Groundwater Impacted System Management Plan

Hampstead Norreys, River Pang

July 2021

Thames Water

It's everyone's water

Version control

Version	Date	Amendment	Author	Checked	Reviewed
1-d1	16/06/2021	Draft for EA	AJ	SE	DJ
1-d2	26/06/2021	Final Draft for EA	AJ	SE	DJ
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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 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 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 and 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 '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 Hampstead Norreys catchment

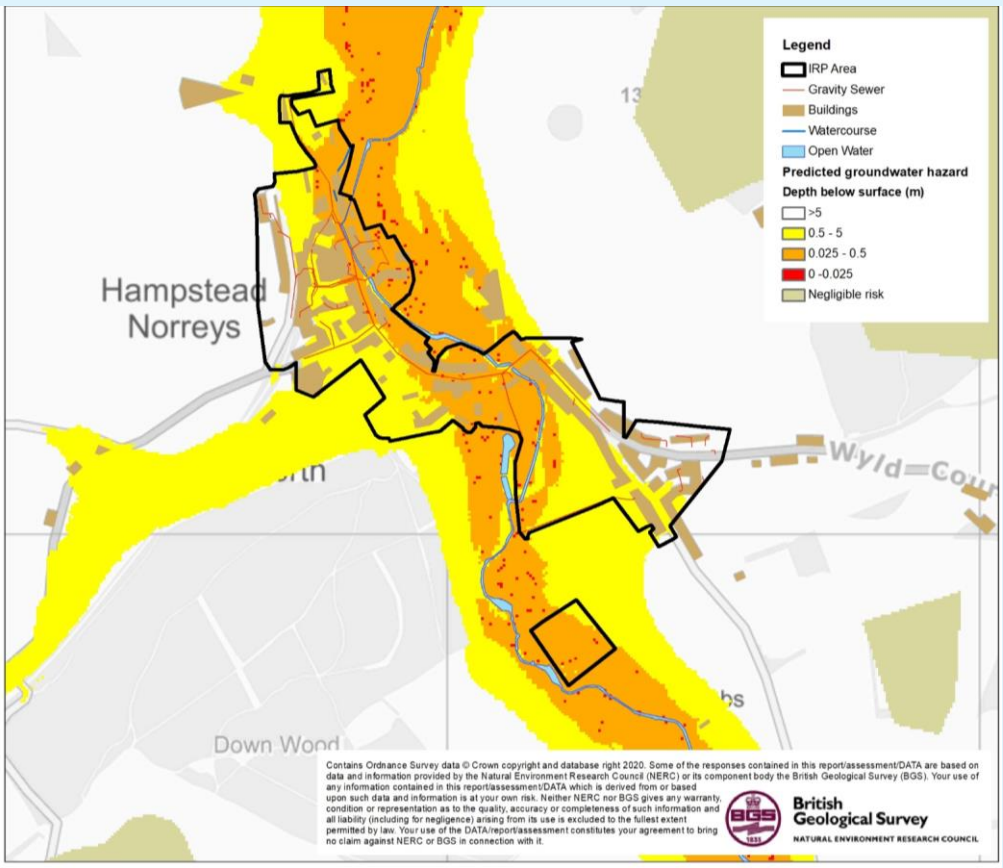

Figure 1.0 – Hampstead Norreys catchment

Hampstead Norreys is located in Berkshire, England, approximately 7 miles north-east of Newbury. Hampstead Norreys serves a population equivalent[3] of 609 with a predominantly separate sewerage network totaling some 5 km in length excluding private drains and sewers. The extent of the catchment is shown in Figure 1.0 above.

Problem characterisation

Groundwater has potential to enter our sewers when levels are high and a positive head above the soffit of the sewer is created. Significant groundwater ingress can impact sewer capacity and increased risk of the sewer becoming overwhelmed. There's a strong link between rising river levels and rising groundwater levels, particularly adjacent to the River Pang (chalk stream), and the drainage issues some of our customers have experienced, including sewer flooding and restricted use of their toilets and bathrooms. The impacts of surface runoff from agricultural and built-up land has also contributed to these drainage issues.

[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.

Additionally, prolonged and heavy rainfall and raised groundwater levels have overwhelmed the sewer system causing operational problems at the Hampstead Norreys sewage pumping station.

The sewerage system is identified on the public sewer records as being a partially separate foul system, rather than a combined system. We believe that significant volumes of surface water runoff from surrounding saturated fields and built-up land have entered the foul sewerage network during recent wet winters, causing the network to become overloaded and surcharge (mainly through submerged manholes).

The surveys we have carried out have detected that there is some evidence of unwanted flows in the foul sewer network when groundwater levels are high, and surface water inundation from highways, public spaces and properties and fluvial flooding from local watercourses. Surface water misconnections (i.e. down pipes from roofs into the sewer network) are also suspected to be a contributing factor, hence further analysis is required to determine the extent to which this has contributed to sewer flooding.

A number of our sewerage systems include for 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 use of storm sewage overflows is accepted by our regulators, subject to conditions.

We believe it is likely that groundwater infiltration in the Hampstead Norreys catchment is the most probable cause of incidences where the sewage treatment works and the network has not been able to cope with unwanted flows , triggering problems to homes and spills to the environment at the STW. The root causes of unwanted flows and sewer surcharges require all stakeholders responsible for drainage in the catchment to resolve them together.

Our permit conditions for Hampstead Norreys 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."

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 Lead Local Flood Authority, Council and 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 unavoidable sewage escapes in the network as a result of surcharging manholes causing pollution.

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 tempor-ary overflows has been undertaken in the system.

General outline plan & timescale

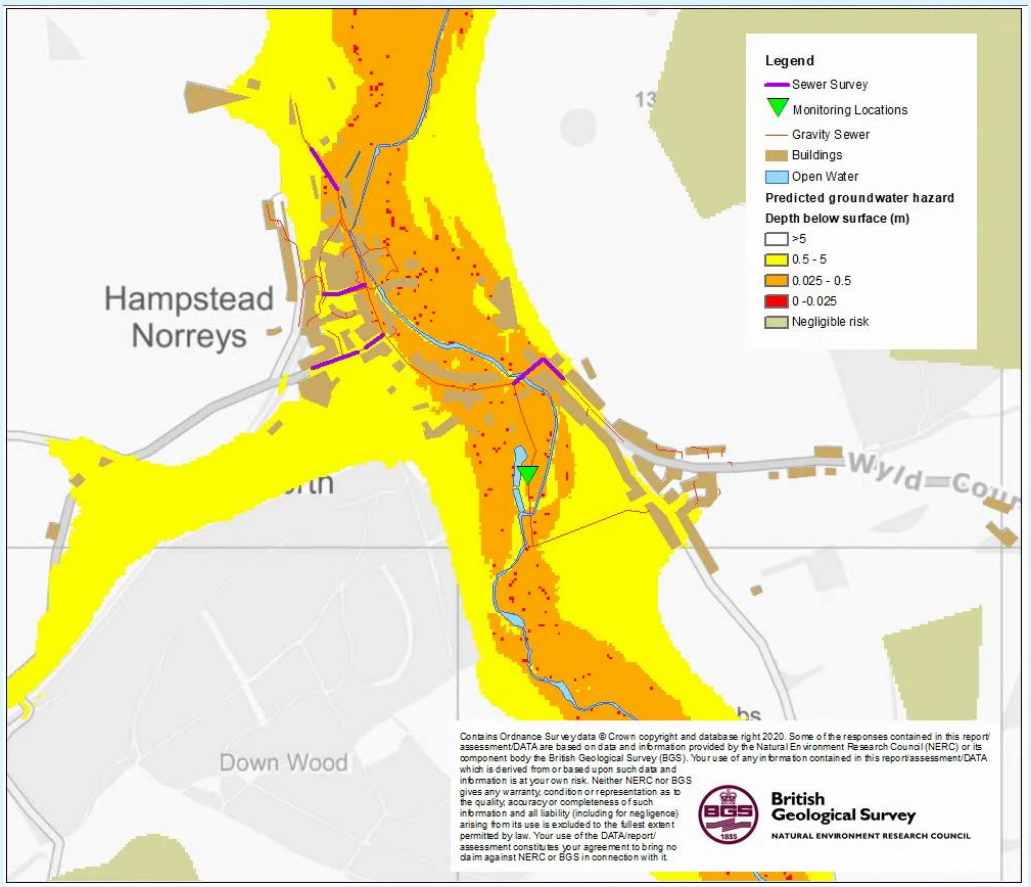

Figure 2.0 – Hampstead Norreys monitoring and infiltration zones

Key to bringing the impact of groundwater infiltration under control is an enhanced monitoring regime. We have identified and have installed a telemetered depth monitor location in the Hampstead Norreys 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 Hampstead Norreys 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, 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 Hampstead Norrys.

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

Model Zones	2020/21	JBA have been engaged to undertake modelling activities to identify the areas (zones) to be targeted for sealing in the 56 systems identified as being impacted by infiltration in the Thames Water region.
Install monitors	2020	Monitors have now 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 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 will 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.

Hampstead Norreys Infiltration Management Plan

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

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

High level approach statement

For Hampstead Norreys 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);

- Installed additional monitoring to back up the analysis 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.

- 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 (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 next investment planning cycle.

[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 now 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.

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) 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 Hampstead Norreys we do not envisage needing to undertake mitigation work beyond tankering within the network.

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 classified by the groundwater infiltration risk zones. The lengths of sewers within these zones are presented in the table below.

Risk category	Description	Length (km)	Percentage
High	Predicted groundwater extreme >1m above pipe invert	1.24	43.8
Medium	Predicted groundwater extreme 0-1m above pipe invert	0.25	8.8
Low	Predicted groundwater extreme 0-1m below pipe invert	0.34	12.0
Very Low	Predicted groundwater extreme >1m below pipe invert	1.00	35.4
Total		2.83[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	14	13.1
Medium	Inundation risk in 1% AEP fluvial or pluvial event	4	3.7
Low	Inundation risk in 0.1% AEP fluvial or pluvial event	14	13.1
Very Low	All other manholes	75	70.1
Total		107	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

The three tables below summarise the findings of the survey and implementation work identified in the 2020/21 period.

