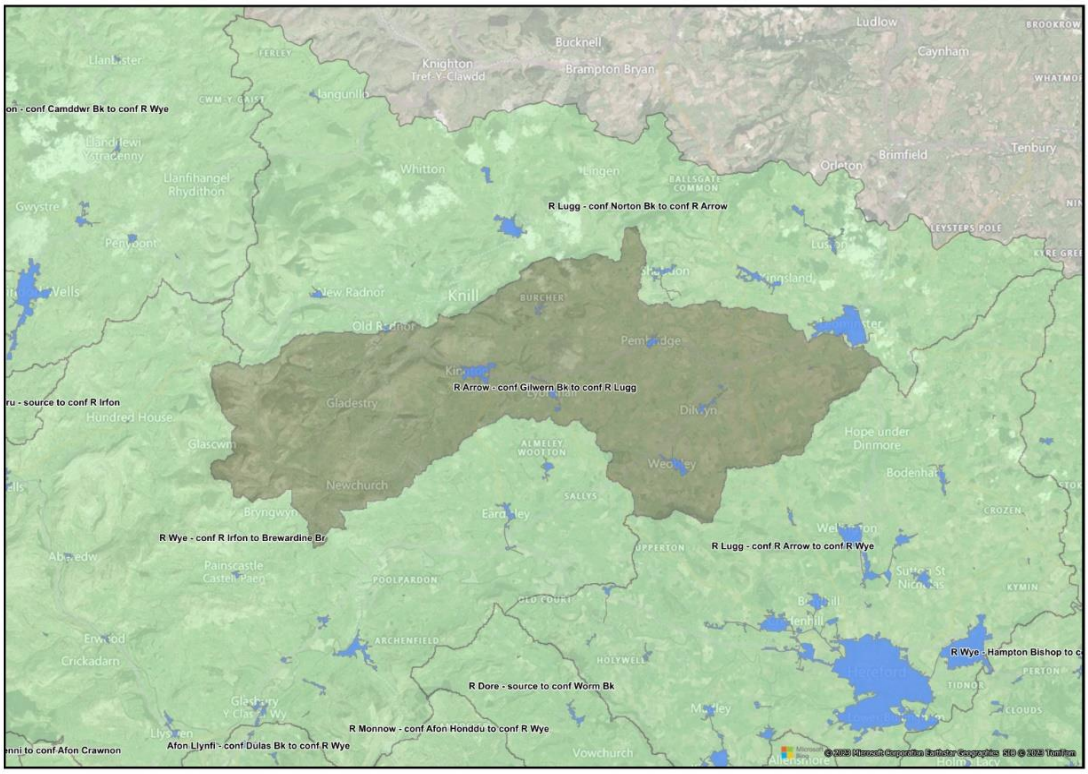


Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans.

Further information on how we are and will continue to engage with stakeholders can be found in the 'How have we engaged with customers and stakeholders?' chapter of the Main Plan.

Stakeholder Engagement Opportunities
Stakeholder engagement meetings have been held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. No multi-agency schemes have been identified at this stage, however engagement has been made to establish alignment with stakeholder plans, policies and to explore the concept of joint working going forward.

Table 1 - Stakeholder opportunity partnerships

The 'Where we want to work with you' document, which further explains our stakeholder engagement plan, can be found in the Risk section of the DCWW DWMP page found here:

Drainage Wastewater Management Plan

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England which are within our operating region, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

Urban creep is the term used to explain loss of green spaces. For example, when new driveways or house extensions are built. This often leads to more rainwater entering sewers. Our forecasts, which are based on a UKWIR study, suggest that urban creep will add up to 0.63 metres squared of impermeable area per house per year.

A UKWIR report on urban creep can be found here, Impact of Urban Creep on Sewerage Systems.
Climate change is predicted to increase the intensity of storms by around 15% in this region. This is based on a 2017 UKWIR report, which used a high-resolution climate model for the UK to predict changes in design storm intensities for a high emissions scenario (RCP8.5). In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the R Arrow - conf Gilwern Bk to conf R Lugg region is set to increase to 5800 by 2050, a change of 12% based on our future projections. For a further a breakdown of population change in the L3 region please see the L4 report.
There are no major developments in localised areas that will contribute to future pressures on the network.

The Core Management plan for the River Wye SAC provides an overview of the conservation required on site. The plan details the drive in enhancing the social, economic and natural value of the area, by summarising conservation objectives with regards to maintenance, restoration and future connections between the wider ecology and connecting surroundings. The plan can be found here :

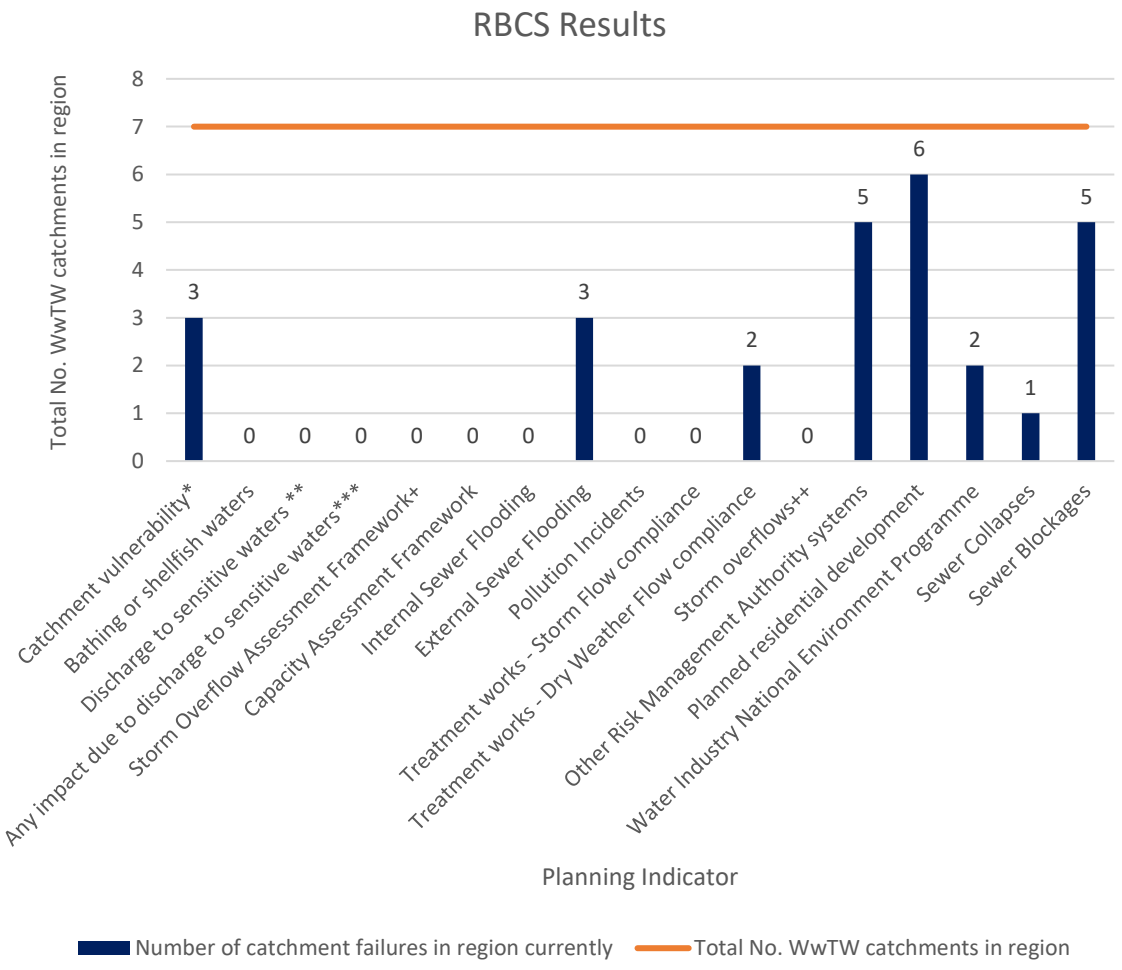
Core Management Plan

Future predictions of growth in the area have been estimated based on the average between the rate of properties that have been built in the past 10 years and the rate that the local development plan predicts houses should be built. In addition to this, we have accounted for the changes in the existing population by the change in the number of people living in an average property in the area.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. The results are shown in Figure 3. Descriptions of the indicators can be seen in Appendix B. All catchments passed through to a more detailed risk assessment (BRAVA).

For this strategic planning area the biggest risks indicated by the RBCS are Planned residential development, followed by Other Risk Management Authority systems and Sewer Blockages.



*To sewer flooding due to extreme wet weather events.
**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.
***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.
+Frequency investigation triggered.
++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment. Figures 4 and 5 illustrate the outcome of the BRAVA assessment for this strategic planning area.

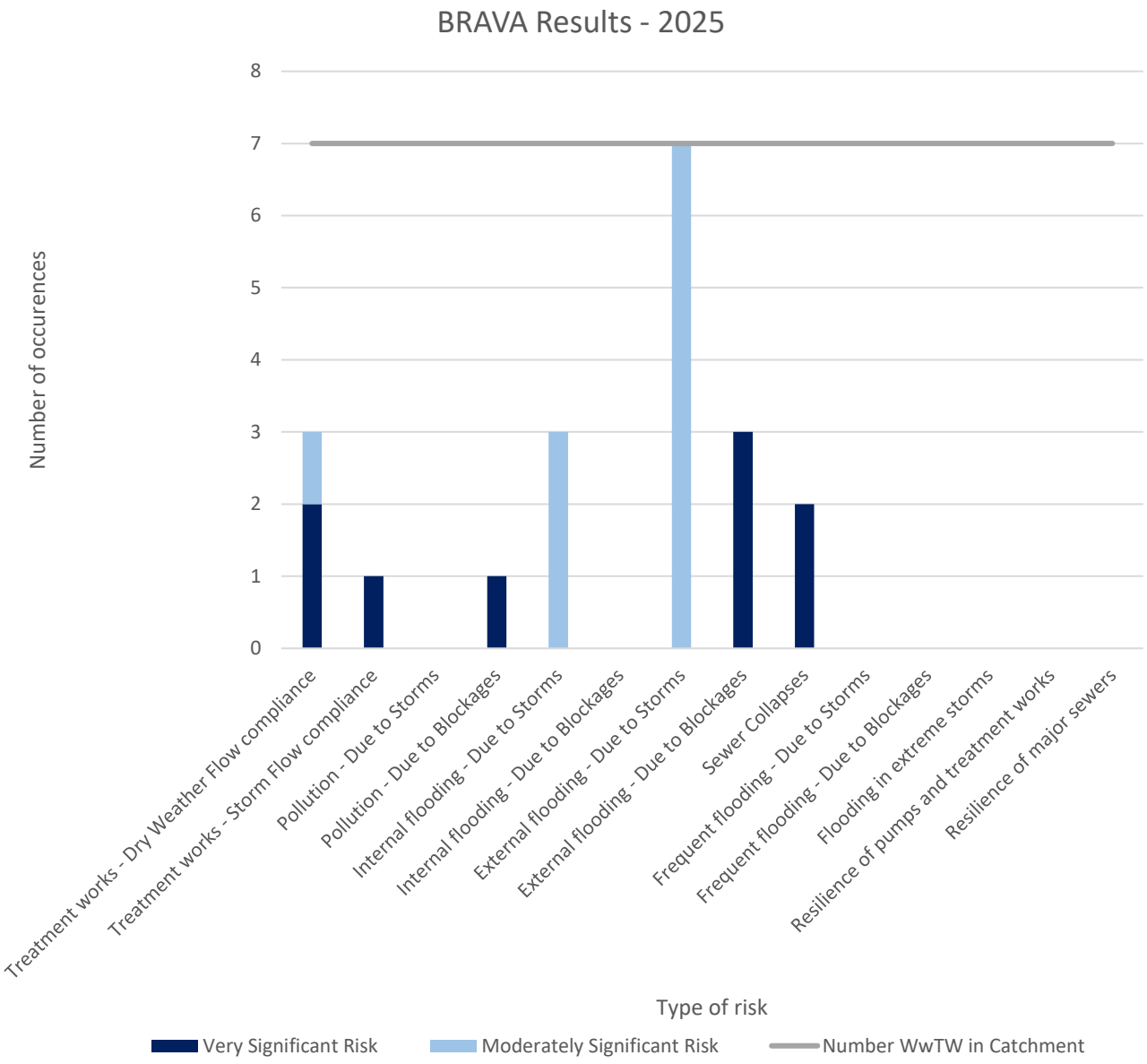


Figure 4 - BRAVA 2025 Summary

In 2025, External flooding - Due to Blockages and External flooding - Due to Storms are the biggest risks in this strategic planning area.

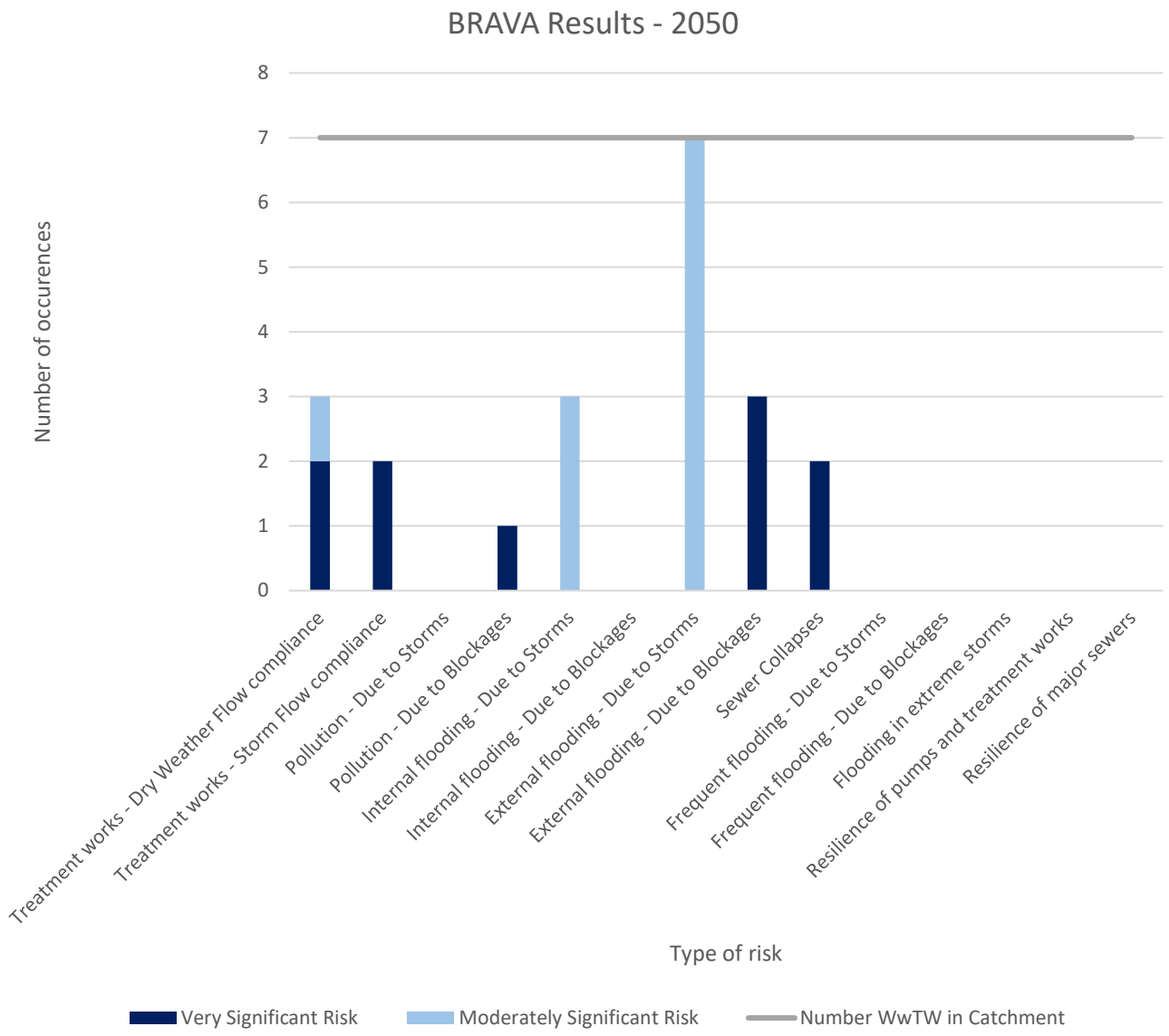


Figure 5 - BRAVA 2050 Summary

In 2050, External flooding- Due to Blockages and External flooding- Due to Storms are the biggest risks in this strategic planning area.

Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment.

From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to require a standard option assessment methodology.

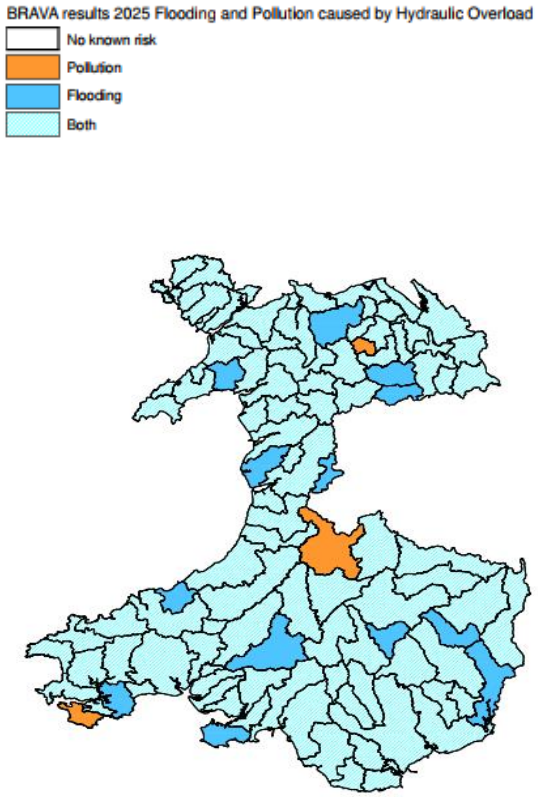


Figure 6 - Associated Strategic Planning Area priority (2025)

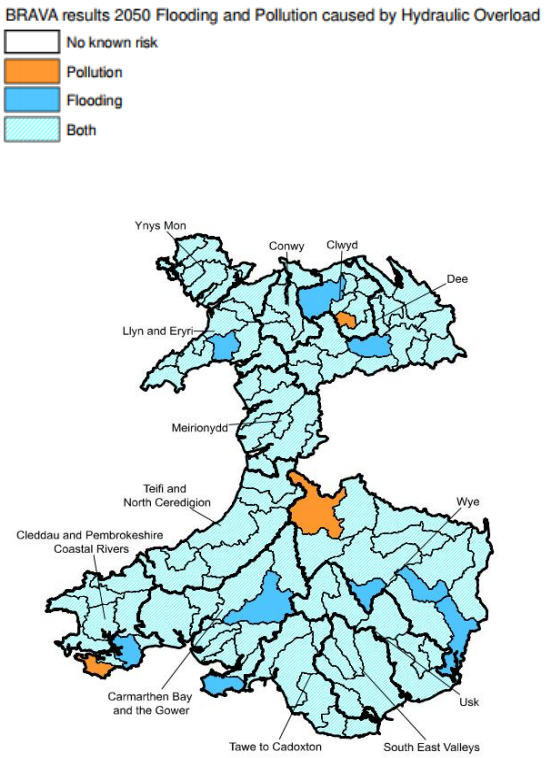


Figure 7 - Associated Strategic Planning Area priority (2050)

3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
R Arrow - conf Gilwern Bk to conf R Lugg	8	1	6	0	1

Table 2 - WFD status'

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

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Table 3 shows that for the R Arrow - conf Gilwern Bk to conf R Lugg catchment the balance between supply and demand currently passes the assessment criteria avaliable, for headroom only, and will continue to pass through to 2050. It should be noted that local issues are present in the Dilwyn and Lyonshall L4 catchments. Further detail is provided in the relevant L4 summaries.

5.0 Options

To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment's rainfall in just a few storms. In sewer modelling, these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.

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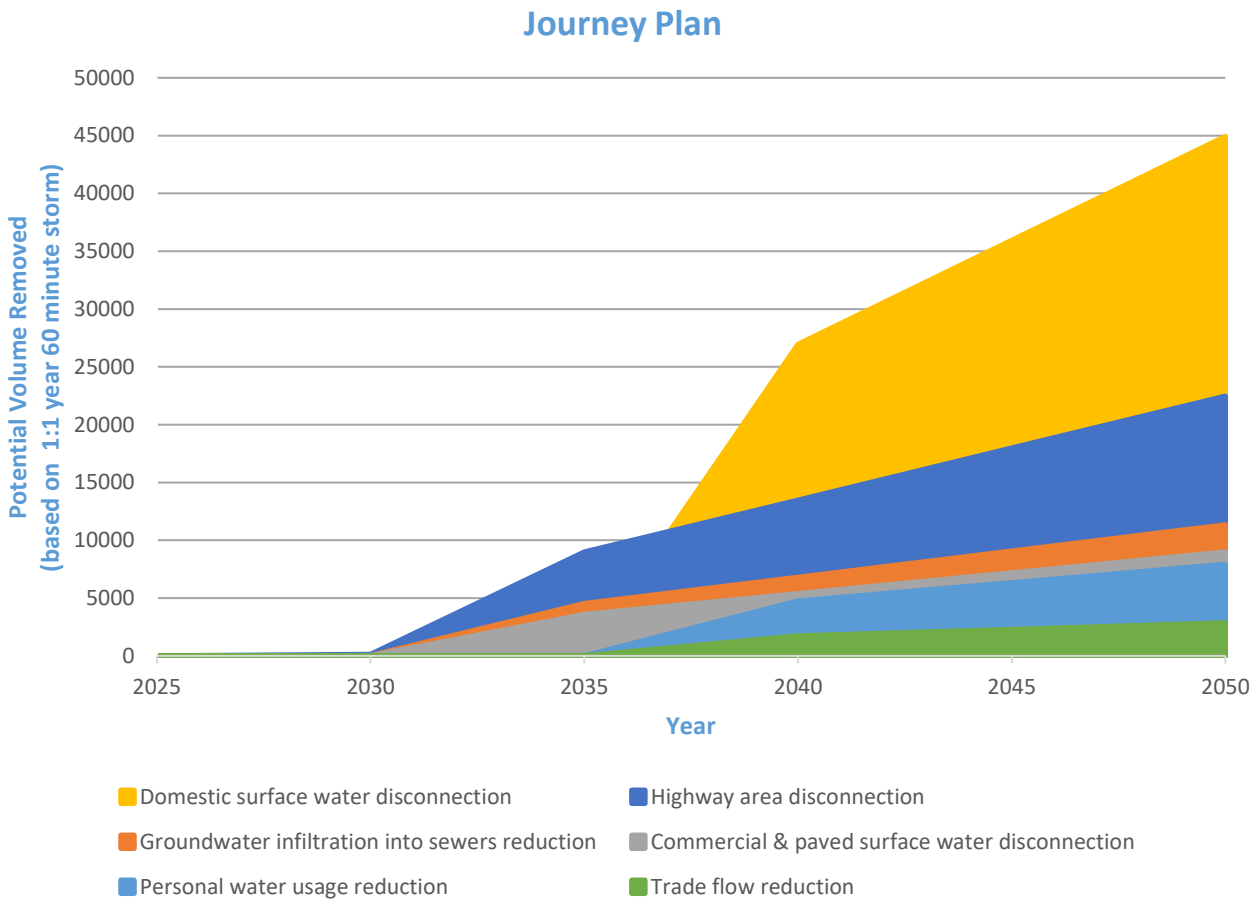

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Table 5 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

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Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£24,000,000.00	£39,000,000.00
40 spills in a typical year	£4,000,000.00	£4,000,000.00	£4,000,000.00
20 spills in a typical year	£9,000,000.00	£8,000,000.00	£10,000,000.00
10 spills in a typical year	£12,000,000.00	£12,000,000.00	£15,000,000.00
0 spills in a typical year	£25,000,000.00	£26,000,000.00	£30,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	34.00	38.00	41.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£0.00	£0.00	£0.00
External escapes in gardens	£0.00	£0.00	£0.00
Escapes in highways	£1,600,000.00	£1,900,000.00	£2,900,000.00
All other remaining flooding	-	£0.00	£0.00
Total	£1,600,000.00	£1,900,000.00	£2,900,000.00

*Internal escapes - All flooding that results in flooding within a property is stopped

*External escapes in gardens - All flooding within the curtilage of the property is stopped

*Escapes to highways - All flooding from DCWW systems impacting public highways is stopped.

Table 6 - Summary of Flooding Option Investments Strategy Costs

We have developed solutions which aim to provide a resilient sewerage network when tested against a range of future legislative scenarios. The solutions developed highlight the level of investment required to bring the entire network up to the level of protection required to be resilient to future demands. We have derived costs for a range of potential legislative future scenarios to ensure the cost impact of choices made is recognised.

We are beginning to break down the investment indicated in Table 5 and 6 by creating practical schemes ready for delivery. These schemes are designed as traditional engineering solutions, sustainable or green infrastructure, or a combination of both. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the Habitat Directive, as a priority against drainage and network failure which result in pollution events and flooding. The solutions developed highlight the level of investment required to bring our network to the level of protection required to mitigate against these risks. Appendix A shows the number of solutions within this tactical planning unit (Level 3).

For more information on the methodology developed to carry out the assessments see the DWMP Main Plan.

If you would like to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please contact us at DWMP@dwrcymru.com.

