Infiltration Reduction Plan

St Mary Bourne

Barton Stacey Catchment

August 2024

Version 7

from Southern Water

Contents

Document Control

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Glossary

AMP – Asset Management Programme
CCTV - Closed-circuit television
CSO – Combined Sewer Overflow
EA - Environment Agency
GW – Ground Water
IRP - Infiltration Reduction Plans
l/s - litres per second
MH – Manhole
ODI – Oucome Delivery Incentive
RPS - Regulatory Position Statement
SW – Southern Water
WaSC - Water and Sewerage Companies
WC – Water Closet
WPS - Wastewater Pumping Station
WTW - Wastewater Treatment Works

1. Background

This Infiltration Reduction Plan (IRP) for St Mary Bourne in the Barton Stacey catchment has been prepared in response to the Environment Agency's (EA) Regulatory Position Statement (RPS). SW has been carrying out work for many years to survey and repair sources of groundwater infiltration to the sewers serving St Mary Bourne ultimately leading to Barton Stacey Wastewater Treatment Works (WTW) in Hampshire.

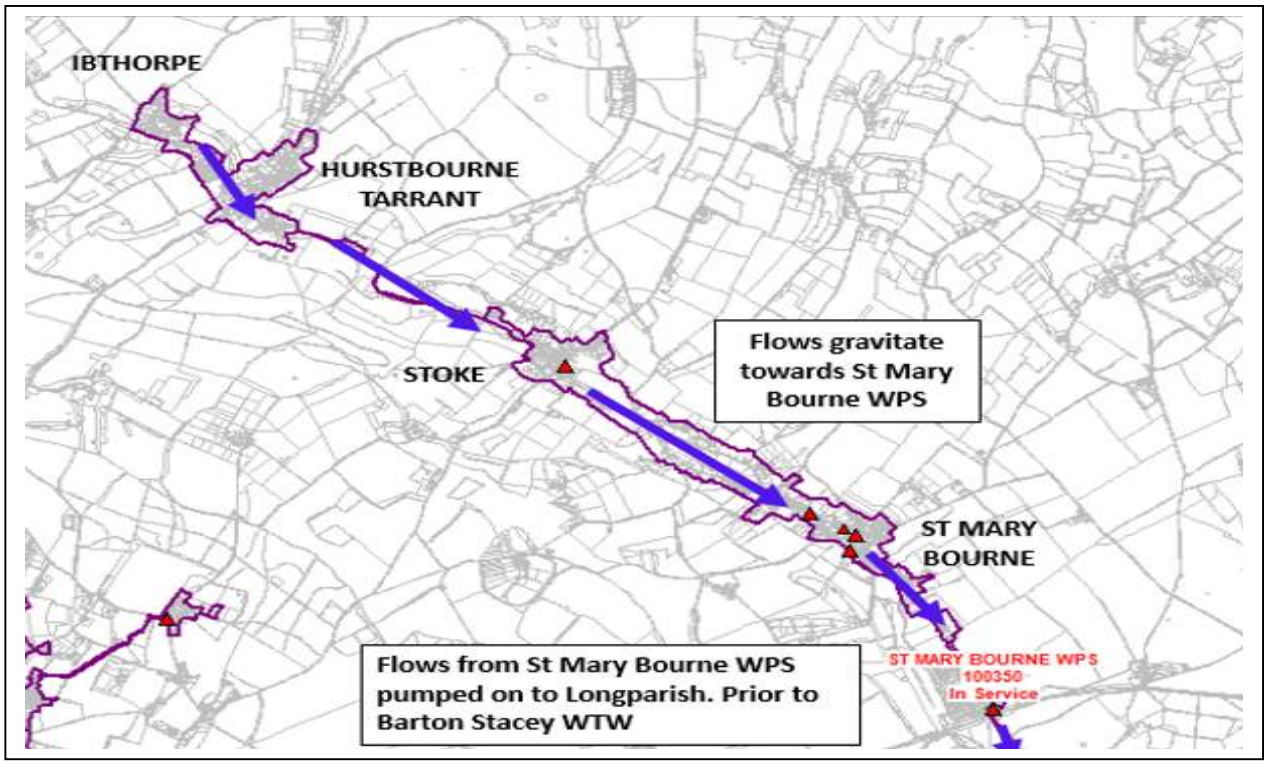
This IRP covers the villages of St Mary Bourne, Stoke, Hurstbourne Tarrant and Ibthorpe. Figure 1.1 shows the extent of the catchment between Ibthorpe and St Mary Bourne WPS.