The final table summarises our current known plans for remediating groundwater infiltration issues.

2020/21 Survey Statistics

Elements		Units	Value	Comment
Planned Survey		m	316	Survey was planned for a significant part of the valley floor. It was possible to complete 64% of the survey (see Figure 2) .
Survey Completed		m	203	
		%	64	
		Lengths (No.)	12	
Clear Flow Observed		m	0	49 Manholes were lifted - as the system at the time of the CCTV was surcharged, little CCTV could be completed. Of the 49 MHs 55% were surcharged and 4% had evidence of clear flow
		%	0	
Sewer Infiltration Locations Identified	Infiltration Gushing	No.	1	9 groundwater infiltration locations were identified in the sewers. Of those 6 were identified as "gushing" and therefore should be the focus of repair as soon as possible.
	Infiltration Gushing at Joint		5	
	Infiltration Running		1	
	Infiltration Running at joint		2	
	Infiltration Dripping		0	
	Infiltration Dripping at joint		0	
	Infiltration Seeping		0	
	Infiltration Seeping at joint		0	
	Grand Total		9	

Elements		Units	Value	Comment
Manhole Infiltration Locations Identified	Infiltration around pipe	No.	0	10 groundwater infiltration locations were identified at manhole locations. Of those 4 were identified as "gushing" and therefore should be the focus of repair as soon as possible.
	Infiltration through benching		1	
	Infiltration through chamber wall		1	
	Gushing		4	
	Running		3	
	Dripping		0	
	Seeping		1	
	Grand Total		10	
Monitoring Locations Active		No.	1	1 Sewer level monitoring location has been installed within the catchment and its location is shown in Figure 2.
Details of other Surveys			N/a	Look at lift surveys were carried out (see previous table)

2019/20/21 Implementation Works

Activities	Value	Comment
Sewer Lining Length (m)	0	There has been no sewer lining or manhole sealing in the Hampstead Norreys system during 2019/20
Infiltration Points Targeted (no.)	0	
Manhole Sealing (no.)	0	

Future Works

These are subject to feasibility and contractor review as the classification of gushers and runners is still a relatively subjective analysis.

	Priority 2020/2021	Known follow On Work
Survey	Further surveys are proposed in 2021/22	
Sewer Lining	6 gushing locations identified. An additional 25m of leak tight liner and 3 patch repairs have also been approved for implementation in Summer 2021 (by our Operational teams)	3 weeping locations identified in 2020/21 Locations identified in Future Surveys
Manhole Sealing – Infiltration Ingress	4 gushing locations identified An additional 7 manholes have been approved for sealing/ and lining for implementation in Summer 2021, by our operational teams.	6 weeping locations identified in 2020/21 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	

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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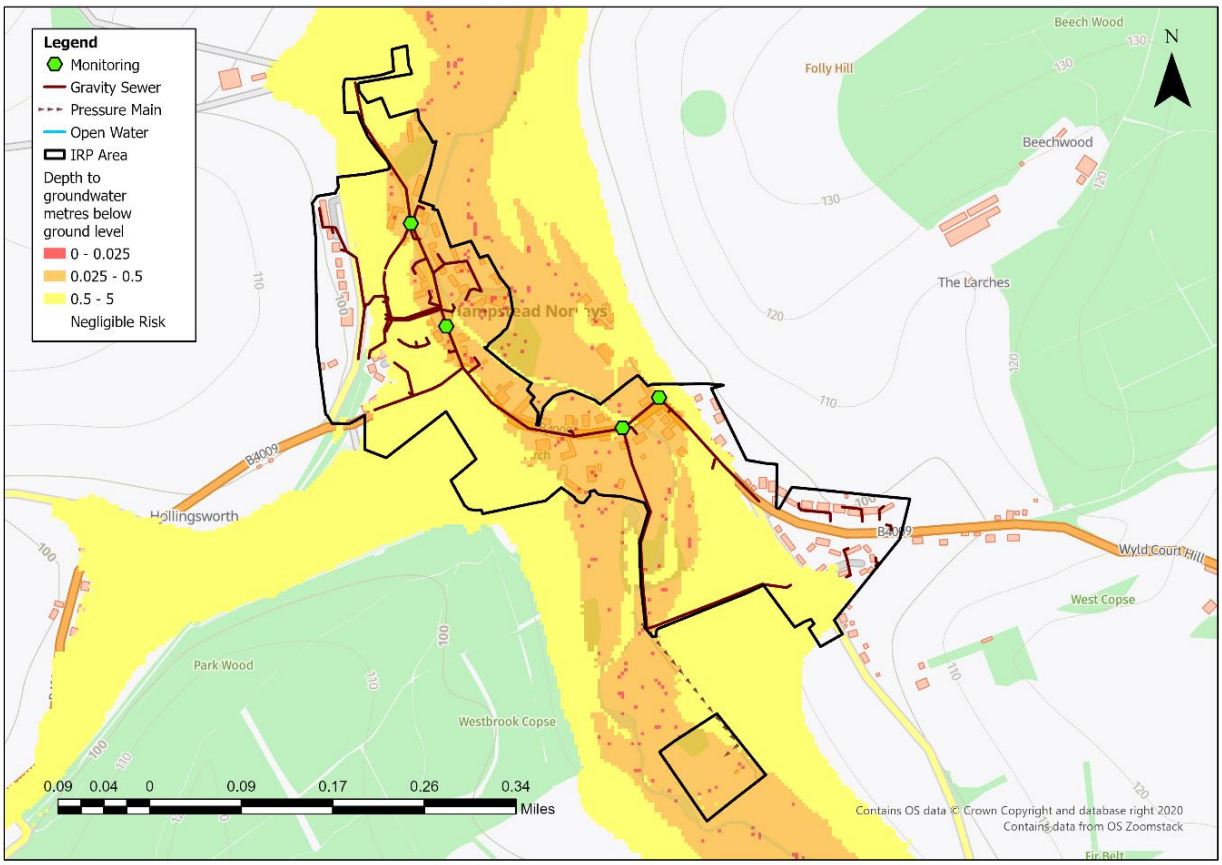
Overview

This addendum to the Hampstead Norreys 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 – Hampstead Norreys Monitoring Plan



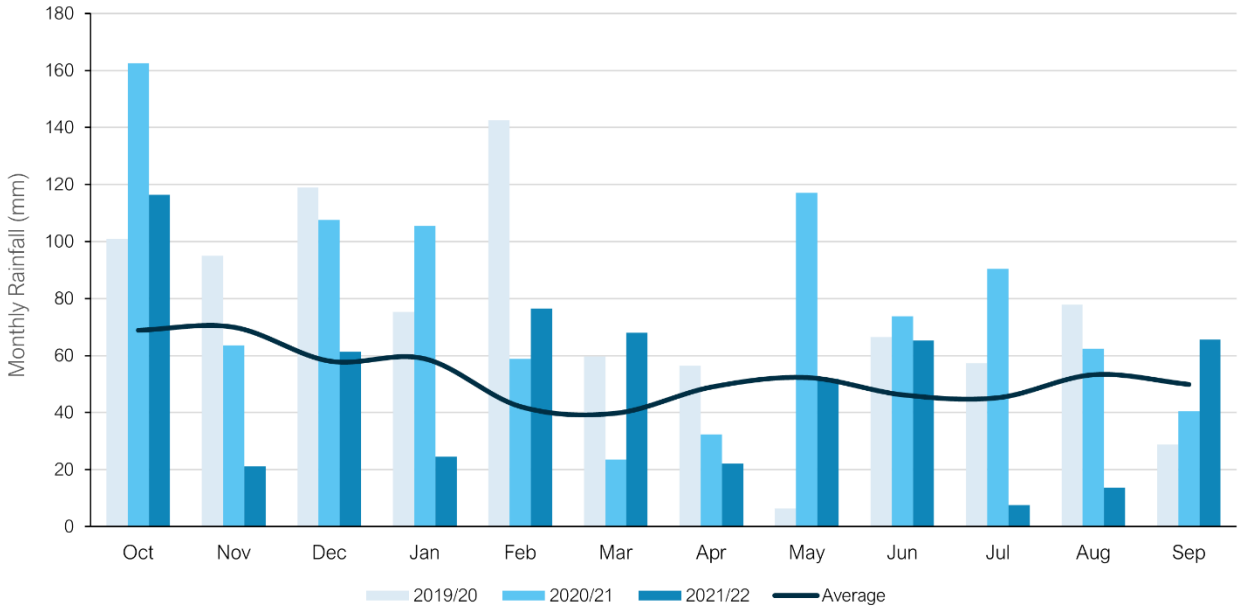
Hydrological Review – 2021-2022

This section summaries the hydrological conditions within the Hampsted Norreys 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 Benson based on the period 1991-2020

The total rainfall for the 2021/22 hydrological year is 5% 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)
634	886	938	604

Groundwater / Local River Level

The Hampstead Norreys catchment is situated in the Berkshire Downs water resources area. It sits in the Seaford Chalk Formation, generally comprised of carbonate material forming distinctive beds of chalk. The formation is a dedicated principal aquifer within the UK.