We will continue to work with the Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Appendix A - Schemes in L4 catchment within L3 catchment

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

Table A1 - Number of schemes in L4 catchment within L3 catchment

L4 Catchments	No. Schemes
KINGTON	0
LYONSHALL	0
WEOBLEY	0
PEMBRIDGE	0
DILWYN	0
TITLEY SWK	0
IVINGTON (NR LEOMINSTER)	0

Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WwTW O compliance	Historical measure relating to the performance of the treatment works (discharge permit

WwTW Q compliance	of the treatment works (discharge permit compliance (numeric)).
WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.

DWMP Strategic Planning Area Summary

R Dore - source to conf Worm Bk

1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how we as Dŵr Cymru Welsh Water (DCWW), will manage and improve our assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The R Dore - source to conf Worm Bk planning catchment lies within the Wye catchment (see Figure 1).

The R Dore - source to conf Worm Bk catchment covers an area stretching from Dorstone in the north as far as Pontrilas in the south. The geography of the catchment is predominantly rural.
There are several main rivers within the L3 including the River Dore and Dulas Brook, with the river basin district of this catchment is the Severn. The catchment covers several major urban areas including the villages Peterchurch and Pontrilas.
The largest WwTW is Pontrilas STW which serves a residential population of 834.

This planning catchment consists of 7 wastewater catchments (see Figure 2). There is a combined population of 3678, this is set to decrease to 2600 by 2050, a change of -28%. There is a total sewer length of 20km, with a foul sewer length of 18km, a surface water length of 1.2km and a combined sewer length of 0km. There are 7 Wastewater Treatment Works (WwTW), 4 Sewerage Pumping Stations (SPSs), and 4 Combined Storm Overflows (CSOs) across this strategic planning area.

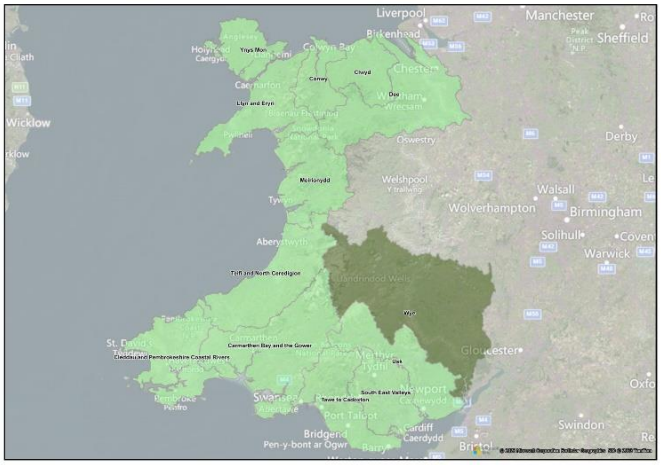


Figure 1 - River basin location detailing the strategic planning area

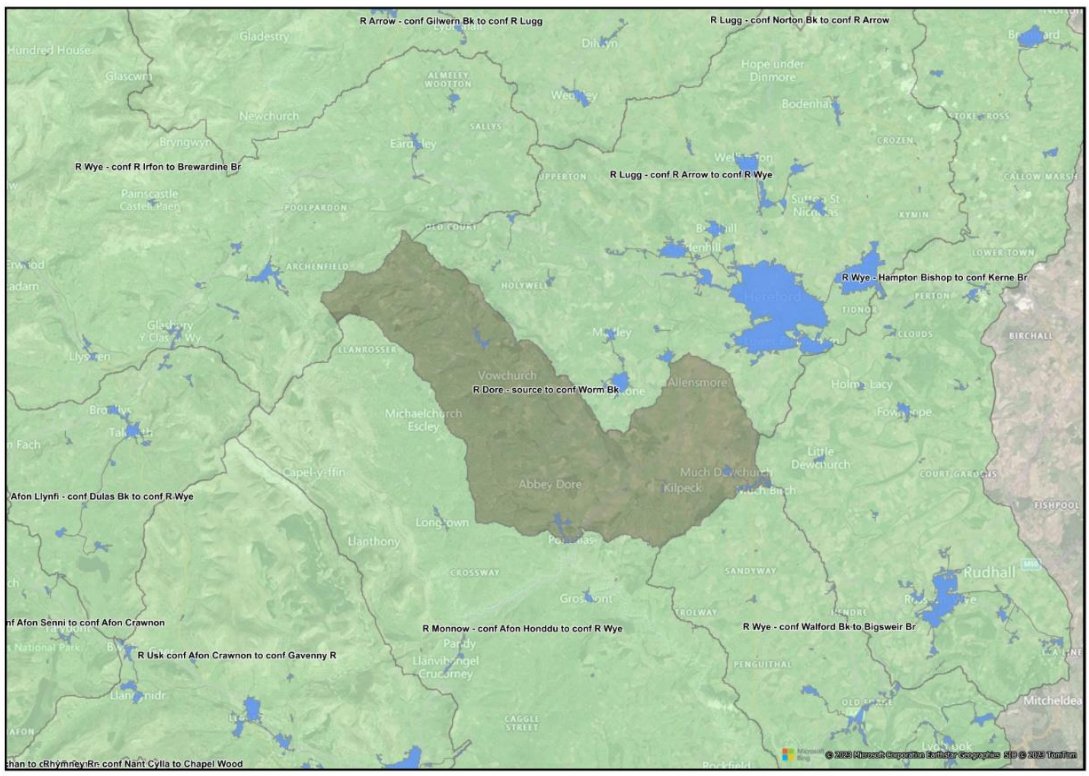


Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans.

Further information on how we are and will continue to engage with stakeholders can be found in the 'How have we engaged with customers and stakeholders?' chapter of the Main Plan.

Stakeholder Engagement Opportunities
Stakeholder engagement meetings have been held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. No multi-agency schemes have been identified at this stage, however engagement has been made to establish alignment with stakeholder plans, policies and to explore the concept of joint working going forward.

Table 1 - Stakeholder opportunity partnerships

The 'Where we want to work with you' document, which further explains our stakeholder engagement plan, can be found in the Risk section of the DCWW DWMP page found here:

Drainage Wastewater Management Plan

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England which are within our operating region, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

Urban creep is the term used to explain loss of green spaces. For example, when new driveways or house extensions are built. This often leads to more rainwater entering sewers. Our forecasts, which are based on a UKWIR study, suggest that urban creep will add up to 0.63 metres squared of impermeable area per house per year.

A UKWIR report on urban creep can be found here, Impact of Urban Creep on Sewerage Systems.
Climate change is predicted to increase the intensity of storms by around 15% in this region. This is based on a 2017 UKWIR report, which used a high-resolution climate model for the UK to predict changes in design storm intensities for a high emissions scenario (RCP8.5). In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the R Dore - source to conf Worm Bk region is set to decrease to 2600 by 2050, a change of -28% based on our future projections. For a further a breakdown of population change in the L3 region please see the L4 report.
There are no major developments in localised areas that will contribute to future pressures on the network.

The Core Management plan for the River Wye SAC provides an overview of the conservation required on site. The plan details the drive in enhancing the social, economic and natural value of the area, by summarising conservation objectives with regards to maintenance, restoration and future connections between the wider ecology and connecting surroundings. The plan can be found here :

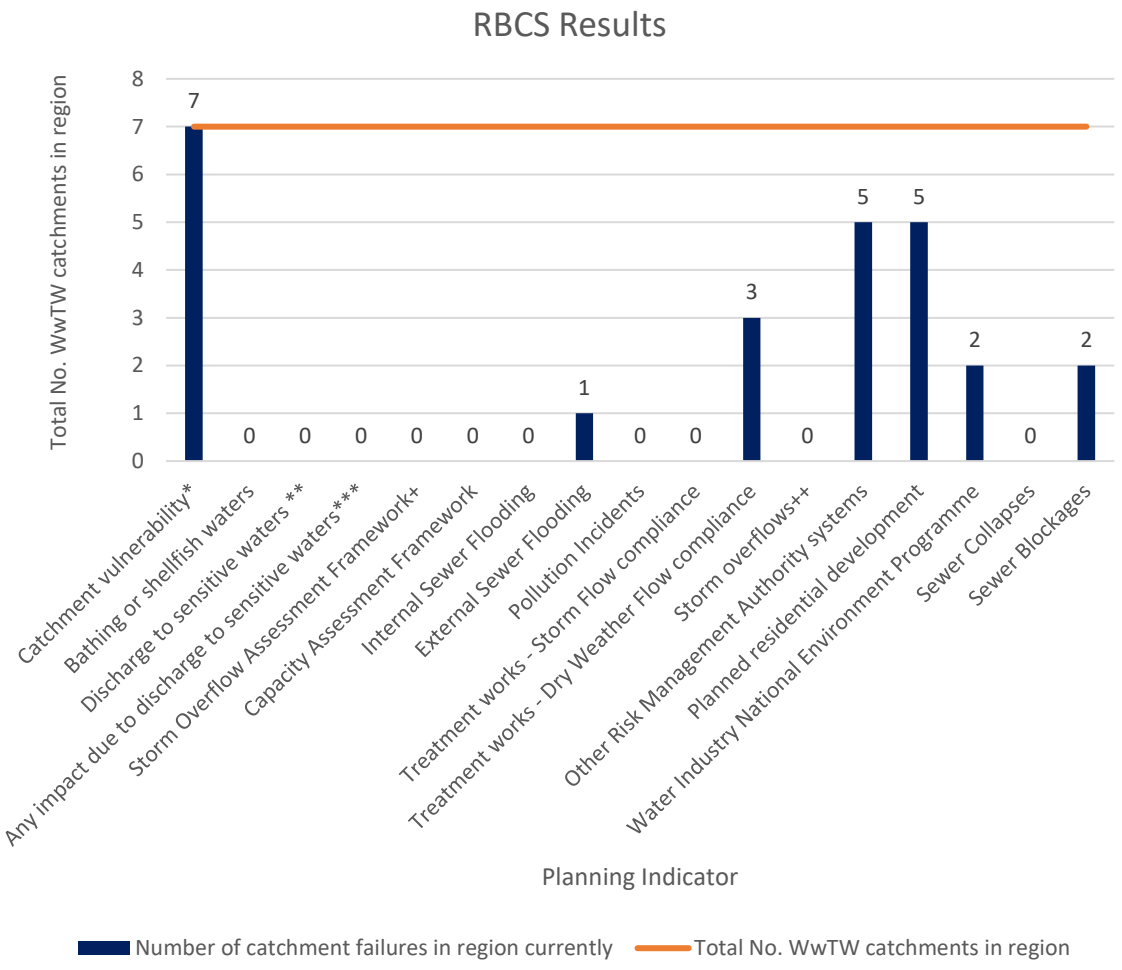
Core Management Plan

Future predictions of growth in the area have been estimated based on the average between the rate of properties that have been built in the past 10 years and the rate that the local development plan predicts houses should be built. In addition to this, we have accounted for the changes in the existing population by the change in the number of people living in an average property in the area.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. The results are shown in Figure 3. Descriptions of the indicators can be seen in Appendix B. All catchments passed through to a more detailed risk assessment (BRAVA).

For this strategic planning area the biggest risks indicated by the RBCS are Catchment vulnerability, followed by Planned residential development and Other Risk Management Authority systems.



*To sewer flooding due to extreme wet weather events.
**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.
***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.
+Frequency investigation triggered.
++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment. Figures 4 and 5 illustrate the outcome of the BRAVA assessment for this strategic planning area.

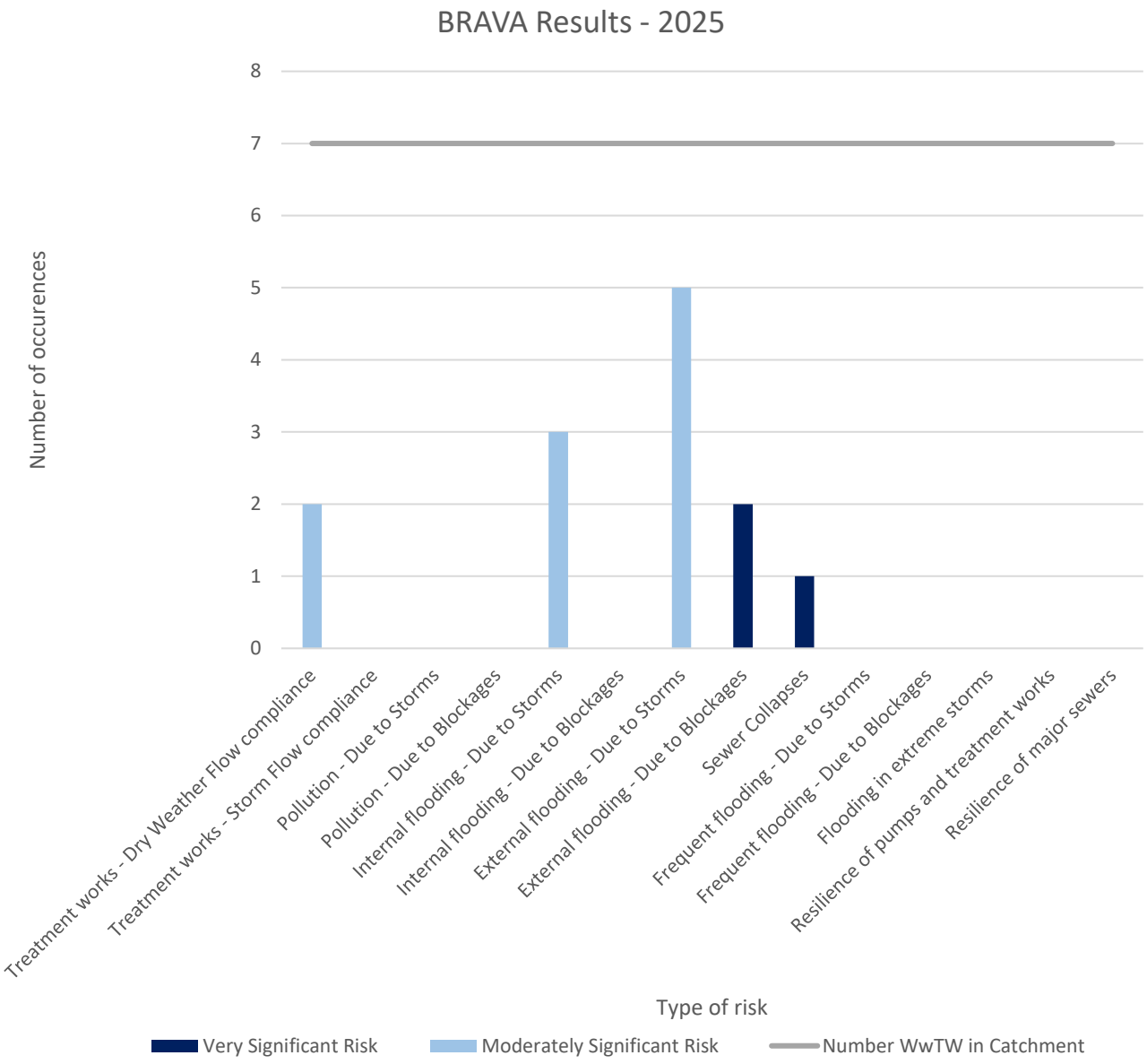


Figure 4 - BRAVA 2025 Summary

In 2025, External flooding - Due to Blockages and External flooding - Due to Storms are some of the biggest risks in this strategic area.

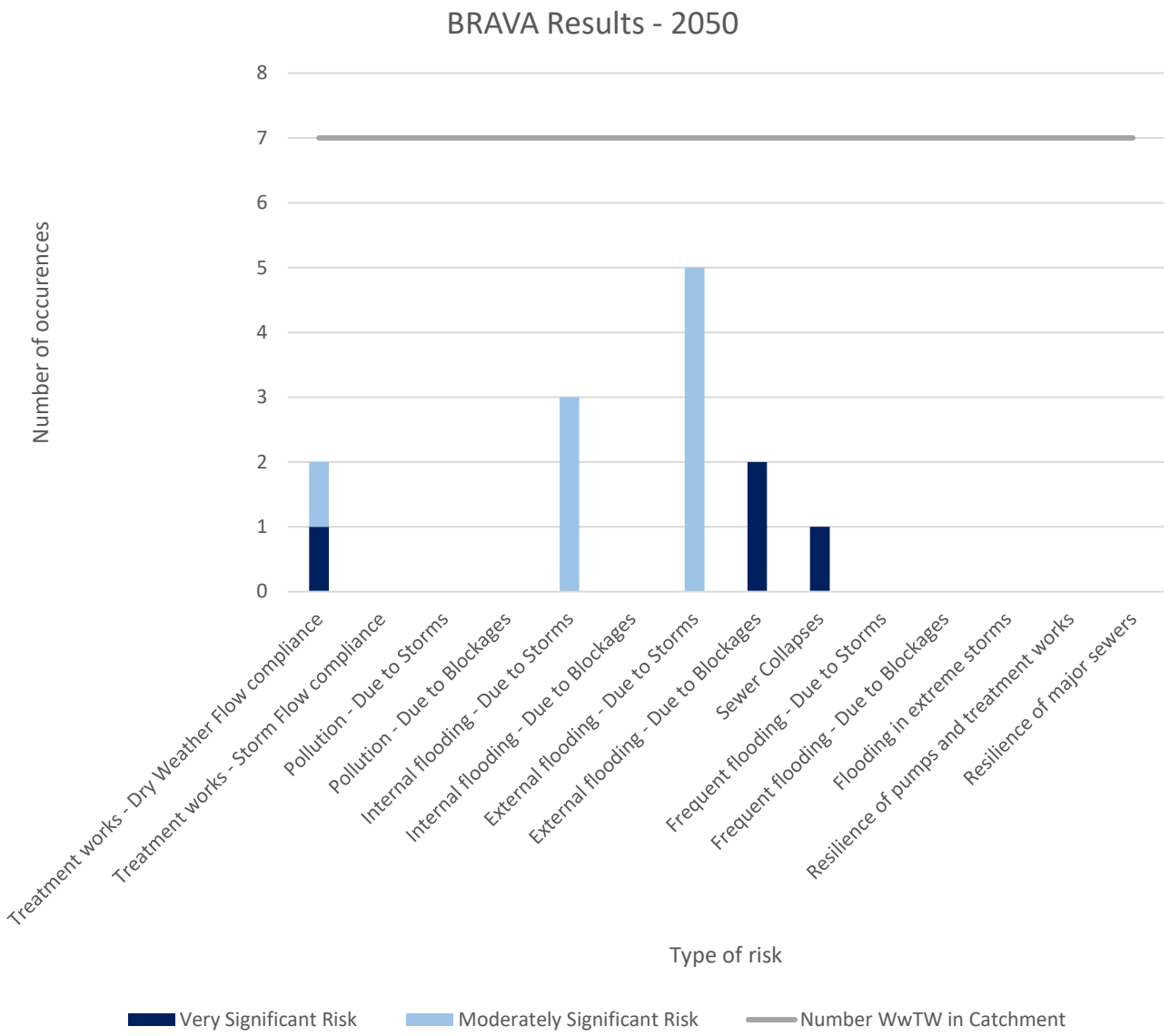
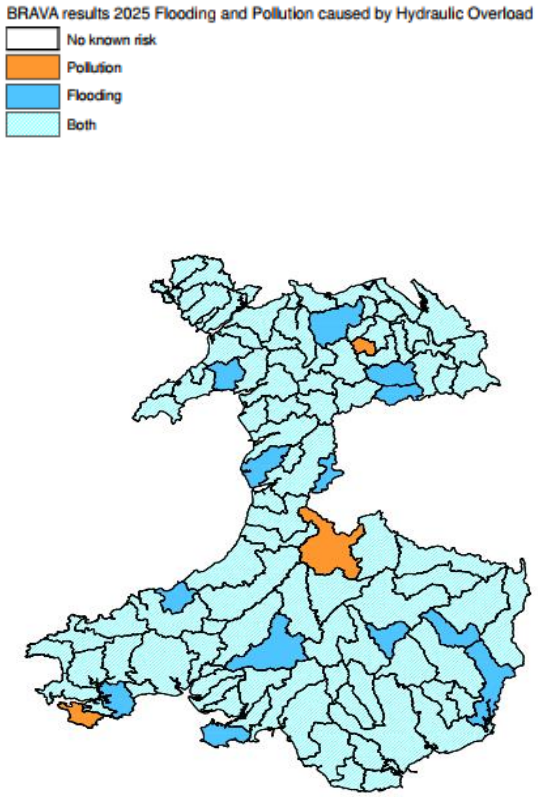


Figure 5 - BRAVA 2050 Summary

In 2050, External flooding - Due to Blockages and External flooding - Due to Storms are some of the biggest risks in this strategic area.

Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment.

From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to require a standard option assessment methodology.



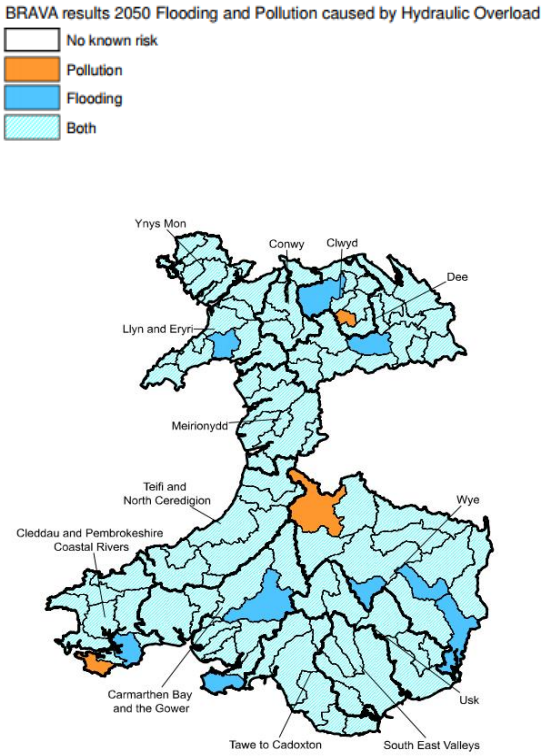


Figure 6 - Associated Strategic Planning Area priority (2025)

Figure 7 - Associated Strategic Planning Area priority (2050)

3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
R Dore - source to conf Worm Bk	3	0	3	0	0

Table 2 - WFD status'

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

The wet weather assessment takes pass forward flow (PFF) consent values, where available, as an indication of WwTW capacity, and estimates the amount of incoming flow the treatment works is able to treat across a year. It uses the same estimates as the DWF assessment for current flow, but also includes an estimate as to how much rainfall the WwTW might be able to deal with in the future, by including growth, climate change and creep. Climate change is expected to change the periodicity and amount of rain across a "typical" year. Creep, the gradual misconnection of storm sewers to the foul sewer network, is also expected to have an impact on the amount of flow a WwTW receives during storms. This gives us an approximation of where we might expect problems to arise in the future during wet weather due to growth, creep, and climate change. Areas with the greatest estimated wet weather treatment shortfall are shown in the darkest blue.

L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key
R Dore - source to conf Worm Bk	Headroom							Pass / Close Pass / Close fail / Fail
	Wet weather capacity							>90% / 80%-90% / 70%-80% / <70%

Table 3 - Supply Demand Balance

Table 3 shows that for the R Dore - source to conf Worm Bk catchment the balance between supply and demand currently passes the assessment criteria avaliable, for headroom only, and will continue to pass through to 2050. It should be noted that local issues are present in the Abbeydore, Dorstone (Oakland Place) and Much Dewchurch L4 catchments. Further detail is provided in the relevant L4 summaries.

5.0 Options

To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment's rainfall in just a few storms. In sewer modelling, these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon we have tested various types of schemes, and combinations of schemes, to ensure a robust plan is delivered. Table 4 shows different ways that we can reduce the risks to customers and the environment. We can stop rainwater entering our sewers from homes (domestic surface water disconnection), businesses or paved areas (commercial and paved surface water disconnection) or from roads (highway area disconnection). Sometimes water gets into sewers through small gaps that can occur in ageing sewers - by replacing or repairing the sewers we can reduce the likelihood of this happening (groundwater infiltration into sewers reduction). Reducing how much water homes and businesses use can also help to reduce the risk to people and the environment (personal water usage reduction or trade flow reduction).

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers.	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures.	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 4 - Scheme types

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a Journey Plan, see Figure 8. The Journey Plan provides an indicative overview of the most effective option types against a timeline indicating when they might be applied.

