Groundwater Impacted System Management Plan

Moreton-in-Marsh, River Evenlode

April 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	April 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

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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 excessive and likely to be the source of uncontrolled escape of untreated or partially treated sewage.

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 approach to date lacks a degree of certainty of resolution and for this reason Thames Water has in 2020 undertaken a different approach for the medium to long-term management of groundwater, which is covered within this

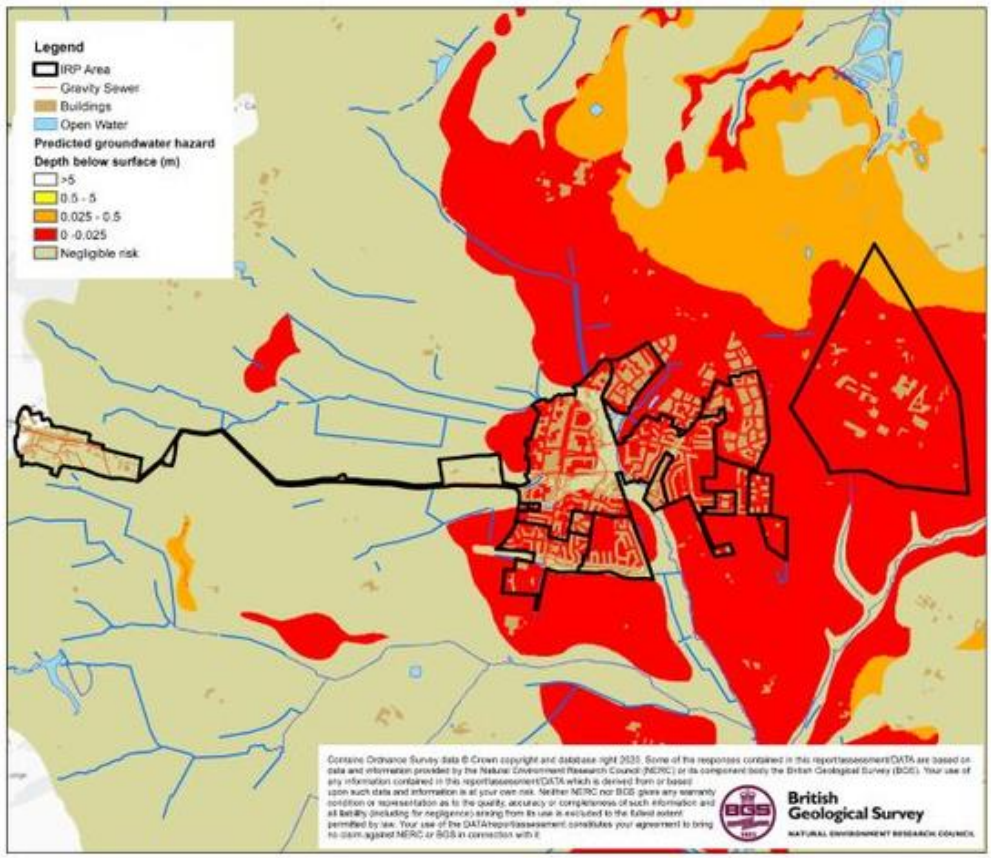
[1] Sewers for Adoption makes an allowance for 10% of normal wastewater flow to allow for unaccounted flows such as groundwater infiltration.

[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. 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 Moreton-in-Marsh system



1.0 – Moreton-in-Marsh catchment

Moreton-in-Marsh lies on the River Evenlode in Gloucestershire, England, 6km north of Stow on the Wold. Moreton-in-Marsh serves a population equivalent[3] of 5,801 with a predominantly separate sewerage network totaling some 35km in length excluding private drains and sewers. The extent of the catchment is shown in Figure 1.0 above

Problem characterisation

Groundwater can enter our sewers when levels are high which reduces their capacity and increases their risk of flooding. There's a strong link between the rising river levels that cause rising groundwater levels, and the drainage issues some of our customers have experienced, including sewer flooding and restricted use of their toilets and bathrooms.

[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.

In recent years, the foul sewerage system in the Moreton-in-Marsh 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, as well as highway flooding. 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 the combination of foul and surface water, however, there are a limited number of public surface water sewers in the area.

We believe that volumes of surface water run off from the surrounding saturated fields can also enter the foul sewerage network (inundation) causing the network to surcharge. Surface water run-off from saturated fields and roads to the East of Moreton-in-Marsh has been reported. The surveys we have carried out to date also suggest that there is some evidence of groundwater infiltration into the foul sewerage network when groundwater levels are high. Surface water misconnections (i.e. down pipes from roofs into the foul sewerage network) may also be a contributing factor, however further analysis is required to determine the extent to which this has contributed to sewer flooding.

The impact of the groundwater infiltration and high flows in the Moreton-in-Marsh catchment has overloaded the gravity sewers, terminal sewage pumping station and the STW and on occasions may impact the performance of the STW.

A limited 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 storm separation for Moreton-in-Marsh STW is situated at Primrose Court sewage pumping station, which is the site of the previous STW before it was relocated. This site has storm tanks and also a Land Treatment Area (LTA There are two permitted Combined Sewer Overflow's (CSO) to the watercourse at this location. These are key to mitigating the flood risk to properties upstream. On occasions where the incoming flow has exceeded network capacity for sustained periods, the LTA is utilised and spills to the river have occurred on both wet and dry days.

Our permit conditions for the CSO directly upstream of Primrose Court sewage pumping station 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"

Our permit conditions for the CSO from the Land Treatment Area at Primrose Court sewage pumping station state:

"The effluent discharged shall only consist of storm sewage effluent" and "No discharge of storm sewage effluent shall be made until such time as the rate of flow arriving at Moreton-in-Marsh Sewage Pumping Station exceeds 1814m^3 per day"

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.

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 Cotswolds District Council 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).

Anticipated unavoidable discharges

Within recent years there have been unplanned unconsented unavoidable discharges in the network as a result of surcharging manholes causing pollution incidents. This has been as a direct result of the influence of groundwater infiltration.