The repairs carried out by SW improve the integrity of the sewerage system. SW has been working with the following organisations and is dependent on their support to achieve the objective of reducing non-sewage flows into the sewers.

- Environment Agency
- Hampshire County Council
- St Mary Bourne Parish Council
- Basingstoke & Deane Borough Council
- Test Valley Borough Council
- The Local Member of Parliament

Southern Water will continue to consult with representatives of these parties as part of the IRP development and implementation.

Figure 1.1 - Representation of the sewerage system for Barton Stacey catchment draining to St Mary Bourne WPS.



2. Groundwater Infiltration at St Mary Bourne

2.1. The significance of groundwater infiltration.

St Mary Bourne is one of a number of areas in Southern Water's operating area where, during excessively wet winters, customers have been inconvenienced by the effects of groundwater infiltration into sewers. Such effects can include flooding and restricted toilet use (RTU).

Southern Water strives to maintain services for customers by a programme of investigation, repair, maintenance, and mitigation. Mitigation measures include the use of tankers and groundwater treatment. Such mitigation measures are not sustainable and are disruptive to communities, so since 2014 SW has invested in carrying out major improvements to the integrity of the sewers and manholes in the vicinity of St Mary Bourne in order to minimise the occasions on which mitigation measures are required.

2.2. What would happen if Southern Water did not take action?

Despite the significant groundwater flow through the valley during winter conditions, incidents of sewer flooding have been relatively infrequent. Table 2.1 below show reported incidents of sewer flooding since April 2012.

Figure 2.1 shows that there appears to be a correlation between wetter years and an increased number of incidents, as would be expected. There appear to have been more incidents in 2019-20 than 2013-14, which may be indicative of a localised issue.

Table 2.1 - Reported Flooding Incidents by Category, in St Mary Bourne Barton Stacey Catchment

Year	External Flooding (Properties & Gardens)	External Flooding (Highways & Other)	Internal Flooding	Restricted Toilet Use	Total
2012-2013	1	0	0	2	3
2013-2014	1	4	0	2	7
2014-2015	0	5	0	0	5
2015-2016	0	0	0	0	0
2016-2017	0	3	0	0	3
2017-2018	0	0	0	0	0
2018-2019	0	0	0	0	0
2019-2020	2	0	1	3	6
2020-2021	0	0	0	0	0
2021-2022	0	17	0	0	17
2022-2023	0	11	0	0	11
2023-2024	1	30	0	0	31
Total	5	70	1	7	**83**

3. Investigation & repairs

3.1 Outline Plans to Investigate Sources of Infiltration

The Generic Plan describes Southern Water's Infiltration Reduction process. The specifics of the investigations and repairs at St Mary Bourne are captured in Section 3.2 below, and includes the following elements:

- Manhole Inspections and CCTV Surveys
- Flow Monitoring Surveys
- Manhole and Sewer Repairs
- Follow-Up Surveys and Repairs

3.2 Investigation and Repairs in St Mary Bourne

Groundwater infiltration into sewers has been a long-running issue for the St Mary Bourne area. SW has been making significant investments over many years to minimise infiltration and the need for interventions such as tankering and groundwater treatment.

SW recently completed a major programme of survey and repairs to the sewers in the St Mary Bourne catchment. The investigations and repairs followed the process set out in the Generic Plan. The timing and status of each step is in Table 3.1 below.

