



Groundwater Impacted System Management Plan

Ramsbury, River Kennet

December 2020



It's everyone's water

Version control

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Introduction

This document sets out Thames Water's approach to the management of groundwater infiltration in sewerage systems where the influence of groundwater infiltration is viewed as being significant and likely to lead the sewerage network, on occasions, becoming overwhelmed.

All sewerage systems combined and separate will experience some groundwater infiltration¹ and a nominal allowance in design will be made for this. However, in some catchments the impact of groundwater infiltration can be considerable leading to impacts on service during periods of high groundwater, typically during the winter.

Groundwater can enter the sewerage system through the pipes and manholes, this may occur at a defect (crack, hole, displaced joint) or on a normal joint on the sewer or in the manhole. A key point to note is that where infiltration occurs it is not necessarily an indicator that the sewer is in poor structural state simply that jointing techniques used are not completely watertight.

Ingress of groundwater is not limited to the public system that Thames Water owns and maintains but potentially the private drains, manholes and sewers that connect to our system.

Preventing and reducing the impact of groundwater infiltration is predominately achieved through the lining of sewers and

sealing of manholes. This entails the application of a synthetic liner within the pipe that creates a contiguous membrane for the length of the pipe or possibly section if the source of ingress can be narrowed down. For manholes it will typically entail sealing in a similar manner.

To line all sewers and manholes within most catchments would be prohibitively expensive to do so. Our approach to date has been centred on a 'find and fix' basis which has involved monitoring and investigating the networks in periods of high groundwater to identify sources of ingress and fix as we find them. This approach is constrained for the reason that investigations are typically limited to periods of high groundwater and when high groundwater occurs there are limited windows of time in which investigations can be successfully undertaken before flows either subside or the system is fully surcharged meaning CCTV surveys are not possible². Once sections of sewers have been lined, it will be a case of waiting until high groundwater levels reoccur to assess the effectiveness of the work undertaken, which may not be the subsequent winter but several years later.

It is recognised that the 'find & fix' approach to date lacks a degree of certainty of resolution and for this reason Thames Water has in 2020 undertook a different approach for the medium to long-term management of groundwater, which is covered within this

¹ Sewers for Adoption makes an allowance for 10% of peak wastewater flow to allow for unaccounted flows such as groundwater infiltration.

² On occasions it is possible to over-pump between manholes to isolate sections of sewer to survey, this is not always feasible when the flows involved are simply too great to over-pump or the location prohibits this approach.

document under the plan section. These plans require significant investment which Thames Water will seek to secure. In the meantime, we will continue to investigate sources of infiltration when it occurs and where feasible, undertake the work through our capital maintenance budgets. We refer to these as 'quick win' opportunities i.e. where we have high degree of certainty of reducing point sources of infiltration and can do so with reasonable costs and time.

The structure of this document has been created with input from the Environment Agency and structured around the Environment Agency's Regulatory Position Statement (RPS) for 'Discharges made from Groundwater Surcharged Sewers' (Dated: December 2016). Sections covered in this document include our 'Outline Plan' with timescales, locations of anticipated 'Unavoidable discharges', Mitigation i.e. how we intend to manage the risk until our plan is fully implemented and when we will publish future updates on progress against this plan. If we need to make an unavoidable discharge we will provide an authorisation document to the Environment Agency seeking their approval for any temporary discharge of groundwater surcharged sewers.'

Brief description of Ramsbury catchment

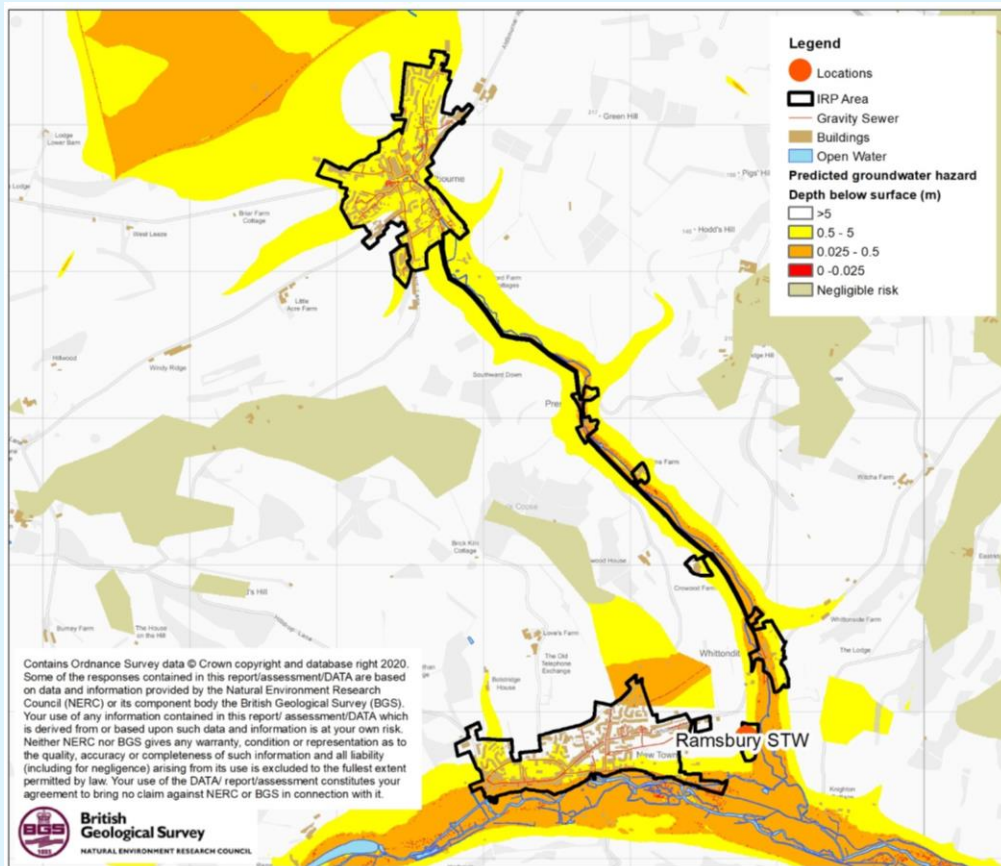


Figure 1.0 – Ramsbury catchment

Ramsbury is located in the Kennet Valley, Wiltshire, England. The nearest towns are Hungerford (4.5 miles East) and Marlborough (5.5 miles West) with Swindon 12 miles to the North West. Ramsbury serves a population equivalent³ of 3,270 with a predominantly separate sewerage network totalling some 17 km in length excluding private drains and sewers. The extent of the catchment is shown in Figure 1.0 above.

Problem characterisation

Groundwater has the potential to enter our sewers when levels are high which reduces their capacity and increases their risk of flooding. There is an observed link between the rising groundwater levels across the Aldbourne area and the drainage issues some of our customers have experienced, including sewer flooding and restricted use of their toilets and bathrooms. Due to the Chalk geology in the Aldbourne area, the area is

³ Population equivalent or unit per capita loading, (PE), in waste-water treatment is the number expressing the ratio of the sum of the pollution load produced during 24 hours by industrial facilities and services to the individual pollution load in household sewage produced by one person in the same time.

susceptible to groundwater flooding which tends to last for weeks or months. This tends to be caused by long duration and high intensity rainfall, resulting in high river levels in the Kennet and the Aldbourne Stream, activation of springs and infiltration into sewers.

In recent years the foul sewerage system in the Aldbourne sub-catchment of Ramsbury has become overwhelmed for weeks at a time, following prolonged heavy rainfall. This has resulted in pollution issues, properties suffering from sewer flooding and restricted toilet use.

We believe that the system has surcharged due to a combination of groundwater infiltration, surface water run-off from saturated fields, surface water inundation from highways, public spaces and properties, and surface water misconceptions. The impact of the groundwater infiltration and high flows in Aldbourne has overloaded the gravity sewers and sewage pumping station. Surface water and fluvial flows also enter the sewerage system causing some properties to flood and suffer instances of restricted toilet use, along with pollution. During the winter of 2012/13 and 2013/14 tankers operated 24 hours a day to maintain services to customers.

Thames Water is responsible for the collection and treatment of commercial and domestic sewage. Typically, this will be the foul sewerage. Domestic or commercial roof and paved drainage will often go to a soakaway or directly to a water course/river, which if so is not the responsibility of Thames Water.

The Flood and Water Management Act 2010 places a responsibility on Lead Local Flood Authorities (LLFAs), to manage flood risk from surface and groundwater, plus a duty on all Risk

Management Authorities (RMAs), to cooperate regarding flood risk. In our role as an RMA, Thames Water will work with West Berkshire Council as the lead local flood authority and as the planning authority, and the Environment Agency to ensure that a collaborative approach can be developed to address the problems.

Thames Water also has a statutory obligation to comply with environmental legislation. The Water Framework Directive establishes a strategic approach to managing the water environment, which the Environment Agency achieves through River Basin Management Plans and setting environmental objectives for groundwater and surface water. The environment is also protected from adverse effects of discharges of urban wastewater through the Urban Wastewater Treatment Directive, which requires us to improve and extend the sewerage system according to section 94 of the Water Industry Act (1991).

'Look and Lift' and CCTV surveys of the sewer network found a number of locations where groundwater is entering our network through cracks and other defects. The CCTV footage that we recorded found groundwater entering our network around the joints in the sewer pipe at several locations in the Aldbourne area, and in the sewer down to Whittonditch sewage pumping station. The findings of this survey were supplemented by an additional CCTV survey in 2019/20 detailed in the Appendix of this document. A total of 2,307m of sewers upstream of Whittonditch sewage pumping station have already been lined with watertight lining.

The root causes of sewer surcharges are therefore numerous and resolution of

issues complex, requiring all stakeholders responsible for drainage in the catchment to work together to resolve them. Ramsbury STW includes a storm tank to handle excess flows which stores storm flows and returns them to treatment when the flows subside. Excess flows from the storm tank discharge via a screening chamber to the River Kennet when it is full.

In recent years wet weather events have led to overflowing manholes discharging flows onto the highway and into the Aldbourne Stream and restricted toilet use at several properties.

Anticipated unavoidable discharges

Surcharges from groundwater infiltration currently affect the village square, which sees sewer discharge enter the River Kennet via Roadside Gullies (RSGs) and overland routes.

The works identified within this plan should reduce groundwater infiltration and the risk of surcharges. However, in the short to medium terms these unavoidable discharges may continue to occur in times of high groundwater levels.

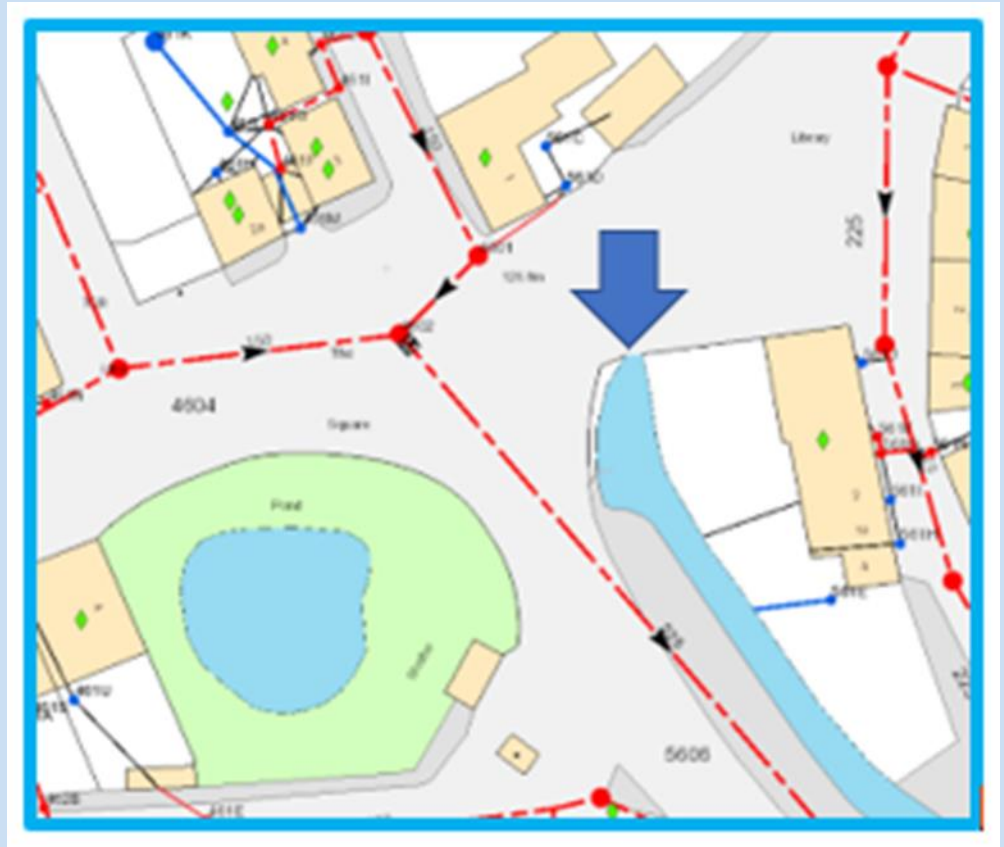
The surcharge in Aldbourne square is due to a fully charged line from the Lottage Road network area as a consequence of continued high groundwater from this area. The strategy to deal with temporary surcharges involves the deployment of an ATAC Biofilter in the carpark to the front of the library to relieve flows from the Lottage Road area (see table below for further

details). This sees the majority of the groundwater still remain in the sewage system. Tanker support would still be used to manage flows in the other sections of the network, if required. The over pumps will also remain in place in Preston to ensure flows are optimised is achieved within the foul system.

Anticipated unavoidable discharges

Location

Lottage Road, Aldbourne. The ATAC would be deployed to the carpark to the front of the library, this would then draw flows from the Lottage Road area via MH 5607. Following filtration, it would then pass flow forward via an unmapped culvert MH. Flows from the culvert MH would be discharged to 51°28'45.4"N 1°37'10.8"W (51.479269, -1.619665)



Discharges

10-20l/s

Mitigation

In order to ensure the current system is working to maximum capability the following actions will be carried out:

- Regular sewer investigations (and resultant sewer cleaning) to remove any blockages.
- During our investigations it has been identified that two areas in the downstream Preston section of the Aldbourne catchment have obstructions restricting sewage flows. To rectify, x2 over pumps will be deployed to the downstream catchment of Preston, enabling a bypass of these sections and ensure maximum flows are passed forward (over pumping of the foul system to the foul system).
- Ongoing investigations and remediation of priority infiltration sources as outlined in this document.
- Tankering where appropriate in other areas of the system.

Anticipated unavoidable discharges

	<p>In order to minimise the impact on the watercourse the discharges will be treated via an ATAC Biofilter which removes solids and biological loading from wastewater influents, whilst also adding dissolved oxygen into the effluent flow.</p>
Mitigation	<p>Should flows stay within the sewer, and not reach the volume to discharge from the sewer, no discharge to the river will take place.</p>
Monitoring	<p>During periods of discharge daily samples of water quality will be taken upstream and downstream to assess impact on the river amenity, use and quality.</p> <p>The following parameters at a minimum will be tested:</p> <ul style="list-style-type: none">• Biological Oxygen Demand• ammonia• solids• phosphorus• and bacterial quality including E. Coli
Contact	<p>If discharges occur the Environment Agency will be informed (by logging through the Agency's National Incident Communication Service). For any other reporting please use the Environment Agency pollution reporting number 0800 807060. In addition, local community representatives will be informed.</p> <p>If the ATACs are deployed signage will be placed in the locality and local letter drops carried out to inform residents. An example of the type of signage and information displayed is shown in the appendix of this document.</p>

General outline plan & timescale

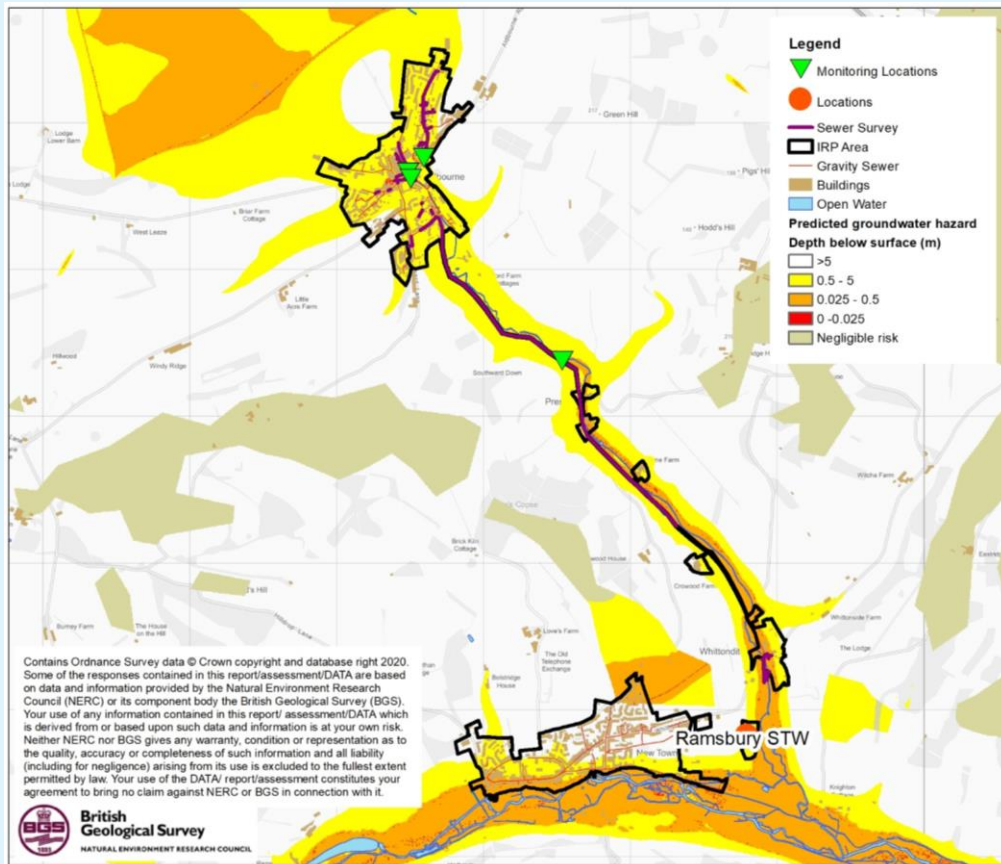


Figure 2.0 – Ramsbury monitoring and infiltration zones

Key to bringing the impact of groundwater infiltration under control will be an enhanced monitoring regime. We have identified and have installed several telemetered depth monitor locations around the Ramsbury system – see Figure 2.0.