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

General outline plan & timescale

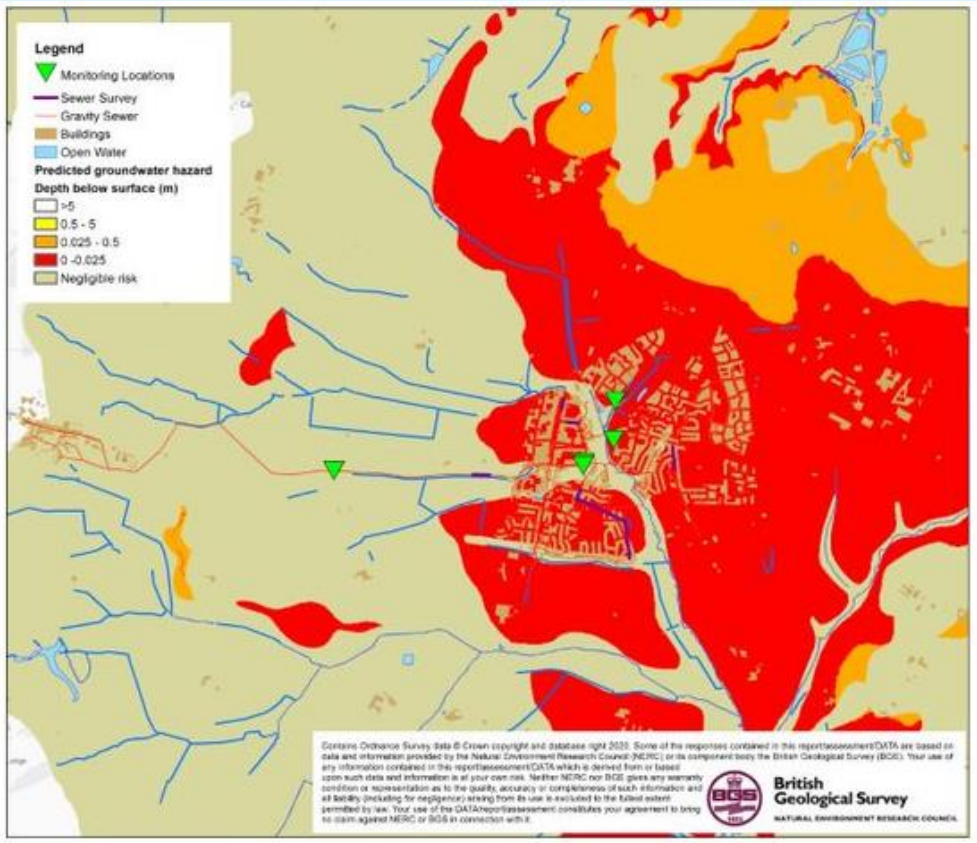


Figure 2.0 – Moreton-in-Marsh monitoring and infiltration zones

Key to bringing the impact of groundwater infiltration under control is an enhanced monitoring regime. We have identified and have installed several telemetered depth monitor locations around the Moreton-in-Marsh system – 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 Moreton-in-Marsh 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 have been 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 in AMP8[5], 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. The decision on this will be based on information obtained from the monitors and depending on the scale of further work required this may need to form part of PR29[6] investment planning.

The monitors are also to be used to monitor change within the system hence even should we determine that infiltration has been brought under control, we will continue to monitor for potential trends in infiltration suggesting the need for further work. We also anticipate monitoring the response of the catchment to surface water and where appropriate will use the monitor data to address this source of storm flow.

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

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

Activity	When	Description
Model Zones	2020/21	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	Monitors have been 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] Decision of extent of sealing will be based on outcomes of works undertaken in AMP7, results of monitoring and successful submission of our plans for investment for AMP8.

[5] Asset Management Plan 8 – covering work between 2025-2030

[6] Price Review 2029

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	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.

Moreton-in-Marsh 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 a project to increase storm storage capacity at Primrose Court sewage pumping station, which is the storm separation point for the STW permit. The main driver for the upgrade is growth, however the new design will reduce reliance on the LTA in certain events. 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 Moreton-in-Marsh sewerage system is outlined below.

High level approach statement

For Moreton-in-Marsh 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[7] to address. To investigate the network, we have:
    - Undertaken a desktop analysis to determine infiltration high to low risk zones (October 2020);
    - Installed 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.
    - Undertaken sample CCTV in the high to low risk zones to assess the general asset health of the sewers and manholes (ongoing).

    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 and need. Significant investment needs may need to be included in our next investment planning cycle at PR24.

[7] 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 we have commissioned JBA Consulting to undertake an exercise involving 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). 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 within 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 the Moreton-In-Marsh system we will continue to tanker where required.

Updates

Work on the Groundwater infiltration management plan will continue, and we will aim to provide an update 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	8.24	36.8
Medium	Predicted groundwater extreme 0-1m above pipe invert	1.15	5.1
Low	Predicted groundwater extreme 0-1m below pipe invert	5.88	26.2
Very Low	Predicted groundwater extreme >1m below pipe invert	7.14	31.9
Total		22.41[8]	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	69	9.6
Medium	Inundation risk in 1% AEP fluvial or pluvial event	31	4.3
Low	Inundation risk in 0.1% AEP fluvial or pluvial event	118	16.5
Very Low	All other manholes	498	69.6
Total		716	100.0

[8] 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

At the time of writing we are currently on site undertaking lift and look and CCTV surveys in the Moreton-In-Marsh system. A summary of findings will be provided in the next update of this report.

Glossary of terms

AEP – Annual Exceedance Potential

AMP – Asset Management Programme

CCTV – Closed Circuit Television

CSO – Combined Sewer Overflow

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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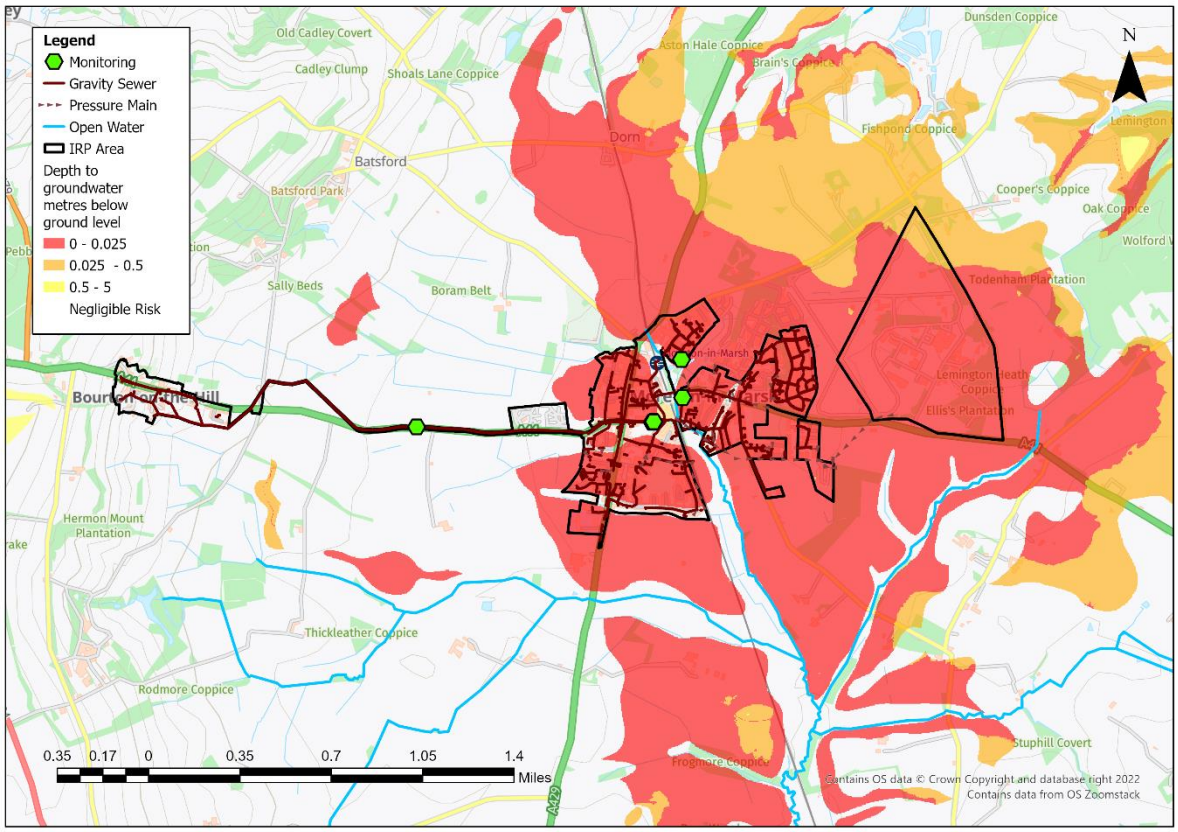
Overview

This addendum to the Moreton-in-Marsh 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 – Moreton-in-Marsh Monitoring Plan



