DRAINAGE & WASTEWATER MANAGEMENT PLAN
Choose a building block.

Dŵr Cymru Welsh Water
Drainage and Wastewater Management Plan 2024

Draft July 2022

IN PARTNERSHIP WITH

rps ATKINS Member of the SNC-Lavalin Group wsp

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PREFACE

We have completed our first DWMP. This Draft DWMP is being published as a consultation. We welcome your comments on what we have produced and your opinion on how we intend to prepare future DWMP's. We are particularly interested in your thoughts with regards to our approach to customer and environmental priorities and how those priorities are to be used in the production of future plans.

This plan is different to other plans we prepare as it tries to answer, not only how to remain compliant with our operating licence, but also tries to prepare the company for the future challenges in society.

One of these is the legacy of combined sewers, which are reliant on storm overflows to prevent localised customer flooding. We need to transition to separate foul and surface water sewers to reduce the need for storm overflows where possible, whilst maintaining our performance. The environmental benefit of achieving this separation over time is to reduce nutrients such as phosphates and nitrates which we as customers use entering the water courses. This is a major driver going forward to achieve high standards in our rivers and oceans to meet the water framework directive.

We need to set out the complexity of the drainage issues across our operating area. Our combined sewers often accept inflows of surface water from roads, car parks, building roofs and even land drainage, which we do not own or control. We need to work closely with other stakeholders, and need their ongoing support, to gather the evidence and deliver the right long-term solutions to these challenges.

Our DWMP shows that the costs of making this transition will be significant. The DWMP provides an evidence base to begin discussion with Welsh Government and our regulators on the pace of change that they expect to see. It goes beyond the current focus on storm overflows, influencing long-term integrated drainage priorities for Wales and the border areas of England within which we operate.

We recognise that stakeholders are looking towards us to readdress storm overflows and minimise their use. Our preferred approach considers how to make widespread improvements at an affordable rate for our customers. We have estimated that to remove storm overflows and customer flooding would cost between £9 billion and £27 billion. This quantum, when considered as a bill increase, is not tenable and unlikely to be acceptable to our customers. Ultimately, the pace of the improvements we can make will be heavily dictated by the scale of water and sewerage bills that our customers can afford to pay.

As part of developing our first DWMP we have followed the national DWMP Framework but have also developed our own innovative approaches to planning, which allow choices to be made in terms of what needs to be achieved in the short term, and then creating a pathway for each local area to maintain progress to that destination.

It builds on principles developed by all companies for water and sewerage planning to gain a holistic catchment approach to finding risks, developing options to resolve those risks, and

providing an indicative timeline of when that risk may materialise and when the solution will need to be resolved.

The Plan and the regional summaries lay out the types of risks that we are facing, the strategic option types that are needed in each location to address those risks and a high-level cost to get to improved performance in our wastewater systems.

This is a consultation to discuss the approach we have taken, the pace of change that is realistic and how we can integrate our approach with other stakeholders to deliver the best solutions for customers and the environment. We have identified several different investment scenarios to get us to our long-term destination in systematic affordable steps. We would like your opinion on which approach to take for our next cycle. The plan and the regional summaries, which support it, lay out the types of risks that we are facing, the strategic option types that are needed in each location to address those risks and a high-level cost to get to a future improvement.

Alongside the Plan we have also undertaken a Strategic Environmental Assessment (SEA) and Habitats Regulations Assessment (HRA) of the options developed so far. These documents are also being published for consultation.

The consultations will be assessed as one consultation via the main consultation forum of the virtual room.

The consultation is a significant milestone in considering how we should deal with long term sewerage and drainage planning and we welcome your views and comments.

The consultation will run for 10 weeks, starting on 27th July 2022 and closing at Midnight on 7th of October 2022.

Please respond to the consultation using one of the routes below.

- Using the virtual room and consultation feedback questionnaire
- Via an email to our mailbox at the DWMP@dwrcymru.com
- And finally, via a printed response to our head office

Mr Steve Wilson
Dŵr Cymru Welsh Water
DWMP Consultation
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We would recommend the virtual room as the simplest route to viewing the consultation material.

INTRODUCTION

What is a DWMP?

The Drainage and Wastewater Management Plan (DWMP) is a long-term planning study which looks at drainage and sewerage needs over the next 25 years as a minimum. It looks at future trends and embeds an approach of working together with others to plan for the future and identify options for the sustainable management of drainage and sewerage services. Figure 1defines the areas to be managed that cover the DWMP.

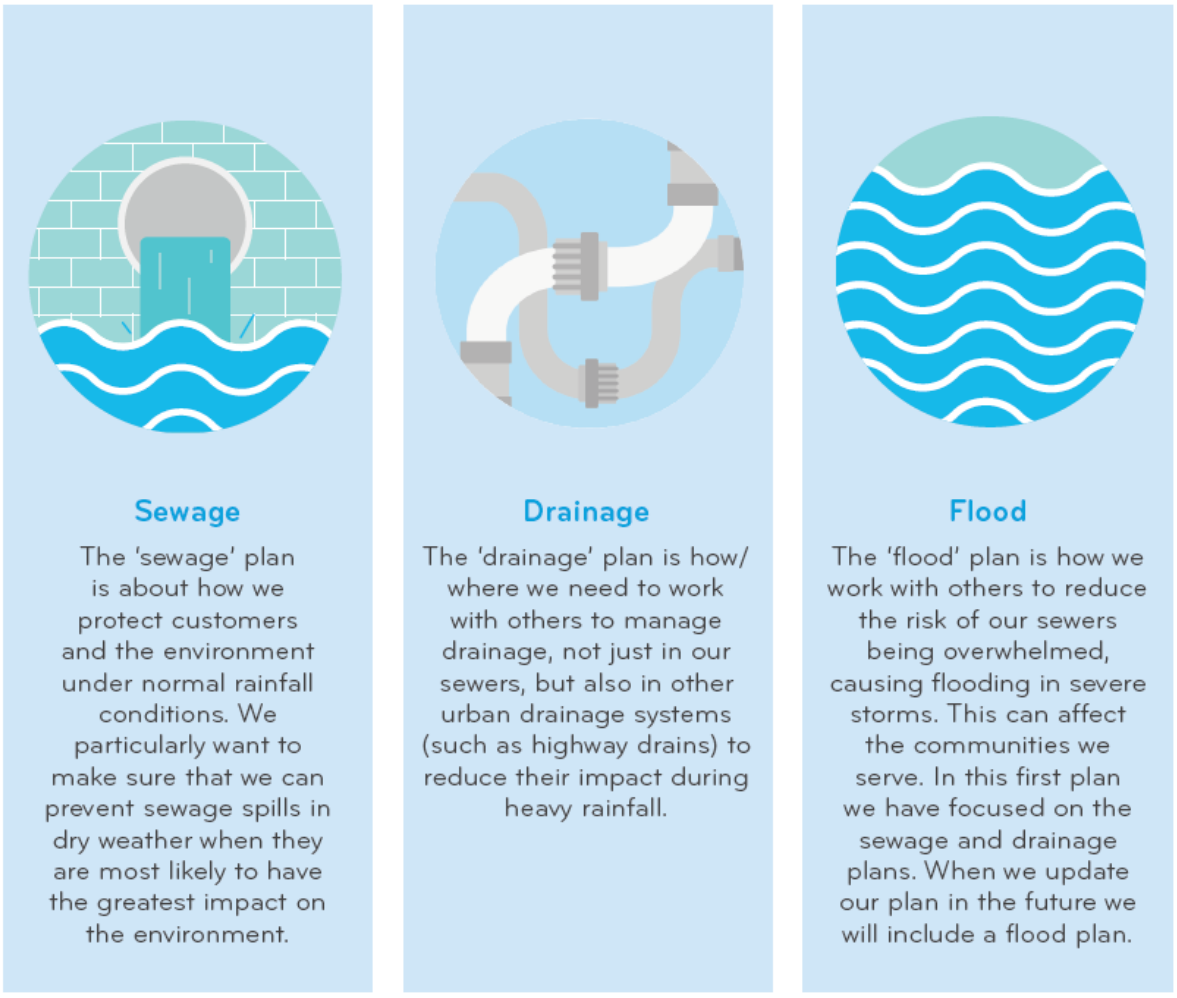


Figure 1 Shows the definition of Sewage, Drainage and Extreme Flooding

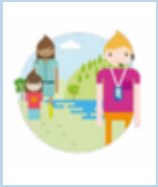
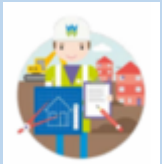
The DWMP is a joint exercise between the Welsh and UK Governments, Water UK, local authorities, environmental non-government organisations, wastewater companies and their regulators. Scotland and Northern Ireland are also participants to this new process. All Water and sewerage companies in England and Wales are undertaking this exercise together and learning from each other as the process progresses. The DWMP is customer-focused and looks at how we will respond to future challenges brought about by a bigger population, growing urban areas and climate change in particular. It sets out how we will extend, improve,

and support drainage and wastewater systems in line with Government direction and our customers' requirements.

The Plan looks to the future and assesses the level of risk we face from climate change, urban developments and changing populations. It covers a period of 25 years as a minimum, with the current plan covering the period 2025-2050. It takes principles from water resources management planning and tried and trusted methods from wastewater processes and merges these ideas together to ensure that governments, together with our customers are reassured that there are plans in place to maintain services that are transparent, robust and forward plan for decisions which affect us all.

It is our intention that the planning process for the DWMP will be updated every 5 years and have progress reviews every year. Whilst we are presenting our progress on this plan, we are at the same time feeding into the development of the next plan. We will be presenting the results of our findings so far and making recommendations to improve methods for the next plan.

Our customers are at the heart of everything we do, and this includes the development of the DWMP. We are including customers at every step to make sure we create a long-term plan that benefits everyone and the environment we all share.

<table>
<tr><td>  </td><td>This is a customer driven plan that will set out how we intend to manage future challenges brought about by population growth, urban creep and climate change</td></tr>
<tr><td>  </td><td>It will set out how we intend to extend, improve and maintain drainage and wastewater systems across Wales and the areas of England that we serve.</td></tr>
<tr><td>  </td><td>It plans for the Long-term, setting out targets that are appropriate to the risks we face, but for a minimum period of 25 years that covers both England and Wales.</td></tr>
<tr><td>  </td><td>It is a best practice approach-built on processes already established such as Water Resources Management Plans and Sustainable Drainage Plans.</td></tr>
<tr><td>  </td><td>It demonstrates greater transparency, robustness and line of sight to investment decisions that affect our customers.</td></tr>
<tr><td colspan="2">Developing this plan will help us work towards our Welsh Water 2050 vision to "earn the trust of our customers every day" and to achieve our mission of becoming "a truly world-class, resilient and sustainable service for the benefit of future generations".</td></tr>
</table>

Wastewater and drainage affect everyone

You may be asking yourself how this work may affect you, or why you should read on to find out more; the answer is simply that water and drainage affects everyone.

One of the most important things that we do to protect public health at Welsh Water is to take away wastewater from homes, businesses, and communities so it can be treated and safely returned to our rivers and seas.

We all rely on clean water every day to drink, cook, clean, bathe and flush the loo. Many of us enjoy living by the sea, fishing, or relaxing near canals and rivers. All these activities interact with the water cycle.

The decisions we make today will have an effect for many years to come and we want to know what you think we should do.

Ensuring we have a clean water supply depends heavily on the way we manage drainage and wastewater. As the demand for clean water increases, the amount of untreated sewage from homes and businesses will go up, too. The way we manage this is important as it will shape the future well-being of Wales, the border areas of England we cover and the environment that we all share.

Changes in future such as climate change, a growing population and larger urban areas with less green spaces will increase the risk of flooding, and impact on the environment. We want to make sure this doesn't happen and the DWMP sets out steps we can take to reduce the risks.

Key stages

Water companies have been asked to produce DWMP's for the first time based on guidance from an agreed framework. The framework is a document which sets out the steps we must follow for developing the DWMP and has been agreed with both Governments and regulators.

The framework was developed with input from other bodies and interested groups which aim to protect communities and the environment. This is a first step on the journey to improve the strategic planning of drainage and wastewater services.

You can find out more information on the Water UK DWMP Framework, or visit the website at www.water.org.uk

The stages involved in creating a DWMP are shown below in Figure 2:

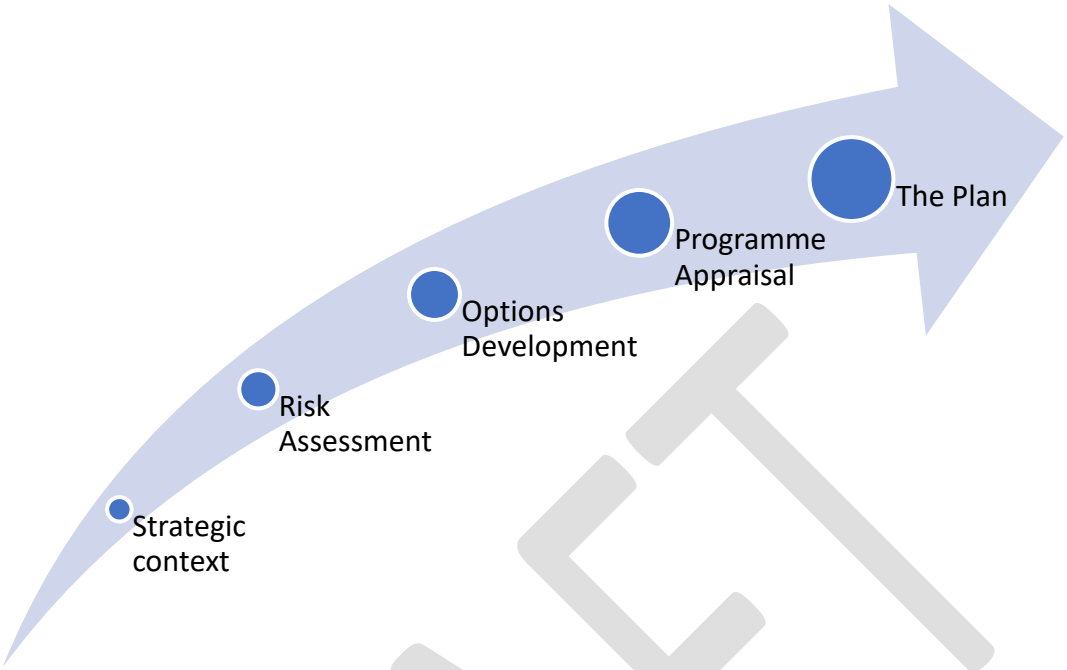


Figure 2 shows the stages of a five-year DWMP

The main stages of creating a DWMP are shown below:

Strategic Context	The first stage in the DWMP planning process which identifies the big issues faced now and, in the future, as well as actions to address them. 2019, Stage 1 'Objective Setting'. Open the new plan for pre-consultation discussions which will continue all the way through the process and will start again in 2023 for cycle 2.
Risks and Issues	This stage outlines information about drainage and wastewater issues that are already being experienced or have been identified. It will also analyse current and future risks and their causes. 2020, Stage 2 'Risk Assessment'. Review current performance and assess future risks, align risks with other organisations risks and will start again 2024 for cycle 2.

Options Development	The options stage will outline the process of developing solutions to address the risks and their degree of uncertainty. 2021-22, Stage 3 'Options Development and Environmental Assessment'. Develop options and create opportunities to work with others to reduce the risks found in stage 2. Carry out a consultation of the SEA and HRA and undertake environmental assessments to understand impacts to habitats etc and will start again in 2025 for cycle 2.
Programme Appraisal	Take the preferred suite of solutions and assess for various programmes and pace over the life of the Plan. 2022, Stage 4 'Programme Appraisal'. Create a preferred set of solutions from the Options and opportunities developed and prioritise those solutions over the life of the plan and will start again in 2026.
Draft DWMP	Publishing the Draft DWMP for public consultation (2022). Public consultation of the draft DWMP which will involve public consultation with stakeholders, regulators and customers via customer research. 2022-23, Stage 5 'Consultation Period' and includes production of the Draft, revised draft and statement of response and Final plan. Plus, The SEA and HRA and the post adoption statement of the SEA and will start again in 2027.
At the end of each cycle Welsh Government will review our plan and give their permission to publish if the plan has met Government direction. The first DWMP is anticipated to be published as a final plan in March 2023 and for cycle 2 this activity will start again in 2028.	

In addition to these stages once the first plan has been published annually on the anniversary of the plan publication date an annual review of progress against the published plan is required.

Why is this document being published?

We are producing the DWMP because we want to have a wastewater and drainage[1] system that is fit for purpose in the 21st century and beyond.

We need to ensure that the wastewater and drainage system reflects the needs and requirements of customers today, whilst planning effectively for tomorrow, just as our Victorian forefathers did.

We also need to ensure that we can more effectively manage joint drainage responsibilities; this means we must work together with lots of other organisations and individual landowners who own the drains, ditches and culverts which pass rainwater in urban areas into our sewers rather than to water courses and rivers. We recognise that as climate change and other pressures impact on us, society is about to make an important decision regarding the future of drainage, and we need to be ready with our plan to implement it.

This document has many aims of one of which is to provide a trial plan that supports government in their preparation of the future regulation of DWMP's due to the enactment of the Environment Bill. The industry request to show while doing what a statutory plan could provide to government.

Another aim of the plan is to think out of the box for this first cycle and trial not only tried and trusted wastewater methodologies but to draw on others experience from a wide range of stakeholders to improve how plans are put together and develop and integrate methodologies to improve efficiency.

And the plan also sets to tell you more about how and what we are doing and involve you in our decision making with regards to the methods, communications, pace and limitations of the approach.

We have also developed our first plan summaries one for each region and local river system. These are structured so that we can add more to these overtime when information become available and when strategic changes occur locally.

Overview

This document will provide a summary of the following sections of the DWMP:

- Introduction
- Background
- Planning areas
- Level of service
- How we engaged with customers and stakeholders
- Plan development
- Options Development

[1] Including those other networks that we don't control but which are just as important for protecting the communities we serve.

- Environmental Assessment
- Programme appraisal
- Proposal for cycle 2
- Concluding the Plan

BACKGROUND

Who is involved?

It's not only Welsh Water who are involved in putting the DWMP together. The government and regulators also have an important role:

- The government directs water companies to produce this plan.
- Regulators check on water companies to make sure we are following instructions from the government and that our plan remains sustainable and affordable.

At Welsh Water, it's our job to supply drinking water and to take away water that's been returned to the sewer, clean it, and then return it to the rivers and seas. Along with others, we also provide a service to take away rainwater and clean it before returning it to our rivers and seas.

We're a bit different to other water companies

We are a 'Not for Profit' organisation. We don't have shareholders and every penny our customers provide we put right back into keeping bills down and looking after your water and the environment we all share – now, and in the future[2].

What are 'assets'?

This is an item of property owned by a person, Local authority or company.

Sewer assets forms a part of the network of sewers, pumping stations and sewage treatment works and anything else which is needed to operate the sewerage system.

Drainage assets include culverts, ditches, and pipes.

The water industry is a regulated business.

We are a licensed water and sewerage provider, we're regulated by Ofwat (The Water Services Regulation Authority) and the environmental regulators, Natural Resources Wales (NRW) in Wales and the Environment Agency (EA) in England, and the drinking water inspectorate (DWI) who are specifically focused on drinking water.

In the wastewater and drainage sector we are regulated principally to reduce the impact we have on the environment, and make the best use of our available funding.

[2] If you would like more information, it can be found at https://corporate.dwrcymru.com/en/about-us/company-structure/glas-cymru

We are also subject to the policies and legislation of the Welsh and UK governments. Regulators act on behalf of the government to make sure we follow regulations and guidance.

There are other important official bodies that carry out a function due to our company being a regulated business, in particular the Consumer Council for Water who provide an independent voice for water customers in Wales and England. Similarly, Natural England are a regulator who provide science-based practical advice on the environment (in England). In Wales this function has been incorporated into NRW.

The DWMP process is assumed to be on par with the Water Resources Management Plan (WRMP) and will follow the steps as indicated in the Figure 3. There is a list of activities that we the water company undertake as the lead on the plan and the flow chart indicates stages where 3rd parties and Government play their part in the process. Below is a list of organisations and their role in the process as in addition to water companies, the government and regulators, there are other organisations and people who are involved in planning draining urban areas – and the DWMP:

- Local councils who plan future housing and businesses, deal with new or extended roads, and manage most urban and highway drains.
- Natural Resources Wales and the Environment Agency manage the amount and quality of water in our rivers and seas. They also manage drainage as part of the water cycle, such as river flooding and coastal defences.
- Land and asset owners are responsible for looking after their own land and making sure their drainage assets are fit for purpose (some of which pass flows to the sewerage system). This includes important national infrastructure such as reservoirs and water courses.
- Groups with environmental or social concerns that are affected by our drainage and sewerage infrastructure.
- Customers and the communities we serve.

Welsh Water is responsible for managing sewerage and sewage treatment alone, but we also are responsible for our sections of drainage infrastructure. To manage drainage, we must work together with the different organisations and people listed above. This highlights how important it is for us to work together with others to deliver the Plan.

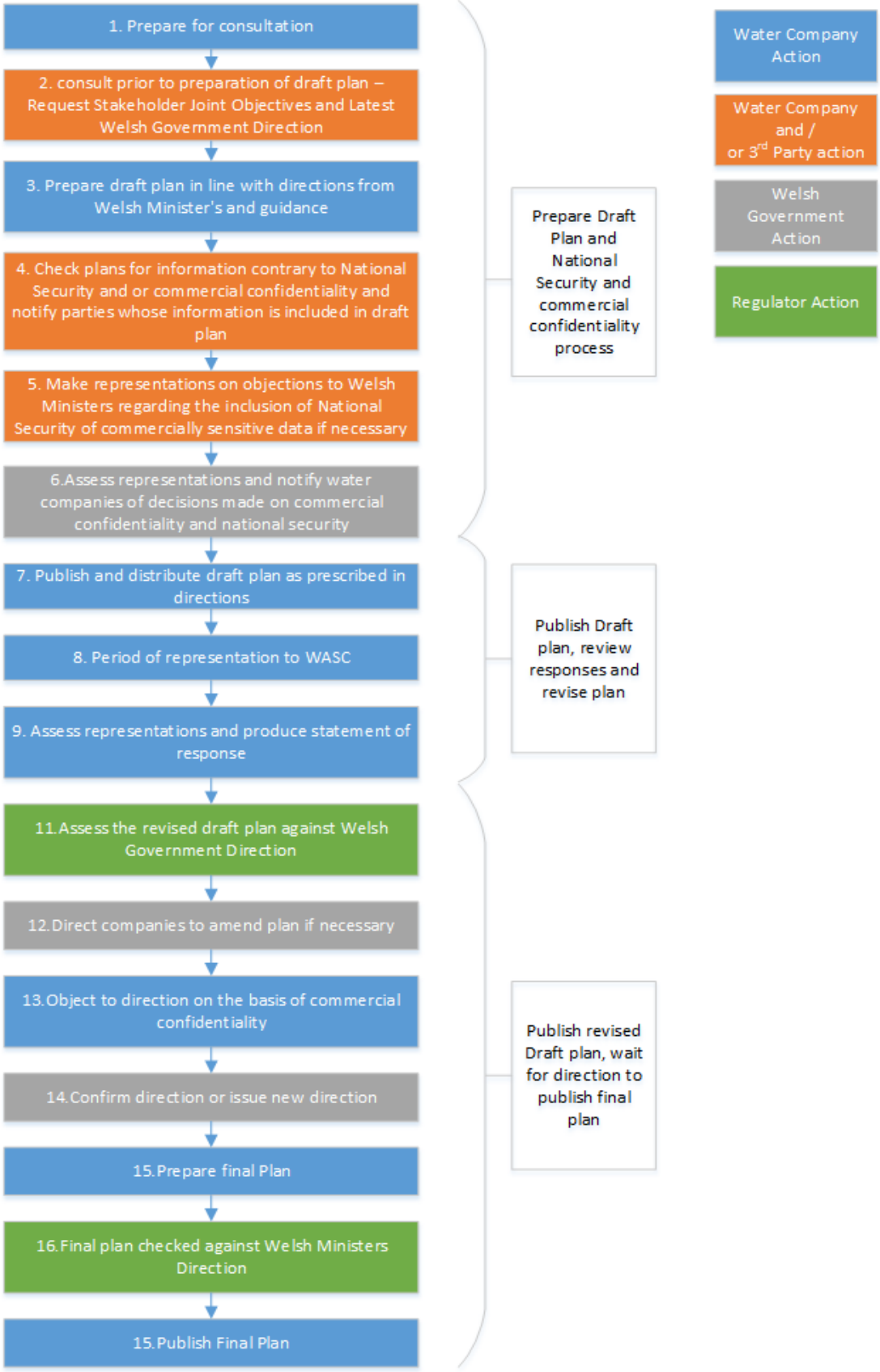


Figure 3 Stages of a DWMP format taken from the WRMP Guideline

What does Welsh Water do?

You might be surprised by how much we do - everything from managing the sewerage and water networks, treatment of sewage and drinking water, to serving customers and working with our local communities:

 **SERVING OUR CUSTOMERS**		
1.4 million homes and businesses	3 million people in most of Wales, Herefordshire, and parts of Deeside	Over 600 million litres of wastewater treated on an average day
 **OUR COMPANY**		
The 4th largest company in Wales	Employ over 3,000 people	Completed a £1.5 billion investment programme 2010-15
 **OUR ASSETS**		
Maintaining over 30,000km of sewers and over 26,500km of water mains	Managing over 800 wastewater treatment works including improvements to meet new environmental standards and 69 Water Treatment Works	Looking after more than 2500 Sewage pumping stations and 679 water pumping stations and over 2,000 combined storm overflows (CSOs)
 **IN THE COMMUNITY**		
One million visitors to our reservoir sites and visitor centres every year	Over 164,000 children have visited our education centres to date	Looking after 40,000 hectares of land

Why do we need a plan?

As a water company, the decisions we make today will affect our customers and the environment we all share for generations to come. There is a need for longer term planning but the approach to this historically varies between different water companies. These individual approaches make it difficult for our regulators to compare and consider plans from across the whole of the UK, with information not always being produced or shared in the same way.

This means there is not enough consistency and transparency to reassure governments, and our customers, that this key service will remain fit for purpose into the future.

The goal of the DWMP is to bridge this gap – it is an opportunity to work better with other organisations to deliver the best outcomes for everyone in a sustainable and planned way, where we can work as partners, as set out in the Wellbeing of Future Generations Act, to meet the needs of our customers and stakeholders.

We have worked with the Welsh Government, regulators and national groups as part of Water UK to achieve better consistency between water companies.

All water companies have been putting together their first DWMP during the 2020-25 period.

We believe our approach to planning the DWMP delivers what is best for customers and the communities where we operate.

The goal of the DWMP is to put together an integrated plan which covers all the areas we operate in. These areas are shown in the map in Figure 4, which shows our operating areas in Wales, Herefordshire and parts of Deeside:

"The DWMP will help us to do the right thing for our customers and the environment for the long term."