Table 3.1 - Summary of Survey and Repairs at St Mary Bourne

Step.	Description	Approx. Date	Status
1.	Manhole lifting followed by CCTV Investigation (11km of sewers and 119 manholes surveyed)	Spring 2013	Completed
3.	Determination of required repairs	Spring 2013	Completed
5a.	Dry Weather Flow Survey	7th July to 14th August 2013	Completed
4a.	Repairs – 923m of sewers repaired and 30 manholes sealed [refer previous issues of the IRP]	October 2013 – July 2014	Complete
5b.	Wet Weather Flow Survey	9th April to 6th May 2014	Completed. for the upstream end of the catchment.
4b.	Relaying of sewer south of St Mary Bourne village (25m length)	October 2014	Complete
6.	Targeted follow up survey	June 2014	Complete
7.	Targeted Repairs	Autumn 2015/ Spring 2016	Complete, but further work scheduled for 2017/18
8.	Ongoing monitoring	Commenced Jan 2015	Ongoing.
9.	CCTV Surveys carried out	January 2018	Completed
10.	Targeted Repairs	October 2017-Febuary 2018	Completed
11.	Further surveys and subsequent repairs	Summer 2021 – Spring 2022	Completed

12.	Electro scan surveys	2022	Completed
13	Further repair work	2023 - 2024	In progress
13	Continue with Pathfinder approach across the remainder of the villages	From April 2025	Planned

The investigations in 2013 at St Mary Bourne identified most of the infiltration at manholes. This is not surprising because the previous rehabilitation work had focussed on sealing sewers, 7km of which were sealed in 2007/08.

Following the CCTV surveys in Spring 2013, repairs commenced in October 2013 and completed in July 2014. The planned repair programme was completed in October 2014 when a length of sewer south of St Mary Bourne village was re-laid. Completion of this work improved flows to St Mary Bourne pumping station. The extent of these repairs is shown in earlier versions of the IRP. A further 7km of sewers was surveyed in 2015/16, and the majority of the repairs were carried out in 2016/17. The final repairs were completed during the remainder of 2017/18. Further investigations were carried out using a system called Electroscan in 2020 covering 3.7 km of the sewer network between Ibthorpe and Gangbridge Lane. Further surveys were undertaken in 2022 which have led to additional sealing work being required which will be completed during 2024 once the high groundwater in the current 2023/24 wet winter period has subsided.

4 Mitigation measures

4.1 Circumstances that lead to mitigation

Since 2013, SW has made significant investment to reduce infiltration and to protect specific properties at risk of flooding, with the objective of reducing the frequency of discharges to watercourses.

As previously highlighted a large amount of improvement work has been completed in St Mary Bourne sewer network (both public and private) to reduce infiltration toward an acceptable level. This work, coupled with improvements to St Mary Bourne WPS, should reduce the likelihood of sewer flooding issues caused by high groundwater. The rehabilitation work will continue through SW's cyclical planned maintenance programme.

Within St Mary Bourne and the villages upstream, it has been agreed with stakeholders that ground water treatment to the Bourne Rivulet will not form part of the mitigations to high flows. Instead, alleviation of the system in wet winters will be via tankers to protect water quality.

There may be exceptional times however, when during particularly wet winters the groundwater levels rise to such an extent that high flow levels in the sewers start to impact on customers' use of their facilities. Should tankers not be sufficient to control excessive flows, some alternative, or concurrent approach would be required. Whilst the sewers and the pumps at Longparish are designed to accommodate the flows from St Mary Bourne WPS, pumping higher flows for a prolonged period will increase pressure at Longparish WPS which is located close to the River Test. In the event of high flows from St Mary Bourne WPS, exceeding the capacity of Longparish WPS during prolonged periods of high groundwater, action would be needed to prevent sewer flooding.

Although groundwater treatment has historically been utilised as a mitigation measure in St Marybourne it is not currently an option being considered due to the environmental impact this may cause to the sensitive receiving waters and those businesses dependent on the high water provided by the natural watercourse.

In the winters of 2019/20 and 2020/21, tankering was used instead of Ground water treatment.

- Between 11th March and 24th May 2020

- Between 7th January and 23rd April 2021

SW has mitigated against the option of ground water treatment by having completed the following:

- Extensive sewer survey and repairs over the last decade as detailed in Section 3
- Relaying one length of sewer to improve the hydraulics.
- Upgrading the pumps at St Mary Bourne Pump Station
- Throttling flows upstream of the village at times of very high flow.
- Contributing to the cost of weed clearance in the Bourne to improve carrying capacity which helps avoid elevated water levels.
- Pre-winter preparations (Section 4.5.1)
- Use of tankers to prevent sewer flooding locally

Figure 4.1 illustrates groundwater levels in the period 2013 to 2024. There is a strong correlation between the level at the Vernham Dean borehole, and flows arriving at Barton Stacey wastewater treatment works. It can be seen that the groundwater in October 2023 is abnormally high due to the wet summer and autumn which has resulted in early recharge of the chalk aquifers.