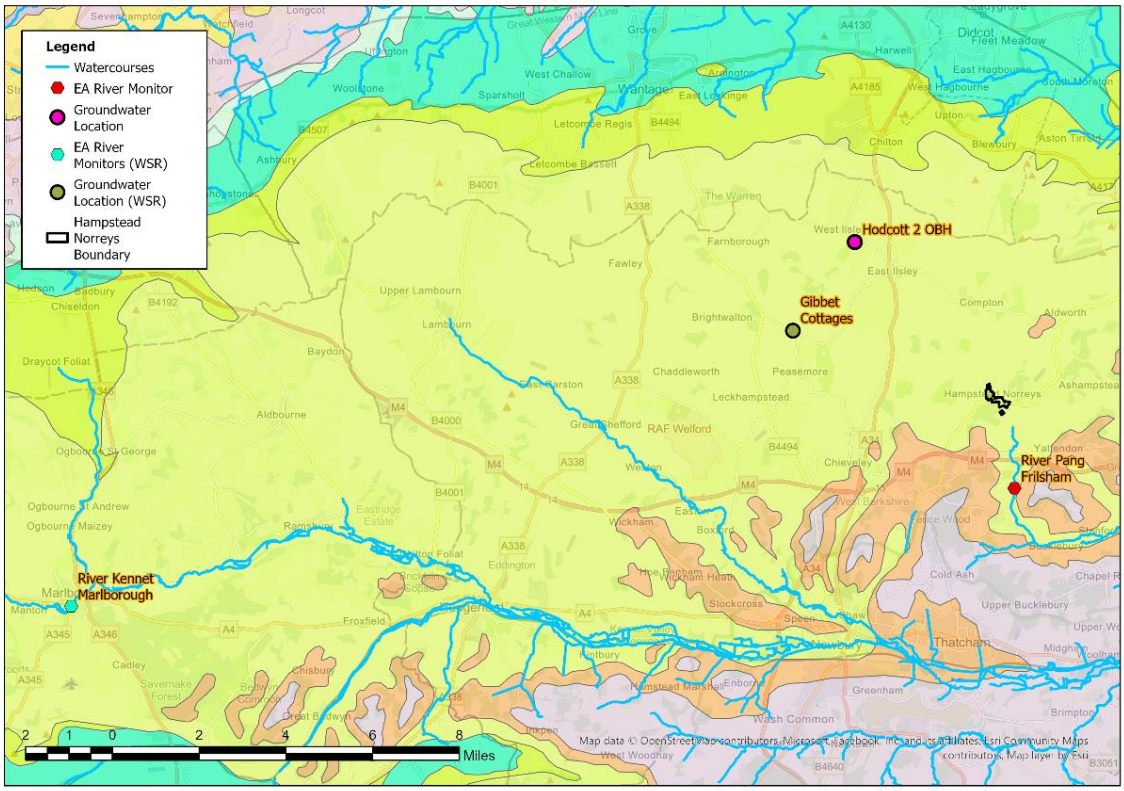
The Environment Agency has gauging stations on local watercourses measuring stage and observation boreholes measuring groundwater levels locally to the catchment which can be used to provide indicative local groundwater performance.

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

- River Pang, Frilsham
- Hodcott 2 OBH

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

Figure 4 – Local Monitoring Stations



The following figure represents the last three hydrological years of level information at the indicator site 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 Pang at Frilsham

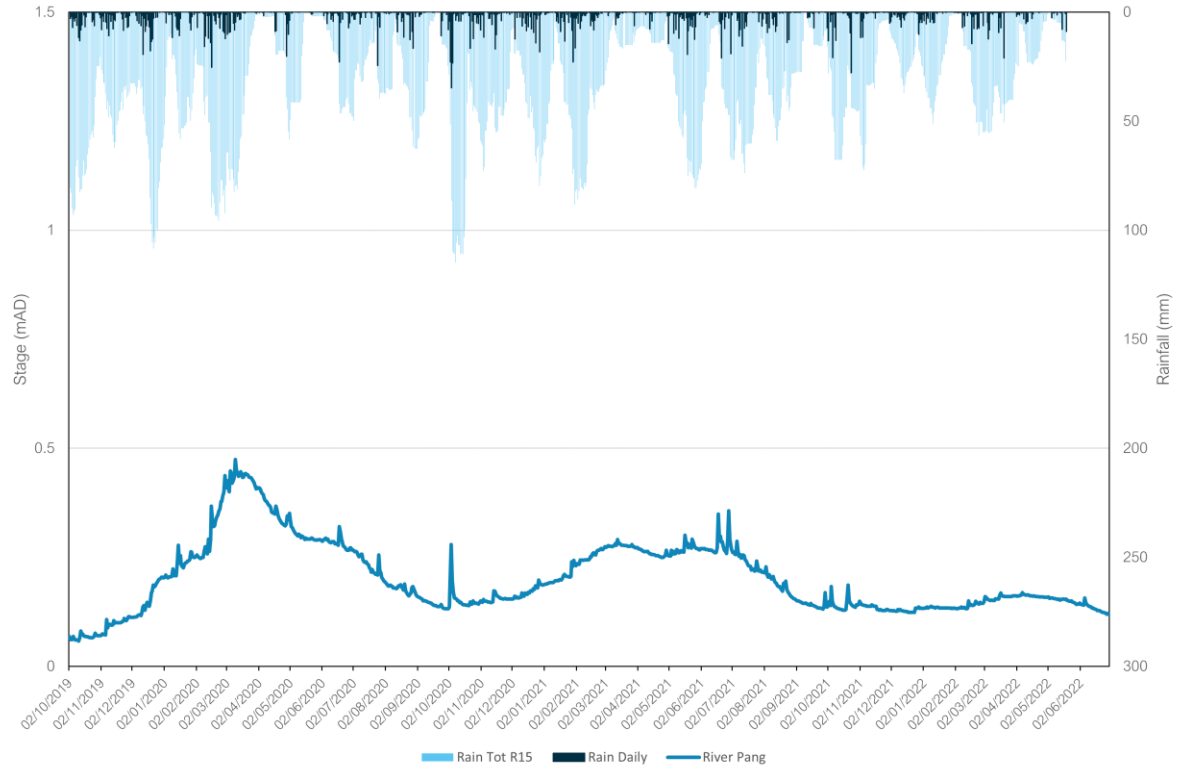
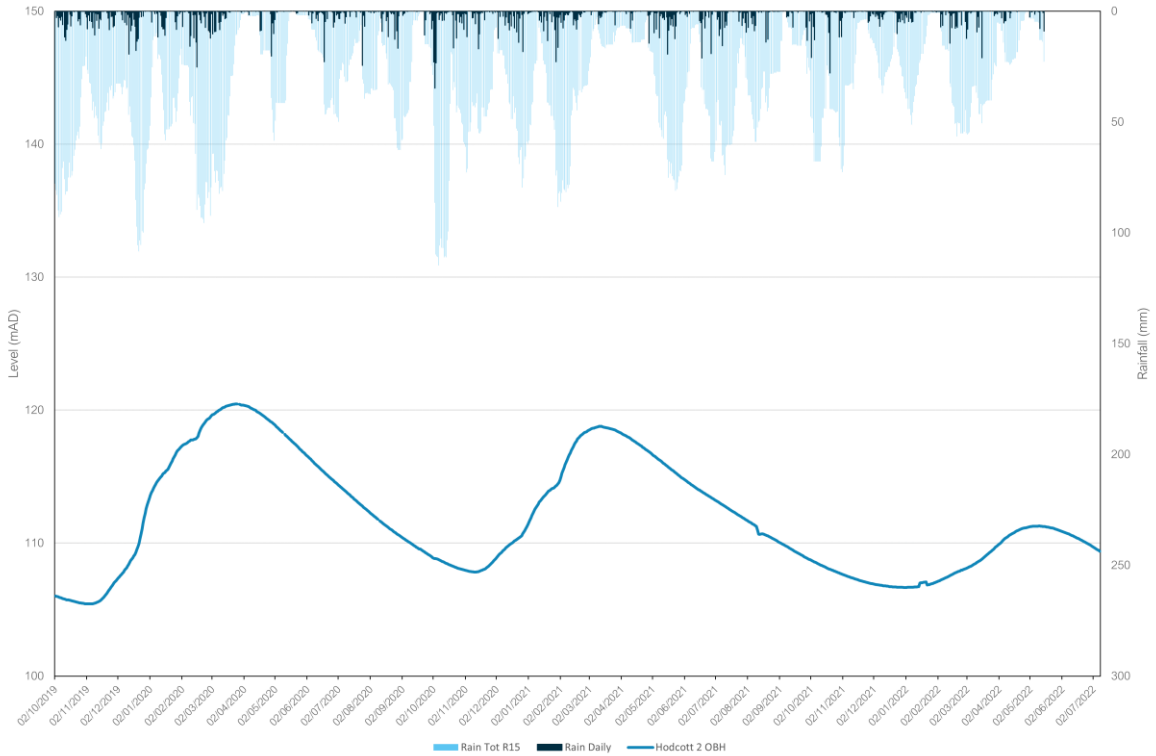
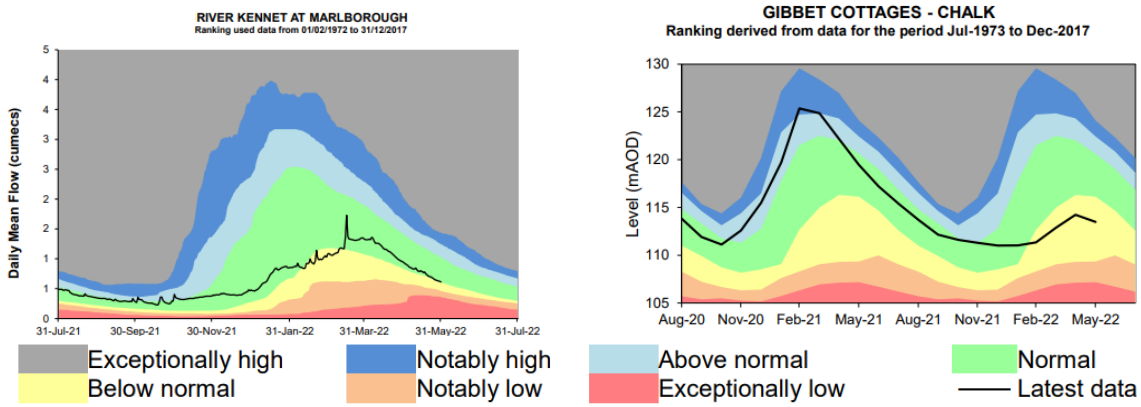