Complimenting the flow [at the treatment works] and depth measurement [in the sewer network] we will use pumping station run time data, rainfall data, river level data, and groundwater level data to create a full picture of movement and source of flows around the catchment.

Zones of Groundwater Risk

We engaged with JBA Consulting to develop plans for Ramsbury that identify zones of groundwater risk, see Figure 2.0. These zones are modelled areas where the groundwater has been determined to be above the sewer and hence pose a potential risk for groundwater ingress.

The sewer depth monitors referred to earlier are being sited in and around these zones to verify and calibrate the risk in each of the zones.

If following the proposal to the sealing in part or wholly⁴ of the high risk zones, should it be required, the system is found to be still experiencing excessive infiltration we would then look to potentially seal 'private' laterals and/or drains along with starting to seal the medium to low risk zones.

This document sets out an unconstrained approach to resolving the impact of groundwater infiltration within the system. Investment to address infiltration will be assessed and prioritised against other drivers e.g. STW upgrades, both in the catchment and across the region at each price review.

With this plan we remain committed to minimising the impact of groundwater on the sewerage system in Ramsbury.

Our general medium to long term plan is therefore to apply a hierarchy to sealing the sewer as follows:

Activity	When	Description
Model Zones	2020	JBA have been engaged to undertake modelling activities to identify the areas to be targeted for sealing in the 56 systems identified as being impacted by infiltration.
Install monitors	2020	Monitors installed in the zones to help calibrate and validate the zones. Each year completeness / coverage monitors will be reviewed and added to / or modified, as necessary.
Calibrate zones	Refined each year	Following each winter, we intend to review the data from the monitors and if necessary, redefine the zones.
Look & Lift	Each winter	The look & lift surveys have two purposes, firstly to compliment the monitoring and secondly to identify 'quick fixes' that we would address through our normal capital maintenance.

⁴ Decision of extent of sealing will be based on outcomes of works undertaken to date, results of monitoring and successful submission of our plans for investment

Activity	When	Description
CCTV	2020-2023	Required to confirm sewer condition and provide information to assist with costing any sewer lining.
Minor works	2020-2023	As mentioned, if we detect minor works being required, we would look to resolve these as and when we find them.
PR24	2023/24	Ideally through monitoring and on-going investigations work towards managing the infiltration risk, in AMP7, will be successful. However, in the absence of evidence justifying the need not to undertake sealing of the high-risk zone this is to be included as part of PR24 investment plan. This work will be subject to Cost Benefit Analysis and Best Technical Knowledge Not Entailing Excessive Cost (BTKNEEC) assessments.
High risk zone sealing	2025-30	Sealing of high-risk zone undertaken subject to need being demonstrated.

Ramsbury Infiltration Management Plan

As detailed above Infiltration causes a range of issues.

As part of our current investment plan, we have a project to increase the flow to full treatment at Ramsbury STW. This is driven by Dry Weather Flow (DWF) capacity issues at the site and as part of the Flow to Full Treatment re-calculation method takes into account historic and future growth and applies an allowance for infiltration to ensure that the upgrade will be sufficient. This work is programmed to be completed by 31/03/2025.

In the intervening period we intend to continue to monitor the network for potential sources of infiltration that may improve the performance prior to upgrade of the sewage treatment works.

High level approach statement

For Ramsbury our approach to tackling infiltration will be undertaken as follows:

1. Our programme for implementation of the upgrade of Ramsbury STWs is completion by 2025.
2. In parallel to the progression of the STWs solution to deal with the infiltration received we will investigate the network with a view to identifying sources of ingress of infiltration that are cost effective⁵ to address. To investigate the network, we/will:

- Have undertaken a desktop analysis to determine infiltration high to low risk zones (October 2020);
 - Installed additional monitoring to back up the analysis (a) and to aide focusing of locations for identification of infiltration (2020 to 2023). Each year we will assess the completeness of monitoring and if required add to or modify the current locations.
 - Undertake sample CCTV in the high to low risk zones to assess the general asset health of the sewers and manholes (ongoing).
 - Review results of Winter 2019/20 and 2020/21 with historic data to build up evidence to support interventions in the network (Summer 2021).
3. Where interventions can be undertaken as part of normal sewer maintenance activities these will be communicated and progressed. If significant investment is identified as being required, then this will need to be considered in terms of relative need compared to other systems being investigated for infiltration reduction. However, where viable opportunities are identified these will be included in our programme of investment. Significant investment needs may need to be included in future investment cycles.

⁵ Assessment of cost effectiveness is based on assessment of the ratio of the cost of a solution to the monetised benefit gained from implementing the solution i.e. reduction in flood/pollution risk and/or reduced operating costs.

Investigations

As mentioned above JBA Consulting have been supporting by undertaking an exercise involving assessing groundwater elevation data to determine which areas of the network are potentially below the groundwater table during high groundwater periods.

Site investigations, undertaken by Dene-Tech and our Customer Field Services (Thames Water Operations) have included 'look & lift' surveys, CCTV and where necessary dye tracing to confirm connectivity.

A table of the work undertaken is included in the appendix to this report.

Monitoring

Sewer Depth Monitors have been installed in the catchment in 2020 (see Figure 2.0), apart from in one location on Drain Hill where we have been unable to access the manhole and there is no alternative location. These devices are telemetered and provide real time data on the level of flow in the sewer.

The purpose of these units is to act as alerts for high groundwater impact in the sewer, calibration of the zones of infiltration risk and to demonstrate benefit gained from work undertaken to reduce infiltration.

To provide evidence in the future of further need to manage the impact of infiltration.

Mitigation

On occasions to avoid flooding of properties or to manage the risk of damage to the environment we may undertake tankering from (manholes) on

the network, make use of pumps to contain flows or deploy settlement tanks to part treat sewage before release to the environment.

With regard to Ramsbury we are considering the deployment of an ATAC unit as detailed above. We would only look to deploy this mitigation either where all other approaches have ceased to be effective or where property flooding and / or pollution would be a likely risk had we not undertaken the mitigations.

Updates

Work on the Groundwater infiltration management plan will continue, and we will aim to provide updates annually by the end of October each year.

Appendix

Groundwater infiltration potential analysis

The sewer network has been classified by the groundwater infiltration risk zones. The lengths of sewers within these zones is presented in the table below.

Sewer Length by Groundwater Infiltration Risk Zones

Risk category	Description	Length (km)	Percentage
High	Predicted groundwater extreme >1m above pipe invert	5.81	35.1
Medium	Predicted groundwater extreme 0-1m above pipe invert	3.88	23.5
Low	Predicted groundwater extreme 0-1m below pipe invert	2.06	12.5
Very Low	Predicted groundwater extreme >1m below pipe invert	4.78	28.9
Total		16.53 ⁶	100.0

In addition, the table below presents the surface water flood risk classification for manholes within the catchment

Manholes by Surface Water Inundation Risk Category

Risk category	Description	Number	Percentage
High	Inundation risk in 3.3% AEP fluvial or pluvial event	62	13.5
Medium	Inundation risk in 1% AEP fluvial or pluvial event	69	15.1
Low	Inundation risk in 0.1% AEP fluvial or pluvial event	60	13.1
Very Low	All other manholes	267	58.3
Total		458	100.0

⁶Total of sewer length is for length of mapped sewers only and will not include unmapped S105a transferred sewers in all cases.

Investigations & remedial work undertaken since 2019/20 and future plans

The three tables below summarise the finding of the survey and implementation work identified in the 2019/20 period. The final table summarises our current known plans for remediating groundwater infiltration issues.

2019/20 Survey Statistics

Elements		Units	Value	Comment
Planned Survey		m	5,361	Survey was planned for a significant part of the valley floor. It was possible to complete 80% of the survey (see Figure 2)
Survey Completed		m	4,777	
		%	89	
		Lengths (No.)	130	
Clear Flow Observed		m	1,553	25.5% of the sewer network surveyed had evidence of groundwater infiltration
Sewer Infiltration Locations Identified	Infiltration Gushing	No.	2	31 groundwater infiltration locations were identified in the sewers. Of those 11 were identified as “gushing” and therefore should be the focus of repair as soon as possible.
	Infiltration Gushing at Joint		9	
	Infiltration Running		2	
	Infiltration Running at joint		7	
	Infiltration Dripping			
	Infiltration Dripping at joint		5	
	Infiltration Seeping			
	Infiltration Seeping at joint		6	
	Grand Total		31	

Elements		Units	Value	Comment
Manhole Infiltration Locations Identified	Infiltration around pipe	No.		14 groundwater infiltration locations were identified at manhole locations. Of those 2 were identified as “gushing” and therefore should be the focus of repair as soon as possible.
	Infiltration through benching		2	
	Infiltration through chamber wall		5	
	Gushing		2	
	Running		2	
	Dripping			
	Seeping		3	
	Grand Total		14	
Monitoring Locations Active		No.	4	4 Water level monitoring locations have been installed within the catchment. Their locations are shown in Figure 2.
Details of other Surveys				No other surveys have occurred in the catchment during the period

2019/20 Implementation Works

Activities	Value	Comment
Sewer Lining Patches	11	A further 4 manholes sealing and 250m of CCTV survey is planned for 2020
Manhole Sealing (no.)	19	

In addition, prior to winter 2019/20, 2,307m of the sewer network was lined with watertight lining upstream of the Whittonditch Sewage Pumping Station (SPS) as outlined in our previous Drainage Strategy.

Future Works


	Priority 2020/2021	Known follow On Work
Survey	see main text	
Sewer Lining	6 gushing Priority 1 locations identified	20 weeping locations identified in 2019/20 Locations identified in Future Surveys
Manhole Sealing – Infiltration Ingress	2 gushing Priority 1 locations identified	12 weeping locations identified in 2019/20 Locations identified in Future Surveys
Manhole Sealing – Pluvial and Fluvial Ingress	Plan to be developed based on at risk manholes identified in JBA analysis	
Sewage Treatment Works Upgrade	See main text	

Example information and signage



 Your reference number
BB973534

 [thameswater.co.uk](https://www.thameswater.co.uk)

 0800 316 9800
We're open 24/7

03 April 2020

Working in Aldbourne

This ATAC Eco filter is a mobile sewage filtering unit which will operate 24 hours a day.

How it works?

The Eco filter works using the same basic principles as our traditional Sewage Treatment Works. A pump will feed dirty water into the unit so it can be filtered. Any contaminants within the water are broken down and once water has passed through the Eco filter it can safely be returned to the environment.

Why is this needed?

The high groundwater levels experienced recently have caused extra water to enter our sewers and overwhelm them causing sewer flooding. This is one of the measures being put in place to address the issue and by installing this unit, we will improve the quality of the water which we are not able to prevent from escaping.

What does it look like?

Outside view:



Dirty water entering the filter unit to be treated and then pumped to the top of the unit

Treated water leaving the unit and returning to the environment

Page 1 of 2

Inside view:

Dirty water being pumped into the unit and working its way through the filter system.



Glossary of terms

AEP – Annual Exceedance Potential

AMP – Asset Management Plan

CCTV – Closed Circuit Television

EA - Environment Agency

IRP – Infiltration Reduction Plans

MH- Manhole

STW – Sewage Treatment Works

WINEP – Water Industry National Environment Programme

Addendum – Annual Update 2021

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Introduction

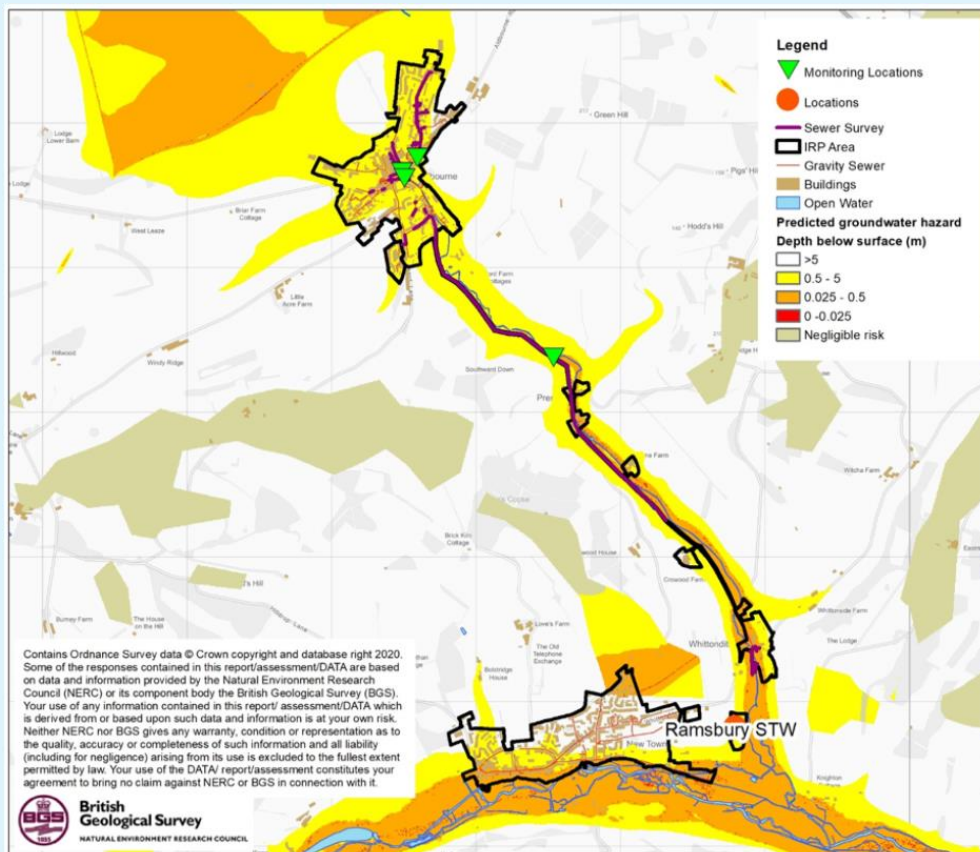


Figure 1 – Ramsbury monitoring and infiltration zones

This addendum to the Ramsbury Groundwater Impacted System Management Plan 2020 (GISMP) provides an update on performance/work undertaken in the period from September 2020 to September 2021 (the UK Hydrological Year ¹) key points covered include:

- Hydrological Conditions
- How the sewerage system has performed over this period
- Mitigation / remedial measures progressed over the last year and being planned.
- Summary and next steps

⁷ [Happy New Water Year! | National River Flow Archive \(ceh.ac.uk\)](https://www.ceh.ac.uk/)

2020-21 Hydrological Review

This section summaries the hydrological conditions at Ramsbury in the period.