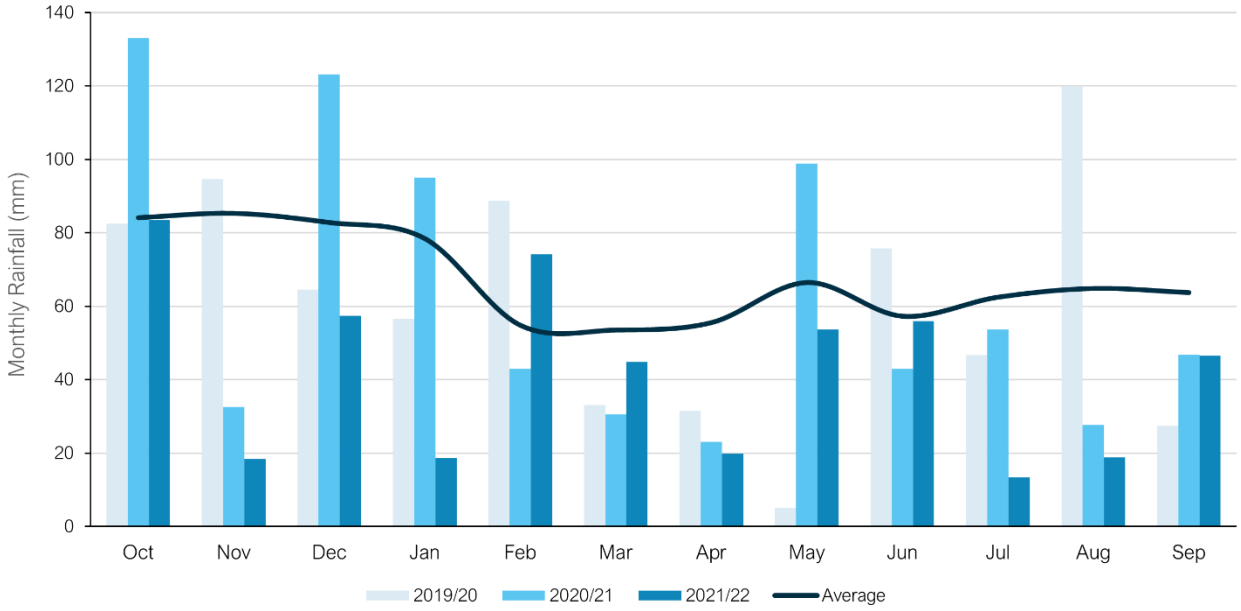
Hydrological Review – 2021-2022

This section summarises the hydrological conditions within the Moreton-in-Marsh 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 Little Rissington based on the period 1991-2020

The total rainfall for the 2021/22 hydrological year is 37% 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)
810	726	750	511

Groundwater / Local River Level

The Moreton-in-Marsh catchment is situated in the Cotswolds East water resources area. It sits in the Charmouth Mudstone Formation of sedimentary bedrock. This is not a designated principal aquifer within the UK.

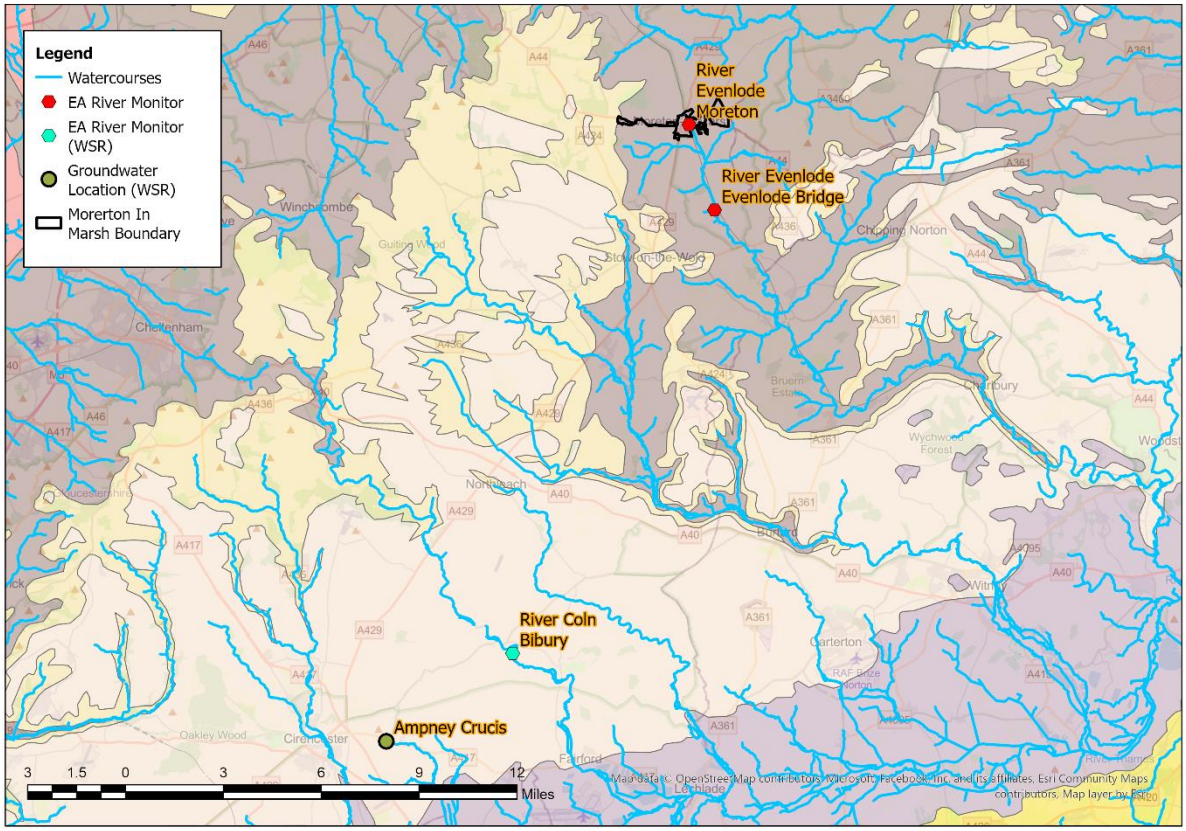
The Environment Agency has gauging stations on local watercourses measuring stage and observation boreholes measuring groundwater levels locally to the catchment which can be used to provide indicative local groundwater performance.

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

- River Evenlode, Evenlode Bridge.
- River Evenlode, Moreton-in-Marsh.

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 – River Evenlode, Evenlode Bridge