Figure 5B – Hodcott 2 OBH



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for the Berkshire Downs water resources area. The closest groundwater reference station is Gibbet Cottages. 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)]

Network Performance

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

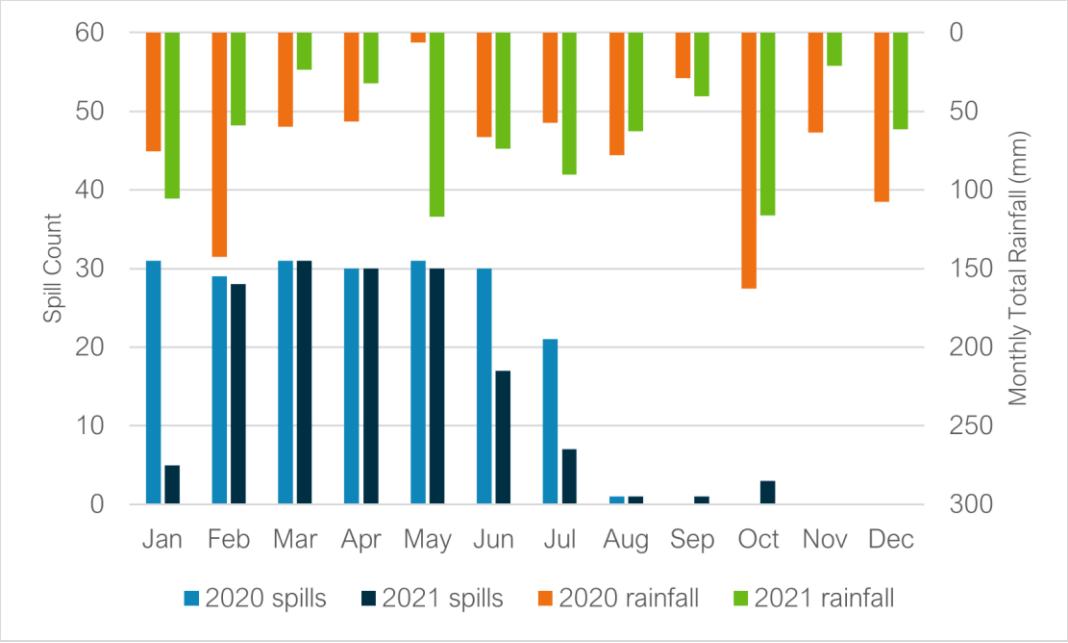
Table 7 below details the last 2 years performance of overflows within the catchment.

Table 7 – Event Duration Monitoring

Overflow	2020		2021	
	Spills	Duration (hours)	Spills	Duration (hours)
Hampstead Norreys STW	204	4111.95	153	2622.34

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



Years 2020 and 2021 show broad consistency in late winter early spring spills despite variability in rainfall. However, the wetter winter in 2019/20 shows higher spill frequency early in the year and a slower tail off as higher groundwater levels receded.

With significantly lower groundwater levels being observed in 2021/22, it is anticipated that this will demonstrate an impact on 2022 spill frequency when finalised.

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 4 monitors installed within the Hampstead Norreys catchment. There are currently no further monitor installs planned.

Remediation Works Undertaken this Hydrological Year

Table 9 below provides a summary of the investigations and remediation works undertaken or planned within the Hampstead Norreys 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	50 metres
Patch lining	N/A
Manhole sealing	10 manholes completed, 1 due to be completed by end of November 2022

With the seasonal trends in groundwater being low in comparison with previous years and the SDM installations not showing significant groundwater presence, the larger scale survey, identification and remediation of the sewerage network has not been possible in the 2021/2022 Hydrological Year.

In addition to the interventions detailed for the 2021-2022 Hydrological Year, approval has been given to progress proposals for lining and sealing high risk sewers and manholes during AMP7 in the Hampstead Norreys catchment. Project definition and pre-survey will be undertaken over the next 3-6 months with lining and sealing to commence in year 4 of AMP7 (April 2023 – April 2024).

Summary

Rainfall in the Hampstead Norreys catchment over the 2021/22 hydrological year has been below average, with groundwater levels in the aquifer beneath Hampstead Norreys not reaching the levels seen in previous years which triggered groundwater ingress into the sewerage network. Further network performance analysis and investigation will continue when EDM spills for 2022 are confirmed to help identify the principal factors affecting network performance

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

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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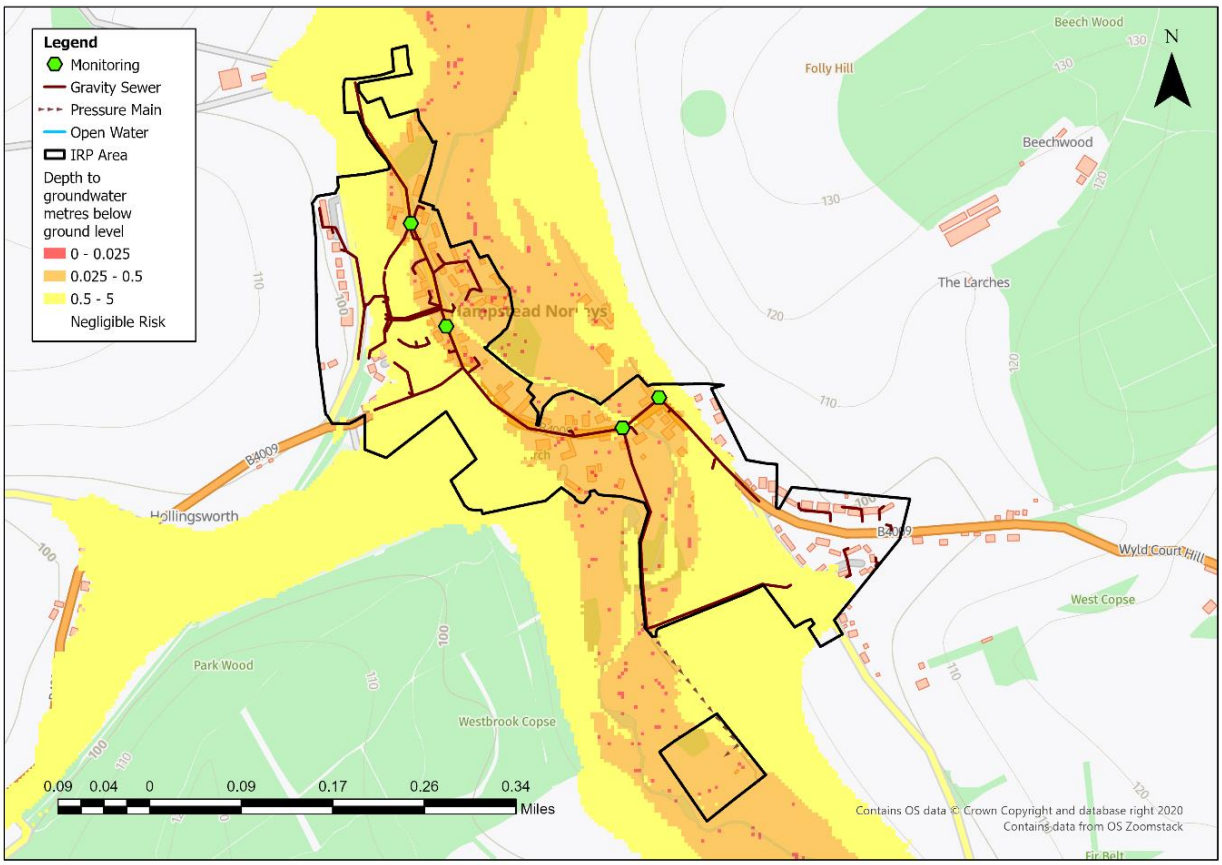

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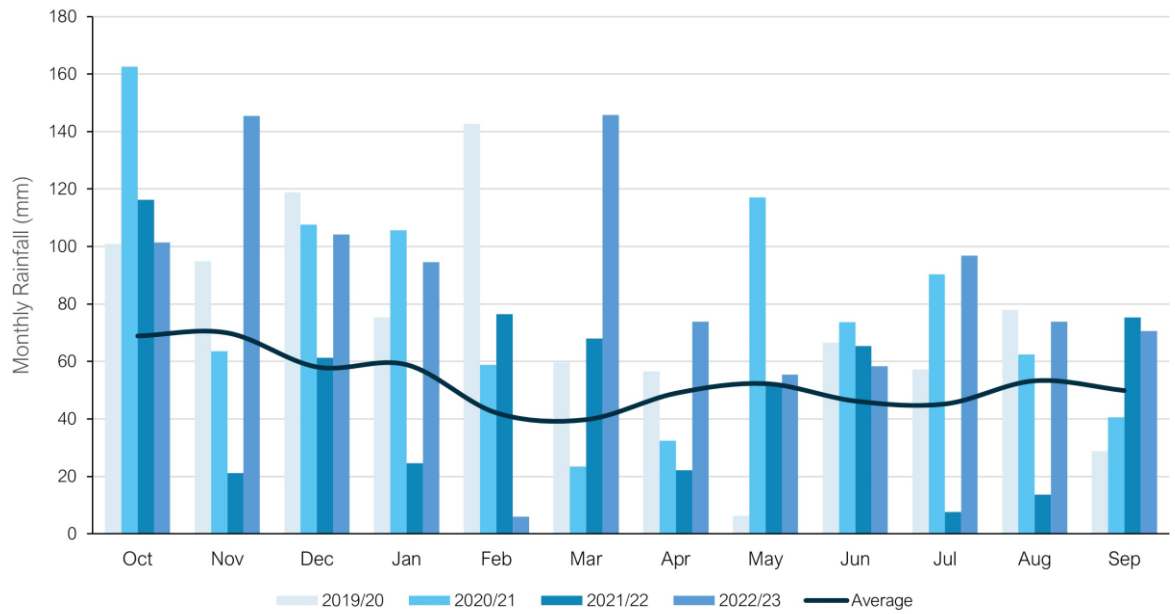


Average Values taken from Met Office Weather Station at Benson based on the period 1991-2020

The total rainfall for the 2022/23 hydrological year is 62% 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)
634	886	938	604	1026

Groundwater / Local River Level

The Hampstead Norreys catchment is situated in the Berkshire Downs water resources area. It sits in the Seaford Chalk Formation, generally comprised of carbonate material forming distinctive beds of chalk. The formation is a dedicated principal aquifer within the UK.

