Groundwater Impacted System Management Plan

Fairford, River Coln

March 2021

Thames Water

It's everyone's water

Version control

Version	Date	Amendment	Author	Checked	Reviewed
1-d1	March 2021	Draft for EA	DJ	SE	APH
1-V1	March 2021	Version 1	DJ	APH	JO
1-V2	July 2021	Update to introductory text and infiltration potential figures	DJ	APH	JO
1-V3	July 2021	Update to infiltration potential figures	DJ	APH	JO
Annual Update 2022	October 2022	Addition of Annual Update 2022	MB/JH	DJ	DJ
Annual Update 2023	October 2023	Addition of Annual Update 2023	MB	DJ	DJ
Annual Update 2024	October 2024	Addition of Annual Update 2024	CW/MW	DJ	DJ

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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 significant likely leading to the sewerage system, on occasions, to become overwhelmed.

All sewerage systems combined and separate will experience some groundwater infiltration[1] 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 centered 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 possible[2]. 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 in 2020 undertook a different approach for 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 through the price review process as service enhancement. 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 ‘minor works’ 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. Sections covered in this document include our ‘Outline Plan’ with timescales, 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.

Brief description of the Fairford system

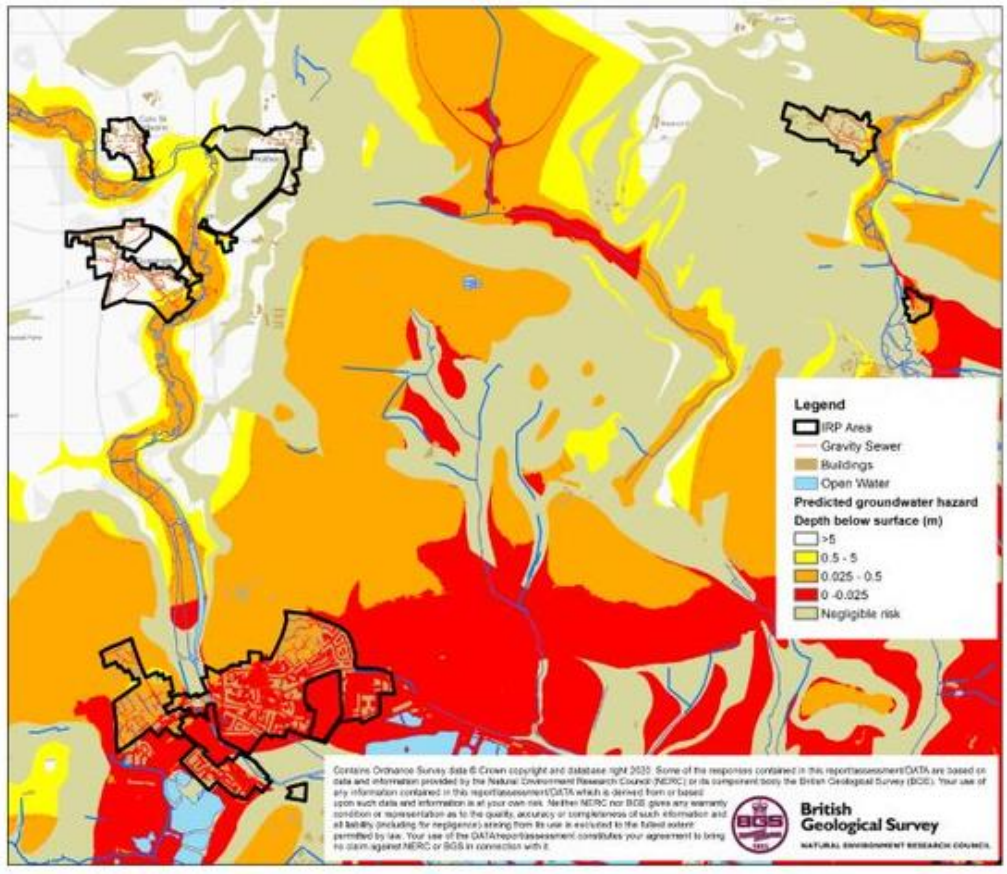

Figure 1.0 – Fairford catchment

Fairford lies on the River Coln, in Gloucstershire, England, 14km north of Swindon. Fairford serves a population equivalent[3] of 5,268 with a predominantly separate sewerage network totaling some 41.5km in length excluding private drains and sewers. The extent of the catchment is shown in Figure 1.0 above and includes the town of Fairford and the villages of Coln St Aldwyns, Eastleach, Turville, Fyfield, Hatherop, Netherton and Quenington.

Problem characterisation

Groundwater has potential to enter our sewers when levels are high which reduces their capacity and increases their risk of the network becoming overwhelmed. There's a strong link between the rising river levels (in the River Coln) that cause rising groundwater levels, and the drainage issues some of our customers have experienced.

[3] Population equivalent based on 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.

In recent years the foul sewerage system in the Fairford catchment has become overwhelmed, following prolonged and heavy rainfall and raised groundwater levels. This has resulted in certain properties suffering from sewer flooding and restricted toilet use. The sewerage system is identified on the public sewer records as being a separate foul system, rather than a combined system. It should therefore, in theory, only be accepting foul drainage rather than a combination of foul and surface water, however, there are limited areas with public surface water sewers in the area, mainly in the new development area north east of Fairford town.

We believe that the system has surcharged due to a combination of groundwater infiltration to public sewers and private drainage, possible surface water misconnections (i.e. down pipes from roofs), significant volumes of run off from surrounding saturated fields, inundation from overloaded highway drains and public spaces and river water overflowing from the River Coln.

Fairford is situated at the boundary where the bedrock limestone of the Cotswolds escarpment meets the grave beds of the Upper Thames Valley. Some areas have a thick bed of permeable gravel over impermeable clay, which can contribute to considerable variations in groundwater levels. The catchment drains to the south east where a series of interlinked lakes act as Fairford's flood reservoir.

The root causes of sewer surcharges and STW performance issues are therefore numerous and resolution of issues complex, requiring all stakeholders responsible for drainage in the catchment to work together to resolve them.

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 Gloucestershire County Council as Lead Local Flood Authority, County Council and Cotswold District Council as 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).

A number of our sewerage systems include for permitted overflows, these structures are there to protect against sewer flooding as a result of rainfall or equipment failure where appropriate. Discharges from these structures should not be impacted by excessive infiltration as detailed by the EA Regulatory Position statement on groundwater impacted sewerage systems.

The impact of the groundwater infiltration and high flows in the Fairford catchment has overloaded the gravity sewers, sewage pumping stations and the STW; which has also impacted the.

performance of the STW.

Our permit conditions for Fairford STW state:
"The discharge shall only occur when and only for as long as the flow passed forward is equal to or greater than the overflow setting indicated due to rainfall and/or snow melt" and "Off-line storm storage must be fully utilised before a discharge occurs. It shall only fill when the flow passed forward is equal to or greater than the overflow setting indicated due to rainfall and/or snowmelt and shall be emptied and its contents returned to the continuation flow as soon as reasonably practicable"

There is some correlation between flows arriving at the works and river levels within the catchment. This is not indicative or evidence of a direct connection between the river and the sewerage system, simply that similar sources of flow are likely to be influencing both systems, and hence helps to further our understanding of what some of the mechanisms might be leading to increased winter flows (at the STWs). We therefore have a perceived understanding of the possible root causes, which we are in the process of investigating, monitoring, and verifying over the forthcoming winter periods.

On occasions, where the incoming flow has exceeded treatment capacity for sustained periods, the storm tanks have become full and spills to watercourses have occurred.

Anticipated unavoidable discharges

Within recent years there have been unavoidable sewage escapes in the network as a result of surcharging man-holes.

We anticipate that this situation may continue until such time we are able to implement a long-term solution.

No mitigation in the form of temporary overflows has been undertaken in this system.

General outline plan & timescale

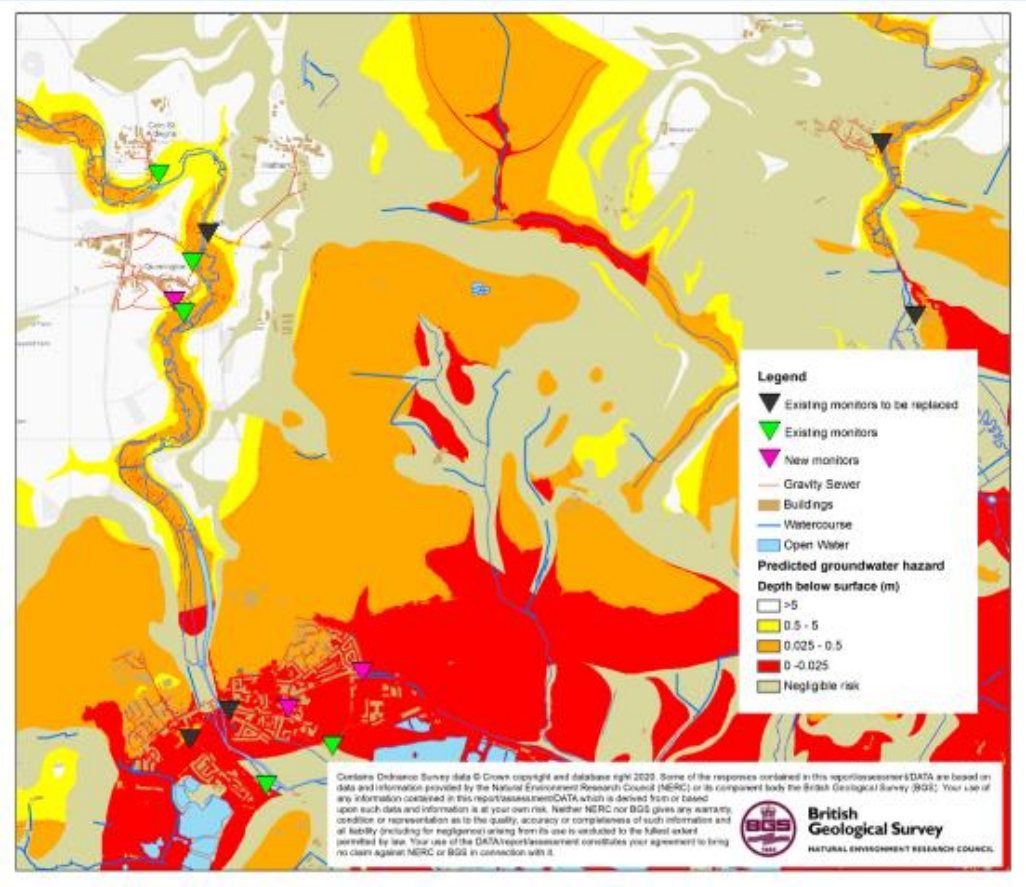

Figure 2.0 – Fairford monitoring and infiltration zones

Key to bringing the impact of groundwater infiltration under control is an enhanced monitoring regime. We have identified several additional telemetered depth monitor locations around the Fairford system, where installation will be carried out, in addition to a number of monitors being replaced– see Figure 2.0.