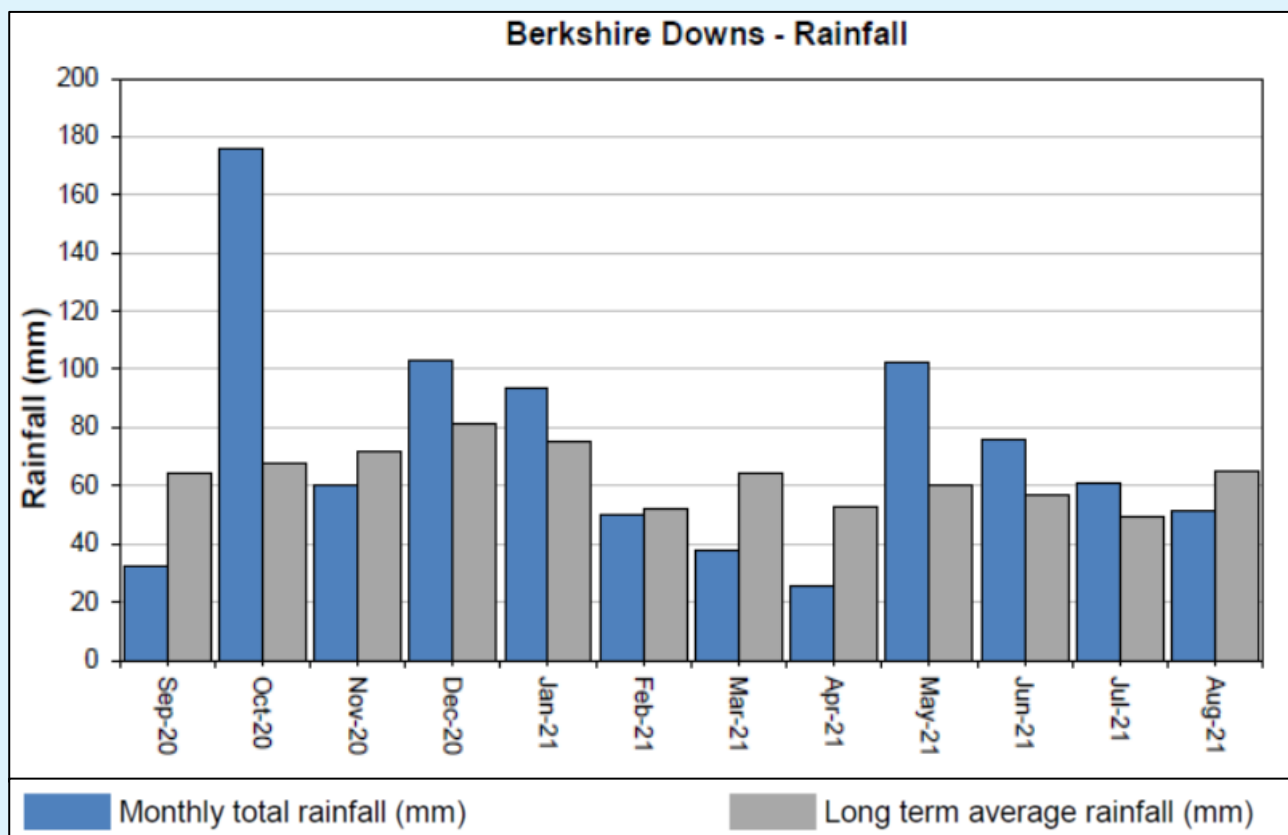


Figure 2 – Monthly rainfall depths local to the system

Ramsbury is situated in the Berkshire Downs water resources area. Figure 2 shows the monthly rainfall total depths against the long-term average rainfall in the location of Ramsbury over the period taken from the *Environment Agency Water Situation Report August 2021*.⁸

The graph indicates that monthly rainfall at times in the last year has significantly exceeded long-term average, especially in the month of October 2020 due to Storm Alex.

Figure 3 shows the location of the British Geological Survey (BGS) monitoring borehole at Wateracre. Figure 4 and 5 present the last year and nine years of groundwater level data. This data show that generally last winters groundwater levels have been notably higher than the previous five years and almost as high as the 2012/13 and 2013/14 winter periods.

⁸Environment Agency Water Situation Report August 2021

3 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1016481/Thames_Water_Situation_Report_August_2021.pdf).

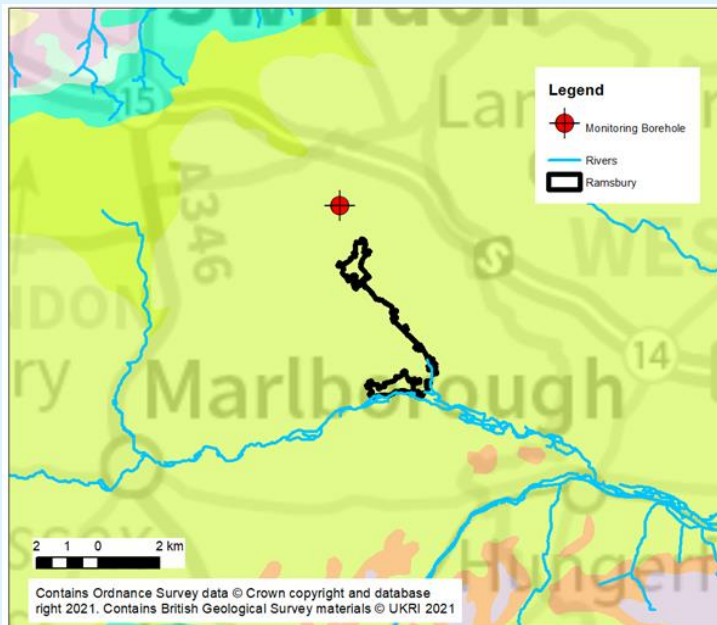


Figure 3 – Location of Wateracre Monitoring Borehole Relative to Ramsbury

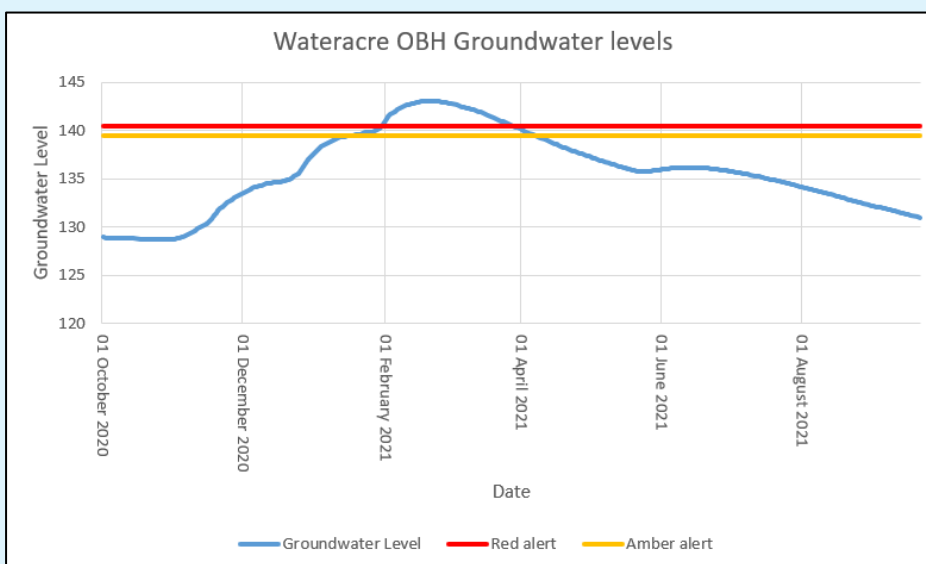


Figure 4 – 2020/21 Groundwater Levels at Wateracre

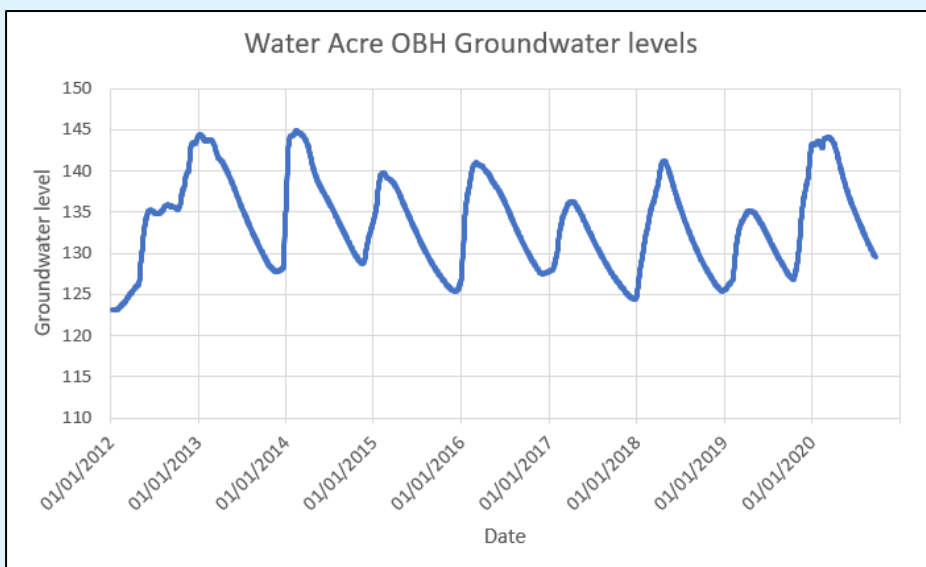


Figure 5 – 2012-2021 Groundwater Levels at Wateracre

Investigations & remedial work undertaken in the period and future work

The two tables below in summary provide an update on recent survey and remediation work undertaken during the period.

Remediation works in period

Activities	Value	Comment
Sewer Lining Length (m)	1 patch liner has been installed by our Operational teams. A further 60m of lining is due to commence in October 2021 to address the gushers identified in the original GISMP report.	Remaining work subject to site conditions being suitable.
Manhole Sealing (no.)	2 manholes have been re-benched by our Operational teams. A further 2 manholes are due to be sealed in October 2021 to address the gushers identified in the original GISMP report.	

Future Works

Activity	Planned work in 2021/22	Known follow On Work
Survey	Further survey to be carried out this winter as groundwater conditions allow.	To be confirmed
Sewer Lining	To be confirmed	To be confirmed
Manhole Sealing – Infiltration Ingress	To be confirmed	To be confirmed
Manhole Sealing – Pluvial and Fluvial Ingress	Plan to be developed based on at risk manholes identified in JBA analysis.	
Sewage Treatment Works Upgrade	As part of our current AMP7 investment plan, we have a project to increase the flow to full treatment at Ramsbury STW. This is driven by Dry Weather Flow (DWF) capacity issues at the site (historic growth). As part of the Flow to Full Treatment re-calculation method takes into account historic and future growth and applies an allowance for infiltration to ensure that the upgrade will be sufficient. This work is programmed to be completed by 31/03/2025	

2020-21 Infiltration Review

This section looks at the impact of infiltration in Ramsbury over the period.

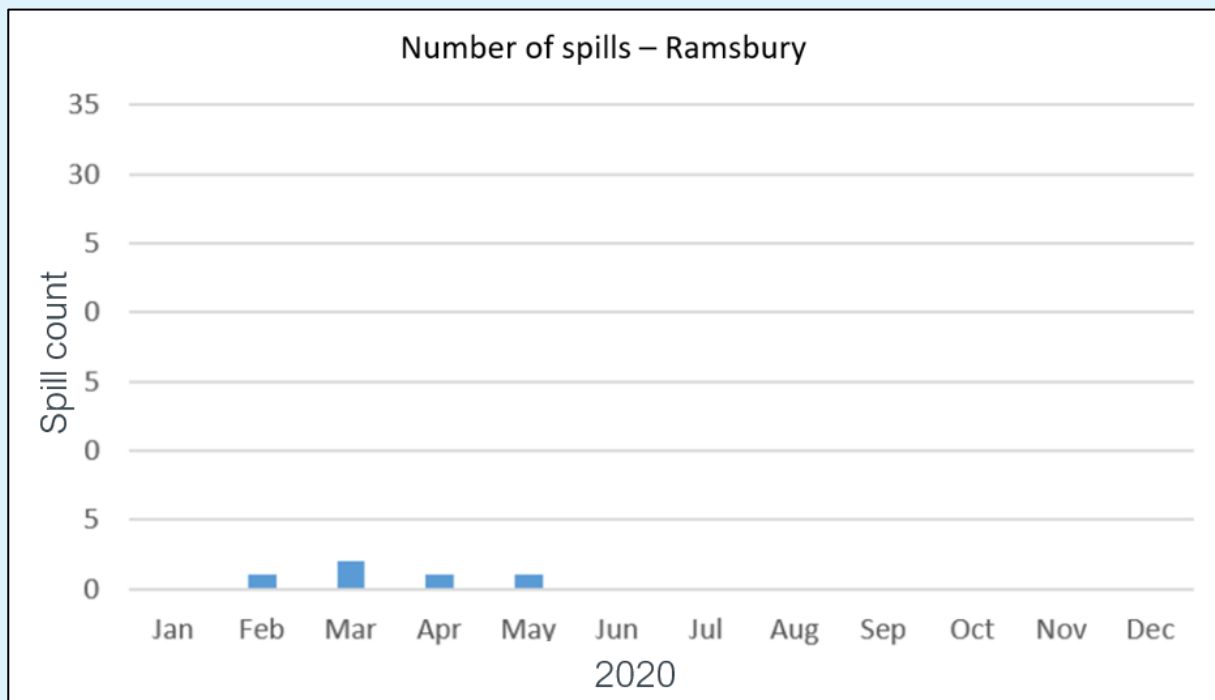


Figure 6 – Number of spills (discharge count) at Ramsbury STW (taken from Event Duration Monitor (EDM) Data).*

Figure 6 shows the number of spills per month from Ramsbury Sewage Treatment Works. The number of spills at this location indicates that the impact of groundwater infiltration at the STW is minimal. Tankering was carried out in the Ramsbury system over the Winter period to minimise the risk of property flooding. Tankers were unable to keep up with the levels of flows experienced, therefore an ATAC bio-filter was deployed to protect properties from flooding as outlined in the original GISMP report.

Anticipated Unavoidable Discharge	
Switch on date	15 th February 2021 (deployed in place prior to this date, but not operated)
Switch off date	22 nd March 2021
Sampling Data Summary	Regular sampling undertaken during the period showed that Dissolved Oxygen (DO) levels decreased from 116% to 112% at the point of ingress and Ammonia levels rose from 0.057mg/l to 0.082mg/l. A small amount of sewer fungus was observed in the watercourse between the 20 th and 22 nd March. No rags or solids were noted at any monitoring point. Independent periodic monitoring by OHES observed any fish alive, dead or in distress. This period of discharge was classified as a CAT3 pollution due to the controlled release of untreated sewage.

Summary

The winter of 2020-21 was a particularly wet winter with groundwater levels in the aquifer beneath Ramsbury as high as those experienced in the winters of 2012/13 and 2013/14. The majority impacts of groundwater infiltration are seen in the foul network where tankering was undertaken until it was no longer sustainable to protect against property flooding. To protect properties an anticipated unavoidable discharge was made via a bio-filter (ATAC) unit as outlined in our original GISMP between the dates of 15th February 2021 and 22nd March 2021. This discharge event was classified as a CAT3 pollution to the watercourse. The impact of groundwater infiltration was therefore not seen at the Sewage Treatment works as indicated by the Event Duration Monitoring (EDM) data.

Remedial measures continue to be implemented and further lining and manhole sealing is planned over the next year.

Lift and look and CCTV surveys will continue throughout the remaining wet winter periods within this AM7 period (2020- 2025) with the aim of finding further priority locations for remediation and investigating/justifying the need for future larger scale lining as part of our 2024 Price Review (PR) process.

As part of our current investment plan, we have a project to increase the flow to full treatment at Ramsbury STW. This is driven by Dry Weather Flow (DWF) capacity issues at the site and as part of the Flow to Full Treatment re-calculation method takes into account historic and future growth and applies an allowance for infiltration to ensure that the upgrade will be sufficient. This work is programmed to be completed by 31/03/2025.

It is notable that the spill frequency at Ramsbury STWs is relatively low compared to other groundwater impacted sewerage systems in the region, most adverse impact from groundwater infiltration is occurring in the village of Aldbourne. The performance of the sewer that exits the village alongside the Whittonditch is possible pinchpoint in the network that we are going to investigate over the next period, it is important to investigate this aspect of the system ahead of the improvement works to Ramsbury STWs.