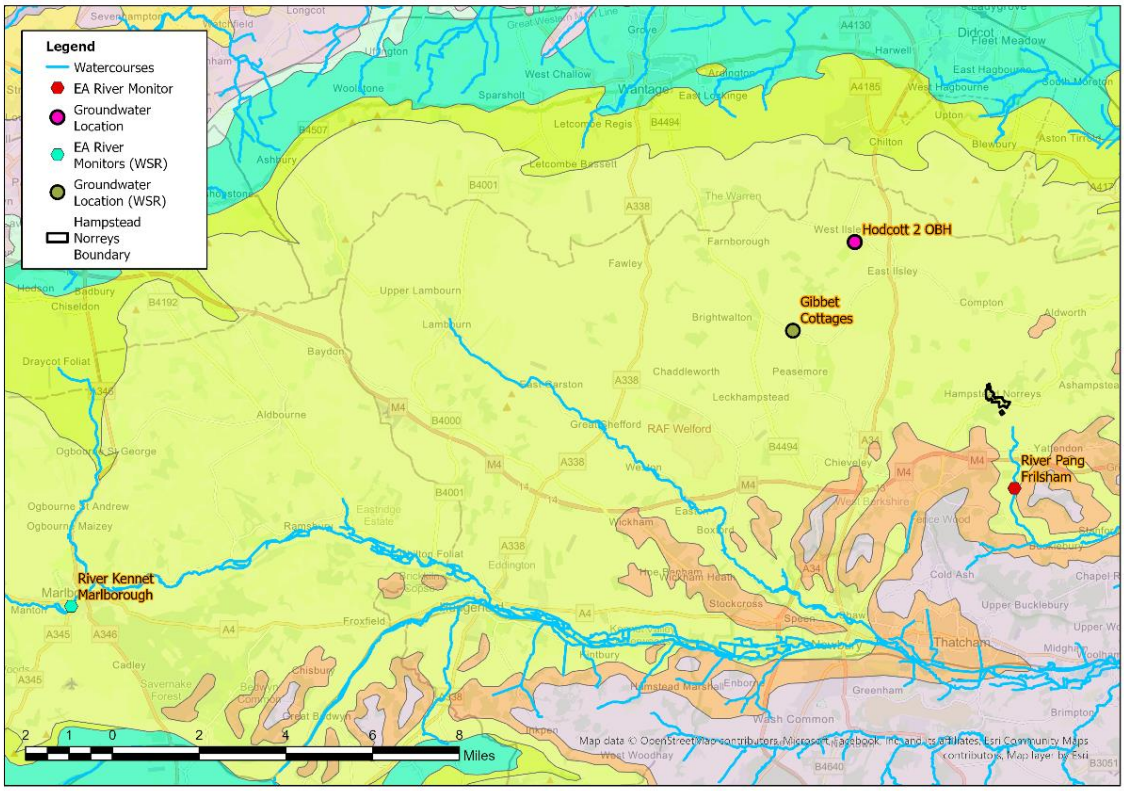
The Environment Agency has gauging stations on local watercourses measuring stage and observation boreholes (OBH) measuring groundwater levels locally to the catchment which can be used to provide indicative local groundwater performance.

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

- River Pang, Frilsham
- Hodcott 2 OBH

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

Figure 4 – Local Monitoring Stations



The following figure represents the last three hydrological years of level information at the indicator site 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 Pang at Frilsham

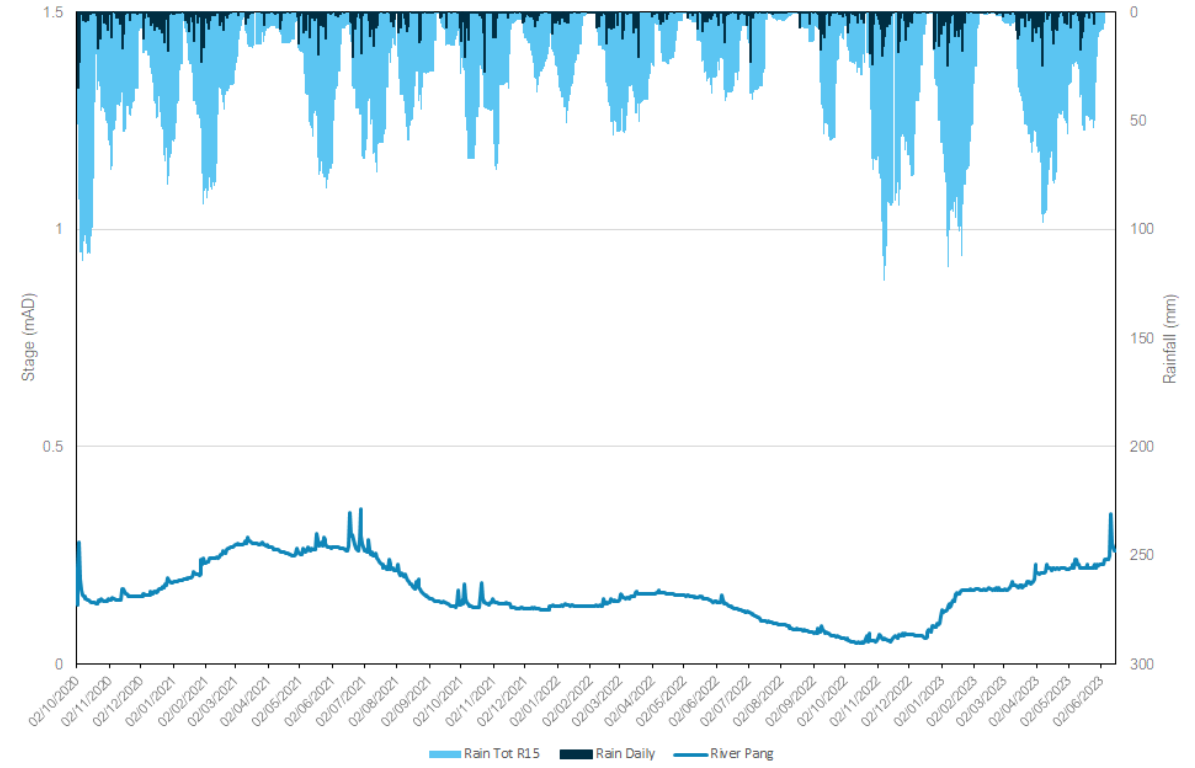
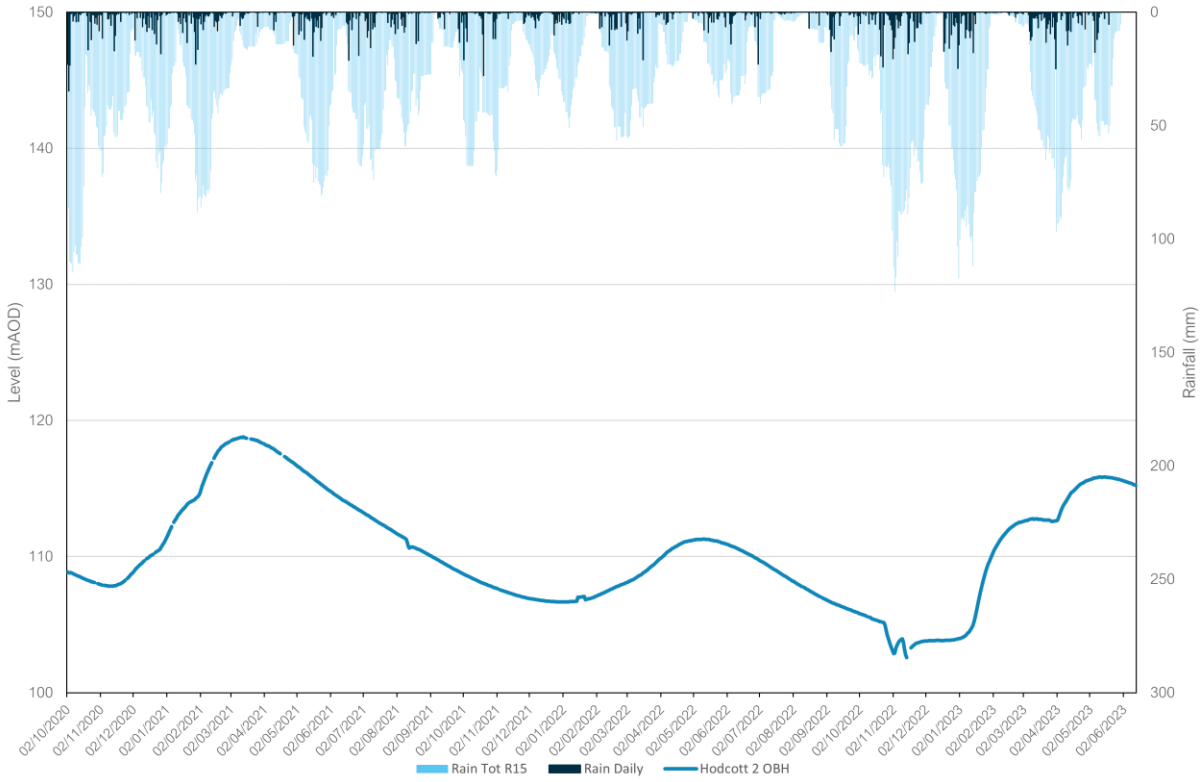
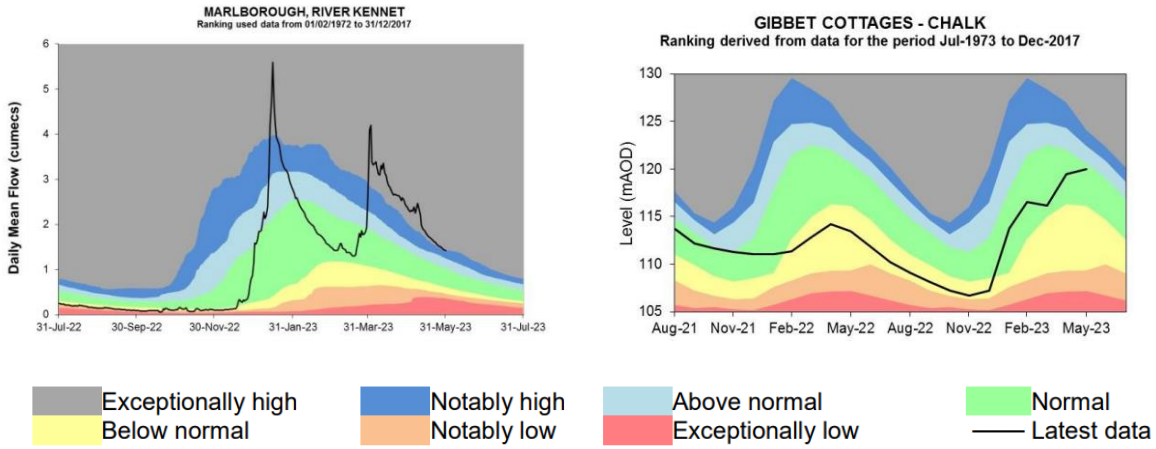