Complementing 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 Fairford 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 additional/replacement sewer depth monitors referred to earlier will be 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 wholly[4] 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 Fairford.

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 in the Thames Water region identified as being impacted by infiltration.
Install monitors	2020-2023	Further monitors will be 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.
CCTV	2020-2023	Required to confirm sewer condition and provide information to assist with costing any sewer lining.

[4] Decisions regarding the extent of sealing will be based on outcomes of works undertaken to date, result of monitoring and successful submission of our plans for investment.

Activity	When	Description
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 / Price review	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.

Fairford Infiltration Management Plan

As detailed above the impact of infiltration is experienced in the network and at the STW.

As part of our current investment plan, we have projects to increase the flow to full treatment at Fairford STW. The main driver for the upgrade is growth, however the rate of maximum observed infiltration is considered as part of the calculation for the new treatment flow rates. 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.

Our approach to the resolution of infiltration impacting the Fairford sewerage system is outlined below.

High level approach statement

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

1. We will investigate the network with a view to identifying sources of ingress of infiltration that are cost effective[5] to address. To investigate the network, we have:

- Undertaken a desktop analysis to determine infiltration high to low risk zones (October 2020);

To further investigate the network, we will:

- Install additional monitoring to back up the analysis and to aid 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.

We will also review results of Winter 2019/20 and 2020/21 with historic data to build up evidence to support interventions in the network (Summer/Autumn 2021).

2. Where interventions can be undertaken as part of normal sewer maintenance activities these will be communicated and progressed.

3. 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 AMP9 (2030-35) programme of investment. Significant investment needs may need to be included in our 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) will include '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

Further Sewer Depth Monitors will be installed in the catchment in 2021 (see Figure 2.0). 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.

These units will also 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) points on the network, make use of pumps to manage flows or deploy settlement tanks to part treat sewage before release to the environment.

With regard to the Fairford system we will continue to tanker where required .

Updates

Work on the Groundwater infiltration management plan will continue, and we will provide updates in October 2022 and annually in October thereafter.

Appendix

Groundwater infiltration potential analysis

The table below presents a summary of the JBA groundwater infiltration analysis which identifies the sewers and manholes which are likely to be vulnerable to groundwater infiltration.

Sewer Length by Groundwater Infiltration Risk Zones

Risk category	Description	Length (km)	Percentage
High	Predicted groundwater extreme >1m above pipe invert	14.12	59.8
Medium	Predicted groundwater extreme 0-1m above pipe invert	1.51	6.4
Low	Predicted groundwater extreme 0-1m below pipe invert	0.48	2.0
Very Low	Predicted groundwater extreme >1m below pipe invert	7.51	31.8
Total		23.61[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	58	7.3
Medium	Inundation risk in 1% AEP fluvial or pluvial event	41	5.1
Low	Inundation risk in 0.1% AEP fluvial or pluvial event	93	11.7
Very Low	All other manholes	604	75.9
Total		796	100.0

[6] Total 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

Lift and Look and CCTV surveys have not yet commenced in the Fairford System. Our next update to the plan will include information on our progress in these areas.

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 2022

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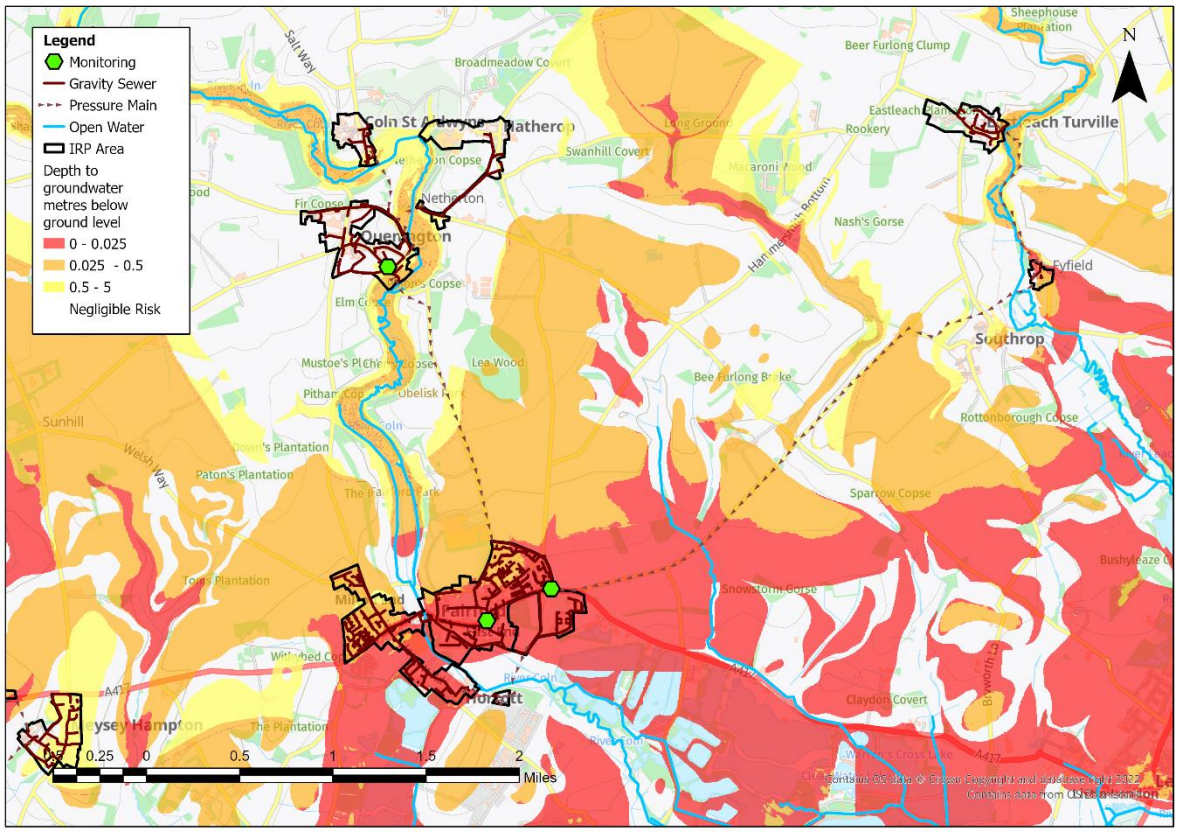
Overview

This addendum to the Fairford Groundwater Impacted System Management Plan 2021 (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 – Fairford Monitoring Plan



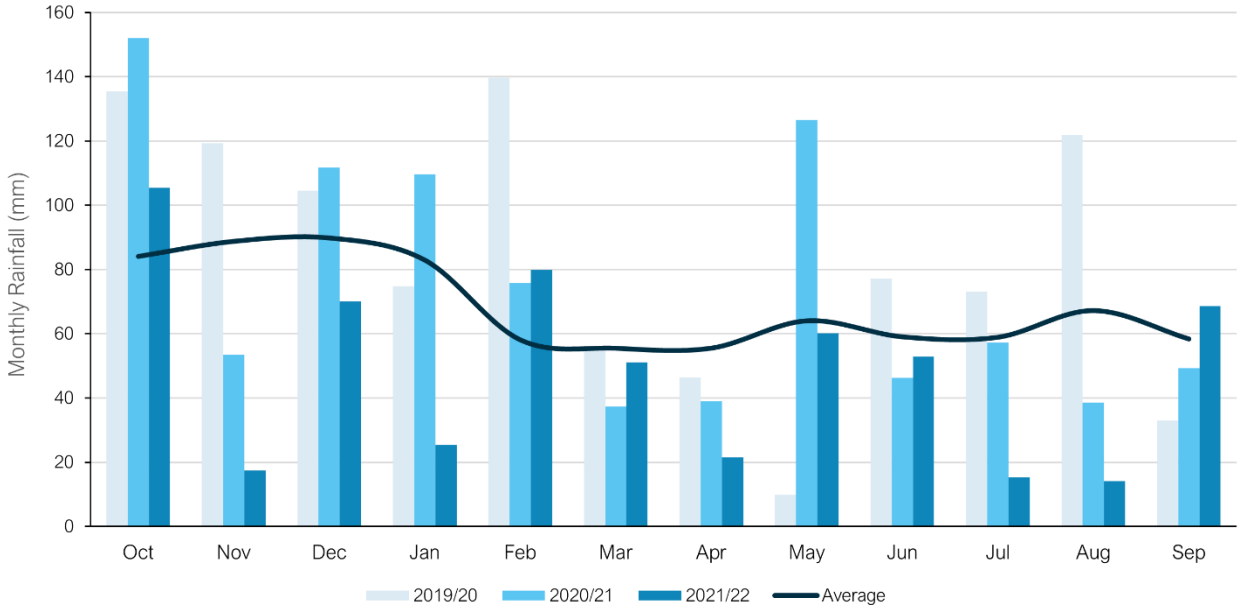
Hydrological Review – 2021-2022

This section summarises the hydrological conditions within the Fairford 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 Cirencester based on the period 1991-2020

The total rainfall for the 2021/22 hydrological year is 28% 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)
823	991	897	591

Groundwater / Local River Level

The Fairford catchment is situated in the Cotswolds West and Upper Thames water resources areas. It primarily sits in the Cornbrash Formation of limestone and the White Limestone Formation. The White Limestone Formation is a designated principal aquifer within the UK.