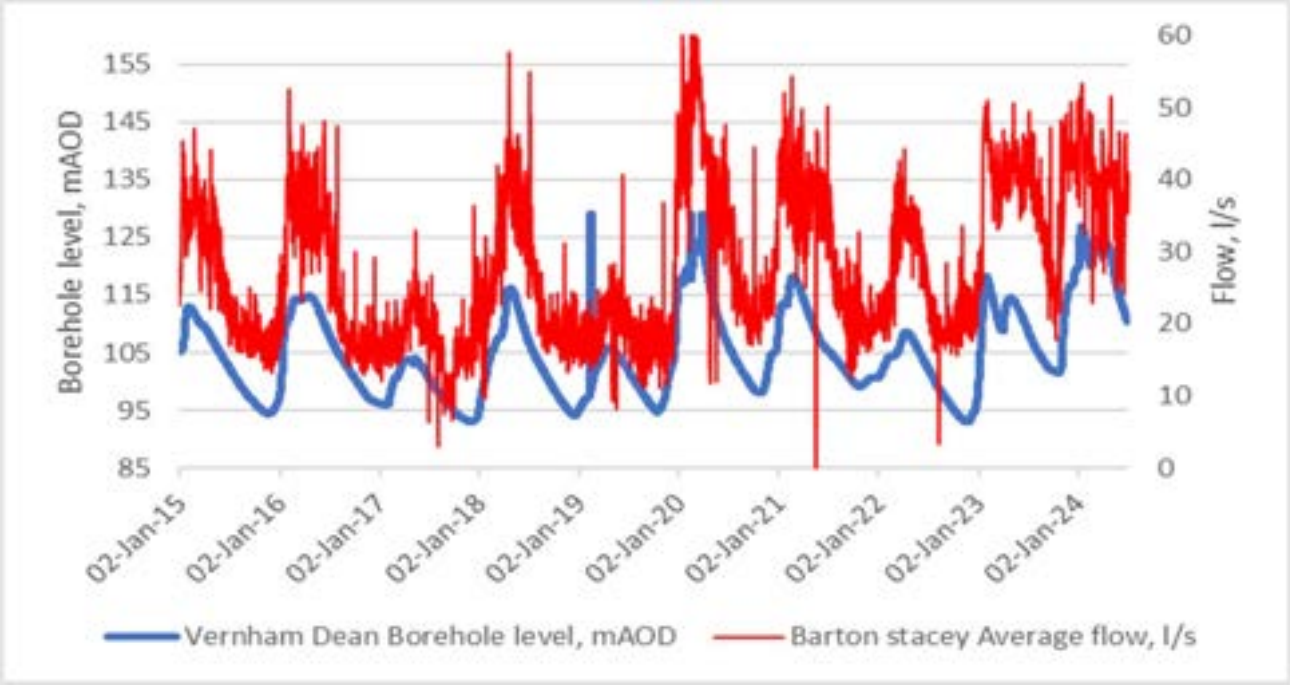


Figure 4.1 - Groundwater levels from 2012 to 2024

4.2 Steps to prevent discharges to the environment.

The Generic Plan details the typical activities that Southern Water undertakes to minimise the requirement for discharges to watercourses. Since 2013, SW has undertaken extensive surveys and repaired sewers and manholes where infiltration had been found (the extent of the work is shown in Appendix A). This built on the repairs that had been carried out in previous years (shown in Appendix A).

Following the main repairs, further targeted repairs were completed.

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4.3 3rd Party Communications about groundwater treatment

Since the start of the Infiltration Reduction Programme in 2013, Southern Water has been active in communicating with stakeholders and customers about planned and completed work to improve the integrity of the sewerage system. Stakeholders have been kept informed of progress on survey and sealing work via emails and or face-to-face meetings. However, we recognise there is more to do in this area to keep everyone informed of the mitigation measures that may be required and informing when we have deployed the measures.

SW will attend and convene meetings with local groups to ensure progress against the plan and the on-site mitigation activity is clearly communicated. Meetings that have been held over the last 10 years with local council and EA representatives have been influential in helping to shape the IRP. The latest version of the IRP approved by the EA, will be published on SW's website.