The plan ensures we have a joined-up and more effective approach to addressing some of the biggest challenges we face including climate change, a bigger population and growing urban areas.

Although the DWMP is not currently a statutory obligation for water companies in Wales and England, it is included within the Environment Act (2021) and we anticipate will be made mandatory in 2023.

Where do we operate?

Figure 4 shows Our Operating Area for both Water supply and Sewerage services

Future trends and the need for action

The nature of the environment we operate in means that future uncertainties are likely to have a big impact on what we do and the service we provide to our customers. It is important that we consider both the challenges and opportunities these trends present so that we can continue to meet customer needs, both now and in the future.

The key future trends we have considered as part of the development of the plan are:

 *Changing climate patterns* The increasing frequency and severity of extreme weather events such as drought and flooding	 *Emerging and persistent contaminants* Continuing to find solutions to legacy contaminants such as microplastics and pharmaceutical compounds. This includes issues with recycling of biosolids/sludge recycling, micropollutants, nitrate vulnerable zone designations and potential associated changes in regulations.
 *Decarbonisation and sustainable business practices* The resource cost and trade-offs linked to implementing the necessary move towards net zero carbon to achieve 2050 target, as well as the need for energy efficiency in operations, circular economy practices, and sustainable supply chains.	 *Increasing customer and stakeholder expectations* Keeping up with accelerating customer expectations around service levels and technology, while ensuring we retain customer and stakeholder trust against a background of increasing environmental concerns such as carbon net zero, water quality impacted by phosphate levels and CSO discharges, recycling of bioresources, and the other concerns of stakeholders and pressure groups.
 *Price caps, affordability and potential trade-offs* The constraints of balancing affordability concerns for customers, price caps imposed by regulators limiting necessary investment, and the need to invest in initiatives such as improving infrastructure and environmental protection.	 *Legacy Infrastructure* Considering the set of risks posed by physical, biological and chemical degradation of infrastructure and/or lack of capacity in design of legacy infrastructure. Also considering the risks posed by ageing digital infrastructure.

 *Regulatory changes* The UK Environment Act (2021), and several other regulatory changes which will become law in a post-Brexit Wales by 2025, are likely to bring tighter environmental standards, driving significantly increased monitoring and investment costs.	 *Environmental responsibility* Managing the impact of our activities on freshwater biodiversity and the important ecosystem services biodiversity brings. Considering the overall environmental responsibility of DCWW in their operations.
 *Drainage and combined sewer overflows (CSOs)* Managing issues of river water quality and pollution, linked to lack of treatment capacity or functionality in drainage systems, exasperated by climate change, whilst facing increasing public pressure and expectations to resolve such issues.	 *Demographic and behaviour changes* The growth of homeworking and its implications and preparing for a growing and ageing population.

Through longer term planning and a greater emphasis on working together with others, the DWMP will help us to respond to these future trends and challenges.

Climate change has already brought big changes including heavy and unpredictable rainfall which happens more often. We are seeing increases in the amount of water being collected and returned to the sewer. This puts more pressure on the sewer network which has a fixed capacity, and it means we have to use our storm overflows more often to protect homes and businesses from flooding.

storm overflows

What a storm overflow does and is it wanted anymore?

Storm overflows are designed to operate when it's raining, or shortly after, to help the sewerage system cope as it drains. They provide pressure relief and protect customers from flooding. They were designed over 100 years ago to fix a problem where people were dying from water borne diseases. The decision to mix rainwater with sewage has led to our current position. Our urbanised areas are dry and have fewer green parks and woods. This highlights the need to review how storm overflows currently work, and whether there is a need for them anymore.

However, some storm overflows are now operating regularly throughout the year, not just during heavy rainfall events as they were initially designed for. They are there to protect customers from flooding.

Customer promises

We have developed six customer promises in response to changing expectations shown in Figure 5, key priorities, and a changing environment:

Safe, clean water for all	**Personal service that's right for you**	**Safeguard our environment for future generations**
Put things right if they go wrong	**Fair bills for everyone**	**A better future for all our communities**

Figure 5 showing the 6 customer Promises from Welsh Water 2050

We have ensured that the DWMP reflects these customer promises and considers how the plan can ensure that we deliver a service that is robust and resilient to future pressures, in addition to meeting customer needs while keeping fair bills for everyone.

Key drivers

There are several key drivers which we have used to develop the DWMP. Engagement with our customers and stakeholders has been used throughout to help shape the key drivers and our long-term planning:

- Environment challenges

Tightening environmental standards, Climate change and a growing population will all put more pressure on making sure we have effective drainage and wastewater management.

- Behaviours and expectations

We need to meet everyone's expectations and ensure systems are adaptable, fit-for-purpose and responsive to changes in technology. This means that we will need to understand how our changing societal needs can be met, and where we can help ourselves to reduce the risk of flooding and our impact on the environment.

- Resilience

We need to look at the factors that challenge us, respond to an uncertain future, and think about things that can be difficult to predict.

We need to be able to cope with and recover from disruptions, maintain services for our customers and protect the environment.

We need longer-term and integrated planning carried out by all those responsible for drainage and more effective procedures for others to work with us (in the form of the DWMP) to ensure we can meet the scale and complexity of these challenges.

Objectives

There are three overall themes for the plan. The objectives reflect our focus on resilience for the future whilst also providing best value for the customers of today and tomorrow:

2. **Water quantity**

Reducing the risk of flooding to communities.

3. **Water quality**

Improving water quality for the environment

4. **Resilience and maintenance**

Making sure we can adapt to changes in the future, whilst also maintaining important services and protecting the environment

Resilience

Ensuring a resilient wastewater and drainage network is vital and includes many organisations working together on a range of different areas, from assets and systems to people and culture. Being resilient ensures that we are ready to meet the challenges of 2050 and beyond.

The themes are underpinned by national planning objectives to enable company by company comparison by our regulators and company specific objectives that forecast risk to help

companies plan. The objectives will inform the action plans and will help us to achieve our vision, mission statement and Welsh water 2050 objectives.

PLANNING AREAS – HOW HAVE WE SET OUR PLAN AREAS?

A key part of the DWMP is making sure that there is early, continual, and effective engagement between different organisations and stakeholders at different scales; both at company and local level.

If we are to deliver resilient wastewater and drainage systems, we must work together with others and consider different planning areas from national to local.

Plan areas must consider impacts on customers and the environment together with the structure and geography of the communities we serve.

We have developed a structured approach to plan areas for the DWMP which is set out in Figure 6.

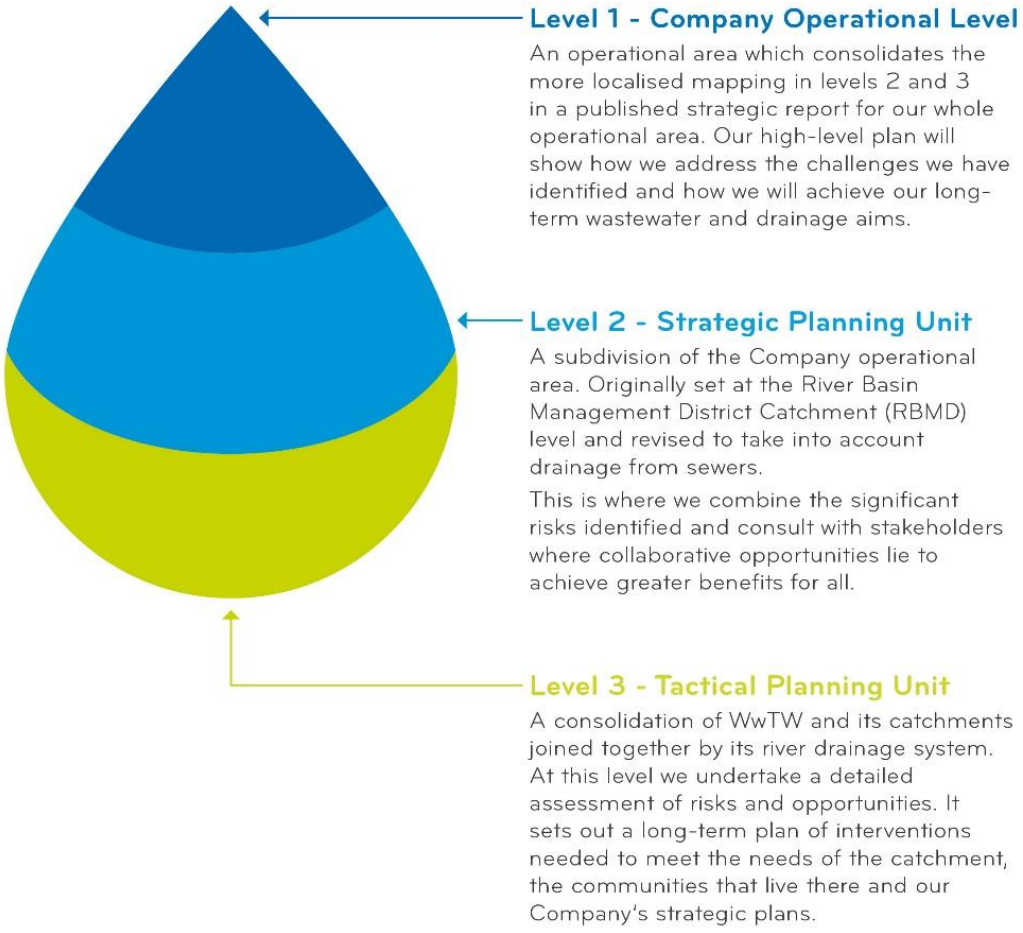


Figure 6 DWMP Planning Hierarchy

These plan levels are adapted from the nationally agreed Water UK framework to ensure they are tailored to our organisation, customers, and stakeholders.

The plan levels also inform how we engage with different groups as part of the DWMP.

For example, we need to use a different approach to speak to a local community about their wastewater concerns when compared to sharing data with other organisations at a national level. The choices made to describe these planning levels ensures we have a more structured and responsive approach to engagement that is tailored to different people's needs.

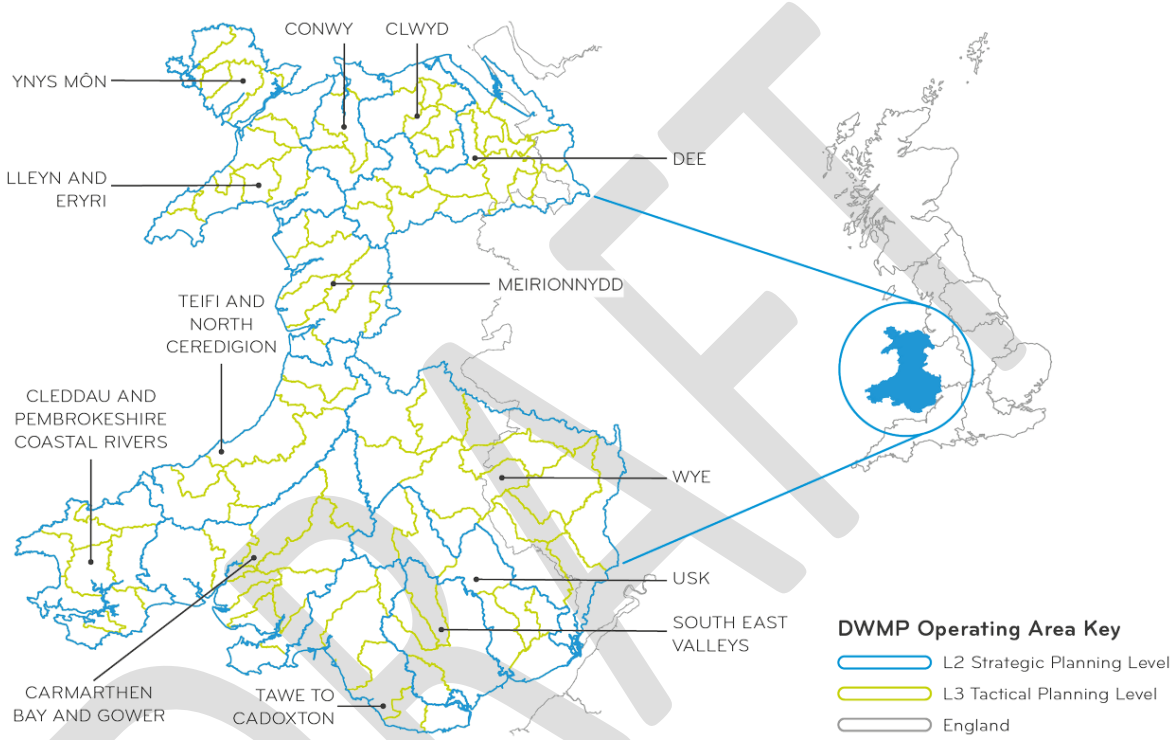


Figure 7 Map showing the DWMP Hierarchy for Level 1, 2 and 3

Figure 7 shows a map of Welsh Water's supply area, divided by blue border lines into the 13 strategic planning units – also known as Level 2 or L2 areas, and divided again by green border lines into the 106 Tactical Planning Units – also known as Level 3 or L3 areas. The Company operational supply area is also known as Level 1 or L1.

LEVEL OF SERVICE

Our regulators measure our performance at a company level with various annual performance measures. We are considering measuring not just performance, but also the level of service that our customers and the environment experience at a local level. The calculation of levels of service is not a simple task as it includes:

- The combination of all performance objectives in a local area
- Assessing the gap between the current level of service and the expected level of service
- Comparing the current and future situation to the desired level of service

In a Level of service plan at a localised area, all of the expected performance measures need to be met, together with a plan in place to achieve the desired level of service. These are then considered through the plan layers to come to a conclusion on level of service at level 2, and then at the company level of service Level 1.

To calculate the level of service, we need to first understand at a local level the volume of flow in the sewer, and the limitations of each of the assets in the whole system. Underlying the process is a need to understand the capacity of all assets that work together. Using this approach, we can define capacity at a local level.

Performance Measures at a local level are included in the table below. They are generally the same as the national and local objectives for the DWMP. Priorities for the environment are also listed in the table below too; our regulator has outlined these in order of importance.

Customers	• Any incidents which can affect our customers.
	• This may include
	  ○ Flooding inside or outside homes and businesses
	  ○ Flooding which can affect roads

Environment	• Prioritising where the most damage could occur which can affect the environment. Considering frequency, intensity and seasonality of events.
	• This may include:
	  ○ Protecting environmentally sensitive areas
	  ○ Protecting Bathing and amenity waters
	  ○ Protecting other river and coastal waters

It's also important that we have enough data on assets to feed into an assessment of level of service. We currently have information on sewerage, but for drainage there is information missing. This information is missing because we do not own the assets; they may be owned by a Local Authority, for example. This again highlights the need to work together with others and manage drainage in an integrated way.

Pollution in rivers – where does it come from?

Water pollution in our rivers comes from lots of different sources. There's water from rainfall runoff from agriculture, mining, urban runoff, storm overflow, forestry and roads.

The quality of the water will vary depending on the substances it can pick up as it drains to the rivers contributing to pollution levels.

Think about when there's heavy rain – water runs through soil, litter, and anything else that's been left on our roads and pavements. This can all end up in our rivers causing pollution.

How do we manage river quality?

As a water company, we look at our impact on river and coastal water. We test and report on the quality of water which is discharged from our wastewater treatment works.

In addition, we look at how much of the pollution going into our rivers and coastal waters comes from different sources. This helps us to better understand how our service contributes to the river, and it informs where we may need to focus our investments to help protect the environment.

Climate change may change the water levels in our rivers, particularly during dry summers. This will make it harder to ensure our rivers remain healthy.

As a water company, we must report on our performance against a range of different measures requested by our regulators, Natural Resources Wales, Environment Agency and Ofwat.

As part of the DWMP, we have looked at the level of service we provide to our customers and the environment locally and compared this with our view of what we need to provide to deliver a wastewater network which is fit for the 21st century. This includes dealing with the current concerns such as storm overflows, and tackling other issues that allow us to respond to the big challenges we face in the near- and long-term future.

What is our Destination?

Our work understanding what customers and stakeholders want by 2050 sets out a milestone into the future. In this plan we have explored what society wants to achieve and how fast that destination can be achieved. We are asking during our plan what is the destination planning needs to consider? Where do we go once we have achieved our first milestone?

We consider there to be two equally important destinations

- Our customer destination
- Our Environmental destination

What does that destination look like? Read on to help us define what they should be.

Our overall goal is to ensure that we can achieve the expected level of service in all the areas we operate. This can take a long time and requires very significant investment, many billions of pounds. The DWMP helps us to set out the steps we need to take to reach these destinations. We are proposing the following stages to achieve our environmental and customer destinations:

- We start with the worst problems and focus on fixing them first and also focusing on the area that have a designated status.
- We then move onto the 'next worst' problems until the point at which we have planned how to address all the identified problems.
- This approach allows us to maximise benefits we can deliver for both customers and the environment jointly, and it ensures we can deliver these benefits as quickly as possible.

Water companies' level of service?

Companies must report on a variety of performance measurements to our economic regulator, Ofwat. The measurements describe the number of incidents that have occurred, and we also forecast the number of incidents we expect in the future. These measurements are classified as either affecting our customers or the environment.

This ensures that all water companies provide enough information to allow Ofwat to compare the performance of water companies, and it supports the development of investment plans for both new and replacement assets across the water network.

However, in terms of a definition of Level of service; a unique measure that brings all the objectives together – this hasn't been defined yet.

We are suggesting that the following Measures of Level of service be used locally.

To Manage the sewerage system;

- The Capacity Versus Demand comparison bringing together the environment capability to receive effluent,
- the total demand on the network pipework and equipment such as pumps and its ability to transport the effluent and
- the constraints at the treatment works to clean the effluent but to 2 planning levels that is average conditions and dry weather conditions.

To Manage the drainage system

The resilience of a system to a Return period or type of storm including flood conditions.

To explain Level of service and the milestones to be achieve the graph in Figure 8 shows 3 zones of increasing risk to storms. The blue area is experienced most often at about 240 days in an average year, the green area is experience less often but still for over 115 days in an average year and the 3rd pink area is experienced the least at about 7-10 days in an average year.

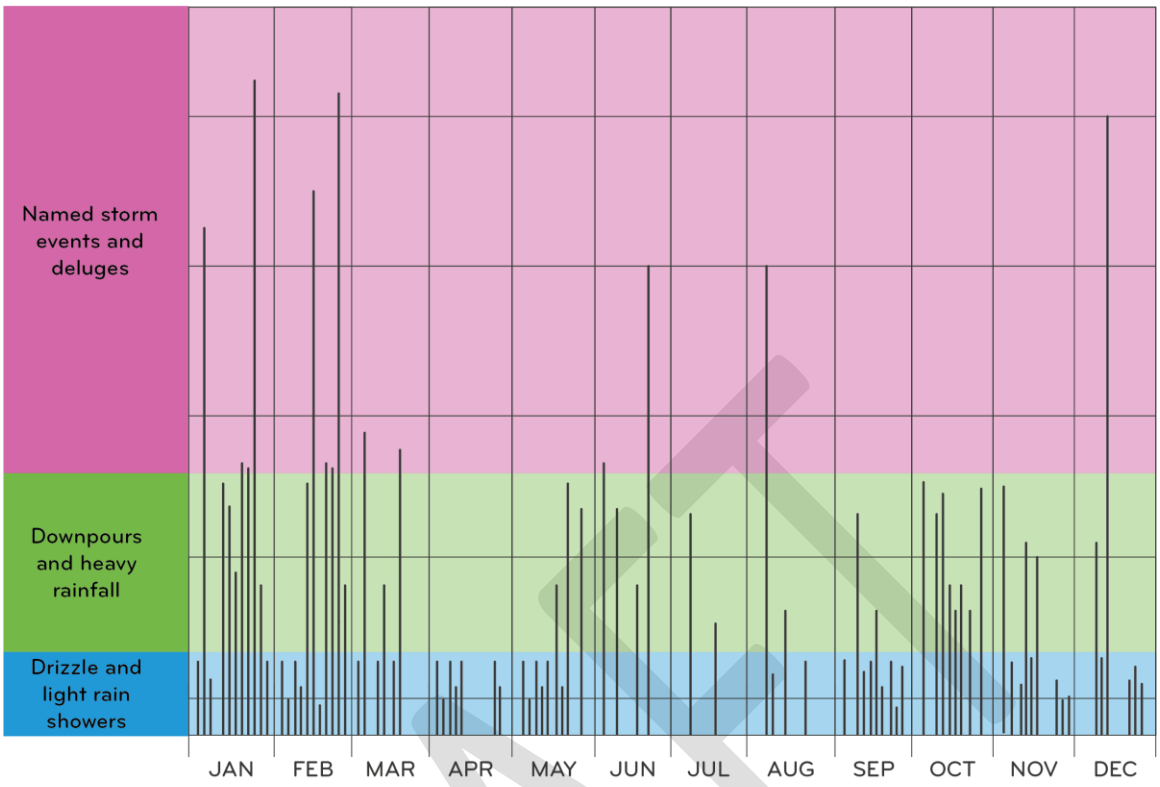


Figure 8 Idealised graph of rainfall intensity and milestone zones of planning

The speed to achieve the desired Level of Service is limited by affordability and the practicalities of reengineering the drainage systems of communities. The matrix in Figure 9 has been drawn to show how planning priorities will progress. We have started to investigate and create solutions in the top left box marked where there could be perceived to be the most environmental harm in a Special area of conservation (SAC) and where customers experience more than one flood internally to their property. We will then move on to the SAC locations and where customers have or predicted to experience a single internal flood to their property. the matrix is highlighting that we need then to move on to special areas of scientific interest (SSSI) and for the same customer priority and so on until we have plans in place to address each classification of both Environmental priority and customer priority.

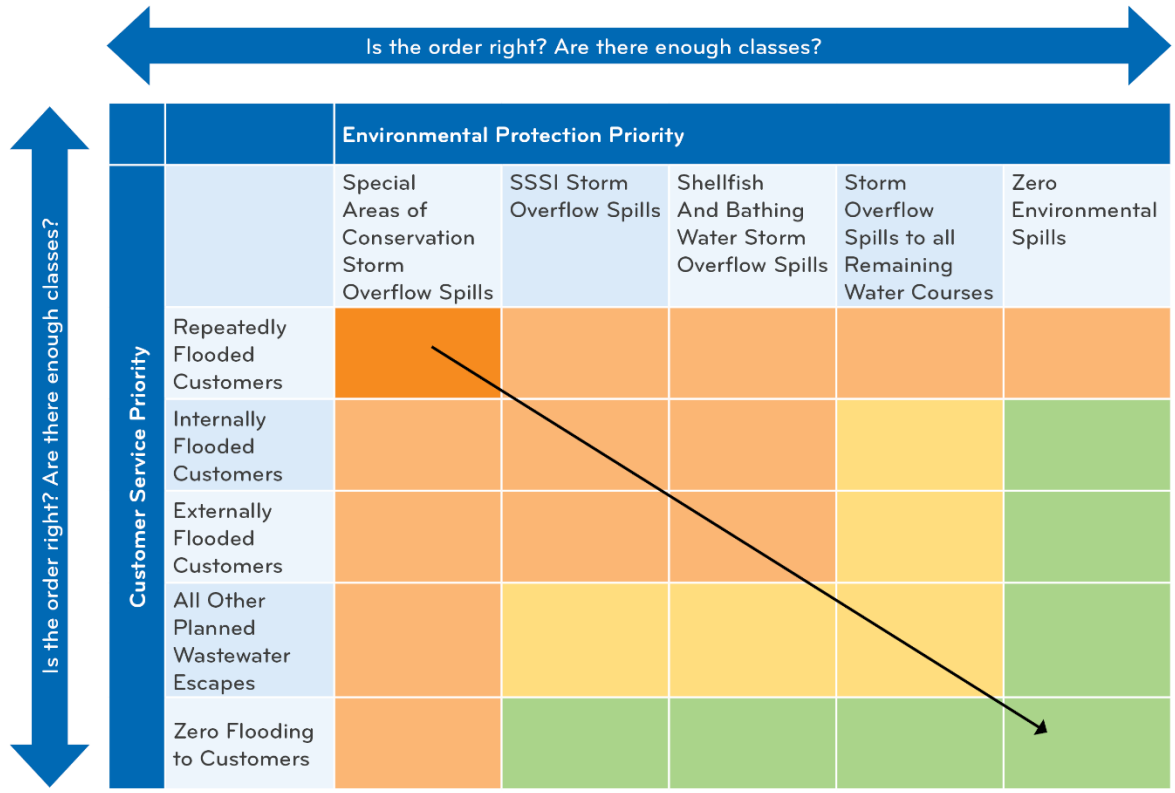


Figure 9 Order and Priority of planning

How does this relate to the DWMP?

The DWMP is being used to inform and define the level of service based on the capacity of the sewerage and drainage system we are providing now, and what level of service we need to provide in future.

This is different to anything we have been asked to do previously as it is a new obligation under the recently enacted Environment Act 2021 which has asked us to calculate capacity.

HOW HAVE WE ENGAGED WITH CUSTOMERS AND STAKEHOLDERS?

In this section, we'll look at how engagement has been carried out and how our customer research and engagement has informed the development of the Plan.

The purpose of engaging with our stakeholders is to create opportunities for joint solutions and to inform the decision-making process and development of the DWMP.

What is engagement?

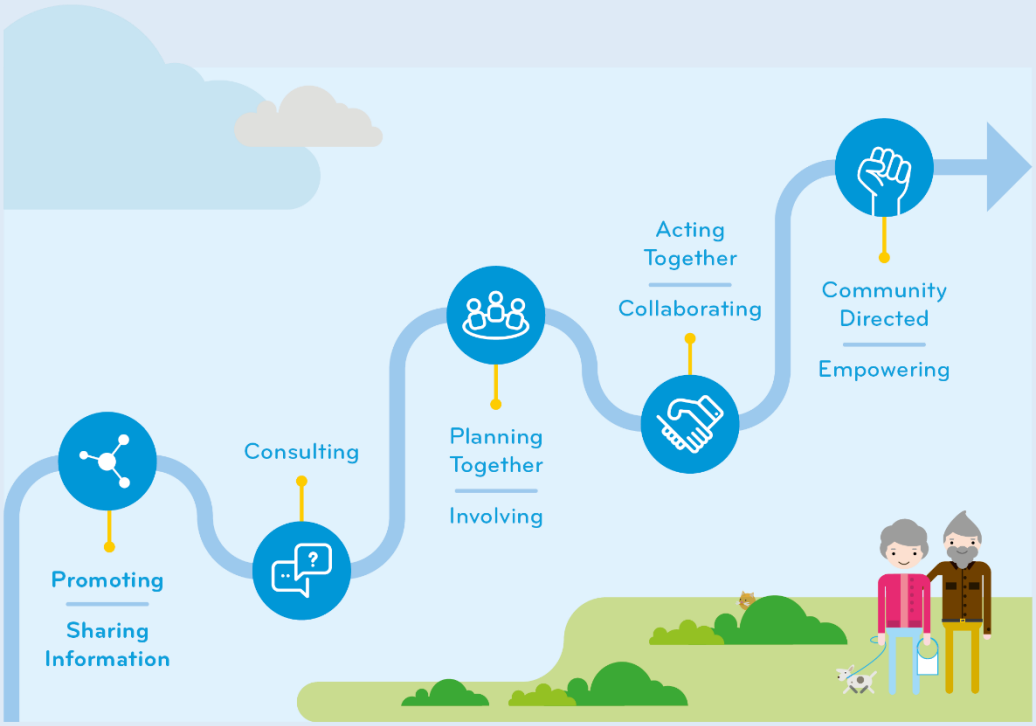


Figure 10 Community Engagement Model (MFSH, 2008)

By engagement, we mean a broad and ongoing process of sharing information and updates with all our stakeholders, getting their feedback and acting together. Stakeholders are anyone who has an interest in what we are doing; everyone from our customers to the government, regulators, and other water companies.

