



Our final plan

Our Drainage and Wastewater Management Plan 2025-2050

Technical Appendices
Appendix T – Groundwater Quality

May 2023



Contents

Preface	4
Executive Summary.....	6
1 Our Drainage and Wastewater Management Plan (DWMP)	8
Our DWMP vision.....	8
Our DWMP aim.....	8
What we're trying to achieve.....	8
Description of the plan.....	8
Framework	8
2 Introduction	9
3 Stakeholder feedback.....	10
Consultation with our stakeholders.....	10
Key feedback	10
4 Context.....	11
What is groundwater?	11
Groundwater contamination.....	11
Potential groundwater contamination risk from sewage.....	12
5 Response to stakeholder feedback.....	15
6 Planning investigations into groundwater quality	17
Planned Thames Water investigations.....	17
Stakeholder Activities	17
Project Groundwater, Chiltern Hills and Berkshire Downs.....	18
Background and challenge	18
Partners.....	18
Partnership solutions	18
Benefits.....	19
Groundwater Impacted System Management Plans (GISMPs)	19
Background and challenge	19
Partners.....	20
Benefits.....	20
7 Conclusion	21
Glossary	22
Navigating our DWMP	26



Figures

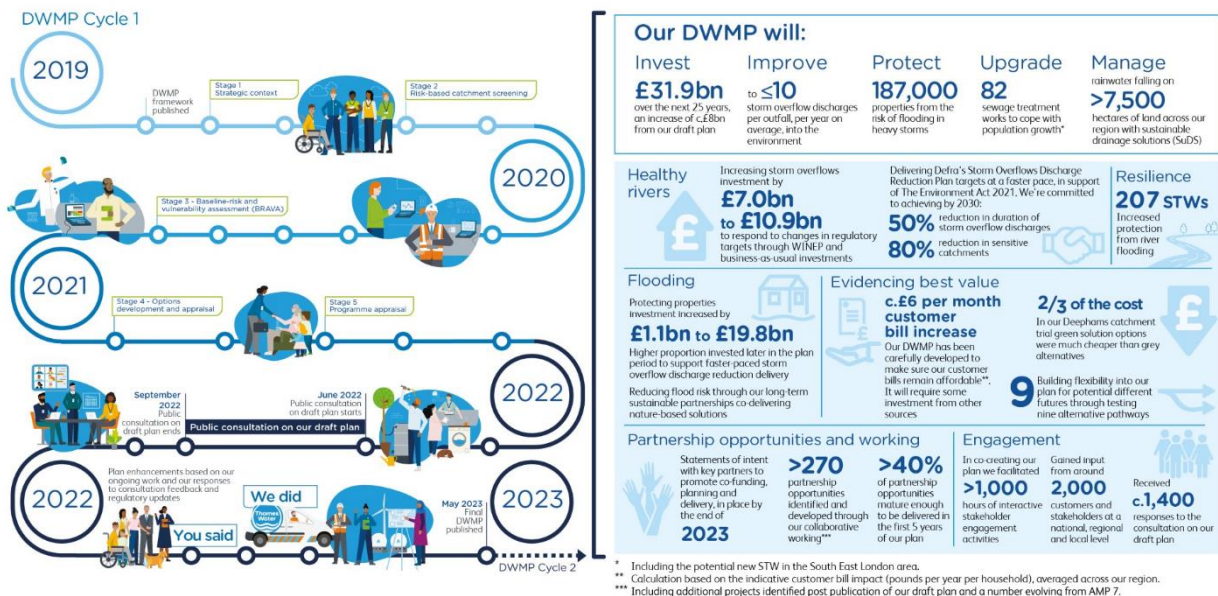
Figure 4-1 The hazards posing a threat to the quality of groundwater (UK Groundwater Forum, 2023)	12
---	----

Tables

Table 4-1 Examples of potential groundwater contamination sources, pathways, and conditions for Thames Water assets.....	14
Table 6-1 Overview of planned WINEP (2025-2035) projects concerning groundwater quality	17

Preface

We're proud to present our first Drainage and Wastewater Management Plan (DWMP) and encouraged by the level of positive feedback we've received. Over the last four years, we've engaged and worked collaboratively with around 2,000 of our customers and stakeholders, to deepen our shared understanding and develop new ways to manage drainage and wastewater across our region. We illustrate our DWMP Cycle 1 and its headlines below.



We've progressed and enhanced our DWMP since we published it for public consultation in June 2022. We were pleased to receive lots of positive comments and support on the quality and ambition of our draft plan as well as useful ideas for making our final DWMP even stronger.

We've updated our draft plan based on our ongoing DWMP work, regulatory updates and our responses to the consultation feedback wherever possible*. Our updates include providing more detail where you felt it was needed and creating new appendices to answer technical queries. For more details on how we've progressed our final plan and responded to the consultation feedback, please see our [Non-technical summary](#) and [You said, We did Technical appendix](#).

* Some public consultation feedback didn't require further action or wasn't relevant to the DWMP process. Other feedback was relevant to future DWMP planning cycles and will be used to inform this work.






Progress signposts

We want to make it easy for you to see what's changed. You can spot all the places we've updated our draft plan with our 'progress signposts' which we've used across our final DWMP documents.

For documents newly created for the fDWMP, we've provided a progress summary table upfront, to demonstrate what type of information the document provides.

Progress summary table

The progress signposts summary table for the chapters in this document is outlined below. We've used orange cells to indicate where our draft plan has been updated with progress.