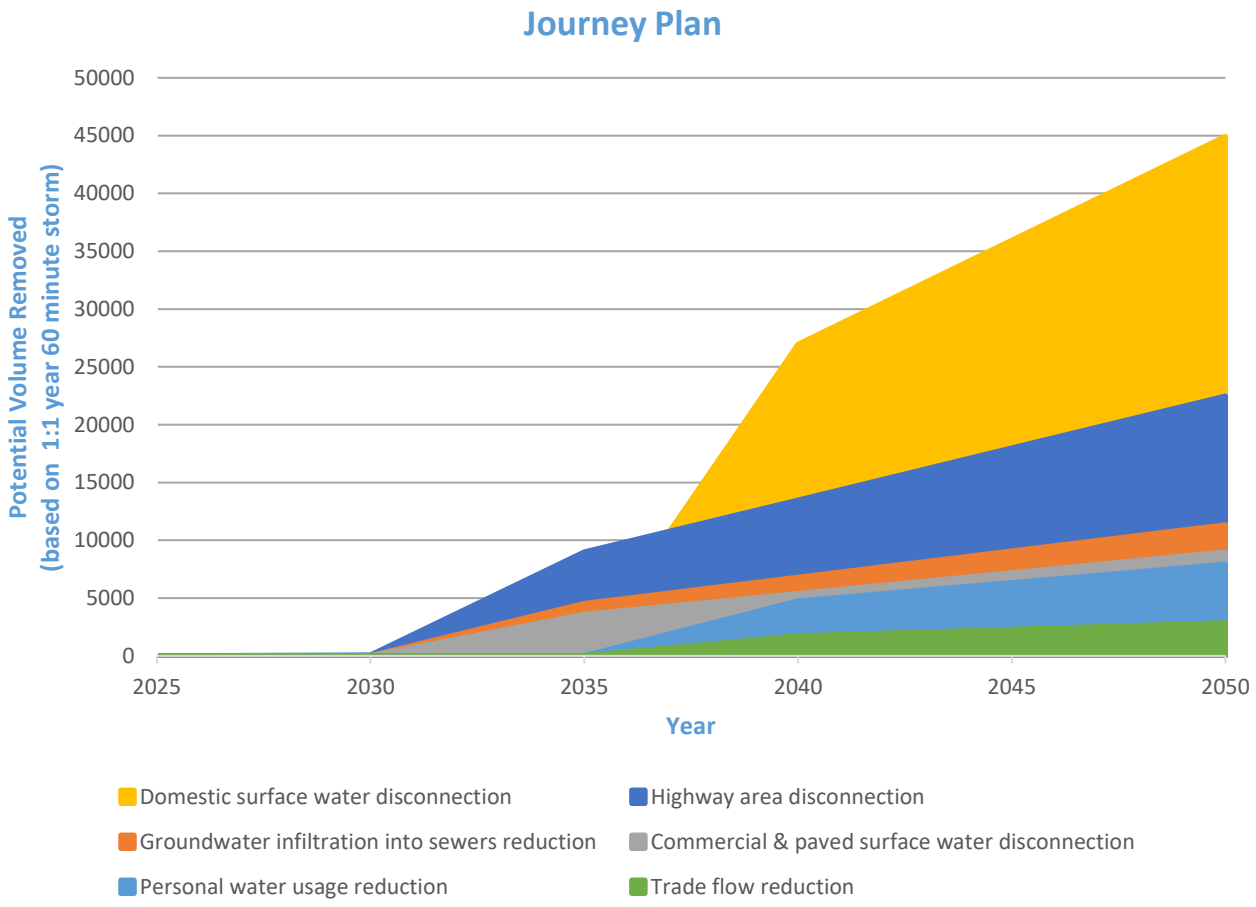


Figure 8 - Journey Plan

The measures within the Journey Plan include all green infrastructure and surface water removal techniques. We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence. We use the size of a storm event that has the probability of occurring once every 30 years.

Table 5 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

Table 6 highlights the potential costs in this region from preventing flooding from manholes scenarios. The assessment includes both the size and cost of potential mitigation measures.
Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£0.00	£0.00
40 spills in a typical year	£0.00	£0.00	£0.00
20 spills in a typical year	£0.00	£0.00	£0.00
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0 spills in a typical year	£0.00	£0.00	£0.00
Equivalent No. Principality Stadiums full of water in 10 spills	0.00	0.00	0.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£0.00	£0.00	£0.00
External escapes in gardens	£700,000.00	£800,000.00	£1,200,000.00
Escapes in highways	£1,300,000.00	£1,600,000.00	£2,400,000.00
All other remaining flooding	-	£0.00	£0.00
Total	£2,000,000.00	£2,400,000.00	£3,600,000.00

*Internal escapes - All flooding that results in flooding within a property is stopped

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We will continue to work with the Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Appendix A - Schemes in L4 catchment within L3 catchment

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

Table A1 - Number of schemes in L4 catchment within L3 catchment

L4 Catchments	No. Schemes
PONTRILAS STW	0
PETERCHURCH SWK	0
DORSTONE (NR HAY-ON-WYE) OAKLAND PL SWK	0
ABBEYDORE	0
KILPECK STW	0
WORMBRIDGE (SW OF HEREFORD)	0
MUCH DEWCHURCH STW	0

Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WwTW O compliance	Historical measure relating to the performance of the treatment works (discharge permit

WwTW Q compliance	of the treatment works (discharge permit compliance (numeric)).
WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.

DWMP Strategic Planning Area Summary

R Ithon - conf Camddwr Bk to conf R Wye

1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how we as Dŵr Cymru Welsh Water (DCWW), will manage and improve our assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The R Ithon - conf Camddwr Bk to conf R Wye planning catchment lies within the Wye catchment (see Figure 1).

The R Ithon - conf Camddwr Bk to conf R Wye catchment covers an area stretching from Llanbister in the north as far as Llandrindod Wells in the south. The geography of the catchment is predominantly rural.

There are several main rivers within the L3 including the River Ithon, Crichell Brook and Camddwr Brook, and the river basin district of this catchment is the Severn. The catchment covers several major urban areas including the town of Llandrindod and the village of Crossgates.

The largest WwTW is Llandrindod Wells SWK which serves a residential population of 5,788.

This planning catchment consists of 8 wastewater catchments (see Figure 2). There is a combined population of 7798, this is set to decrease to 7400 by 2050, a change of -5%. There is a total sewer length of 63km, with a foul sewer length of 27km, a surface water length of 8.69km and a combined sewer length of 26km. There are 8 Wastewater Treatment Works (WwTW), 13 Sewerage Pumping Stations (SPSs), and 12 Combined Storm Overflows (CSOs) across this strategic planning area.

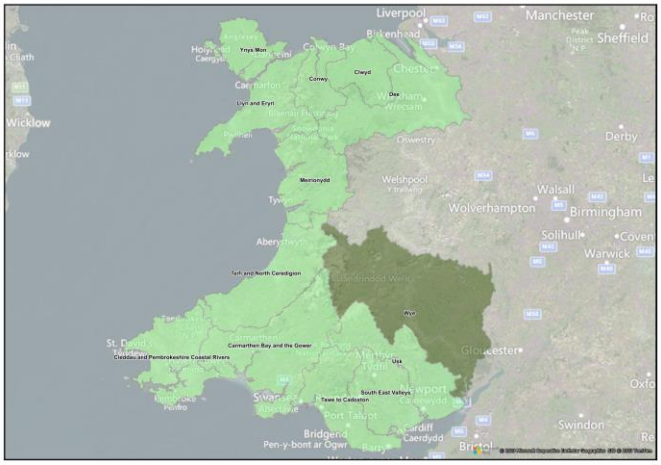

Figure 1 - River basin location detailing the strategic planning area

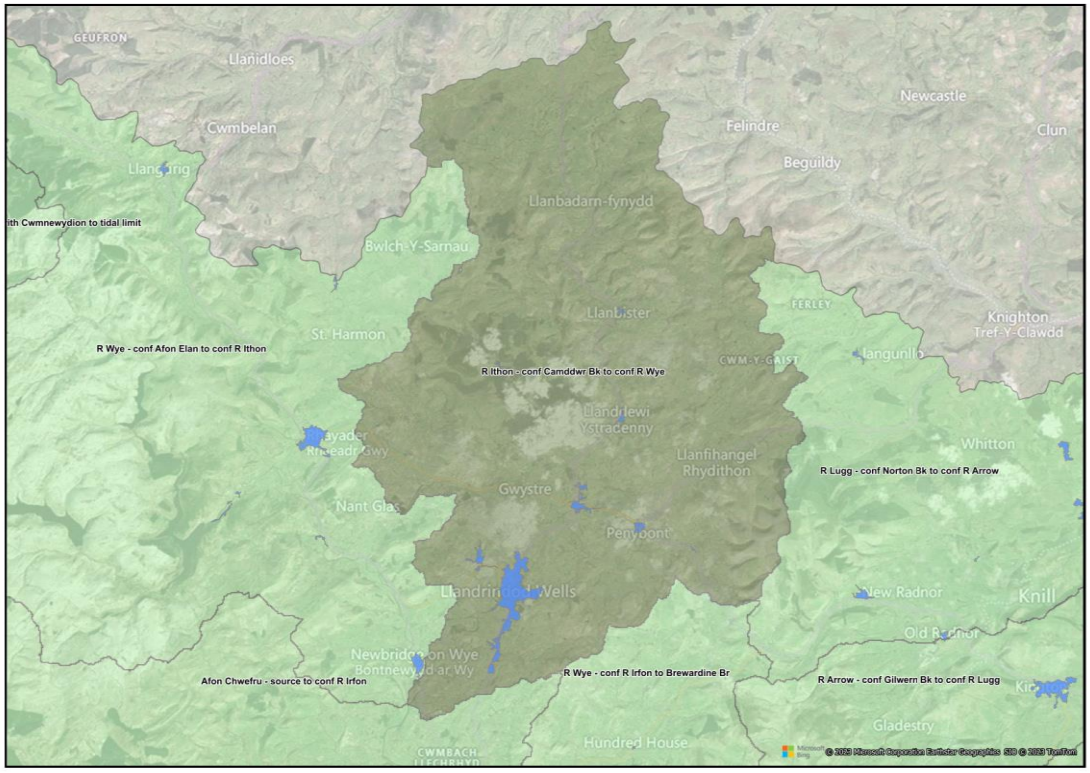

Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)

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Drainage Wastewater Management Plan

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We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England which are within our operating region, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

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For this strategic planning area the biggest risks indicated by the RBCS are Catchment vulnerability, followed by Treatment works compliance - dry and Planned residential development.

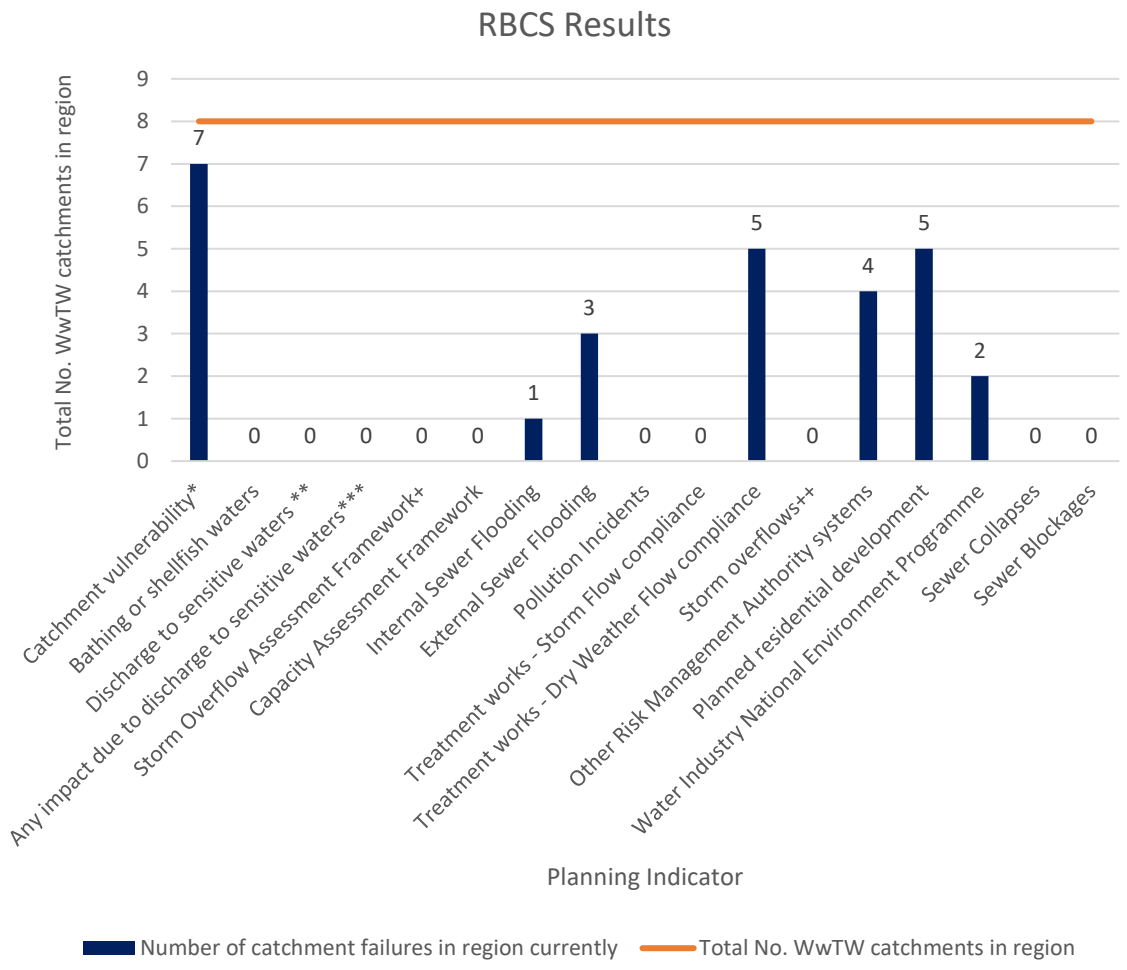

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Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment. Figures 4 and 5 illustrate the outcome of the BRAVA assessment for this strategic planning area.

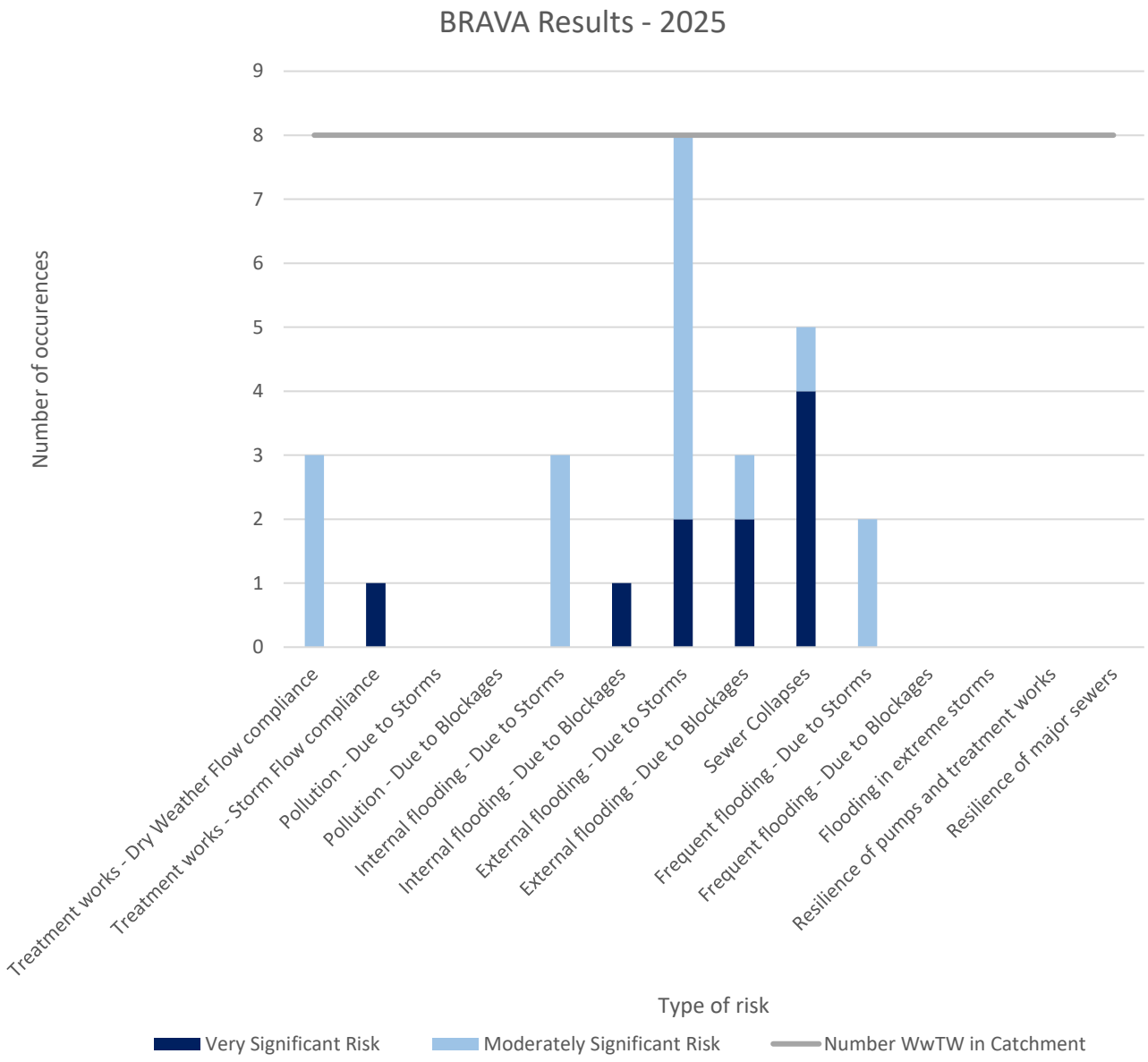


Figure 4 - BRAVA 2025 Summary

In 2025, Sewer Collapses and External flooding - Due to Storms are the biggest risks in this strategic planning area.

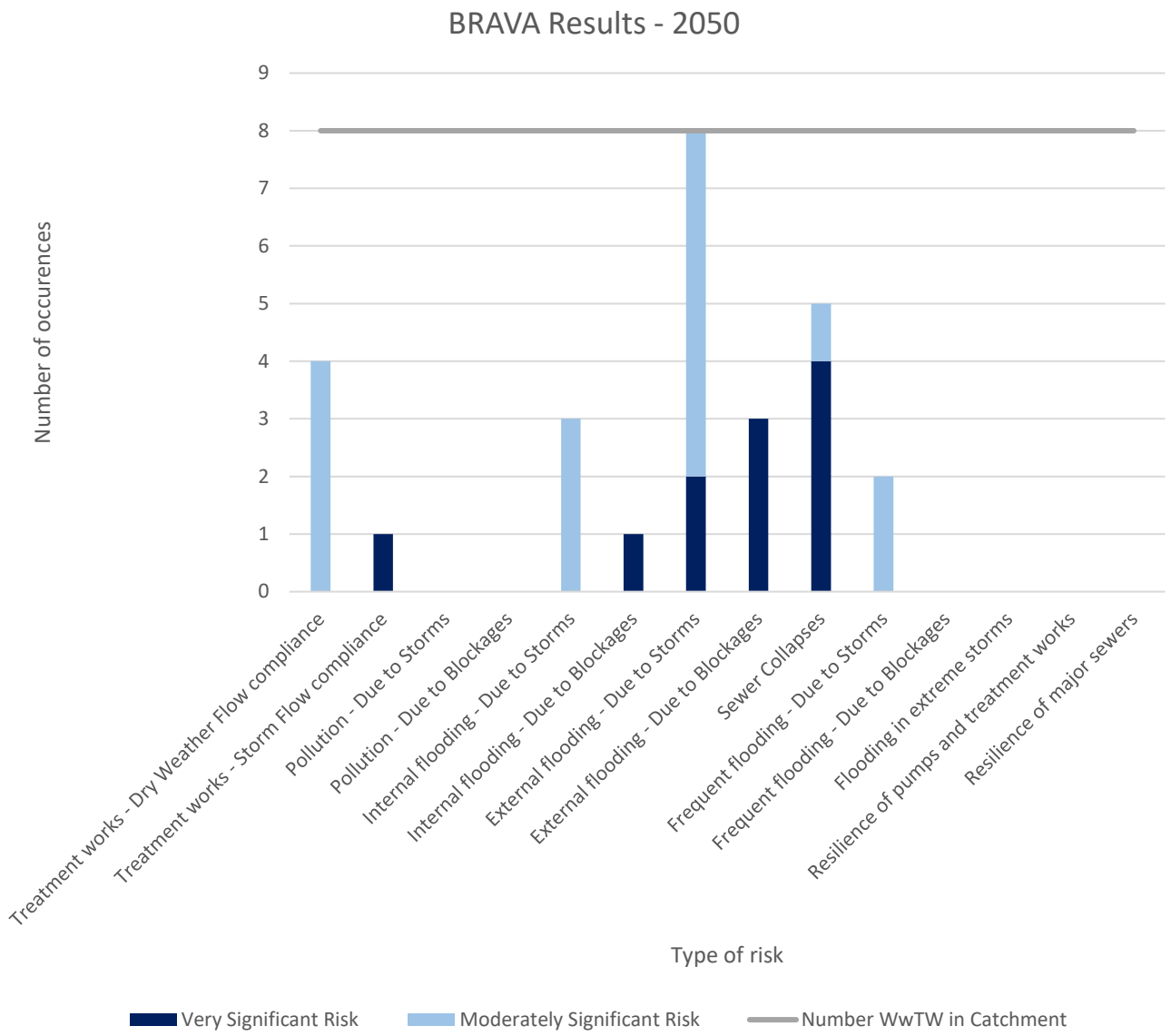
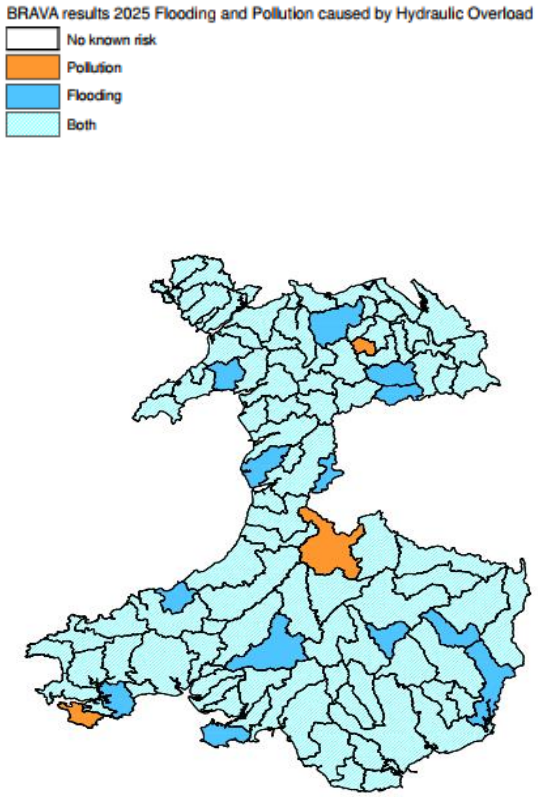


Figure 5 - BRAVA 2050 Summary

In 2050, Sewer Collapses and External flooding- Due to Storms are the biggest risks in this strategic planning area.

Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment.

From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to require a standard option assessment methodology.



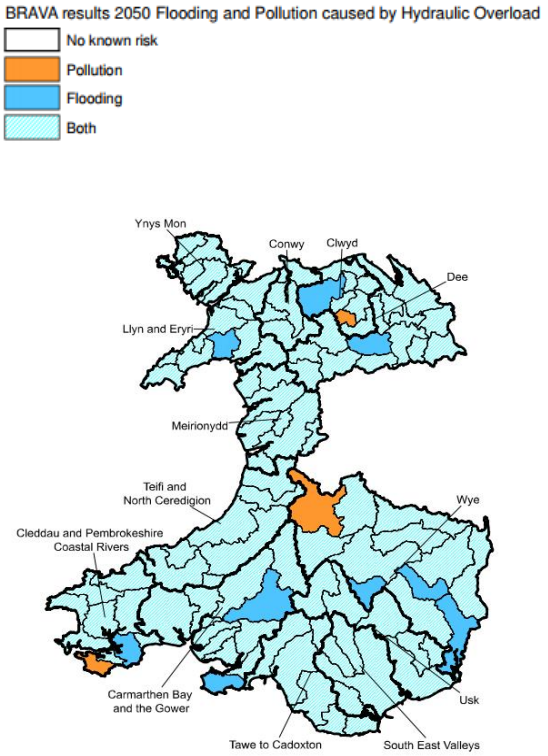


Figure 6 - Associated Strategic Planning Area priority (2025)

Figure 7 - Associated Strategic Planning Area priority (2050)

3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
R Ithon - conf Camddwr Bk to conf R Wye	14	8	6	0	0

Table 2 - WFD status'

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

The wet weather assessment takes pass forward flow (PFF) consent values, where available, as an indication of WwTW capacity, and estimates the amount of incoming flow the treatment works is able to treat across a year. It uses the same estimates as the DWF assessment for current flow, but also includes an estimate as to how much rainfall the WwTW might be able to deal with in the future, by including growth, climate change and creep. Climate change is expected to change the periodicity and amount of rain across a "typical" year. Creep, the gradual misconnection of storm sewers to the foul sewer network, is also expected to have an impact on the amount of flow a WwTW receives during storms. This gives us an approximation of where we might expect problems to arise in the future during wet weather due to growth, creep, and climate change. Areas with the greatest estimated wet weather treatment shortfall are shown in the darkest blue.

L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key
R Ithon - conf Camddwr Bk to conf R Wye	Headroom							Pass / Close Pass / Close fail / Fail
	Wet weather capacity							>90% / 80%-90% / 70%-80% / <70%

Table 3 - Supply Demand Balance

Table 3 shows that for the R Ithon - conf Camddwr Bk to conf R Wye catchment the balance between supply and demand currently passes the assessment criteria avaliable, for headroom only, and will continue to pass through to 2050. It should be noted that local issues are present in the Llanddewi Ystradenni L4 catchment. Further detail is provided in the relevant L4 summary.

5.0 Options

To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment's rainfall in just a few storms. In sewer modelling, these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon we have tested various types of schemes, and combinations of schemes, to ensure a robust plan is delivered. Table 4 shows different ways that we can reduce the risks to customers and the environment. We can stop rainwater entering our sewers from homes (domestic surface water disconnection), businesses or paved areas (commercial and paved surface water disconnection) or from roads (highway area disconnection). Sometimes water gets into sewers through small gaps that can occur in ageing sewers - by replacing or repairing the sewers we can reduce the likelihood of this happening (groundwater infiltration into sewers reduction). Reducing how much water homes and businesses use can also help to reduce the risk to people and the environment (personal water usage reduction or trade flow reduction).

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers.	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures.	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 4 - Scheme types

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a Journey Plan, see Figure 8. The Journey Plan provides an indicative overview of the most effective option types against a timeline indicating when they might be applied.