Addendum – Annual Update 2022

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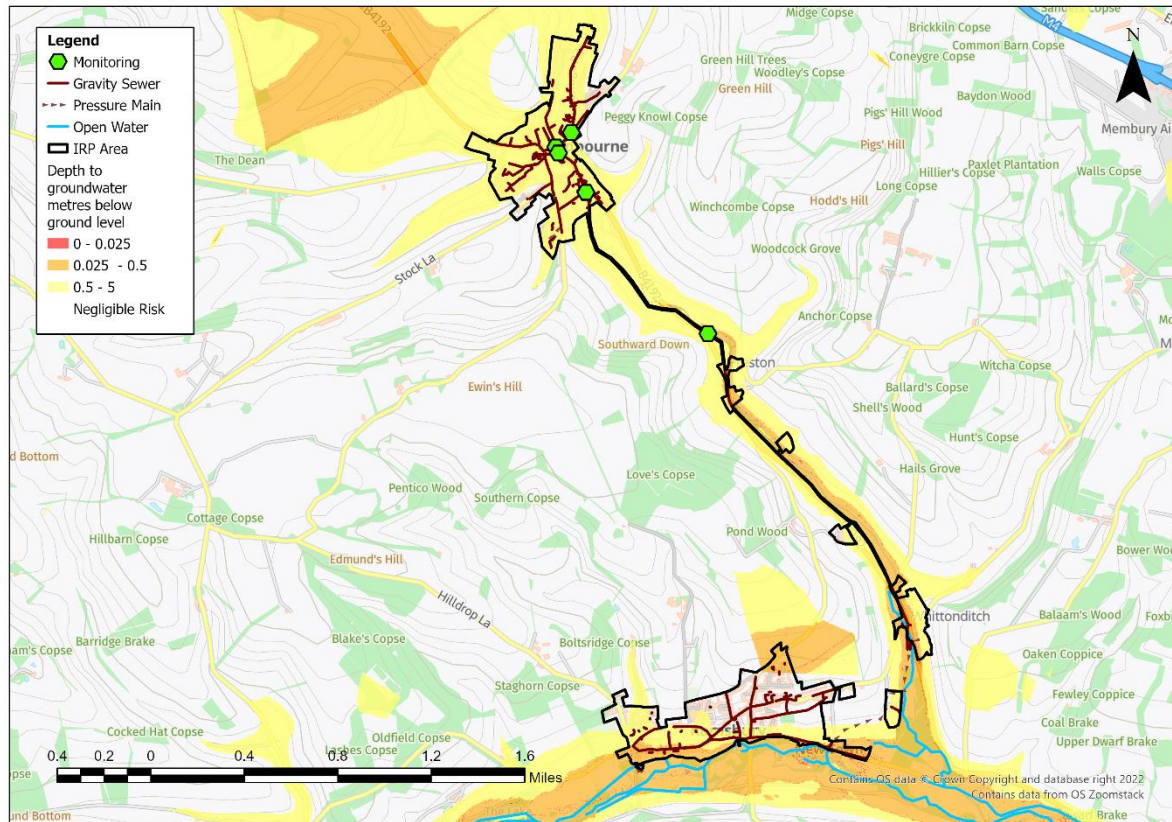
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Overview

This addendum to the Ramsbury Groundwater Impacted System Management Plan 2020 (GISMP) provides an update on performance/work undertaken in the Hydrological Year October 2021 to September 2022. The key points covered include:

- Hydrological conditions
- How the sewerage system has performed over this period
- Mitigation / remedial measures progressed over the last year and being planned
- Summary and plan for 2022/23

Figure 1 – Ramsbury Monitoring Plan



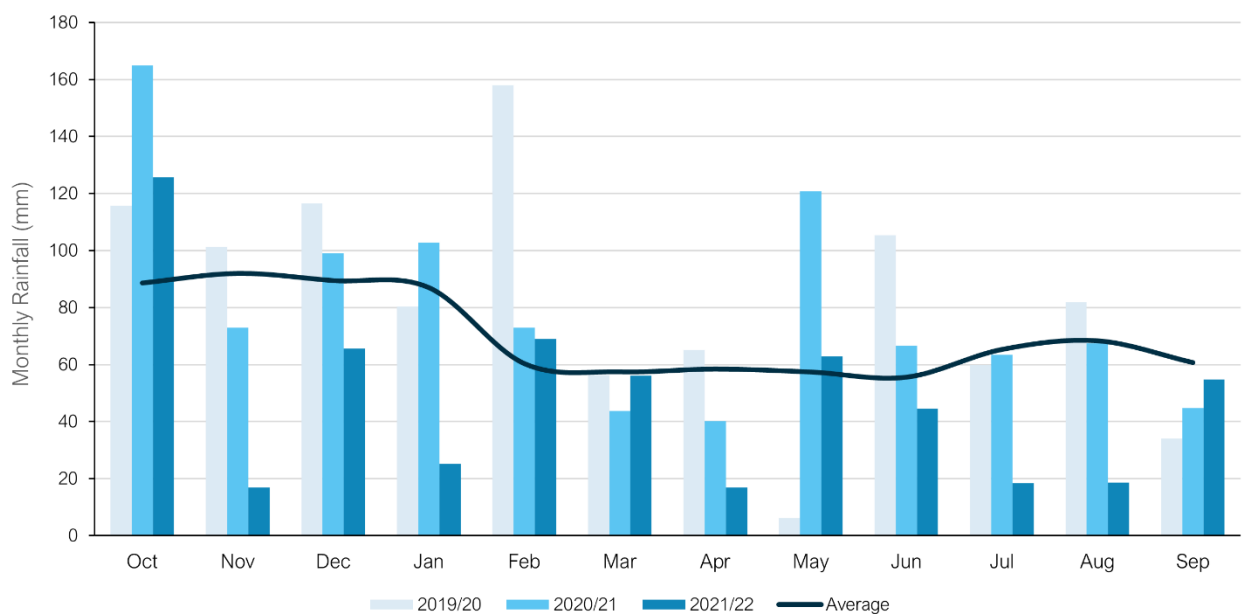
Hydrological Review – 2021-2022

This section summaries the hydrological conditions within the Ramsbury catchment within the period under investigation and provides comparison against previous year’s performance to put the annual performance into context. The hydrological review has been undertaken based on the Hydrological Year which runs October 1st to September 30th.

Catchment Rainfall

Representative Radar rainfall has been used to generate monthly data at catchment level for comparison with average data generated by local Met Office Weather Station Records. Figure 2 presents the comparison of this data for the last three hydrological years to support longer term trends within the local system.

Figure 2 – Monthly Rainfall Performance



Average Values taken from Met Office Weather Station at Marlborough based on the period 1991-2020

The total rainfall for the 2021/22 hydrological year is 31% below the annual average total. Total rainfall values are presented in Table 3 below.

Table 3 – Total Rainfall Based on Hydrological Year

Average (mm)	2019/20 (mm)	2020/21 (mm)	2021/22 (mm)
841	980	960	582

Groundwater / Local River Level

The Ramsbury catchment is situated in the Berkshire Downs water resources area. It sits in the Seaford Chalk Formation, the Lewes Nodular Chalk Formation, and the New Pit Chalk Formation. These are comprised of carbonate material forming distinctive beds of chalk and are designated principal aquifers within the UK.

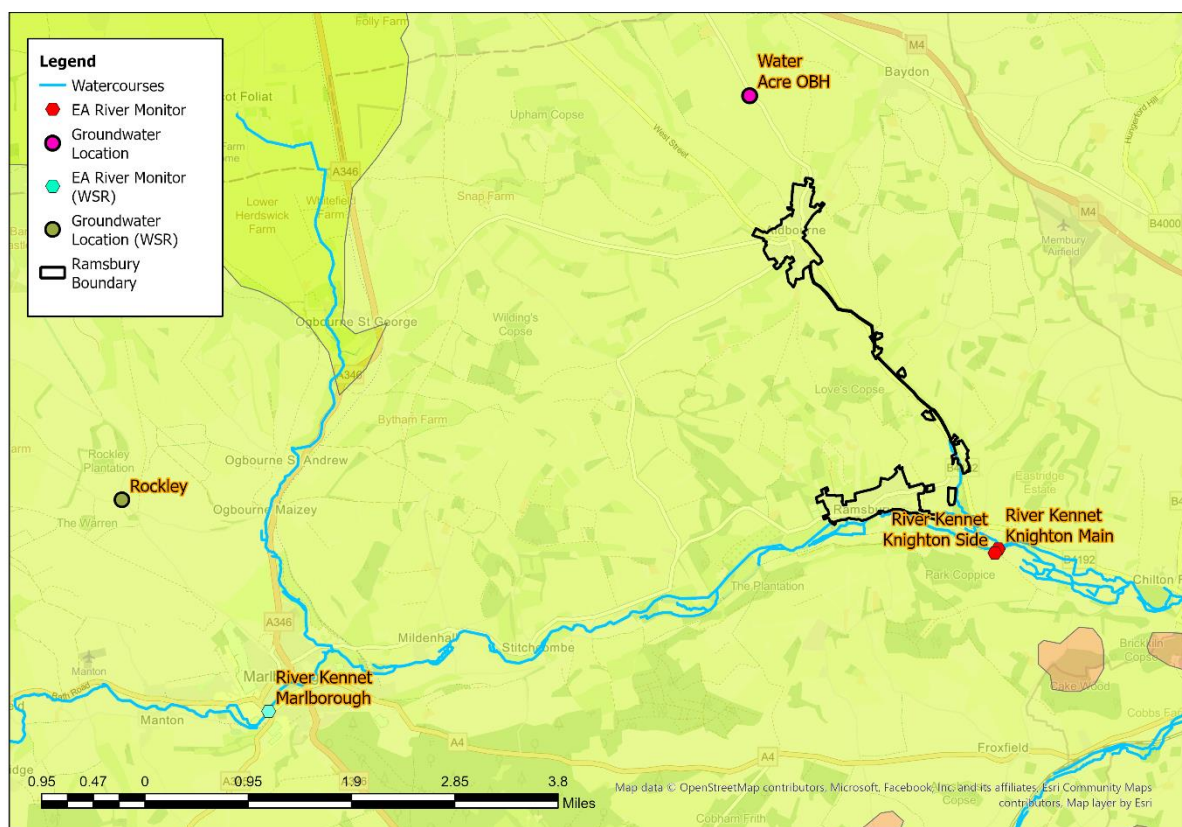
The Environment Agency has gauging stations on local watercourses measuring stage and observation boreholes measuring groundwater levels locally to the catchment which can be used to provide indicative local groundwater performance.

From previous investigations we have identified the following sites are good indicators of groundwater levels within the catchment.

- River Kennet, Knighton Main.
- River Kennet, Knighton Side.
- Water Acre OBH.

These sites are illustrated in the figure below, alongside the closest groundwater reference station and closest gauging station from the Water Situation Report.

Figure 4 – Local Monitoring Stations



The following figures represent the last three hydrological years of level information at the indicator sites to build a picture of the relative conditions prevalent in the current year. It is presented against both the daily total rainfall values for the catchment and a rolling 15 day total rainfall.

Figure 5A – Kennet, Knighton Main

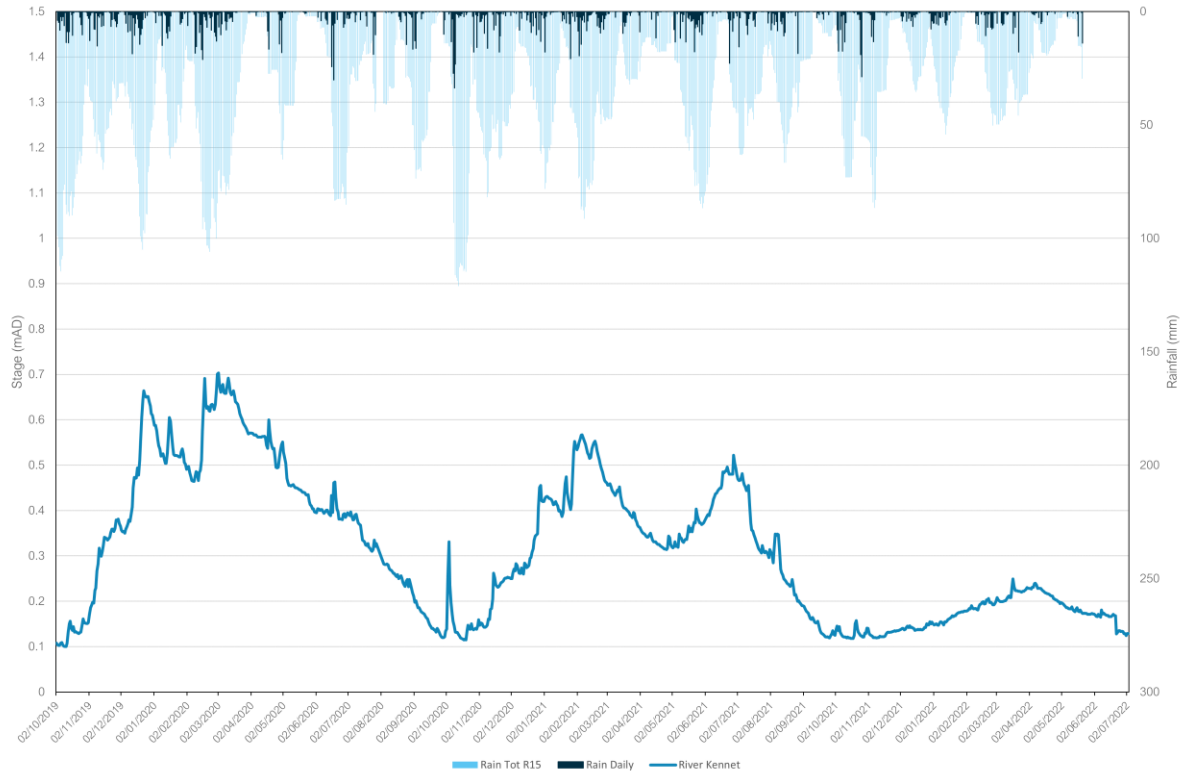


Figure 5B – Kennet, Knighton Side

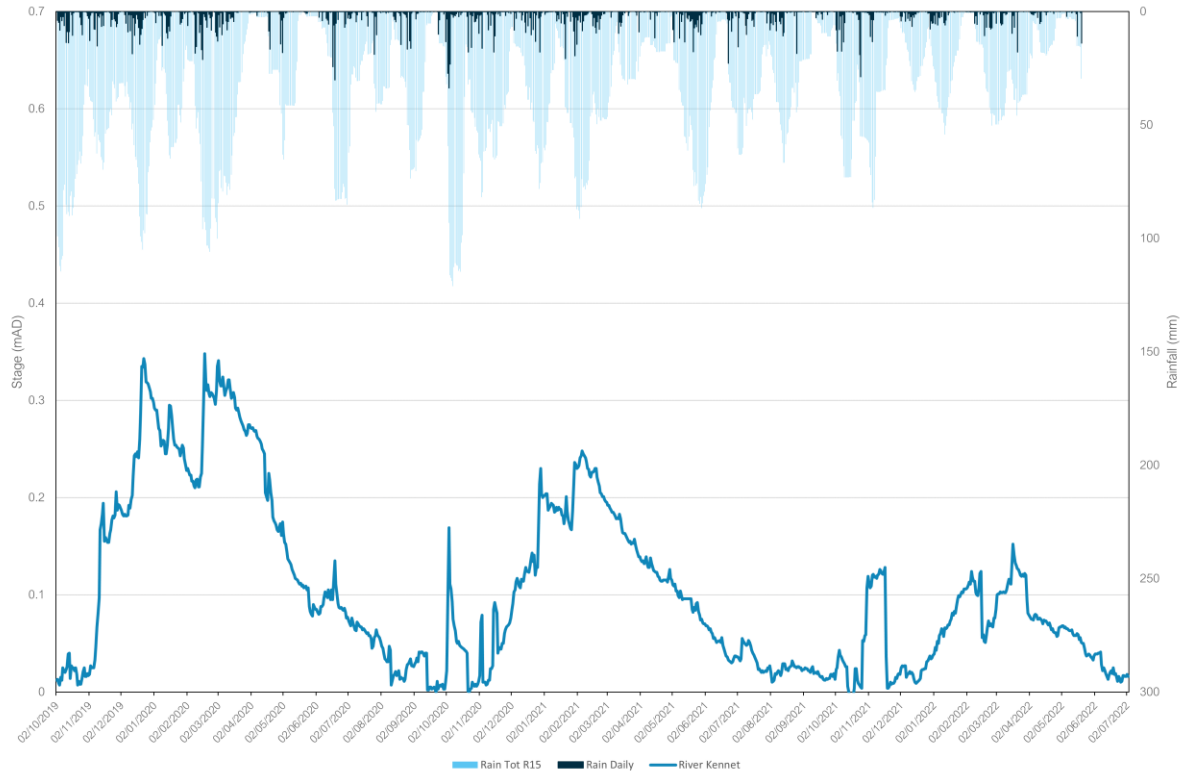
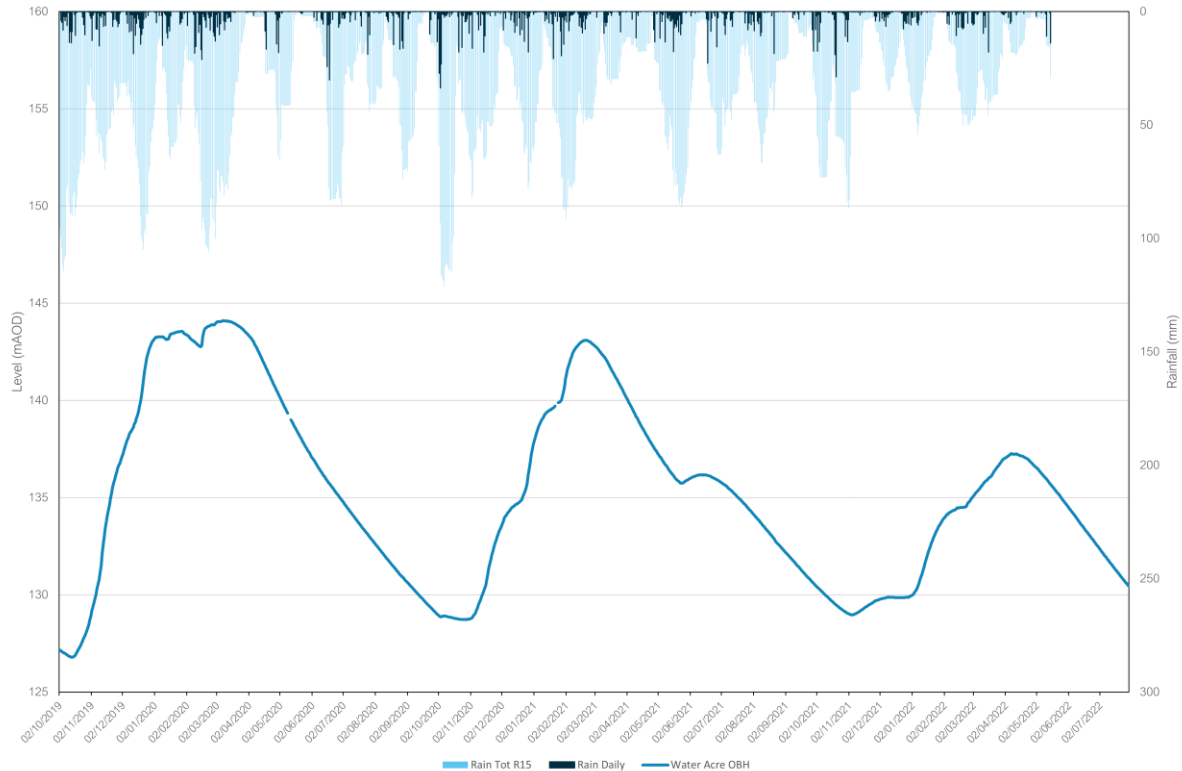
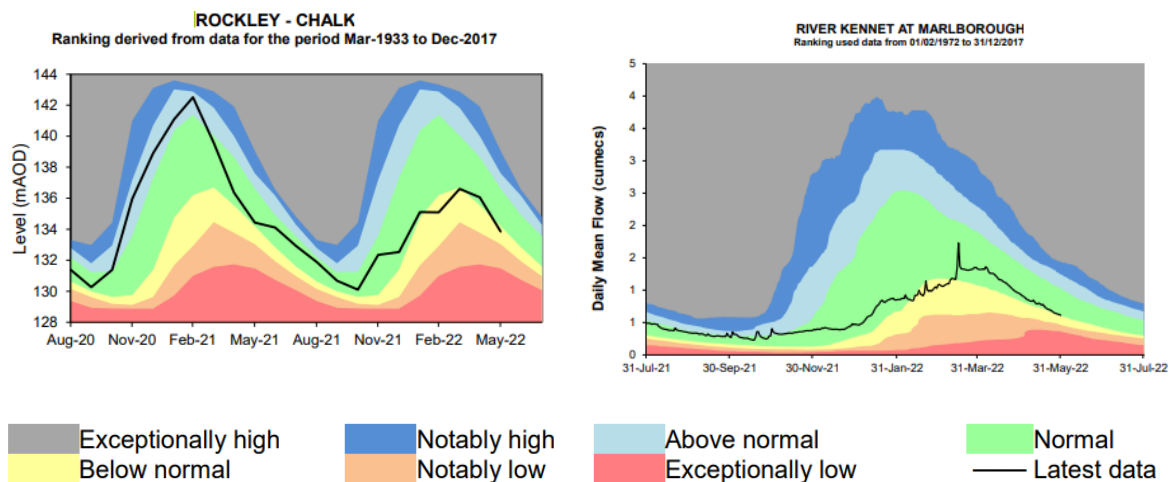