Figure 5B – Hodcott 2 OBH



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for the Berkshire Downs water resources area. The closest groundwater reference station is Gibbet Cottages. This site shows generally higher groundwater levels than the previous hydrological 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)]

Network Performance

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

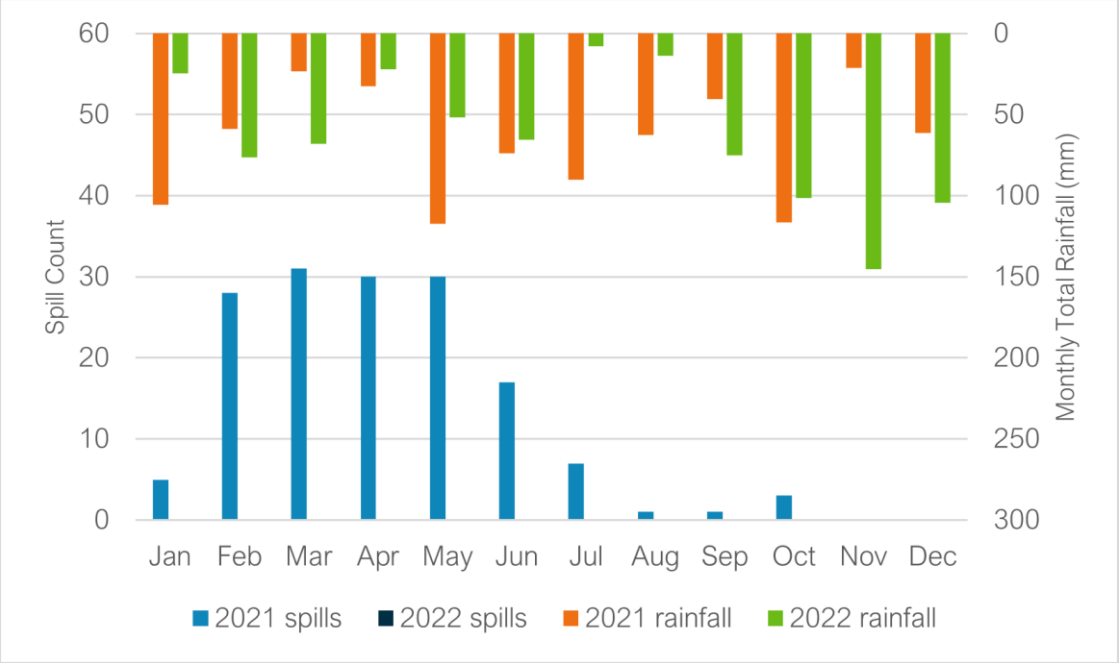
Table 7 below details the last 2 years performance of overflows within the catchment.

Table 7 – Event Duration Monitoring

Overflow	2021		2022	
	Spills	Duration (hours)	Spills	Duration (hours)
Hampstead Norreys STW	153	2622.34	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 year 2021, shows a much higher spill frequency than 2022, in which no spills were recorded at Hampstead Norreys STW. The indicator sites shown in Figure 5, suggest groundwater levels in the Hampstead Norreys catchment were significantly higher over the winter/spring 2021 period compared to the same period in 2022. Figure 6 suggests a consistently 'below normal' groundwater level in the catchment during 2022, which correlates with no spills being recorded over the period, despite some months displaying relatively high rainfall totals. The spills recorded July-September 2021, also suggest spills occurring in the catchment during intense rainfall events outside of periods of high groundwater infiltration.

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 4 monitors installed within the Hampstead Norreys catchment. There are currently no further monitor installs planned.

Remediation Works Undertaken this Hydrological Year

Table 9 below provides a summary of the investigations and remediation works undertaken or planned within the Hampstead Norreys 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 2021/22	Number/ length undertaken 2022/23
CCTV survey	N/A	N/A
Look and lift survey	N/A	N/A
Sewer lining	50 metres	N/A
Patch lining	N/A	N/A
Manhole sealing	10 manholes	1 manhole*
Manhole sealing plates	N/A	N/A
Manhole covers and frames replaced	N/A	N/A

*Marked as outstanding in last year's addendum report

Sewers previously lined will be surveyed as part of this process to ensure liners are still intact and re-lining undertaken if necessary.

In addition to this, an upgrade is planned for Hampstead Norreys STW. This will improve its ability to treat the volumes of incoming sewage, reducing the need for untreated discharges to the environment. The scheme is due for completion in 2025.

Summary

The absence of any recorded spills at Hampstead Norreys STW during 2022, is indicative of the role of groundwater infiltration on spills in the catchments, with indicator site data suggesting a consistently 'below normal' groundwater level in the catchment during 2022. This hydrological year (October 2022- September 2023), 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.

Extensive sewer lining is planned in the catchment during the remainder of AMP7, with the aim of significantly reducing levels of groundwater infiltration into the network.

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.

Addendum - Annual Update 2024

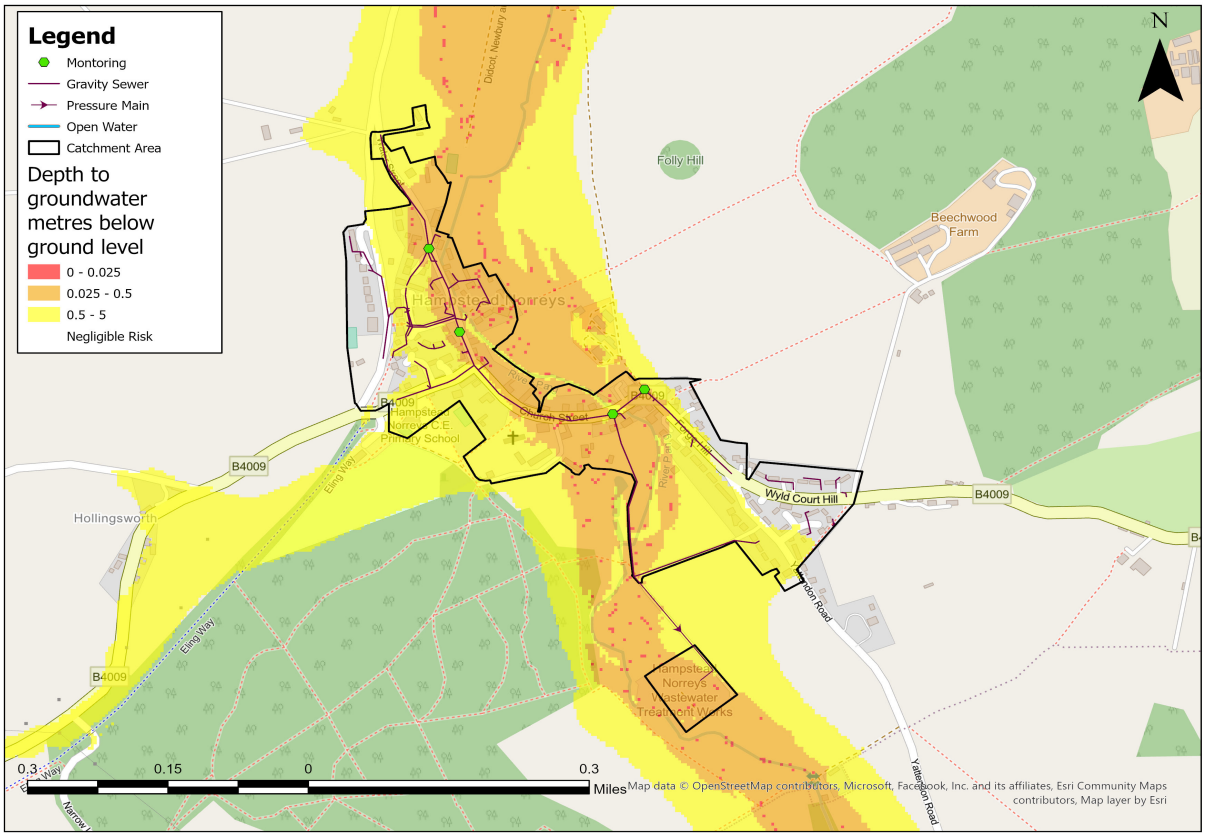
Table of contents

Overview

This addendum to the Hampstead Norreys Groundwater Impacted System Management Plan 2021(GISMP) provides an update on performance/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 being planned
- Summary and plan for 2024/25