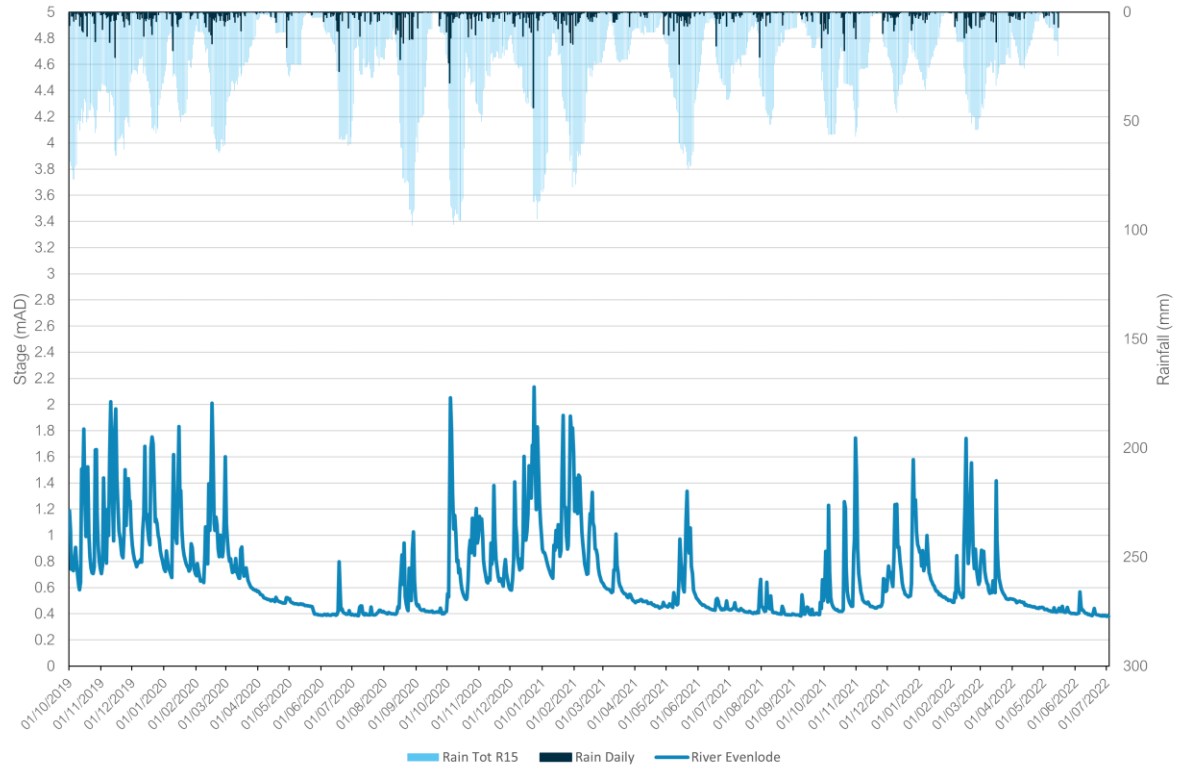
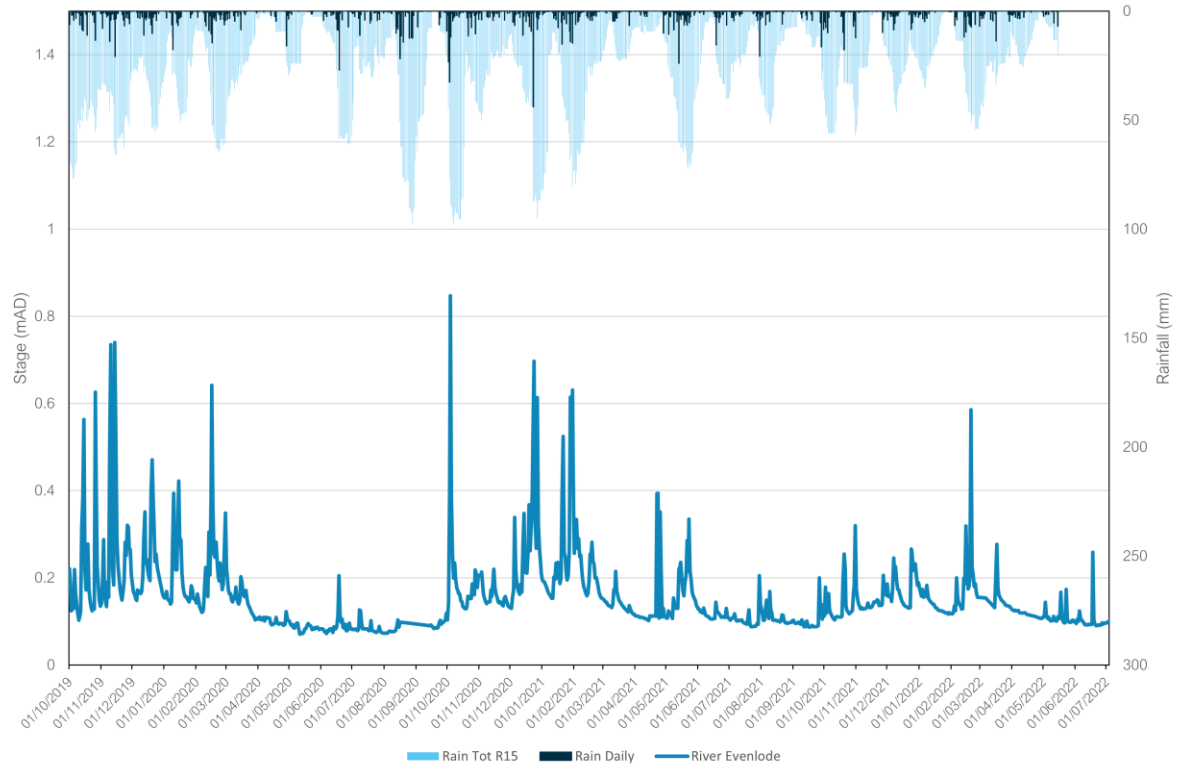
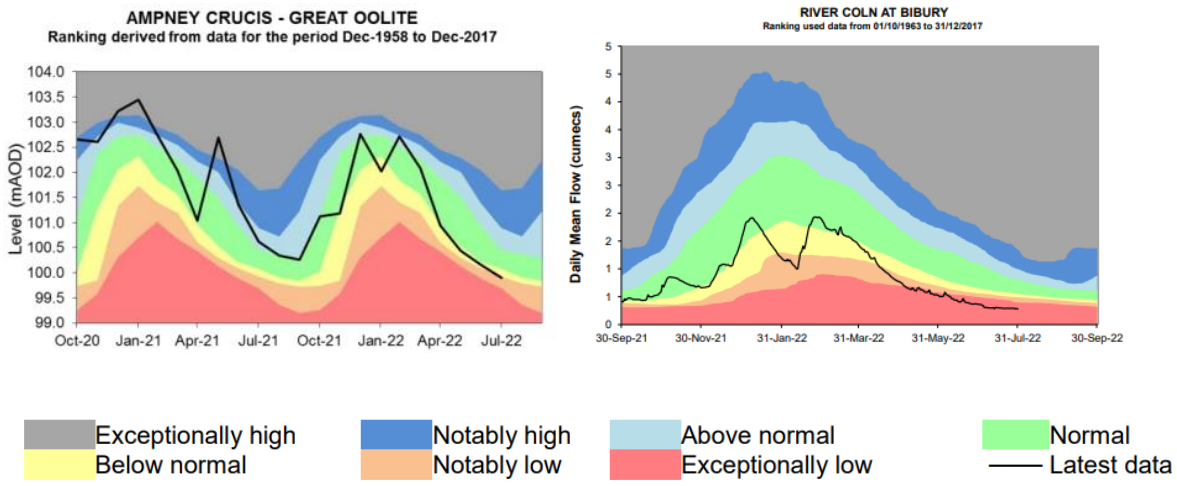


Figure 5B – River Evenlode, Moreton-in-Marsh



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for Cotswolds East. 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 Moreton-in-Marsh catchment there are two sites detailed within the Environment Agency Consents Database which have an Event Duration Monitor (EDM) fitted. The data presented below is based on the current understanding of the performance of each overflow within the Moreton-in-Marsh catchment.

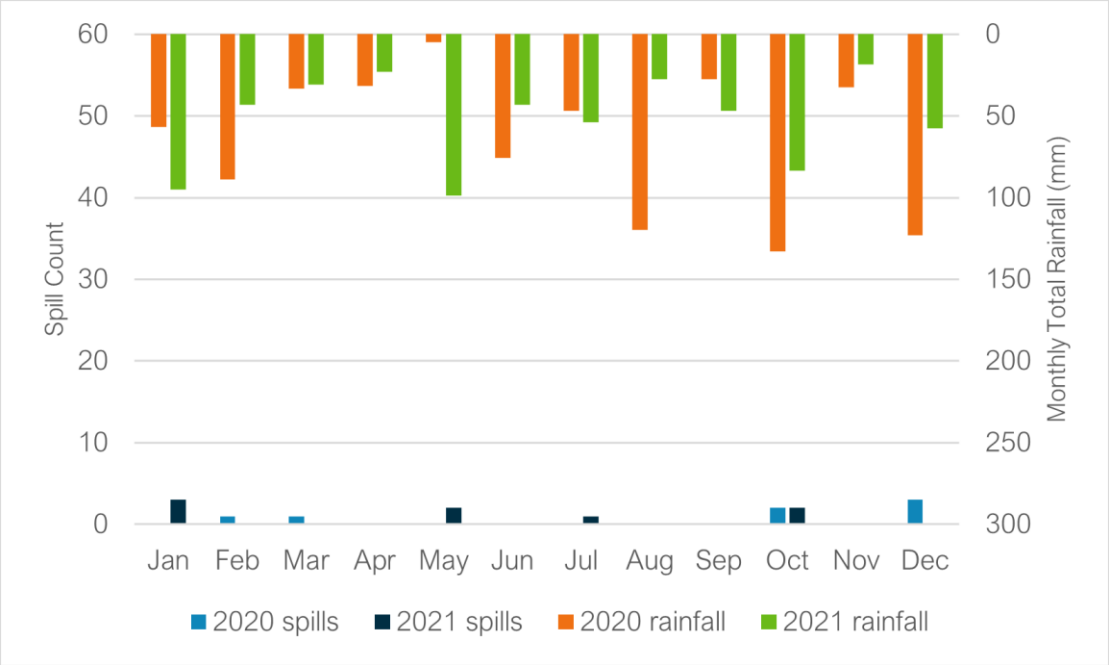
Table 7 below details the last 2 years performance for overflow 'Storm sewage irrigation area, Moreton-in-Marsh'.