Figure 10 shows the stages of engagement that we are aspiring to achieve using the DWMP principles to gain community involvement in decisions.

How mature is our engagement?

We have undertaken an assessment of our engagement maturity using the principles from the international association of public participation and we have concluded that in terms of the

DWMP we are at the informing/sharing information stage. Our milestone programme has been built to improve our assessment.

We are working together with our stakeholders to develop the DWMP and ensure that the needs of our different stakeholder groups, including our customers, are reflected in the Plan. We have three milestones and five objectives which will help us to achieve our plan:

Milestones	1. Create the right environment for engagement to take place. 2. Align our objectives with stakeholder feedback. 3. Jointly agree the approach and methodology with our stakeholders.
Objectives	1. Engage with stakeholders in good time and in a way that meets everyone's needs and expectations. 2. Engage in a clear, consistent, and meaningful way to ensure everyone's views are properly understood and considered. 3. Build public awareness of the DWMP by providing clear and easily accessible material suitable for the audience. 4. Ensure that all materials and communications have the same style, tone of voice and messaging. 5. Make sure that all stakeholders are given enough information on the DWMP and have an opportunity to feed into the development of the Plan.

A summary of what we have done to meet each of our three key milestones has been included below.

Milestone 1 - Create the engagement environment

We followed the following steps to create the right environment for engagement to take place:

1. Mapped out key stakeholders, how they fit with the DWMP, how they currently work and their current links with Welsh Water.
2. Identified what was already in place in terms of forums or other methods key stakeholders had to speak with us regarding flooding, pollution, drainage, and other issues.
3. Decided on an approach for how we can best work with these stakeholders and get their input.
4. Identified the main regulatory bodies and their interest areas in the DWMP.
5. Carried out engagement with customers to better understand:
    - Awareness and understanding of drainage and wastewater.
    - Expectations of drainage and wastewater service.
    - Views on our 25-year plan for drainage and wastewater.

The key outcomes of this stage were:

- A list of key stakeholders, their links with Welsh Water and why they have an interest in the development of the DWMP.

- Overview of what's already in place to engage with these stakeholders.
- Outline of best approach for working with these stakeholders.
- Understanding of customer awareness, views, and expectations of DWMP, their drainage and wastewater services and our 25-year plan.

Overall, this stage helped us to find out how stakeholders would prefer to work with us and what they want from engagement and the DWMP. This helped us to develop our Plan objectives.

Milestone 2 - Align objectives and plans with others

After we considered how to create the engagement environment, we have discussed our approach to engagement with stakeholders, and talked about the opportunities and barriers, we found that there was a need to create an engagement forum to feed into the development of the DWMP.

The steps followed as part of this stage included:

- Engaged with key stakeholder organisations through email or face to face to better understand their objectives and initiatives and how these could align with the DWMP.
- Met local councils and stakeholders face to face and online, which provided an opportunity to establish contact and develop relationships at a regional level.
- Met with small local community interest groups to learn more about their drivers.
- Reviewed key stakeholder organisations plans and documents to understand how these can align with the DWMP.

Despite face-to-face engagement being impacted by Coronavirus restrictions, we were able to take key messages and objectives from stakeholder organisations and ensure that these have been considered as part of the Plan.

The key outcomes of this stage were:

- Identified the need to create a new engagement forum to feed into DWMP as there wasn't any forums that discussed both Quality and Quantity at the same time.
- More Understanding how stakeholders' own plans and aims align with the DWMP.

This allowed us to agree on an overall approach and method for carrying out our engagement.

Milestone 3 - Jointly agree the approach and methodology

Our aim is to have a joint working approach with stakeholders and local communities to feed into development of the Plan and deliver options. We want local communities to be involved in the process and feel that their voice is being heard.

We have agreed that we need a separately managed group so that opportunities to manage drainage collectively can be discussed and then together application for funds can be made,

A barrier to joint working was identified where each organisation could not obtain joint funds easily and many previous joint opportunities have been difficult to deliver even at the initial stages to obtain funds for the project to start.

As part of planning the joint working groups, we have held workshops with local councils and planning authorities to look at how stakeholders would like to engage with Welsh Water in the future. These workshops have taken place throughout the development of the DWMP.

Joint working Trial

We have been trialling our joint working approach with Isle of Anglesey County Council. We have been getting to know each other better, getting to know where our current risks are, building models that include both organisations pipework, but we are learning that there is some give and take and alteration of standpoint required. We both need to think about the community and not about the organisation and funding. Now we need to find a scheme to support. Then learn how to fund it.

The key feedback and outcomes from this stage were:

- A joint working group is a good idea, but a different approach may be needed which is more tailored to different areas and stakeholders.
- There are some issues holding back the idea of a joint working group which include lack of money, resources and time, and differing priorities.
- Local councils and planning authorities want to work with us on the DWMP and identify opportunities to work better together.
- We need a mixture of boards (rather than just the 3-boards identified) and we may need more (or less) boards based on what will work best in different areas.

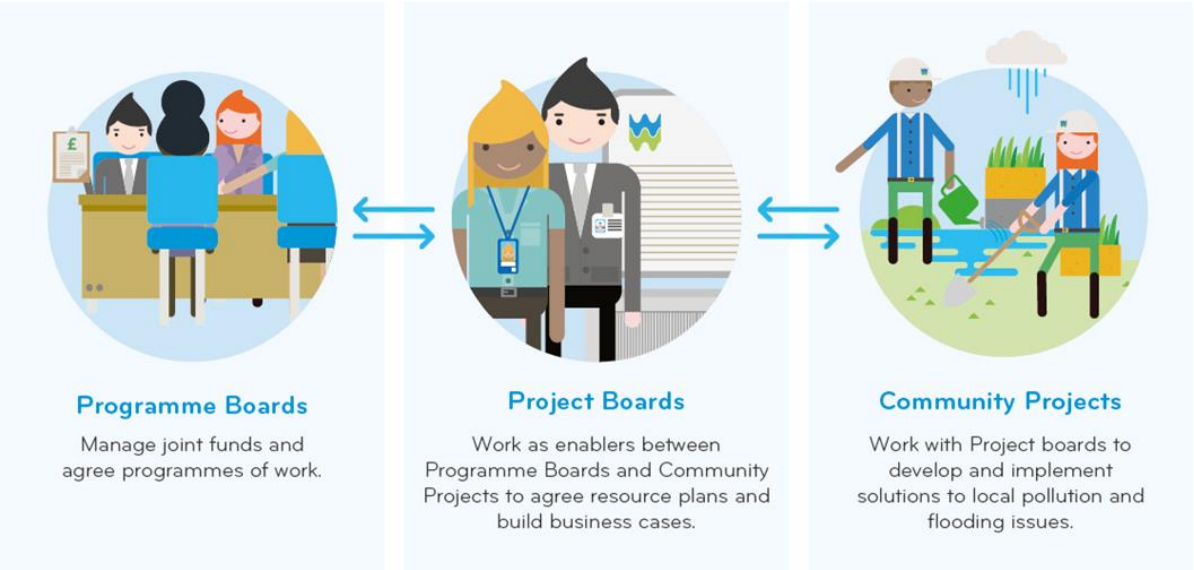


Figure 11 Represents the setup of functioning groups with skills for each group to facilitate opportunities

Figure 11 shows three circular images, with each representing a Programme Board, Project Board or Community Project.

- Programme Boards: Manage joint funds and agree programmes of work
- Project Boards: Work as enablers between Programme Boards and Community Projects to agree resource plans and build business cases.
- Community Projects: work with Project Boards to develop and implement solutions to local pollution and flooding issues.

How mature is our engagement locally?

We are still at the informing stage in 12 out of the 13 areas. We are moving between the informing and collaboration stages in 1 area. We must build relationships first in order to gain trust, and then move to collaboration.

We need to Identifying the right contacts in an organisation to carry out actions and who are also in a position to agree to support the opportunities, not only with funds to carry out the scheme on the ground but to support the development of a cocreated pipeline of schemes, already worked up.

To achieve this, our aim is to put together joint working groups which are made up of people with the skills of the Programme Board, but predominantly carrying out the tasks we would associate with a Project board:

1. A Programme Board managing funds and agreeing work.
2. A Project Board acting as the link between the Programme Board and local communities, planning and agreeing resources and putting forward work for funding.

3. A Community Project Board working with Project Boards to put forward suggestions and act as a main point of contact for local communities in terms of local flooding and pollution issues and putting forward ideas and options.

We are proposing going forward to support the development of drainage plans in Wales. We together create the remaining 12 project Boards in the same way as the Isle of Anglesey County Council trial.

We will consider programme boards and community project boards while we develop our next plan.

Engaging with our Stakeholders

We have met regularly with the independent environmental advisory panel (IEAP) throughout this process. The panel is made up of representatives of organisations such as Afonydd Cymru, Wales Environment Link and many more who are there to challenge and advise.

Engaging with our customers

We are committed to bringing the voice of customers into the heart of our business and the DWMP. We want to understand the views of our customers on key parts of the plan, particularly in terms of how quickly we make improvements as this will impact on their bills.

We have particularly ensured early research and ongoing engagement to provide opportunities for customers to help shape the development and speed of changes of the Plan.

We have also met regularly with the Customer Challenge Group who are an independent group of individuals from organisations that supply scrutiny of our plans from a customer point of view.

Working with our customers

Throughout the development of the plan, we have worked closely with our customers through a series of research sessions. These sessions have informed us of customer awareness, expectations, and support for different options.

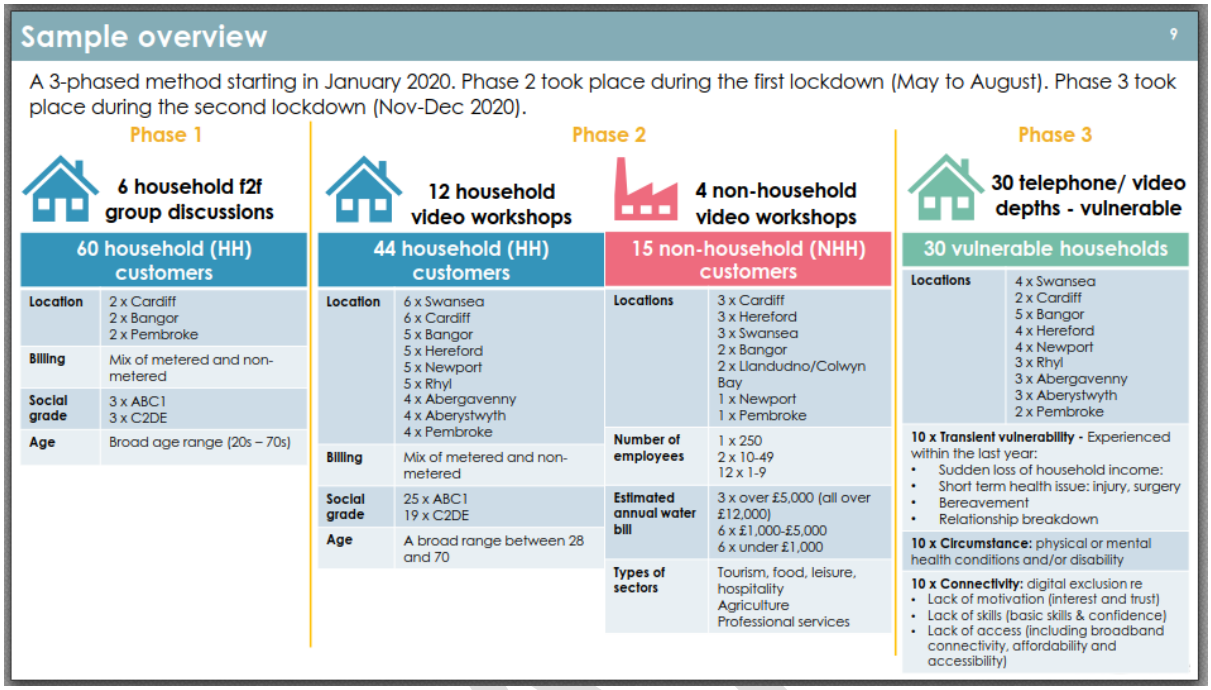
This has fed into the development of the Plan, ensuring that the outcomes are in the best interests of both existing customers and future generations who will benefit from it.

Our findings show a strong link between customer priorities and our objectives for the Plan; these include planning for the long term, acting in an environmentally friendly way and providing good value for money.

Customer research sessions

We carried out research with a broad range of customers including hard to reach groups over three phases during 2020. We engaged with 117 customers during this time, including 15 hard

to reach and 30 vulnerable customers. Figure 12 shows the phases and customer coverage undertaken for the first plan.



Sample overview

9

A 3-phased method starting in January 2020. Phase 2 took place during the first lockdown (May to August). Phase 3 took place during the second lockdown (Nov-Dec 2020).

Phase 1

6 household f2f group discussions

60 household (HH) customers

Location	2 x Cardiff 2 x Bangor 2 x Pembroke
Billing	Mix of metered and non-metered
Social grade	3 x ABC1 3 x C2DE
Age	Broad age range (20s – 70s)

Phase 2

12 household video workshops

44 household (HH) customers

Location	6 x Swansea 6 x Cardiff 5 x Bangor 5 x Hereford 5 x Newport 5 x Rhyl 4 x Abergavenny 4 x Aberystwyth 4 x Pembroke
Billing	Mix of metered and non-metered
Social grade	25 x ABC1 19 x C2DE
Age	A broad range between 28 and 70

4 non-household video workshops

15 non-household (NHH) customers

Locations	3 x Cardiff 3 x Hereford 3 x Swansea 2 x Bangor 2 x Llandudno/Colwyn Bay 1 x Newport 1 x Pembroke
Number of employees	1 x 250 2 x 10-49 12 x 1-9
Estimated annual water bill	3 x over £5,000 (all over £12,000) 6 x £1,000-£5,000 6 x under £1,000
Types of sectors	Tourism, food, leisure, hospitality Agriculture Professional services

Phase 3

30 telephone/ video depths - vulnerable

30 vulnerable households

Locations	4 x Swansea 2 x Cardiff 5 x Bangor 4 x Hereford 4 x Newport 3 x Rhyl 3 x Abergavenny 3 x Aberystwyth 2 x Pembroke

10 x Transient vulnerability - Experienced within the last year:
- Sudden loss of household income:
- Short term health issue: injury, surgery
- Bereavement
- Relationship breakdown

10 x Circumstance: physical or mental health conditions and/or disability

10 x Connectivity: digital exclusion re
- Lack of motivation (interest and trust)
- Lack of skills (basic skills & confidence)
- Lack of access (including broadband connectivity, affordability and accessibility)

Figure 12 The extent of customer research

During this customer research, we wanted to find out:

- What do customers know about drainage and wastewater services?
- What level of service do customers want in terms of drainage and wastewater?
- What options for drainage and wastewater management do customers want us to focus on?
- What do customer's think about different investment options?

Our key findings were:

- Customers generally have a low level of knowledge about drainage and wastewater services, and the role of surface water.
- Despite limited knowledge, customers understand that collecting and treating wastewater is a vital part of everyday life.
- Customers are generally aware of future challenges around a bigger population and climate change, but they are less aware of other issues such as growing urban areas (urban creep). Customers don't fully understand how these issues will impact drainage and wastewater.
- Customers were positive about efforts being made to plan for the future, having a longer-term view and working closely with others to achieve change.

Drawn conclusion - A customer said in essence in a research session which is important to note, that they pay the water company, they pay their Tax, they pay their council tax can we just be efficient with the money. What this means is each of these funds contribute to manage drainage it doesn't matter where it comes from and how much each contribute, we need to make our plans together and be efficient in how it is spent.

Next steps

We will be talking to our customers over the summer to understand their opinion and requirements of the pace of change that they will support, and we will include the results of this research within the revised draft plan after the consultation.

PLAN DEVELOPMENT

This section looks at how we have developed the Plan and gives an overview of:

- Planning objectives
- Forecasting demand and understanding capacity
- How we consider risk
- Problem characterisation

Planning Objectives

As part of the Plan, we have created planning objectives which measure risk across the different areas where we operate, and to feed into the development of options. By options, we mean steps which we will take, both now and in the future, to meet these objectives and address the key challenges we face including climate change and a growing population.

Our Plan is based on 3 themes:

1. **Water quantity**

   Reducing the risk of flooding to communities.

2. **Water quality**

   Improving water quality for the environment.

3. **Resilience and maintenance**

Making sure we can adapt to changes in the future, whilst also maintaining important services and protecting the environment.

Underpinning these themes are national objectives to allow industry comparison and company specific objectives which are tailored to the needs of our stakeholders and customers. The relationship between the themes and national and local planning objectives can be seen in Figure 13

The themes were developed together with our stakeholders and aid discussion around key issues from a water company perspective, but also the perspective of other organisations and issues they face. This allows us to consider the key issues and constraints faced by all organisations involved, not just Welsh Water.

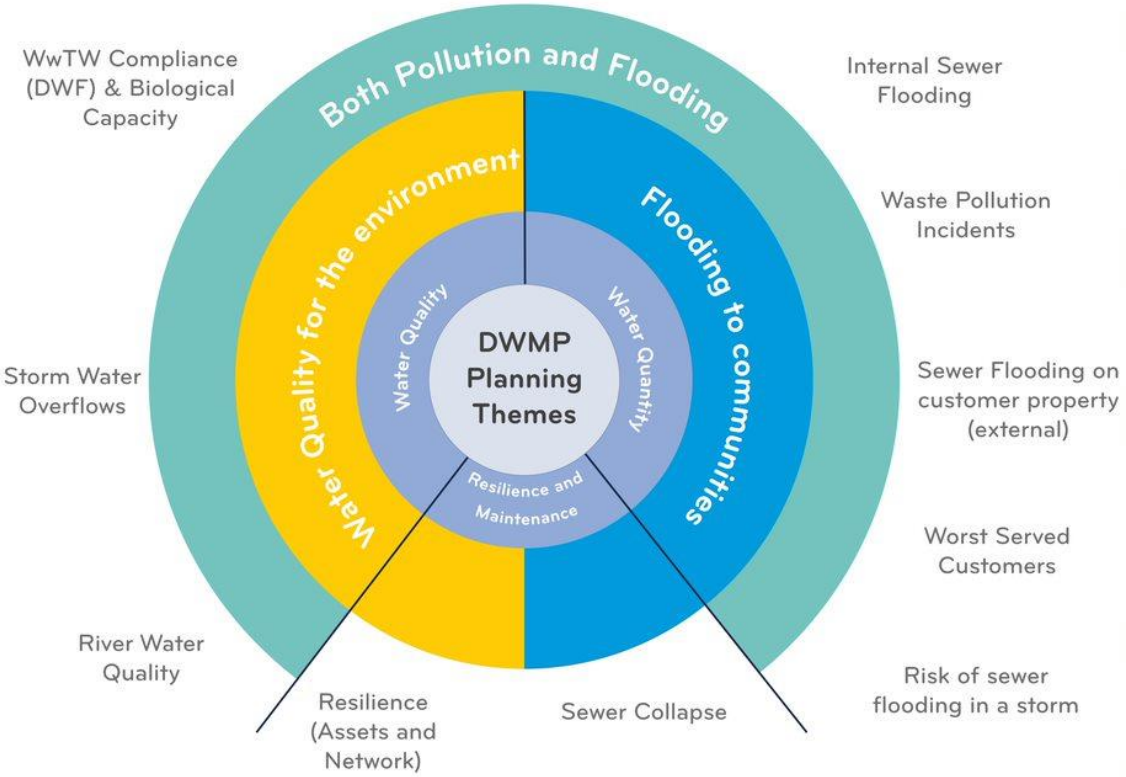


Figure 13 Shows the DWMP Common and company objectives categories within the main themes of the plan

The national planning objectives align with targets already set out in our business plan and Welsh Water 2050; this ensures that the Plan can act as a roadmap to 2050 and beyond, link to business planning price reviews and help us to address our key challenges, whilst also considering a wider perspective.

We published our strategic context to the DWMP containing our gathered objectives. There were two produced: one aimed at stakeholders and the other for customers. They are published on our website.

Each of the planning objectives have a detailed definition and assessment approach. This ensures that we can accurately and robustly assess our performance against each of the objectives, and our regulator can compare our results with those of other companies.

The Common Objectives that have been requested by the Water UK Steering group are

- Risk of sewer flooding in a severe storm (1 in 50-year storm)
- Internal sewer flooding
- Storm Overflow Performance

- Risk of wastewater treatment works quality compliance failure
- Pollution Risk
- Sewer Collapse

These are included on Figure 13 and form the basis of the results at a theme level.

We want to deliver continuous improvement across Wales and the borders which have different characteristics, such as high mountains or steep sided valleys and flat plains.

There are also new requirements for water companies outlined in the Environment Act highlighting the importance of having a robust understanding of the capacity of sewerage and drainage systems. The Framework was not created to do this.

We have developed a process for the Plan that aligns with the Water Resource Management Plan with the aim that this will allow us to target priority areas at a catchment level before having to analyse each individual planning objective. It allows us to monitor progress easier and carry out this assessment on an annual basis.

To understand capacity, we need to understand usage. We rely on Local Authorities, the Office of National Statistics and the Government national plan to help us forecast usage. We work with developers and individual house builders to analyse where future buildings will be placed and whether the location is capable of absorbing the additional usage. We also compare the proposals with historical information - known as the historical build out rates.

Our method for forecasting and understanding capacity includes:

- Defining the capacity of the environment.
- Defining the capacity of treatment facilities.
- Defining the capacity of the network.

Defining the capacity of the environment	• Understand the flow and quality of the river or coastal water today. • Understand how the flow and the quality of the river will change in the future. • Understand the tides of today and how sea level may change this in the future. • A key challenge in this area relates to how changes in the environment, such as climate change and land use, may affect the quality of river and coastal waters when combined with population growth. This is important as changes in this area will have a direct impact on planning where and when we should invest. • To respond to this, we have put together a modelling assessment which uses the principles of 'what if' scenario planning as an innovative risk-based screening approach to pinpoint areas of the environment which could be most sensitive to changes in the future. • We have also looked at how an increase in sea level may affect our ability to operate.
Defining the capacity of treatment facilities	• The capacity of the treatment works is defined as the discharge consent for this plan. • We have used two different approaches to look at whether our wastewater treatment facilities have enough capacity now, and whether they are likely to have enough capacity in future. • We have identified treatment facilities that may not have enough capacity in the future and, with scenario planning, considered which are to be prioritised first. We have listed these for further investigation as part of plan development. • The company already have schemes for improvement to treatment facilities from our previous business plan, these are identified through the National Environment programme.
Defining the capacity of the network	• We have carried out an assessment of network capacity by looking at how much water flows during the network during 'normal' or dry weather conditions. • We have also considered how much network capacity we need during wet weather in order to protect our customers from flooding. • This has allowed us to pinpoint areas where pipes might not be big enough or where we need to reduce water flows. • To prioritise this assessment, we have used a scenario approach considering different forecasts for what the future could look like in terms of climate change, a bigger population and growing urban areas.

	• Overall, this process allows us to understand whether the current network can meet the needs of today and tomorrow.

Figure 14 Brick Lined Sewer with the concept of Spare Capacity- Image courtesy of St John Archaeology

The capacity of a sewer pipe is illustrated in Figure 14. The use of the sewer changes during the day when there are low usage periods and high usage periods, this is dry weather flow. This illustration shows an egg-shaped sewer that was created to ensure that as flows reduce the velocity of the content is maintained. When an assessment of capacity is taken for networks, it is important to understand what makes up the section that is used and whether that assessment is made at peak usage during the day or at night time when the flows are expected to be at the lowest. The aim is to ensure that every pipe has spare capacity so that sewage is contained. An added complication for combined sewers is that on top of the fluctuating daily usage the capacity can be swallowed up by a rainfall event; the greater the volume of water in a rainstorm the more of the capacity of the sewer is used. When the capacity is full, the rain backs up, filling the sewer lengths upstream until no more can enter the sewer until downstream has passed flow onwards.

The Used element of the network needs to be understood in detail which includes what customers and businesses return to the sewer, the volume of flow that has got into the pipe through cracks and permitted traders with special requirements. These elements are used to calculate the Dry Weather flow as no rainfall is assumed during these days. These elements form the basis of all foul only networks and our sewage plan. In addition to this Dry Weather flow the used component also needs to include rainfall. This is where the combined network and drainage planning starts.

Dry Weather Flow and Why is it important

In a typical year there are about 240 days without rainfall; this is over half of the year, during these days the sewer generally contains what we as users return to the sewer. As it doesn't include rain; This is the minimum size that the sewer system needs to be.

Forecasting Demand and understanding Capacity

We have combined demand and capacity together

After we have looked at the capacity of the **network**, the capacity of our **treatment facilities** and the capacity of the **environment** we can then come to an overall view of whether different areas can cope with changes in demand and climate that we are expecting in the future.

The table shows that during dry weather, and at a Level 2 scale, the level of facilities overall to treat and transport the used water and the ability of the environment to receive it would be sufficient in all areas but 1. When an additional scenario is included, that risk rises to 3. This analysis is not a typical wastewater analysis or specified within the framework; it does highlight where to look first in terms of capacity issues. The same assessment can be carried out in more and more detail and like a tree the process points to the localised areas, branches, where to look first. This is an assessment that tells us when the capacity limitations are brought together whether the system could manage dry weather flow i.e., times when there is no rainfall. This is a sewer plan as it excludes management of rainfall. And is the approach to manage our foul only systems. A more complex assessment is required to understand drainage capacity. However, this is the first building block in either system i.e., sewerage or drainage system.

What this table shows is not that the zones within the area have capacity it just says where to look first, I.e., the greatest risks, the ones indicated red. This analysis has been carried out at level 2 below and again at level 3 which can been seen in each of the level 2 summaries showing again where to focus the next investigations. In terms of the wet weather analysis, more detail can be seen in the level 2 summaries.