Figure 1 – Hampstead Norreys Monitoring Plan



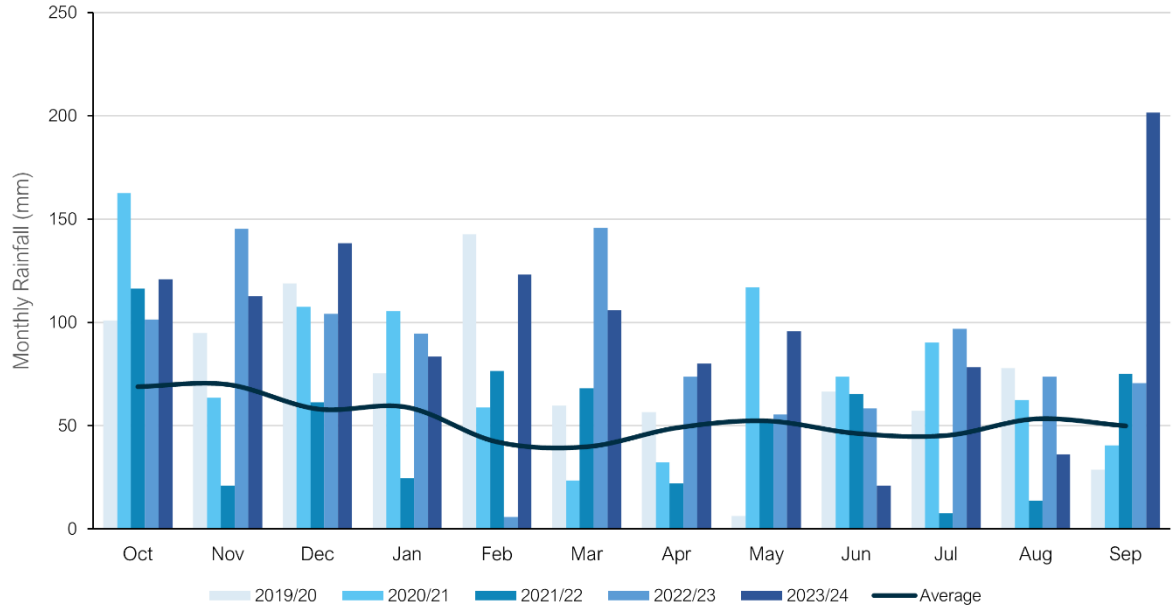
Hydrological Review – 2023-2024

This section summaries the hydrological conditions within the Hampsted Norreys 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 Benson based on the period 1991-2020

The total rainfall for the 2023/24 hydrological year is 89% 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)
634	886	938	604	1026	1198

Groundwater / Local River Level

The Hampstead Norreys catchment is situated in the Berkshire Downs water resources area. It sits in the Seaford Chalk Formation, generally comprised of carbonate material forming distinctive beds of chalk. The formation is a dedicated principal aquifer within the UK.

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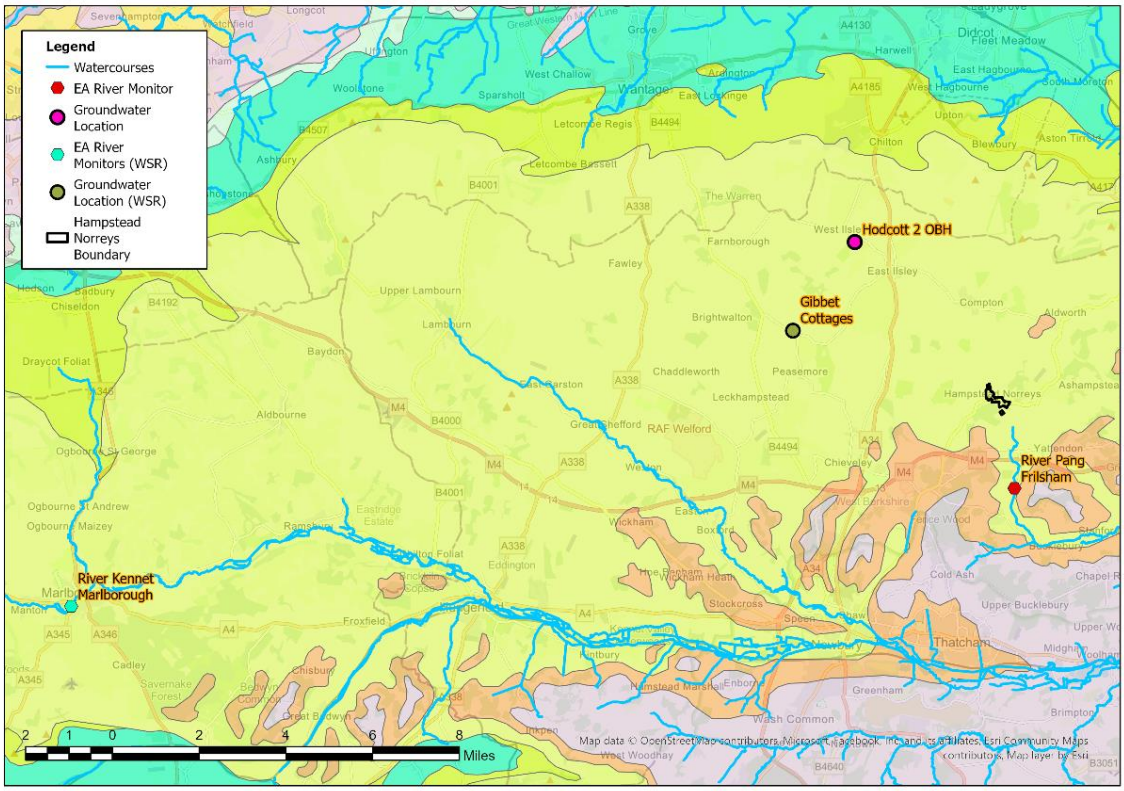

Figures 5A-5B represent the last three hydrological years of level information at the indicator site to build a picture of the relative conditions prevalent in the current year. It is presented against both the daily total rainfall values for the catchment and a rolling 15 day total rainfall.

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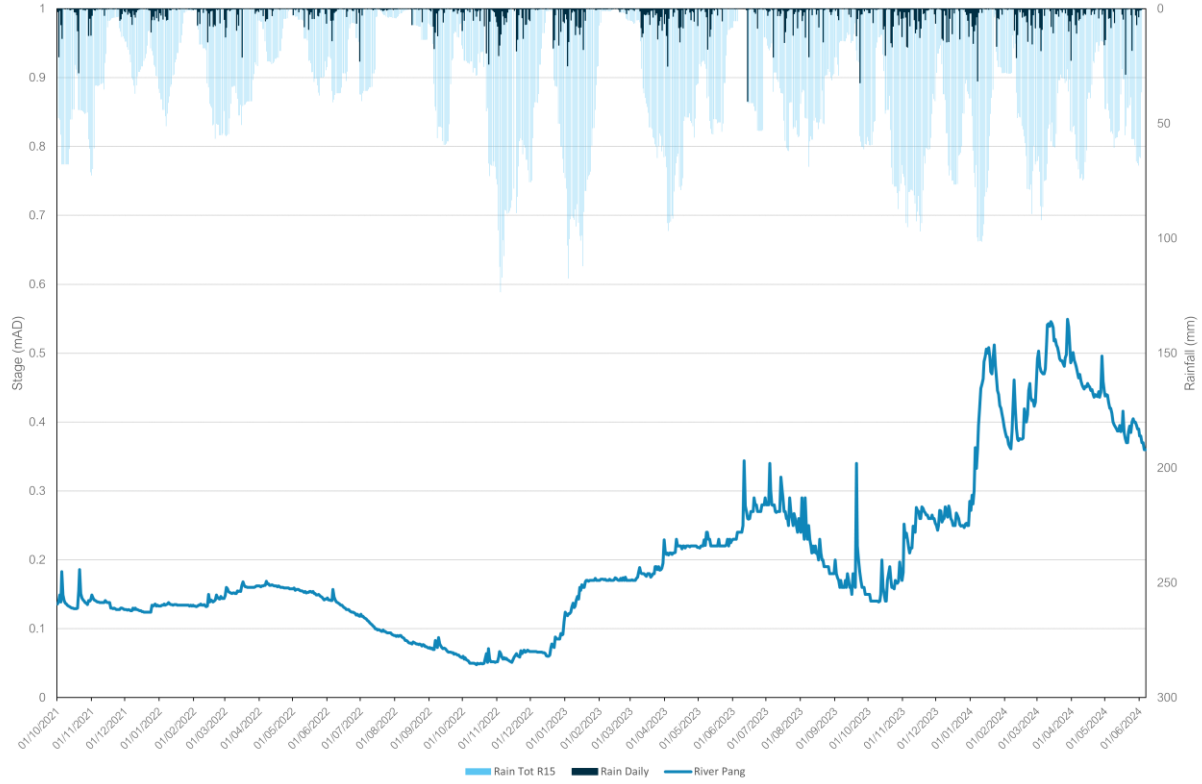
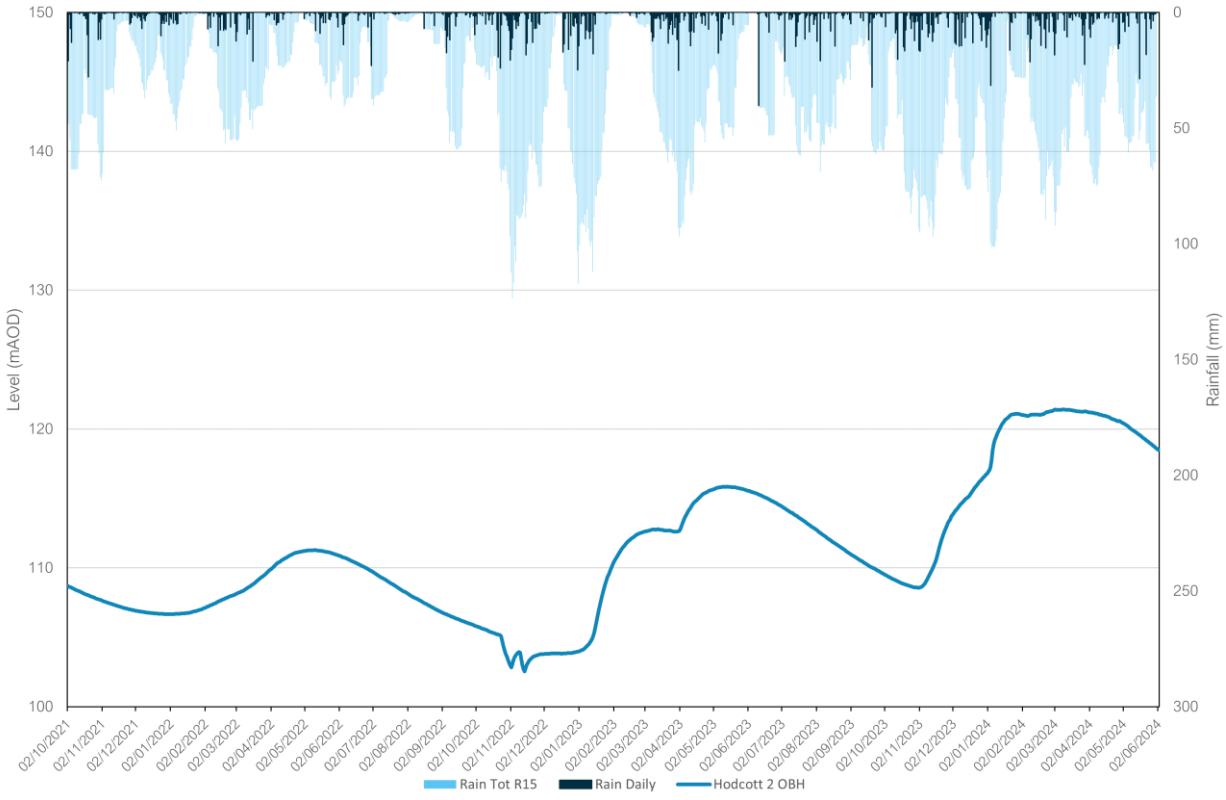