Table 7 – Event Duration Monitoring, Storm sewage irrigation area, Moreton-in-Marsh

Overflow	2020		2021	
	Spills	Duration (hours)	Spills	Duration (hours)
Storm sewage irrigation area, Moreton-in-Marsh	7	51.95	8	46.11

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, Storm sewage irrigation area, Moreton-in-Marsh



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 across the two recorded years, when the indicator sites suggest groundwater levels in the catchment were higher. This suggests a wider relationship between rainfall, elevated groundwater levels and spill frequency.

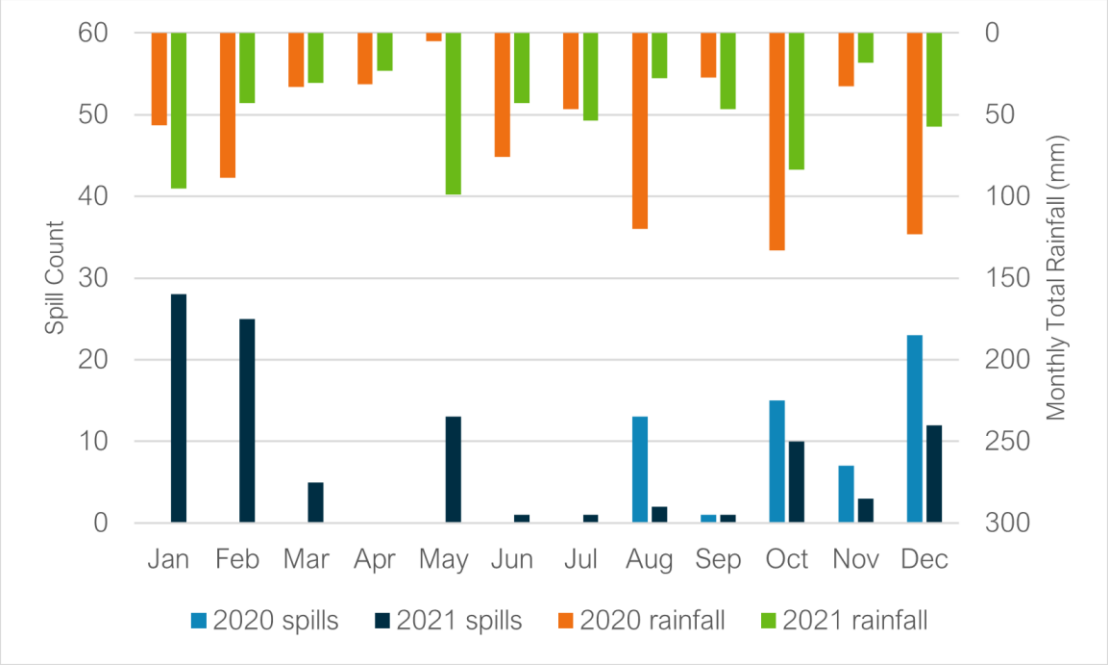
Table 9 below details the last 2 years of overflow performance for overflow 'Consented Overflow Level 2 = SPS to LTA'.

Table 9 – Event Duration Monitoring, Consented Overflow Level 2 = SPS to LTA

Overflow	2020		2021	
	Spills	Duration (hours)	Spills	Duration (hours)
Consented Overflow Level 2 = SPS to LTA	59	910.57	101	1388.84

Figure 10 below presents the EDM performance trend and rainfall for recent years. Note that the first year of reporting for the overflow was 2020, therefore the monthly spill counts for 2020 are from April.

Figure 10 – EDM Monthly Performance, Consented Overflow Level 2 = SPS to LTA



As with overflow 'Storm sewage irrigation area, Moreton-in-Marsh', 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 across the two recorded years, when the indicator sites suggest groundwater levels in the catchment were higher. This suggests a wider relationship between rainfall, elevated groundwater levels and spill frequency.

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 Moreton-in-Marsh 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 11 below provides a summary of the investigations and remediation works undertaken or planned within the Moreton-in-Marsh catchment in the 2021-22 Hydrological Year.

Table 11 – 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	30 metres planned by end of November 2022
Patch lining	N/A
Manhole sealing	N/A
Manhole sealing plates	N/A
Manhole covers and frames replaced	N/A

With the seasonal trends in groundwater having been low in comparison with previous years and the SDM installations generally not showing significant groundwater presence, the larger scale survey, identification and remediation of the sewer system has not been possible within the 2021/2022 hydrological year.

Summary

Rainfall in the Moreton in Marsh catchment over the 2021/22 hydrological year has been below average, with groundwater levels in the aquifer beneath Moreton-in-Marsh 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 within this AMP7 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 if required.

Addendum - Annual Update 2023

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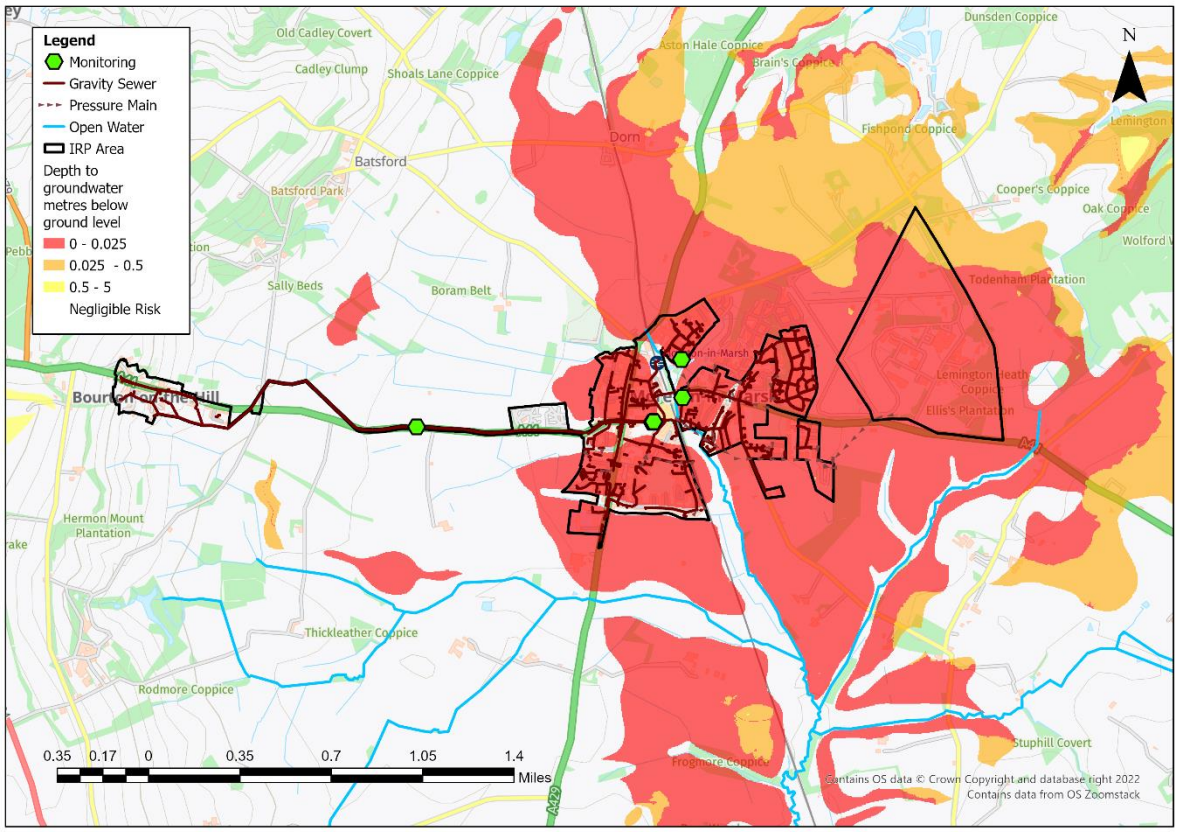