Progress signposts summary: Appendix T – Groundwater Quality					
	 Progress updated	 More detail or new content	 Number(s) updated	 Delivery timeframe updated	 Informing DWMP cycle 2
1 Our Drainage and Wastewater Management Plan					
2 Introduction					
3 Stakeholder feedback					
4 Context					
5 Responses to stakeholder feedback					
6 Planning investigations into groundwater quality					

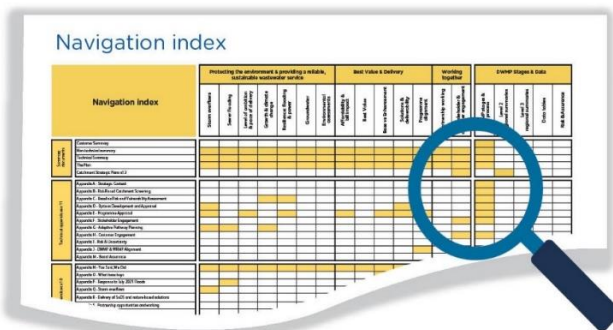
Key DWMP content

This document specifically includes the following key DWMP content:

- Protecting the environment and providing a reliable, sustainable wastewater service:
 - Groundwater

Navigating our documents

To help you navigate around our final DWMP document suite and find where key DWMP content features, we've placed a Navigation index at the back of this document.



Executive Summary

Our draft Drainage and Wastewater Management Plan (dDWMP) was published in June 2022. It's our long-term roadmap that is focused on collaborative and partnership-led working and outlines how we will address the future challenges to our wastewater service. During the consultation period that followed, we engaged with our customers and stakeholder which, has been fundamental to the ongoing development of the final plan.

One of the key pieces of feedback was that we needed to detail our consideration of groundwater quality in our final DWMP. This document responds to this by outlining key feedback, providing context, and summarising our current activities and plans.

Stakeholders would like us to:

- Consider both groundwater quality and quantity through inclusion of a specific planning objective on groundwater quality
- Demonstrate the alignment between other strategic programmes and the DWMP
- Identify areas at higher risk of groundwater contamination from Thames Water assets (depending on asset condition)
- Collaborate with partners to mitigate the risks cause due to groundwater infiltrating sewers and contributing to storm discharges and/or flooding

High level context:

- Groundwater is water present underground, in rocks or other geological strata called aquifers. Groundwater feeds surface water ecosystems, and is abstracted for public water supply, commercial, industrial, and agricultural use
- 30% Thames Water's raw water supply is groundwater. Raw water is treated to strict drinking water standards¹ regardless of its source
- The sensitivity of groundwater bodies to contamination is dependent on their geological setting
- Groundwater can be contaminated by various point and diffuse sources: agriculture, industry, contaminated land, septic tanks, landfill, petrol stations, as well as wastewater assets
- Groundwater contamination can impact surface water ecosystems adversely
- Poor raw water quality leads to higher treatment costs and/or need for blending with higher quality sources to meet strict drinking water quality standards
- Thames Water is thus both impacted by deteriorating groundwater quality as well as potentially impacting it

Current and planned activities:

- **To safeguard water quality in our water abstraction boreholes:** We currently have 15 ongoing groundwater schemes in AMP7 (2020-2025 investment cycle) as part of the Water Industry National Environment Programme (WINEP), which seek to protect groundwater abstraction areas by educating farmers and funding equipment to aid optimal fertiliser and pesticide application. This work will continue and expand in AMP8 (2025-2030 investment cycle) under WINEP.

¹ <https://www.dwi.gov.uk/drinking-water-standards-and-regulations/>

- **To gauge the potential impact of our wastewater assets** on groundwater quality we have eight planned investigations for AMP8 under WINEP. Investigations cover continuous permitted discharges as well suspected leakage from sewers.

1 Our Drainage and Wastewater Management Plan (DWMP)

Our DWMP vision

- 1.1 Working in partnership to co-create a 25-year plan for drainage and wastewater that sustainably benefits communities and the natural environment in our region.

Our DWMP aim

- 1.2 To identify future catchment risks to our drainage and wastewater treatment systems and develop sustainable, efficient solutions to address them.

What we're trying to achieve

- 1.3 Protection of our environment, looking after the health of our rivers (aiming for zero harm from storm overflow discharges), being resilient to the risks of flooding and generating wider benefits to the communities we serve. DWMP outcomes for:
- Customers and communities – fair charges, improved health and wellbeing, increased amenity, and a resilient service
 - Drainage and wastewater services – reduce sewer flooding and achieve 100% Sewage Treatment Works (STW) compliance
 - The environment – increase biodiversity, zero harm from storm overflow discharges, environmental net gain

Description of the plan

- 1.4 A DWMP is a long-term costed plan that is focused on partnership working, which sets out the future risks and pressures for our drainage and wastewater systems. It identifies the actions that are required to make sure we can continue delivering our services reliably and sustainably, while also achieving positive outcomes for our customers, communities and environment.
- 1.5 Our long-term, collaborative plan aims to ensure a resilient and sustainable wastewater service for the next 25 years and beyond.

Framework

- 1.6 This is the first time we've produced a long-term plan for our wastewater business. Based on the national DWMP framework² that was developed jointly by regulators and industry bodies including Ofwat, Defra, the Environment Agency, Water UK, Welsh Government, Natural Resources Wales, Consumer Council for Water, Association of Directors of Environment, Economy, Planning and Transport and Blueprint for Water, the DWMP creates a roadmap for how we adapt our wastewater service to cope with future challenges.