From time to time, SW updates stakeholders about completed and planned work, as part of stakeholder meetings with the local councils.

4.4 Monitoring quality of the downstream watercourse

The Generic Plan provides details of water quality monitoring that will be undertaken, should groundwater treatment be required.

5 Steps to minimise the volume and duration of groundwater treatment

5.1 3rd Party Communications about groundwater treatment

SW will attend and convene meetings with local groups to ensure progress against the plan and the on-site mitigation activity is clearly communicated. Meetings that have been held over the last 10 years with the MP,

local council and EA representatives all of whom have been influential in helping to shape the IRP. The latest version of the IRP approved by the EA, will be published on SW's website.

From time to time, SW updates stakeholders about completed and planned work, as part of stakeholder meetings with the local councils.

5.2 Monitoring quality of the downstream watercourse

The Generic Plan provides details of water quality monitoring that will be undertaken, should groundwater treatment be required though this is not proposed at St Marybourne.

6 Options to Reduce Infiltration

6.1 Sewer Rehabilitation Programme

Infiltration reduction is on-going and iterative process. In recent years, SW has invested in excess of £1m in surveys and repairs at St Mary Bourne; over £400k of this was spent in the infiltration reduction programme instigated early in 2013. That work was completed except for a few repairs at St Mary Bourne, Hurstbourne Tarrant and Ibthorpe which were carried out during 2016.

To ensure that benefit continues to be gained from the work that has been done, SW continued the programme of infiltration reduction investment across its region during AMP6 (2015 – 2020). Additional repairs were completed in 2017 through to 2019 as further infiltration sources were found through CCTV investigations between March 2016 and August 2018. Further Electroscan surveys and investigations were undertaken in 2021 through to Spring 2022. Sewer lining work identified through these surveys is ongoing and will be completed in spring/summer 2024.

Table 6.1 below summarises the work undertaken in the system since 2014.

Action	Km of sewer (table 6.2)
CCTV Length	32.7
Electroscan	5.4
Sewer Length Sealed	14.9
Sewers not requiring sealing	23.2
Manholes Sealed No.	46

Table 6.2 below is an annual summary of work undertaken.

Reporting Year	Surveyed (km)	Sewers Sealed (km)	Manholes Sealed
Pre 2013	23.05	10	0
2013	6.9	0.4	19
2014	1.91	0.1	0
2015	0.17	1.3	21
2016	0.51	0.5	6
2017	0.03	0.7	0
2018	0.13	0.3	0
2019	0	0	0
2020	0	0.2	0
2021	5.4	0.1	0
2022	0	1.6	0
2023	0	0	0
2024	0	0	0

Figure 6.1 shows the flow recorded at Barton Stacey WTW at different heights of groundwater both before and after sewer sealing. It can be seen that the sewer sealing work has been effective as the level of groundwater now has to be 3m higher to achieve a comparable flow rate of 18 l/s. However, the graph also shows that at higher groundwater levels the flow increases and this is due to more pipes at a higher level now becoming

submerged by rising groundwater. Our surveys in other areas show that the network of private sewers is also part of the problem here and Southern Water will work with others to address this issue across the holistic drainage system.

6.2 Improvement actions agreed with St Marybourne Forum

In addition to the sealing of sewers identified through site surveys the list of actions in Table 6.3 have been committed to improve the flow of wastewater though the drainage system. These are all programmed to be completed before end summer 2025 with the majority completed ahead of the next winter and potential high groundwater season.

Item	When
Piping through Gangbridge Lane	Summer 2024
Addressing belly in sewer south of village	Summer 2024
Sealing of rider sewer to Holdaway WPS	Summer 2024
Lining of laterals from 4 properties to Holdaway	Summer 2024
Agreement to not pump basements to sewer	Summer 2024
Install pumped AFD at Applegate	Summer 2024
Extend RM from Bourneside by 9m to rider sewer	Summer 2024
Connect 1 property to rider sewer	Summer 2024
End seals on existing liners (assume 10)	Summer 2024
Leaking of wet well structure at Holdaway - investigate	Summer 2024
Leaking of wet well structure at Holdaway – seal if required	Summer 2024
Redirecting Holdaway Cottage rising main	Autumn 2024
Extend rising main from Prosen House	Summer 2025

Table 6.3 – Actions committed at St Marybourne flood group meeting

6.3 Property Level Protection

Non-return valves have always been part of our method for dealing with the consequences of infiltration, but they are only effective if infiltration is under control on both the lateral and the main sewer. Having completed

the current phase of rehabilitation work, which has improved the integrity of the main sewers, the potential for using more property level NRVs to isolate individual properties or groups of properties is being investigated, with the objective of reducing the requirement for groundwater treatment.