Figure 5B – Hodcott 2 OBH



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for the Berkshire Downs water resources area. The closest groundwater reference station is Gibbet Cottages. This site shows groundwater levels generally at normal levels in 2023 before rising towards the end of the year to reach exceptionally high levels. Groundwater levels have remained exceptionally high in 2024. This can be seen in Figure 6 alongside the river indicator location at Marlborough on the River Kennet.

Figure 6 – Water Situation Report

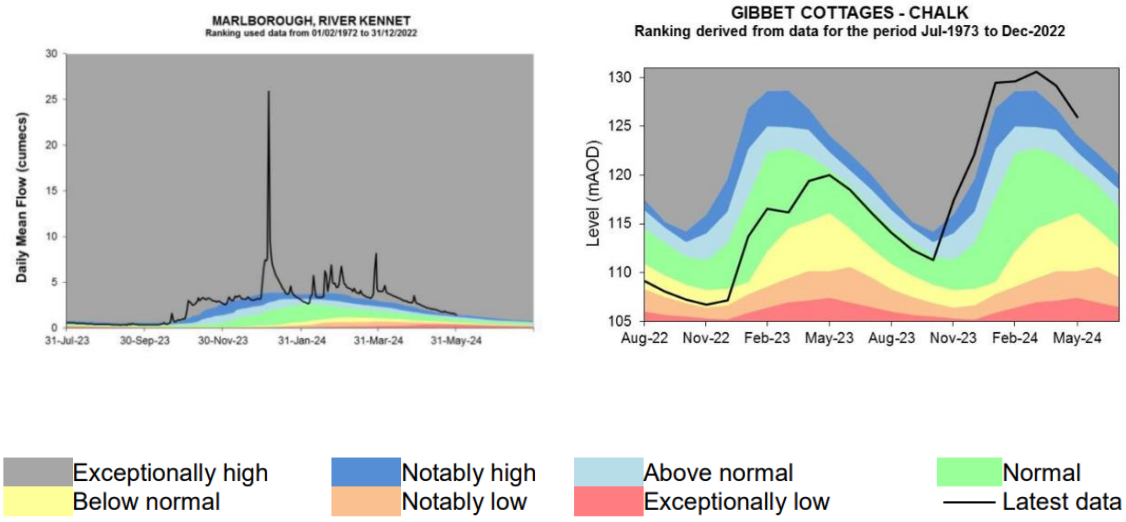


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Table 7 below details the last 2 years performance of overflows within the catchment.

Table 7 – Event Duration Monitoring

Overflow	2022		2023	
	Spills	Duration (hours)	Spills	Duration (hours)
Hampstead Norreys STW	0	0	83	1295.75

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.

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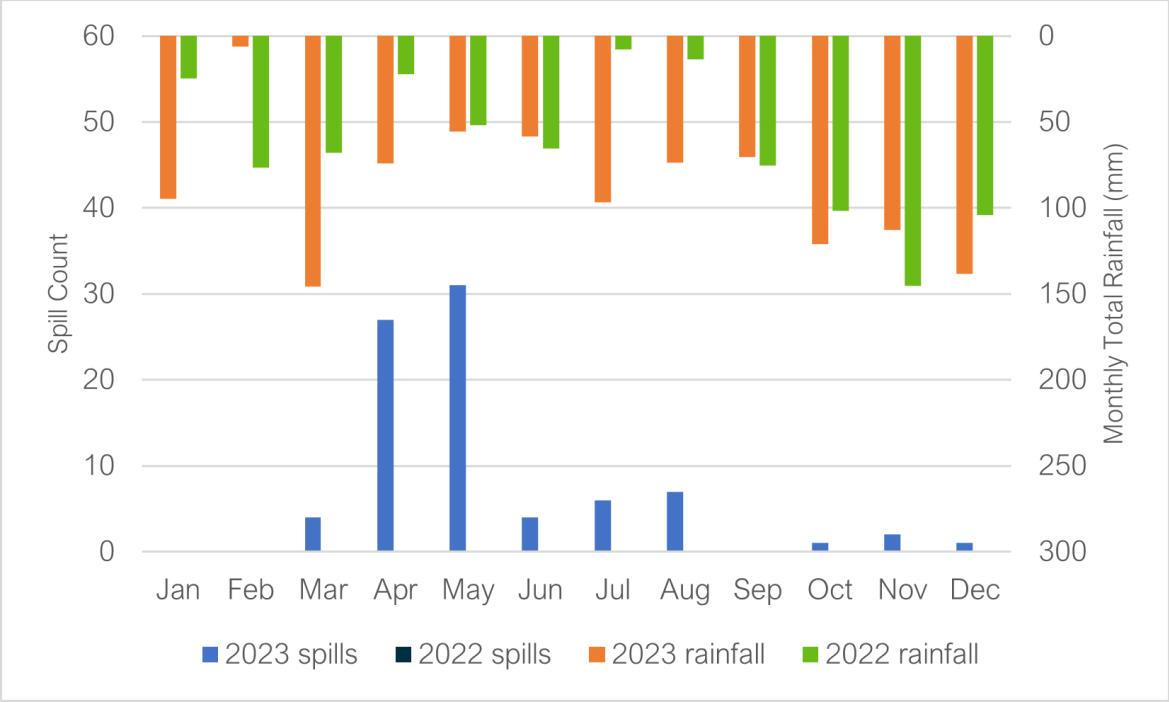

The year 2023, shows a much higher spill frequency than 2022, when no spills were recorded at Hampstead Norreys STW. Figure 5 suggests lower groundwater levels in the catchment throughout 2022, which correlates with no spills being recorded over the period, despite some months displaying relatively high rainfall totals. The high number of spills recorded in April and May 2023, coincides with when the Hodcott 2 OBH indicator site data shown in Figure 5 suggests that groundwater levels in the catchment peaked and reached significantly higher levels than within the same period in 2022. The relatively high number of spills that occurred in the catchment during the summer months, also suggests spills occurring in the catchment as a direct response to rainfall, 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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Investigation/ remediation type	Number/ length undertaken 2021/22	Number/ length undertaken 2022/23	Number/ length undertaken 2023/24
CCTV survey	N/A	N/A	1.044 kilometres planned
Look and lift survey	N/A	N/A	N/A
Sewer lining	50 metres	N/A	80 metres
Patch lining	N/A	N/A	N/A
Manhole sealing	10 manholes	1 manhole	24 manholes*
Manhole sealing plates	N/A	N/A	N/A
Manhole covers and frames replaced	N/A	N/A	N/A

*Mix of MH sealing and MH sealing plates

It is planned that the sealing of high-risk assets in the catchment will continue throughout the summer 2023/24 period. Continuation of lining/sealing is dependent on groundwater being at manageable levels to proceed with this. Sewers previously lined will be surveyed as part of this process to ensure liners are still intact and re-lining undertaken if necessary.

In addition to this, an upgrade is planned for Hampstead Norreys STW. This will improve its ability to treat the volumes of incoming sewage, reducing the need for untreated discharges to the environment. The scheme is due for completion 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.

It is expected that this catchment will meet all government targets for storm overflows by 2030.

Summary

Indicator site data suggests groundwater levels in the Hampstead Norreys catchment have reached higher levels this hydrological year (October 2023 – September 2024) than in the previous hydrological year. The EDM data for 2023 is indicative of the impact 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.

Extensive sewer lining is planned in the catchment during the remainder of AMP7, with the aim of significantly reducing levels of groundwater infiltration into the network.

It's everyone's water