²<https://www.water.org.uk/wp-content/uploads/2019/09/Working-together-to-improve-drainage-and-environmental-water-quality-an-overview-of-Drainage-and-Wastewater-Management-Plans.pdf>

2 Introduction

- 2.1 The draft Drainage and Wastewater Management Plan (dDWMP), published for consultation in June 2022, is our long-term roadmap that outlines how we intend to adapt our wastewater service to cope with the future challenges of population growth and climate change.
- 2.2 Focused on partnership working, the DWMP identifies the actions that we will take to address present and future risks. This will ensure that we continue to deliver our wastewater services reliably and sustainably, achieving positive outcomes for our customers, communities, and the environment.
- 2.3 This document seeks to address stakeholder feedback around our consideration of groundwater quality within the DWMP.

3 Stakeholder feedback

Consultation with our stakeholders

3.1 Since the publication of our draft DWMP we have conducted extensive stakeholder engagement exercises to gather feedback. Using a wide range of methodology to engage with all our stakeholder groups from public and private consumers through to community interest groups and our regulators. The findings from this research can be found in Appendix F - Stakeholder Engagement³.

Key feedback

3.2 Stakeholder feedback is a crucial part of understanding how we can deliver a better service and provide the right information. One of the key pieces of feedback we received during the public consultation was inclusion of groundwater where it is close proximity to the ground surface and therefore potentially interacts with our sewer system as well as the quality of groundwater.

3.3 In the feedback we received from our public consultation; stakeholders provided 61 comments on groundwater from 18 different stakeholder groups. These included (but are not limited to):

- Local Planning Authorities
- Lead Local Flooding Authorities
- Catchment Partnerships
- Other Water Companies
- The Environment Agency (EA)
- As well as individual and community groups

3.4 Stakeholders would like us to:

- Consider both groundwater quality and quantity through inclusion of a specific planning objective on groundwater quality
- Demonstrate the alignment between other strategic programmes and the DWMP
- Identify areas at higher risk of groundwater contamination from our assets (based on asset condition)
- Collaborate with partners to mitigate the risks where groundwater infiltrating sewers may be potentially impacting storm discharges and/or flooding

³<https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-and-wastewater/appendix-f-stakeholder-engagement.pdf>

4 Context

What is groundwater?

- 4.1 The Environment Agency defines groundwater as *“Water stored below the ground in rocks or other geological strata is called groundwater. The geological strata that hold water are called aquifers. Groundwater may rise to the surface through naturally occurring springs or be abstracted using boreholes and wells. Groundwater may also naturally flow into rivers (called base flow) and support wetlands, forming part of local ecosystems.”*
- 4.2 Groundwater is used for public water supply, industrial, and agricultural customers. Depending on the use it will be subject to further treatment.
- 4.3 Around 30% of Thames Waters water supply is groundwater. Raw water is subject to further treatment to meet targets set out in UK regulation⁴.
- 4.4 The level at which rocks or soil underground are saturated with water is known as the water table. The level of the water table changes throughout the year and in specific areas will rise above the ground surface in response to rainfall.
- 4.5 Groundwater emergence above the ground surface will contribute to many surface water environments including wetlands, rivers, and lakes. Some aquatic environments are reliant on the baseflow generated from groundwater.

Groundwater contamination

- 4.6 Contamination of groundwater can originate from a single **point source** or from **diffuse sources** (present across a wide area). Examples of contamination sources could be runoff from roads, fuel storage that is not correctly contained, agriculture, fertilisers, industry, historically contaminated land, and landfill sites that are not properly banded. Figure 4-1 is a diagram from the UK Groundwater Forum⁵ demonstrating some examples of sources of potential groundwater contamination.
- 4.7 The **sensitivity of groundwater bodies to contamination is dependent on their geological setting**: unconfined aquifers are more susceptible to contamination due to the absence of geological protection from the recharge occurring directly onto the ground surface through rainfall and snow, whereas confined aquifers are better protected through impermeable layers between the confined aquifer and the ground surface. Recharge of confined aquifers occurs through rainfall onto unconfined portions of the aquifer, often a significant distance from the confined location. Due to these significant distances, contamination of confined aquifers from the ground surface is much less common.

⁴ <https://www.legislation.gov.uk/uksi/2016/614/contents>; <https://www.dwi.gov.uk/drinking-water-standards-and-regulations/>

⁵ <http://www.groundwateruk.org/>

- 4.8 Key contaminants that are of most concern for groundwater are:
- Nitrogen (e.g., from fertilisers)
 - Microbiological contaminants that can cause human and animal disease
 - Heavy metals
 - Pesticides, fungicides, and herbicides.
 - Perfluoroalkyl and polyfluoroalkyl substances (commonly referred to as “PFAS”)
- 4.9 When groundwater contamination does occur, it is difficult to identify the source due to the various potential contamination point or diffuse sources. This is due to the often vast areas covered by groundwater systems and the very slow (decades) response of some groundwater systems to change.
- 4.10 Groundwater quality is protected by legislation and the Environment Agency is the statutory body responsible for the protection and management of groundwater resources in England.