	Dry Weather	Dry Weather with 20% allowance for resilience
Dee		
Clwyd		
Conwy		
Llyn and Eryri		
Anglesey		
Meirionnydd		
Teifi		
Pembrokeshire		
Swansea Bay		
Tawe to Cadoxton		
SE Valleys		
Usk		
Wye		

How we consider Risk

Next, we look at risks we need to consider as part of developing the Plan, that are required in the framework.

We have looked at a range of different areas as part of an overall assessment of risk:

- Risk Based catchment screening (RBCS)and Catchment Vulnerability Assessment - A ‘risk screening’ process to identify areas most at risk now and where we need to focus most of our efforts. In this plan all Level 3 areas were carried forward to the next assessment stage.
- Baseline Risk and vulnerability Assessment (BRAVA) - A method to bring together different elements and help us consider what the key problems are both now and in the future. This has highlighted the differing levels of information behind the assessments and the need for greater focus going forward on planned development, such as creating more models.
- Problem Characterisation - Characterising problems which we need to solve in terms of how complex they are. We have concluded that there are 24 level 3 localised areas that need to be investigated in greater detail.

Risk-based catchment screening (RBCS) Where are we today and where do we need to focus our efforts?	• This is a screening exercise to see which areas need to progress to more detailed analysis. • This process is important as the outputs will allow us to focus our efforts on the most in need areas. • All 106 Level 3 areas were triggered not allowing us to focus on any areas. This is a result of the amalgamation of areas into river reaches.
Baseline Risk and Vulnerability Assessment (BRAVA) Where will we be in the future if we only maintain the standards of today?	• This is an assessment of zonal performance against planning objectives. This is only for zones that triggered the RBCS however our conservative approach at RBCS, our coverage of models and our approach to zone creation meant that all our zones were assessed. • In the assessment, however, many zones were identified as requiring further investigation to understand risk. This means we need to increase our understanding of the whole catchment and how it interacts. We will need to increase the types of models and the model coverage to feed into this additional investigation as part of plan development for cycle 2.

Problem characterisation How big and complex are the problems we'll need to solve?	• We look at problems we'll need to solve and how big and complex they are. • We categorise each area as Standard, extended and Complex. This categorisation shows where there are multiple risks in a geographical location and indicates if growth could be a big problem in the future. • From this information, we can produce a 'risk matrix' which gives each problem a category based on how complex they are. • This helps us to predict the level of effort we'll need to put into developing options for each of these problems. Options for more complex problems will take more time to develop. • Our results showed that the majority of areas would require a standard assessment.

Initial Risk based catchment screening (RBCS) has been undertaken to pinpoint where to put our efforts in this cycle. What was concluded from the left map from Figure 15 showed that every area had at least 1 issue. And using the right-hand map when taking population density into account different areas were being highlighted as greater risk. This analysis didn't show a clear set of areas to be prioritised over others so all areas were taking forward for further analysis.

The Baseline Risk and Vulnerability assessment (BRAVA) then followed the RBCS. The results at level 1 are summarised in Figure 16. What the results show is similar to the supply demand assessment of risk. There is a need to drill down into the areas to find where the risks are so that solutions can be prepared for them. If we were to prioritise areas with the worst risk e.g., those showing a 2. Only sewer collapse would have been investigated but this measure isn't answering the environmental query of capacity.

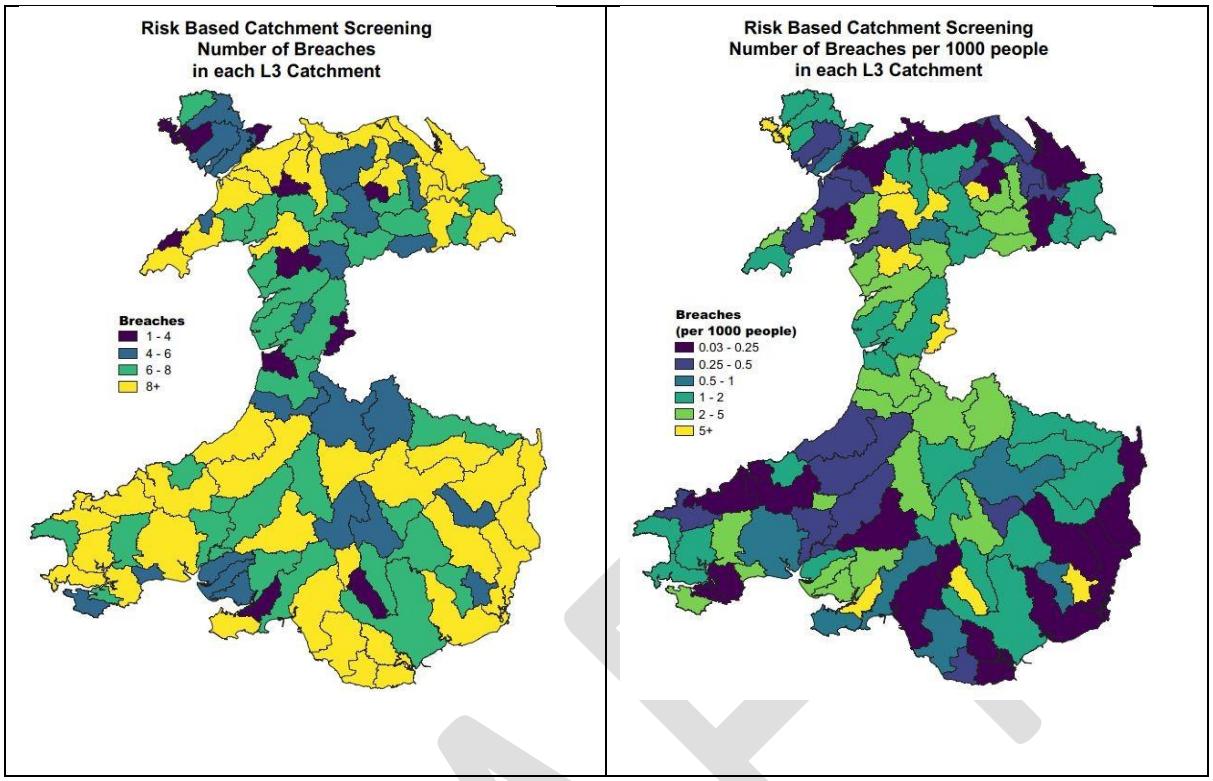


Figure 15 Risk based catchment screening results shown in numbers of breaches and Breachers per 1000 people in each L3 area

Common Objectives summarised at Level 1	Sewer collapse risk	Internal Sewer flooding	Flooding in a severe storm	Pollution Risk	Storm Overflow Performance	WWTW compliance
2020	2	0	1	0	0	0
2050	Not Assessed	Not Assessed	1	Not Assessed	0	1

Figure 16 The Common Objective BRAVA results summarised at Level 1 operating area

Common Objectives summarised at Level 2	Sewer collapse risk			Internal Sewer flooding			Flooding in a severe storm			Pollution Risk			Storm Overflow Performance			WWTW compliance		
	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
2020	2	6	5	8	5	0	0	8	5	9	4	0	11	2	0	11	2	0
2050	Not Assessed			Not Assessed			0	8	5	Not Assessed			10	3	0	4	8	1

Figure 17 the common Objective BRAVA Results summarised at Level 2 Strategic planning unit

What do the results suggest at level 2. Figure 17 shows greater detail and again if we were to investigate only those with risks scoring a 2, we would look at 5 out of 13 areas for collapses and 5 areas out of 13 for flooding in severe storms and a further 1 area at risk of WWTW compliance in 2050. This would mean investigating 7 of the 13 areas as the risks do not always overlap. The greatest risk across the whole area is risk of severe flooding in a storm. Work undertaken on this annually again reinforces the need to drill down into the patches of the area with that risk as with latest reported figures showing only 25% of our population is at risk but this measure is showing the risk to be much higher.

Drilling down again into Level 3 Figure 18 shows the distribution of risk from 0 to 2 and the percentage of the area with those risks. The reality found from the BRAVA analysis driven mainly to the number of measures being considered all at once is that when summarised into 2 themes of flooding and pollution the map of our area generally shows both risks in the majority of areas and a similar picture but worsening in the 2050 picture in Figure 19.

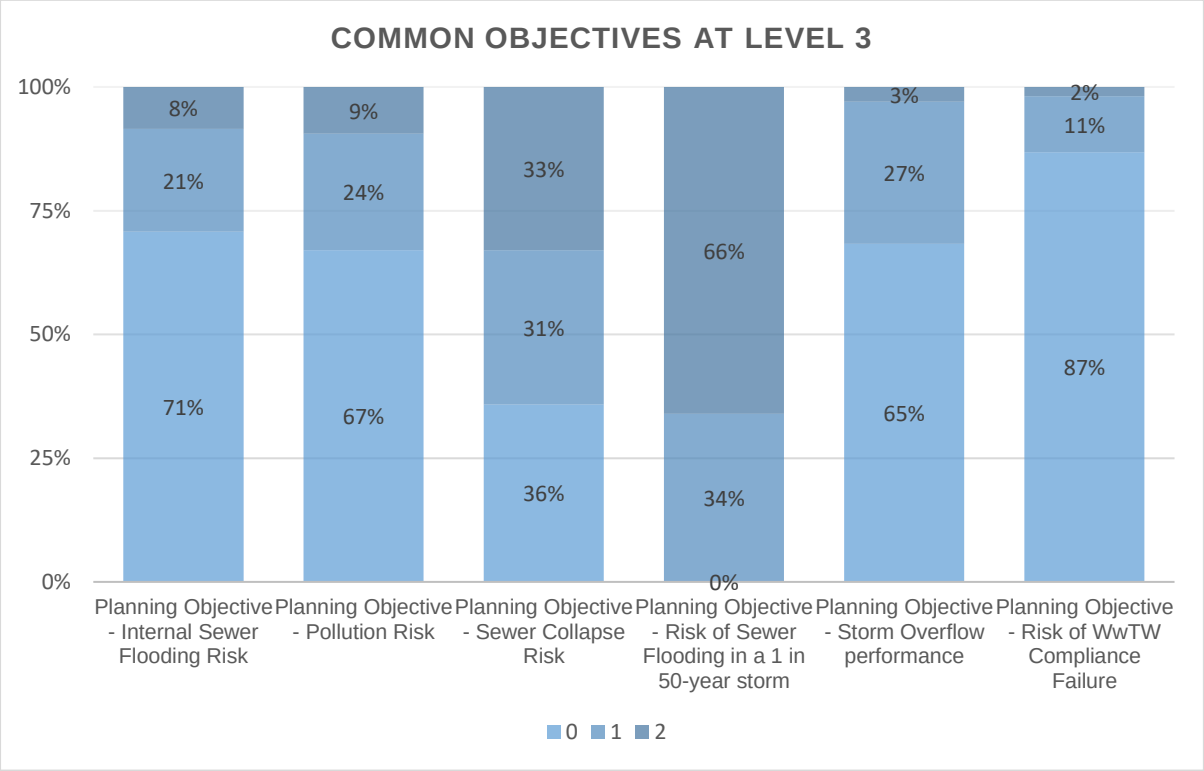


Figure 18 common Objective BRAVA results summarised at Level 3

The remaining theme of resilience and maintenance showing that collapses are equally split with approximately 1/3 rd. of the area in risk range 0, 1/3 rd. in risk range 1 and 1/3 rd. in risk range 2.

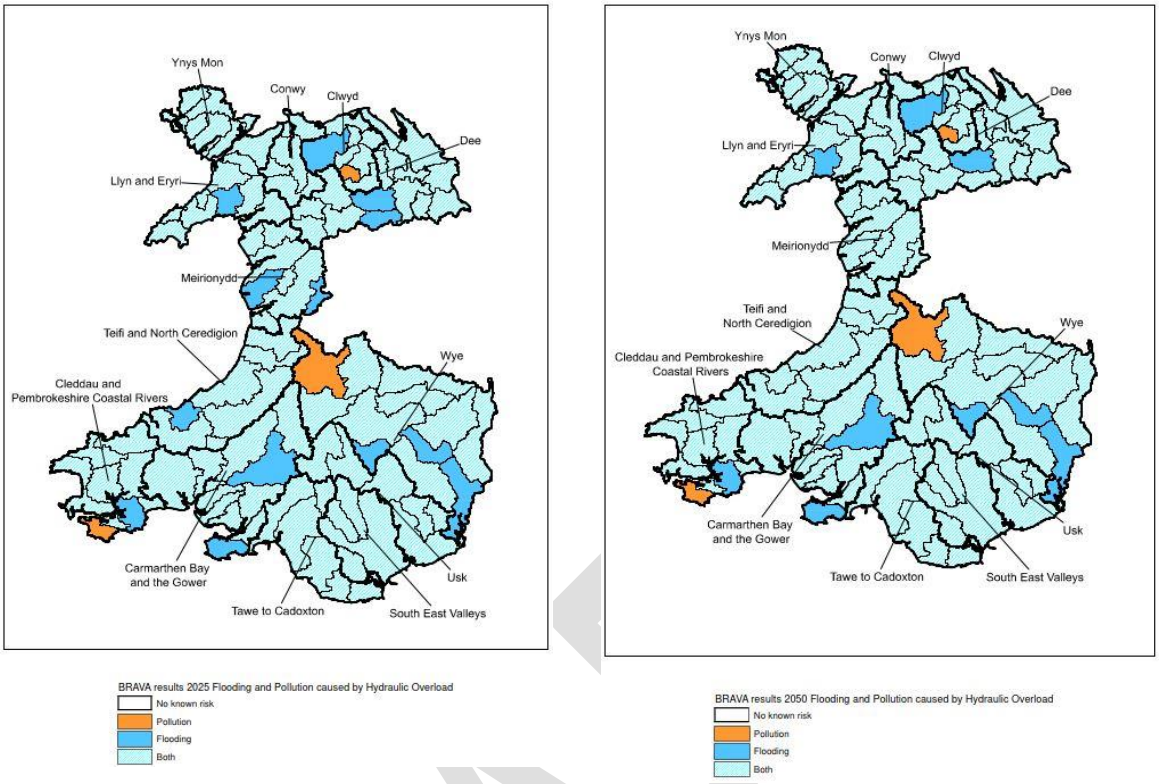


Figure 19 Showing The 2025 and 2050 Themed results from BRAVA

We published our summarised findings on our website in our publication 'How and Where we want to work with you'. Mainly to let our stakeholders know our position and what support we would like. We have separated the company only tasks of maintenance from the collaborative areas of pollution and flooding in this document to ensure that collaboration of these topic could progress while the plan developed.

The two maps in Figure 19 show the distribution of risk over our operating area summarised in our themes. The first map shows the position at the start of the plan (2025) and the second map shows the position we are forecasting (2050). The results show that there is a trend of deterioration with time with areas such as the lower Teifi and North Ceredigion Level 2 and some areas in Meirionnydd Level 2 (area marked dark blue) in 2025 only showing flooding risk but by 2050 worsening to show both (now more areas showing light blue) along with many other areas which already experience both flooding and pollution.

From this assessment, we have established that when comparing risk between companies the choices being made by a single company may be different to another company in the detail of the assessment and this affects the ability of this assessment to directly compare performance between different water companies.

The results from this section show that we have opportunities to work with other stakeholders and communities to reduce flooding, and to improve water quality, particularly when we take a theme-based approach. We have concluded that, as a water company, we need more time to develop our approach and improve our understanding of how drainage systems interact

with one another, as this assessment was highlighted in the majority of areas and has ensured that the majority of areas triggered in RBCS.

Factors that affect capacity

A new consideration that we need to include in the development of our plans and is gaining focus and understanding in 2022 is the possible trade of nutrients. It is possible that as a company we could deliver a high nutrient target and then sell that additional benefit to another organisation who is struggling to achieve their reduction plan. We can focus on ecosystem services and or focus on nutrient reduction plans more development is required in these areas and we will continue trialling into the next plan.

Payment for ecosystem services consideration

Wales faces many challenges, such as securing energy, adapting to climate change, and improving people's health and well-being. Meeting these challenges needs fresh ideas, and new ways of working. One example of a new way of working is an innovative approach called 'payments for ecosystem services' (PES). PES provides a framework of different ecosystem services (or environmental benefits) to be recognised, quantified, and 'traded' between those who can *provide* the benefit and those who *need* the benefit to offset their impact in the catchment. An example of an ecosystem service benefit that can be traded, is habitat creation. Where 1 organisation may have land available, capacity and skills to improve habitat for native wildlife, they can undertake a programme of work, and then 'sell' the benefit to others. Another example of a tradable benefit is nutrient reduction; a water Company is well equipped to 'overengineer' the water quality improvement provided by a scheme, so that the benefit can be offered to a local landowner who maybe struggling to improve their water quality impacts. PES schemes involve a financing mechanism, a payment mechanism and an overarching governance structure. Broadly defined, PES systems are drivers and depend on the 'benefit' being traded. PES approaches require a registry that allows trades to be tracked and monitored to ensure governance and consistent standards. We will be developing our approach to PES as opportunities become known.

Nutrient Trading consideration

The over-enrichment of water bodies by high levels of nutrients, for example phosphorus, is an increasing threat to aquatic life and an ongoing water quality problem for most river catchments. Innovative solutions are needed to advance the pace of improvements from all sectors to reduce nutrients entering the river, particularly for some sectors whose 'diffuse' pollution is difficult to reduce, to monitor and to regulate. One innovative solution is 'nutrient trading'. Nutrient Trading involves setting a target reduction of nutrients entering the watercourse and allows organisations to buy nutrient reduction 'credits' from another organisation who are overperforming, in order to meet the local and regional water quality goals. To facilitate the establishment of these markets, we aim to work with partners to develop an on-line marketplace. This 'nutrient trading marketplace' would allow for sectors to understand their nutrient loads and quantify the *value* of solutions, based on achievable nutrient reductions. Organisations can then 'buy and sell' these environmental benefits. Trading approaches require a registry that allows trades to be tracked and monitored to ensure governance and consistent standards. Nutrient trading is being explored and implemented as

a viable mechanism to reduce nutrient pollution in various catchments across the UK and internationally.

Amenity Value

The value of our natural environment has never been as high as it is currently. As a society one of the noted changes due to the impact of Covid 19 is the need to have time outside. It is also being noted by the health industry that time with nature has a positive effect on people's wellbeing. We were asked to include within our plan the Well-being of Future Generations (Wales) Act and we have included within our investigations how to incorporate a mechanism to prioritise areas with the greatest demand by The People. These considerations are included in our prioritisation of areas and is used within the option development phase.

Water Quality forecast

We have used the Source Apportionment Graphical Interface System (SAGIS) in a scenario planning approach to investigate how possible futures river quality could show us given a number of different variables. The aim was to achieve an envelope in which the future could either be drier or the future could be wetter. We added a number of different changing parameters into the assessment such as discharge permit conditions now, the volume of returned to sewer due to future growth and creep and changes to land use upstream such as moving from sheep farming to arable farming. We wanted to know what the future could be for 4 determinants. These were Ammonia, Nitrate, Biological oxygen demand, and Phosphate.

The tool provided more than expected and Figure 20 below shows the display at a WWTW discharge point and the forecast upstream and downstream components.

The tool allows us to:

- look up a treatment works against the Water framework directive limit or the SAC river limit and analyse whether an intervention is required

or

- if a bigger intervention should be carried now or in the future or even if there would be sufficient nutrient benefit to support a Nutrient trade.

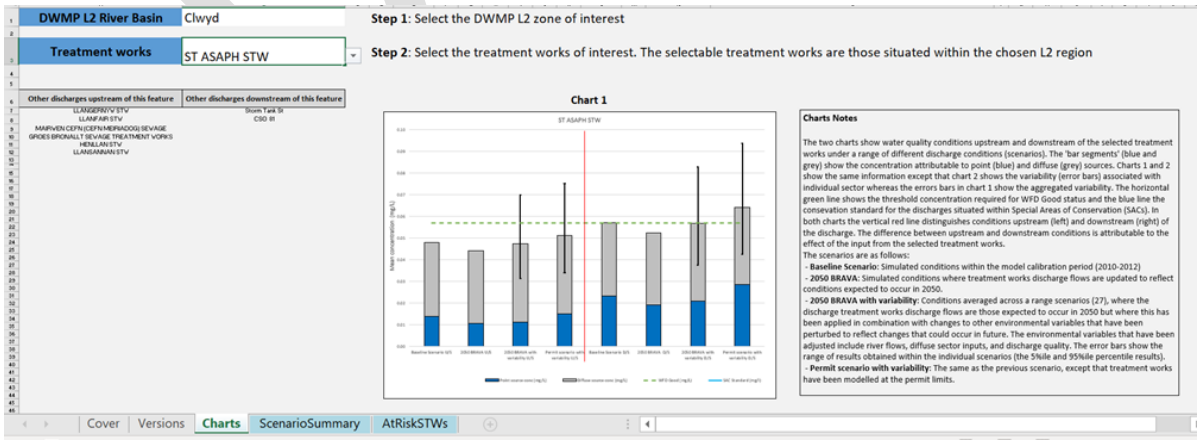


Figure 20 Shows an example of one determinant using the SAGIS WWTW Water Quality tool

The Graph in Figure 21 shows the percentage of WWTW that are affected by 2 scenarios the results from BRAVA suing growth and creep and the permit conditions at current use. There are also 3 alternative futures. These are Face value, Optimistic and Pessimistic based on weather conditions. These are compared to the Ecological Quality Status (EQS) of the river. What can be seen in each of the green circles are:

For the BRAVA future Water Quality at the discharge point could be within a range of 35-60%.

For the Permit future Water Quality at the discharge point could be within a range of 30-55%.

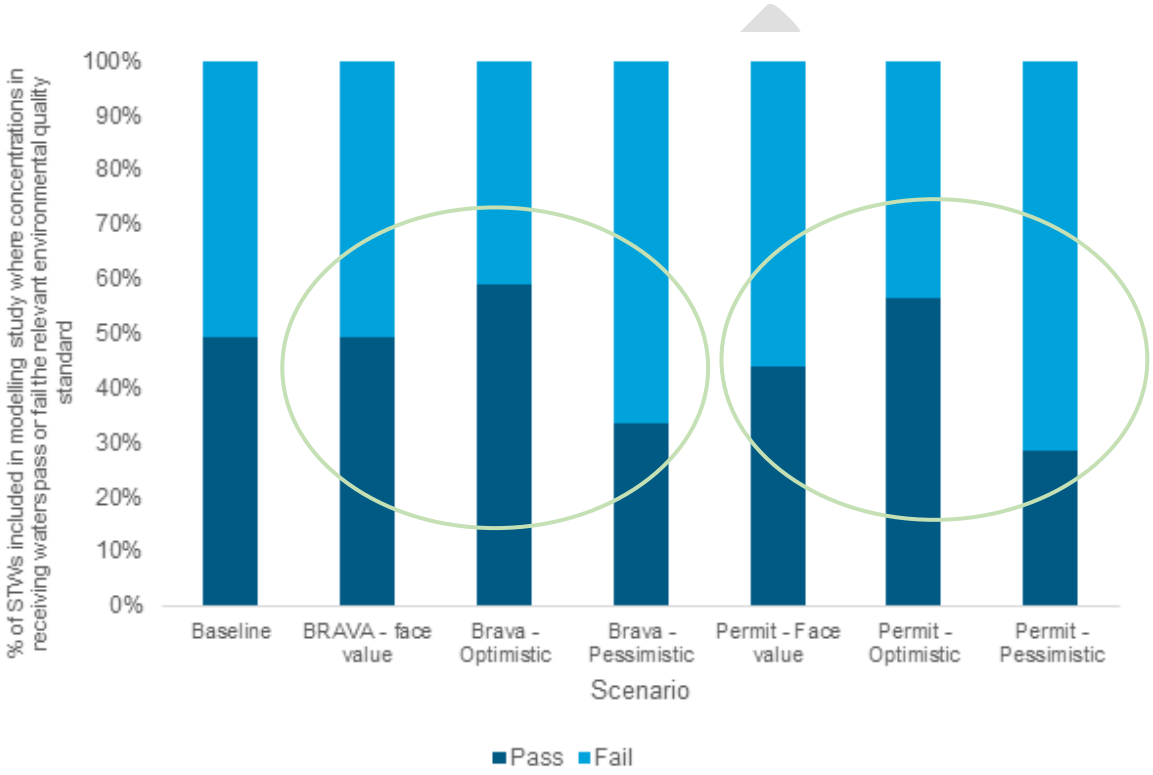
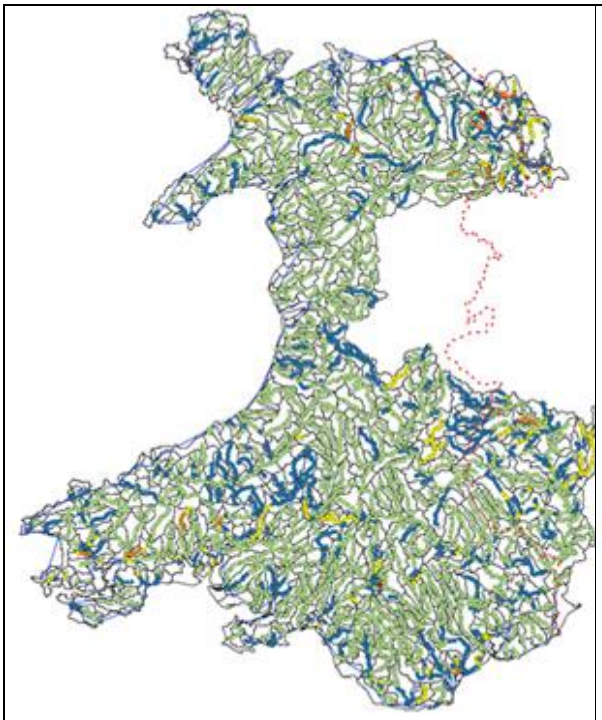


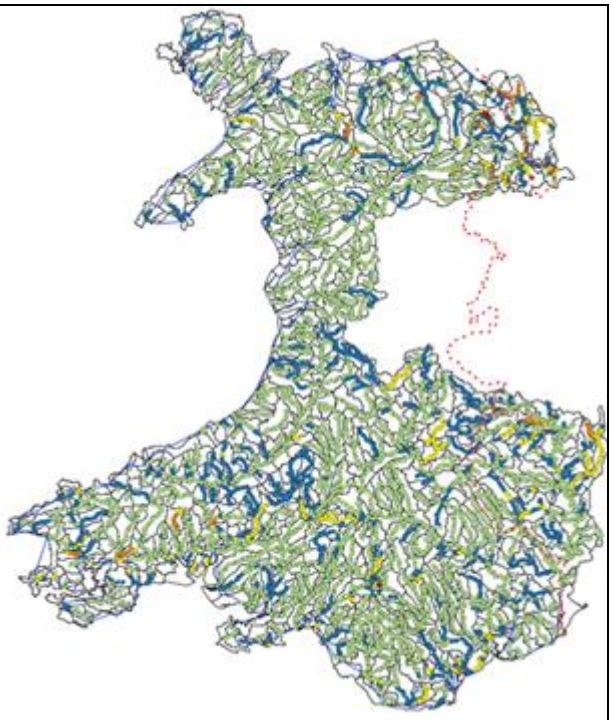
Figure 21 Showing the percentage of WWTW likely to pass or fail the EQS in the future compared to the current baseline

What this allows us to do with these results is to start to investigate the locations within a river that have more than one driver and which appear in both BRAVA and Permit scenarios as a prioritisation.