Figure 5C – Water Acre OBH



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for the Berkshire Downs. The nearest groundwater reference station is Rockley. This site shows significantly lower overall groundwater than the previous year. This can be seen in the figure below alongside the river indicator location at Marlborough on the River Kennet.

Figure 6 – Water Situation Report



Extract from - [Water Situation Report \(publishing.service.gov.uk\)](https://publishing.service.gov.uk)

Network Performance

Within the Ramsbury catchment there is one site detailed within the Environment Agency Consents Database which has an Event Duration Monitor (EDM) fitted.

Table 7 below details the last 2 years performance of overflows within the catchment.

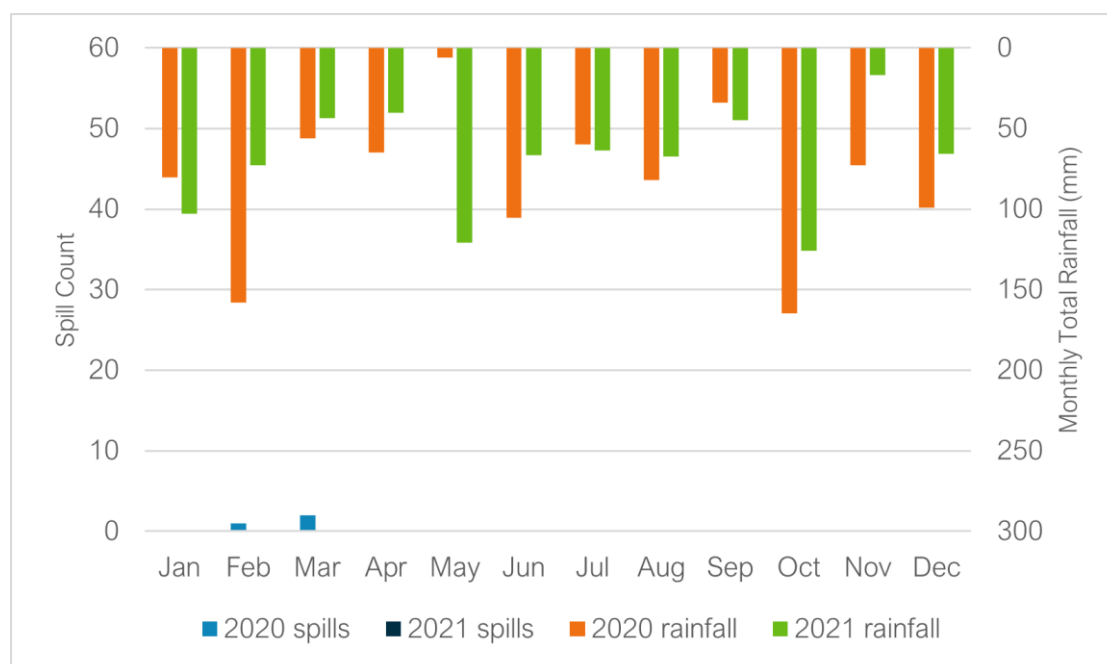
Table 7 – Event Duration Monitoring

Overflow	2020		2021	
	Spills	Duration (hours)	Spills	Duration (hours)
Ramsbury STW	3	10.57	0	0

Note that a spill count of 3 is stated for 2020, which is lower than the published figure of 5. The spill count data has been revalidated/corrected and the revised figure of 3 will be included in the 2020 re-submission.

A critical part of the assessment of EDM performance and its relation to groundwater inundation is to review the month-on-month spill performance, against previous years and the monthly total rainfall values to give context to the performance. Figure 8 below presents the EDM performance trend and rainfall for recent years.

Figure 8 – EDM Monthly Performance



The data suggests a wider relationship between rainfall, elevated groundwater levels and spill frequency, as the only spills recorded over the two-year period were in February and March 2020, when the indicator sites suggest groundwater levels in the catchment were particularly elevated.

Investigations & Interventions

This section details the activities that have been undertaken within the catchment within the Hydrological Year 2021-22.

Monitor Installations

The sewer depth monitor (SDM) programme supports long term groundwater understanding within GISMP catchments. Currently, there are a total of 5 monitors installed within the Ramsbury catchment. There are currently no further monitor installs planned.

The data from these will be cross-referenced with other long-term records (where available) within the catchment.

Remediation Works Undertaken this Hydrological Year

Table 9 below provides a summary of the investigations and remediation works undertaken or planned within the Ramsbury catchment in the 2021-22 Hydrological Year.

Table 9 – Works Undertaken in the 2021/22 Hydrological Year

Investigation/ remediation type	Number/ length undertaken
CCTV survey	N/A
Look and lift survey	N/A
Sewer lining	60 metres*
Patch lining	N/A
Manhole sealing	2 manholes*
Manhole sealing plates	N/A
Manhole covers and frames replaced	N/A

*Completed in October 2021, after previous GISMP update was written, in which it was detailed further interventions were due to commence

With the seasonal trends in groundwater being low in comparison with previous years, the larger scale survey, identification and remediation of the sewerage network has not been possible within the 2021/2022 hydrological year.

Summary

Rainfall in the Ramsbury catchment over the 2021/22 hydrological year has been below average, with groundwater levels in the aquifer beneath Ramsbury not reaching the levels seen in previous years which triggered groundwater ingress into the sewerage network and elevated flow/depth readings at monitoring sites.

Lift and look and CCTV surveys will continue throughout the remaining wet winter periods with the aim of finding further priority locations for remediation and investigating/justifying the need for future larger scale lining as part of our Price Review (PR) process if required.

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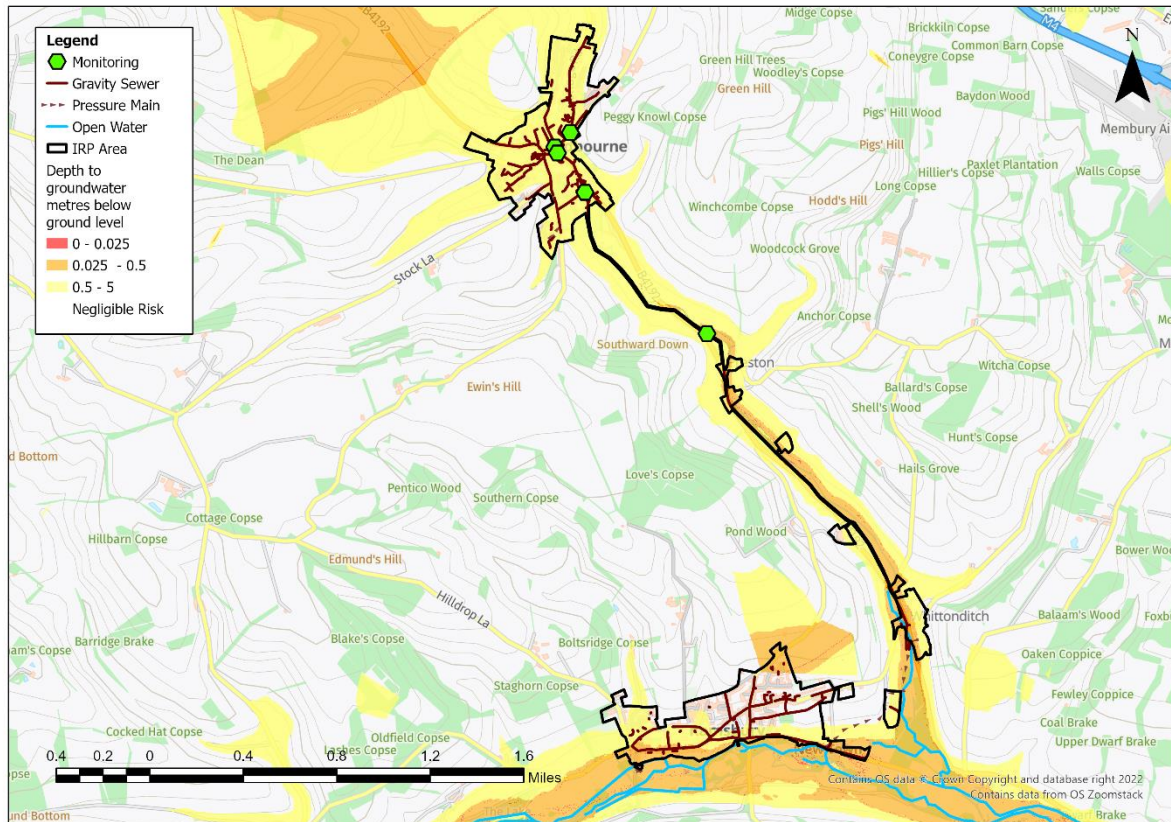
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Overview

This addendum to the Ramsbury Groundwater Impacted System Management Plan 2020 (GISMP) provides an update on performance/work undertaken in the Hydrological Year October 2022 to September 2023. The key points covered include:

- Hydrological conditions
- Performance of the sewerage system
- Mitigation / remedial measures progressed over the last year and being planned
- Summary and plan for 2023/24

Figure 1 – Ramsbury Monitoring Plan



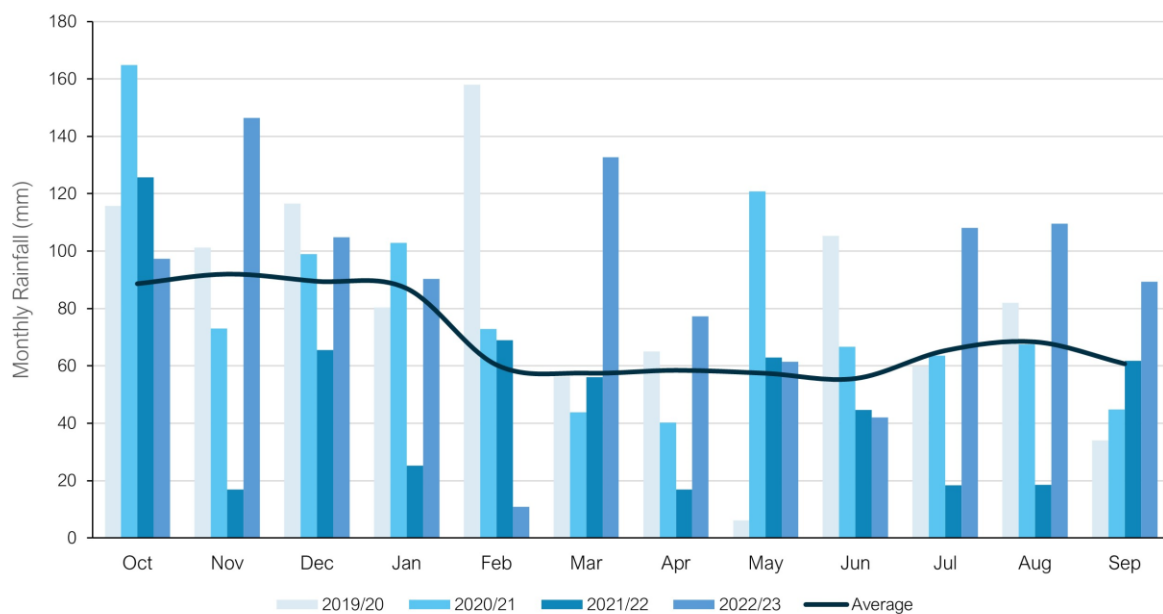
Hydrological Review – 2022-2023

This section summarises the hydrological conditions within the Ramsbury catchment within the period under investigation and provides comparison against previous year’s performance to put the annual performance into context. The hydrological review has been undertaken based on the Hydrological Year which runs October 1st to September 30th.

Catchment Rainfall

Representative Radar rainfall has been used to generate monthly data at catchment level for comparison with average data generated by local Met Office Weather Station Records. Figure 2 presents the comparison of this data for the last four hydrological years to support longer term trends within the local system.

Figure 2 – Monthly Rainfall Performance



Average Values taken from Met Office Weather Station at Marlborough based on the period 1991-2020

The total rainfall for the 2022/23 hydrological year is 27% above the annual average total. Total rainfall values are presented in Table 3 below.

Table 3 –Total Rainfall Based on Hydrological Year

Average (mm)	2019/20 (mm)	2020/21 (mm)	2021/22 (mm)	2022/23 (mm)
841	980	960	582	1070

Groundwater / Local River Level

The Ramsbury catchment is situated in the Berkshire Downs water resources area. It sits in the Seaford Chalk Formation, the Lewes Nodular Chalk Formation, and the New Pit Chalk Formation. These are comprised of carbonate material forming distinctive beds of chalk and are designated principal aquifers within the UK.