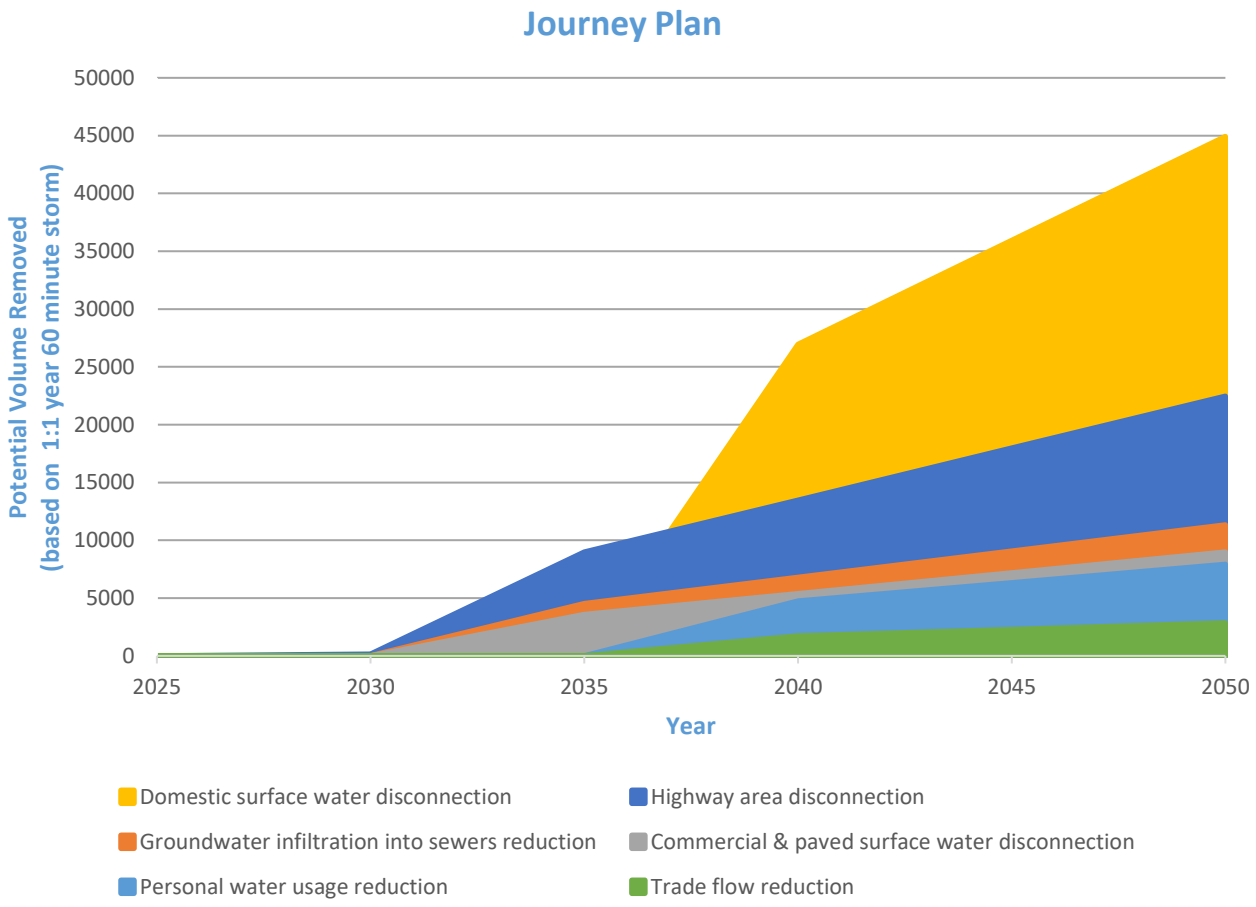


Figure 8 - Journey Plan

The measures within the Journey Plan include all green infrastructure and surface water removal techniques. We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence. We use the size of a storm event that has the probability of occurring once every 30 years.

Table 5 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

Table 6 highlights the potential costs in this region from preventing flooding from manholes scenarios. The assessment includes both the size and cost of potential mitigation measures.
Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£24,000,000.00	£39,000,000.00
40 spills in a typical year	£7,000,000.00	£7,000,000.00	£8,000,000.00
20 spills in a typical year	£10,000,000.00	£10,000,000.00	£12,000,000.00
10 spills in a typical year	£14,000,000.00	£12,000,000.00	£16,000,000.00
0 spills in a typical year	£27,000,000.00	£28,000,000.00	£32,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	49.00	54.00	58.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£0.00	£0.00	£0.00
External escapes in gardens	£700,000.00	£800,000.00	£1,200,000.00
Escapes in highways	£6,800,000.00	£8,300,000.00	£12,600,000.00
All other remaining flooding	-	£0.00	£0.00
Total	£7,500,000.00	£9,100,000.00	£13,800,000.00

*Internal escapes - All flooding that results in flooding within a property is stopped

*External escapes in gardens - All flooding within the curtilage of the property is stopped

*Escapes to highways - All flooding from DCWW systems impacting public highways is stopped.

Table 6 - Summary of Flooding Option Investments Strategy Costs

We have developed solutions which aim to provide a resilient sewerage network when tested against a range of future legislative scenarios. The solutions developed highlight the level of investment required to bring the entire network up to the level of protection required to be resilient to future demands. We have derived costs for a range of potential legislative future scenarios to ensure the cost impact of choices made is recognised.

We are beginning to break down the investment indicated in Table 5 and 6 by creating practical schemes ready for delivery. These schemes are designed as traditional engineering solutions, sustainable or green infrastructure, or a combination of both. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the Habitat Directive, as a priority against drainage and network failure which result in pollution events and flooding. The solutions developed highlight the level of investment required to bring our network to the level of protection required to mitigate against these risks. Appendix A shows the number of solutions within this tactical planning unit (Level 3).

For more information on the methodology developed to carry out the assessments see the DWMP Main Plan.

If you would like to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please contact us at DWMP@dwrcymru.com.

We will continue to work with the Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Appendix A - Schemes in L4 catchment within L3 catchment

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

Table A1 - Number of schemes in L4 catchment within L3 catchment

L4 Catchments	No. Schemes
LLANDRINDOD WELLS SWK	0
LLANDDEWI YSTRADENNI SWK	0
LLANYRE SWK	0
LLANBISTER SWK	0
LLANDEGLEY (NR LLANDRINDOD WELLS) SWK	0
ABBEYCWMHIR STW	0
CROSSGATES (N OF LLANDRINDOD WELLS) SWK	0
PENYBONT (NR LLANDRINDOD WELLS) SWK	0

Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WwTW O compliance	Historical measure relating to the performance of the treatment works (discharge permit

WwTW Q compliance	of the treatment works (discharge permit compliance (numeric)).
WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.

DWMP Strategic Planning Area Summary

R Lugg - conf Norton Bk to conf R Arrow

1.0 Introduction

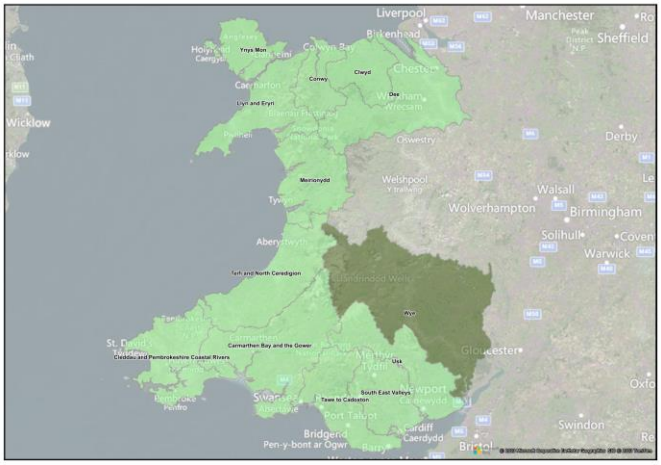
This Drainage and Wastewater Management Plan (DWMP) sets out how we as Dŵr Cymru Welsh Water (DCWW), will manage and improve our assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The R Lugg - conf Norton Bk to conf R Arrow planning catchment lies within the Wye catchment (see Figure 1).

The R Lugg - conf Norton Bk to conf R Arrow catchment covers an area stretching from Llangunllo in the north as far as Leominster. The geography of the catchment is predominantly rural.
There are several main rivers within the L3 including the River Lugg and Whyle Brook, with the river basin district of this catchment being the Severn. The catchment covers several major urban areas including the towns of Leominster and Presteigne.
The largest WwTW is Leominster Worcester Road which serves a residential population of 11,173.

This planning catchment consists of 10 wastewater catchments (see Figure 2). There is a combined population of 17948, this is set to increase to 21100 by 2050, a change of 18%. There is a total sewer length of 110km, with a foul sewer length of 63km, a surface water length of 17.28km and a combined sewer length of 27km. There are 10 Wastewater Treatment Works (WwTW), 26 Sewerage Pumping Stations (SPSs), and 14 Combined Storm Overflows (CSOs) across this strategic planning area.



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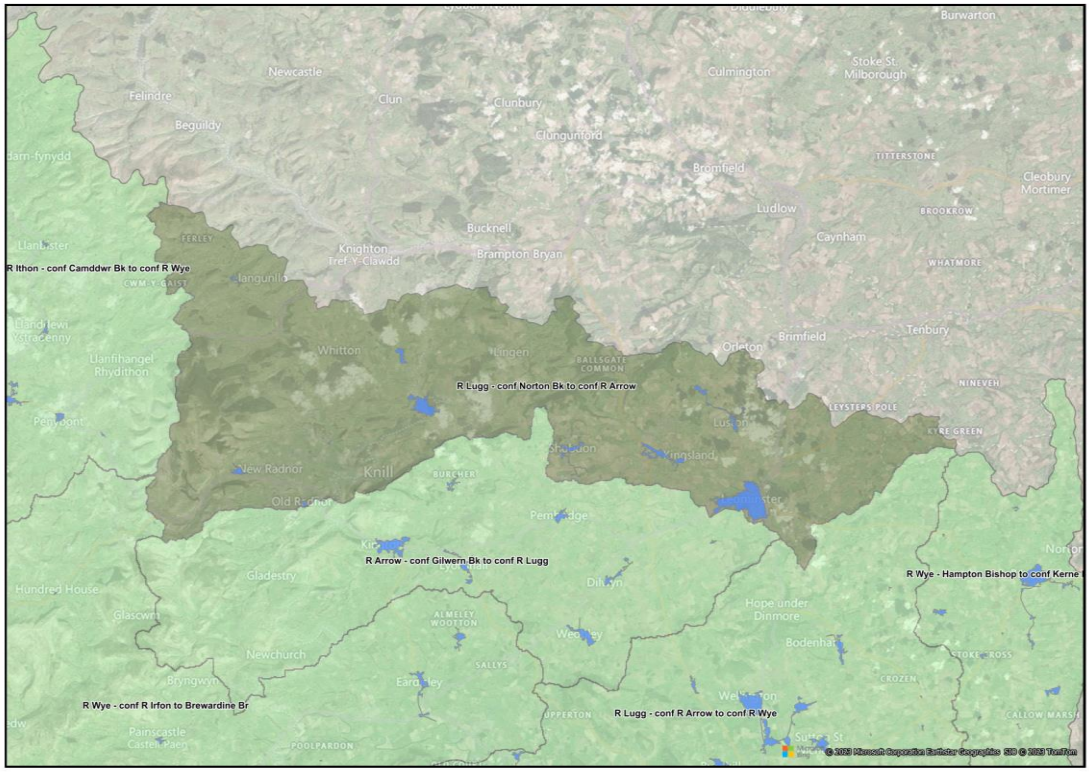

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There are major developments in localised areas that will contribute to future pressures on the network, including Kaye Presteigne Premises, off Lugg View, Prest, with a proposed 30 units, followed by Land off Knighton Road, Presteigne, with a proposed 30 units.
The Core Management plan for the River Wye SAC provides an overview of the conservation required on site. The plan details the drive in enhancing the social, economic and natural value of the area, by summarising conservation objectives with regards to maintenance, restoration and future connections between the wider ecology and connecting surroundings. The plan can be found here :

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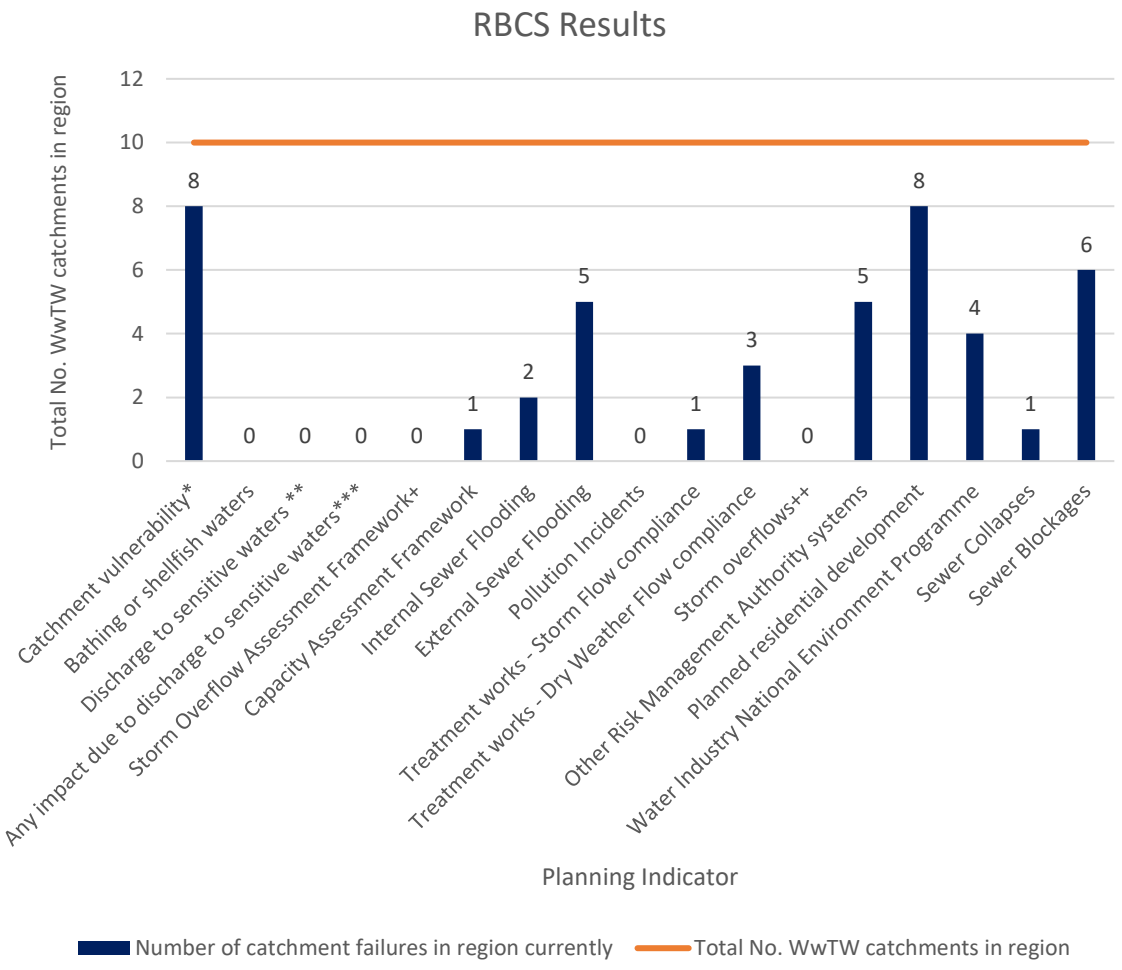

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3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment. Figures 4 and 5 illustrate the outcome of the BRAVA assessment for this strategic planning area.

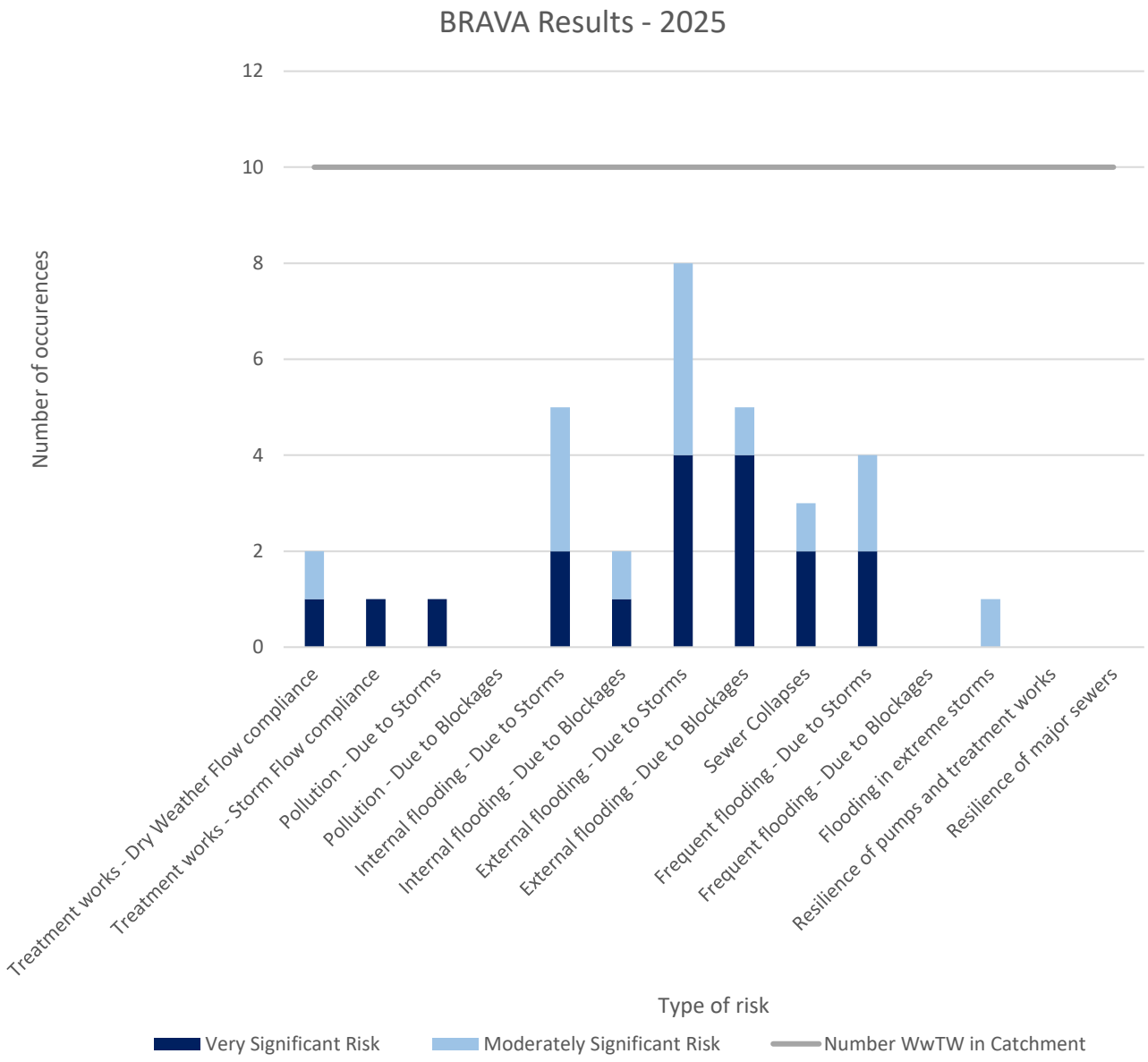


Figure 4 - BRAVA 2025 Summary

In 2025, External flooding - Due to Blockages and External flooding - Due to Storms are the biggest risks in this strategic planning area.

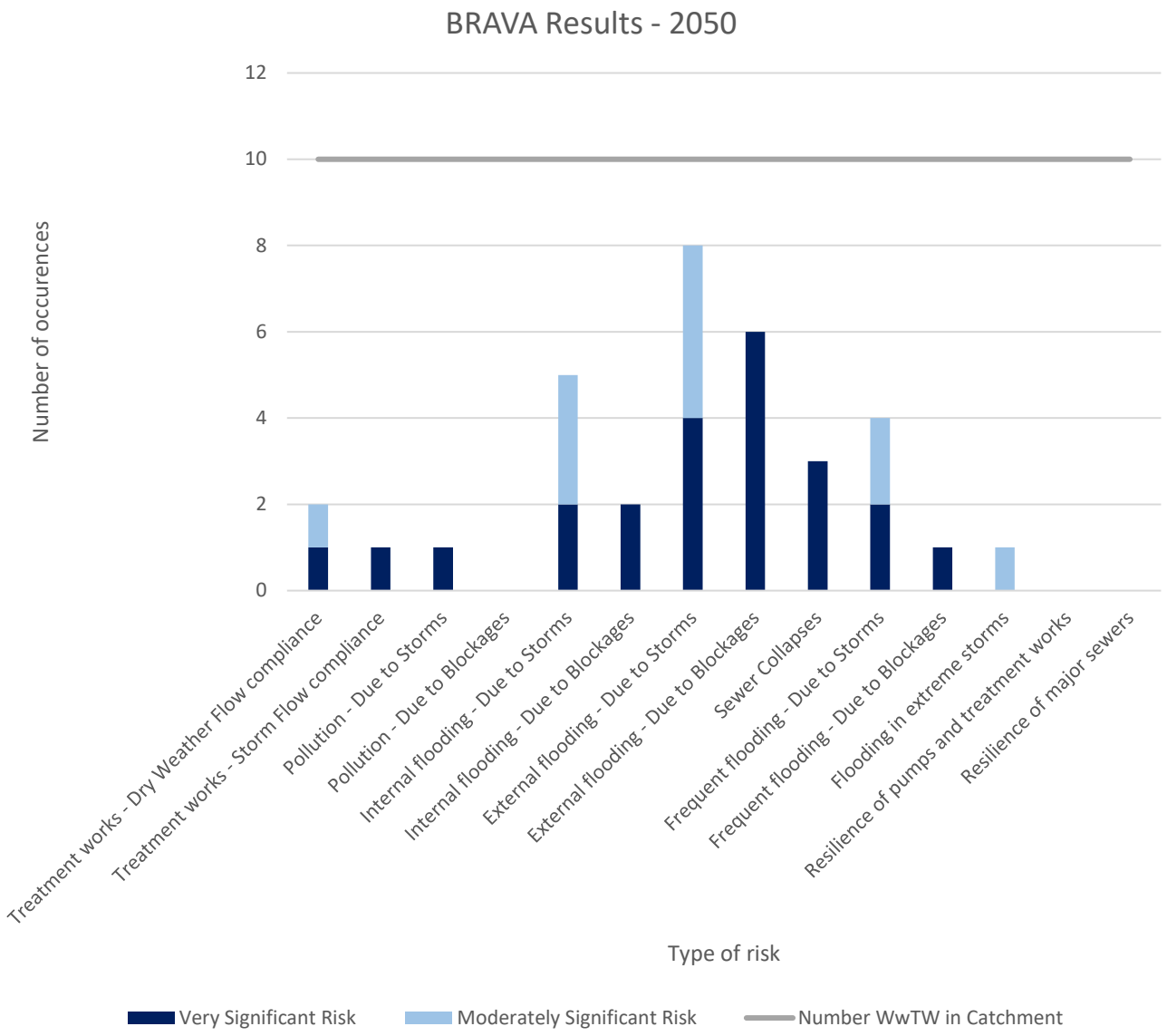


Figure 5 - BRAVA 2050 Summary

In 2050, External flooding - Due to Blockages and External flooding - Due to Storms are the biggest risks in this strategic planning area.

Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment.

From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to require a standard option assessment methodology.

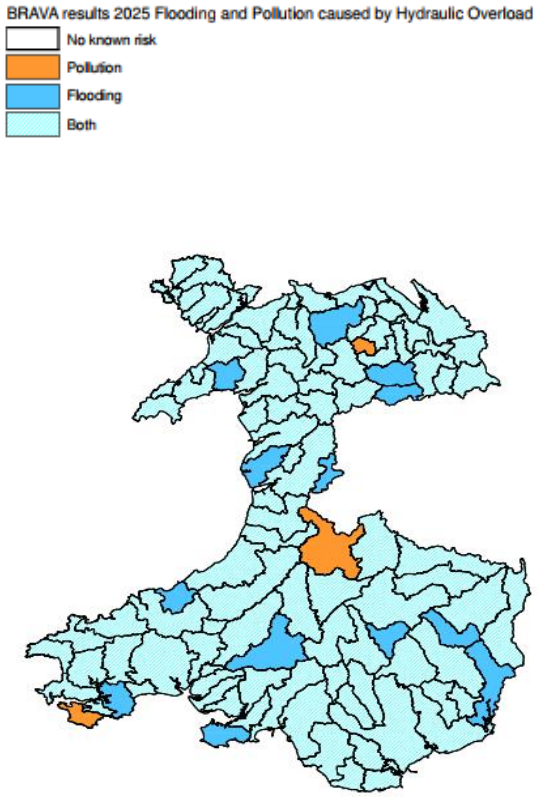


Figure 6 - Associated Strategic Planning Area priority (2025)

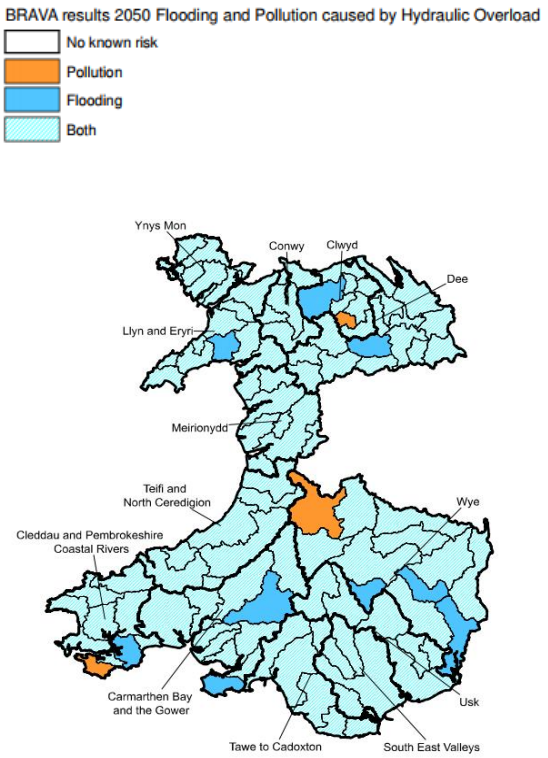


Figure 7 - Associated Strategic Planning Area priority (2050)

3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
R Lugg - conf Norton Bk to conf R Arrow	13	3	6	3	1

Table 2 - WFD status'

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

The wet weather assessment takes pass forward flow (PFF) consent values, where available, as an indication of WwTW capacity, and estimates the amount of incoming flow the treatment works is able to treat across a year. It uses the same estimates as the DWF assessment for current flow, but also includes an estimate as to how much rainfall the WwTW might be able to deal with in the future, by including growth, climate change and creep. Climate change is expected to change the periodicity and amount of rain across a "typical" year. Creep, the gradual misconnection of storm sewers to the foul sewer network, is also expected to have an impact on the amount of flow a WwTW receives during storms. This gives us an approximation of where we might expect problems to arise in the future during wet weather due to growth, creep, and climate change. Areas with the greatest estimated wet weather treatment shortfall are shown in the darkest blue.