The maps in **Error! Not a valid bookmark self-reference.** show that the majority of Wales do not fail EQS in the future scenario but there could be pockets of areas where there either 1, 2 ,3 or 4 determinants higher than the EQS limit. This look at the possible future will allow us to cross reference the areas in our National environmental programme (WINEP and NEP) for this cycle and ensure that we take the future conditions into account if we have to deliver a solution.



Baseline Map showing locations where concentrations for multiple determinants exceed environmental quality standards



BRAVA Map showing locations where concentrations for multiple determinants exceed environmental quality standards

(green = 0, blue = 1, yellow = 2, orange = 3, red = 4)

Figure 22 SAGIS output of Wales showing areas and the number of determinants that could fail EQS using the scenario approach

Sea Level Rise

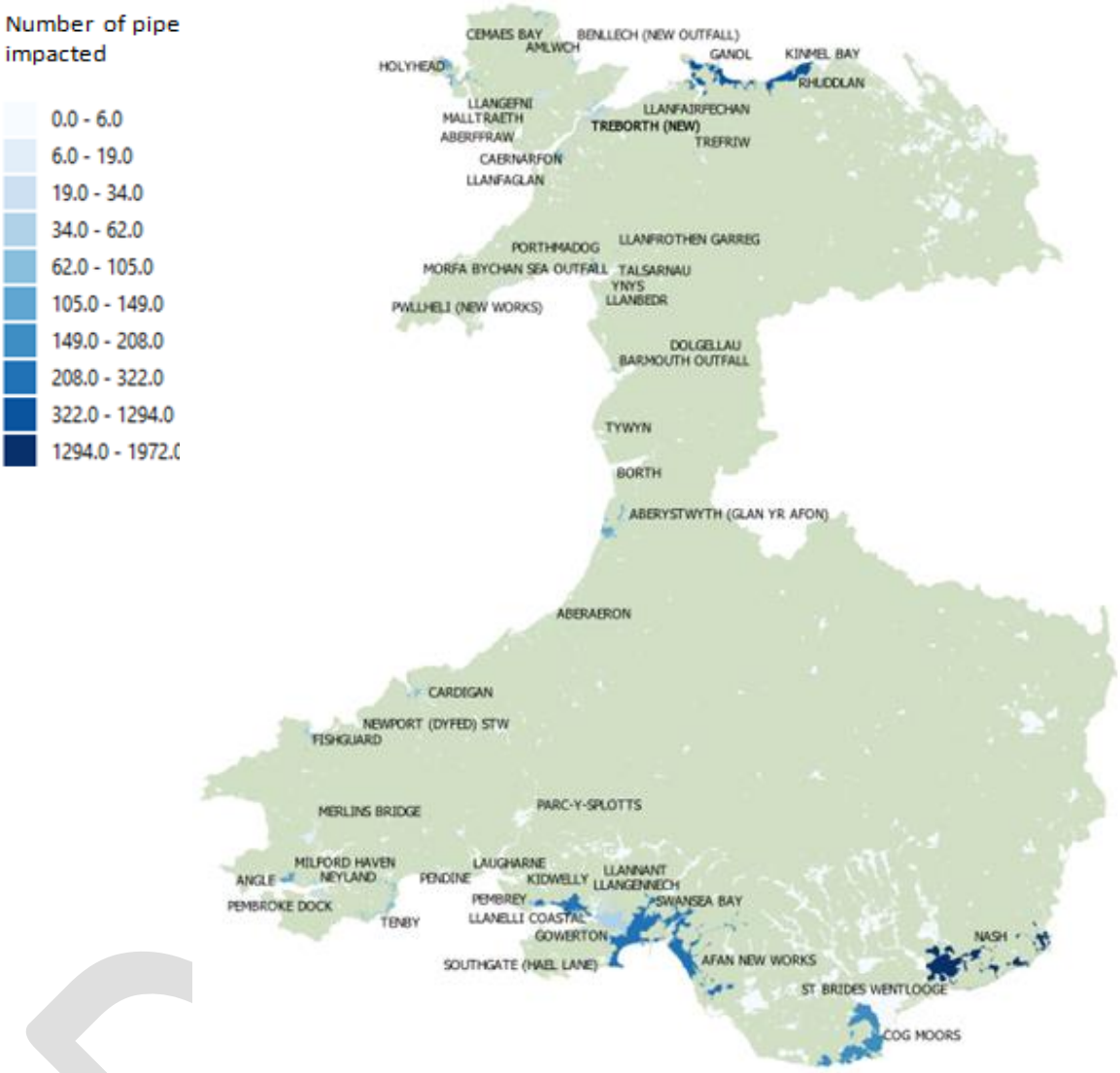


Figure 23 Sea Level rise future risk

The map in Figure 23 shows the areas with more than 20 pipes or chambers that are impacted by a sea level rise scenario of 1.25m. The darker shading reflects more pipes being affected by the assessment and highlight the areas that are most vulnerable to the impacts of sea level rises. These areas highlight the need for sea defences plus consideration how these areas would drain in the future if the current assets were submerged for long periods of time.

Problem Characterisation

		Strategic Needs score "How big is the problem"			
		Negligible	Small	Medium	Large
		1-2	3-4	5-6	7-8
Complexity factors score "How difficult is it to solve"	High (8+)				
	Medium (5-7)				
	Low (<4)				

Figure 24 Problem Characterisation Matrix reproduced from the DWMP Framework

The Figure 24 shows how the framework recommends areas to be categorised. Our results showed that the majority of areas have standard problems with the majority within the green areas. There were 24 areas that had pockets at a very localised area that were in the yellow and red area. What we have learnt from this exercise and similarly to the capacity versus demand assessment earlier, is that there is a need to drill down closely into the zones and split them up until the risk is equally spread in a hydraulically connected area. Again, a comparison can be made to the WRMP process and a defined methodology which is titled Water Resource Zone Integrity (2016) this is published by the EA and is available upon request.

Extract from Water Resources planning guideline

https://www.gov.uk/government/publications/water-resources-planning-guideline/water-resources-planning-guideline#fnref:8 cited 25th May 2022

"Your customers in a resource zone should face the same risk of supply failure and the same level of service for demand restrictions."

Converted to Wastewater and incorporated into this plan to address customers and the environment as follows:

"Customers in a zone should face the same risk of service failure."

We have taken this to mean the customer priority defined in Figure 9 which has been reproduced here, are Repeated flooded customers, internally flooded customers, etc.

"Protected areas in a zone should face the same priority need"

We have taken this to mean that designated protected areas defined in Figure 9 reproduced here, are SAC, SSSI, etc.

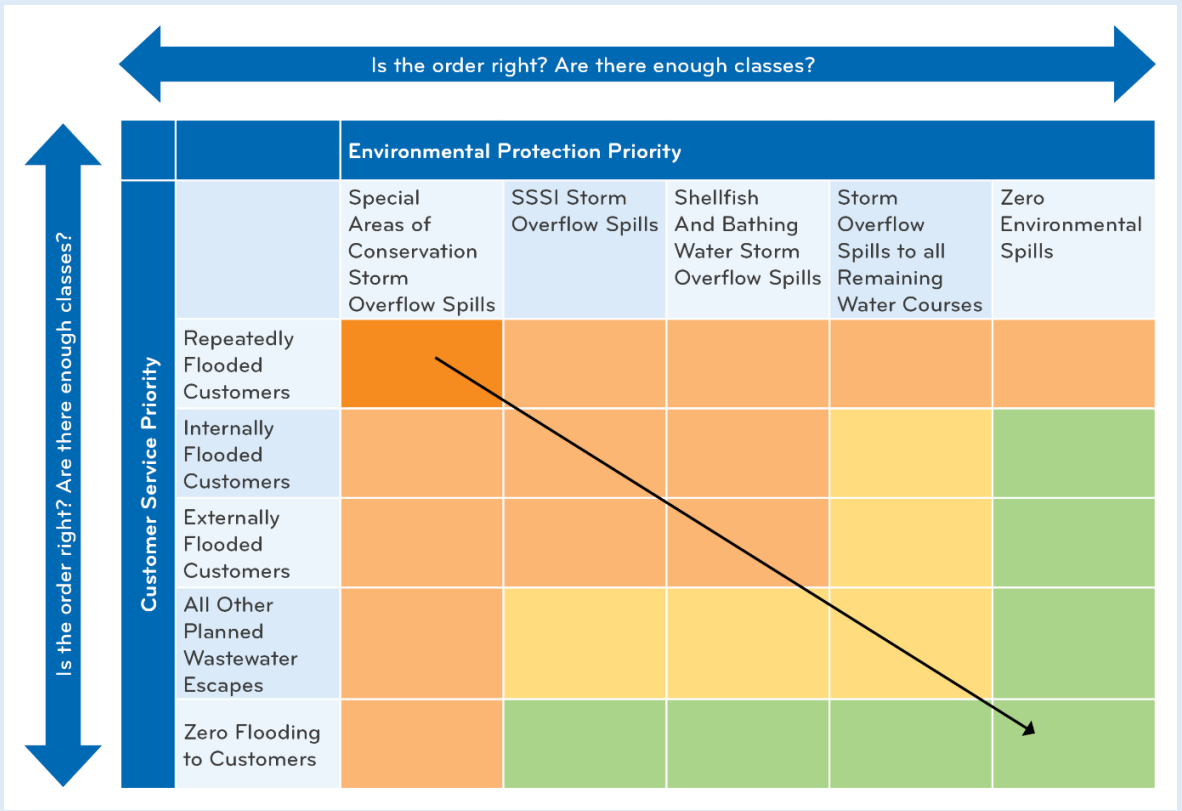


Figure 9 reproduced

This defines the priority areas to be taken forward to options development at a tactical scale however our plan also considered the strategic scale. Strategically we need to consider the whole picture before drilling down tactically to the locations that are at the greatest risk and require an intervention sooner. This drilling down process has been initiated for his plan as the DWMP hierarchy. Starting without operating area, then the Level 2 strategic planning units and on to the Level 3 Tactical planning units. What has been concluded from this plan is that to obtain risks and opportunities that can be turned into deliverable programmes of work, we will need to drill down even further, and we recommend that to produce a workable deliverable scheme would be a hydraulically connected area.

Hydraulically connected Areas

A hydraulically connected area is defined as a sub divided section of a network that drains to an asset such as a pumping station or a storm overflow or a storage tank that alters how the next section drains down.

We have started to define these areas within our network and in terms of planning for the long term, we will need to 'solve' each one of these areas in turn to reach the first milestone of Welsh Water 2050 and the on to the final destination.

OPTIONS DEVELOPMENT

Overall, this stage of the plan sets out the process for developing options in response to the risks we have identified and the amount of uncertainty these risks have (how likely they are to happen). It is the foundation before we can move on to developing options. The option development stage of the Plan sets out the scope, cost and likely timing of different options which could be put in place to help us meet our long-term objectives. It looks at the value of different options in terms of cost, the likely impact on flooding and pollution and the wider benefits for local people, nature, and the environment.

'Solve' is a key concept for the options development stage of the plan.

We have looked at the word 'Solve', and what this means in terms of both wastewater and drainage planning. We have concluded that 'Solve' means a Policy Direction from Government, and we are aware that during the production of this plan 'Solve' is likely to be something different by the final production stage due to the discussions and Government consultations and investigations around storm overflows. We have incorporated scenarios of 'Solve' to investigate what the impact could be to this plan if that policy changed between the publication of the draft and final plan.

We have also found that there is a distinct difference in terms of 'Solve' and in the types of assessments required for each system type. These are linked to the idealised graph in Figure 8 Idealised graph of rainfall intensity and milestone zones of planning because the impacts from different storms plan a greater part to management of these distinct types of systems

The types of systems that are in operation are:

Foul only systems	Have a network that manages sewage.	For these systems, 'solve' could mean in future 100% containment.
Combined systems	Have combined systems to manage drainage.	For these systems, 'solve' means in the future 100% containment of all rain events which is not deliverable, or variations of 100% containment options based on different storm frequencies and intensities.
Surface water only	Have networks (natural and human created) that drain rainfall to water courses generally without treatment.	For these systems, 'Solve' is difficult to define by a single organisation as drainage takes everyone.

It was important to learn what the word “Solve” meant as options can be created to suit any variation. However, options need to be created which are also deliverable, feasible and do not cause environmental harm. ‘Solve’ is simply part of the process but there are other important areas to consider.

As such, we considered what the environmental and customer ‘final destination’ would be, before moving onto the option development and assessment phase:

We assumed that, for customers, ‘solve’ would be to not have any capacity driven flooding.

We assume that, for the environment, ‘solve’ would be to not have any spills.

This does though, still leave the question under ‘Solve’ for both customers and the environment, Under What circumstances should ‘Solve’ be achieved?

Options need to be created in a way that they can be delivered in reality, constructable, do not cause environmental harm, and be affordable to customers and solve the problem.

So, before we moved into the option development assessment phase, we considered what the environmental and customer final destination would be. We assumed that customers would request that solve for them was not to have any capacity driven flooding and that the right thing to do for the environment would be not to spill under defined storm conditions to the extent that water quality would be adversely impacted.

After establishing the ‘final destination’, we next investigated whether we could afford to achieve this in the next 25 years. We estimated the cost to be somewhere between £18 billion and £28 billion. We found that this cost was not affordable, and that it would take not just decades, but a century, to achieve this at the current rate of investment.

The reference Option and Strategic assessments

The reference Option

It is important to note that our estimate is just one estimate being produced. Defra ran a project (The Storm Overflow Evidence Project) to inform their understanding, and Welsh Government are doing the same too and we are following a similar approach. Our initial estimate is in the same region as the DEFRA study I.e., tens of billions with an upper limit closer to £100 billion. The figures quoted below includes investment for both storm overflows and customer flooding service improvements.

We then set about building a policy information table, one that could support investment decisions by the business, but also to help Government to prioritise where to make improvements first.

The table below shows 3 of the 4 estimates we created. It shows the company level estimated investment needed over a century to reach the joint destination of customer flooding and storm overflow escapes. The cost is based on the assumption that there is a volume of water that is forecast into the future that cannot be contained by the current size of the sewer system. It

assumes that either a traditional or sustainable intervention could be required but in every case a traditional solution is possible and therefore the cost has been estimated on a traditional approach alone. The estimate includes all customer and highway flooding and any escape to the environment. The costs were created using a very simple approach. The volume of escapes was obtained from our modelled areas and similarly assumptions associated for our non-modelled areas. This provided a total volume predicted to escape. This was then multiplied by a cost to store that volume in tanks and pipes taken from our database of average costs per volume stored. These have also been estimated for each level 2 area which can be found in the level 2 summaries.

Table 1 Cost of environmental and customer Destination

	Environmental zero spill and Customer Destination	**Environmental 10 spill and Customer Destination**	**Environmental 40 spill and Customer Destination**
Cost of Customer Service improvements	£13.513 Billion	£13.513 Billion	£13.513 Billion
Cost of Drainage Service improvements	£8.477 Billion	£3.206 Billion	£1.175 Billion
Total	£21.990 Billion	£16.719 Billion	£14.688 Billion

Following on from that informative research, we began the company level options development assessment approach. We took the long list of solutions from the framework and considered a few more alongside.

We continued with the assessments in a handful of trial sites at first and confirmed that the answers grouped into actions to be undertaken at a strategic level. The Company DWMP strategy driven from the process is within the graph in Figure 25. The approach lists a hierarchy of actions.

- Starting with managing infiltration i.e., the water from groundwater that gets into sewers through cracks in the pipes etc.
- information for customers regarding blockages from Fats oils and grease and non-flushable items like wet wipes and supporting the message for water efficiency.
- Then to support sewage planning- building bigger to manage future developments and population changes.

This is where the difference between sewage planning, and drainage planning become pronounced.

- Change national policy to remove surface water from the sewer and find a more sustainable and natural approach to integrated drainage management.
- Then and only then make plans to build bigger sewers that continue to have a dual purpose because we know that either of these will be true in the future:

- Surface water is removed from the sewer and the bigger capacity network built to contain it will no longer required at a point in the future and becomes redundant or
- In the future at some point, we will need to build a bigger sewer again and again to keep up with climate change because we didn't start to remove surface water from the sewer in time to manage the impact from climate change.

Blockages and the relationship with the items being flushed down the loo

In general, a sewer is there to take away the 3 p's. Pee, Poo and Paper. Over time as our sewerage system developed, kitchens were added and sewers were then considered as a bin from kitchen waste too. The pipework struggles to keep these non-flushable items moving in the pipes and they gather together and clog like a plug and stop the 3 p's flowing. Eventually a person has to physically remove the plug. This is what is happening today. A short list of non-flushable items are fat, oil, grease, wet wipes*, nappies.

*Wet wipes even those marked as flushable still cause and contribute to blockages.

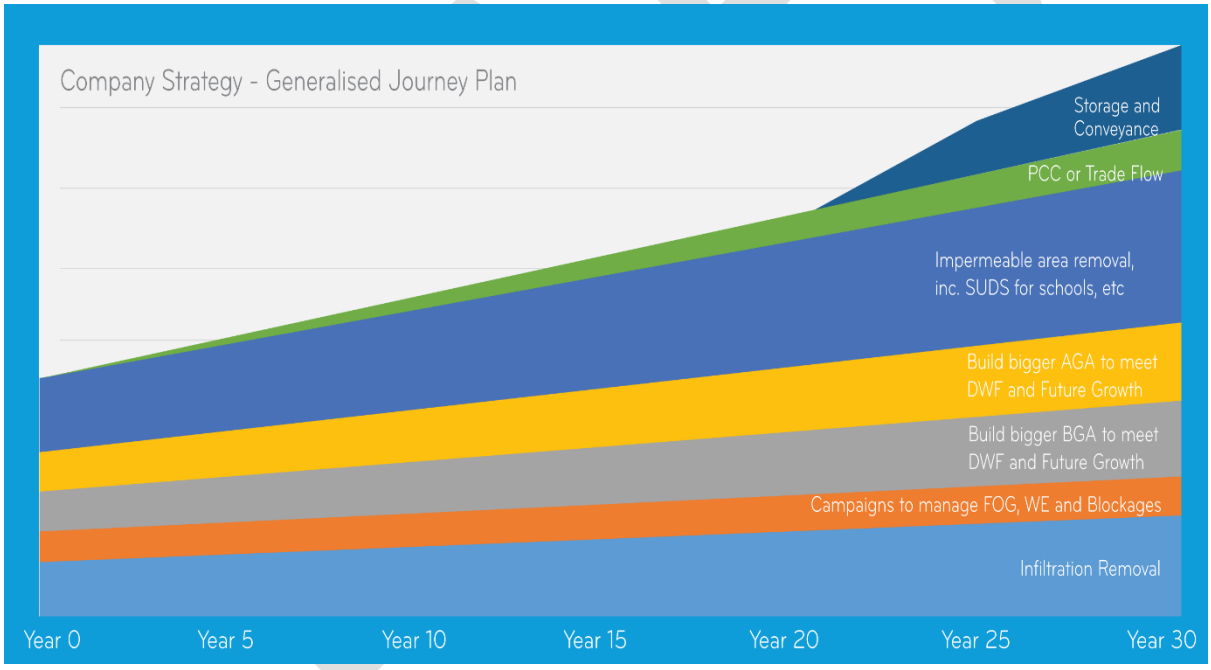


Figure 25 The company journey plan The Strategies to use

The graph in Figure 25 has been drawn from the 5 categories identified within the framework and the 42 generic options that were developed jointly at a Water UK Implementation Group Task and Finish Group series of sessions during 2021-22. We analysed each generic option in a multi criteria analysis approach and concluded that there was a generic repeating set of options which we have presented in the graph. We have also developed these localised strategies for each level 2 which can be found in the Summaries section of the website. The Level 3 summaries are contained in the associated Level 2 summary.

There are a number of activities that are carried out that do not relate to the capacity of the network but do have customer impacts. These are “Other Cause” escapes, what this means is that the escape was not related to a hydraulic constraint in the network. We have mentioned blockages already as this is also classed as an “other cause” escape. Collapsed sewers are also an “other cause” of flooding. We have looked at the deterioration of our network to see how fast our network is aging and whether there needs to be a substantial investment in pipe relaying. For this plan we know that investment is needed to repair when things go wrong. Our initial view of this suggests that we need a continuous fund which we would agree as part of our business plan. There is a relationship with Infiltration and collapses as once a section is weakened there is more likely that the ground around the pipe would be dislodged, and a future possible collapse could be the result. So, investment in infiltration reduction should also aid the reduction of collapses going forward.

Asset specific strategic planning Dry Weather flow capacity risk

We have assessed our network of pipes to determine if the future dry weather flow can be transported through the network without spilling. We have carried out this assessment to find out where the greatest risk from capacity is in our network before the risk materialises and has an impact to customers. We have also carried out this assessment to establish how big pipes would need to be without offline storage to contain Formula A (we have used 6xDWF in the assessment as this is easily calculated as a close proximity)

We are proposing a long-term programme of investment in our sewer network to:

- Upgrade networks where historic growth has led to a lack of capacity.
- Create capacity for future growth.
- Ensure our pipes can pass forward six times dry weather flow, improving dilution before spills happen.
- Replace older sections of pipework that may be deteriorating and at risk of collapse.

Upgrading our pipes to ensure they can pass forward six times average dry weather flow will require investment over the next 100 years at current bill prices. We plan to start with pipes that are most under-capacity in AMP 8, progressively enhancing our network thereafter. By the end of AMP12, we aim to ensure all our network can pass more than three times average dry weather flow. And then where a treatment works is currently not required to meet this capacity we will plan to build in this level of resilience and maintain it to allow growth to occur without delay. However growth will then need to be built back into the system after the development has been verified to ensure our customer of the today are not at risk of developing a lower level of service.

We plan to measure success in terms of the number of our customers impacted by network improvements. We have assessed capacity of every pipe in our network to develop this investment programme, using InfoAsset Manager software.

Assessing future capacity requirements of Pumps and Rising Mains

Pumps and rising mains are different to other assets as these are used to full capacity but only when they are being used. What this means is that a pump contains an element of storage and when that storage is full the pumps turn on and the rising main it is attached to is used for the length of time the pump is on. The assessment of the pump set up, storage and the size of the rising main then need to be assessed as one component.

In our assessment of these location, we have used Info asset manager to advise whether the assets are currently sized for the future flow arriving at the site. Where the future flow is outside of the efficient use of the pump. Our approach indicates where to carry out an investigation. A number of investigations will be carried out verify the risk being indicated. We will build in the ability to contain multiples of dry weather flow until the area is resilient to our customer desired level of service.

Blockages, collapses and Water Efficiency Measures

The company has a baseline programme of customer engagement that provides company level and sometime more local level information programmes. The DWMP has recognised that more targeted or enhanced messages could be required in the future and work has been undertaken to assess the cost of additional more regular information packages. The water efficiency programme driven by the company from a water perspective has also been considered and where localised messaging is indicated in the journey plans talks will commence to bring greater opportunities to customers to take up the water efficiency products offered.

We also manage other types of pressures.

We have an obligation to improve biodiversity and also to manage the spread of invasive non-native species (INNS). To do this we produce a Biodiversity Action Plan (BAP) and strategy of its own, we will be reviewing progress on the last plan this year with a report being published in December 2022 and the next BAP will be produced at the end of 2023.

We are also directed by our environmental regulator NRW and EA via a statutory environment programme. In this plan we have not included the statutory environment programmes; neither the Water industry National Environment Plan (WINEP) for rivers in our English areas or the National Environment Plan (NEP) from our Welsh Areas. The timing of the delivery of schemes from NRW and EA has not aligned with the DWMP production for this cycle. However, our new environmental forecast model has indicated a number of future sites that could be part of a future programme and we can investigate these as part of plan development to inform the next cycle. We will incorporate these as part of DWMP plan development separate to either NRW/EA processes. We will also continue to work with our environmental regulators to define the WINEP/NEP programme and this will form our business plan which will be published in 2023.

The newly enacted Environment Act has also added an additional requirement regarding monitoring. This requirement fits well with the needs of a developing plan and more monitoring technology will be installed in both sewers and rivers to comply with this new requirement but will also support the maturing needs of the plan.

We have been supporting others with a small fund to help others in communities where they can help us to achieve our Welsh Water 2050 aims. These funds have been called in recent years are, Community fund, Partnership fund and the biodiversity fund. The principles of funding others to be able to take their own actions and ownership of the outcome is very important. Citizen science shows that community ownership gain greater benefits and longevity to solutions. The type of project we want to support are local developments to

reroute surface water to a natural stream or river and the management to reduce the spread of INNS.

Categorising areas for Options Assessment

Standard Options Approach – Our approach to the majority of areas has been to consider these for investigation and continue to develop our understanding in these areas in terms of capacity at a river catchment level using the area zonal journey plans from the Level 3 summary. Proactively prepare opportunities to reroute rainwater to nature where there are schools or publicly owned spaces such as carparks.

Extended and Complex Approach – Our approach has been to understand how much investment would be required to increase the resilience locally to stop customers being repeatedly flooded with sewage and to reduce storm overflows in that same area down to zero by 2050.

How we learnt to create a delivery plan

What we wanted to learn next was how to turn the destination into achievable milestones. What we wanted was to create options that would work towards our destination in an approach that considered affordability for customers.

We used a selection of areas identified from problem characterisation and BRAVA to understand how to create a delivery plan.

We assessed 3 sub areas with the aim of achieving the final destination during the first 25 years, finding that the investment required could be as low as £2.2 million per year for 25 years per area. If we only had 1 or 2 locations to solve in this way, it would be achievable, but we need to look at many more sites which mean affordability, expectation and the timescale are all a problem.

We also considered a different approach in terms of taking each area in turn and resolving all the issues in it, before moving onto the next one. However, this means that other areas would have to wait a long time before improvements were made. While waiting, new risks would emerge, but they would have to wait. As such, we have followed the approach set out which allows us to deliver the greatest overall beneficial impact in the shortest possible time.

We then looked at creating solutions where the worst risks could occur by 2050 and only solving locations where customers that may be flooded by sewage internally and where escapes would reach a river or sea in a protected area i.e., a SAC (Special area of conservation). We took a selection of areas some that were standard and some that were categorised as requiring an extended or complex approach. We trialled this approach at 36 localised locations across 24 of the Level 3 areas. In these areas we would need £18 million to deliver 6 schemes per year for the next 25 years, again if we only had a handful of sites to manage it sounds achievable however we need to look at many more sites and other flooding types such as garden/area flooding and other rivers and coastal areas such as bathing waters and SSSI (Site of special scientific Interest). Again affordability, expectation and timescale are all problematic.