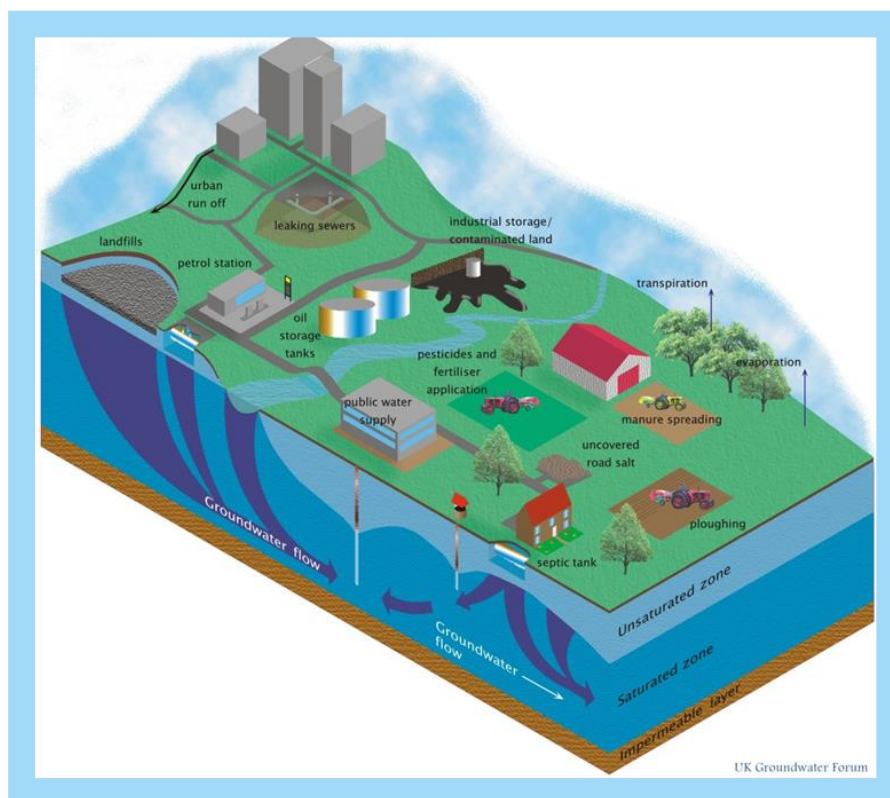


Figure 4-1 The hazards posing a threat to the quality of groundwater (UK Groundwater Forum, 2023)

Potential groundwater contamination risk from sewage

- 4.11 Contamination of groundwater from sewage, below ground, is generally very rare but can occur where a wastewater sewer is in close proximity to a groundwater source and defects in the structural fabric of the sewer exist that allow the escape of sewage. It should be noted that for this to occur a positive head needs to exist between the level of the sewer flow and the surrounding groundwater. Should the groundwater level be higher than the sewer then a positive pressure is exerted on the sewer preventing sewage to escape through the defects, in these instances it is more likely groundwater will infiltrate the sewer.

4.12 Leakage from sewers is dependent on:

- Asset condition
- Sewer surcharge
- Surrounding soil permeability
- A positive head of groundwater over the level of the sewer does **not** exist.

4.13 **Leakage from our assets will not automatically contaminate groundwater.** Contamination is more likely to occur when:

- The sewer in question conveys foul or combined sewage rather than surface water
- There is a substantial amount escaping in volume, duration or widespread leakage
- The underlying groundwater body is an unconfined aquifer
- The groundwater table is close to the asset.

4.14 We inspect sewers as part of maintaining sewer condition and/or where the condition is suspected to be poor, and to be impacting service to our customers. Assets are maintained and remediated in accordance with the Sewer Rehabilitation Manual (WRc 2015).

4.15 Table 4-1 outlines the generic sources, pathways and conditions required for sewage, biosolids, or fuel to enter the groundwater and cause contamination. Please note there are a few locations where treated final effluent is permitted to discharge to a land treatment area and not a river.

4.16 Historic sludge storage practices have not always been what they are today. Sludge was treated and/or stored in un-bunded lagoons or directly on soil. Sludge storage today is on drained concrete pads to prevent potential contamination to groundwater (as well as ground/soil contamination). As with historic landfill sites, there is a risk that historic practices may be linked to future incidences of groundwater contamination.

Source	Potential Contamination Pathway	Asset condition	Environmental conditions	Operational conditions
Sewage	Run off or seepage from a contaminated site (sewage treatment works or pumping station)	Contamination risk increases as assets deteriorate due to age	Contamination risk may increase with rainfall	Contamination risk increases with poor operation such as tanks overtopping, not washing down spills etc.
	Continuous or irregular permitted discharge to a land treatment area			Contamination risk increases with poor operation such as boundary structures and vegetation maintenance
	Sewage spill onto a land treatment area			Contamination risk increases with lack of maintenance to boundary structures and adjacent vegetation
	Leaking sewers and pipes		Contamination risk more likely in dry periods	Contamination risk increases in periods of sewer surcharge.
Sludge and Biosolids	Leaking from biosolids storage assets or historic sludge lagoons areas		Contamination risk increases with rainfall	Contamination risk increases if not inspected regularly/stored appropriately.
Fuel	Leaking fuel tanks			

Table 4-1 Examples of potential groundwater contamination sources, pathways, and conditions for Thames Water assets.

5 Response to stakeholder feedback

Consider both groundwater quality and quantity through inclusion of a specific planning objective on groundwater quality

- 5.1 Assuming that there is sufficient flexibility in the cycle 2 framework, we intend to extend our consideration of impacts to groundwater quality by the following activities:
- Map sensitive receptors (using buffering of area of influence):
 - Abstraction areas (Source Protections Zones & Groundwater Quality Safeguard Zones)
 - Environmentally sensitive areas reliant on baseflow provided by groundwater bodies or impacted disproportionately by poor quality (e.g., SSSI (Site of Special Scientific Interest), SPA (Special Protection Area), RAMSAR, chalk streams, etc.).
 - Map potential Thames Water wastewater asset contamination sources.
 - Screening of sites by identifying and mapping the overlap between the sensitive receptors and potential contamination sources.
 - Categorise likely impact based on:
 - Sewers – geological setting, hydrogeological soil characteristic, sewer type, length, condition, distance to groundwater
 - STW discharge land treatment areas – duration or volume of discharge vs. receptor sensitivity and dilution
 - Storm overflows that discharge to land treatment areas – duration or volume of discharge vs. receptor sensitivity and dilution
 - Locations of wetlands / use of Natural Flood Management / SuDs to manage storm flows.
 - Any identified high-risk locations could then in be included in other programmes for further investigation, such as WINEP.
-