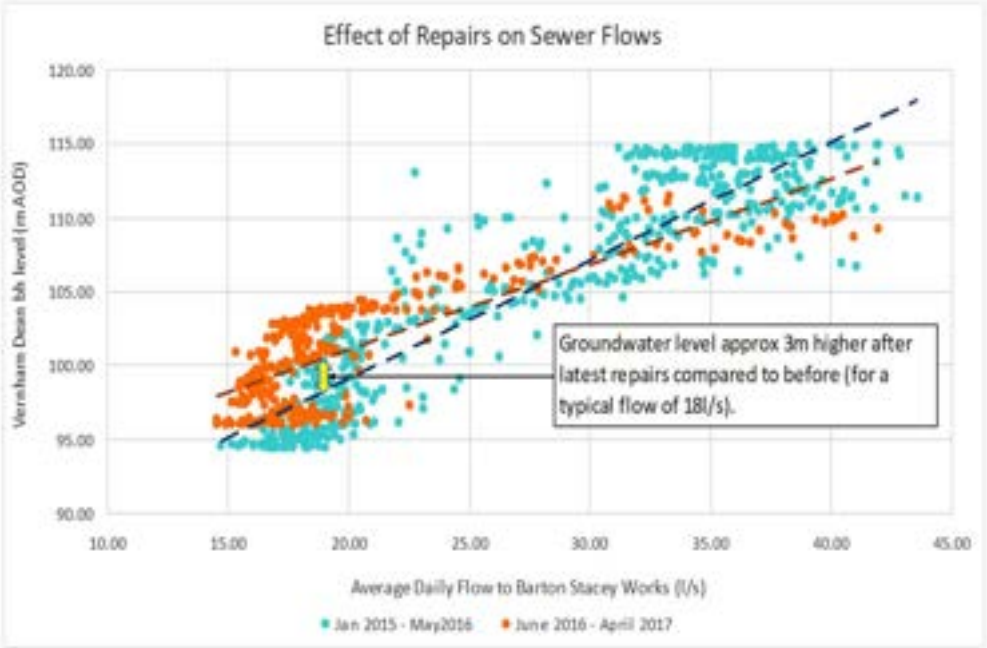

Figure 6.1 – effectiveness of sewer sealing

6.4 Local Flow Control

As noted in Section 4.1, in the winter 2013/14 SW used tankering at four locations and groundwater treatment at five locations. Tankering and groundwater treatment has been required on selected dates during all winters where groundwater levels have impacted levels of service. However, in the high groundwater event of 2023/24 the impact of excess flows in the system was mitigated by tankering flows only and groundwater treatment is no longer considered a viable mitigation technique and will not be used in the future. Full details of tanker locations to be used in future wet winter periods are given in Appendix B.

6.5 Pumping Stations

In order to minimise infiltration, SW is continuing to ensure that design discharges are maintained at pumping stations. This will help to ensure that the design discharge continues to be reliably delivered.

6.6 Monitoring

The St Mary Bourne catchment is one of ten locations, where groundwater levels have been monitored via electronic data since January 2015. This monitoring helps inform SW's response, in terms of when tankering and groundwater treatment are required. The Generic Plan has more detail on the overall monitoring strategy.

The graph in Figure 6.2, is used to predict the timing of an operational mitigation activity to reduce the risk of flooding and pollution incidents. For completeness it shows the historical level at which pumping to

groundwater would take place though this is no longer an option within the catchment. A trigger level for initial communication and readiness to mobilise is set for when groundwater at Vernham Dean borehole reaches 107 mAOD. In addition to the groundwater flooding forecasts explained above, SW is also looking at longer-term trends to monitor the effectiveness of the completed rehabilitation work. These are shown in Figure 6.1 above.