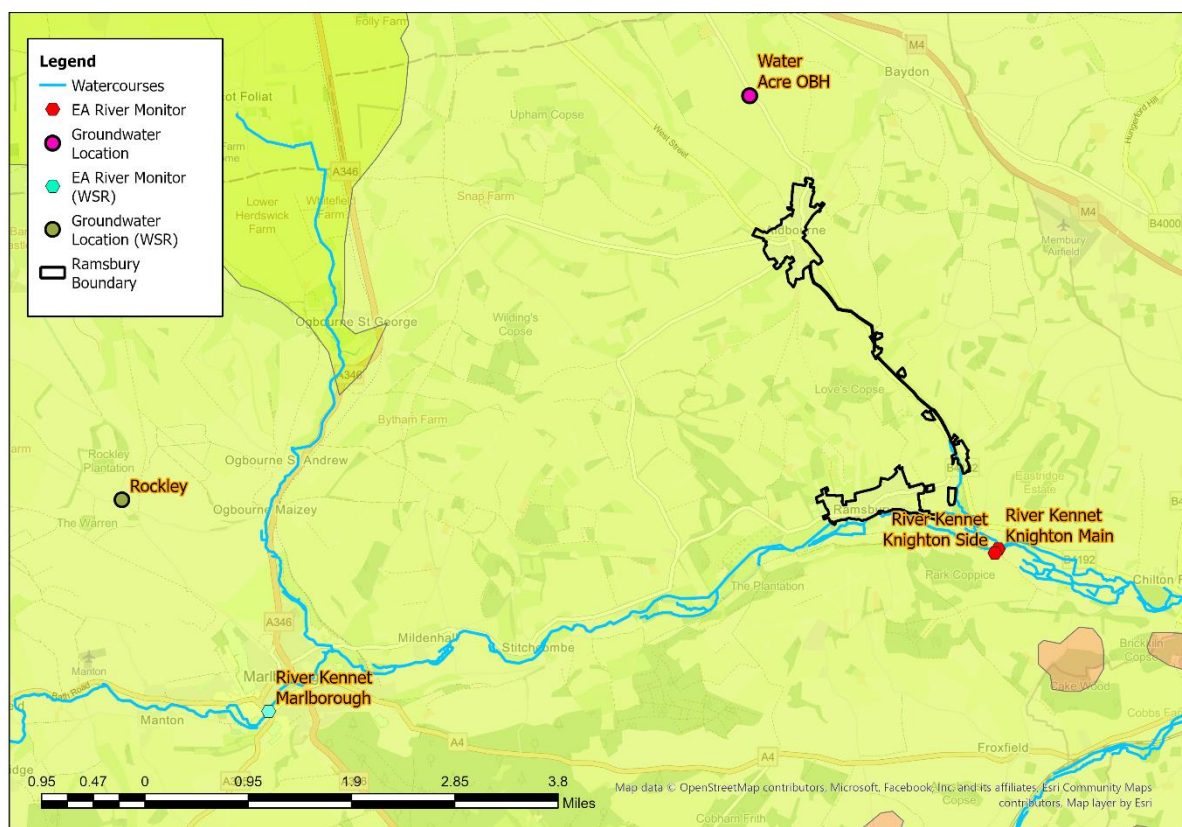
The Environment Agency has gauging stations on local watercourses measuring stage and observation boreholes (OBH) measuring groundwater levels locally to the catchment which can be used to provide indicative local groundwater performance.

From previous investigations we have identified the following sites are good indicators of groundwater levels within the catchment.

- River Kennet, Knighton Main.
- River Kennet, Knighton Side.
- Water Acre OBH.

These sites are illustrated in the figure below, alongside the closest groundwater reference station and closest gauging station from the Water Situation Report.

Figure 4 – Local Monitoring Stations



The following figures represent the last three hydrological years of level information at the indicator sites to build a picture of the relative conditions prevalent in the current year. It is presented against both the daily total rainfall values for the catchment and a rolling 15 day total rainfall.

Figure 5A – Kennet, Knighton Main

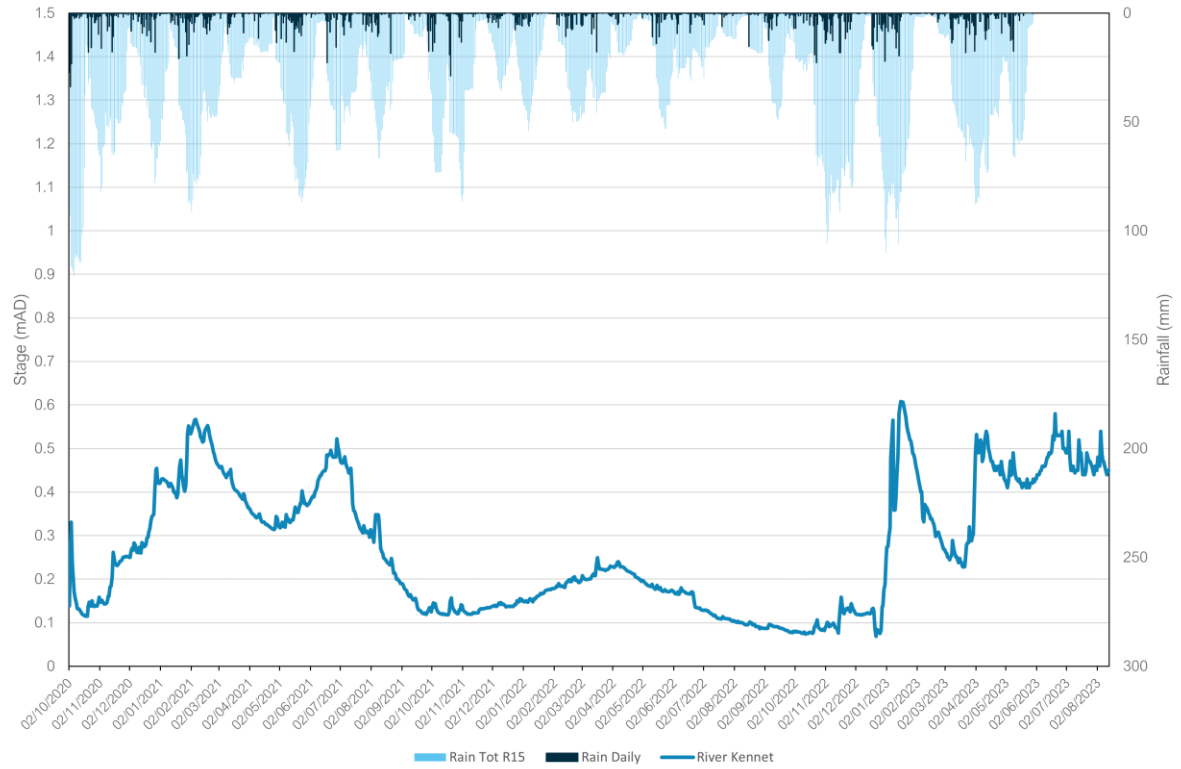


Figure 5B – Kennet, Knighton Side

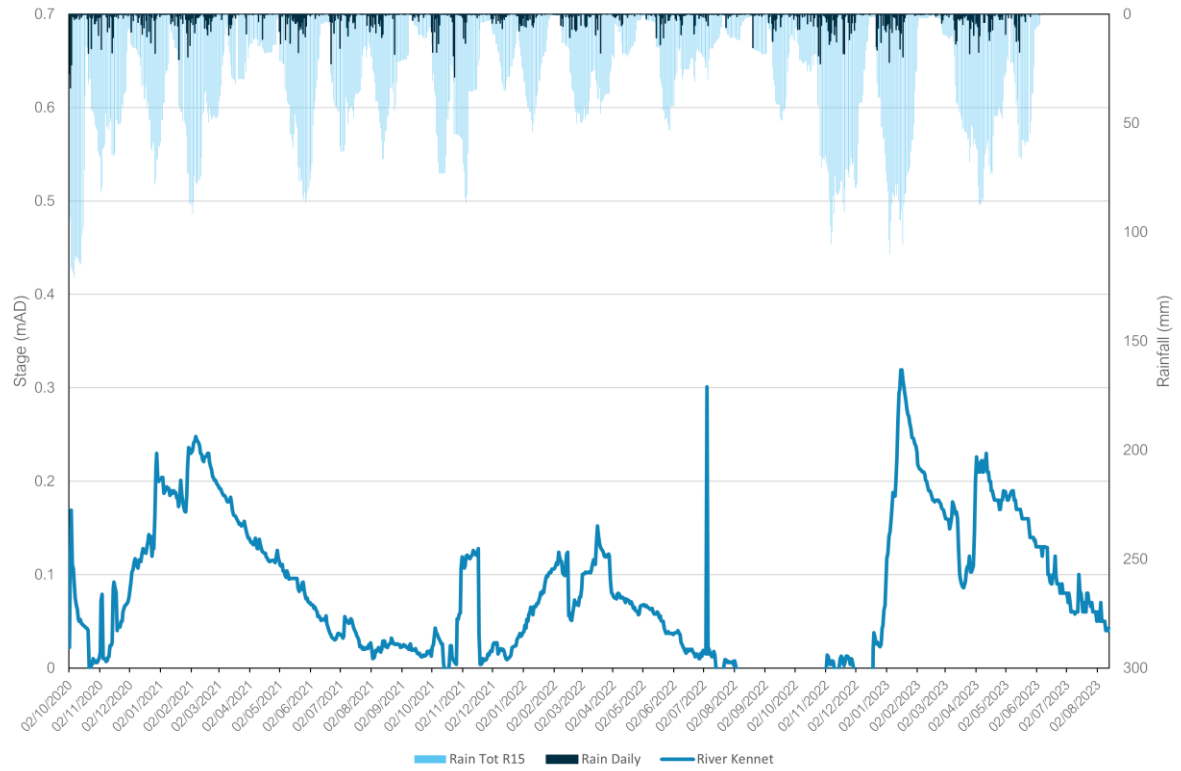
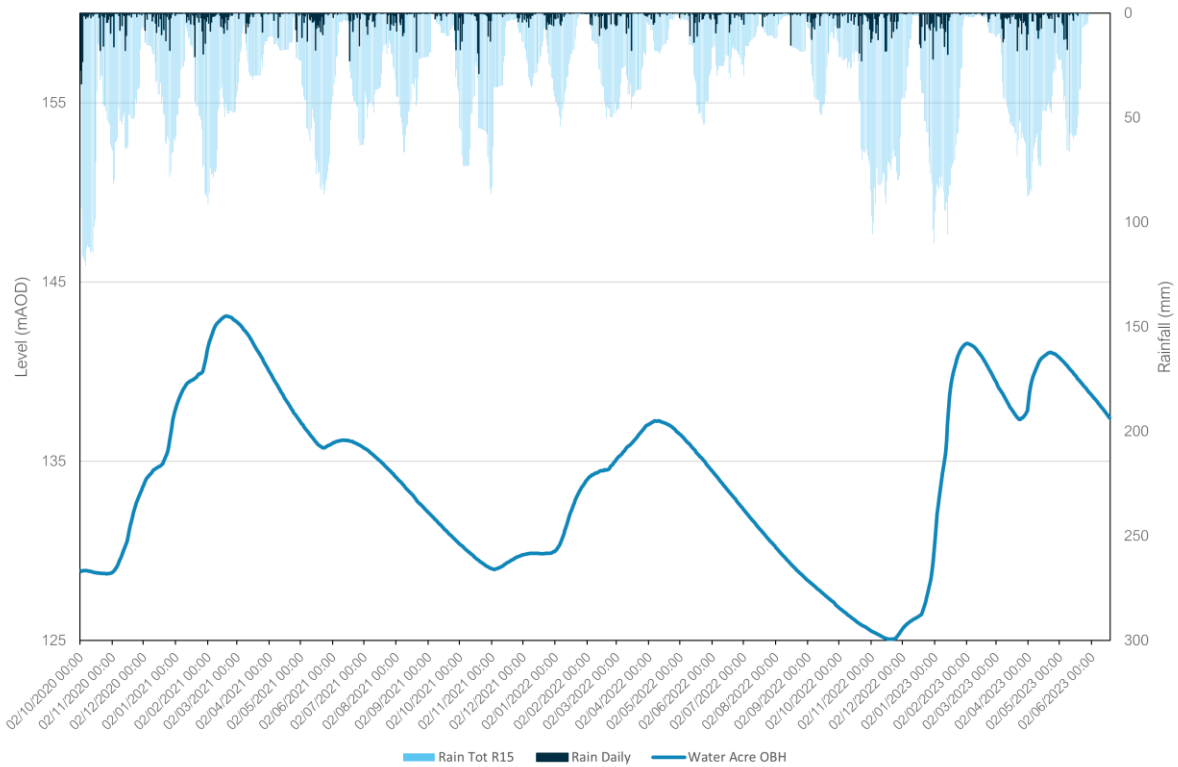
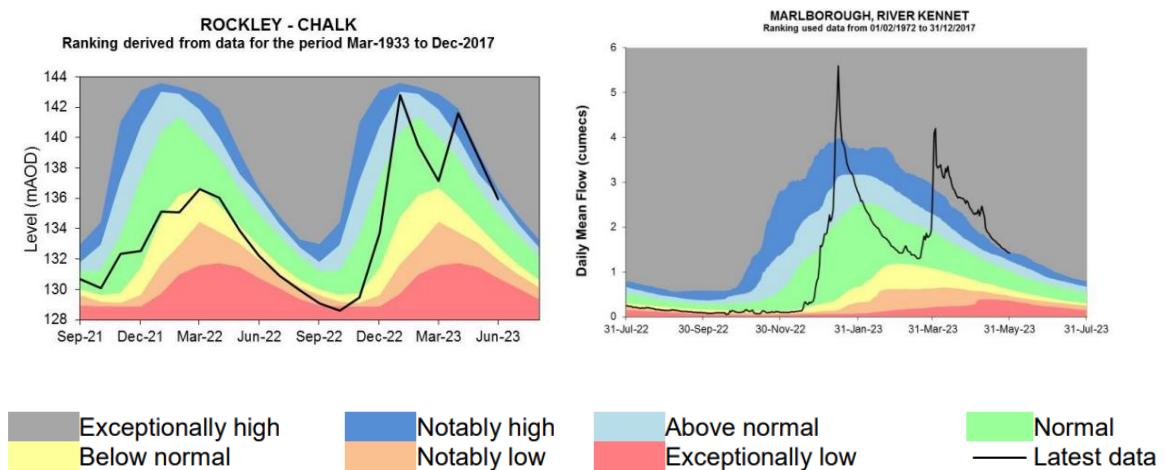


Figure 5C – Water Acre OBH



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for the Berkshire Downs. The nearest groundwater reference station is Rockley. This site shows groundwater levels generally at below normal or notably low levels in 2022, before rising towards the end of the year to reach above normal and notably high levels in 2023. This can be seen in the figure below alongside the river indicator location at Marlborough on the River Kennet.

Figure 6 – Water Situation Report



Extract from - [Water Situation Report \(publishing.service.gov.uk\)](https://publishing.service.gov.uk)

Network Performance

Within the Ramsbury catchment there is one site detailed within the Environment Agency Consents Database which has an Event Duration Monitor (EDM) fitted.

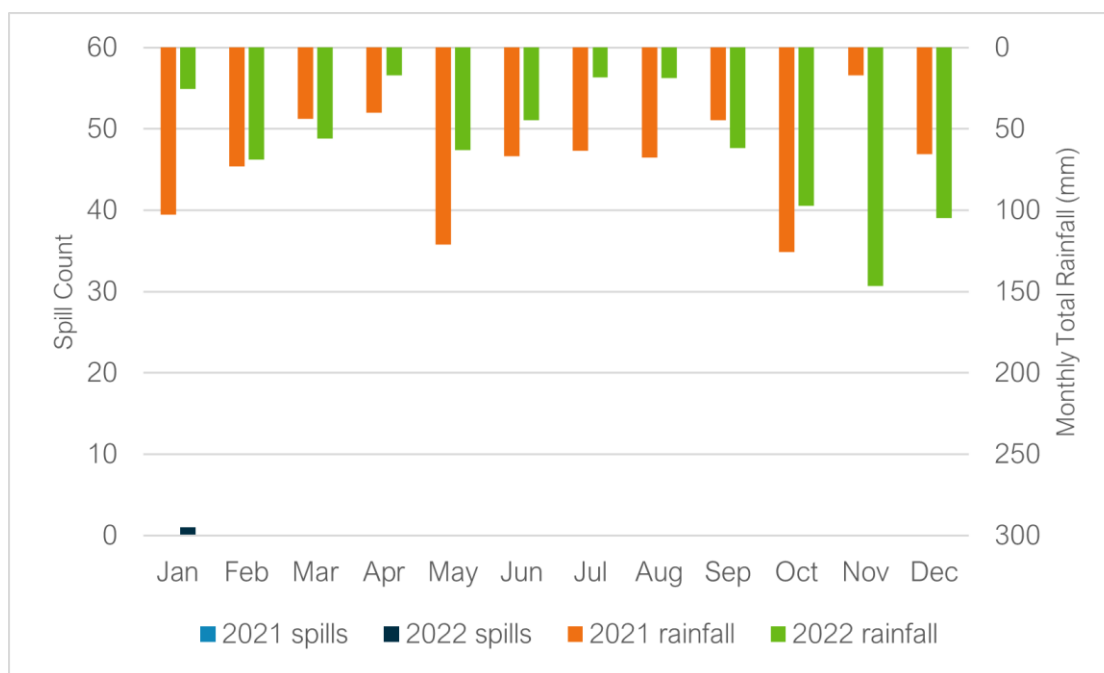
Table 7 below details the last 2 years performance of overflows within the catchment.