Demonstrate the alignment between other strategic programmes and the DWMP

- 5.2 Most current and planned groundwater quality investigations are delivered as part of WINEP. We will consider the inclusion of a Groundwater Quality Objective in the next DWMP cycle (framework permitting) as outlined above
- 5.3 In AMP7, Thames Water developed an industry leading approach to the strategic management of groundwater infiltration in sewers. It had long been recognised the impact groundwater is having on sewerage systems, as part of managing groundwater the focus traditionally had been on sewer condition. However, given that sewers even when new are not designed to be water-tight, maintaining the sewerage system asset health alone would never be sufficient. Thames Water working with JBA's groundwater mapping plans have developed 54 Groundwater Impacted System Management Plans, developed with input from the Environment Agency which we have published on our website. This innovative

approach to managing the impact of groundwater infiltration adopts an Institute of Asset Management technique of Plan-Do-Check-Act, which through a multi-AMP approach will lead to a step change in the way groundwater infiltration is managed in sewerage systems.

Identify areas at higher risk of groundwater contamination from Thames Water assets (depending on asset condition)

- 5.4 Please see comments above on a potential new planning objective for the next DWMP cycle, which would be highlighting areas which are at higher risk.
-

Collaborate with partners to mitigate the risks caused due to groundwater infiltrating sewers and causing storm discharges and/or flooding

- 5.5 To safeguard water quality at our abstraction boreholes, we have been working primarily with farmers to improve groundwater quality since 2011. We currently have 15 ongoing groundwater schemes in AMP7 (2020-2025 investment cycle) as part of the Water Industry National Environment Programme (WINEP), which seek to protect our groundwater abstraction areas by working with farmers and funding equipment which will aid the optimal application of pesticides and fertilisers, to limit leaching into the groundwater. Please find details about our ongoing catchment management schemes here. This work is continued and expanded in AMP8 (2025-2030 investment cycle) under WINEP. Please find further details in sections below.

6 Planning investigations into groundwater quality

Planned Thames Water investigations

6.1 In January 2023 we submitted our WINEP Cycle 2 (2025-2035) proposals to the EA. The feedback from the EA is expected in summer 2023 (after the publication of the final DWMP). The list of groundwater related projects submitted can be found in Table 6-1. These cover source detection of nitrates and metazachlor (a herbicide), and the review of the effectiveness of previous interventions, as well as investigations into potential impact from sewer leakage and continuous discharges. More detail about these is provided in subsections below.

Category	Theme	Area
Working with farmers to reduce the impact of fertilisers and pesticides on groundwater	Drinking Water Protected Area	Cleeve, Oxfordshire
		Woods Farm SGZ (safeguard zones), Parsonage Green , Wiltshire
	Groundwater impact of spreading biosolids on agricultural land	No location defined
Investigating potential impact of our wastewater assets on groundwater quality	Suspected Sewer (exfiltration) leaking	College Avenue, Maidenhead
		Windmill Hill, Alton
		Groundwater body: Epsom North Downs Chalk
		Groundwater body: North Kent Medway Chalk
		Groundwater body: West Kent Darent and Cray Chalk
	Suspected Continuous discharge	Groundwater body: Mid-Chilterns Chalk
		Groundwater body: Lower Thames Gravels
		Groundwater body: Upper Lee Chalk
Strategic management of groundwater impacted sewerage systems	Investing to enhance sewer water-tightness properties in high-risk areas	Various locations across the Thames Valley & Home Counties. ⁶

Table 6-1 Overview of planned WINEP (2025-2035) projects concerning groundwater quality

Stakeholder Activities

6.2 We have many stakeholders working and interested in groundwater risks. This includes a large overlap with flooding caused by high groundwater and discharges from storm overflows impacted by groundwater infiltrating our sewers.

6.3 Buckinghamshire County Council has developed their Department for Food and Rural Affairs (Defra) funded “Project Groundwater.” This is £7.7m of investment funded by Defra’s Flood and Coastal Resilience Innovation programme that aims to:

⁶ [Drainage Plans](#) | [Regulation](#) | [About us](#) | [Thames Water](#) – link to Groundwater Impacted Systems Management Plans

- Share understanding and increase awareness of groundwater
- Actively monitor flood events and improve warning systems
- Prepare communities to respond to and withstand flood events

6.4 A brief case study has been written up by Project Groundwater⁷ and included below.

Project Groundwater, Chiltern Hills and Berkshire Downs

Background and challenge

6.5 Groundwater flooding typically affects small, rural communities. This type of flooding often fails to qualify for flood management funding, which leads to a variety of challenges faced by communities and local flood authorities. These include:

- Lack of information about the risks of groundwater flooding
- Insufficient research, mapping and monitoring
- Little community engagement
- No comprehensive groundwater flood warning system
- Not enough effective ways to manage volumes and duration of floods
- People are often unprepared and unconnected making it hard to support one another and recover

6.6 In the Chiltern Hills and Berkshire Downs, people experience groundwater flooding from water held in the chalk and gravel aquifers. Almost 200 communities and 70,000 properties are at risk of flooding from groundwater in this area alone.

Partners

6.7 Buckinghamshire Council, Local Authorities and Flood Community Groups, Defra and the Environment Agency.

Partnership solutions

6.8 This 6-year programme is working with our partners to transform how communities prepare and respond to groundwater flooding. Project Groundwater is focused on communities in up to nine high-risk flood areas of the Chiltern Hills and Berkshire Downs. It's led by Buckinghamshire Council, five other Local Authorities and Flood Community Groups and is part of Defra's Flood and Coastal Resilience Innovation Programme. The programme is managed by the Environment Agency and is investing £150 million to develop and test innovative and practical approaches to increase resilience in local communities.