A significant positive change in levels is shown in the graph below.

Figure 6.2 – groundwater trigger levels in advance of operational mitigation response

As part of our ongoing work to improve our understanding of how this system reacts to groundwater and also to reduce risk of sewer blockages we have installed monitors permanently in the sewerage system. These monitors constantly record the depth of flow and alert us when levels rise above normal depths. In Figure 6.3 the locations of sewer level monitors are shown. This is a relatively new innovative installation and we will be developing ways of using this for targeted sewer sealing work, more accurate forecasting and monitoring of effectiveness of sealing in the future.

Figure 6.3 – sewer level monitor locations

7 Action Plans

A significant amount has been achieved in the St Mary Bourne catchment in the last ten years. Some actions are ongoing which reflects the continuous improvement process for dealing with infiltration due to groundwater. To make it easy to track progress, the following tables set out the actions to reduce infiltration and also to mitigate the effects of it, if the infiltration cannot be controlled at economic cost. Tables 7.1 and 7.2 cover the actions by SW and by other parties, respectively, to reduce infiltration. Tables 7.3 and 7.4 cover mitigation of the effects of flooding (Communication and other activities).

SW is committed to continuing to pursue infiltration to reduce the frequency of service impacts and mitigation measures. This IRP describes the work that has been done by SW to improve the situation. In addition, it also describes what is being done to monitor flows, the 'winter preparation' work to be carried out to ensure assets are operating correctly, and the work to be developed with other agencies to improve an integrated plan to address flooding.

Colour coding of actions in tables:

- Green – completed
- Orange – imminent action required
- Red – overdue
- White – on-going actions with no specific end dates.

Table 7.1. Southern Water Current Activities to Reduce Groundwater Infiltration

Ref.	Item	Actions	Timescale and Status	Outcomes
1.1	Developments	Respond to planning applications as required	2017/18	SW has completed its current planned actions and achieved reasonable success.
1.2	Preparation and making suitable arrangements for maintaining services to customers in the event of inundation of the sewerage system by ground and/or surface water.	Arrangements discussed with EA at Winter weekly calls. (Not required winter 2016/17)	2017/18	SW has completed its current planned actions and achieved reasonable success.
1.3	Annual IRP updates and quarterly reporting to EA	All quarterly updates for 2016 and to date in 2017 submitted and discussed with the EA	2017/18	SW has completed its current planned actions and achieved reasonable success.
1.4	Activities to investigate infiltration and carry out repairs	Refer to Table 3.1in section 3.1. Minor repairs scheduled for 2017/18	Repairs completed in 2017/18. Further investigations planned in 2021-22	SW has completed its current planned actions and achieved reasonable success.

Ref.	Item	Actions	Timescale and Status	Outcomes
1.5	1.5	Consider alternative solutions	Investigate unconventional options or new technologies when available	2020 – addressing the root cause of the issue i.e. reducing leaks in public and private sewers is the primary solution
1.6	Identification of lengths of sewer to survey or resurvey in the period 2021-25	Review sewer records with available ground water profile date	Summer 2021	Completed August 2021
1.7	Surveys by CCTV or Electroscan lengths of sewer potentially at risk	Compare historical survey coverage with results of 1.15 and produce a survey schedule.	Summer/Autumn 2021	Complete
1.8	Survey result review	Review results of surveys undertaken in 1.16 to determine sewer sealing work.	Autumn/winter 2021	Complete
1.9	Undertake required sewer sealing	Seal sewers and manholes by most appropriate technique	From Autumn 2021 as conditions allow	Complete
1.10	Review effectiveness of any sealing work	Analyse monitoring data and groundwater data to determine benefit of investment	From winter 2021	Complete

Ref.	Item	Actions	Timescale and Status	Outcomes
1.11	Review further options for property protection and alternative tanker points	Consider further improvements	From Summer 2021	Complete
1.12	Electroscan surveys to identify additional leaks in the sewerage system	Undertake surveys	Summer 2022	Complete
1.13	Review electroscan results and undertake further repairs	Undertake repairs	Summer 2024	In progress to be completed by summer 2025
1.14	Deliver other actions resulting from meetings with the St Marybourne Forum as shown in table 6.2	Undertake sewer sealing	Summer 2024	In progress to be completed by summer 2025