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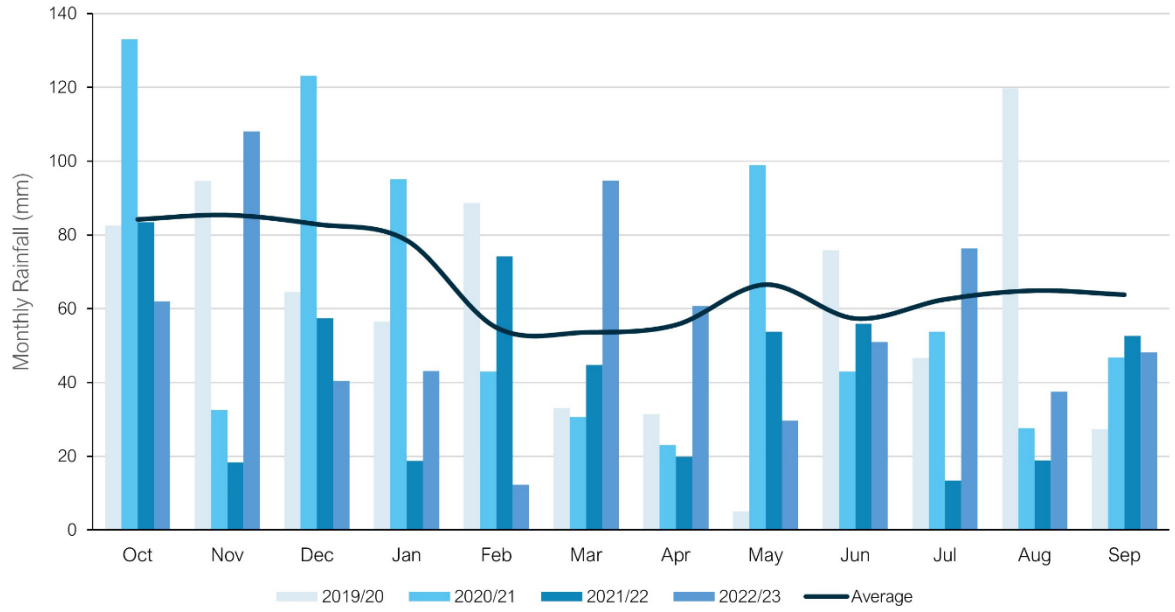

Average Values taken from Met Office Weather Station at Little Rissington based on the period 1991-2020

The total rainfall for the 2022/23 hydrological year is 18% below the annual average total. Total rainfall values are presented in Table 3 below.

Table 3 –Total Rainfall Based on Hydrological Year

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810	726	750	511	664

Groundwater / Local River Level

The Moreton-in-Marsh catchment is situated in the Cotswolds East water resources area. It sits in the Charmouth Mudstone Formation of sedimentary bedrock. This is not a designated principal aquifer within the UK.

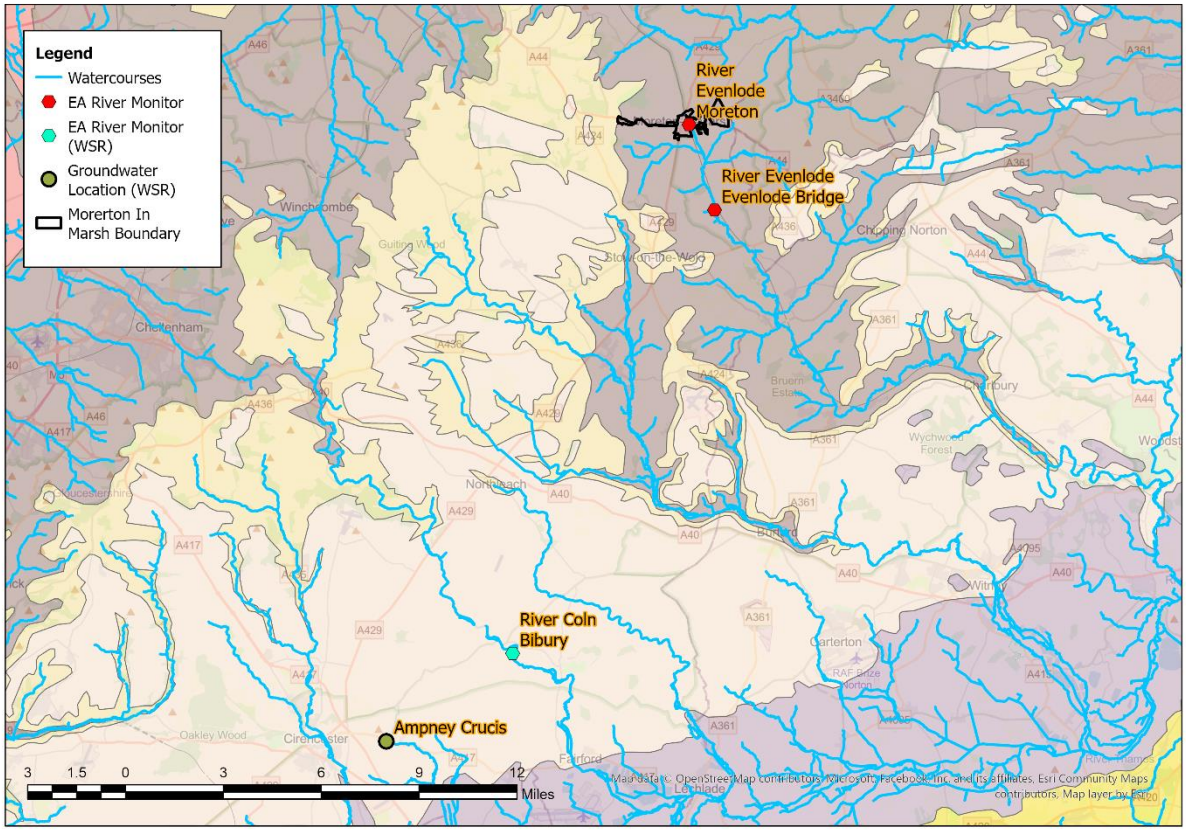
The Environment Agency has gauging stations on local watercourses measuring stage and observation boreholes (OBH) measuring groundwater levels locally to the catchment which can be used to provide indicative local groundwater performance.

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

- River Evenlode, Evenlode Bridge.
- River Evenlode, Moreton-in-Marsh.