6.9 There are 7 workstreams, outlined below, that will address the challenges of groundwater flooding and support communities to become more flood resilient:

- **Engagement and communications** - Coordination of engagement with communities, businesses and partners and production of communications materials
- **Monitoring** - Understand and improved monitoring of groundwater levels which could lead to flooding
- **Modelling** - Model and map groundwater flood hazard in areas of chalk and permeable superficial deposits

⁷ <https://www.projectgroundwater.co.uk>

- **Alerts** - Developing a web-based flood alert service to provide communities with warning of potential groundwater flooding incidents. Currently there are few alert services that cover groundwater flooding, so this will support communities to better prepare and respond
- **Resilience** - Researching and test innovative methods for increasing resilience to groundwater flooding. This includes: updates to properties to increase resilience, methods to prevent groundwater flooding from reaching properties and community resilience to withstand flood events
- **Placemaking** - Strengthen the consideration of groundwater in the planning system. This will include development of ideas for nature-based solutions and investigation of Sustainable Drainage Systems. The aim is to create places that are more resilient to flooding
- **Evaluation, learning and innovation** - Innovation is a fundamental value across all workstreams in the project. We need to constantly evaluate our progress and learning from our work and from our communities

Benefits

6.10 Project Groundwater will transform how communities prepare and respond to groundwater flooding. Increasing our understanding of how groundwater flooding impacts communities will help the people and properties in this area but also inform work in other areas at risk from groundwater flooding. The benefits to the local communities in this area are:

- Increased awareness and understanding of groundwater flooding
- Project outcomes influenced and guided by the needs and wishes of local communities
- Improved monitoring to help us develop more innovative solutions
- Building a library of hazard map outputs to support the creation of the groundwater flood alert service
- Alert service to support communities to better prepare and respond to groundwater flooding
- Creation of a best practice toolkit for communities at risk of groundwater flooding
- Consideration of groundwater flooding in the planning system to create places more resilient to flooding
- Increasing our learning from evaluating our progress and working in partnership with our communities

Groundwater Impacted System Management Plans (GISMPs)

Background and challenge

6.11 The general approach to the management of groundwater infiltration impacting sewerage systems has been to focus on the asset health of the sewerage system by tackling defective sewers. Attending to just sewer condition has been found in many areas to be ineffective as sewers are not designed to be watertight. The challenge is to develop a cost effective approach to sewer sealing that delivers the optimum level of resilience efficiently. These include:

- Industry standard approach to sewer design includes for an allowance for groundwater infiltration (typically 10% of peak dry weather flow).
- Infiltration can occur at structurally sound joints and not just defects.
- Manholes are just as susceptible to infiltration as pipes.

- Soil type / geology is a key component of groundwater infiltration being highly impactful.
- Separate foul sewers are at greater risk of impact of groundwater infiltration than combined sewers, due to simply how they are sized.
- Advances in the mapping of groundwater levels offers considerable insight into potential groundwater infiltration impacted areas.

6.12 Following the winter of 2019 / 2020, during which groundwater infiltration impact peaked above that of an average year, Thames Water embarked on developing a new strategic approach to the management of groundwater infiltration in sewers.

6.13 To date working with the Environment Agency, we have developed 54 GISMP plans that are published on our website. We have started to implement this approach in Bourton on the Water and Chesham. The approach is an iterative technique developed to meet the desired outcome for the most efficient scale of activity, using a Plan-do-check-act approach.

Partners

6.14 Local communities where possible.

Benefits

6.15 Groundwater Impacted system management plans offer a step change in the approach to the management of groundwater in sewers, adopting an innovative approach to the problem. The benefits to the local communities in this area are:

- Increased awareness and understanding of groundwater infiltration
- Awareness for developers as to where sewer groundwater infiltration risk could exist
- Through a network of monitoring the basis for measuring achieved benefit as well as means for monitoring changes in future risk
- By removing unwanted groundwater from the sewer, we create capacity for future growth reducing the need to replace or upsize sewers prematurely
- Reduced local community impact; tankering and over-pumping to manage excess groundwater flows are negated
- Climate change resilient, should climate change increase or prolong groundwater peak levels the consequential impact on the sewers will be eliminated / lowered
- Reduced risk of pollution / flooding
- Improved water quality / river base flow by ensuring groundwater is kept in the natural environment.

These are first iteration of these plans, and we implement them our knowledge will grow, and we can investigate extending the coverage beyond the current 54 systems, if appropriate.

7 Conclusion

- 7.1 This first DWMP is our start of a long term, iterative approach to planning for wastewater. It was non-statutory. The second cycle of the DWMP is statutory with the framework under the control of Defra.
- 7.2 We are keen to develop and enhance our work relating to groundwater within the DWMP. This is dependent on how the statutory framework for cycle 2 evolves.
- 7.3 This document aims to introduce the wider activities underway for groundwater and specifically groundwater quality and how those can be incorporated into the DWMP.