Table 7.2. Multi-Agency Activities to Reduce Groundwater Infiltration

Ref.	Item	Actions	Owner, Timescale and Status	Outcomes
2.1	Strategy for infiltration via private drains	Southern Water to propose a strategy for dealing with infiltration via private drains*	SW supported by EA and local Parish Councils, Summer/ Autumn 2014. Completed 2014.	Southern Water objective is to improve awareness of the significance of infiltration into private drains and the importance for customers to ensure infiltration is repaired when it is discovered.
2.1a	Long-term Monitoring	SW will monitor sewer flow to identify significant increases in inflows.	Ongoing	Early identification of areas where infiltration has increased
2.2a	Investigate highway 'mis-connections'	Where non-sewage flow is identified, check highway drainage relative to sewers to ensure road drainage is not a source of flow into the SW sewers	County Council with support from SW, 2014 onwards. To be pursued as and when required.	Reduced flow of surface water (if connections are found). Complete ni highway connections to the foul sewer found
2.2b	Investigate groundwater infiltration on domestic drains	Where non-sewage flow is identified from domestic properties, investigate to identify source of flow into SW sewers	SW, with assistance from County Council where required, 2014 onwards. To be pursued as and when required.	Reduced flow of surface water (if connections are found). Planned for 2025 onwards
2.3	Consider effects of proposed new developments on infiltration.	District Council to continue to consult with SW on development applications.	District Council, Ongoing.	Developments in areas which would be detrimental to sewer flooding, to have conditions recommended by SW and applied, as appropriate, by the City and District Councils. Ongoing as part of business as usual activity
		SW to determine threshold above which they require to be consulted.	District Council, Ongoing. SW wish to be consulted on all proposed development.	
		Sewerage materials for new developments	SW & District Council, when developments are at planning approval stage. Ongoing.	

*Note: Southern Water does not have powers to require residents to repair private drains. Hence the support of the other agencies is required. It is acknowledged that customers may not be aware of infiltration in their private drains, so SW will consider ways of obtaining information to demonstrate the presence of infiltration. District Councils would only be able to instigate action under Section 59 of the Building Act where proof/evidence is provided of the defect.

Table 7.3. Publicity / Communication Activities to Reduce / Mitigate the Effects of Groundwater Infiltration.

Ref.	Item	Actions	Owner, Timescale and Status	Outcomes
3.1	Public meetings about reducing groundwater infiltration into sewerage system	Attend public meetings with other agencies as appropriate.	SW, as required	Inform stakeholders of progress and planned activities and receive feedback.
3.2	Letters from SW to stakeholders about reducing groundwater infiltration into the sewerage system	Send letters at regular intervals to communicate progress and planned activities	SW, as required	Inform stakeholders of progress and planned activities
3.3	Multi-Agency Group meetings	Discuss and agree actions to reduce requirements for tankering and emergency discharges to watercourses.	All Parties, Discussed and actions agreed in 2013 and 2014. To be discussed in future as required.	Improved understanding and appreciation of issues. Agreement to actions to help reduce the need for tankering and emergency discharges to watercourses

** SW can provide base information to councils to include in articles publicising the role that everyone can play in minimising non-sewage flows into sewers, and the importance of doing so to reduce the incidence of restricted toilet use during periods of high groundwater.

Table 7.4. Activities to Mitigate the Effects of Groundwater Infiltration/ Other Flood Protection Mechanisms

Ref.	Item	Actions	Owner, Timescale and Status	Outcomes
4.1	Early Warning system	Joint continuous monitoring of groundwater levels and sewer levels/flows.	SW, EA, 2014. Ongoing. Commenced Jan 2015. Re-commenced annually	Develop trigger levels by comparing historic customer complaints and tankering with BH levels (or other reference). Note trigger levels should vary as a consequence of rehabilitation. Also they will need to reflect groundwater reaction times.
4.2	Tankering arrangements	Investigate options for improving location of tankers and Groundwater treatment units for future events. e.g. by use of longer hoses/ pumping	SW, Spring 2014, Complete and ongoing	Potentially less disruption to residents when tankering / pumping is essential.

Appendix