Table 7 – Event Duration Monitoring

Overflow	2021		2022	
	Spills	Duration (hours)	Spills	Duration (hours)
Ramsbury STW	0	0	1	0.77

A critical part of the assessment of EDM performance and its relation to groundwater infiltration is to review the month-on-month spill performance, against previous years and the monthly total rainfall values to give context to the performance. Figure 8 below presents the EDM performance trend and rainfall for recent years.

Figure 8 – EDM Monthly Performance



The utility of the last two years of EDM data to suggest a wider relationship between rainfall, elevated groundwater levels and spill frequency is limited, as only one spill was recorded at Ramsbury STW across 2021 and 2022.

Please see the 2022 Addendum Report (included in this PDF document), for discussion regarding trends evident in the EDM data for 2020, indicative of the role of groundwater infiltration on spills in the catchment. The EDM data for 2023 will also be analysed once available, to continue to examine the relationship between groundwater levels and overflow spills in the catchment.

Investigations & Interventions

This section details the activities that have been undertaken within the catchment within the Hydrological Year 2022-23.

Monitor Installations

The sewer depth monitor (SDM) programme supports long term groundwater understanding within GISMP catchments. Currently, there are a total of 5 monitors installed within the Ramsbury catchment. There are currently no further monitor installs planned.

The data from these will be cross-referenced with other long-term records (where available) within the catchment.

Remediation Works Undertaken this Hydrological Year

Table 9 below provides a summary of the investigations and remediation works undertaken or planned within the Ramsbury catchment in the 2022-23 Hydrological Year, as well as works undertaken in the 2021-22 Hydrological Year, 2020-21 Hydrological year and 2019-2020 Hydrological Year.

Table 9 – Works Undertaken in the 2022/23 Hydrological Year, 2021/22 Hydrological Year, 2020/21 Hydrological Year & 2019/20 Hydrological Year

Investigation/ remediation type	Number/ length undertaken 19/20	Number/ length undertaken 20/21	Number/ length undertaken 21/22	Number/ length undertaken 22/23
CCTV survey	4.77 kilometres	N/A	N/A	1.2 kilometres
Look and lift survey	N/A	N/A	N/A	5 surveys
Sewer lining	N/A	N/A	60 metres	N/A
Patch lining	11	1	N/A	N/A
Manhole sealing	19	N/A	2 manholes	N/A
Manhole re- benching	N/A	2	N/A	N/A
Manhole sealing plates	N/A	N/A	N/A	N/A
Manhole covers and frames replaced	N/A	N/A	N/A	N/A

A temporary bio-filter unit (ATAC) was deployed in the Aldbourne area of the catchment, which was operational between 01/02/2023 - 16/02/2023. This was to partially treat flows being discharged to the watercourse during this period of elevated groundwater levels. There was no impact to the watercourse based on ammonia and dissolved oxygen readings.

An upgrade is also being planned for Ramsbury STW. This will provide a major increase in treatment capacity, reducing the need for untreated discharges to the environment at our STW. The project is expected to be completed in 2025.

Summary

Indicator site data suggests groundwater levels in the Ramsbury catchment were generally lower in 2022 than in 2021. This hydrological year, indicator site data suggests groundwater levels have generally been higher than the previous hydrological year, and EDM data for 2023 will be analysed once available to continue to examine the relationship between groundwater levels and overflow spills in the catchment.

Lift and look and CCTV surveys will be undertaken in remaining wet winter periods if conditions allow. The aim of this is to find further priority locations for remediation and investigating/justifying the need for future larger scale lining as part of our Price Review (PR) process if required.

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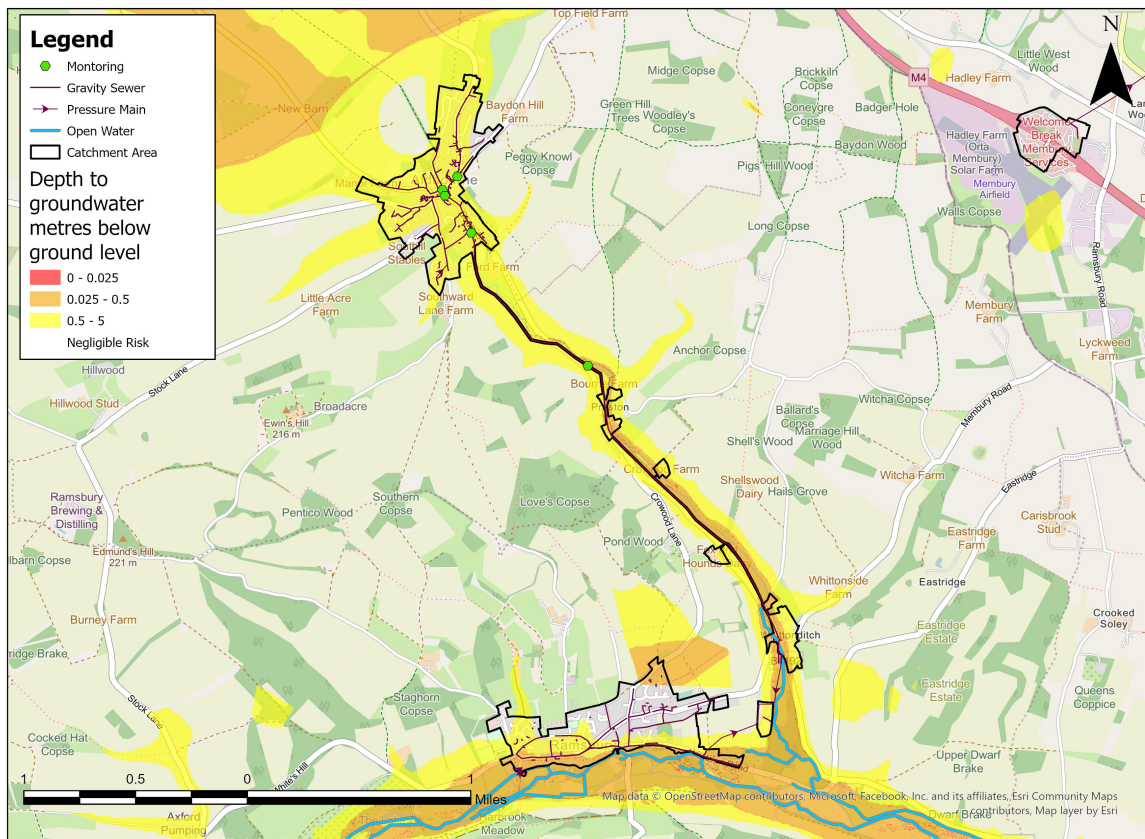
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Overview

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- Mitigation / remedial measures progressed over the last year and being planned
- Summary and plan for 2024/25

Figure 1 – Ramsbury Monitoring Plan



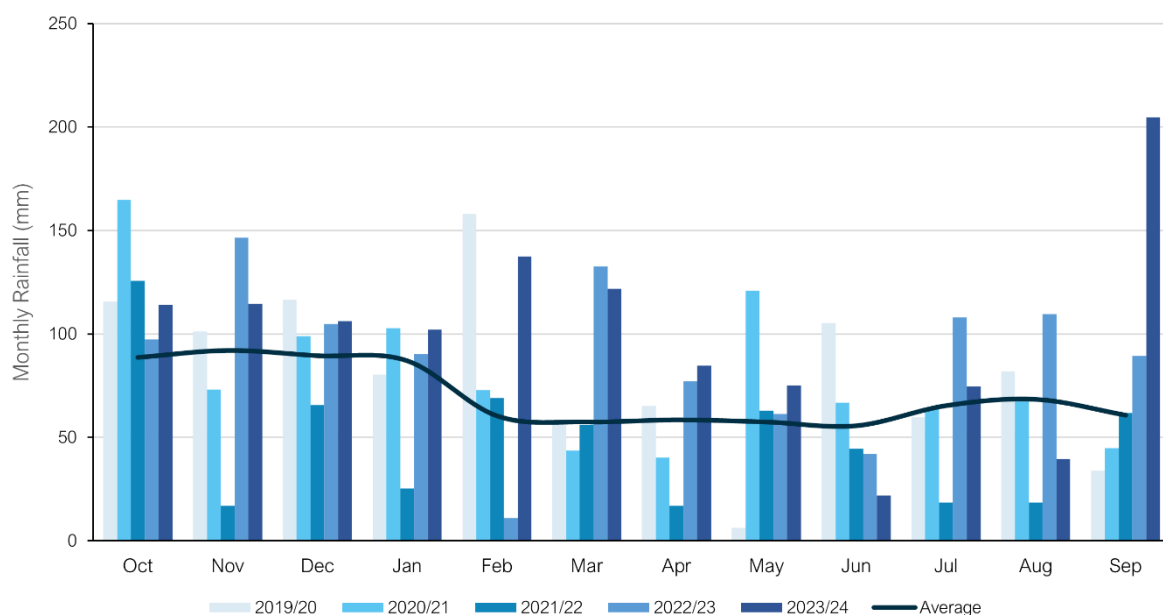
Hydrological Review – 2023-2024

This section summarises the hydrological conditions within the Ramsbury catchment within the period under investigation and provides comparison against previous year’s performance to put the annual performance into context. The hydrological review has been undertaken based on the Hydrological Year which runs October 1st to September 30th.

Catchment Rainfall

Representative Radar rainfall has been used to generate monthly data at catchment level for comparison with average data generated by local Met Office Weather Station Records. Figure 2 presents the comparison of this data for the last five hydrological years to support longer term trends within the local system.

Figure 2 – Monthly Rainfall Data



Average Values taken from Met Office Weather Station at Marlborough based on the period 1991-2020

The total rainfall for the 2023/24 hydrological year is 42% above the annual average total. Total rainfall values are presented in Table 3 below.

Table 3 –Total Rainfall Based on Hydrological Year

Average (mm)	2019/20 (mm)	2020/21 (mm)	2021/22 (mm)	2022/23 (mm)	2023/24 (mm)
841	980	960	582	1070	1197

Groundwater / Local River Level

The Ramsbury catchment is situated in the Berkshire Downs water resources area. It sits in the Seaford Chalk Formation, the Lewes Nodular Chalk Formation, and the New Pit Chalk Formation. These are comprised of carbonate material forming distinctive beds of chalk and are designated principal aquifers within the UK.

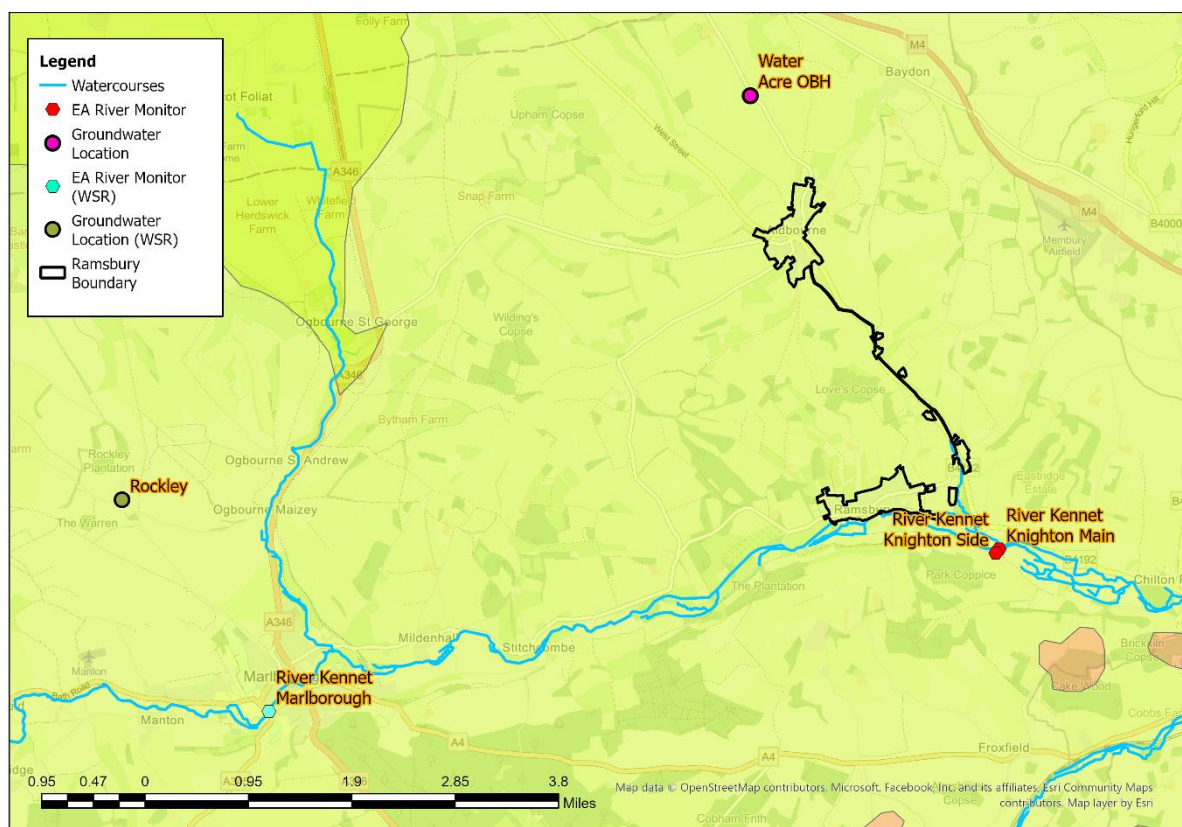
The Environment Agency has gauging stations on local watercourses measuring stage and observation boreholes (OBH) measuring groundwater levels locally to the catchment which can be used to provide indicative local groundwater performance.

From previous investigations we have identified the following sites are good indicators of groundwater levels within the catchment.

- River Kennet, Knighton Main.
- River Kennet, Knighton Side.
- Water Acre OBH.

These sites are illustrated in Figure 4, alongside the closest groundwater reference station and closest gauging station from the Water Situation Report.

Figure 4 – Local Monitoring Stations



Figures 5A-5C represent the last three hydrological years of level information at the indicator sites to build a picture of the relative conditions prevalent in the current year. It is presented against both the daily total rainfall values for the catchment and a rolling 15 day total rainfall. Note that no stage data is available for the River Kennet at Knighton Main site post February 2024.