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 – River Evenlode, Evenlode Bridge

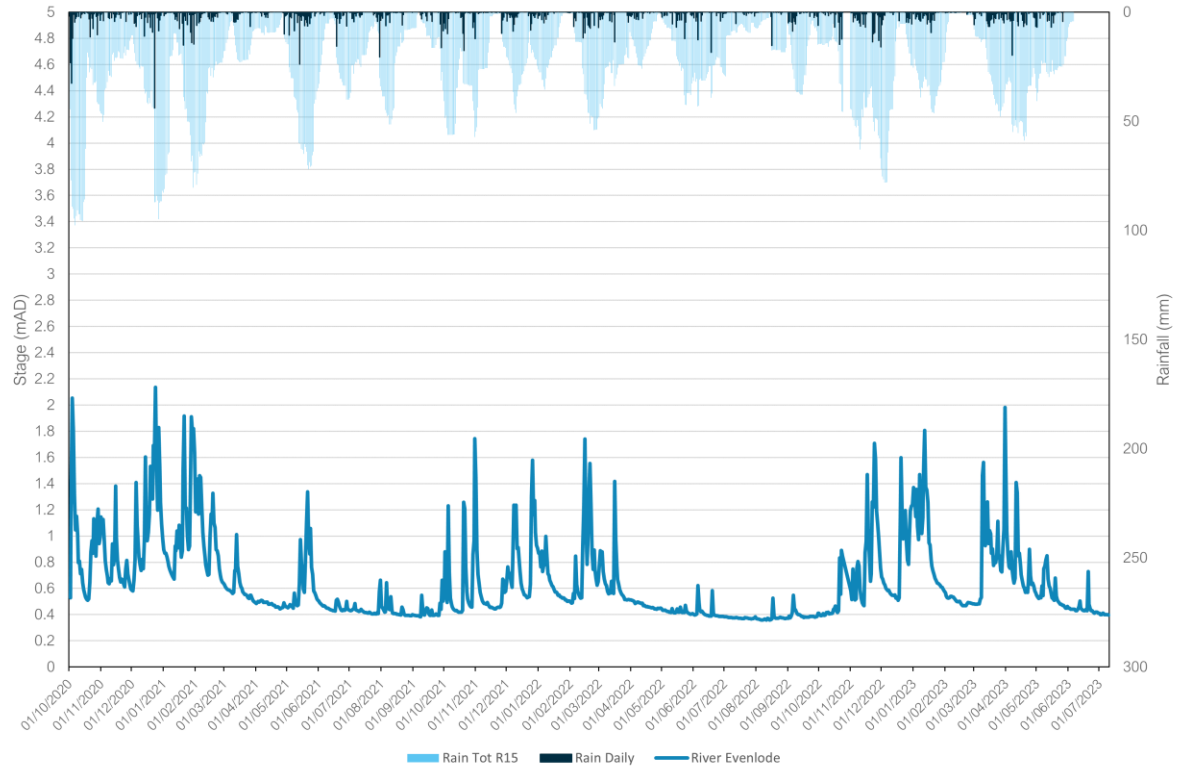
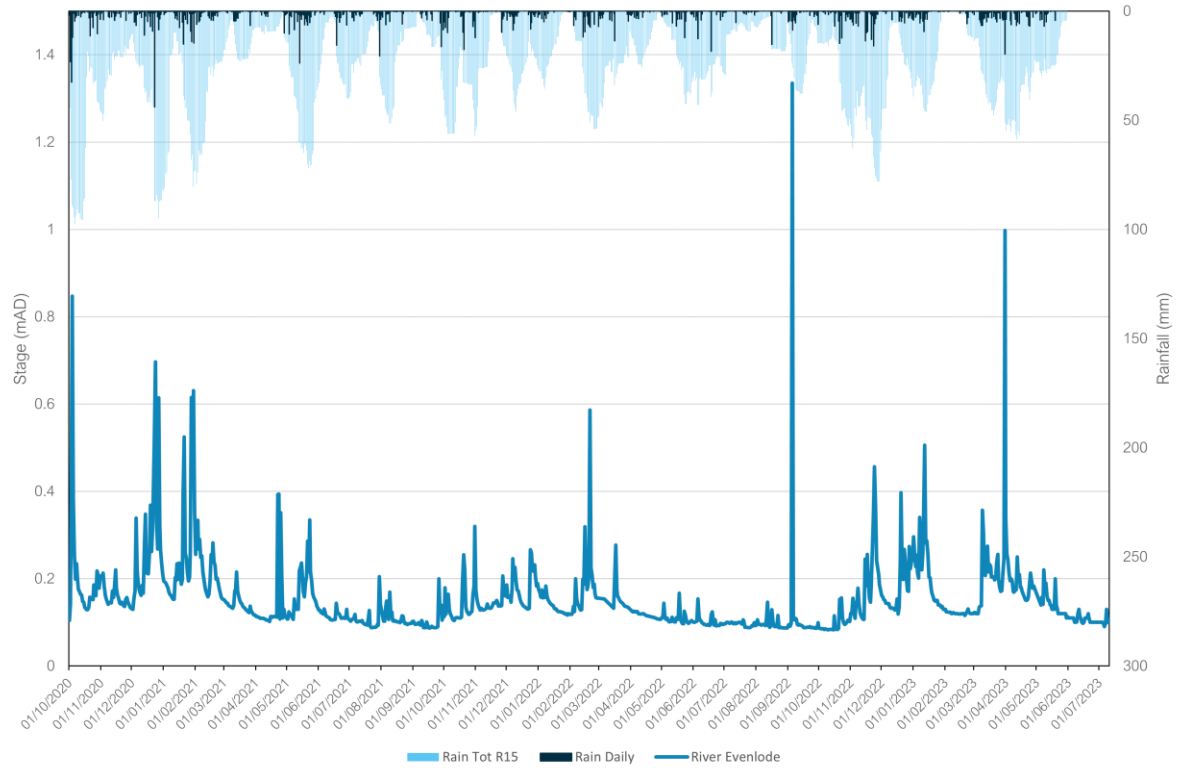
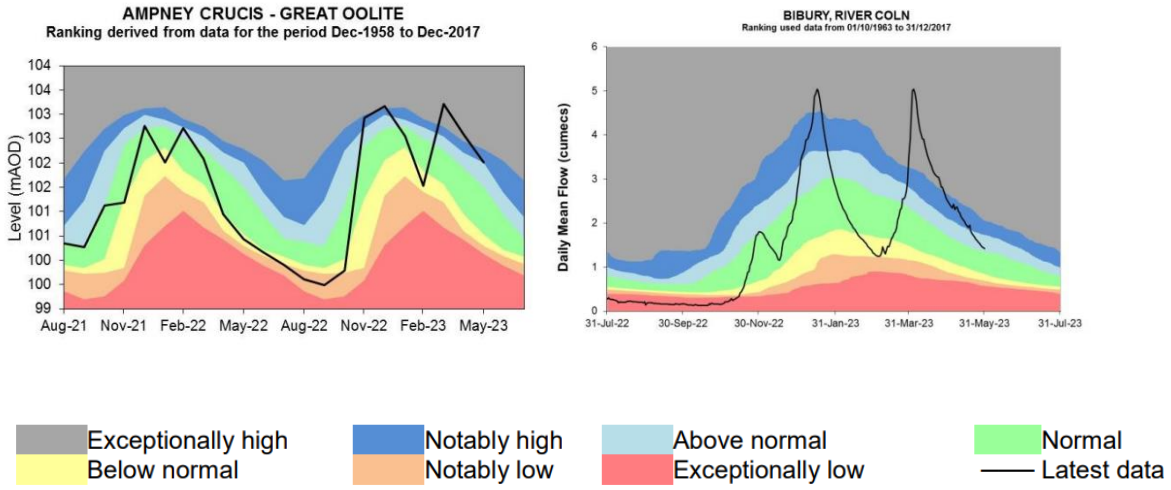


Figure 5B – River Evenlode, Moreton-in-Marsh



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for Cotswolds East. 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 have generally been higher in 2023, reaching above normal, notably high, and exceptionally high levels for significant periods. 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 Moreton-in-Marsh catchment there are two sites detailed within the Environment Agency Consents Database which have an Event Duration Monitor (EDM) fitted. The data presented below is based on the current understanding of the performance of each overflow within the Moreton-in-Marsh catchment.