We needed to come up with an approach that makes many more improvements across a wider area faster, so to do this, we would need to be pragmatic and consider changing our near future desires by prioritising harm by making more achievable incremental milestones but still planning to reach our final destination. We have been sensitive to affordability with so many other pressures on customers' ability to fund improvements right now. We have now spent time working out what that first milestone should be and creating further milestones; a journey plan to get to the final destination.

Other Developing approaches

We are considering using our land to support carbon sequestration as this is the right thing to do but this would not be part of the long list approach but is worthwhile mentioning here that other approaches are being undertaken to develop an improved Environment. We are also making plans to use our land to support biodiversity and ecology improvements. These are included in our Biodiversity Action Plan from 2021. We are currently developing the next plan which will be published in December 2023. some of the requirements for BAP are driven by the WINEP/NEP such as INNS.

We have been involved in the COVID 19 monitoring programme at Wastewater facilities and we will continue to support government while it is needed.

In Wales the Environment Act puts an additional ask on Welsh Companies to support the sustainable management of Natural Resources (SMNR). In this area we are supporting activities on the Wye, Teifi, Dee, Clwyd and Allyn rivers and will be adding Cleddau and Afon as these are SAC rivers too. This approach takes a wider view than normal Asset planning which is the normal function of a Water company. For all options in the DWMP we have included the principles of SMNR at the start of the process so that all our solutions can support this approach. The wider benefits to society are included in this principle such as health and wellbeing.

The Nature based solutions: where we use nature to work with us and develop options using it. We are also developing our approach to support catchment management specifically to support the reduction of phosphorus in our Rivers. Nutrient Management Boards have been set up in the Wye, of which we are a member to coordinate its reduction. Different types of options are being driven in these specialised circumstances that will inform other areas in the future. E.g. The development of offsetting nutrient management schemes and using the polluter pays principles. These area trials are developing wetland management schemes for treatment works, and storm overflows. We have developed a tool to help assess where the approach can be applied and we will continue to develop our understanding with trials of the next few years. We will also link this area to other nutrients such as Nitrates too and look to include areas with multiple nutrient risks as soon as possible.

We recognise that to address climate change we cannot meet the challenge alone. We need to work together to alter the drainage systems and to recognise that systems that the water company own is not the whole drainage system. We will need to ensure that our sewerage system has a minimum standard and that then our drainage system and those of others work seamless together. We plan through the DWMP to task the Level 2 project boards as the place where we discuss the integrated approach to drainage systems and the joint needs to ensure drainage is more naturally redirected to groundwater and streams and rivers. It is estimated that support to create opportunities will require resource costs in the realm of £400k. We have also prepared two programmes of work, Sustainable urban drainage solutions (Suds) for Schools that build on our work in Llanelli and a new opportunity to work in public spaces such as car parks, and government owned buildings. These are suggested opportunities as places

where we can learn how to make retrofitting an easy well-developed solution so that we can then turn the approach into a policy to manage drainage as a whole to support any land owners.

What are 'SuDS'? These are a sustainable solution type

In natural environments, rain can soak into the ground.

The problem to be solved. - In urban areas, where surfaces are sealed by buildings and pavements, rain is not as easily absorbed into the ground. Instead, drains take surface water away. In some cases, this can cause flooding or affect river and coastal water quality. This is caused when combined sewers are filled with surface water, leading to a mixture of sewage and rainfall runoff. This is released into rivers through combined storm overflows to prevent customers' homes and businesses from being flooded.

Sustainable drainage systems (SuDS) are drainage solutions which provide an alternative to taking surface water away through pipes and sewers to watercourses. Examples include special paving which allows water to reach the ground underneath, swales, tree pits and rain gardens. There are also other landscaped areas designed to fill up in wet weather such as ponds and constructed wetlands.

SuDS act like natural drainage and bring a range of benefits:

- Storing or re-using surface water
- Decreasing the amount of water draining fast to watercourses
- Improving water quality

Reduce flooding as these features give more time for the water to soak into the ground

How to create a delivery plan from a DWMP

When we create options, we look at how we could benefit the environment in ways such as tree planting or providing new habitats to improve biodiversity and enhance nature. We include the principles of environmental assessment right from the start.

We have started with a long list of options as we did in the DWMP Company Strategy and, through a series of steps, narrowed the options down to the preferred option and confirmed that it is best value for the strategy. The high-level process is summarised in Figure 26.

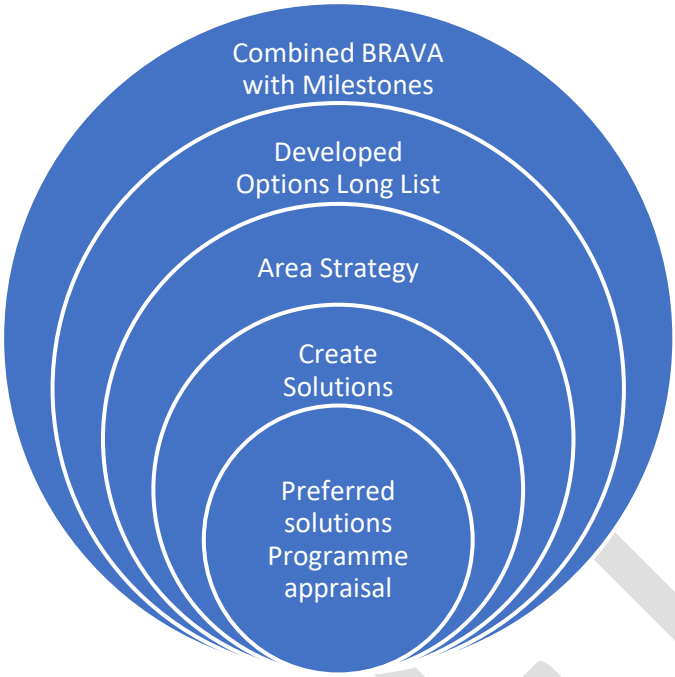


Figure 26 Stages of Options Development

What are we trying to solve?

Take the Results from BRAVA and combine it with the milestone from the customer and environmental destination.

long list and funnel to short list

Through working with our stakeholders, we have put together a 'long list' of generic options that could address current and future flooding and pollution risks. These fall under the following categories:

- Treatment of wastewater
- Better ways of managing surface water
- Options related to further investigation, monitoring or policy changes
- Customer options which may include changing customer habits around water use
- Wastewater and sewage network upgrades

Options types are removed only if they are not possible not promotable to customers and stakeholders and or not feasible to deliver.

Some options from the long list work better at a company or regional level and these have been considered before moving to the short list approach discussed below. These are related to education and customer information programmes. Such as media campaigns to highlight the importance of Water Efficiency. These are activities we undertake as part of our normal activity. In this plan we have also considered how we can tailor our media campaigns to gain greater coverage in society. The messaging we have considered includes the disposal of non-flushable items and the disposal of fats, oils and greases and their consequences. We have also considered how to promote the DWMP with our customers; how to get the message to a

wider audience. We will be trialling these approaches for inclusion in the next plan and in our consultation of this plan. These range from information at the Royal Welsh show to a caravan sited at supermarkets or shopping centre carparks, library pop up events, to Facebook and twitter and local area radio.

We have carried out the Options Development Approach (ODA) process in each area we trialled, noting that not every option will work in every zone or area. We have looked at the characteristics of different areas, and the types of issues they face.

In each area we have:

- Removed options which do not work in that area.
- Removed options which won't fix the risks we have identified between 2025 and 2050 in that area.
- Prioritised options that do the right thing in terms of the strategy.

The results of this work set the zonal strategies, which can be seen in the zonal summaries.

For example, removing the groundwater leaking into our network might help to solve a problem in one area, but not in another.

How to create a solution

We divided the possible short list of options into traditional (i.e., pour concrete) or sustainable (green or nature based). We developed the scope of work required in each approach to deliver the volume benefit required to meet the milestone for 2030 and then the same milestone for 2050. In some cases, a fully sustainable solution could not be developed so a mixed solution was created instead.

When the parts of a solution are put together to create a suite of solutions to deliver in the future, we realised we could compare the benefits of a traditional solution to a sustainable or mixed solution. The diagram below Figure 27 shows how the options were developed so that we could also compare the costs of delivery by 2030 and the costs of delivery by 2050 and whether it would be cheaper to deliver a solution in one programme early i.e., deliver both the 2030 and 2050 solutions by 2030 for a cheaper cost and an early benefit.

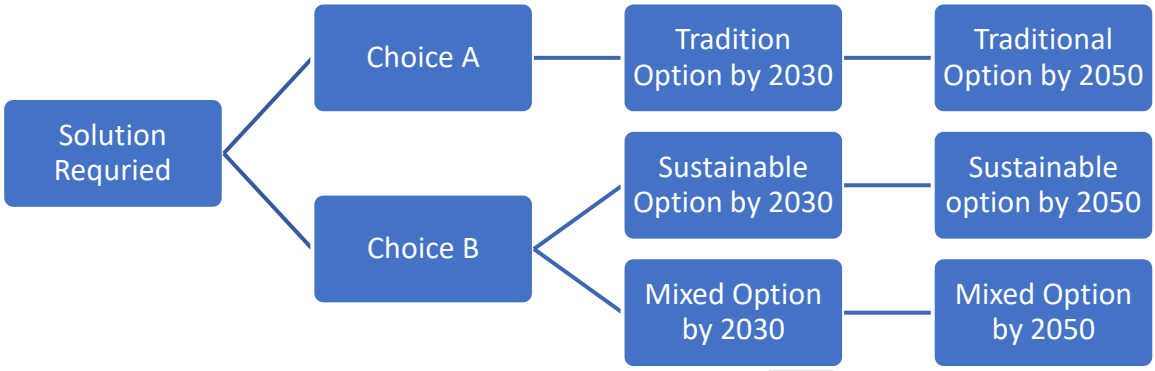


Figure 27 Options - paths developed Traditional, Sustainable and Mixed.

What are the key factors to consider as part of option development?

We have looked at the following key areas to feed into the development of options for the DWMP:

- Understand the need for the option - from analysis of supply and demand, and risks.
- Drive innovation – consider as many different types of options to deliver the need including tried and trusted methods and more innovative approaches.
- Overall ranking of options – considering and rank the different factors together to identify the best solutions.
- Feasibility of options – will they be easy or difficult to put in place?
- Looking at value – considering which options have the best value for money.

We have worked together with our customer challenge group and the independent environmental advisory panel to make sure that everyone's views have been reflected in the development of options for the DWMP.

How have we identified the best options?

We have calculated how much each option is likely to cost and how much 'benefit' it offers. This considers:

- **Capital expenditure cost** – costs for physical assets or 'things' that need to be built such as new tanks or SuDS.
- **Operational expenditure** –day to day costs to maintain an option, for example replacing worn parts at pumping stations.
- **Carbon cost** – we want to prioritise options with lower carbon emissions and have accounted for this by assigning a carbon cost to every option.
- **Environmental and social cost** – we want to prioritise options like SuDS, tree planting and wellbeing, which offer wider benefits to people and the environment and

have accounted for this by calculating an 'environmental and social cost benefit' for every option.

- **Volumetric benefit** – the risk of flooding or pollution can be quantified in terms of the volume of wastewater that escapes from our wastewater system, or the volume needed to increase the system capacity to stop an escape. For each option, we have quantified how much wastewater will no longer impact on people and the environment. to do to use a common reference level storm so that benefits can be standardised.

The Core plan and Adaptive pathway – one of the main requirements that we were asked to incorporate into this plan was to consider how to sequence investment in an area over 25 years and where to position the main decision points. What we have put together is an approach that says we can do nothing, or we can develop solutions to improve the worst environmental harm and the work customer service in either a traditional, which is a more concrete, based solutions or a more green or sustainable solution. This is shown in Figure 28. This choice is then broken down into 2 stages. What has to happen first and what would need to follow for no regret's investment. The graph below shows how the paths are planned for a single cycle of a plan. In this plan a 2 step adaptive plan has been achieved and in future iterations we intend to increase the number of steps being considered.

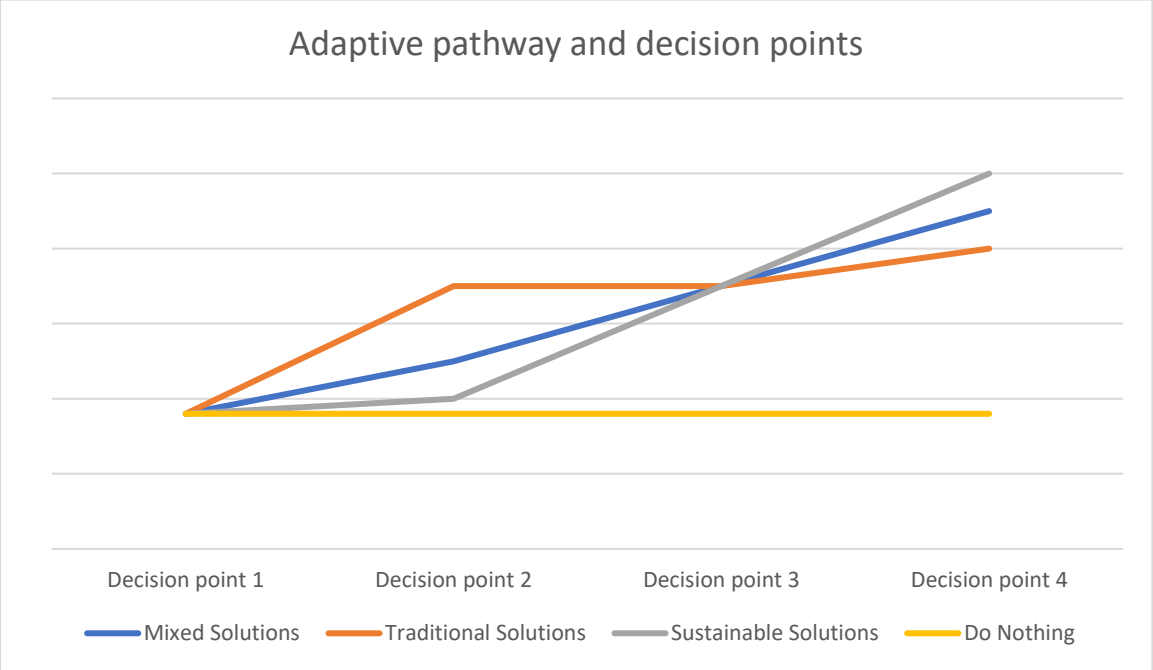


Figure 28 Is a representation of adaptive planning scenarios with decision points

These costs have been calculated using a company standardised approach in line with Ofwat requirements for every pair of options traditional or sustainable/ mixed.

When each pair of options are compared using both the least cost approach and the social and environmental beneficial cost approach, the lowest ranked option is chosen i.e., the preferred solution.

We then carried out additional environmental assessment on the preferred plan based on:

- The SEA (Strategic Environmental Assessment)
- The HRA (Habitat Regulation Assessment)

This final check allows us to demonstrate that the preferred option does not adversely impact the environment or natural habitats, if the option does not score positively, we have then gone back and considered choosing the alternative option which may meet these requirements.

The overall approach summarising how options have been chosen is included in Figure 29:

By **environmental benefits** we mean anything that relates to the environment – this could include rivers, coastlines, and natural habitats.

By **social benefits** we mean anything that relates to people and people's activities – this could include preventing flooding of homes and businesses or improving the environment in urban areas and assessment of carbon impacts.

We conclude by collating all the preferred solutions together into the best value plan.

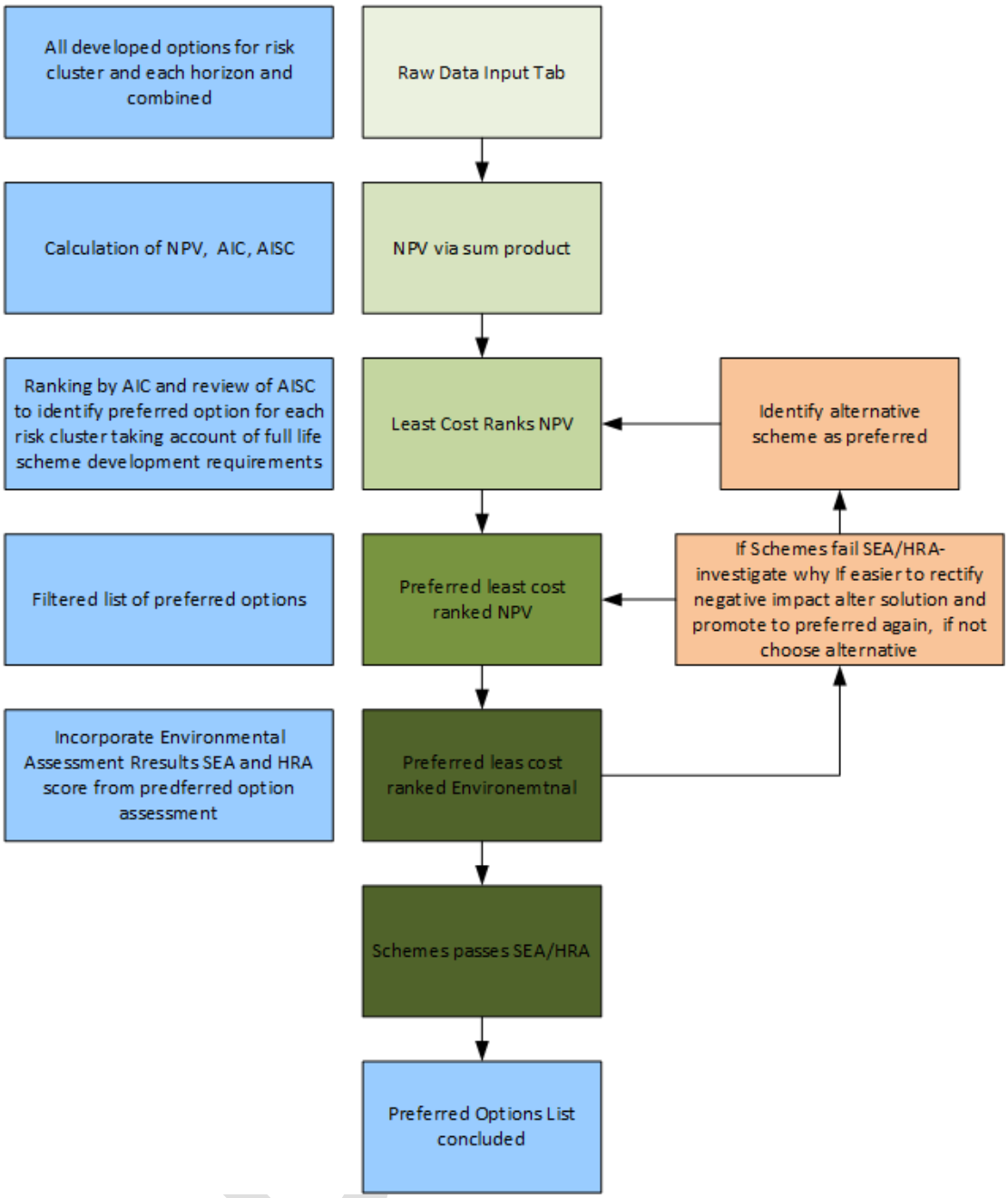


Figure 29 Net Present Value (NPV) Optimisation process Map

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ENVIRONMENTAL ASSESSMENT

We have embedded the principles of the SEA (Strategic Environmental Assessment) and HRA (Habitat Regulation Assessment) early in the plan development process. We are legally required to complete these assessments which ensure that there is no harm cause by our work, or the choices that we are making as part of the plan.

If we find that an option will harm the environment, or natural habitats, we then go back in the process, investigate why there was a perceived risk to the environment, address in in the options or rule that option out and choose an alternative. In some cases, there may not be an alternative option.

This process has been designed so that where a solution is the only solution, and it does cause environmental harm that everyone can comment on it and where there is overriding public interest government can agree to the solution. These are rare but it's important that as a country we have a process to ensure the decision is taken at the highest level when some environmental harm (all be it to produce a benefit elsewhere) may be the consequence.

The Strategic Environmental Assessment (SEA)

The SEA has five key stages:

- Stage A: Scoping.
- Stage B: Develop and Refine Alternatives and Assess Effects.
- Stage C: Prepare Environmental Report.
- Stage D: Consult on the Draft Plan and Environmental Report and Prepare the Post Adoption (SEA) Statement.
- Stage E: Monitor Environmental Effects.

The first stage of the SEA was a review to identify the major economic, social, and environmental concerns that will be considered in the DWMP. The key issues identified have informed the framework that will be used to analyse the consequences of the proposed DWMP.

To be compliant with the SEA, a plan or program must consider the cumulative effects of its provisions. This includes the overall impact of the proposed DWMP in conjunction with other plans and programmes, as well as the individual impacts of specific measures within it. The proposed approach is considered in accordance with Schedule 2 (6) of the SEA regulations.

The impact of the measures proposed in the DWMP were evaluated based on its type, when it occurs, the geographic scope, sensitivity of human or environmental receptors that may be affected, and the duration of any impact. For each of the SEA goals, a set of criteria was established to determine what constitutes a significant, minor or no impact.

The proposed assessment objectives are assessed against the core sustainable and traditional options considered within the DWMP and assessed against their positive or negative impacts during construction and operation.

The specific detail for all options reviews across the entire DCWW region can be found in the full DWMP SEA Environmental Report

Once the draft DWMP has been adopted, the selected schemes for managing drainage and wastewater contained in it will need to be implemented through specific projects. As part of this process, each project may be subject to further assessment to understand and manage its potential environmental and social impacts.

These assessments, which may additionally include HRA and EIA, will take account of the issues discussed in this report but will also be informed by the greater detail available as the work progresses about construction techniques, building materials, and agreed locations and routes.

The post adoption statemen will then be produced and published along with the plan.

Habitats Regulations Assessment (HRA)

Habitats Regulations Assessment (HRA) – examines the potential effects of a plan or project on nature conservation sites that are designated to be of European importance. The HRA is mandated by the Conservation of Habitats and Species Regulations 2017 (the 'Habitats Regulations'), which transposes into UK law the European Directive 92/43/EEC (The Habitats Directive).

The HRA process begins when the development of the DWMP has reached sufficient progress to include specific details about potential projects, such as location and scale. There are no formal guidance or precedent cases to directly inform the application of a HRA to the DWMP. Therefore, there is a degree of flexibility for the HRA process. This allows the process to be ran in a manner that provides maximum benefit for plan development and decision-making. there are 4 stages to a HRA.

Stage 1 – Screening or 'Test of significance'

This stage looks for the potential consequences of a project or plan on a designated site, either alone, or in combination with other projects or plans, and assesses whether these outcomes are likely to be significant.

Stage 2 – Appropriate Assessment (including the 'Integrity test')

This stage is a more thorough analysis of the plan or project, in which the consequences on relevant locations have been identified as significant or uncertain and is required to assess the likely significant effects of the proposal on the integrity of the site and its conservation objectives.

The HRA test must show beyond all reasonable scientific doubt if an adverse effect on the site's integrity can be ruled out; this is called the 'Integrity Test'.

Mitigation measures, which have been included in the plan, or have been developed during the HRA process in response to the potential adverse effects, must be assessed to determine likely effectiveness.

Stage 3 – Assessment of Alternative Solutions

Where adverse effects remain after the inclusion of mitigation measures, Stage 3 examines alternative ways of achieving the objectives of the plan that avoid these impacts. A plan that has adverse effects on the integrity of a designated site cannot be permitted if alternative solutions are available, except for reasons of overriding public interest.

Stage 4 – Assessment Where No Alternative Solutions Exist and Where Adverse Impacts Remain

This stage assesses compensatory measures where it is deemed that there are no alternatives that have no or lesser adverse effects on designated sites, and the project or plan should proceed for imperative reasons of overriding public interest (IROPI).

The HRA process will therefore be used iteratively to inform the optioneering stage by providing a mechanism for proposal assessment that ensures proposals are not ultimately prohibited under the Habitat regulations.

A key issue for the HRA is the level at which assessment can be reasonably and meaningfully undertaken. For a DWMP L3 level, which is relatively wide-ranging; an HRA undertaken would necessarily be quite high-level also and would likely defer much of the assessment to a lower planning tier due to the absence of detail on the location of interventions. With risk clusters considered at greater resolution within individual WwTW catchments to resolve issues, the scope of the HRA is based on a review of the scale and characteristics of the specific options proposed. Following high level screening against proximity to European sites, options which could not be excluded from having an impact had an additional 'appropriate assessment' undertaken to identify in closer detail other features that may be relevant to site integrity including typical species, supporting habitats and functional habitats.

In most instances, the environmental changes associated with the options will almost certainly be manageable or avoidable at the scheme level. However, this relies on mitigation assumptions and, as such, some options and WwTW Catchments are 'screened in' for appropriate assessment.

The SEA and HRA will be consulted on at the same time as the draft plan and will also be informed by responses made to it. Final versions and post adoption statement will be produced after the consultation.

It is important to recognise that the DWMP consultation includes the separate formal consultations of the draft SEA and HRA. The responses to those consultations will be collated and reviewed. Consultation responses will be provided in the form of a published statement of response (SOR). A revised draft SEA and HRA will then be developed, which will form the final SEA and HRA, once the Welsh Government gives its direction to publish the final DWMP.

Overall

We have produced our best value options for each location we have looked at using the approaches discussed to inform the next plan. These zonal plans have been combined together so they can be summarised in the zonal summaries and to be brought together as one programme to be taken into the next stage which is to create a prioritised company programme of work.

Two separate reports on the options developed have been written showing the detail of the environmental risk. The detail from these reports are available alongside this main report.

PROGRAMME APPRAISAL

This is where all the best value options (from the option development phase) are brought together into a plan over time.

After we have developed our lists of best value options we need to plan when these solutions can be delivered, and in which order. They are considered together across Wales.

We plan a decade ahead to understand when a solution will need to be delivered to reduce a future identified risk.

During the programme appraisal stage -This is where all the best value solutions are brought together into one single plan over time. Once we have developed our preferred option lists of best value solutions we then plan when these solutions can be delivered and in which order they need to be delivered. This is where we plan in which decade a solution will need to be delivered to reduce any risks identified.

- There are two key decisions included within our programme appraisal stage:
    - Ranking by least cost, or by environmental benefits – known as 'least cost or benefit'.
    - How to modify solutions to meet a funding constraint - known as 'investment constraint analysis'. This includes three different approaches:
        - The unconstrained programme by date the risk may materialise
        - The equally constrained affordability programme
        - The variable constrained affordability programme

Least cost or benefits

We take the combined best value list from the option development part of the plan and then rank the options on each of the following:

1. **Least cost:** What are the lowest cost options?
2. **Benefits:** Which options bring the most environmental and social benefits?

We have chosen to rank our programme based on the greatest environmental benefit. Our initial thoughts were to produce a least cost plan as the ODA step had already included the greatest beneficial options in our preferred list, however our challenge groups asked us to reconsider. We are driving as many environmentally cost beneficial schemes as possible.

We have chosen to produce a Benefit programme of work for the plan, with affordability being the next stage to consider.