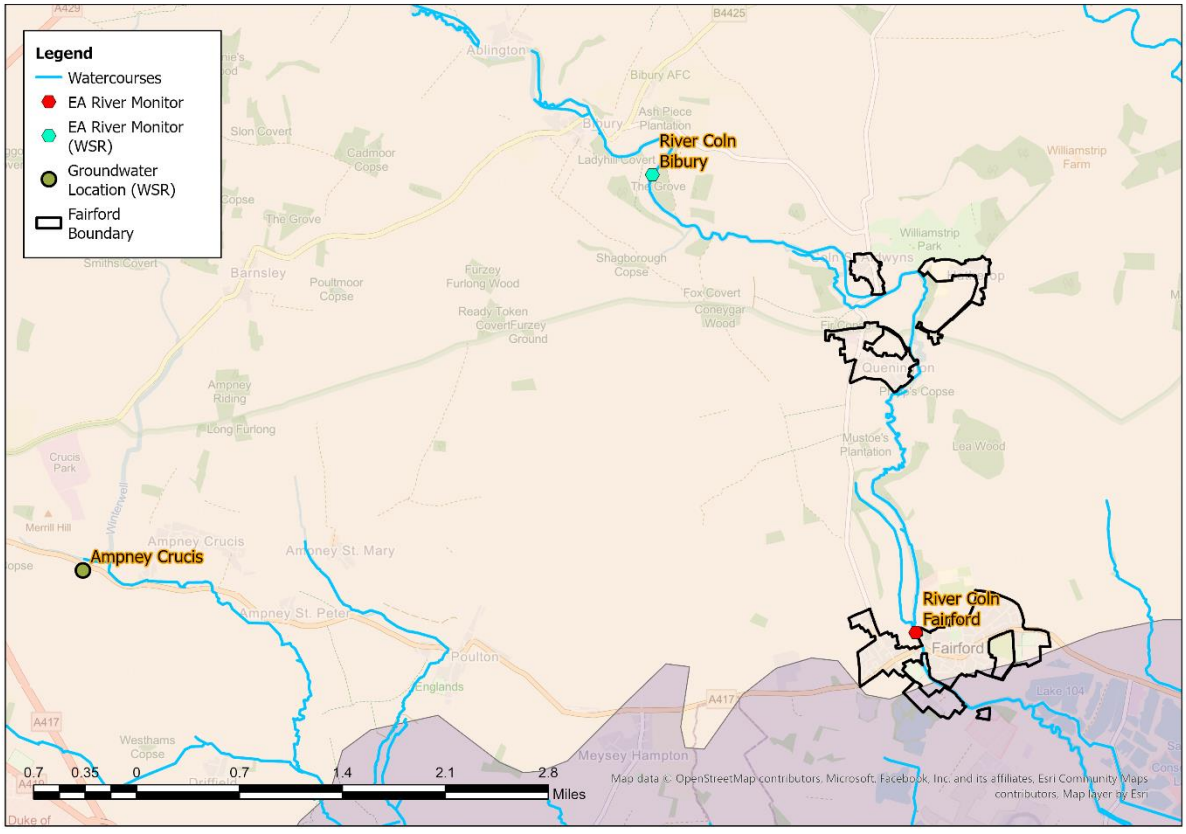
The Environment Agency has gauging stations on local watercourses measuring stage and observation boreholes measuring groundwater levels locally to the catchment which can be used to provide indicative local groundwater performance.

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

- River Coln, Bibury.
- River Coln, Fairford.

These sites are illustrated in the figure below, alongside the closest groundwater reference station and closest gauging station from the Water Situation Report – note the closest gauging station from the WSR is also the River Coln at Bibury.

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 – River Coln, Bibury

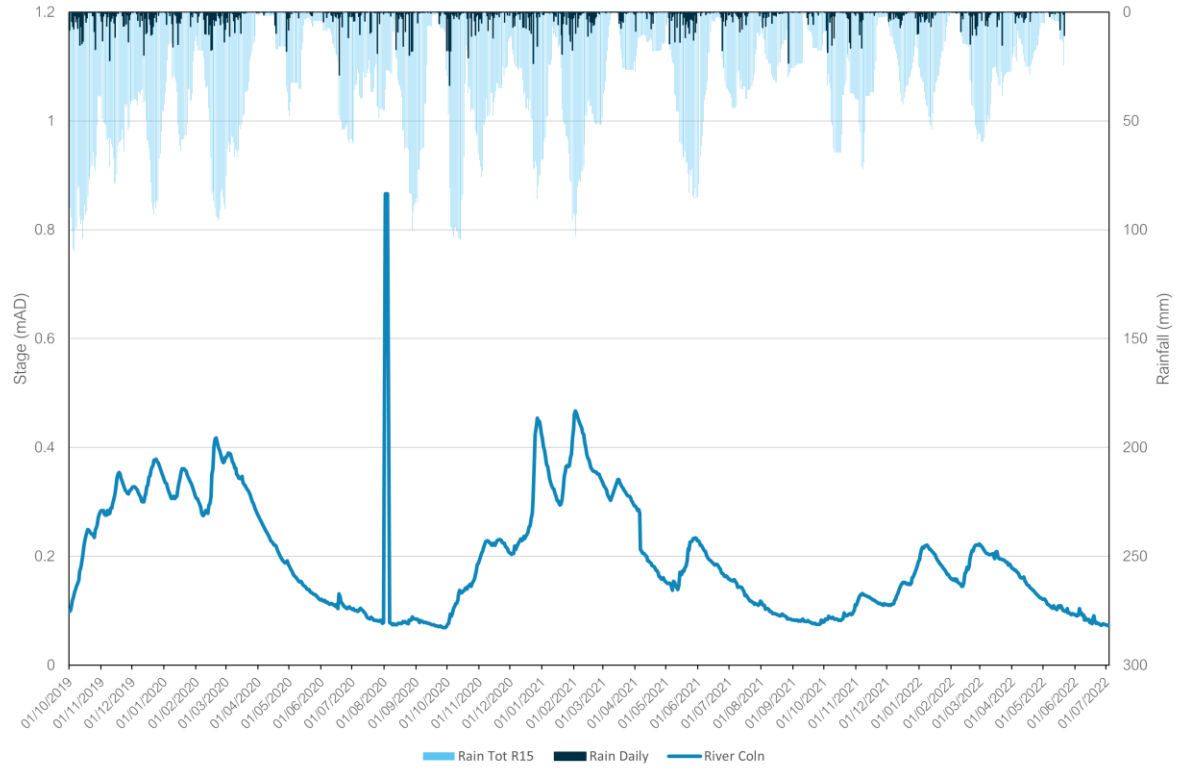
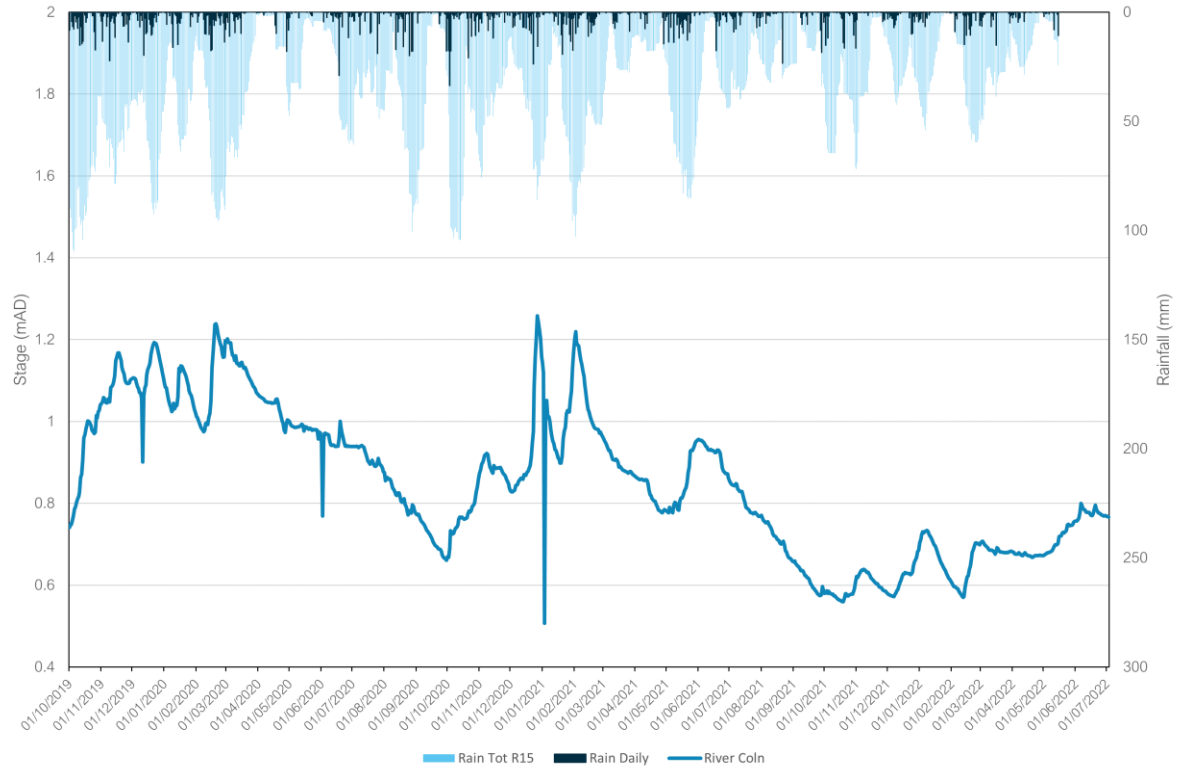
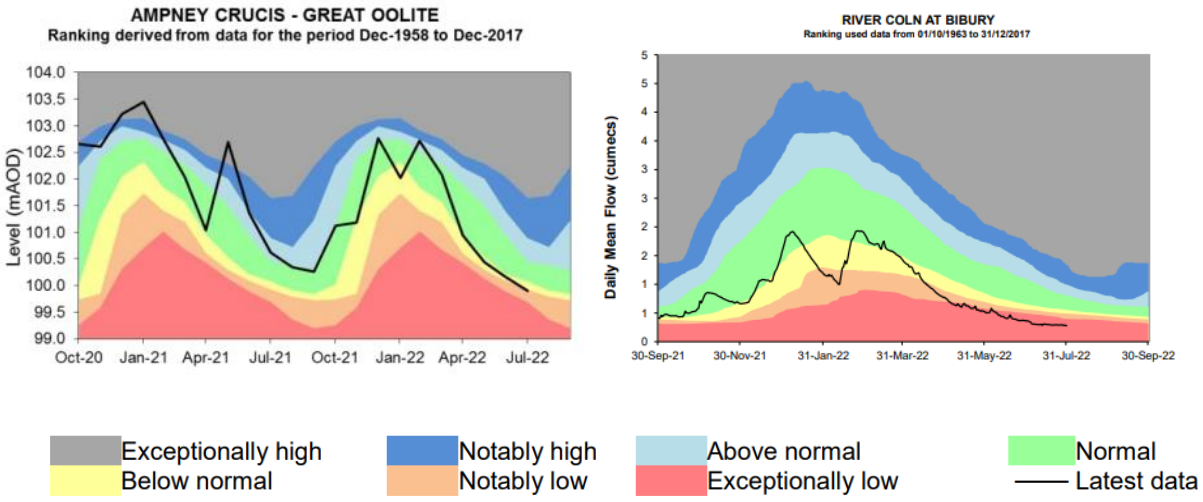


Figure 5B – River Coln, Fairford



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for Cotswolds West. The nearest groundwater reference station is Ampney Crucis. 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 Bibury on the River Coln.