Figure 5A – Kennet, Knighton Main

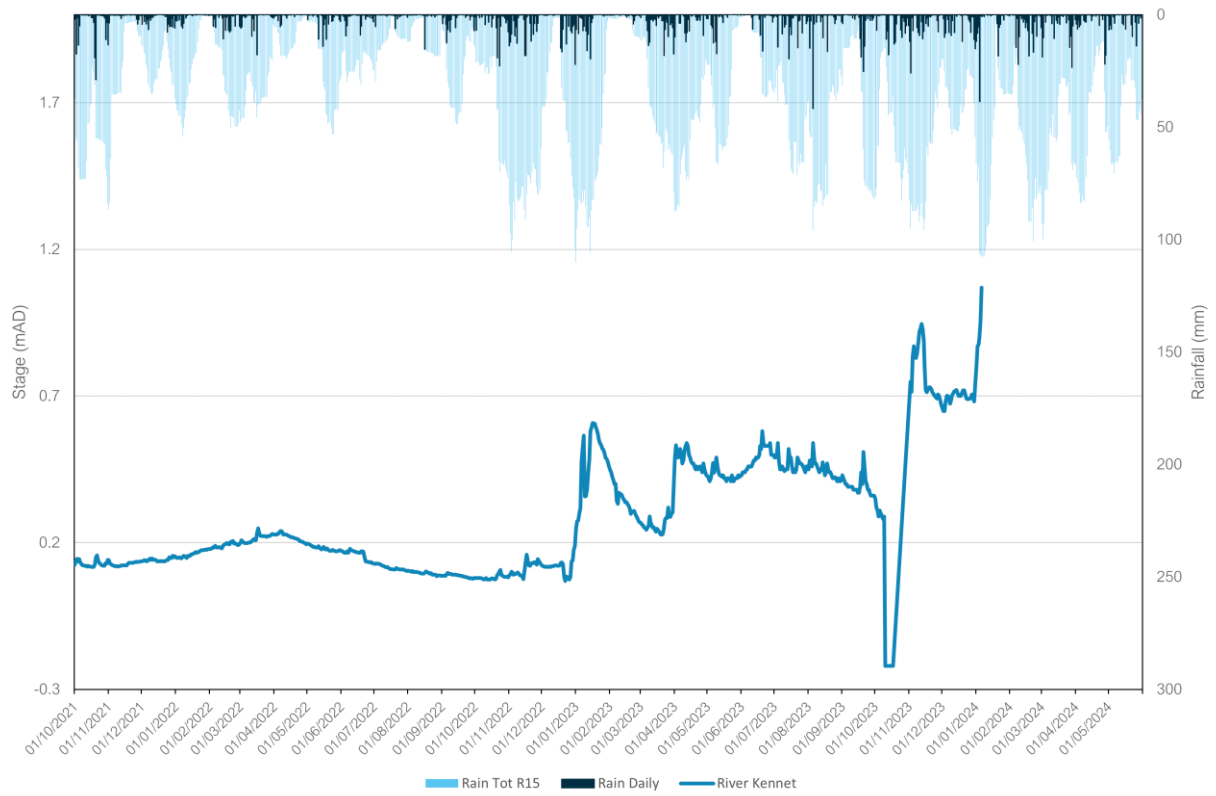


Figure 5B – Kennet, Knighton Side

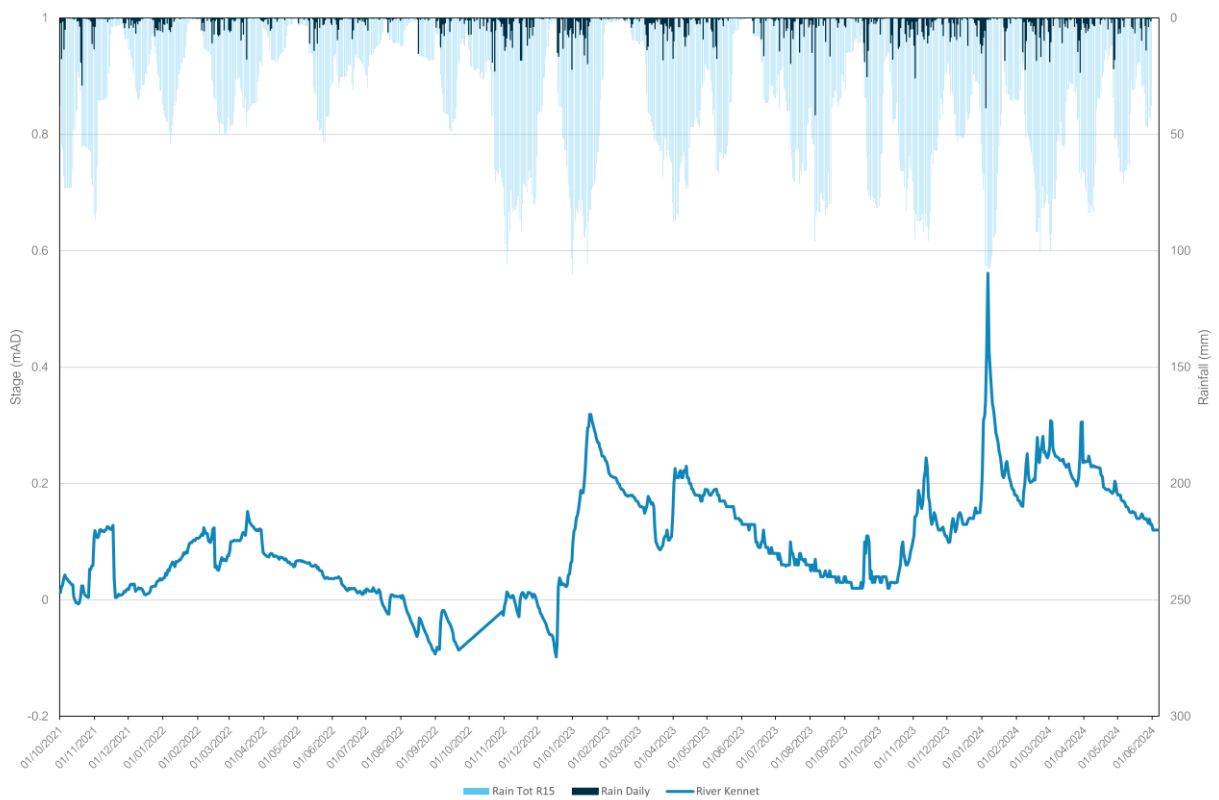
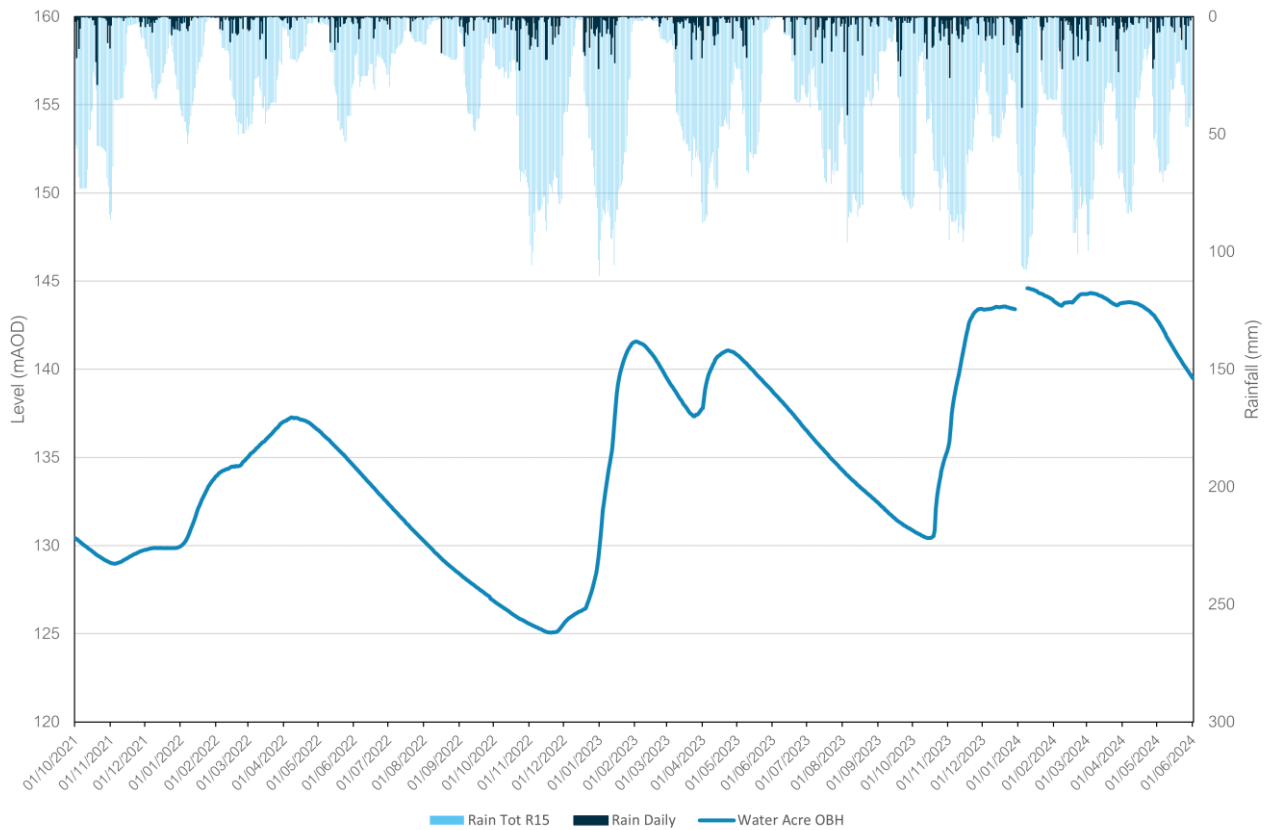
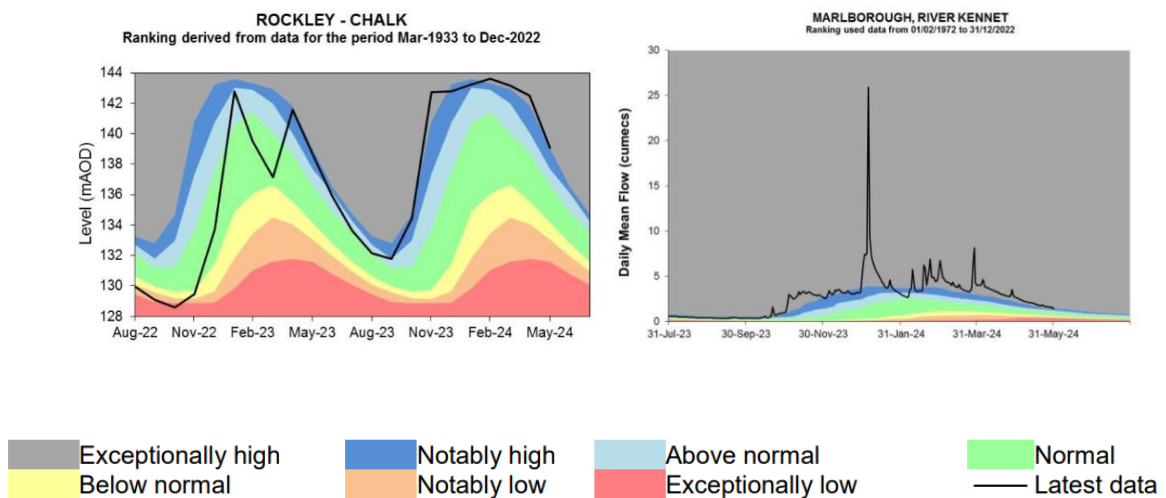


Figure 5C – Water Acre OBH



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for the Berkshire Downs. The nearest groundwater reference station is Rockley. This site shows groundwater levels in 2023 were mostly at above normal / notably high levels, rising to exceptionally high in November. In comparison, groundwater levels in 2024 have consistently been observed at notably/ exceptionally high levels. This can be seen in Figure 6 alongside the river indicator location at Marlborough on the River Kennet.

Figure 6 – Water Situation Report



Extract from - [Water Situation Report \(publishing.service.gov.uk\)](https://publishing.service.gov.uk)

Network Performance

Within the Ramsbury catchment there is one site detailed within the Environment Agency Consents Database which has an Event Duration Monitor (EDM) fitted.

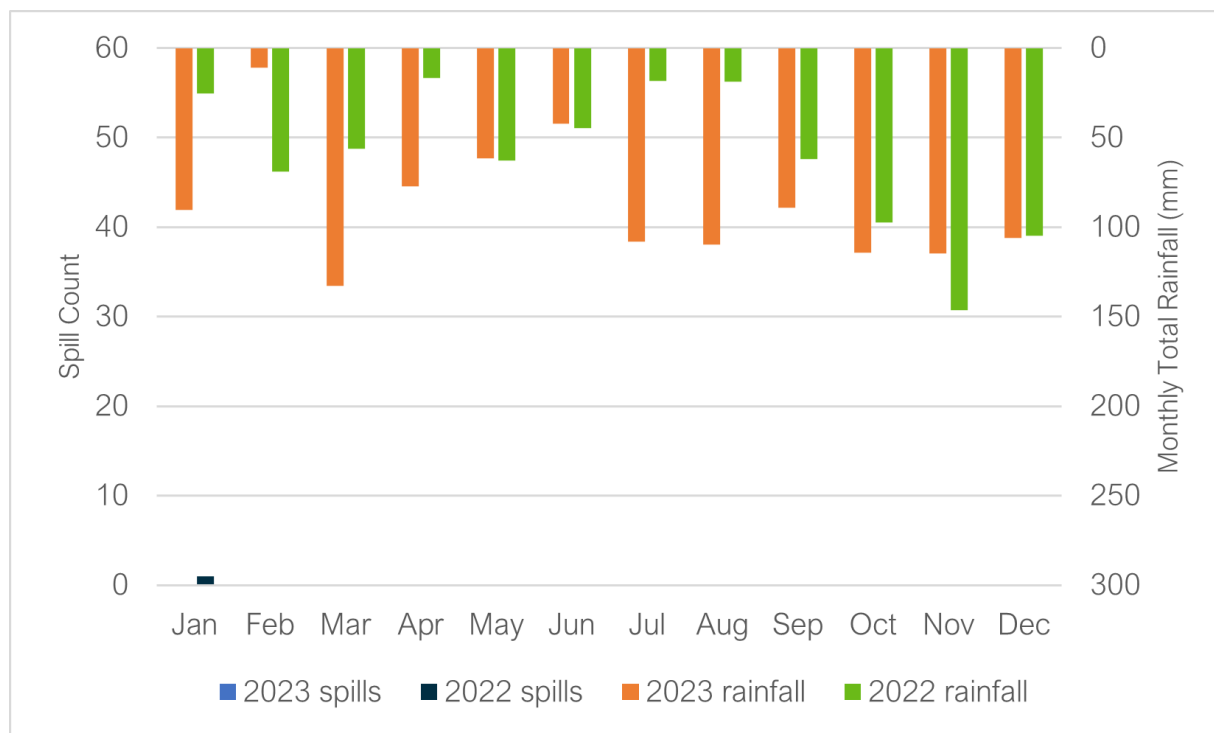
Table 7 below details the last 2 years performance of overflows within the catchment.

Table 7 – Event Duration Monitoring

Overflow	2022		2023	
	Spills	Duration (hours)	Spills	Duration (hours)
Ramsbury STW	1	0.77	0	0

A critical part of the assessment of EDM performance and its relation to groundwater infiltration is to review the month-on-month spill performance, against previous years and the monthly total rainfall values to give context to the performance. Figure 8 below presents the EDM performance trend and rainfall for recent years.

Figure 8 – EDM Monthly Performance



The utility of the last two years of EDM data to suggest a wider relationship between rainfall, elevated groundwater levels and spill frequency is limited, as only one spill was recorded at Ramsbury STW across 2022 and 2023.

Please see the 2022 Addendum Report (included in this PDF document), for discussion regarding trends evident in the EDM data for 2020, indicative of the role of groundwater infiltration on spills in the catchment. The EDM data for 2024 will also be analysed once available, to continue to examine the potential relationship between groundwater levels and overflow spills in the catchment. The indicator site data shown in Figures 5 and 6, suggests that groundwater levels in the catchment reached higher levels in 2024 than those observed in 2022 and 2023.

Investigations & Interventions

This section details the activities that have been undertaken within the catchment within the Hydrological Year 2023-24.

Monitor Installations

The sewer depth monitor (SDM) programme supports long term groundwater understanding within GISMP catchments. Currently, there are a total of 5 monitors installed within the Ramsbury catchment. There are currently no further monitor installs planned.

The data from these will be cross-referenced with other long-term records (where available) within the catchment.

Remediation Works Undertaken this Hydrological Year

Table 9 below provides a summary of the investigations and remediation works undertaken or planned within the Ramsbury catchment in the 2023-24 Hydrological Year, as well as works undertaken in the previous four hydrological years.

Table 9 – Works Undertaken in the 2023/2024, 2022/23, 2021/22, 2020/21 & 2019/20 Hydrological Year.

Investigation/ remediation type	Number/ length undertaken 19/20	Number/ length undertaken 20/21	Number/ length undertaken 21/22	Number/ length undertaken 22/23	Number/ length undertaken 23/24
CCTV survey	4.77 kilometres	N/A	N/A	1.2 kilometres, additional 465 metres	3.5 kilometres
Look and lift survey	N/A	N/A	N/A	5 surveys	12 surveys
Sewer lining	N/A	N/A	60 metres	N/A	N/A
Patch lining	11	1	N/A	N/A	N/A
Manhole sealing	19	N/A	2 manholes	N/A	N/A
Manhole re-benching	N/A	2	N/A	N/A	N/A
Manhole sealing plates	N/A	N/A	N/A	N/A	N/A
Manhole covers and frames replaced	N/A	N/A	N/A	N/A	N/A

A temporary bio-filter (ATAC) unit was deployed and operational in the Aldbourne catchment area of the catchment between 24/11/2023 - 05/06/2024. This was to partially treat flows being discharged to the watercourse during this period of high groundwater levels. Treated water at the ATAC indicated dissolved oxygen levels to be generally above 80% and no ammonia presence was recorded.

In addition to investigations previously detailed, 465 metres of CCTV survey was undertaken in the catchment over the summer 2023 period. The purpose of these surveys was to assess the structural condition of sewers predicted to be at high risk of groundwater infiltration, rather than to identify locations of groundwater infiltration into the network. All surveyed network

(accounting for 8% of the high-risk system) was identified as being in a good or acceptable structural condition.

An upgrade is also being planned for Ramsbury STW. This will provide a major increase in treatment capacity, reducing the need for untreated discharges to the environment at our STW. The project is expected to be completed in 2025, however, delivery dates are being managed at a programme level, delivery dates stated are based upon current views and are subject to change.

Summary

This hydrological year (October 2023 – September 2024), indicator site data suggests groundwater levels in the Ramsbury catchment have generally been higher than in the previous hydrological year, and EDM data for 2024 will be analysed once available to continue to examine the potential relationship between groundwater levels and overflow spills in the catchment.

Lift and look and CCTV surveys will be undertaken in remaining wet winter periods if conditions allow and subject to funding and available capacity. The aim of this is to find further priority locations for remediation and investigating/justifying the need for future larger scale lining as part of our Price Review (PR) process if required.



It's everyone's water