Investment constraint analysis

We analysed the preferred list, all of which needs to be delivered at some point. We compared different ways of making decisions so that we can find the programme to meet a no regrets first stage and then to find the ones that would provide greatest benefit if delivered earlier;

these may not be required just now but could be cheaper and bring more benefit for the next stage of investment and then to programme those that are left.

We looked at options in terms of investment constraints. All options are constrained to different levels by the amount of investment that can be realistically obtained to deliver them.

This stage is focused on understanding the consequences of different options and decisions on our plans. It tells us whether we can delay spending now until the future, and what the future programme would then need to look like so we can continue improving our service.

Our appraisal takes into account how affordability of today could alter the number of solutions delivered in the first five years and then the consequence to the remaining 20 years of this DWMP period. We have created 173 separate projects overall costing £1.29 billion prior to the assessment of the SEA and HRA. The full breakdown of schemes into a programme of work is shown below. however, the reduced list of positive environmental schemes is also shown.

The unconstrained programme – this programme is based on risk and meeting the final destination when we forecast that risk and the future policy could materialise. This programme has produced an investment to improve the environment and to reduce occurrences of flooding to homes and businesses and is in the realm of £650 Million by 2030 and £160 million every 5 years up to 2050.

We have then constrained the programme equally over 25 years and this has produced an investment programme of £60 Million every 5 years for 25 years and £992 million programmed after 25 years.

We have then also constrained the programme with a variable investment over time of £60 million between 2025 and 2030, £240 million between 2031 and 2040 and £480 million between 2041 and 2050 leaving £511 million after 2050.

We have developed a total of 120 solutions costing £350 million to address customer flooding.

And a total of 53 solutions costing £941 million to reduce storm overflow spills.

And in our 3 trial areas we have developed 13 solutions to cover both environmental and customer risks but to solve the zone completely by 2050 costing £190 Million which is also included in the 2 programmes of work above.

However, it is important to understand that this is our first plan produced in this way. We have learnt a lot during its preparation and there are some recommendations we need to consider when we produce the next plan. Some of these recommendations have been included in the proposal below as we have learnt that during the phase to manage affordability and produce a delivery programme the manner in which the solution is created has a large impact on the design of the final programme. The development of zonal milestones is also a realisation that needs to be taken into account when appraising the schemes and we will be looking into that further for cycle 2.

We have also received the results of the SEA and HRA and learned that some of the solutions had a perceived negative impact with the majority being of minor perceived negative impact. Again, as this is our first iteration of a plan in this way, we are going to be cautious when promoting any solutions that may be perceived as negative whether major or minor. The impact on the programme and reduction in cost is brought out in the following statements.

This post SEA HRA programme has been reduced from £1.29 billion to £386 million overall with 107 projects being included in our preferred plan. With an unconstrained investment based on risk of flooding and pollution in the realm of £72 million by 2030 and £78 million every 5 years up to 2050.

We have then constrained the programme equally over 25 years and this has produced an investment programme of £60 million every 5 years for 25 years and £84 million programmed after 25 years.

We have then also constrained the programme with a variable investment over time of £60 million between 2025 and 2030, £162 million between 2031 and 2040 and £163 million between 2041 and 2050 with all project being included in the 25 years.

We have developed a total of 93 solutions costing £269 million to address customer flooding

And a total of 14 solutions costing £117 million to reduce storm overflow spills.

We will review the SEA and HRA solutions and reincorporate the solutions or bring forward the alternative options in the next cycle.

We are recommending the Fixed Budget programme of £60Million.

Delivery Approach 1 - Fixed Budget			
Priority	**Total Number schemes**	**Total Cost**	**Proportion of total schemes**
Inv. Priority 1	39	£60,357,976	36%
Inv. Priority 2	13	£60,468,264	49%
Inv. Priority 3	25	£60,406,235	72%
Inv. Priority 4	7	£60,372,735	79%
Inv. Priority 5	21	£60,404,734	98%
Inv. Priority 6	2	£84,353,874	100%

The programme graph in Figure 30 shows that the value invested each AMP remains the same but the number of solutions delivered for the same money is variable.

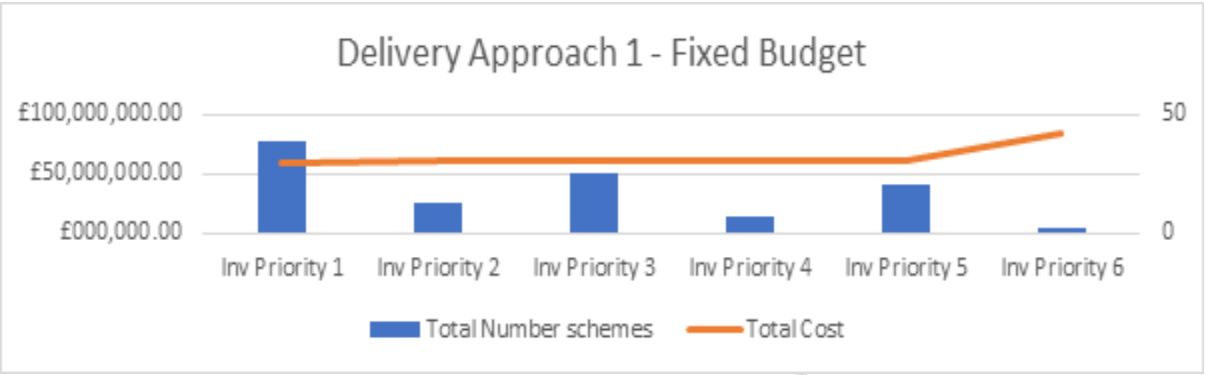

Figure 30 Flat Budget Recommended Delivery plan

Carbon Impact

During this learning phase of the DWMP we have produced a preferred best value plan that delivered a direction of travel to a more sustainable future. In doing so we found that there is still a necessity to build traditional schemes in the short term to ensure there is enough capacity for the sewage plan - I.E., the blue band mentioned earlier. Inevitably in terms of a carbon impact it is recognised that the solutions driven from this plan when added up will have a carbon increase. We would like to bring this element out in this plan so that we can learn from this outcome and work out how to limit these increases in future iterations of DWMPs.

What happens Next to our options

Once the DWMP has carried out its assessment and compared the results. The final list is passed on for the business to incorporate the solutions into the price review process to support their funding in future decades. This process is called the price review and is managed by OFWAT our financial regulator. It is only when they conclude their assessment will we know which solutions will be supported for delivery and the consequence of that submission can be re-analysed and form part of the annual review of the DWMP and becomes the beginning position of the next plan which will be published as a draft in 2028 and the cycles go on.

We have also created 2 programmes of opportunities as the basis to start our level 2 engagement with other stakeholders. They are a programme to look at schools across our operating area and confirm where there are real opportunities to then develop the solutions ready for the next cycle and a similar programme to verify if there are opportunities at government owned land such as carparks and council buildings. We are now looking for the next focused programme and we will add that into plan development during cycle 2.

The first stage of building our project boards is to have an opportunity to work through. We are proposing these as a place to start. There are 993 school locations and 807 public spaces that are candidates for discussion and our initial opportunities. The cost of engagement from all who participate every 5 years would be in the realm of £400k across Wales. The cost of the solutions would be on top. It is important not to underestimate the cost to a pooled staff resources on the 13 project boards as this too can be a barrier to success.

To develop joint plans of any kind will take time and the expertise of the organisations involved. We also have to consider the constraints from delivery as we cannot undertake work too fast too early without developing a supply chain of organisations to undertake the work. This is where we need to learn from each other and build virtual cross organisational teams to work for Team Wales.

Environmental Harm

We have carried out an innovative approach to assessing future water quality using the SAGIS software as mentioned in section Water Quality forecast. we have considered a number of situations that could change into the future to assess environmental risk with climate change.

- The future could be either drier on average or more wet on average.
- The future wastewater discharge to the river could be higher than today or lower than today
- Future Land use could be more Agricultural or less agricultural etc.

When combining all of the predictions an envelope of possible risk containing 28 ensembles is concluded. These scenarios were then used to predict a value for Ammonia, Nitrate, Biological Oxygen Demand and Phosphate. This evidence reinforced that the dry scenario noted the areas with the greatest concern in the future. This is also borne out when the principles of aqueous chemistry are considered in a column of water's ability to dilute and a flow of water's ability to disperse. When these three concepts are brought together an assumption of when environmental harm may occur can be concluded.

The volume of water in a river but also relates to the speed of that river as it flows. What is needed is a mixing effect like a washing machine. the speed of the flow and the friction effect and eddies created as rivers flow mix the discharge and disperses it. In dry weather with river levels dropping and mixing ability dropping the capability of a river to mix drops and due to the viscosity of different waters two separate plumes of water can be seen. This is a naturally occurring phenomenon and is a principle of river dynamics. We are going to use this in our future dry scenario to indicate where a future possible higher risk of environmental harm could occur.

The other principle to help us predict the future environmental harm is dilution. Again, using out SAGIS model which indicates we can assume also that change in the sources of upstream contributions to chemicals in relation to land use could either make dilution easier or harder in the future. Using this dry scenario, we have identified locations across our area that could be of greater water quality risk if that scenario were to materialise in 25 years' time.

When both these pieces of work are combined, we can prepare and investigation programme to delve deeper into those identified and to target options in these areas earlier.

These conclusions draw us to managing the seasonal effect of our operation on the environment first and once that is understood move on to average conditions then to more extreme events and this is incorporated into our proposal for cycle 2.

In Britain we have a large proportion of days with either no rainfall or showers. In hydrology a typical river is known to have periods of low flow and as a generalisation we will say these are clustered in a few months with a couple of weeks being in this low flow range. For ease of discussion let's use April, June and September. This is simplified for discussion. If we consider these to be average conditions but there are also other generalisations that we need to think about which are years that are very dry and years that are very wet.

In terms of environmental harm, we can leap to a conclusion for use in forecasting that a river's ability to disperse is reduced in dry weather and we can also leap to a conclusion that in wet weather that river's ability to dilute is also reduced in dry weather. Our proposal incorporates these two factors, we need to ensure that sewage is contained when the river is at its lowest. The approach will reduce environmental harm to those species susceptible to these risks and in an assumed manner consider the future environmental harm as this is something that does not currently have a methodology.

In terms of nutrient content however the first flush of rain after a dry spell is also a higher risk for some aquatic life not only from the Water industry but also from the catchment users and this risk was included within the SAGIS future assessment.

Amenity Use

When is amenity at its highest with the greatest number of users. On a warm sunny summer day or evening the river and coast sees flocks of families and individuals looking to be closer to nature. This increase of activity during these drier weather periods again reinforces the proposal being put forward from an environmental harm point of view that from an amenity point of view the same conditions should also be used. Our improvements need to start when the rivers and coast is at its greatest demand. Again, this is incorporated into our proposal going forward as a place to begin.

Learning from undertaking a WRMP approach to Cycle 1

From the outset we stated we were undertaking a WRMP type of assessment on top of carrying out a typical wastewater type of assessment. This decision has brought difficulties and it has brought opportunities.

To break down the dynamic water environment that includes sewage and drainage, there are 3 distinct assessments.

1. There's the hydrology of the river and the fluvial dynamics.
2. There's the surface water drainage that again is a hydrological assessment and
3. There's the artificial sewer and drain networks

During drier weather periods of light drizzle, it is reasonable to conclude that sewage and slightly diluted sewage needs to be contained.

Unlike a water supply the sewerage system is not a sealed system it is open to infiltration and escapes. We have concluded there are three influencing sets of systems and they interact as set out in Figure 31. Rainfall enters the Sewerage system and can flow into rivers and Coastal

systems, likewise rainfall enters the drainage system which also flows into rivers and coastal systems. There are also areas where drainage enters the sewerage system and sewage escapes the drainage system. How do we limit the interaction between the sewerage system and the drainage system so that water being drained sustainably doesn't include expensive treatment processes and water within the sewerage system doesn't then escape and pollute a River and Coastal system.

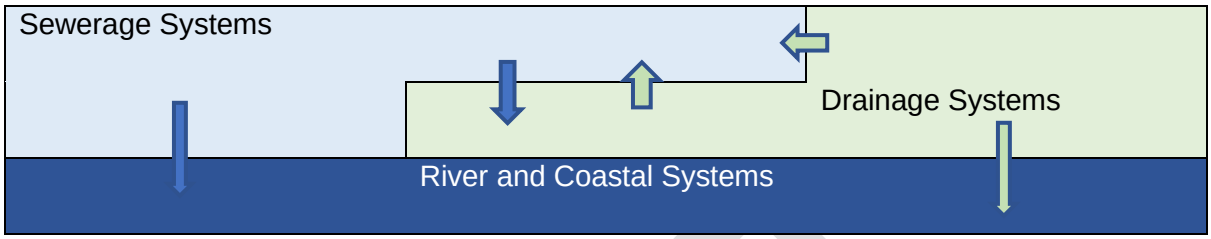

Figure 31 System Interactions - Sewerage, Drainage and River and Coastal

Another conclusion from the investigations so far, every organisation test cycle us that or generalisation that manage these three are focusing on different rainfall events. These events are termed in the likelihood of occurrence.

Sewers are designed to transport high frequency low intensity levels of rainfall

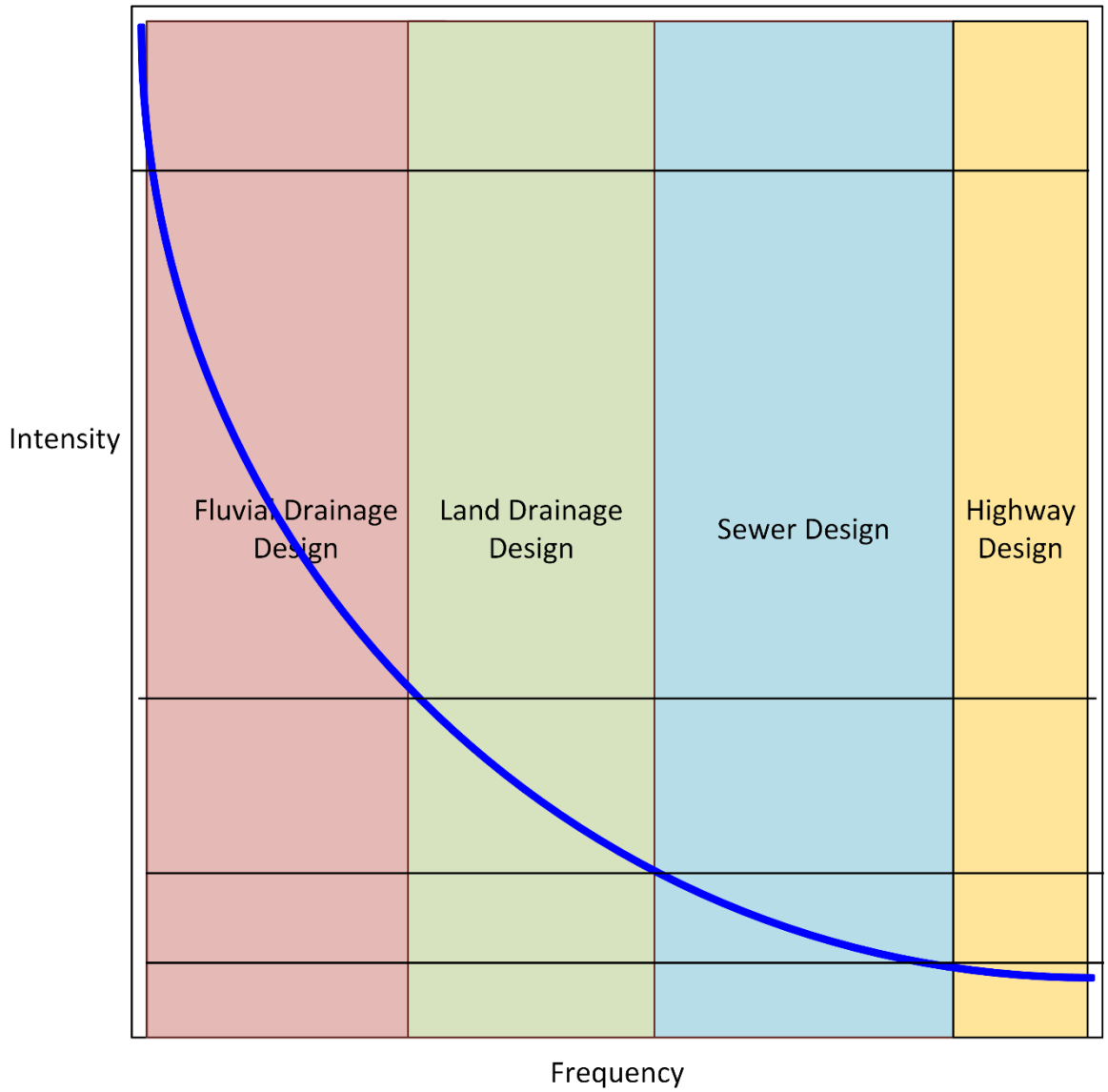

Figure 32 Intensity Frequency Curve showing the idealised focus of Design

Which means that there needs to be adequate natural or urban routes that are not sewers to transport the flows above the design of a sewer or we need to change the design criteria of all sewers in the future and retrospectively to those that are already in situ. The graph Figure 32 shows an intensity - frequency curve of rainfall return-periods and the design relevant to the curve

To draw this out further have you ever driven on a road during a deluge of rain, the roads are flooded and acting as rivers. The gullies cannot accept any more flows however. This is another part of the design constraints; gullies are also designed to allow a specified amount of water into its network of pipes. Again, this is the same for all assets, each has been designed given a criterion before climate change.

A conclusion has been drawn that organisations are focused on different event intensity and this drives different needs and highlights why co created schemes are not an everyday

occurrence when considering opportunities to collaborate. The team Wales approach to drainage does change this. When the three systems are seen as one system and solutions are required for all intensities the collaboration is required and will increase and the issues of in-combination effects are managed more effectively so that one change does not impact adversely on another.

The starting position of a catchment and this cycle and greatest benefit while looking at the affordability challenge during the development of the first cycle to achieve their final destination

It was found that benefit in terms of volume reduction versus the intensity and frequency of a storm was dependent on the current situation. What this means was that if a catchment was already resilient to downpours greater effort was required to move that resilience to heavy rainfall events etc. So it was important to note that more resilience can be achieve if the lower resilient areas were improved first.

This is a measure of an assets ability to achieve its final destination at each increasing intensity.

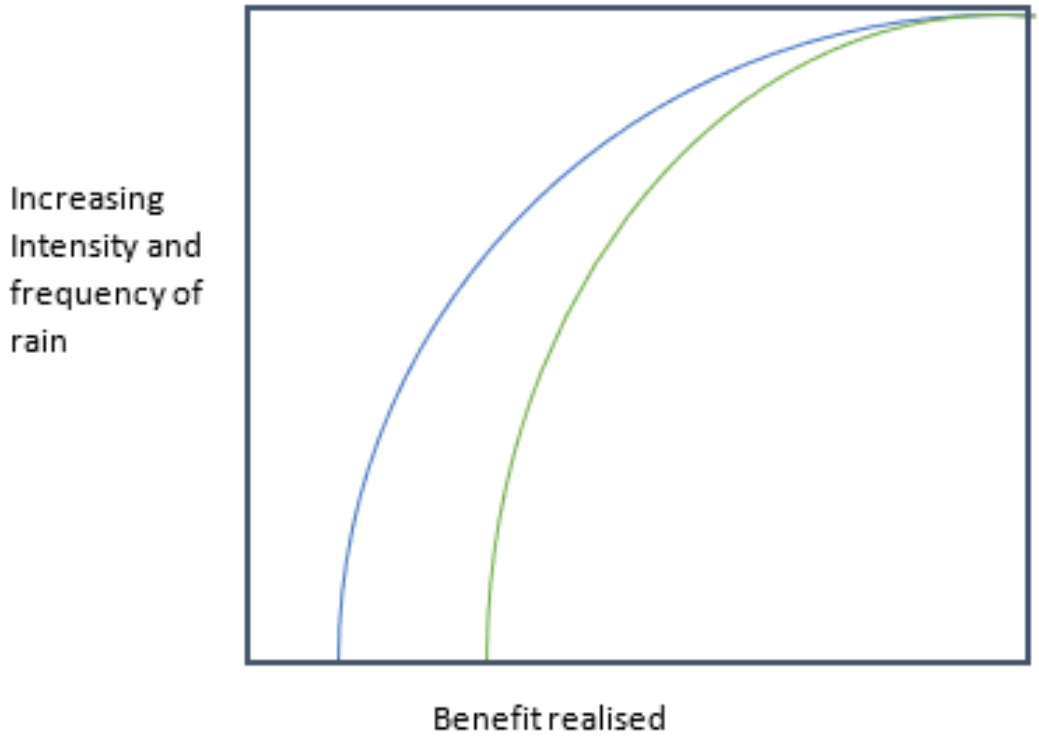

Figure 33 Increasing Intensity and Frequency of rain versus benefit derived from different starting positions

The Graph in Figure 33 shows that an asset that has a low operational intensity score will gain a greater % benefit required than those that already have a higher operational intensity score. this is because the curve to achieve the same benefit is steeper because some benefits have already been realised. This innovative approach to classifying drainage assets is in its infancy but early indications reinforce the initial assessment that the lower intensity storms are equally

important as the assessments at the higher intensity until the average intensity score across the whole operating area is above the midway point.

What does this mean in terms of the next plan?

There are priorities in terms of the system and how they interact

- The Sewerage system
- The drainage system
- The hydrological system

These are linked to rainfall intensity and frequency.

All these systems interact with the dynamics of water and its ability to dilute and disperse and it is known then the ability of a body of water to carry out these tasks are made difficult when the flow is low and the temperature is high, indicating a seasonal difference to the environment.

Finally, and part of each of the 3 systems, is the assets that make up the system. How the asset currently operates and its resilience to pressures such as storm intensity is another aspect, but each asset cannot be analysed in isolation, the whole catchment plan is required. However, in delivery the lower the resilience of an asset the greater the benefit will be seen. When prioritising in a catchment, the worst performing asset should be improved first. But it is important to conclude that the plans for the whole catchment are needed to ensure that the right solution is driven for each and every contributing asset in a planned and sequential basis.

Its these conclusions that have drawn out the proposals put forward for cycle 2.

In all catchments we need to assess its overall current intensity scores, its frequency score and its connectivity to others scores.

Then apply this to the 2-dimensional matrix of customer service priority and environmental sensitivity priority. We will then have a method to bring the greatest benefit while also protecting customers and the environment.

For example, an area that has a current repeated flooding to a customer is priority for optioneering to be delivered as long as they are also in an area that discharges to a SAC and that in these areas' assets of low operational intensity score are of a higher priority over another asset in the same location.

This though doesn't mean that plans stop there, the full picture is required to enable decisions for investment and affordability and programming. Now we already know how much the full picture could cost, we can create incremental zonal milestone plans to achieve that destination using the principles we have concluded from this first cycle.

We can then plot the minimum resilience to flooding predicted in each zone from, the risk matrix an example is shown in Figure 34. For the example of SAC rivers which map where at a Level 3 have a minimum customer service of worst served customers, internal or external

flooding to property or to the highway. We can then track the progress of an area through solutions to provide greater resilience to storms.

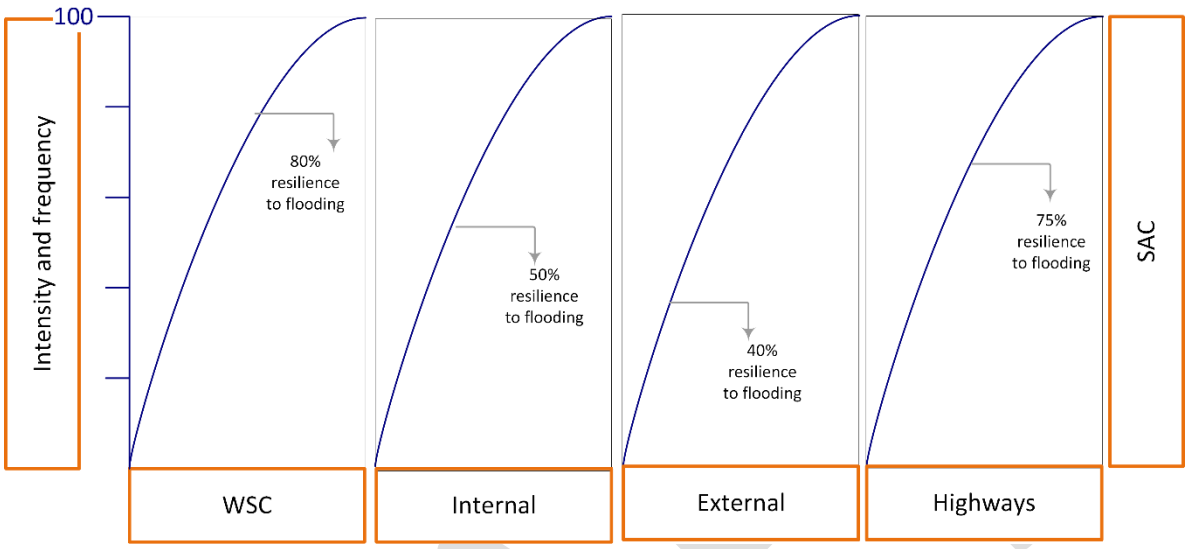

Figure 34 Idealised Resilience plots showing how progress can be monitored

Maintenance

Collapses and Blockages are separate to the above as these standard measures relate to maintenance everyday business activities and customer behaviour these are considered separately to the proposal for cycle 2 as these activities form business as usual. We have a company level programme of education that covers water efficiency, fats oils and greases and non-flushable items which are the main contributor to blockages. And deterioration of assets over time are contained within management planning as the starting level to create new policy change. However, where additional education programmes and increased maintenance above the assumed level is needed a management plan will highlight that a scheme is required and will be put forward to drive change.

There is a consideration around a principle of siltation and the relationship to Headroom. in Figure 35 shows that overtime pipes will silt-up and reduce the capacity in the network. The regular routine of removing silt is required to keep the capacity for emergencies and reacting to new ad-hoc connections. An allowance needs to be made that reduces the capacity due to operational activity such as siltation. We should start with an assumption of 20% for this plan. Locations where 20% capacity loss would cause additional spills or escapes will be areas where we will investigate as part of plan development. Please note that this is a starting point to understand risk on a course scale. as time progresses there will be a need to vary the allowance for siltation and headroom based on evidence from surveys and methodologies to incorporate uncertainty.