Figure 6 – Water Situation Report



Extract from - [Water Situation Report (publishing.service.gov.uk)]

Network Performance

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

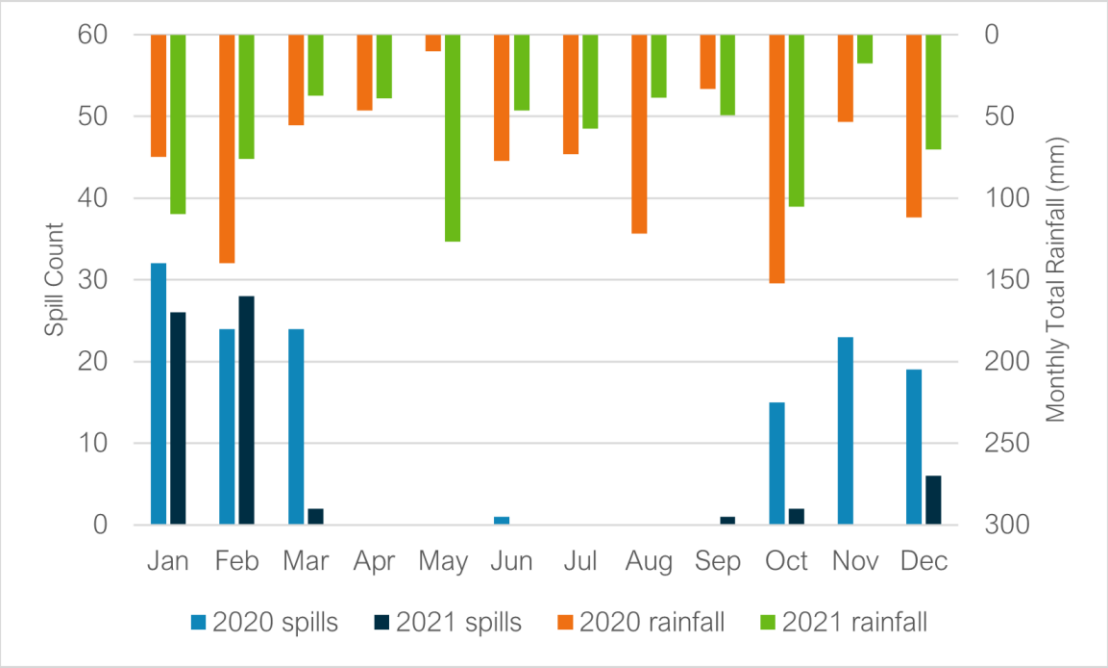
Table 7 below details the last 2 years performance of overflows within the catchment.

Table 7 – Event Duration Monitoring

Overflow	2020		2021	
	Spills	Duration (hours)	Spills	Duration (hours)
Fairford STW	138	2491.52	65	1221.41

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 trend in spill performance across the two recorded years does show variation in spills, with an overall focus on spills during the autumn and winter months. The data suggests a wider relationship between rainfall, elevated groundwater levels and spill frequency. A slower tail off in spills is evident within the first half of 2020, when the indicator sites suggest groundwater levels within the catchment were higher than within the first half of 2021. A much greater number of EDM spills was also recorded October – December 2020, compared to the same period in 2021. The indicator sites suggest groundwater levels in the catchment were higher in 2020.

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 3 monitors installed within the Fairford 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 Fairford 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	114 metres
Look and lift survey	N/A
Sewer lining	N/A
Patch lining	1
Manhole sealing	1 manhole
Manhole sealing plates	N/A
Manhole covers and frames replaced	N/A

Although the seasonal trends in groundwater have been low in comparison with previous years and the SDM installations are generally not showing significant groundwater presence, targeted surveys and appropriate remedial action have been undertaken where groundwater levels have allowed.

Summary

Rainfall in the Fairford catchment over the 2021/22 hydrological year has been below average, with groundwater levels in the aquifer beneath Fairford not reaching the levels seen in previous years which triggered groundwater ingress into the sewerage network and elevated flow/depth readings at monitoring sites. This is indicated by the lower number of EDM spills recorded at Fairford STW October – December 2021, compared to October – December 2020, when the indicator sites suggest groundwater levels in the catchment were higher.

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.

Addendum - Annual Update 2023

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Overview

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- Performance of the sewerage system
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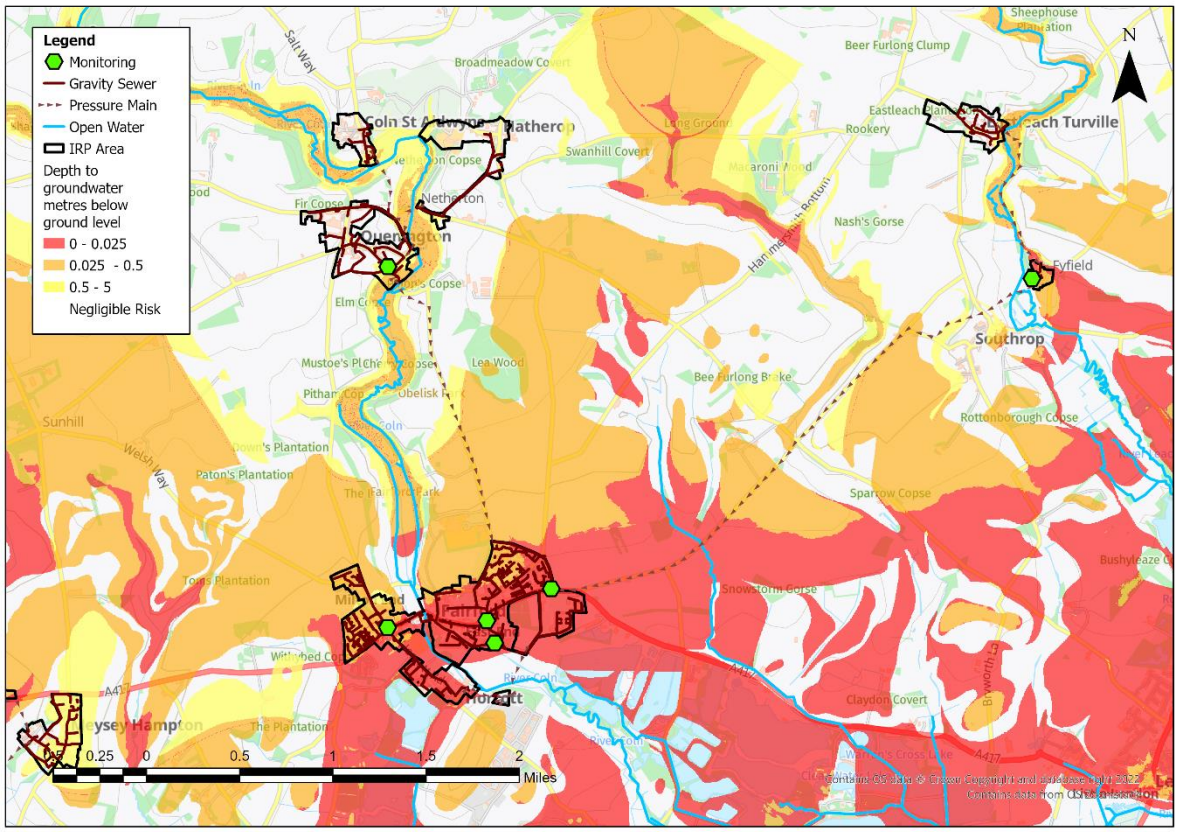

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This section summarises the hydrological conditions across the Fairford catchment within the period under investigation and provides comparison against previous year's performance to put the annual performance into context. The hydrological review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

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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.

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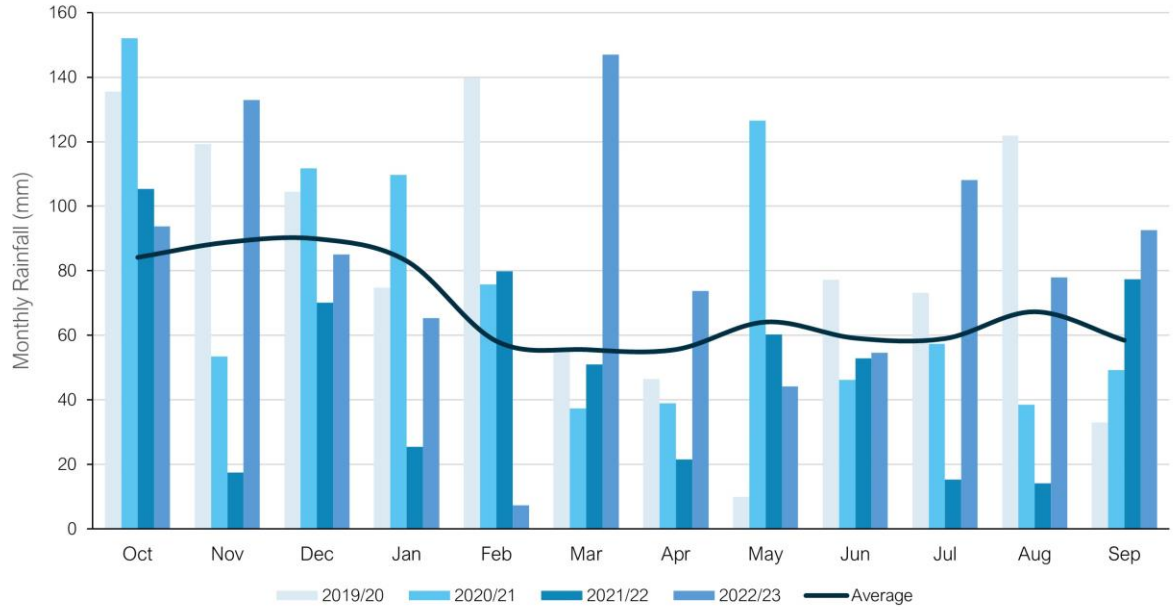