L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key
R Lugg - conf Norton Bk to conf R Arrow	Headroom							Pass / Close Pass / Close fail / Fail
	Wet weather capacity							>90% / 80%-90% / 70%-80% / <70%

Table 3 - Supply Demand Balance

Table 3 shows that for the R Lugg - conf Norton Bk to conf R Arrow catchment the balance between supply and demand currently passes the assessment criteria avaliable, for headroom only, and will continue to pass through to 2050. It should be noted that local issues are present in the Norton (Old) L4 catchment. Further detail is provided in the relevant L4 summary.

5.0 Options

To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment's rainfall in just a few storms. In sewer modelling, these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon we have tested various types of schemes, and combinations of schemes, to ensure a robust plan is delivered. Table 4 shows different ways that we can reduce the risks to customers and the environment. We can stop rainwater entering our sewers from homes (domestic surface water disconnection), businesses or paved areas (commercial and paved surface water disconnection) or from roads (highway area disconnection). Sometimes water gets into sewers through small gaps that can occur in ageing sewers - by replacing or repairing the sewers we can reduce the likelihood of this happening (groundwater infiltration into sewers reduction). Reducing how much water homes and businesses use can also help to reduce the risk to people and the environment (personal water usage reduction or trade flow reduction).

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers.	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures.	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 4 - Scheme types

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a Journey Plan, see Figure 8. The Journey Plan provides an indicative overview of the most effective option types against a timeline indicating when they might be applied.

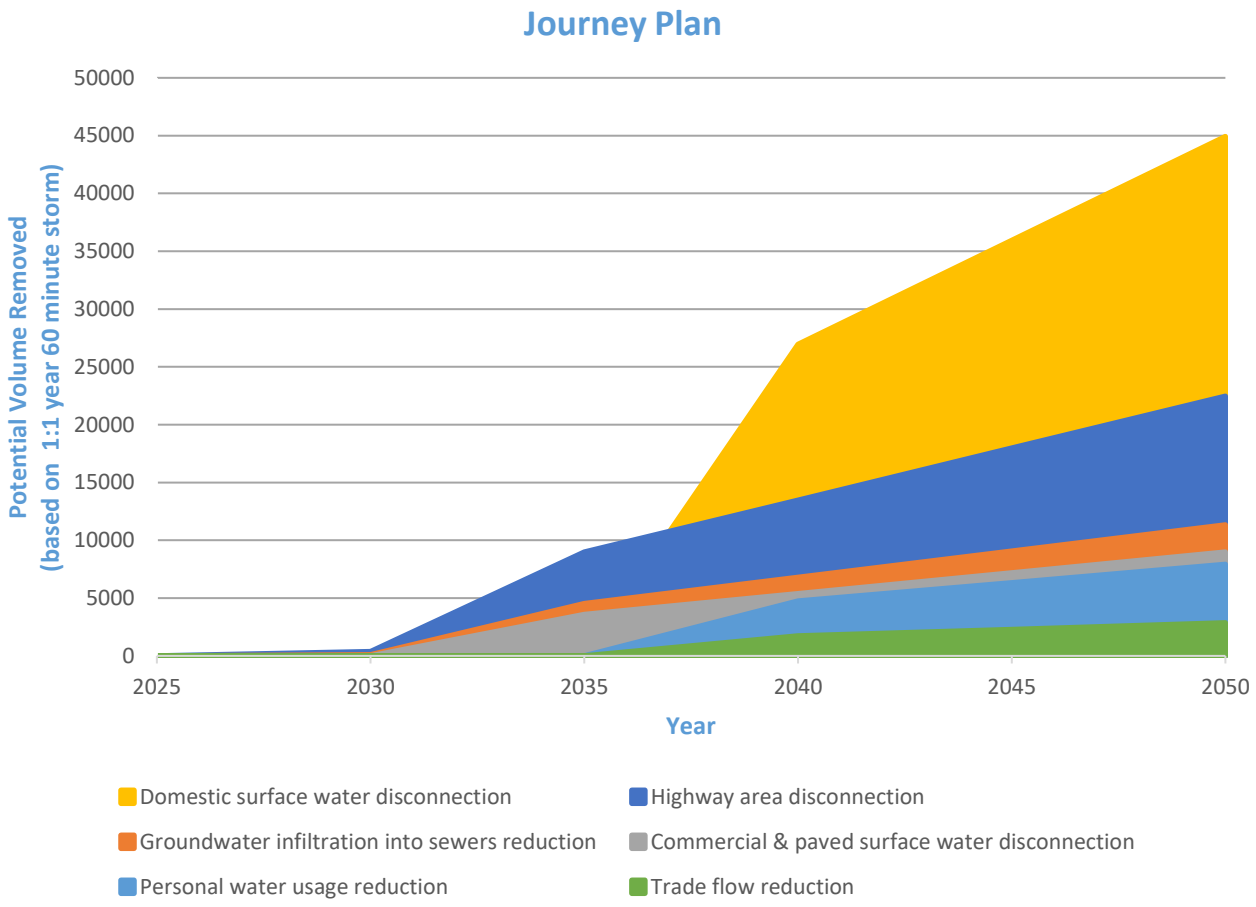


Figure 8 - Journey Plan

The measures within the Journey Plan include all green infrastructure and surface water removal techniques. We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence. We use the size of a storm event that has the probability of occurring once every 30 years.

Table 5 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

Table 6 highlights the potential costs in this region from preventing flooding from manholes scenarios. The assessment includes both the size and cost of potential mitigation measures.
Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£14,000,000.00	£20,000,000.00
40 spills in a typical year	£3,000,000.00	£3,000,000.00	£3,000,000.00
20 spills in a typical year	£5,000,000.00	£5,000,000.00	£5,000,000.00
10 spills in a typical year	£6,000,000.00	£6,000,000.00	£6,000,000.00
0 spills in a typical year	£14,000,000.00	£15,000,000.00	£15,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	22.00	24.00	26.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£1,200,000.00	£1,600,000.00	£3,000,000.00
External escapes in gardens	£1,300,000.00	£1,700,000.00	£2,300,000.00
Escapes in highways	£28,700,000.00	£36,900,000.00	£66,700,000.00
All other remaining flooding	-	£0.00	£0.00
Total	£31,200,000.00	£40,200,000.00	£72,000,000.00

*Internal escapes - All flooding that results in flooding within a property is stopped

*External escapes in gardens - All flooding within the curtilage of the property is stopped

*Escapes to highways - All flooding from DCWW systems impacting public highways is stopped.

Table 6 - Summary of Flooding Option Investments Strategy Costs

We have developed solutions which aim to provide a resilient sewerage network when tested against a range of future legislative scenarios. The solutions developed highlight the level of investment required to bring the entire network up to the level of protection required to be resilient to future demands. We have derived costs for a range of potential legislative future scenarios to ensure the cost impact of choices made is recognised.

We are beginning to break down the investment indicated in Table 5 and 6 by creating practical schemes ready for delivery. These schemes are designed as traditional engineering solutions, sustainable or green infrastructure, or a combination of both. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the Habitat Directive, as a priority against drainage and network failure which result in pollution events and flooding. The solutions developed highlight the level of investment required to bring our network to the level of protection required to mitigate against these risks. Appendix A shows the number of solutions within this tactical planning unit (Level 3).

For more information on the methodology developed to carry out the assessments see the DWMP Main Plan.

If you would like to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please contact us at DWMP@dwrcymru.com.

We will continue to work with the Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Appendix A - Schemes in L4 catchment within L3 catchment

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

Table A1 - Number of schemes in L4 catchment within L3 catchment

L4 Catchments	No. Schemes
LEOMINSTER WORCESTER ROAD	0
SHOBDON	0
KINGSLAND	0
LUSTON & YARPOLE	0
PRESTEIGNE	0
EVENJOBB (NR NEW RADNOR)	0
OLD RADNOR	0
LLANGUNLLO (W OF KNIGHTON) SWK	0
NEW RADNOR	0
NORTON (N OF PRESTEIGNE)	0

Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WwTW O compliance	Historical measure relating to the performance of the treatment works (discharge permit

WwTW Q compliance	of the treatment works (discharge permit compliance (numeric)).
WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.

DWMP Strategic Planning Area Summary

R Lugg - conf R Arrow to conf R Wye

1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how we as Dŵr Cymru Welsh Water (DCWW), will manage and improve our assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The R Lugg - conf R Arrow to conf R Wye planning catchment lies within the Wye catchment (see Figure 1).

The R Lugg - conf R Arrow to conf R Wye catchment covers an area stretching from Sparrington in the north as far as Kingstone and Madley. The geography of the catchment is predominantly rural.
There are several main rivers within the L3 including the River Lugg and River Wye, with the river basin district of this catchment being the Severn. The catchment covers several major urban areas including the towns of Bodenham and Hereford.
The largest WwTW is Hereford Eign which serves a residential population of 68,896.

This planning catchment consists of 18 wastewater catchments (see Figure 2). There is a combined population of 135942, this is set to decrease to 97500 by 2050, a change of -28%. There is a total sewer length of 509km, with a foul sewer length of 240km, a surface water length of 104.3km and a combined sewer length of 160km. There are 18 Wastewater Treatment Works (WwTW), 103 Sewerage Pumping Stations (SPSs), and 28 Combined Storm Overflows (CSOs) across this strategic planning area.

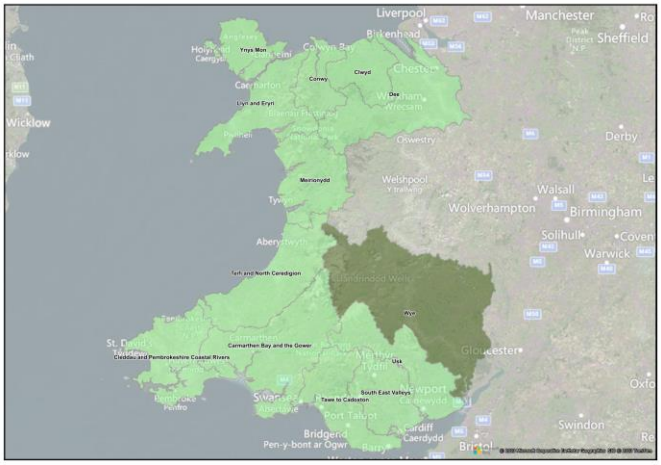


Figure 1 - River basin location detailing the strategic planning area

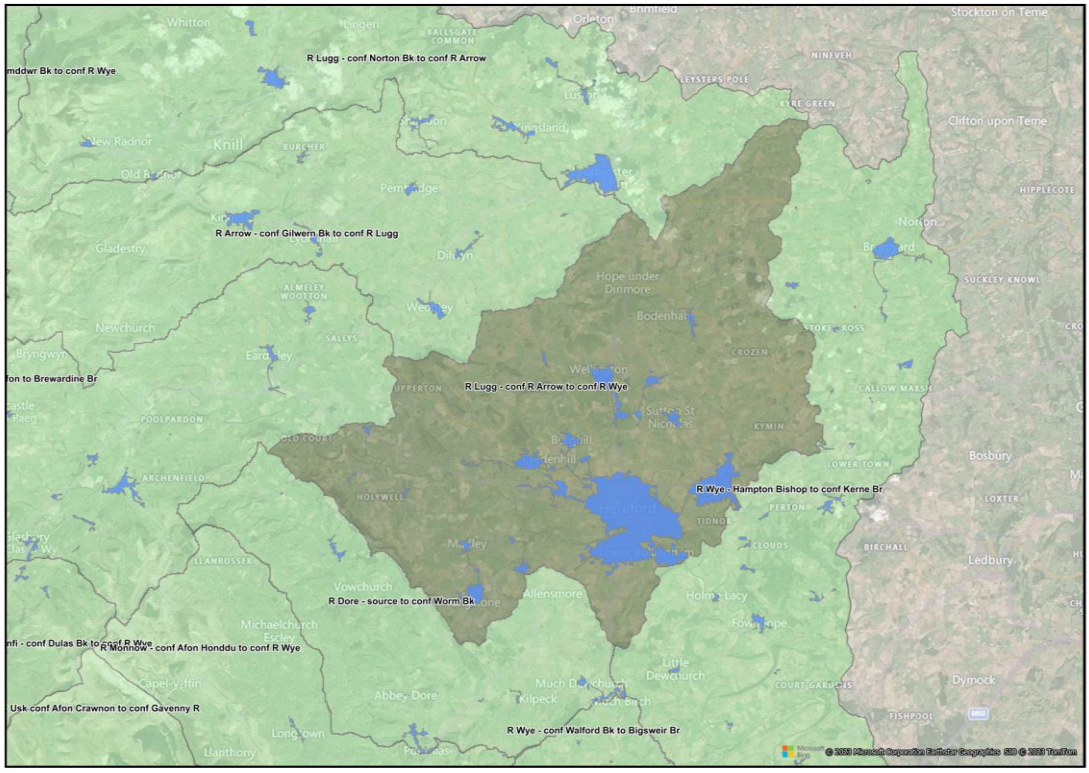


Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans.

Further information on how we are and will continue to engage with stakeholders can be found in the 'How have we engaged with customers and stakeholders?' chapter of the Main Plan.

Stakeholder Engagement Opportunities
Stakeholder engagement meetings have been held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. No multi-agency schemes have been identified at this stage, however engagement has been made to establish alignment with stakeholder plans, policies and to explore the concept of joint working going forward.

Table 1 - Stakeholder opportunity partnerships

The 'Where we want to work with you' document, which further explains our stakeholder engagement plan, can be found in the Risk section of the DCWW DWMP page found here:

Drainage Wastewater Management Plan

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England which are within our operating region, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

Urban creep is the term used to explain loss of green spaces. For example, when new driveways or house extensions are built. This often leads to more rainwater entering sewers. Our forecasts, which are based on a UKWIR study, suggest that urban creep will add up to 0.63 metres squared of impermeable area per house per year.

A UKWIR report on urban creep can be found here, Impact of Urban Creep on Sewerage Systems.
Climate change is predicted to increase the intensity of storms by around 15% in this region. This is based on a 2017 UKWIR report, which used a high-resolution climate model for the UK to predict changes in design storm intensities for a high emissions scenario (RCP8.5). In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the R Lugg - conf R Arrow to conf R Wye region is set to decrease to 97500 by 2050, a change of -28% based on our future projections. For a further a breakdown of population change in the L3 region please see the L4 report.
There are no major developments in localised areas that will contribute to future pressures on the network.

The Core Management plan for the River Wye SAC provides an overview of the conservation required on site. The plan details the drive in enhancing the social, economic and natural value of the area, by summarising conservation objectives with regards to maintenance, restoration and future connections between the wider ecology and connecting surroundings. The plan can be found here :

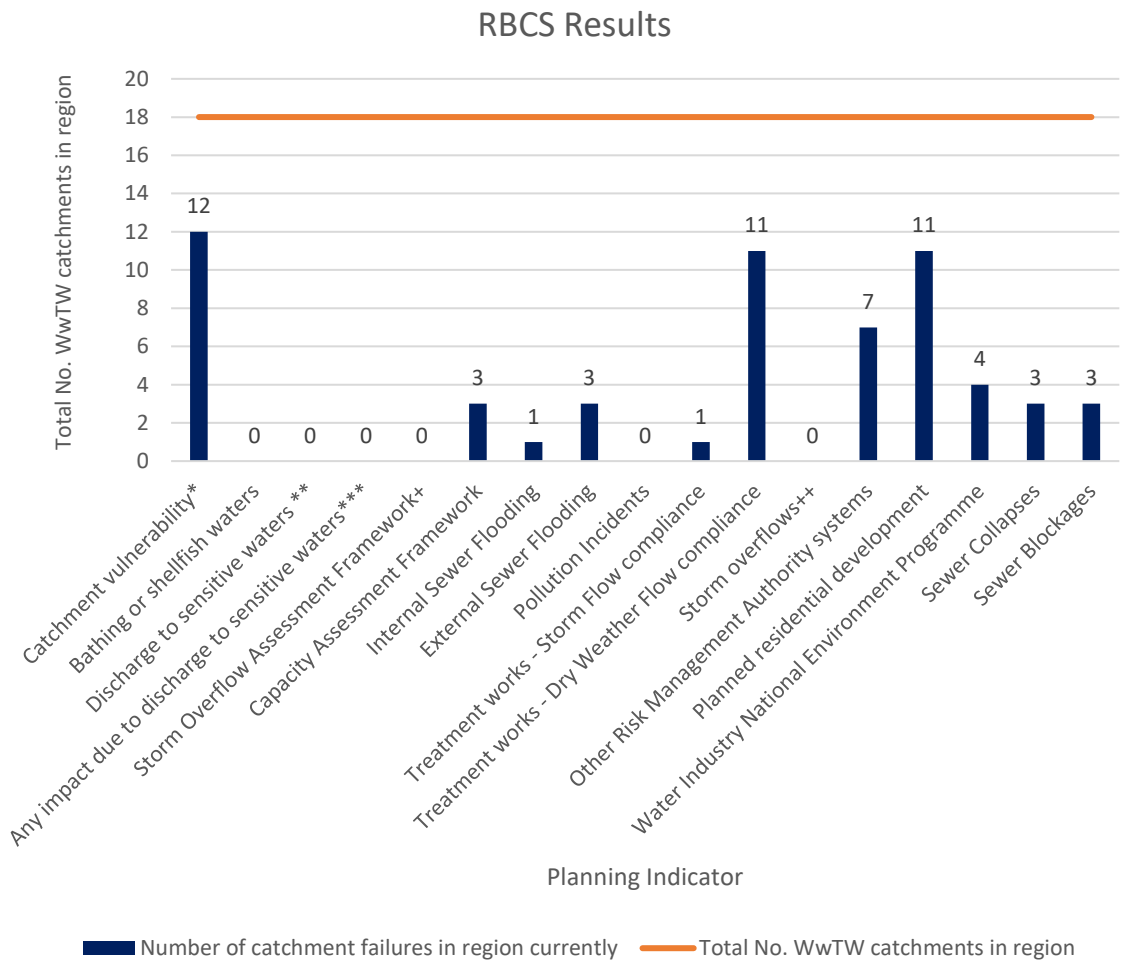
Core Management Plan

Future predictions of growth in the area have been estimated based on the average between the rate of properties that have been built in the past 10 years and the rate that the local development plan predicts houses should be built. In addition to this, we have accounted for the changes in the existing population by the change in the number of people living in an average property in the area.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. The results are shown in Figure 3. Descriptions of the indicators can be seen in Appendix B. All catchments passed through to a more detailed risk assessment (BRAVA).

For this strategic planning area the biggest risks indicated by the RBCS are Catchment vulnerability, followed by Treatment works - Dry Weather Flow compliance and Planned residential development.

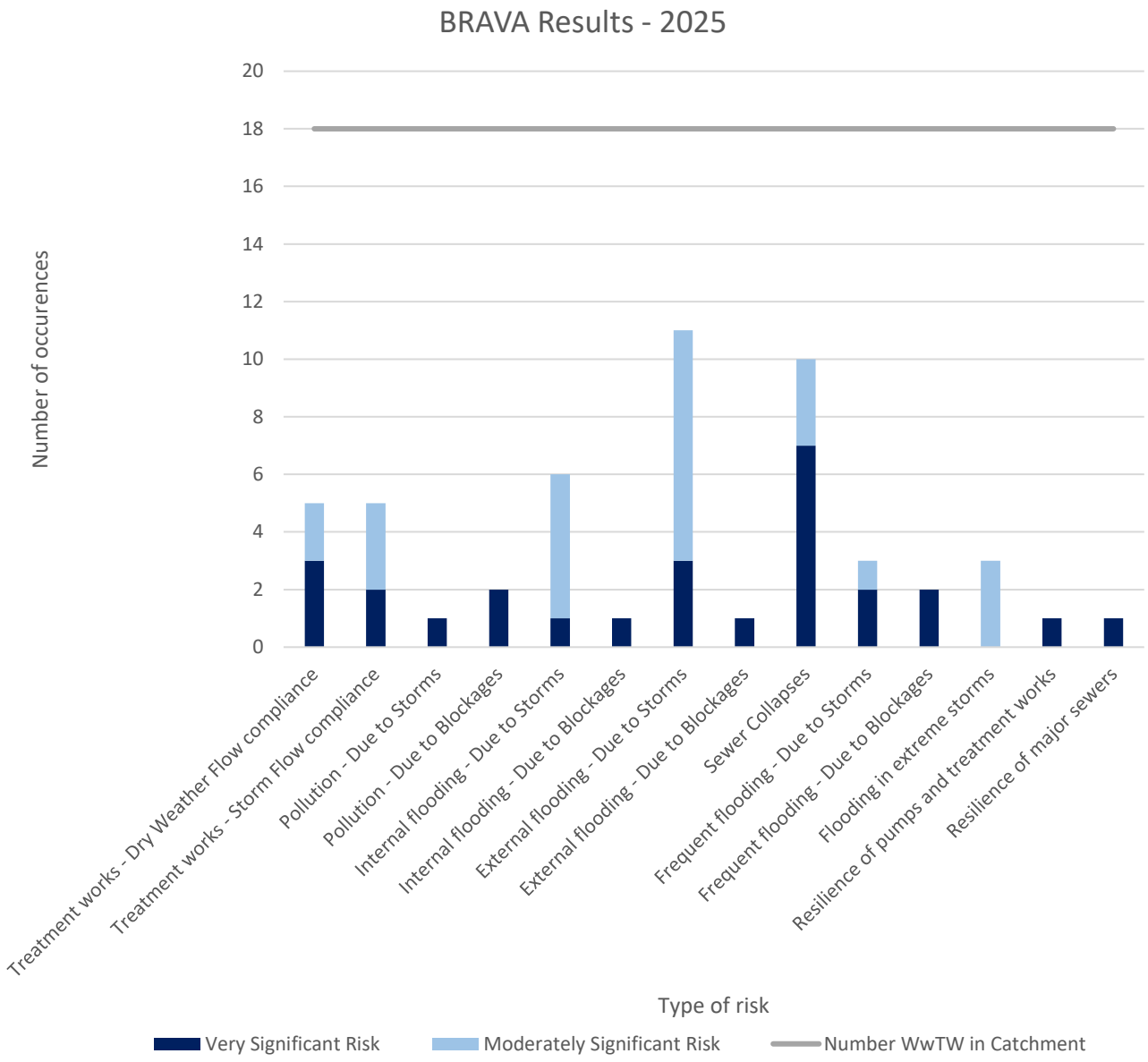


*To sewer flooding due to extreme wet weather events.
**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.
***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.
+Frequency investigation triggered.
++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment. Figures 4 and 5 illustrate the outcome of the BRAVA assessment for this strategic planning area.



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In 2025, Sewer Collapses and External flooding - Due to Storms are the biggest risks in this strategic planning area.