Glossary

Term	Description
1 in 30-year storm	A storm that has a 1 in 30 chance (3.33% probability) of being equalled or exceeded in any given year. This does not mean that a 30-year flood will happen regularly every 30 years, or only once in 30 years.
1 in 50-year storm	A storm that has a 1 in 50 chance (2% probability) of being equalled or exceeded in any given year. This does not mean that a 50-year flood will happen regularly every 50 years, or only once in 50 years.
Asset Management Plan (AMP)	A five-year planning cycle used by English and Welsh water industry regulators to set allowable price increases for privately owned water companies and for the assessment of performance indicators such as water quality and customer service.
Baseline Risk And Vulnerability Assessment (BRAVA)	Following Risk Based Catchment Screening (RBCS), more detailed risk assessments on those catchments where we believed there was an adverse risk to performance over time. We modelled their performance to 2020 (baseline), 2030, 2035 and 2050.
Business Plan	Business Plans are produced by water companies every 5 years. They set out their investment programme to ensure delivery of water and wastewater services to customers. These plans are drawn up through consultation with the regulators, stakeholders and customers and submitted to Ofwat for detailed scrutiny and review.
Catchment Strategic Plans (CSPs)	Summary reports to promote system thinking across large wastewater catchments. These provide early sight of our final plans enabling co-authoring opportunities for our stakeholders. Each document outlines the challenges that the catchment will face in the future and the long-term plans to address these issues.
Combined sewer	A sewer designed to receive both wastewater and surface water from domestic and industrial sources to a treatment works in a single pipe.
Customer Challenge Group (CCG)	An independent body that challenges both our current performance and our engagement with customers on building our future plans.
Cycle 1 and Cycle 2 DWMP	Our current DWMP is referred to as Cycle 1, it covers a planning period of 2025–2050. Our next plan will be published in five years' time and is referred to as our Cycle 2 DWMP, it will cover a planning period of 2030–2055.
Department for Environment, Food and Rural Affairs (Defra)	UK government department responsible for safeguarding the natural environment, food and farming industry, and the rural economy.
Drainage and Wastewater Management Plan (DWMP)	A Drainage and Wastewater Management Plan (DWMP) is ' <i>a long-term strategic plan that sets out how wastewater systems, and the drainage networks that impact them, are to be extended, improved and maintained to ensure they are robust and resilient to future pressures</i> '. The planning period is 25 years, from 2025 to 2050. DWMP is iterated every five years; the first known as 'Cycle 1', published as a final plan in May 2023.
dDWMP	The draft version of the Drainage and Wastewater Management Plan, published in June 2022.
fDWMP	The final version of the Drainage and Wastewater Management Plan, to be published in May 2023.
Dry Weather Flow (DWF)	Dry Weather Flow is the average daily flow to a Sewage Treatment Works (STW) during a period without rain.

Environment Agency (EA)		UK government agency whose principal aim is to protect and enhance the environment in England and Wales.
EA Categories 1 to 3	Pollution	<p>Category 1 incidents have a serious, extensive or persistent impact on the environment, people or property.</p> <p>Category 2 incidents have a lesser, yet significant, impact.</p> <p>Category 3 incidents have a minor or minimal impact on the environment, people or property with only a limited or localised effect on water quality.</p> <p>Further Ofwat guidance available here: WatCoPerfEPAmethodology v3-Nov-2017-Final.pdf (ofwat.gov.uk)</p>
Event Monitoring (EDM)	Duration	Event duration monitoring (EDM) measures the frequency and duration of storm discharges to the environment from storm overflows.
External sewer flooding	hydraulic	<p>External flooding occurs within the curtilage of a property due to hydraulic sewer overload.</p> <p>Further Ofwat guidance available here: Reporting-guidance-sewer-flooding.pdf (ofwat.gov.uk)</p>
Foul sewer		A foul sewer is designed to carry domestic or commercial wastewater to a sewage works for treatment. Typically, it takes wastewater from sources including toilets, baths, showers, kitchen sinks, washing machines and dishwashers from residential and commercial premises.
Grey infrastructure		New sewers, sewer upsizing and attenuation storage to provide additional capacity in the wastewater networks. Also covers new pumping stations, rising mains and/or civil structures at STWs.
Green infrastructure		Sustainable surface water management solutions, including sustainable drainage systems (SuDS), that are designed to mimic naturally draining surfaces. Typically applied to surface water or combined sewerage systems, but can also be applied to land, highway or other forms of surface drainage.
Historic England (HE)		A non-departmental public body of the government whose aim is to protect the historical environment of England by preserving and listing historic buildings, ancient monuments.
Hydraulic overload		Hydraulic overload occurs when a sewer or sewerage system is unable to cope with the receiving flow.
Internal sewer flooding	hydraulic	<p>Flooding which enters a building or passes below a suspended floor caused by flow from a sewer.</p> <p>Further Ofwat guidance available here: Reporting-guidance-sewer-flooding.pdf (ofwat.gov.uk)</p>
L2 Area (Strategic Planning Area)		An aggregation of level 3 catchments (tactical planning units) into larger level 2 strategic planning areas. The level 2 strategic planning areas allow us to describe strategic drivers for change (relevant at the level 2 strategic planning area scale) as well as facilitating a more strategic level of planning above the detailed catchment assessments.
L3 (Tactical Unit)	Catchment Planning	Geographical area in which a wastewater network drains to a single STW. Stakeholders may be specifically associated with this area. Includes for surface water sewerage that may exist which serves the wastewater geographical area but drains to a water course.
Lead Authorities (LLFAs)	Local Flood	LLFAs are Risk Management Authorities as defined by the Flood and Water Management Act 2010. They have statutory duties with respect to flood risk management, investigating flooding and the compilation of surface water management plans.