Average Values taken from Met Office Weather Station at Cirencester based on the period 1991-2020

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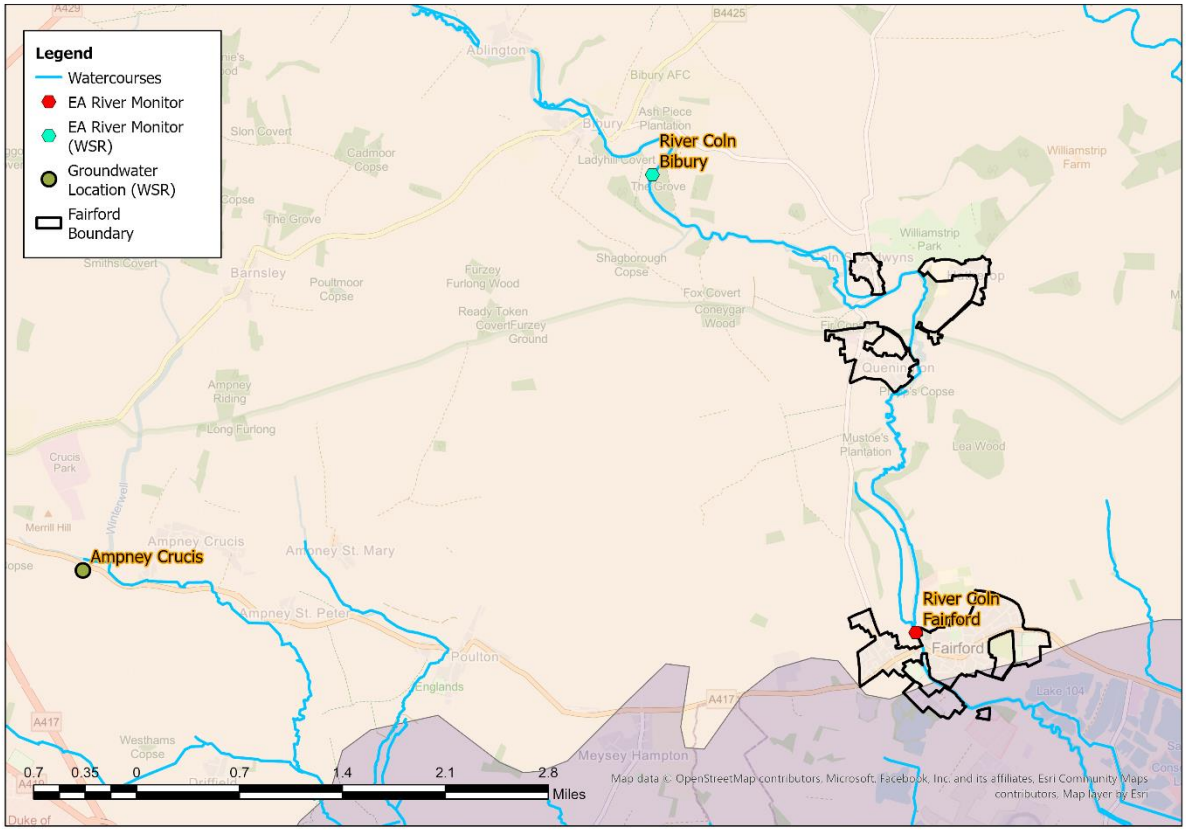


The following figures represent the last three hydrological years of level information at the indicator sites to build a picture of the relative conditions prevalent in the current year. It is presented against both the daily total rainfall values for the catchment and a rolling 15-day total rainfall.

Figure 5A – River Coln, Bibury

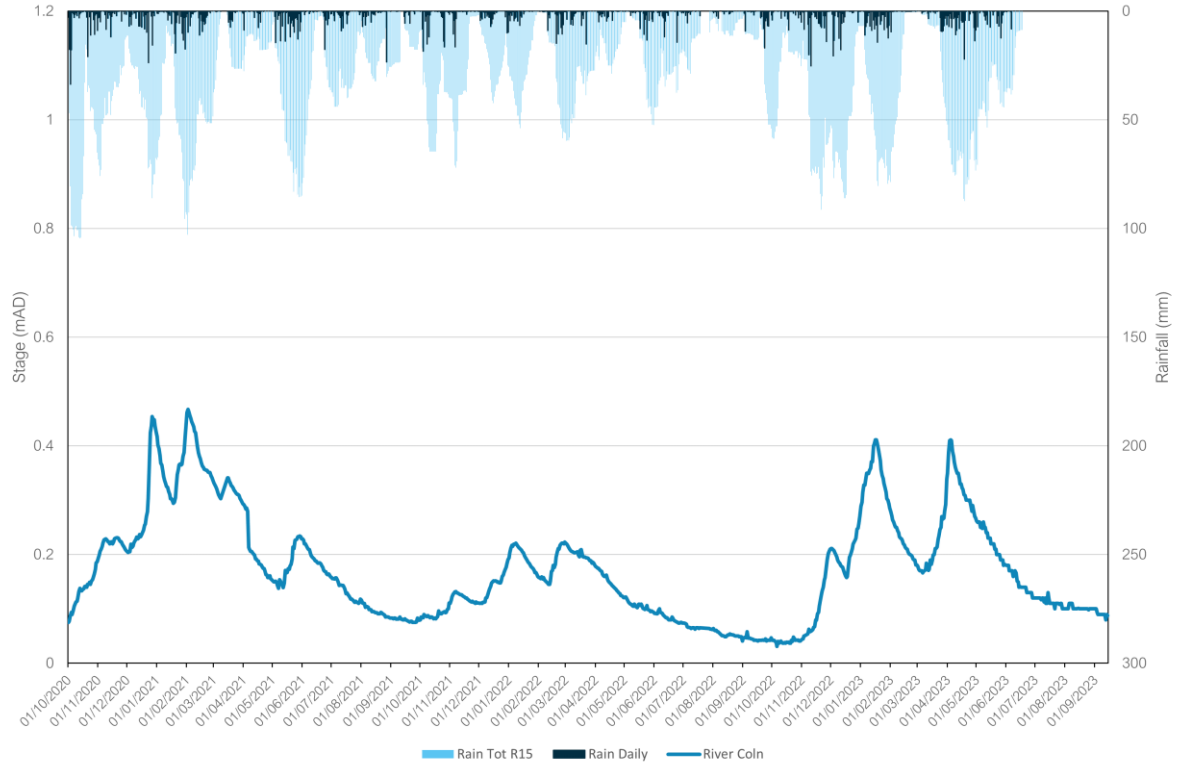
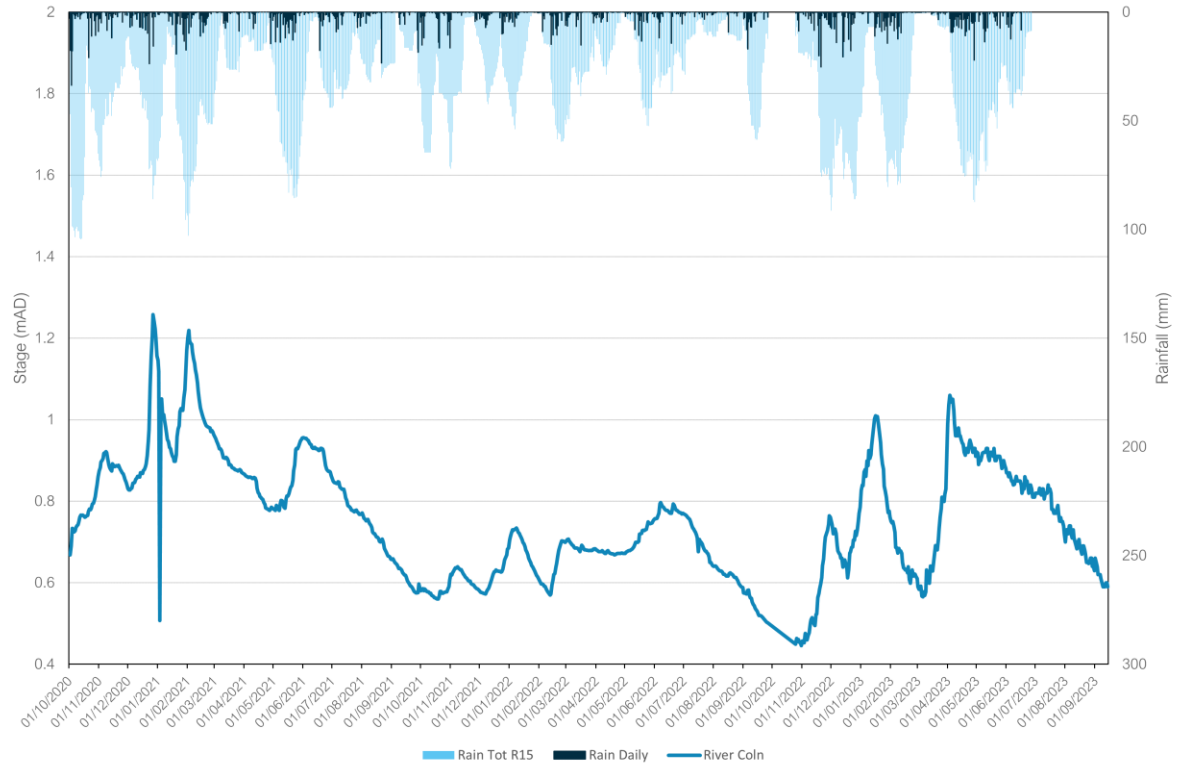
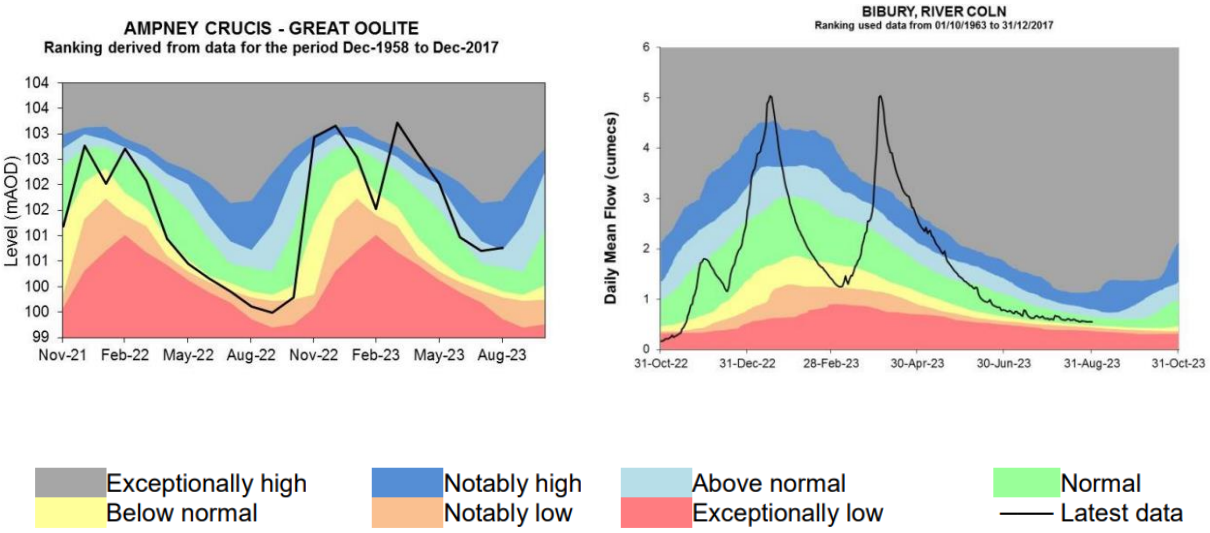