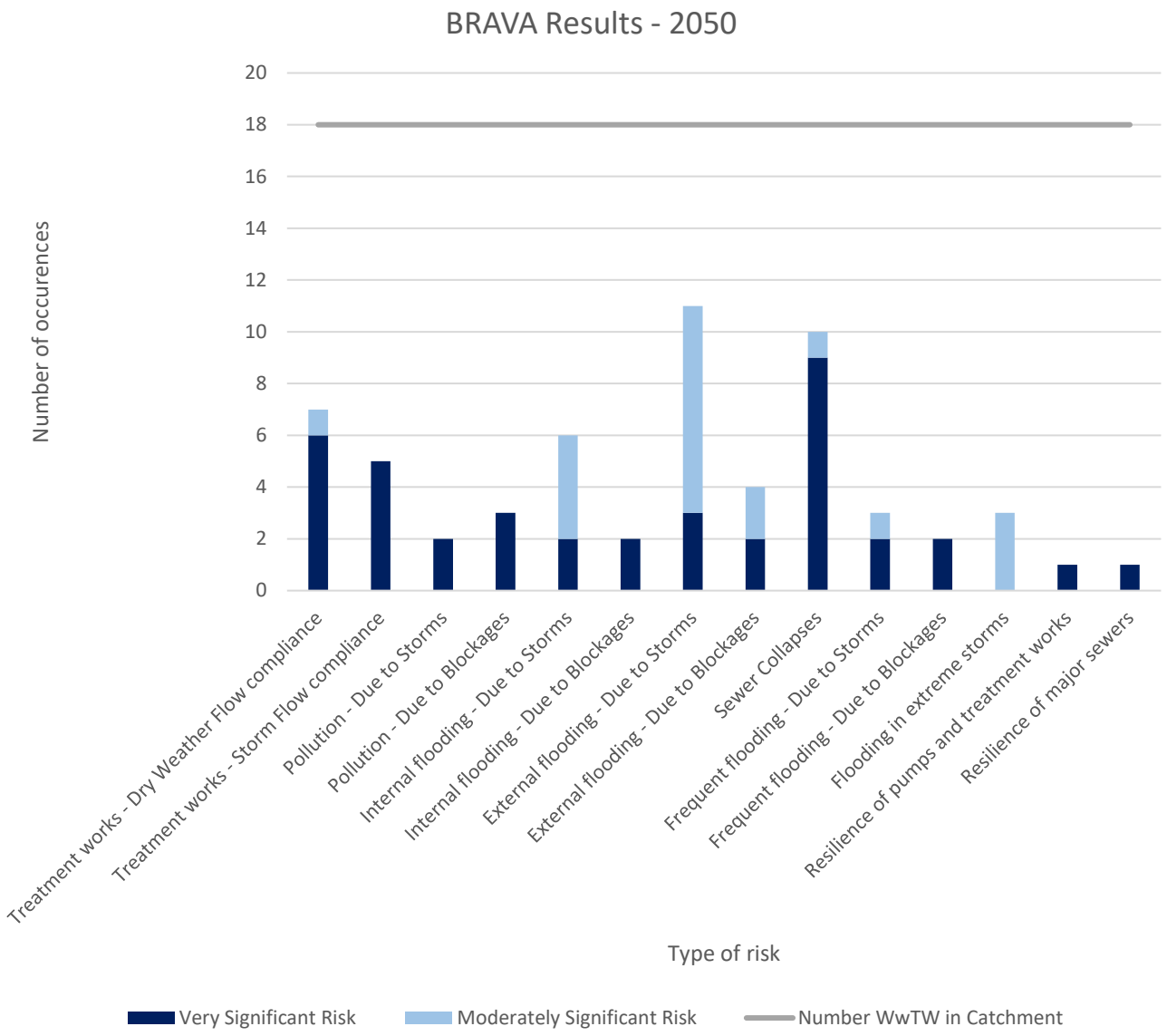


Figure 5 - BRAVA 2050 Summary

In 2050, Sewer Collapses followed by Treatment works - Dry Weather Flow compliance and External flooding - Due to Storms are the biggest risks in this strategic planning area.

Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment.

From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to be in the Extended or Complex category and required a more detailed option assessment.

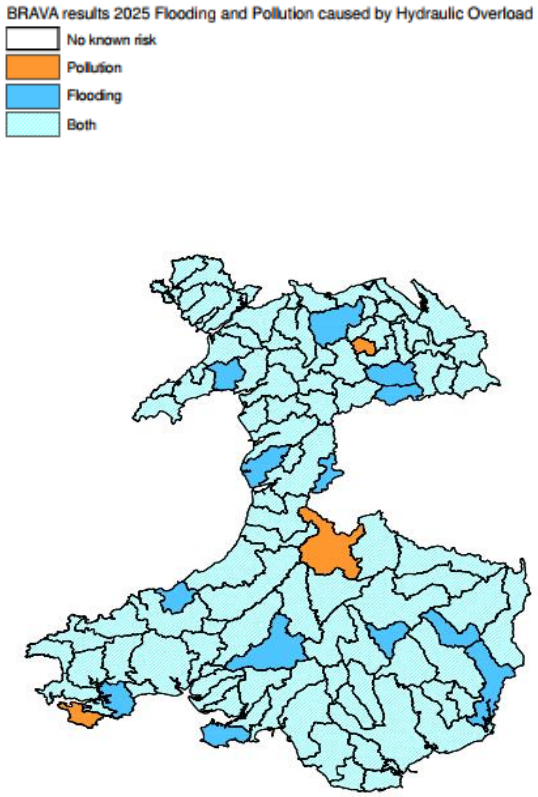
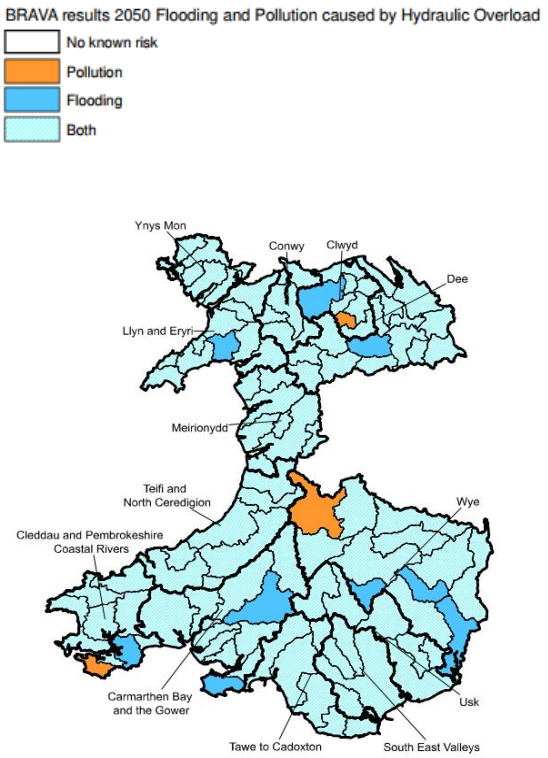


Figure 6 - Associated Strategic Planning Area priority (2025)



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3.3 Water Framework Directive

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Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
R Lugg - conf R Arrow to conf R Wye	14	2	10	2	0

Table 2 - WFD status'

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

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L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key	
R Lugg - conf R Arrow to conf R Wye	Headroom							Pass	Close fail
								Close Pass	Fail
	Wet weather capacity							>90%	70%-80%
								80%-90%	<70%

Table 3 - Supply Demand Balance

Table 3 shows that for the R Lugg - conf R Arrow to conf R Wye catchment the balance between supply and demand currently passes the assessment criteria avaliable, for headroom only, and will continue to pass through to 2050. It should be noted that local issues are present in the Canon Pyon, Preston Wynne and Preston-On-Wye L4 catchments. Further detail is provided in the relevant L4 summaries.

5.0 Options

To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment's rainfall in just a few storms. In sewer modelling, these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.

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10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
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50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers.	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures.	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 4 - Scheme types

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a Journey Plan, see Figure 8. The Journey Plan provides an indicative overview of the most effective option types against a timeline indicating when they might be applied.

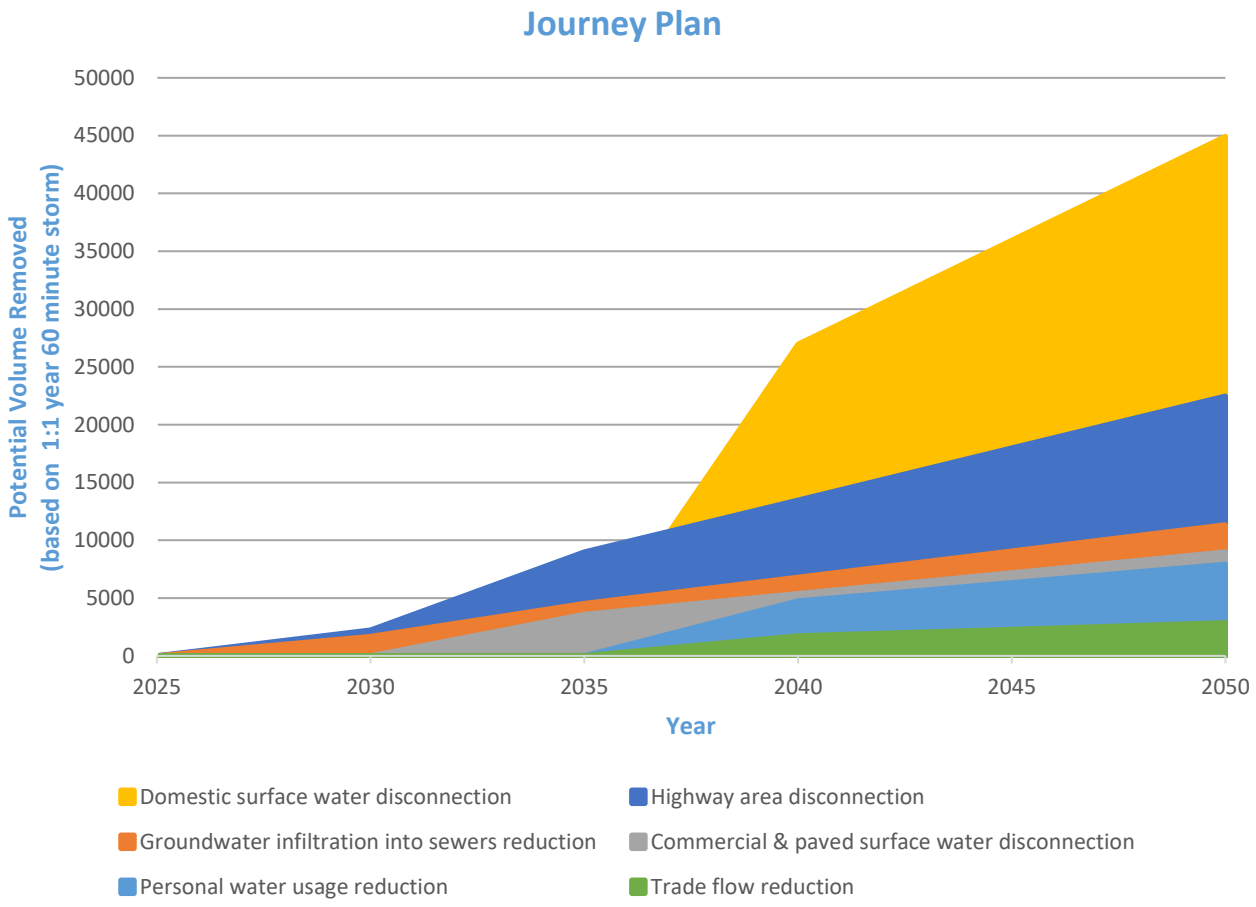

Figure 8 - Journey Plan

The measures within the Journey Plan include all green infrastructure and surface water removal techniques. We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence. We use the size of a storm event that has the probability of occurring once every 30 years.

Table 5 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

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Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£13,000,000.00	£21,000,000.00
40 spills in a typical year	£6,000,000.00	£6,000,000.00	£6,000,000.00
20 spills in a typical year	£13,000,000.00	£13,000,000.00	£13,000,000.00
10 spills in a typical year	£20,000,000.00	£20,000,000.00	£21,000,000.00
0 spills in a typical year	£163,000,000.00	£165,000,000.00	£170,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	129.00	133.00	140.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£8,800,000.00	£11,300,000.00	£15,100,000.00
External escapes in gardens	£4,500,000.00	£5,700,000.00	£8,400,000.00
Escapes in highways	£19,100,000.00	£24,300,000.00	£36,700,000.00
All other remaining flooding	-	£0.00	£0.00
Total	£32,400,000.00	£41,300,000.00	£60,200,000.00

*Internal escapes - All flooding that results in flooding within a property is stopped

*External escapes in gardens - All flooding within the curtilage of the property is stopped

*Escapes to highways - All flooding from DCWW systems impacting public highways is stopped.

Table 6 - Summary of Flooding Option Investments Strategy Costs

We have developed solutions which aim to provide a resilient sewerage network when tested against a range of future legislative scenarios. The solutions developed highlight the level of investment required to bring the entire network up to the level of protection required to be resilient to future demands. We have derived costs for a range of potential legislative future scenarios to ensure the cost impact of choices made is recognised.

We are beginning to break down the investment indicated in Table 5 and 6 by creating practical schemes ready for delivery. These schemes are designed as traditional engineering solutions, sustainable or green infrastructure, or a combination of both. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the Habitat Directive, as a priority against drainage and network failure which result in pollution events and flooding. The solutions developed highlight the level of investment required to bring our network to the level of protection required to mitigate against these risks. Appendix A shows the number of solutions within this tactical planning unit (Level 3).

For more information on the methodology developed to carry out the assessments see the DWMP Main Plan.

If you would like to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please contact us at DWMP@dwrcymru.com.

We will continue to work with the Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Appendix A - Schemes in L4 catchment within L3 catchment

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

Table A1 - Number of schemes in L4 catchment within L3 catchment

L4 Catchments	No. Schemes
ROTHERWAS (HEREFORD) STW	0
KINGSTONE & MADLEY (W OF HEREFORD)	0
MORETON-ON-LUGG STW	0
CANON PYON	0
BODENHAM	0
PRESTON WYNNE	0
PIPE & LYDE (N OF HEREFORD)	0
CLEHONGER - Cage Brook	0
STAUNTON-ON-WYE SWK	0
EATON BISHOP (NR HEREFORD)	0
ULLINGSWICK DINMARSH	0
MOCCAS SWK	0
PRESTON-ON-WYE SWK	0
BULLOCKS BRIDGE (NR ULLINGSWICK)	0
SPARRINGTON	0
BREDWARDINE STW	0
OCLE PYCHARD	0
HEREFORD EIGN	0

Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
Bathing or shellfish waters	Mechanism to understand the significance of any impact of water company operations on environmental receptors (bathing or shellfish waters).
Discharge to sensitive waters (part A)	Mechanism to understand the significance of any impact of water company operations on environmental receptors.
Discharge to sensitive receiving (part B) (Tier 2)	
SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
Internal Sewer Flooding	Historical measure that records the number of internal flooding incidents per year (sewerage companies only).
External Sewer Flooding	Historical measure that records the number of external flooding incidents per year (sewerage companies only).
Pollution Incidents	Historical measure that identifies incidents of unexpected release of contaminants that have resulted in environmental damage.
WwTW O compliance	Historical measure relating to the performance of the treatment works (discharge permit

WwTW Q compliance	of the treatment works (discharge permit compliance (numeric)).
WwTW DWF compliance	Historical measure of compliance with flow permits.
Storm overflows	Examines issues associated with all storm overflows not captured by other indicators (e.g. issues to be considered include non-compliance with pass forward flow conditions, storm storage conditions (where relevant) and screening requirements).
Other RMA systems	A mechanism to understand risk posed by other RMA assets in the catchment.
Planned residential development	Uses predicted residential population growth forecasts to target catchments requiring investigations for potential future capacity constraints.
WINEP	WINEP sets out the actions that companies will need to complete to meet their environmental obligations.
Sewer Collapses	Historical measure that identifies risks to the integrity of the sewer system.
Sewer Blockages	Historical measure that records obstructions in a sewer (that require clearing) which causes a reportable problem (not caused by hydraulic overload), such as flooding or discharge to a watercourse, unusable sanitation, surcharged sewers or odour.
Bespoke Indicators (Tier 2)	Not applied in cycle 1.

DWMP Strategic Planning Area Summary

R Monnow - conf Afon Honddu to conf R Wye

1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how we as Dŵr Cymru Welsh Water (DCWW), will manage and improve our assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The R Monnow - conf Afon Honddu to conf R Wye planning catchment lies within the Wye catchment (see Figure 1).

The R Monnow - conf Afon Honddu to conf R Wye catchment covers an area stretching from Llanrosser in the north on the English border, and Llanthony on the Welsh border and as far as Cwmcaravan to the south. The geography of the catchment is predominantly rural.

There are several main rivers within the L3 including the River Trothy and River Monmow, with the river basin district of this catchment being the Severn. The catchment covers a number of populous areas including the town of Monmouth. The largest WwTW is Monmouth WwTW (Wyesham) which serves a residential population of 10,475.

This planning catchment consists of 15 wastewater catchments (see Figure 2). There is a combined population of 14334, this is set to increase to 14900 by 2050, a change of 4%. There is a total sewer length of 122km, with a foul sewer length of 79km, a surface water length of 31.28km and a combined sewer length of 11km. There are 15 Wastewater Treatment Works (WwTW), 17 Sewerage Pumping Stations (SPSs), and 9 Combined Storm Overflows (CSOs) across this strategic planning area.

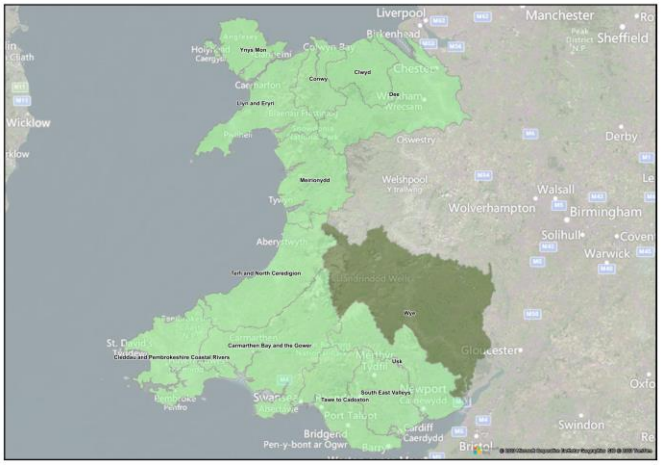


Figure 1 - River basin location detailing the strategic planning area

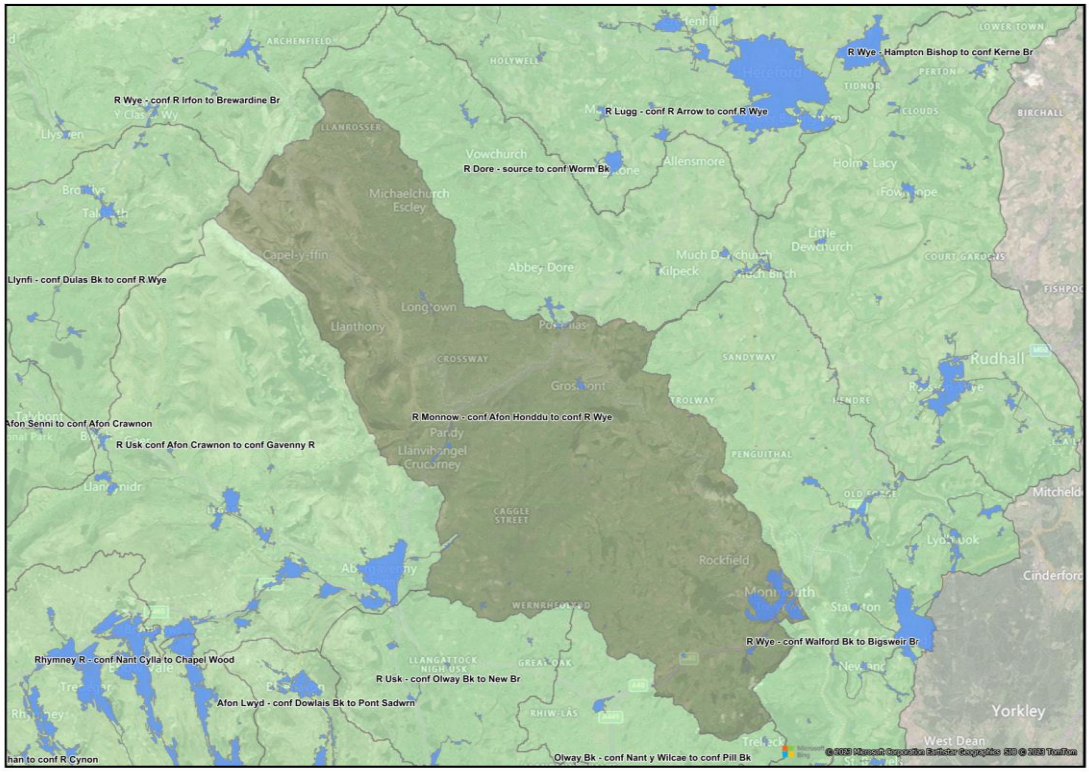


Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans.

Further information on how we are and will continue to engage with stakeholders can be found in the 'How have we engaged with customers and stakeholders?' chapter of the Main Plan.

Stakeholder Engagement Opportunities
Stakeholder engagement meetings have been held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. No multi-agency schemes have been identified at this stage, however engagement has been made to establish alignment with stakeholder plans, policies and to explore the concept of joint working going forward.

Table 1 - Stakeholder opportunity partnerships

The 'Where we want to work with you' document, which further explains our stakeholder engagement plan, can be found in the Risk section of the DCWW DWMP page found here:

Drainage Wastewater Management Plan

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England which are within our operating region, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

Urban creep is the term used to explain loss of green spaces. For example, when new driveways or house extensions are built. This often leads to more rainwater entering sewers. Our forecasts, which are based on a UKWIR study, suggest that urban creep will add up to 0.63 metres squared of impermeable area per house per year.

A UKWIR report on urban creep can be found here, Impact of Urban Creep on Sewerage Systems.
Climate change is predicted to increase the intensity of storms by around 15% in this region. This is based on a 2017 UKWIR report, which used a high-resolution climate model for the UK to predict changes in design storm intensities for a high emissions scenario (RCP8.5). In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the R Monnow - conf Afon Honddu to conf R Wye region is set to increase to 14900 by 2050, a change of 4% based on our future projections. For a further a breakdown of population change in the L3 region please see the L4
There are major developments in localised areas that will contribute to future pressures on the network, including Wonastow Road, Monmouth with a proposed 342 units, followed by Tudor Road, with a proposed 35 units.
The Core Management plan for the River Wye SAC provides an overview of the conservation required on site. The plan details the drive in enhancing the social, economic and natural value of the area, by summarising conservation objectives with regards to maintenance, restoration and future connections between the wider ecology and connecting surroundings. The plan can be found here :

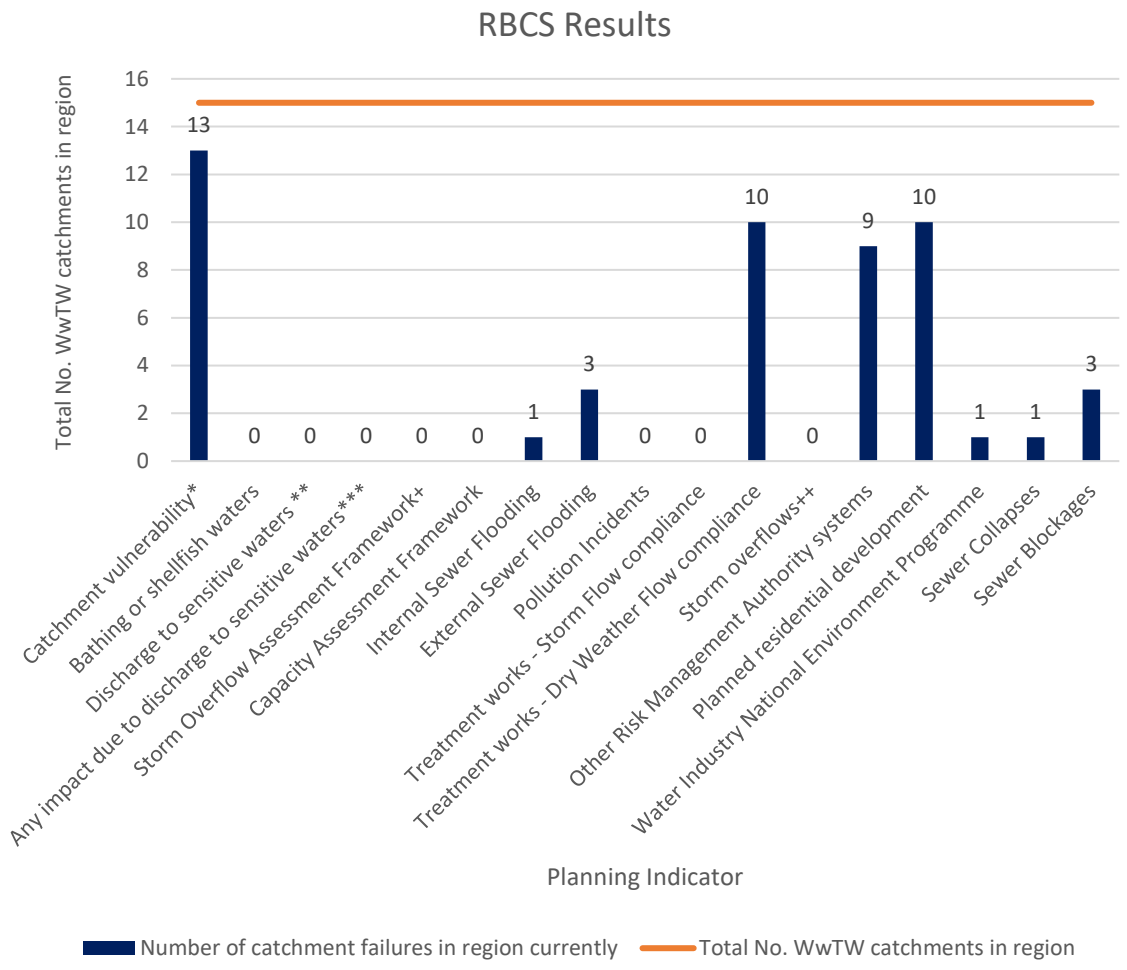
Core Management Plan

Future predictions of growth in the area have been estimated based on the average between the rate of properties that have been built in the past 10 years and the rate that the local development plan predicts houses should be built. In addition to this, we have accounted for the changes in the existing population by the change in the number of people living in an average property in the area.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. The results are shown in Figure 3. Descriptions of the indicators can be seen in Appendix B. All catchments passed through to a more detailed risk assessment (BRAVA).

For this strategic planning area the biggest risks indicated by the RBCS are Catchment vulnerability, followed by Treatment works - Dry Weather Flow compliance and Planned residential development.



*To sewer flooding due to extreme wet weather events.
**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.
***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.
+Frequency investigation triggered.
++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment. Figures 4 and 5 illustrate the outcome of the BRAVA assessment for this strategic planning area.