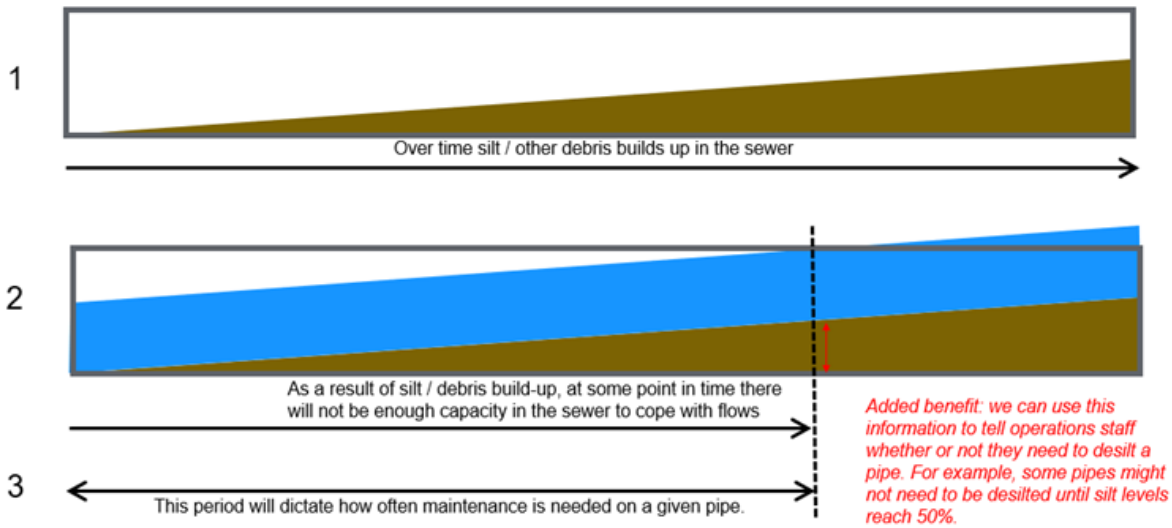

Figure 35 Siltation over time model showing loss of capacity

Treatment works compliance

Our environmental regulators NRW and the EA issue agreements at points where the sewer system interact with the river and coast. these agreements come in 2 forms;

- Descriptive, which relates to smaller and less environmental sensitive facilities

and

- Numerical, which contain variables of flow and quality standards to control impacts to the ecology and biodiversity these normally have parts that relate to dry weather and a part that has different values for wet weather conditions.

The main principle at a treatment work is to protect the biological process to ensure that it carries out its task of cleaning the water before it is discharged. the size of the treatment work is carefully chosen to make sure of that.

The changing climate and changes being driven by human patterns of usage is altering the underlying flow and load volumes in that calculation.

The decision currently sees discussion to change policy with regards to storm overflows spills is also going to alter the underlying flow and load volumes in the calculation. it is anticipated that a review is going to be required within the next 15 years of the treatment work facilities across our area so that the biological treatment continues to be protected.

In Figure 36 simple model has been drawn of the interactions between the assets and the environment. In the current conditions flow model shows that as flow travels through the system there is a separation into the environment through discharges of untreated water. The second system model shows as each discharge is reduced and disconnected more flow will need to be contained within the sewer model and assets such as pipes, pumps, storage and treatment will need to be readjusted to accommodate the future position.

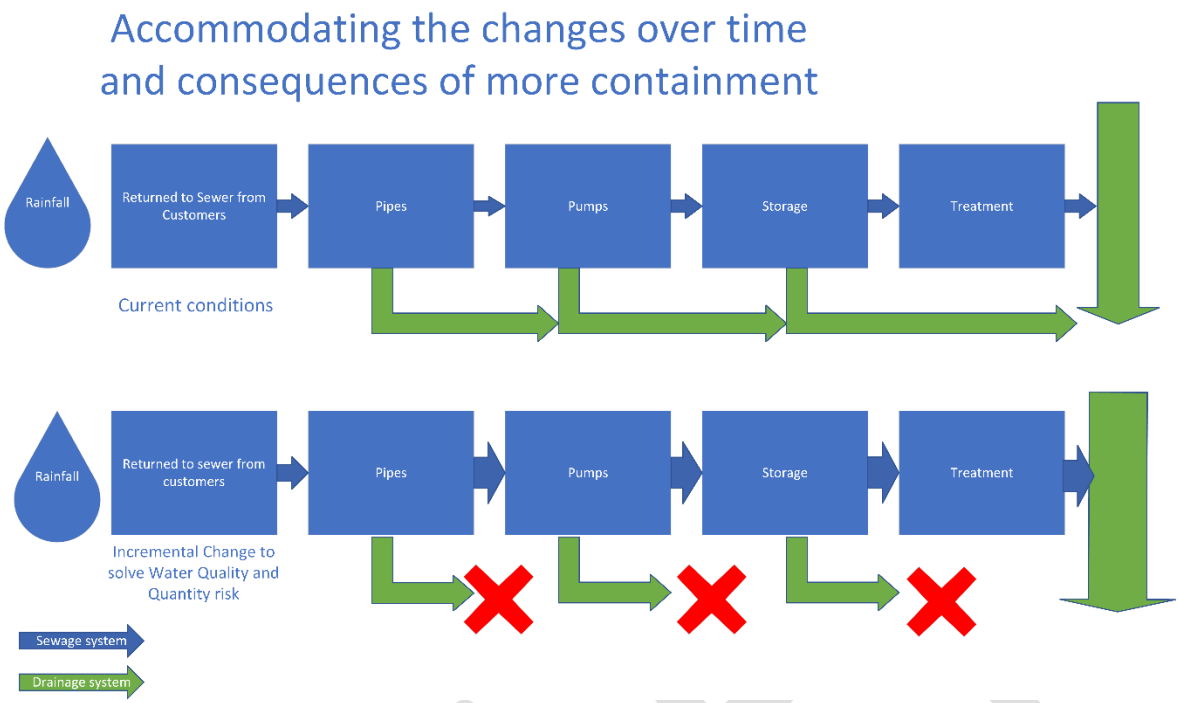

Figure 36 Catchment based approach to Storm Overflows while maintaining compliance at all locations

The flow currently arrives at a treatment works is lower because the system is designed to let water out while it drains to the treatment works. In the future as each storm overflow and customer escape is contained a larger amount of flow will arrive at the treatment works generally and a larger amount of flow will arrive when it is raining.

The consequence of this gap between dry days and wet days will need an alteration and is required to protect the biological process and similarly the environment and ecology of the river and sea. This variable flow and load i.e. the water quantity and the quality difference between dry days and wet days could become more extreme and even nature based or low carbon solutions may be put under pressure which again will drive more need to protect the natural process I.e., the biological process that forms the active cleaning of wastewater. Again, suggesting that to reduce the likelihood of high variability driven from climate change and heavy rainfall that sewage and drainage systems are managed differently in the future.

A simple example is shown in Figure 37. On dry days the volume of wastewater arriving at a treatment work is directed through the works and out into the environment. As it rains in the catchment and water starts to arrive at the treatment works the treatment processes need to be protected so an amount of flow is stored and when the rain stops that stored water is returned thought the treatment process and on to the environment. The larger storms such as a deluge cannot be stored and this is designed to spill directly into the environmental as per the agreement with our regulators.

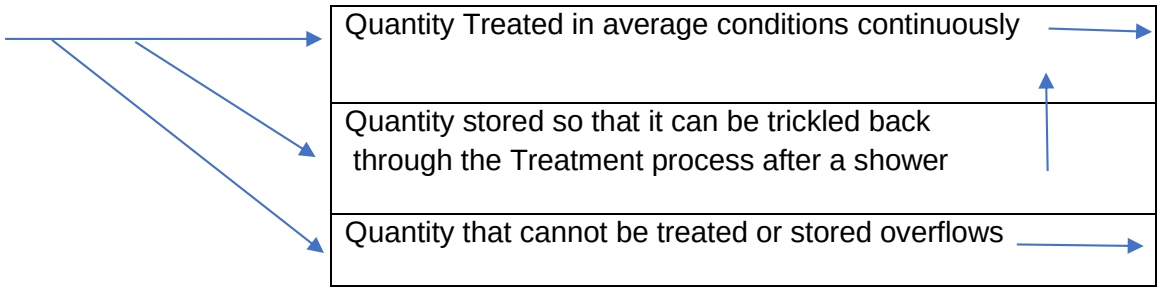

Figure 37 A simple example of rainfall storage and treatment capacity contain and how flow is routed with storm intensity.

It's the Excess Quantity of water discharged to the environment during high intensity and low frequency events that cannot be treated due to biological constraints in treatment process such as diurnal change and seasonal sudden change

What does this mean? Our network delivers flows in litres per second and this base flow, the sewage flow arrives daily. When it rains the flows ramp up as the storm passes and continues to rise until the flows start to drop again after the storm, so a treatment works needs to be able to manage both the constant flow and the changing flow. An approach to manage the changing flow is to store the majority of it so that it can be trickled back along with the daily constant flow. But these tanks are also designed to a time when intensity and frequency were lower, indicating that storage at treatment works will need to be bigger in the future. The more frequent storms also indicate that greater storage will be needed if a policy of contain is eventually concluded. This is because a storm tank design is designed to drain down over a period of time. If these times are shorter in the future, then the tank will need to be bigger to allow each hour of rainfall to be stored until the series of rainfall events stop which then allows capacity to be again made in the storm tank as it trickles through the treatment works before discharge to the environment. Figure 38 shows the new maximum capacity of storage and volume needed to be stored above the original assessment. the volume of additional flow to be stored is the area between the 2 curves not just the peak.

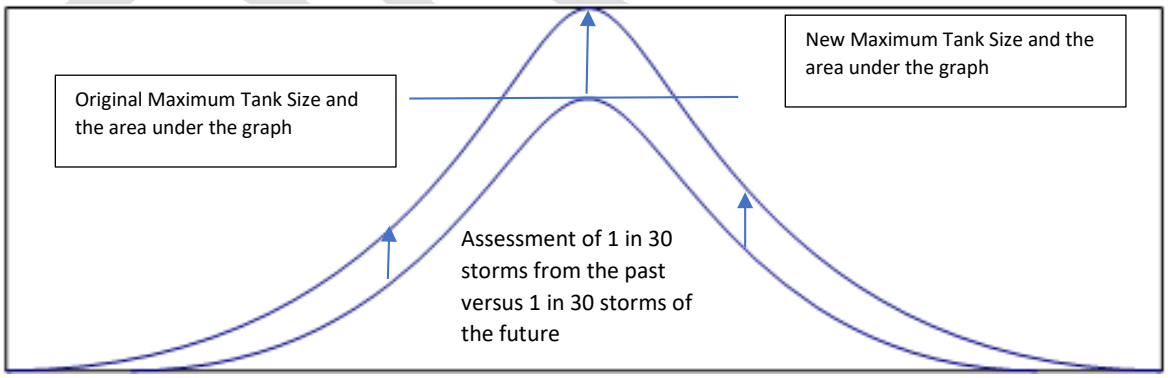

Figure 38 Curve of current and future rainfall impacting on the size of a storage tank

This too indicates a need to reassess the resilience to the latest frequency and intensity of storms and consider setting a new storage design or retaining the current design and changing how rainfall is designed in the network system to a surface water or sub surface drainage only system.

Yet again this analysis reinforces the 3-system approach to manage flow and load. the continuous volume of flow is directly linked to the sewage plan along with the partly designed to include drizzle and low intensity rainfall which actually helps with dilution in the network itself and self-cleaning velocity flushes which is also a hydrological principle that needs careful consideration as we make changes to any water cycle. At a point where the drainage cannot be contained at the treatment work and it then spills out to the environment then that volume will need to be managed differently in the network as it can't be contained at the treatment process because the biological process needs to be protected and the volume of excess water becomes too great maybe greater than 3 or 4 Olympic sized swimming pools.

The load on the river which is the other element of an agreement relates to disperse and dilution. which we discussed earlier during dry weather then more flow we treat through the biological process the less the river will need to dilute however the disperse of the river is also important and as climate change will need to add more nature based processed top the ned of the current treatment works process to overcome that dispersion problem by using natural groundwater trickling processes to support base flow in the river and use the natural groundwater filtration system to disperse and dilute flows more naturally and slower.

Conclusion

In conclusion this first plan has been exceptionally difficult as it has not just been turning the handle on tried and trusted wastewater principles and practice. The delivery of the framework allowed us as a company to take the opportunity to delve much further.

Starting at the beginning with a willingness to support citizen science research programme which set the direction of travel. A new approach in the water industry asking direction but then not associating these questions with the cost.

Then learning to merge together principles of wastewater management with principles behind water resource management such as hydrology and hydrogeology and aqueous geochemistry.

Defining the difference between course modelling versus detailed modelling and allowing course models to guide where to carry out detailed modelling.

Dry weather, average weather, wet weather and extreme weather condition and each of these having a contribution to a calendar year of 365 days and then using these as scenarios to define prioritisation.

These definitions of weather as scenarios then led us to understand why co-funded opportunities are not commonplace. Mainly because our focus in terms of frequency and intensity rarely overlap and each organisation draws their own conclusion whether the co-funded opportunity contribution is significant or insignificant to their project.

The work also quantified for the first time using a simple method to allow an informative decision relating to differing policies for both volume of water escaping to a water body or customer home and business and the realisation that the cost is not currently affordable to

achieve zero without further discussion with customers who set the pace of change by the money they can afford.

We then also started to break down affordability into steps and realised where investment benefit by delivering schemes is when the highest frequency and lowest intensity and warmest conditions and highest amenity overlap.

And the final piece that joins all of the above to normal wastewater planning which is to monitor performance at a company level using the main objectives for customers and the environment which are Internal sewer flooding, external sewer flooding, pollution events, storm overflow performance, and treatment works compliance. The DWMP will need to track zonal targeting and the company will report on company targeting as it currently managed through the annual reporting process in a similar way to the WRMP.

The framework has allowed us to deviate from these normal practices and understand risk at a localised level with targets for each area and allowed us to move away from sewer catchments to understand risk in a river catchment rather than at company level. This being a way to discuss opportunities for the greater good rather than be limited to the company's own targets.

When all these pieces are combined, we improve our understanding from a societal point of view, and we can create better opportunities for more efficient management of wastewater and drainage.

Assumptions we have concluded from cycle 1

The framework has given us a great start to how we manage sewerage and drainage and river and coastal water quality. We have tried to evolve what we would have undertaken as part of previous wastewater company planning and challenge ourselves to go further during this non statutory phase before the new regulation of this process is written.

- We now have an assumption when environmental harm could occur
- We now have an assumption when amenity is at its highest
- Marrying this with sewage planning leads us to developing risk assessments that go further than asset planning
- We now have an assumption that sewage needs to be contained but we still need guidance to the level of containment and government policy to inform that decision.
- Marrying this with drainage planning leads us to developing integrated drainage plans with other organisations with focus not only on the extreme wet but on a full range of conditions.
- We now have an assumption that rainfall needs to be separated but we will need guidance to the level of separation and government policy to inform that decision.
- We now have an understanding that each incremental improvement needs to be affordable in a 5-year time step and constructed fit the timeframe and cost limitation.
- The optimiser we have tested manages to produce pre-feasibility level programmes of work ready to be taken forward into the business plan process.

These concluded assumptions during our first cycle will now be fed into our risk and options methodologies because we want to understand not only what happens in the worst-case conditions as indicated in the framework and general wastewater planning but we need to be able to understand average, wet and dry conditions. And make plans for each. This is different to usual wastewater planning.

PROPOSAL FOR CYCLE 2

Capacity constraints and Storm Overflows

The first version of the plan has considered legislation and policy to put together recommended options and outputs. At the time of this document being published, a DEFRA consultation is running focusing on the future role of storm overflows. The Welsh Government are also obtaining evidence to review their policy direction in this area.

We have considered the likely outcome of this policy and legislation in advance of government conclusions. We have also estimated the likely impact of this on water bills which is potentially significant. However, we must look at all areas where we need to improve, not just storm overflows as customer flooding are a greater risk to human health and has to be prioritised too.

We have trialled different approaches during this voluntary phase of the DWMP because we wanted to find the most efficient way to bring greater benefits to both our customers and the environment. To that end we have prepared two approaches for consideration during the consultation of the draft plan and these are set out below. However, the development process will continue during the consultation and any additional evidence will be presented along with responses to the consultation in the final plan.

1. Preferred approach - As part of the Plan, we have looked at how to improve both storm overflows and network capacity at the same time, covering both the water quality and water quantity themes of our plan,
    a. On an incremental improvement basis - We have looked at how more benefits can be achieved through increasing overall system capacity.
    b. Small zone approach - We have also looked at reducing the impact of both storm overflows and customer sewer flooding on a zone-by-zone basis, where we would deliver improvements in one step.
4. Standard approach – This would involve continuing with the current approach of investing to meet individual company level performance commitments, and targets agreed with regulators, to gain the greatest target reduction.

Headroom

Headroom, or capacity availability over and above the predicted demand, is an approach to manage uncertainty while developing the forecast data. It allows us to build in a margin of error into our forecasts for the future requirements. It also allows us to consider how much resilience we have in the system and to what level of risk our customers and stakeholders are willing to accept. This ranges from high-risk position in which there is zero headroom to a low-risk position 100% headroom.

For example, we could invest in the capacity of a sewage pumping station to provide double the forecast demand (i.e., 100% headroom). Alternatively, we could provide only for the existing demand (i.e., 0% headroom). The former would provide us with a very low risk

position but at a high cost whilst the latter would be a high-risk position but at lower cost. Building some headroom into our design is sensible to cope with the changes that might occur, and we need to consider how much is acceptable?

Preferred approach

Take incremental but consistent steps to do the right thing for both customers and the environment.

- **Sewage Planning –** Work with regulators to ensure that our assets are fit for the future and are able to respond to changes, such as the effects of climate change and dryer weather.
    - **No regrets capacity solutions –** these are the solutions that ensure the system is resilient to the dry weather flow. It is also important to consider that during dry weather when the river is at its lowest that greater environmental protection happens with the no regrets solutions
    - **Adaptive plan capacity solutions–** These are solutions that provide time to respond when things go wrong such as blockages and provides for smaller developments to connect to our network while we then build that capacity back into the system– we call this extra capacity above the predicted demand Headroom.
- **Drainage Planning** – Carry out sewage planning first then work closely with other organisations also responsible for drainage. Slow down and re-route rainwater safely through communities whilst still ensuring that it can either slowly drain to local water courses or be absorbed into the ground as close as possible to where it fell. These approaches often involve “green infrastructure” such as swales and planting in urban areas which will support longer term sustainability of our environment and encourage greater local biodiversity.
- **No regrets drainage solutions** – Solutions for the removal of rainwater where escapes occur in frequent but less intensive rain events i.e., days of light drizzle and short summer downpours. It is also worth considering that when the river is at its lowest the opportunity to have greater benefits in river quality also happen.
- **Adaptive plan drainage solutions** – These are solutions to rainfall events that occur less frequently during a year. They have a higher intensity where intensity ranges from winter multiple days of heavy rainfall to named storms. As named storms are less frequent our planning has considered the more frequent multiday rainfall events first.

*It is important this the drainage plan brings with it a consideration for policy change in Wales. As a Water and sewerage company we have neither the required powers nor funding from customers to pay for other organisations drainage responsibilities. We need to make sure we and other drainage operators are working together in the best interest of the communities we serve or stakeholders will lose confidence in our plan.

With careful planning both the sewage and drainage plan together can also comply with the standard approach

- **Emergency flood planning –** This is when communities are affected by flooding not only from sewers but flooding from rivers and streams (fluvial), overland (pluvial) and/or coastal areas (inundation) is affecting whole areas. We will update our plans to work with other organisations who have a role in emergency planning, such as the Lead Local Flood Authorities, to minimise the impact of such flooding events. When flooding does happen, we will work with these organisations to ensure that we can restore our service as quickly as possible after flooding has occurred while supporting the communities during the event.

Our preferred approach builds on more traditional ways of planning to better understand not only our drainage network, but also how we can improve how we work with other organisations and deliver improved environmental outcomes.

This means we can work together with others to put together sensible solutions. We believe these solutions to be the right thing based on the information we have and set us on the right path for future generations to come.

Small zone approach – Zone by zone

This approach calculates the risk in each zone and then produces solutions to achieve the whole zone environmental and customer destination within 1 plan cycle. Once this approach is carried out the zone is allowed to deteriorate slowly with storm overflows gradually increasing the average number of spills again over time. The reason for this is that it would take at least 2-3 planning cycles (50-75 years) before further investment is carried out in that zone to restore capacity. This approach is not recommended for large zones but it may successfully be applied to small zones. this is part of the preferred approach and will be delivered where affordability allows this pace of change.

Standard approach

This approach is to continue as we are now, providing solutions to meet individual performance and regulatory targets:

- Where there is a **cost benefit** to acting or implementing a solution.
- Where there is a **key policy** which determines we must take action to meet our obligations as a water company.
- Where there is a **shorter-term performance target** for a specific objective such as internal sewer flooding or WWTW compliance.

The standard approach ensures compliance with our financial regulator.

CONCLUDING THE PLAN.

Implementation

This first non-statutory cycle of the DWMP has developed the tools and approach for meeting the stages of the national DWMP framework.

The DWMP assessment of risk has allowed us to highlight the areas at greatest risk, but also those areas where there is remaining uncertainty. The certain and complex risks have been taken forward to optioneering, and then into programme appraisal. At programme appraisal, solutions have been selected to achieve the best suite of options to meet the recommended customer destination and environmental destination for the localised area. These localised solutions have been aggregated to develop a programme of investment at DWMP Level 2 and Level 1, which has been phased over short to long-term timescales to deliver the most effective strategic wastewater investment programme.

It must be noted that, during this first non-statutory cycle of the DWMP, this strategic investment programme does not identify the specific solutions required to meet each performance commitment. This task will be developed as part of our PR24 and subsequent price reviews. However, the DWMP does identify the type of solutions required to meet the overall destination over time.

Whilst the DWMP may not yet have developed a plan for implementation it does give us tools and outputs that can help inform national policy on the pace and affordability of change. It also demonstrates the scale of the challenge of managing surface water inflows to our combined sewers in addressing customer and environmental risk.

The disjointed ownership of drainage in our urban communities will mean that implementation of our plan in future cycles will require considerable integration with other stakeholders. We view this ability to inform and influence policy decisions, that will inform future DWMP cycles, as an essential long-term component of this first iteration.

Our proposed Plan

We have reviewed our risk and concluded that risk is variable across our operating area with pockets of great service and pockets of medium to good service. Our planning proposal has been created to ensure that as many areas as practicable see an improvement. Our delivery plan has focused on areas that have been identified as impacting a SAC and where customers may have seen more than 1 episode of internal sewer flooding. We reviewed these solutions for environmental impact and the positive ones have been carried forward to our business plan. All the remaining solutions will be assessed again, along with more risk areas and the process of DWMP planning will carry on again in cycle 2.

In addition to these delivery schemes the plan has highlighted programmes of work that would be beneficial to start straight away. These programmes of work will gain momentum and ensure that drainage is managed more environmentally friendly and prepare for green solutions rather than grey solutions. But it is important to note that 3rd party planning alongside our planning is required to make green solutions successful and programmes such as Surface water separation are in this category. We have developed opportunities at Schools and Publicly owned land to aid that process and help inform the level of resource required to make drainage planning a seamless joint multi-organisational programme.

We also have assessed our assets in general terms to ensure that capacity of the whole network is maintained into the future. we have created a programme of investment over time that will meet future legislation, as it is important to recognise that reliance on storm overflows will need to reduce and the impact from that will be the need for larger pipes, pumps and treatment works. Taking steps now to plan at a catchment scale will ensure that each river and bay will improve systematically and an assessment be carried out for all areas at the next cycle.

Monitoring

Twelve months after the plan is published, the first Annual review of the plan will be required, and annually on the same date each year until the next DWMP plan is published. The annual review steps, which are outlined in the national framework (WaterUK, DWMP Framework, 2018), and are summarised below, ensure that any new information is reviewed and assessed in a timely manner. Any new information that alters the direction of the DWMP sufficiently to alter the policies or direction from Government will trigger the production of a new plan.

Conclusions

To ensure that our strategic long-term wastewater plan can help inform this policy debate, we have considered the likely outcome of various policy impacts and their potential consequences for customer bills. However, as a society, we cannot single out storm overflows alone for improvement. We need to ensure that our long-term plans set out to deliver the broader aspects of wastewater resilience at our treatment works and sewers, to manage water quantity and quality in the face of the impacts of climate change, growth, and urban creep.

In developing our plan, we have explored the impact from an affordability, deliverability, skill shortage and resource perspective. This has led us to promote a set of realistic investment scenarios for consideration in our PR24 business plan preparations in addition to the wider, more strategic level outputs of our plan.

Observations driven from the first cycle of plan development are summarised below:

- Intensive modelling will be required to fully understand catchment performance from a quality and quantity scale, particularly the interactions with other drainage systems. This reliance on modelling, to increase confidence in the bottom-up assessments, will have an impact on the pace of improvements and the accuracy of our plan in future cycles.
- Even after modelling, if the root cause is not fully understood, then confidence over whether we are choosing the highest priority location to address is compromised.
- If many solutions are required in a 5, or 10-year period, a traditional approach is more likely to be chosen than a more sustainable approach. This is mainly because the lead time before getting to site is longer for SuDS and other sustainable solutions.
- Collaborative schemes that take multiple organisations to get together to resolve drainage or pollution take a longer lead time, sometimes greater than 5 years in discussions and planning.
- Joint funding of collaborative solutions is not clearly defined in government processes, presenting significant challenges in aligning funding, accounting for benefits, and ensuring delivery programmes can be met.
- Ofwat do not have a clear policy on co-funding schemes that others will deliver.

Recommendations

We must recognise that during the first cycle a range of pilots and other learning activities have been undertaken to identify the most appropriate tools and approaches to deliver a DWMP. This work has identified that, to achieve a mature, resilient, repeatable plan we will need to invest in data that we have not collected before. We also need to consider investing in systems to analyse that data and expert staff resources to apply the processes.

Building on our learning from Cycle 1, the following general recommendations are proposed going forward:

- We need to increase the data collected to support our modelling and data improvement aspirations.
- We need to develop integrated systems not just within Welsh Water but jointly with our colleagues from Councils, Natural Resources Wales and the Environment Agency and Environmental NGO's so that we collect and work from the same data, improving the usefulness of that data and increasing our joint understanding so that we all work together to improve the environment from both Quality (pollution impact) and Quantity (flooding and drought impact) perspective.
- We need to increase our understanding of asset capacity and increase the coverage of our hydraulic models to forecast that capacity, including integrated models that consider the implications of our surface water separation plans on other catchment drainage systems.
- We need to improve and automate our DWMP analysis tools to integrate these results together to provide more time to review data and less time checking and verifying.
- We need to acknowledge that we must continue to capture lessons learned by those responsible for DWMP production, as the first iteration is completed, so that they can be embedded in time for second cycle DWMPs.
- We need to continue to work with the contacts and groups created during the development of the framework, and associated workshops, as a practitioner support network throughout the DWMP process, enabling a shift in focus to a shared vision, to obtain the greatest benefit from net gains.
- We need to ensure that the DWMP Framework and process continues to evolve and embeds current good/best practice.
- We need to develop the framework to facilitate collaborative working with other organisations who can play a role in the implementation journey for the DWMP, such as local authorities.