Figure 5B – River Coln, Fairford



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for Cotswolds West. The nearest groundwater reference station is Ampney Crucis. This site shows groundwater levels generally at normal, below normal and notably low levels in 2022. Groundwater levels are observed to rise towards the end of the year to reach notably high levels by the end of November. For 2023, groundwater levels have been higher than the equivalent periods in 2022. This can be seen in the figure below alongside the river indicator location at Bibury on the River Coln.

Figure 6 – Water Situation Report



Extract from - [Water Situation Report (publishing.service.gov.uk)]

Network Performance

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

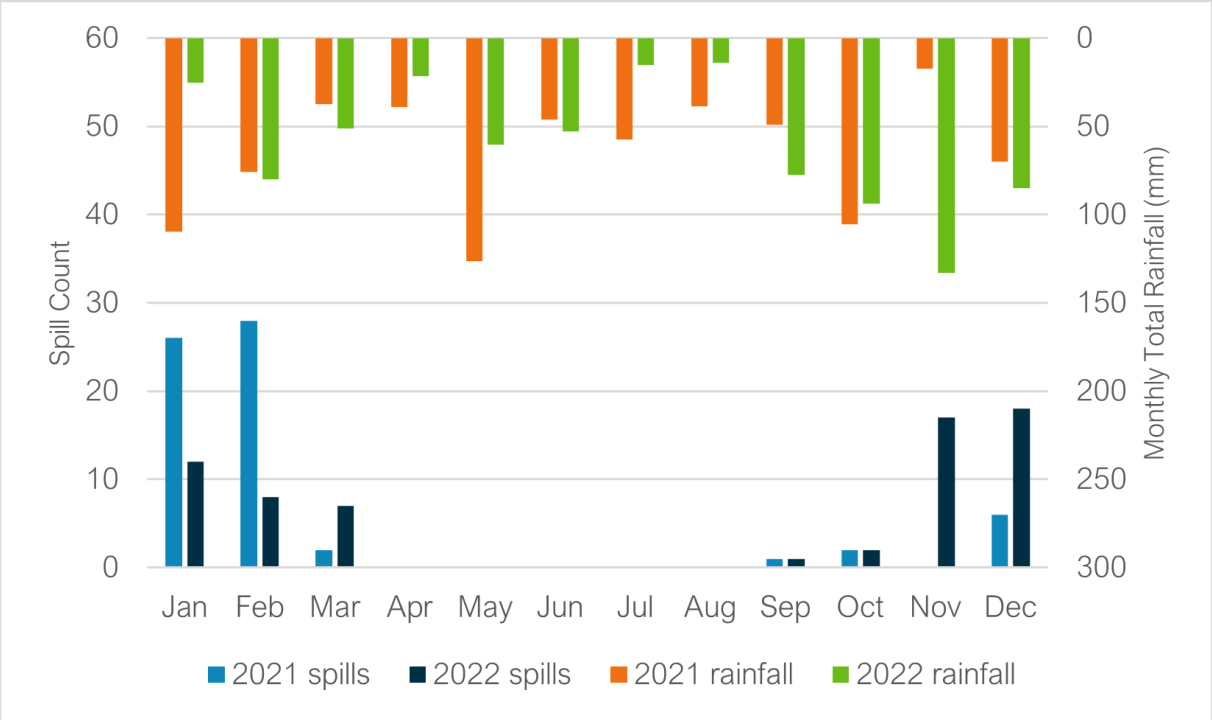
Table 7 below details the last 2 years performance of overflows within the catchment.

Table 7 – Event Duration Monitoring

Overflow	2021		2022	
	Spills	Duration (hours)	Spills	Duration (hours)
Fairford STW	65	1221.41	65	1023.57

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 trend in spill performance across the two recorded years does show variation in spills with a focus on spills during the autumn and winter months. The data suggests a wider relationship between rainfall, elevated groundwater levels and spill frequency. Where groundwater levels were observed as notably high in November and December 2022 (see Figure 6), this corresponds with a significant number of EDM spills at Fairford STW. Similarly, despite broadly similar rainfall totals, significantly more spills were recorded at Fairford STW in February 2021 compared to February 2022. The indicator site data shown in Figure 5, suggests groundwater levels in the catchment were higher in February 2021.

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 6 monitors installed within the Fairford 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 Fairford catchment in the 2022-23 Hydrological Year, as well as works undertaken in the 2021-22 Hydrological Year.

Table 9 – Works Undertaken in the 2022/23 Hydrological Year & in the 2021/22 Hydrological Year

Investigation/ remediation type	Number/ length undertaken 21/22	Number/ length undertaken 22/23
CCTV survey	114 metres	30 metres
Look and lift survey	N/A	3 surveys
Sewer lining	N/A	N/A
Patch lining	1	1 outstanding*
Manhole sealing	1 manhole	N/A
Manhole sealing plates	N/A	N/A
Manhole covers and frames replaced	N/A	N/A

*Rollover from last hydrological year.

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

Summary

This hydrological year, indicator site data suggests groundwater levels in the Fairford catchment have generally been higher than the previous hydrological year, with the number of spills recorded at Fairford STW November – December 2022 indicative of the role of groundwater infiltration on spills in the catchment. The 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 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.

Addendum - Annual Update 2024

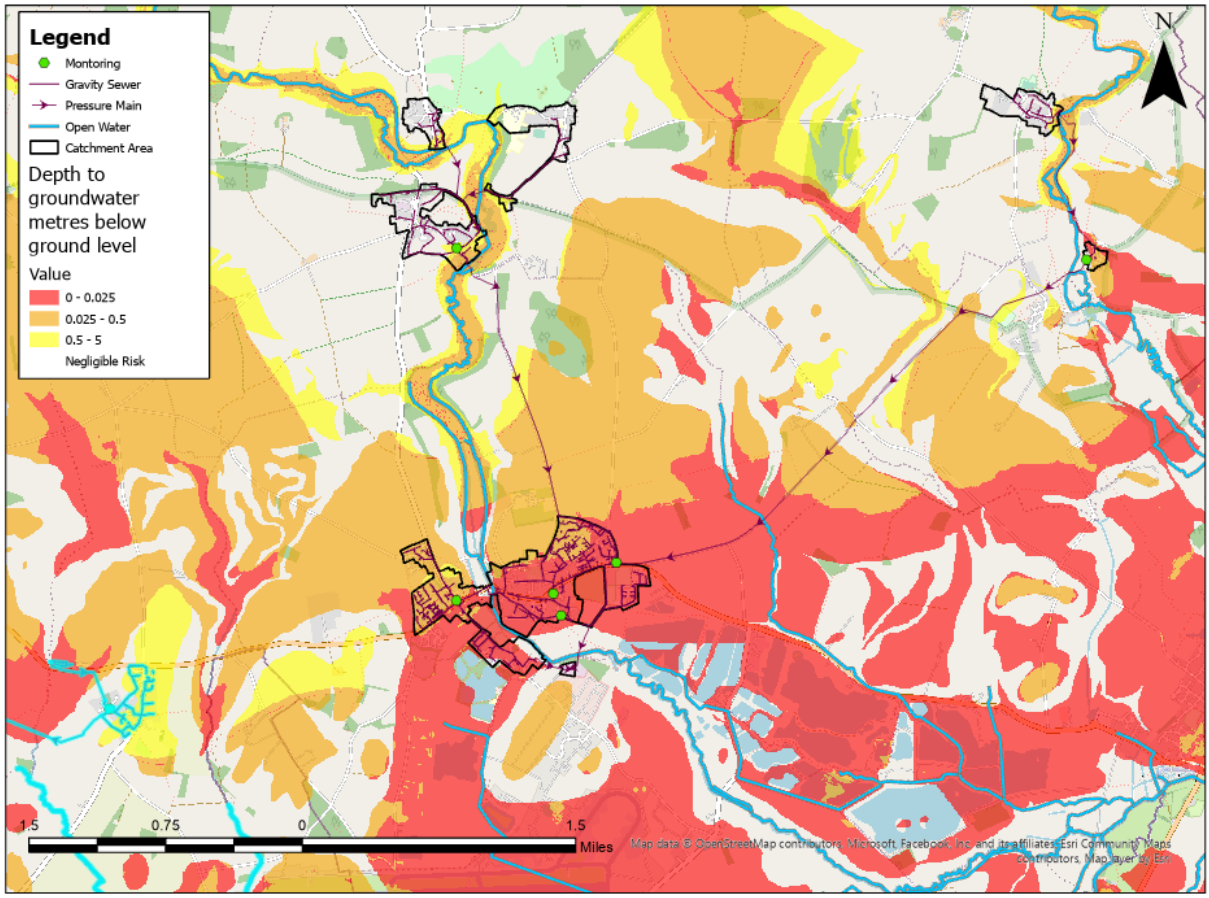
Table of contents

Overview

This addendum to the Fairford Groundwater Impacted System Management Plan 2021 (GISMP) provides an update on work undertaken in the Hydrological Year October 2023 to September 2024. The key points covered include:

- Hydrological conditions
- Performance of the sewerage system
- Mitigation / remedial measures progressed over the last year and those being planned
- Summary and plan for 2024/25

Figure 1 – Fairford Monitoring Plan



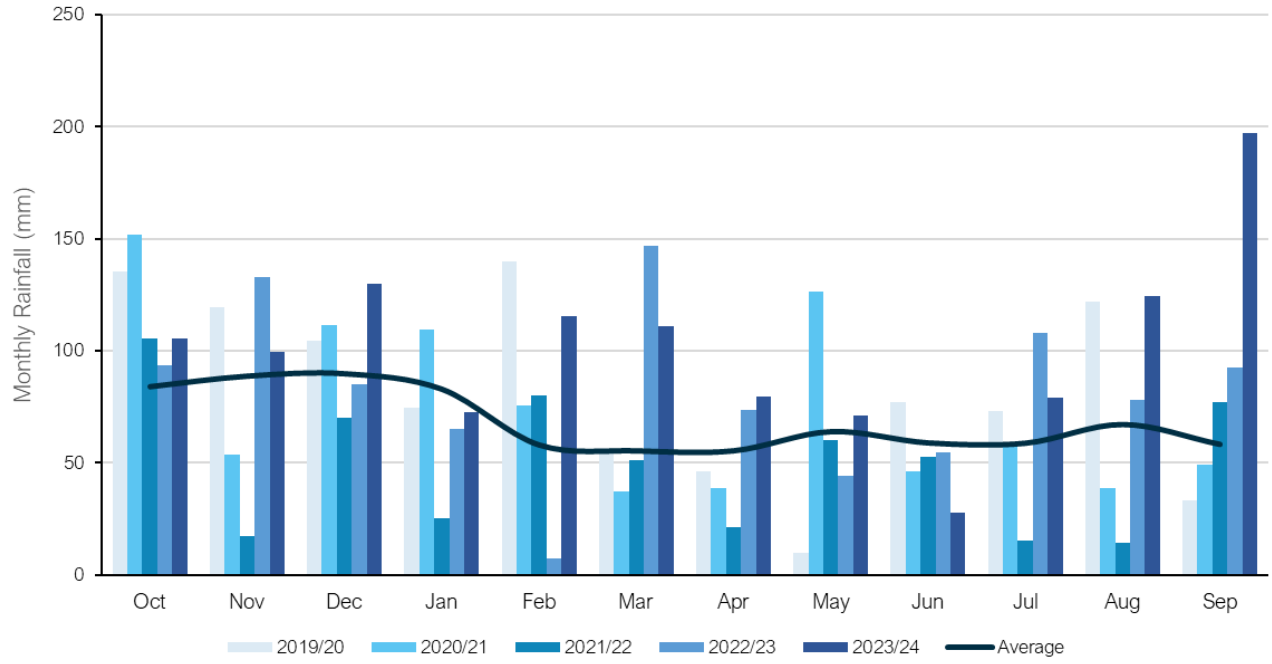
Hydrological Review – 2023-2024

This section summarises the hydrological conditions across the Fairford 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 Cirencester based on the period 1991-2020

The total rainfall for the 2023/24 hydrological year is 48% 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)	2023/2024 (mm)
823	991	897	591	983	1214

Groundwater / Local River Level

The Fairford catchment is situated in the Cotswolds West and Upper Thames water resources areas. It primarily sits in the Cornbrash Formation of limestone and the White Limestone Formation. The White Limestone Formation is a designated principal aquifer within the UK.

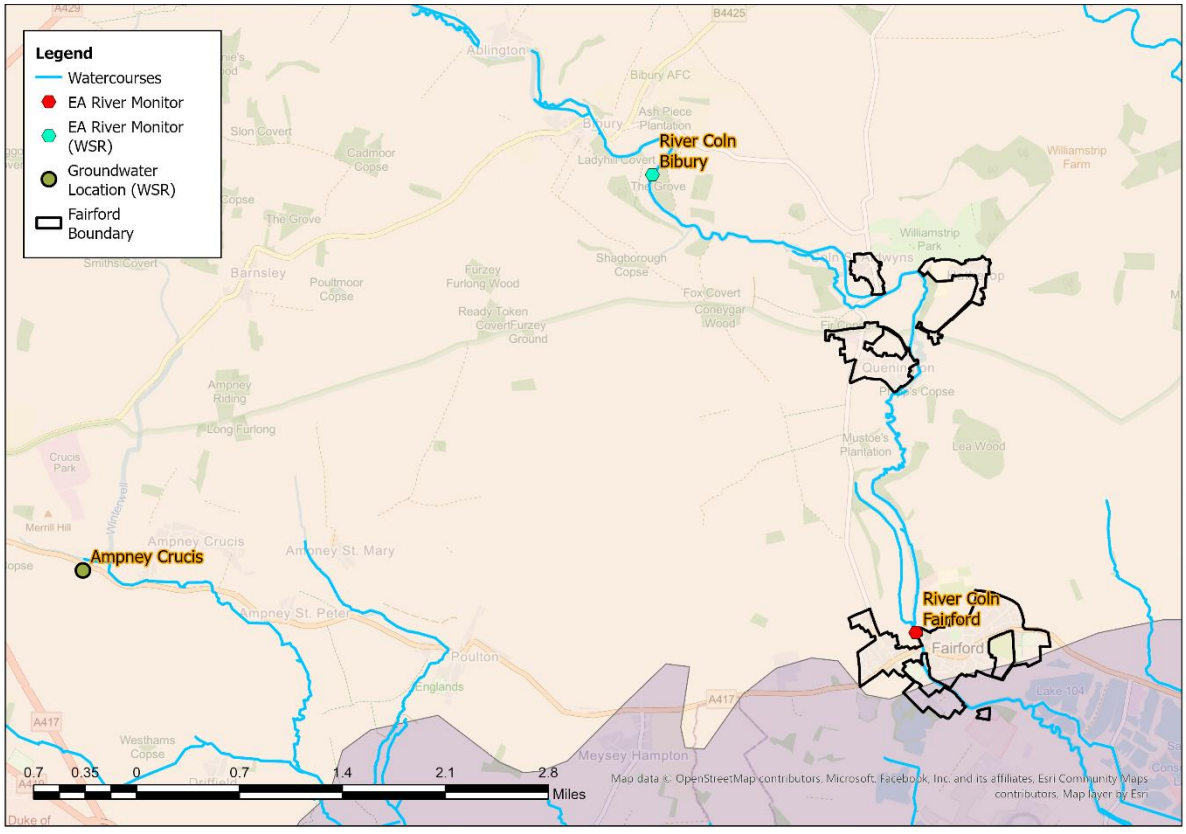
The Environment Agency has gauging stations on local watercourses measuring stage, and observation boreholes (OBH) measuring groundwater levels locally to the catchment which can be used to provide indicative local groundwater performance.

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

- River Coln, Bibury.
- River Coln, Fairford.

These sites are illustrated in Figure 4, alongside the closest groundwater reference station and closest gauging station from the Water Situation Report – note the closest gauging station from the WSR is also the River Coln at Bibury.

Figure 4 – Local Monitoring Stations



Figures 5A-5B 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.

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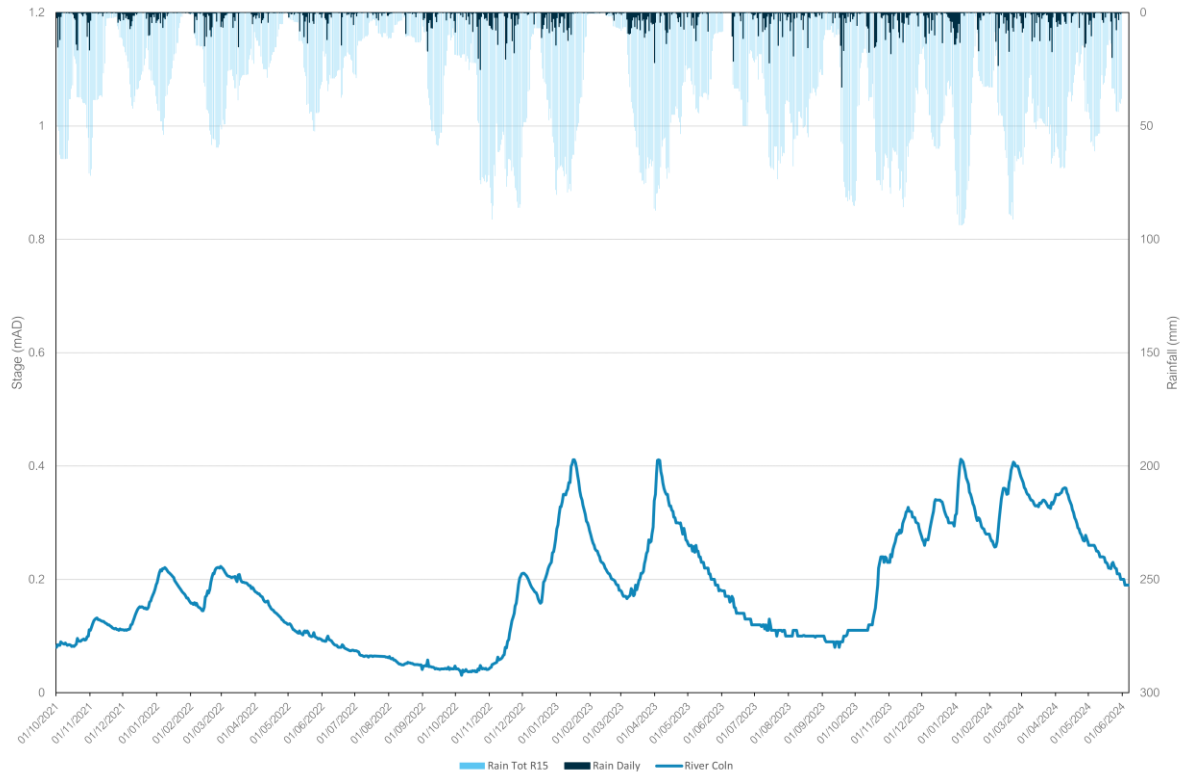