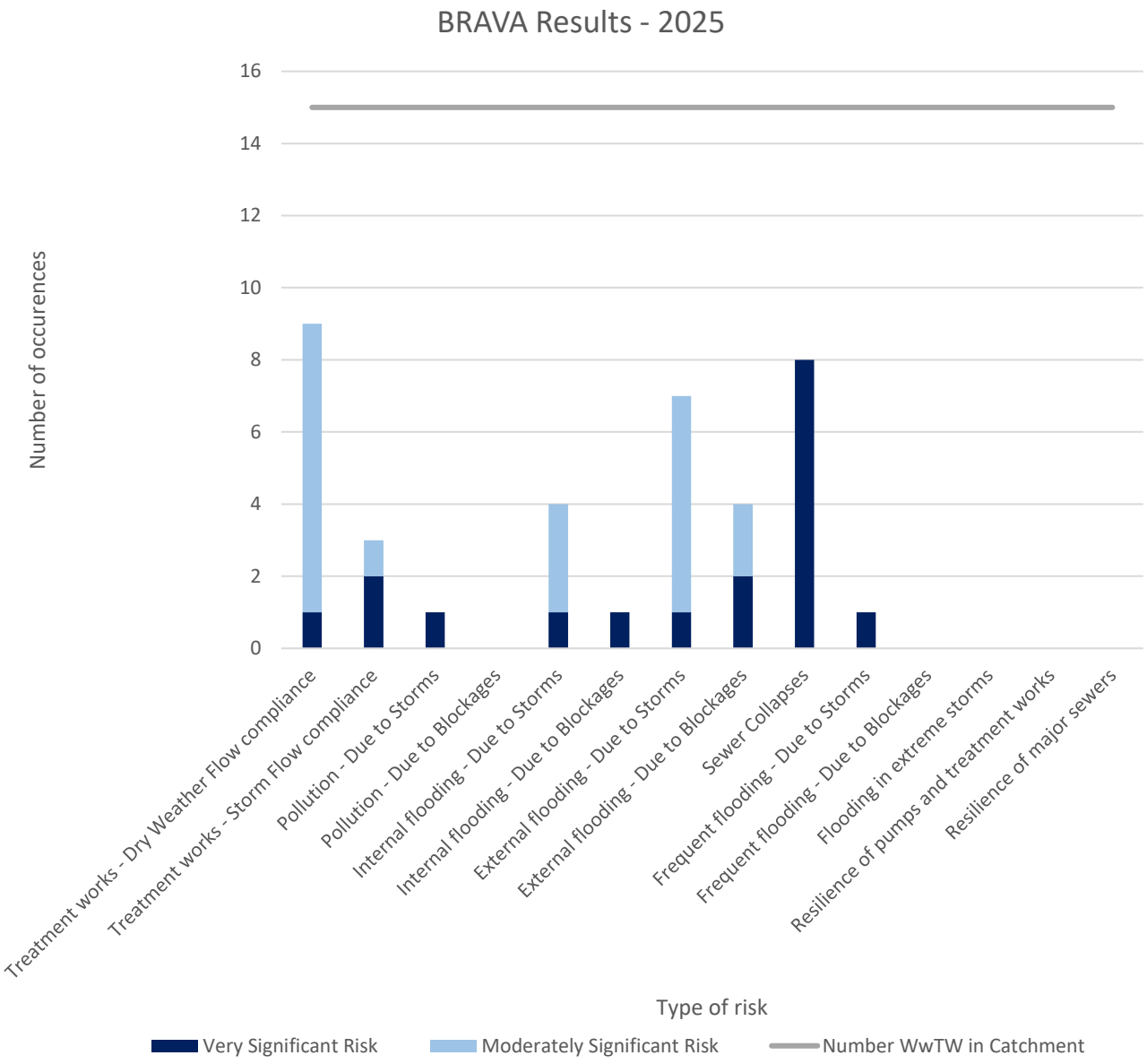


Figure 4 - BRAVA 2025 Summary

In 2025, Sewer Collapses and Treatment works - Dry Weather Flow compliance are the biggest risks in this strategic planning area.

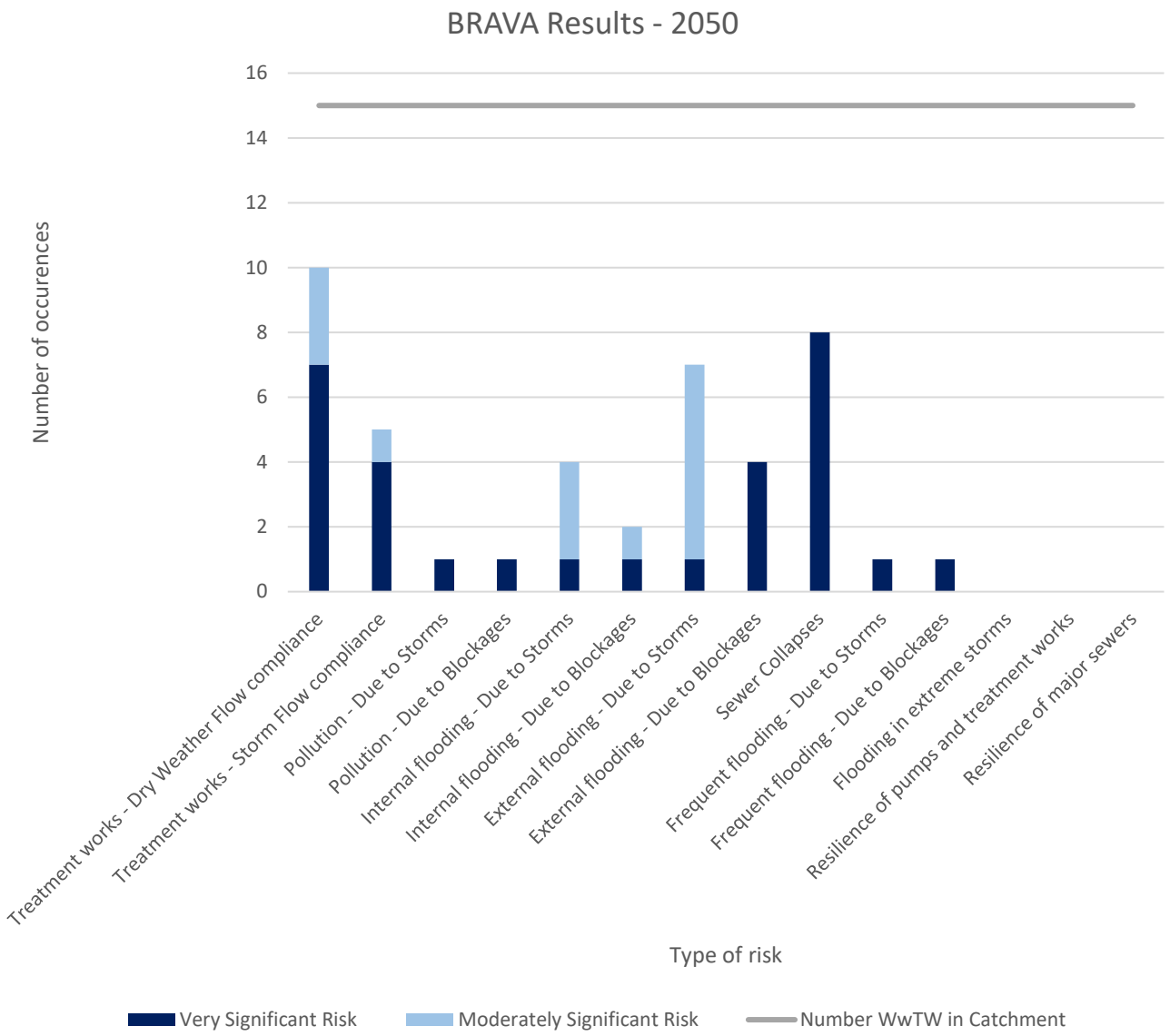


Figure 5 - BRAVA 2050 Summary

In 2050, Sewer Collapses and Treatment works - Dry Weather Flow compliance are the biggest risks in this strategic planning area.

Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment.

From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to require a standard option assessment methodology.

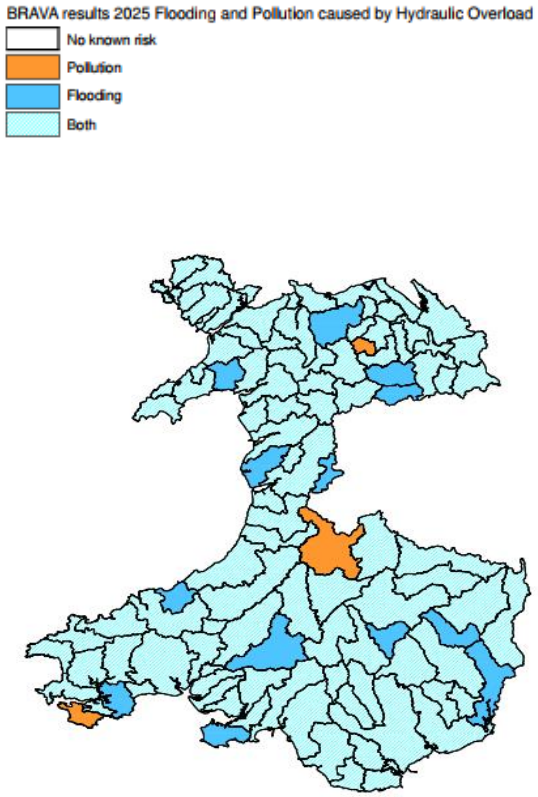


Figure 6 - Associated Strategic Planning Area priority (2025)

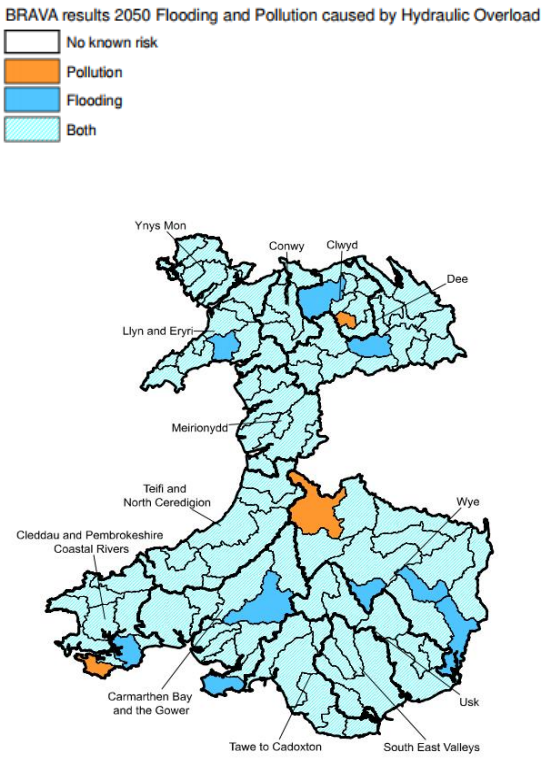


Figure 7 - Associated Strategic Planning Area priority (2050)

3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
R Monnow - conf Afon Honddu to conf R Wye	12	3	8	1	0

Table 2 - WFD status'

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

The wet weather assessment takes pass forward flow (PFF) consent values, where available, as an indication of WwTW capacity, and estimates the amount of incoming flow the treatment works is able to treat across a year. It uses the same estimates as the DWF assessment for current flow, but also includes an estimate as to how much rainfall the WwTW might be able to deal with in the future, by including growth, climate change and creep. Climate change is expected to change the periodicity and amount of rain across a "typical" year. Creep, the gradual misconnection of storm sewers to the foul sewer network, is also expected to have an impact on the amount of flow a WwTW receives during storms. This gives us an approximation of where we might expect problems to arise in the future during wet weather due to growth, creep, and climate change. Areas with the greatest estimated wet weather treatment shortfall are shown in the darkest blue.

L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key
R Monnow - conf Afon Honddu to conf R Wye	Headroom							Pass / Close Pass / Close fail / Fail
	Wet weather capacity							>90% / 80%-90% / 70%-80% / <70%

Table 3 - Supply Demand Balance

Table 3 shows that for the R Monnow - conf Afon Honddu to conf R Wye catchment the balance between supply and demand currently passes the assessment criteria avaliable, for headroom only, and will continue to pass through to 2050. It should be noted that local issues are present in the Cwmyoy, Kentchurch (Parkside), Kentchurch (Crabs Castle), Llantilio Crossenny, Penrhos and Rockfield L4 catchments. Further detail is provided in the relevant L4 summaries.

5.0 Options

To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment's rainfall in just a few storms. In sewer modelling, these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.

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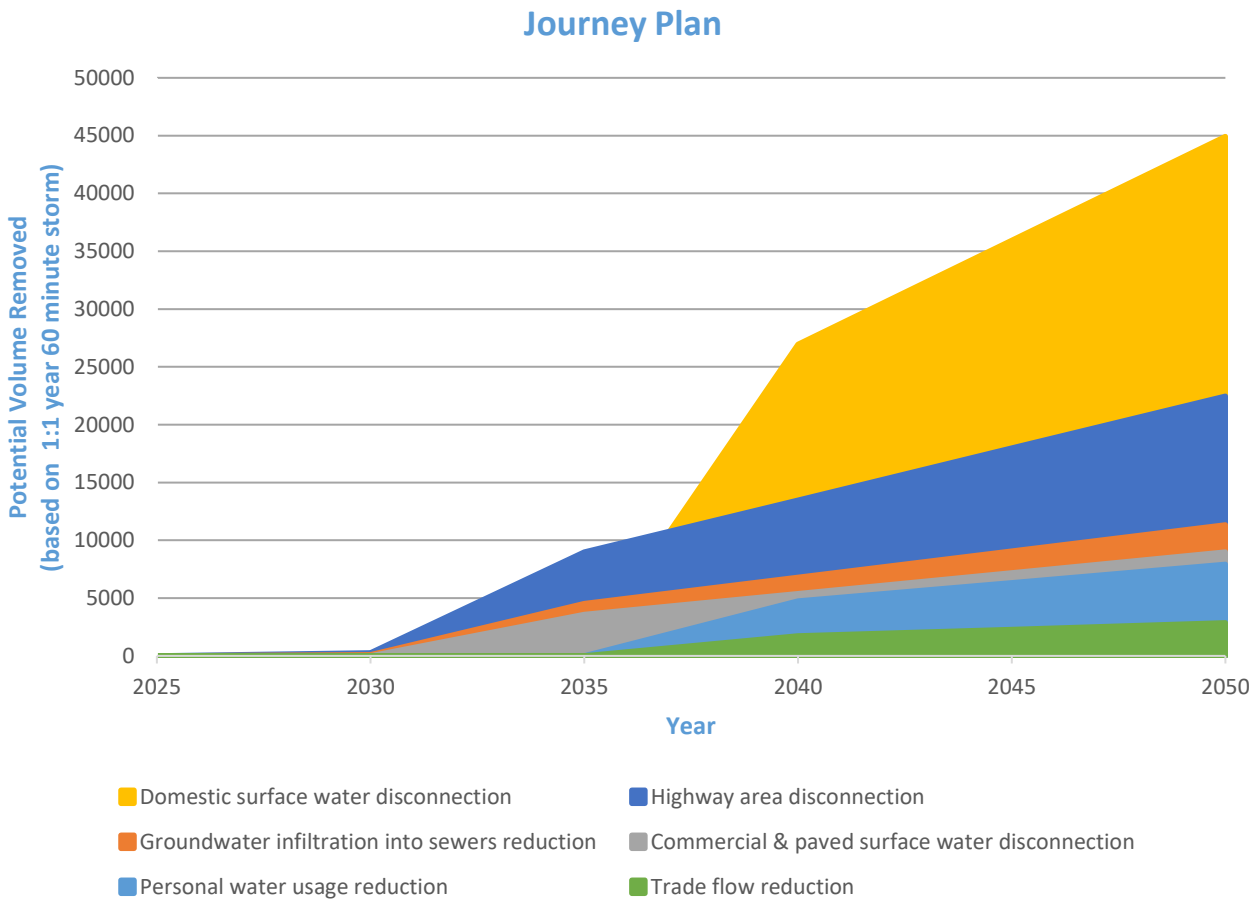
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers.	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures.	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 4 - Scheme types

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a Journey Plan, see Figure 8. The Journey Plan provides an indicative overview of the most effective option types against a timeline indicating when they might be applied.



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Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£4,000,000.00	£5,000,000.00
40 spills in a typical year	£7,000,000.00	£3,000,000.00	£1,000,000.00
20 spills in a typical year	£8,000,000.00	£7,000,000.00	£7,000,000.00
10 spills in a typical year	£9,000,000.00	£8,000,000.00	£8,000,000.00
0 spills in a typical year	£21,000,000.00	£21,000,000.00	£21,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	55.00	69.00	80.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£400,000.00	£700,000.00	£700,000.00
External escapes in gardens	£2,000,000.00	£2,400,000.00	£3,700,000.00
Escapes in highways	£3,100,000.00	£3,700,000.00	£5,800,000.00
All other remaining flooding	-	£0.00	£0.00
Total	£5,500,000.00	£6,800,000.00	£10,200,000.00

*Internal escapes - All flooding that results in flooding within a property is stopped

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Table 6 - Summary of Flooding Option Investments Strategy Costs

We have developed solutions which aim to provide a resilient sewerage network when tested against a range of future legislative scenarios. The solutions developed highlight the level of investment required to bring the entire network up to the level of protection required to be resilient to future demands. We have derived costs for a range of potential legislative future scenarios to ensure the cost impact of choices made is recognised.

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Appendix A - Schemes in L4 catchment within L3 catchment

The information provided in this summary is the culmination of the DWMP framework methodology and does not currently include other industry methodologies such as National Environment Programme, Water Industry National Environment Programme or Price Review 2024. Further work to integrate these methodologies will continue after this publication.

Table A1 - Number of schemes in L4 catchment within L3 catchment

L4 Catchments	No. Schemes
MONMOUTH WWTW (WYESHAM)	0
LONGTOWN (HEREFORDSHIRE) STW	0
PENRHOS (N OF RAGLAN)	0
CWMYOY	0
LLANVAPLEY	0
LLANTILIO CROSSENNY	0
ROCKFIELD (N OF MONMOUTH)	0
CROSS ASH WWTW	0
LLANDDEWI RHYDDERCH	0
CRABS CASTLE	0
KENTCHURCH (HEREFORDSHIRE) PARKSIDE	0
DINGESTOW STW	0
GROSMONT	0
GARWAY (NNW OF MONMOUTH) FAIRVIEW NO 1	0
LLANFIHANGEL CRUCORNEY PANDY	0

Appendix B - Risk Based Catchment Screening

Table B1 - Risk Based Catchment Screening (RBCS) indicators

Indicator	Description
Catchment Characterisation (Tier 2)	Provides a mechanism to understand the vulnerability of the catchment/subcatchments to sewer flooding as a result of an extreme wet weather event.
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SOAF	Considers current / potentially future activity instigated by SOAF procedures.
CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
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Bespoke Indicators (Tier 2)	Not applied in cycle 1.

DWMP Strategic Planning Area Summary

R Wye - conf Afon Elan to conf R Ithon

1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how we as Dŵr Cymru Welsh Water (DCWW), will manage and improve our assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The R Wye - conf Afon Elan to conf R Ithon planning catchment lies within the Wye catchment (see Figure 1).

The R Wye - conf Afon Elan to conf R Ithon catchment covers an area stretching from Eisteddfa Gurig along A44 in the north as far as Newbridge-On-Wye in the south. The geography of the catchment is predominantly rural and mountainous.
There are several main rivers within the L3 including the River Wye and Afon Elan, Afon Tarenig, with the river basin district of this catchment being the Severn. The catchment covers populous areas including the towns of Llangurig and Rhayader. The largest WwTW is Rhayader SWK which serves a residential population of 1,755.

This planning catchment consists of 8 wastewater catchments (see Figure 2). There is a combined population of 3182, this is set to decrease to 2900 by 2050, a change of -7%. There is a total sewer length of 31km, with a foul sewer length of 12km, a surface water length of 8.06km and a combined sewer length of 10km. There are 8 Wastewater Treatment Works (WwTW), 5 Sewerage Pumping Stations (SPSs), and 8 Combined Storm Overflows (CSOs) across this strategic planning area.

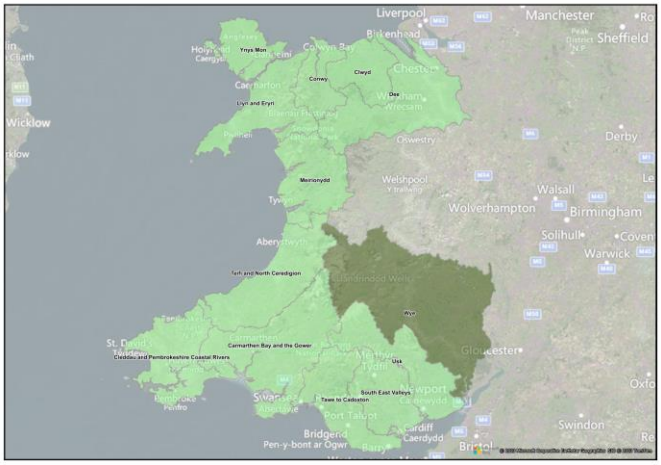


Figure 1 - River basin location detailing the strategic planning area

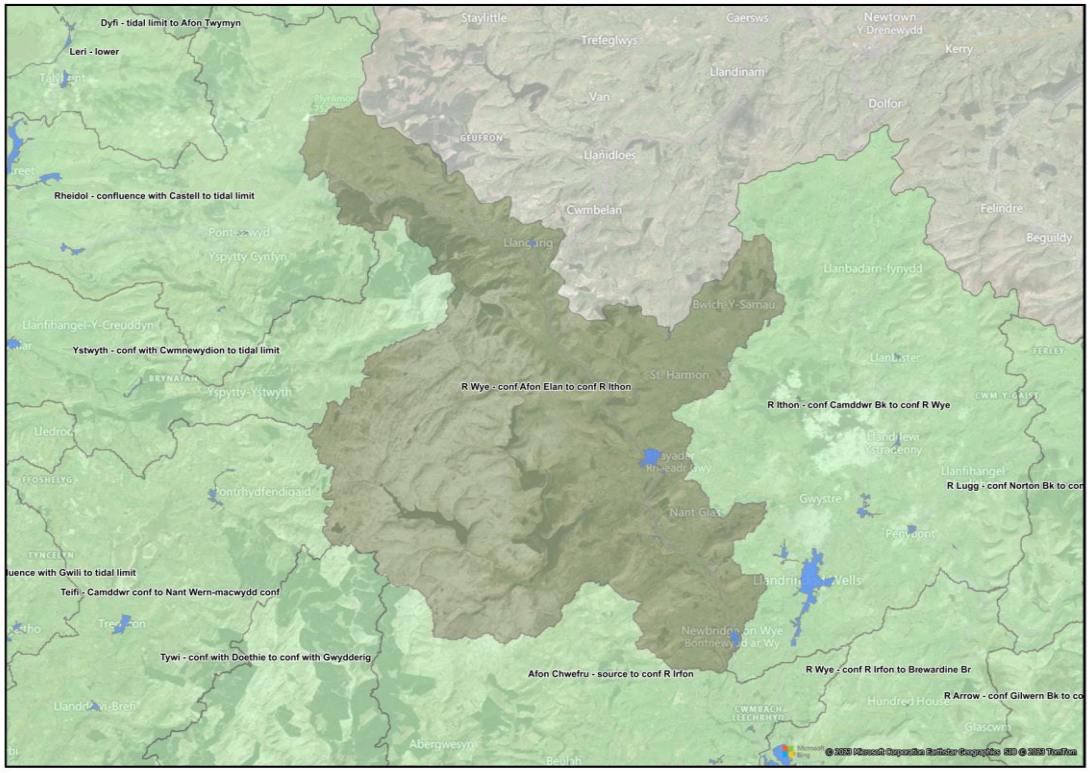


Figure 2 - Tactical planning catchment (dark green) and WwTW catchments (blue)

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans.

Further information on how we are and will continue to engage with stakeholders can be found in the 'How have we engaged with customers and stakeholders?' chapter of the Main Plan.

Stakeholder Engagement Opportunities
Stakeholder engagement meetings have been held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. No multi-agency schemes have been identified at this stage, however engagement has been made to establish alignment with stakeholder plans, policies and to explore the concept of joint working going forward.

Table 1 - Stakeholder opportunity partnerships

The 'Where we want to work with you' document, which further explains our stakeholder engagement plan, can be found in the Risk section of the DCWW DWMP page found here:

Drainage Wastewater Management Plan

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England which are within our operating region, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

Urban creep is the term used to explain loss of green spaces. For example, when new driveways or house extensions are built. This often leads to more rainwater entering sewers. Our forecasts, which are based on a UKWIR study, suggest that urban creep will add up to 0.63 metres squared of impermeable area per house per year.

A UKWIR report on urban creep can be found here, Impact of Urban Creep on Sewerage Systems.

Climate change is predicted to increase the intensity of storms by around 15% in this region. This is based on a 2017 UKWIR report, which used a high-resolution climate model for the UK to predict changes in design storm intensities for a high emissions scenario (RCP8.5). In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the R Wye - conf Afon Elan to conf R Ithon region is set to decrease to 2900 by 2050, a change of -7% based on our future projections. For a further a breakdown of population change in the L3 region please see the L4 report.

There are major developments in localised areas that will contribute to future pressures on the network, the largest include Rhayader and Tir Gia with a proposed 70 units, followed by Nant Rhyd-Hir, with a proposed 23 units.