Long-Term Delivery Strategy (LTDS)	A requirement by Ofwat on water companies, to ensure that short term expenditure meets long term objectives for customers, communities, and the environment. These will be submitted as part of the Price Review.
Misconnections	Misconnections are where either surface water drainage or foul water is connected to the wrong system e.g., surface water to foul only or foul to surface water systems.
Natural capital accounting	The process of calculating the total stocks and flows of natural resources in a given system, either in terms of monetary value or in physical terms.
Natural England (NE)	A non-departmental public body sponsored by the Department for Environment, Food and Rural Affairs to protect the natural environment in England, helping to protect England's nature and landscapes.
Non-governmental organisation (NGO)	An organisation that operates independently of any government, typically one whose purpose is to address a social or political issue.
Options Development and Appraisal (ODA)	A method to focus the level of planning effort, i.e., proportionate to the risks identified, with a view to providing a measure of consistency across the industry.
Ofwat	The regulatory body responsible for economic regulation of the privatised water and wastewater industry in England and Wales.
PR24	<p>Every five years, water companies set out their plans for what they'll deliver and how much they'll charge customers⁸. Their plans over the next five years should include how they will:</p> <ul style="list-style-type: none"> • Provide a safe and clean water supply • Provide efficient sewerage pumping and treatment services • Control leaks • Install meters • Maintain pipes and sewers • Maintain and improve environmental standards <p>This process is known as the price review, and the next one will be in 2024, when Ofwat will make its final decisions. We call this PR24.</p>
Risk-Based Catchments Screening (RBCS)	A first-pass screening exercise of catchment vulnerability against 17 different risk indicators. To understand which catchments are low risk catchments and those that are likely to be at risk in the future if not supported by our long-term plan.
Risk Management Authorities (RMAs)	Authorities responsible for Flood Risk as defined in the Flood and Water Management Act 2010. These include, Lead Local Flood Authorities, Highway Authorities, Local Planning Authorities, Natural England and the Environment Agency.
Sewage Treatment Works (STW)	A sewage treatment works receives and treats wastewater to a standard legally agreed with the Environment Agency, before it is released back into the environment.
Specific, Measurable, Achievable, Relevant, and Time-Bound (SMART)	A framework for setting effective targets.
Storm overflow discharges	Storm overflows are used to manage excess flows, which typically occur as a result of heavy rainfall. Excess flow that may otherwise have caused flooding is released through a designated outfall to a water course, land area or alternative drainage system.

⁸ <https://www.ccwater.org.uk/priorities/price-review/>

Strategic Environmental Assessment (SEA)		A systematic decision support process to ensure that environmental and other sustainability aspects are considered effectively in policy, plan and programme making.
Surface water sewer		A surface water sewer collects rainwater from domestic and commercial roofs, driveways, patios etc to a local watercourse or suitable surface water drainage system.
Sustainable Drainage systems (SuDS)		Drainage solutions that provide an alternative to the direct channelling of surface water through networks of pipes and sewers to nearby watercourses. SuDS aim to reduce surface water flooding, improve water quality, and enhance the amenity and biodiversity value of the environment. SuDS achieve this by lowering flow rates, increasing water storage capacity and reducing the transport of pollution to the water environment.
Thames Flood and Committee area	Regional Coastal (TRFCC)	The TRFCC area was established by the Environment Agency under the Flood and Water Management Act 2010 that brings together members representing the Constituent Authority. Featured TRFCCs are listed here on our DWMP portal: Drainage and Wastewater Management Plan (arcgis.com)
Water National Environmental Programme (WINEP)	Industry	The framework under which Defra and the EA require environmental improvements to be delivered by water companies. Guidance is released by regulators, which water companies interpret for their geographical area, and resubmit the outputs back to regulators for endorsement.

Navigating our DWMP

We've developed a comprehensive document suite to share our final DWMP. This includes five summary documents that contain increasing levels of detail. To help you to navigate around our document suite and to find key DWMP content, we provide a Navigation index below and on our DWMP webpage. The orange cells refer to where key DWMP content can be found across our final document suite.

Navigation index		Protecting the environment and providing a reliable, sustainable wastewater service						Best value and delivery					Working together		DWMP stages and data					
		Storm overflows	Sewer flooding	Level of ambition & pace of delivery	Growth & climate change	Resilience: flooding & power	Groundwater	Environmental assessments	Affordability & bill impact	Best Value	Base vs Enhancement	Solutions & deliverability	Programme alignment	Partnership working	Stakeholder & customer engagement	DWMP stages & process	Level 2 regional summaries	Level 3 regional summaries	Data tables	Risk & Assurance
Summary documents	Customer summary																			
	Non-technical summary																			
	Technical summary																			
	The Plan																			
	Catchment Strategic Plans x13																			
Technical appendices x11	Appendix A - Strategic context																			
	Appendix B - Risk-Based catchment screening																			
	Appendix C - Baseline risk and Vulnerability assessment																			
	Appendix D - Options development and appraisal																			
	Appendix E - Programme appraisal																			
	Appendix F - Stakeholder engagement																			
	Appendix G - Adaptive pathway planning																			
	Appendix H – Customer engagement Part A – Draft DWMP																			
	Appendix I - Risk and uncertainty																			
	Appendix J - DWMP and WRMP alignment																			
	Appendix M - Assurance																			
New technical appendices x9	Appendix N - You Said, We Did (YSWD)																			
	Appendix O - What base buys																			
	Appendix P - Response to July 2021 Floods																			
	Appendix Q - Storm overflows																			
	Appendix R - Delivery of SuDS and nature-based solutions																			
	Appendix S - Partnership opportunities and working																			
	Appendix T - Groundwater quality																			
	Appendix U - Resilience																			
	Appendix V – Customer engagement Part B – Consultation Survey Report																			
Environmental assessments	Appendix K - Strategic environmental assessment (SEA)																			
	Appendix L - Habitats regulations assessment (HRA)																			
Portals and data	Customer portal																			
	Practitioner portal																			
	Data tables																			
	Data tables commentary																			

We welcome your views on our DWMP. Please share them with us by emailing:
DWMP@thameswater.co.uk.

This document reflects our DWMP 2025-2050 as published in May 2023.