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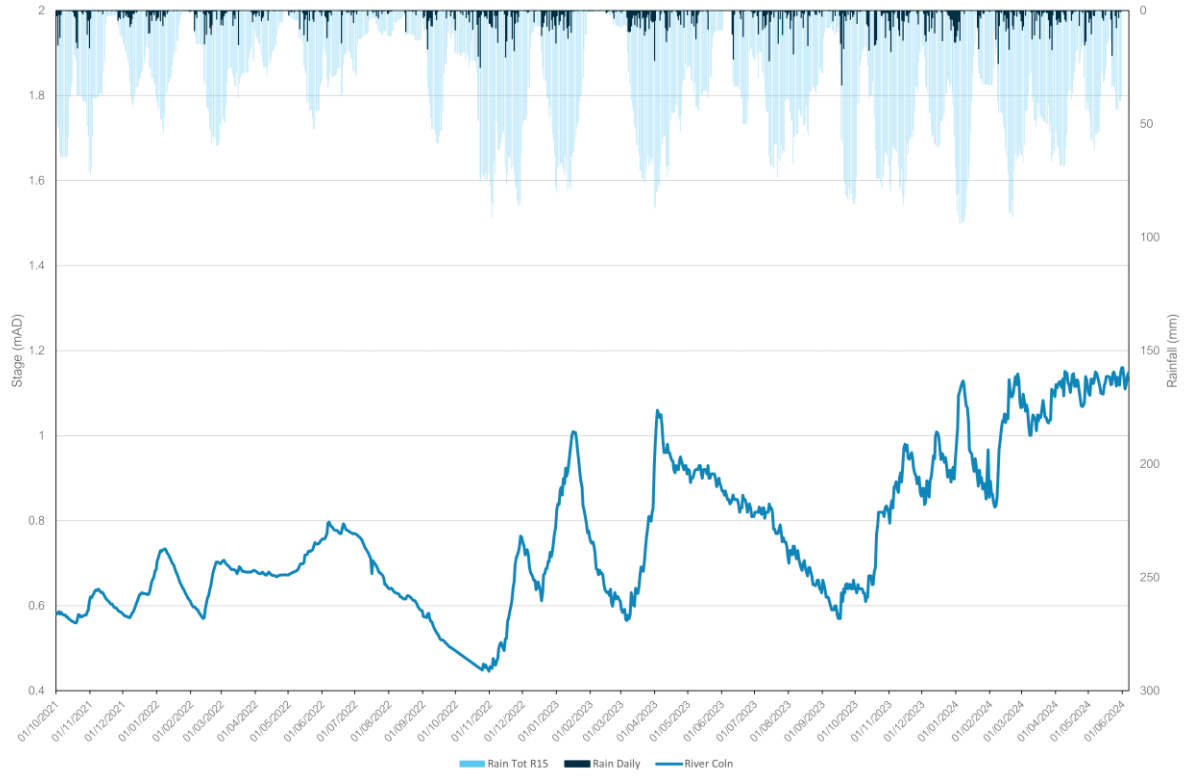

In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for Cotswolds West. The nearest groundwater reference station is Ampney Crucis. This site shows groundwater levels from March through to the end of year in 2023 to be at above normal, notably high and exceptionally high levels. Groundwater levels in 2024 can be observed to sustain above normal / notably high levels throughout the January – May period. This can be seen in Figure 6 alongside the river indicator location at Bibury on the River Coln.

Figure 6 – Water Situation Report

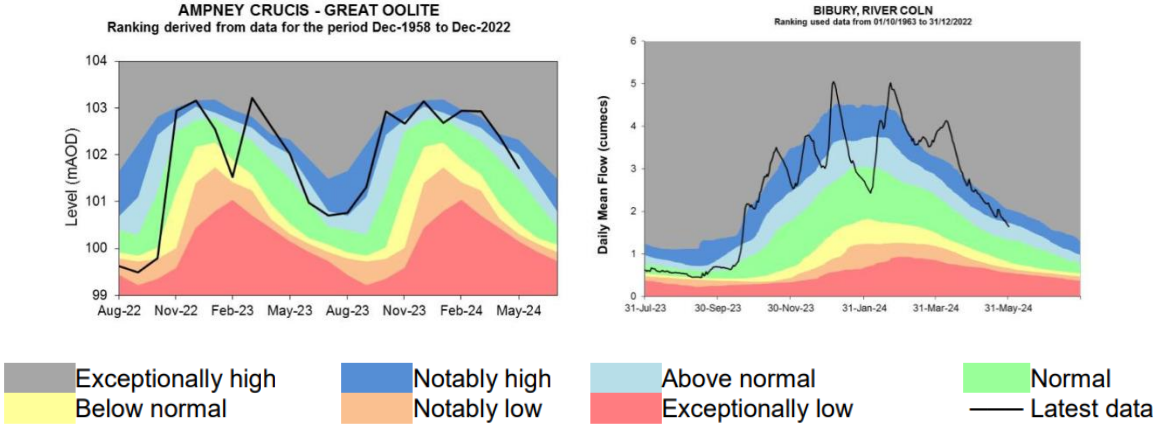

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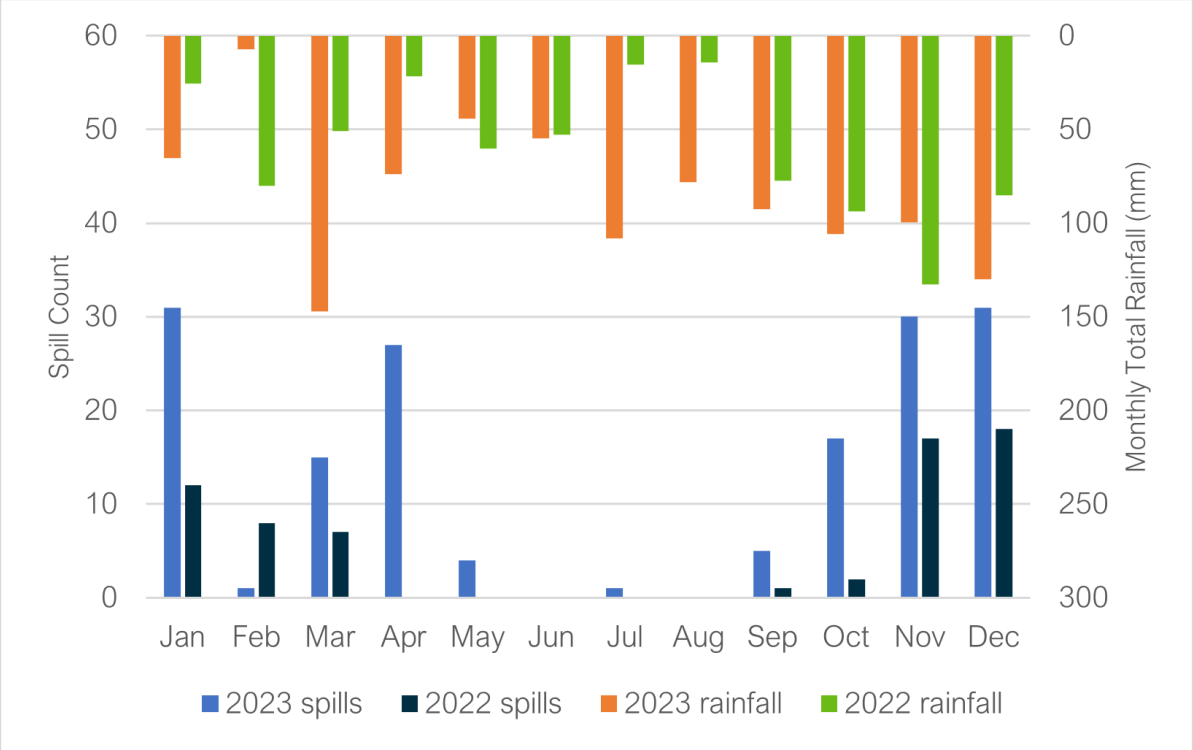
Table 7 below details the last 2 years performance of overflows within the catchment.

Table 7 – Event Duration Monitoring

Overflow	2022		2023	
	Spills	Duration (hours)	Spills	Duration (hours)
Fairford STW	65	1023.57	162	3391

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 trend in spill performance across the two recorded years does show variation in spills with a focus on spills during the autumn and winter months. The data suggests a wider relationship between rainfall, elevated groundwater levels and spill frequency. For example, despite a higher rainfall total in November 2022, more spills were recorded at Fairford STW in November 2023. The indicator site data shown in Figure 5, suggests that groundwater levels in the catchment were more elevated in November 2023. Similarly, the high number of spills recorded in January, April and December 2023, coincides with when the indicator site data shown in Figures 5 and 6, suggests that peaks in groundwater levels occurred in the catchment. The occurrence of spills in July 2023, is also indicative of spills occurring in the catchment during prolonged or intense rainfall events, outside of periods of elevated groundwater levels.

Investigations & Interventions

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

Monitor Installations

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

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Investigation/ remediation type	Number/ length undertaken 21/22	Number/ length undertaken 22/23	Number/ length undertaken 23/24
CCTV survey	114 metres	30 metres	215 metres completed 165 metres planned
Look and lift survey	N/A	3 surveys	4 surveys
Sewer lining	N/A	N/A	50 metres
Patch lining	1	1*	N/A
Manhole sealing	1 manhole	N/A	N/A
Manhole sealing plates	N/A	N/A	N/A
Manhole covers and frames replaced	N/A	N/A	N/A

*Rollover from previous hydrological year.

An upgrade is also planned for Fairford STW. This project will provide a major increase in treatment capacity, reducing the need for untreated discharges to the environment. The project is expected to be completed in AMP8 (2025 – 2030), however, delivery dates are being managed at a programme level, delivery dates stated are based upon current views and are subject to change.

It is expected that this catchment will meet all government targets for storm overflows by 2040 – 2045.

Summary

This hydrological year (October 2023-September 2024), indicator site data suggests groundwater levels in the Fairford catchment have generally been higher than the previous hydrological year. EDM data for 2023 is indicative of the role of groundwater infiltration on spills in the catchment. The EDM data for 2024 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 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.

It's everyone's water