The Core Management plan for the River Wye SAC provides an overview of the conservation required on site. The plan details the drive in enhancing the social, economic and natural value of the area, by summarising conservation objectives with regards to maintenance, restoration and future connections between the wider ecology and connecting surroundings. The plan can be found here :

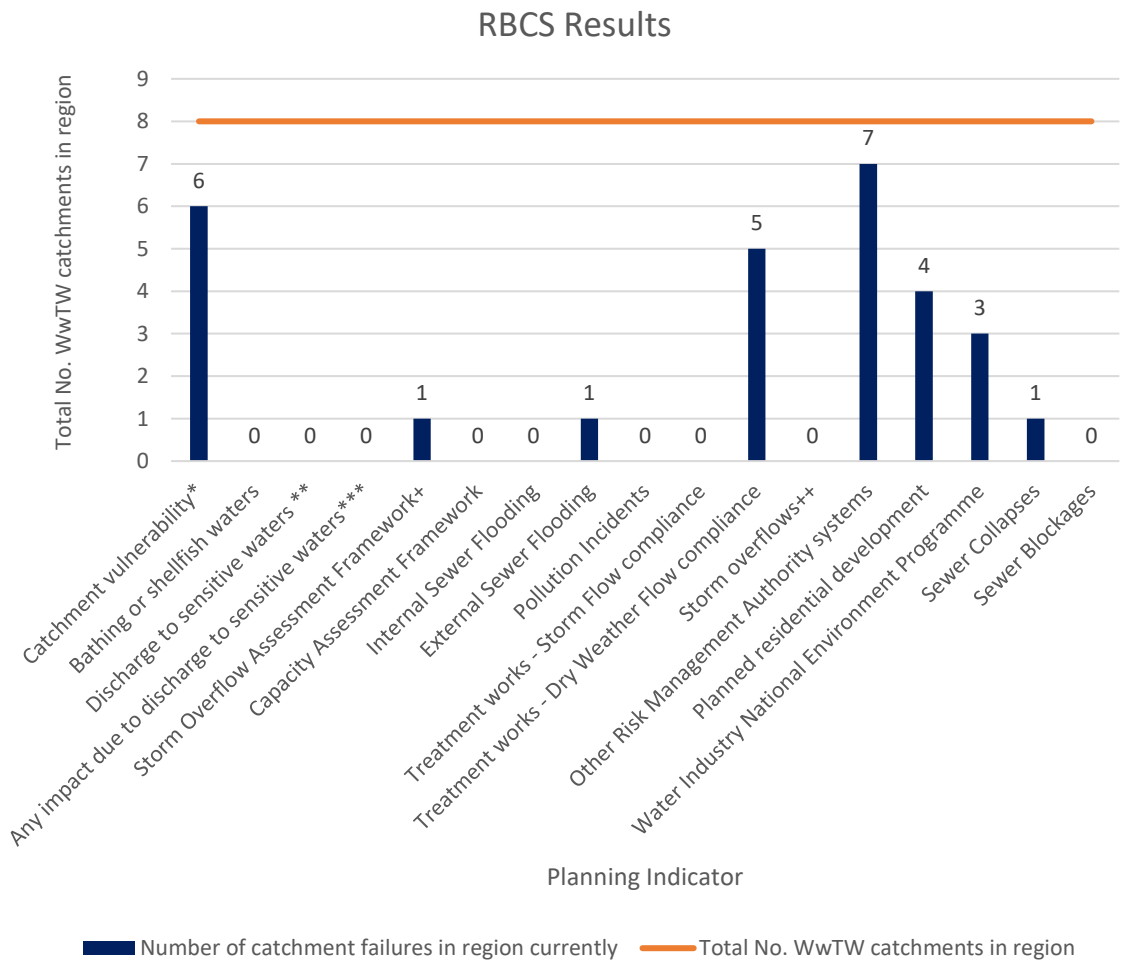
Core Management Plan

Future predictions of growth in the area have been estimated based on the average between the rate of properties that have been built in the past 10 years and the rate that the local development plan predicts houses should be built. In addition to this, we have accounted for the changes in the existing population by the change in the number of people living in an average property in the area.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. The results are shown in Figure 3. Descriptions of the indicators can be seen in Appendix B. All catchments passed through to a more detailed risk assessment (BRAVA).

For this strategic planning area the biggest risks indicated by the RBCS are Other Risk Management Authority systems, followed by Catchment vulnerability.



*To sewer flooding due to extreme wet weather events.
**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.
***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.
+Frequency investigation triggered.
++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment. Figures 4 and 5 illustrate the outcome of the BRAVA assessment for this strategic planning area.

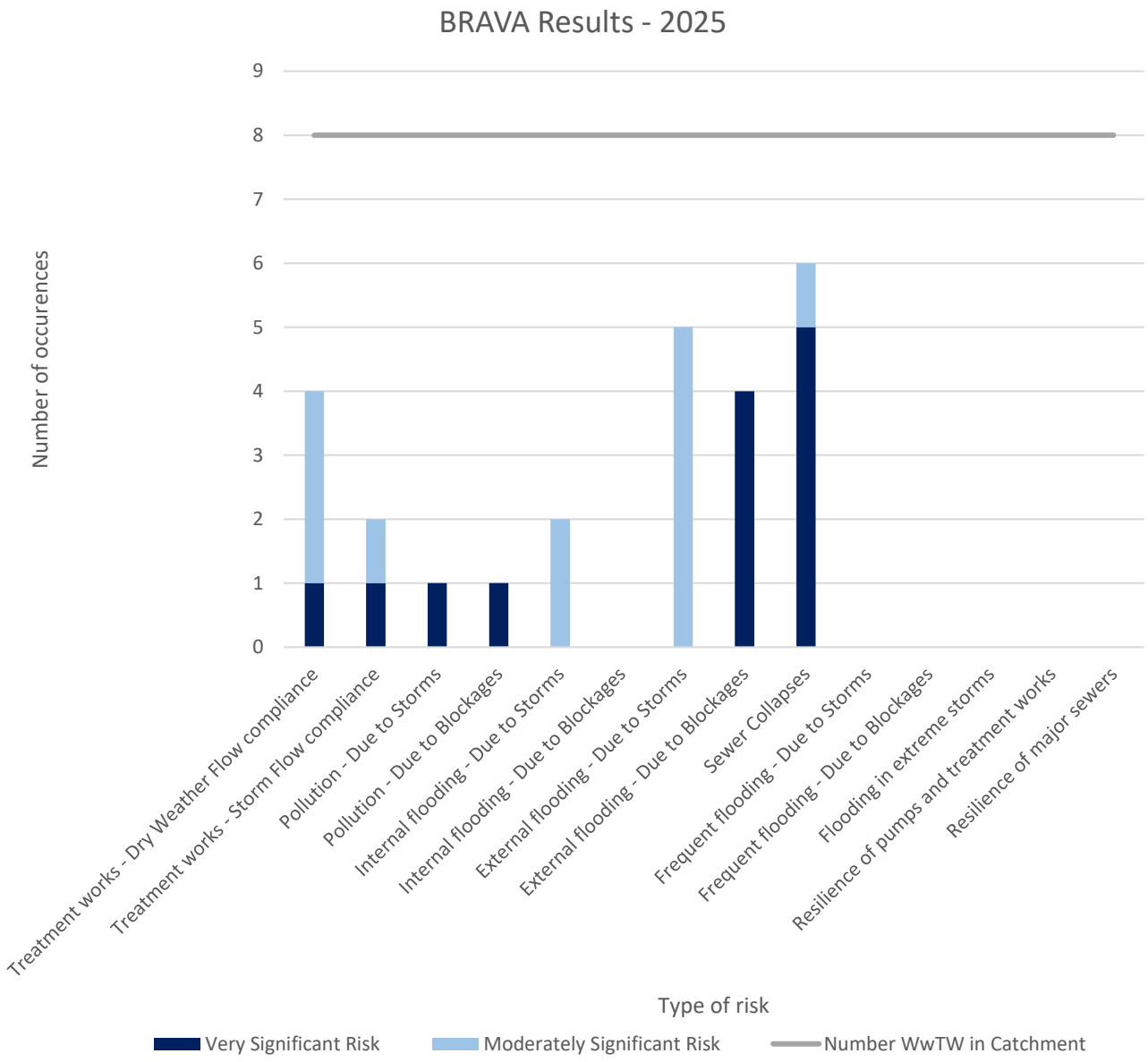


Figure 4 - BRAVA 2025 Summary

In 2025, Sewer Collapses followed by External flooding - Due to Blockages are the biggest risks in this strategic area.

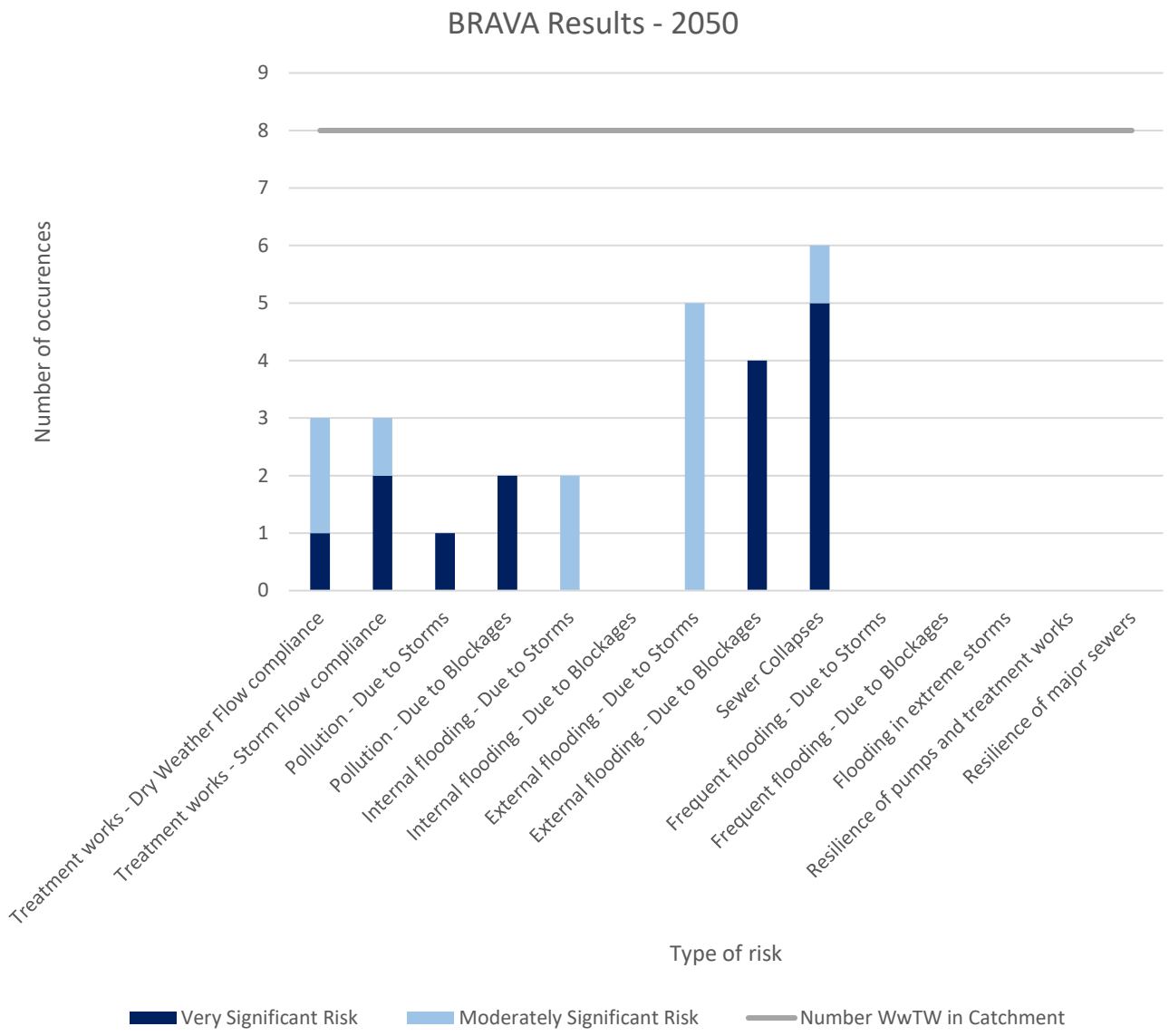


Figure 5 - BRAVA 2050 Summary

In 2050, Sewer Collapses followed by External flooding - Due to Blockages are the biggest risks in this strategic planning area.

Figure 6 and 7 indicate the 2025 and 2050 risk of both flooding and pollution caused by a lack of hydraulic capacity across our operating region. These maps illustrate where the issues occur and where we want to work with local communities and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment.

From the completion of the BRAVA analysis, we assessed the problem characterisation of the risks identified. This catchment was concluded to require a standard option assessment methodology.

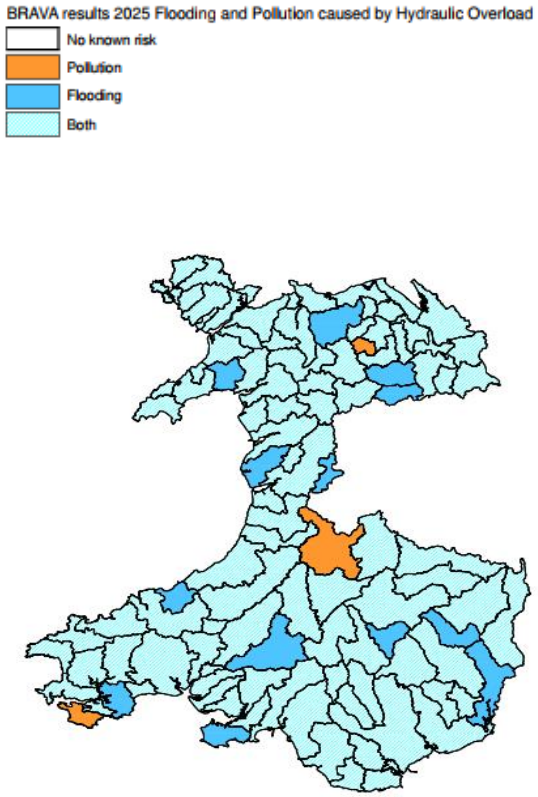


Figure 6 - Associated Strategic Planning Area priority (2025)

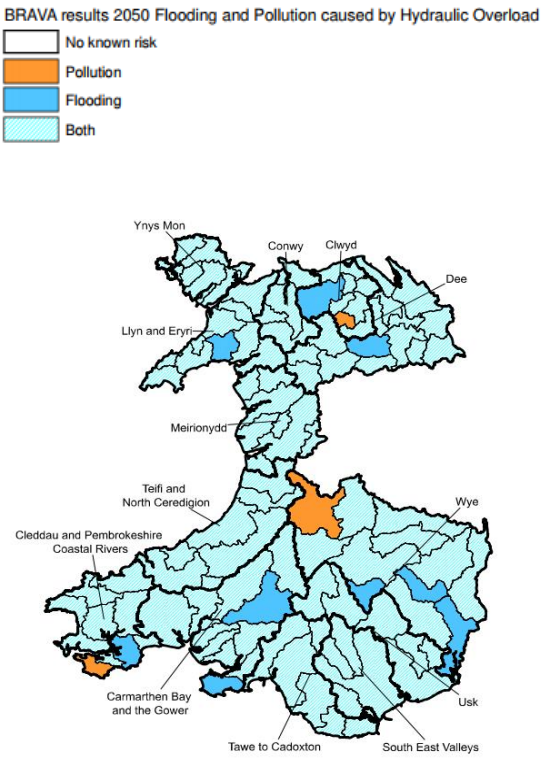


Figure 7 - Associated Strategic Planning Area priority (2050)

3.3 Water Framework Directive

Since 2000, the Water Framework Directive (WFD) has been the main law for water protection in Europe. It applies to inland, transitional and coastal surface waters as well as groundwaters. It ensures an integrated approach to water management, respecting the integrity of whole ecosystems, including the regulation of individual pollutants and setting corresponding regulatory standards. It is based on a river basin district approach to make sure that neighbouring countries manage the rivers and other bodies of water they share.

Table 2 shows a count of river waterbodies managed under the WFD in this region and WFD status' they have achieved in Cycle 2 (2015).

L3 Area	Total	Good	Moderate	Poor	Bad
R Wye - conf Afon Elan to conf R Ithon	14	2	8	4	0

Table 2 - WFD status'

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the DWF consents is tested against forecast future growth and changes in water consumption. In the north of our operational area, population is expected to decrease by 2050, and in the south, it's expected to increase. We're aiming to reduce water consumption to 100 litres per person per day by 2050 so this has been accounted for in the assessment. The shade of blue indicates how much "headroom" the treatment works is thought to have at each time horizon – with the lighter shades of blue indicating more spare capacity at our treatment works, i.e. more "headroom". If an area cannot cope with the expected DWF, then without investment, we would expect final effluent quality to decrease.

The wet weather assessment takes pass forward flow (PFF) consent values, where available, as an indication of WwTW capacity, and estimates the amount of incoming flow the treatment works is able to treat across a year. It uses the same estimates as the DWF assessment for current flow, but also includes an estimate as to how much rainfall the WwTW might be able to deal with in the future, by including growth, climate change and creep. Climate change is expected to change the periodicity and amount of rain across a "typical" year. Creep, the gradual misconnection of storm sewers to the foul sewer network, is also expected to have an impact on the amount of flow a WwTW receives during storms. This gives us an approximation of where we might expect problems to arise in the future during wet weather due to growth, creep, and climate change. Areas with the greatest estimated wet weather treatment shortfall are shown in the darkest blue.

L3 Area	Assessment	2025	2030	2035	2040	2045	2050	Key
R Wye - conf Afon Elan to conf R Ithon	Headroom							Pass / Close Pass / Close fail / Fail
	Wet weather capacity							>90% / 80%-90% / 70%-80% / <70%

Table 3 - Supply Demand Balance

Table 3 shows that for the R Wye - conf Afon Elan to conf R Ithon catchment the balance between supply and demand currently passes the assessment criteria avaliable, for headroom only, and will continue to pass through to 2050. It should be noted that local issues are present in the Pantydwr L4 catchment. Further detail is provided in the relevant L4 summary.

5.0 Options

To analyse a catchments response to rainfall we use design storms. A design storm is the use of artificial rainfall where the total rainfall depth has a specified return period. Design storms represent the statistical characteristics of rainfall derived from analysis of many years of actual rainfall records. They are easier to use than observed rainfall and can approximate a catchment's rainfall in just a few storms. In sewer modelling, these storms may be used for peak flow, surcharge and flooding analysis and for the development of flooding solutions and peak screening rates for CSOs. The notation we use for design storm is a 1 in X year event, for example a 1 in 1 year event is rainfall which we might expect to occur on average once a year, or a 1 in 30 year event is a rainfall event which we might expect to occur, on average once every 30 years.

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon we have tested various types of schemes, and combinations of schemes, to ensure a robust plan is delivered. Table 4 shows different ways that we can reduce the risks to customers and the environment. We can stop rainwater entering our sewers from homes (domestic surface water disconnection), businesses or paved areas (commercial and paved surface water disconnection) or from roads (highway area disconnection). Sometimes water gets into sewers through small gaps that can occur in ageing sewers - by replacing or repairing the sewers we can reduce the likelihood of this happening (groundwater infiltration into sewers reduction). Reducing how much water homes and businesses use can also help to reduce the risk to people and the environment (personal water usage reduction or trade flow reduction).

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers.	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures.	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 4 - Scheme types

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a Journey Plan, see Figure 8. The Journey Plan provides an indicative overview of the most effective option types against a timeline indicating when they might be applied.

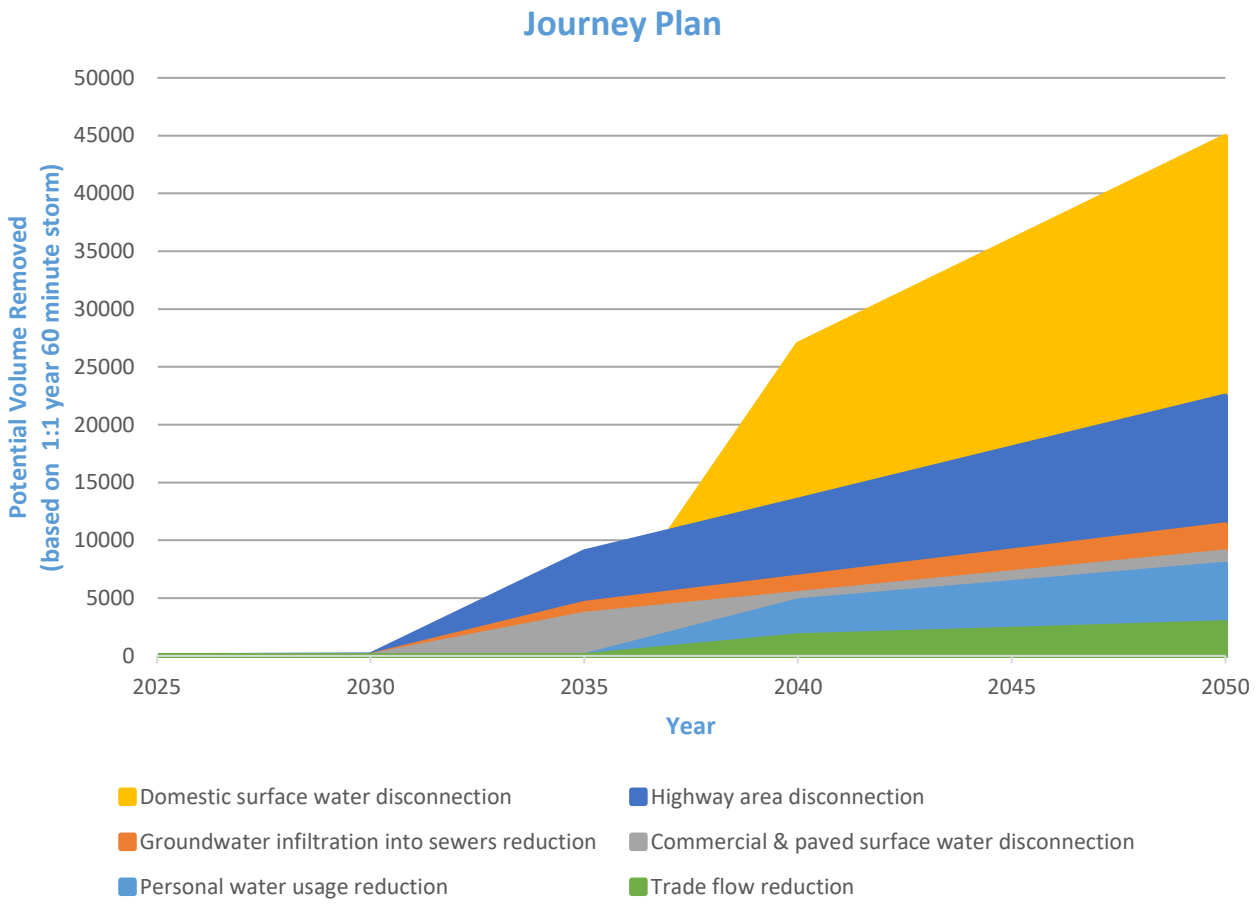


Figure 8 - Journey Plan

The measures within the Journey Plan include all green infrastructure and surface water removal techniques. We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence. We use the size of a storm event that has the probability of occurring once every 30 years.

Table 5 highlights the potential costs required to ensure CSOs maintain their existing performance and spill no more than a maximum of that indicated in the scenario within a 'typical year'. To achieve this we need to offset any future impact on our assets, ensuring we continue to maintain the level of service provided. The cost assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs and we assess CSOs based on the number of times they are predicted to spill in a 'typical year'.

Table 6 highlights the potential costs in this region from preventing flooding from manholes scenarios. The assessment includes both the size and cost of potential mitigation measures.
Costs in Table 5 are in addition to those in Table 6, for example, in order to achieve 10 spills in a typical year across all our assets in this region, no internal escapes and no external escapes in gardens, these three costs need to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain existing performance*	-	£10,000,000.00	£15,000,000.00
40 spills in a typical year	£4,000,000.00	£4,000,000.00	£4,000,000.00
20 spills in a typical year	£5,000,000.00	£5,000,000.00	£5,000,000.00
10 spills in a typical year	£6,000,000.00	£6,000,000.00	£6,000,000.00
0 spills in a typical year	£11,000,000.00	£11,000,000.00	£11,000,000.00
Equivalent No. Principality Stadiums full of water in 10 spills	26.00	39.00	42.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 5 - Summary of Combined Sewer Overflow Option Investment Strategy Costs

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Internal escapes	£700,000.00	£800,000.00	£1,200,000.00
External escapes in gardens	£0.00	£0.00	£0.00
Escapes in highways	£1,300,000.00	£1,600,000.00	£2,500,000.00
All other remaining flooding	-	£0.00	£0.00
Total	£2,000,000.00	£2,400,000.00	£3,700,000.00

*Internal escapes - All flooding that results in flooding within a property is stopped

*External escapes in gardens - All flooding within the curtilage of the property is stopped

*Escapes to highways - All flooding from DCWW systems impacting public highways is stopped.

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L4 Catchments	No. Schemes
RHAYADER SWK	0
LLANGURIG SWK	0
NEWBRIDGE-ON-WYE SWK	0
ELAN VALLEY HOTEL SWK	0
ELAN (GLAN-YR-AFON) SWK	0
ELAN VILLAGE OXIGEST UNITS SWK	0
LLANWRTHWL SWK	0
PANT-Y-DWR SWK	0

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Discharge to sensitive receiving (part B) (Tier 2)	
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CAF	Provides an indication of capacity constraints in the network as a leading indicator to service failure.
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Bespoke Indicators (Tier 2)	Not applied in cycle 1.