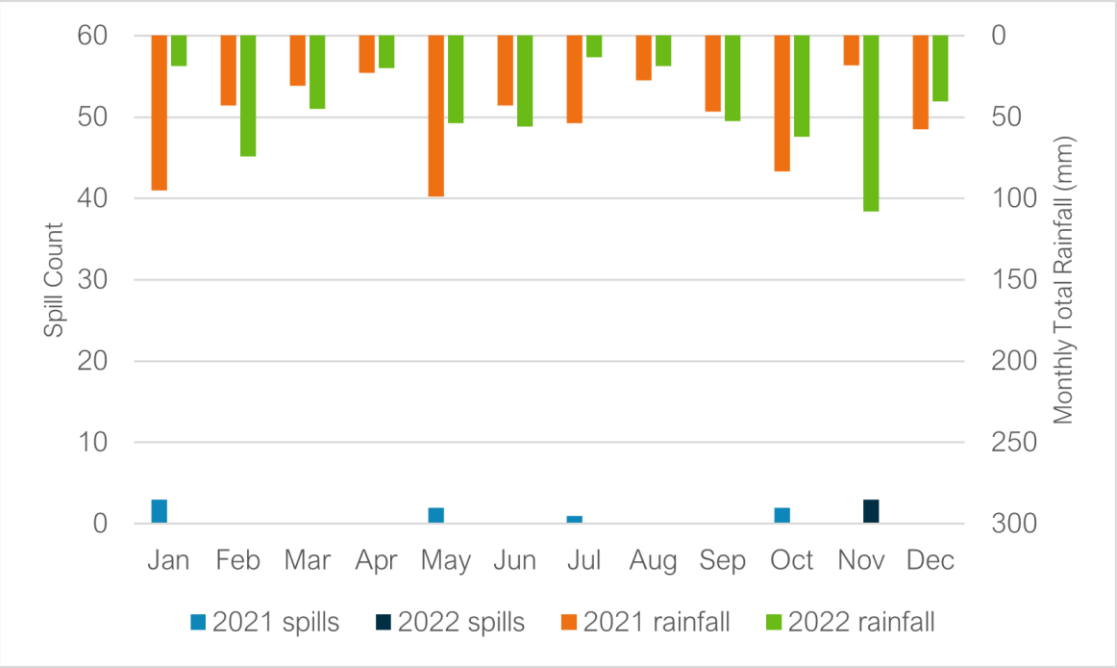
Table 7 below details the last 2 years performance for overflow 'Storm sewage irrigation area, Moreton-in-Marsh'.

Table 7 – Event Duration Monitoring, Storm sewage irrigation area, Moreton-in-Marsh

Overflow	2021		2022	
	Spills	Duration (hours)	Spills	Duration (hours)
Storm sewage irrigation area, Moreton-in-Marsh	8	46.11	3	39.02

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. Note that in 2022, the EDM was only operational for 31% of the year, which may have impacted the recorded spill count. Figure 8 below presents the EDM performance trend and rainfall for recent years.

Figure 8 – EDM Monthly Performance, Storm sewage irrigation area, Moreton-in-Marsh



Due the low number of spills recorded over the two years, and the monitor issues encountered in 2022, the utility of the data to indicate a wider relationship between rainfall, elevated groundwater levels and spill frequency is limited. However, the occurrence of some spills in the spring/summer months, does suggest some overflow spills occurring during intense rainfall events in the catchment, outside of periods of significantly elevated groundwater levels.

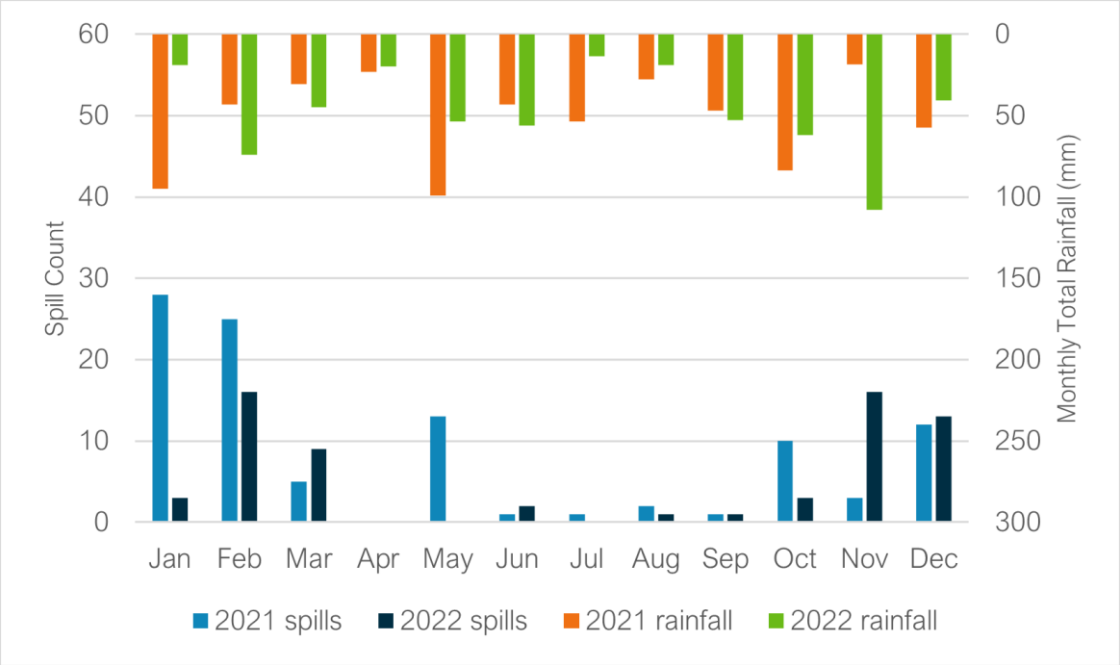
Table 9 below details the last 2 years of overflow performance for overflow 'Consented Overflow Level 2 = SPS to LTA' (Primrose Court SPS).

Table 9 – Event Duration Monitoring, Consented Overflow Level 2 = SPS to LTA

Overflow	2021		2022	
	Spills	Duration (hours)	Spills	Duration (hours)
Consented Overflow Level 2 = SPS to LTA (Primrose Court SPS)	101	1388.84	64	710.03

Figure 10 below presents the EDM performance trend and rainfall for recent years.

Figure 10 – EDM Monthly Performance, Consented Overflow Level 2 = SPS to LTA



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. For example, despite a higher rainfall total in February 2022, significantly more spills were recorded at 'Consented Overflow Level 2 = SPS to LTA' in February 2021. The indicator site data shown in Figure 5, suggests groundwater levels in the catchment were generally more elevated in February 2021. A significant number of spills were also recorded in November 2022, with Figure 6 suggesting groundwater levels in the catchment reached high levels during this period. The occurrence of some spills during the spring/ summer months, does also suggest overflow spills occurring during intense rainfall events in the catchment, outside of periods of significantly elevated groundwater levels.

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 Moreton-in-Marsh 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 11 below provides a summary of the investigations and remediation works undertaken or planned within the Moreton-in-Marsh catchment in the 2022-23 Hydrological Year, as well as works undertaken in the 2021-22 Hydrological Year.

Table 11 – Works Undertaken in the 2022/23 Hydrological Year & in the 2021/22 Hydrological Year

Investigation/ remediation type	Number/ length undertaken 2021/22	Number/ length undertaken 2022/23
CCTV survey	N/A	N/A
Look and lift survey	N/A	N/A
Sewer lining	N/A	36 metres*
Patch lining	N/A	N/A
Manhole sealing	N/A	N/A
Manhole sealing plates	N/A	N/A
Manhole covers and frames replaced	N/A	N/A

*Further work detailed as planned in last year's Addendum Report and completed this hydrological year. Lining based on results of surveys undertaken in 2021, omitted in error from previous reporting.

Moreton-in-Marsh STW is also being upgraded to increase the capacity of the storm tanks. This will reduce the need for untreated discharges to the environment. The scheme is due to be completed in early 2025.

Summary

EDM data is indicative of the role of groundwater infiltration on overflow spills in the Moreton-in-Marsh catchment. This hydrological year (October 2022 – September 2023), indicator site data suggests groundwater levels in the catchment have reached higher levels 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, within this AMP7 period (2020- 2025). 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 2024 Price Review (PR) process if required.

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