

Infiltration Reduction Plan

St Mary Bourne

November 2021
Version 3.3



from
**Southern
Water** 

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Document Control

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Glossary

AMP – Asset Management Programme
CCTV - Closed-circuit television
EA - Environment Agency
GW – Ground Water
IRP - Infiltration Reduction Plans
l/s - litres per second
MH – Manhole
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.

Figure 1.1 shows flows to St Mary Bourne WPS. This IRP covers the sewer system serving the villages of St Mary Bourne, Stoke, Hurstbourne Tarrant and Ibthorpe. The villages of Longparish and Forton are covered by a separate IRP. The total catchment of the Bourne Rivulet and the River Swift (the upstream continuation of the Bourne Rivulet, in the vicinity of Ibthorpe and Hurstbourne Tarrant), also contains the villages of Upton and Vernham Dean at the head of the valley. It should be noted that the watercourses through these villages are, in fact, bourns that only flow during periods of high groundwater.

The Bourne Valley is home to a significant food processing facility which relies heavily on local water sources from its own boreholes. There are also various fishing interests downstream which equally rely on an excellent water quality being maintained.

The repairs carried out by SW improve the integrity of the sewerage system. SW has been working with the following organisations and stakeholders, 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 has consulted with these stakeholders during meetings and also, through the river management group, with all of the local parish councils.

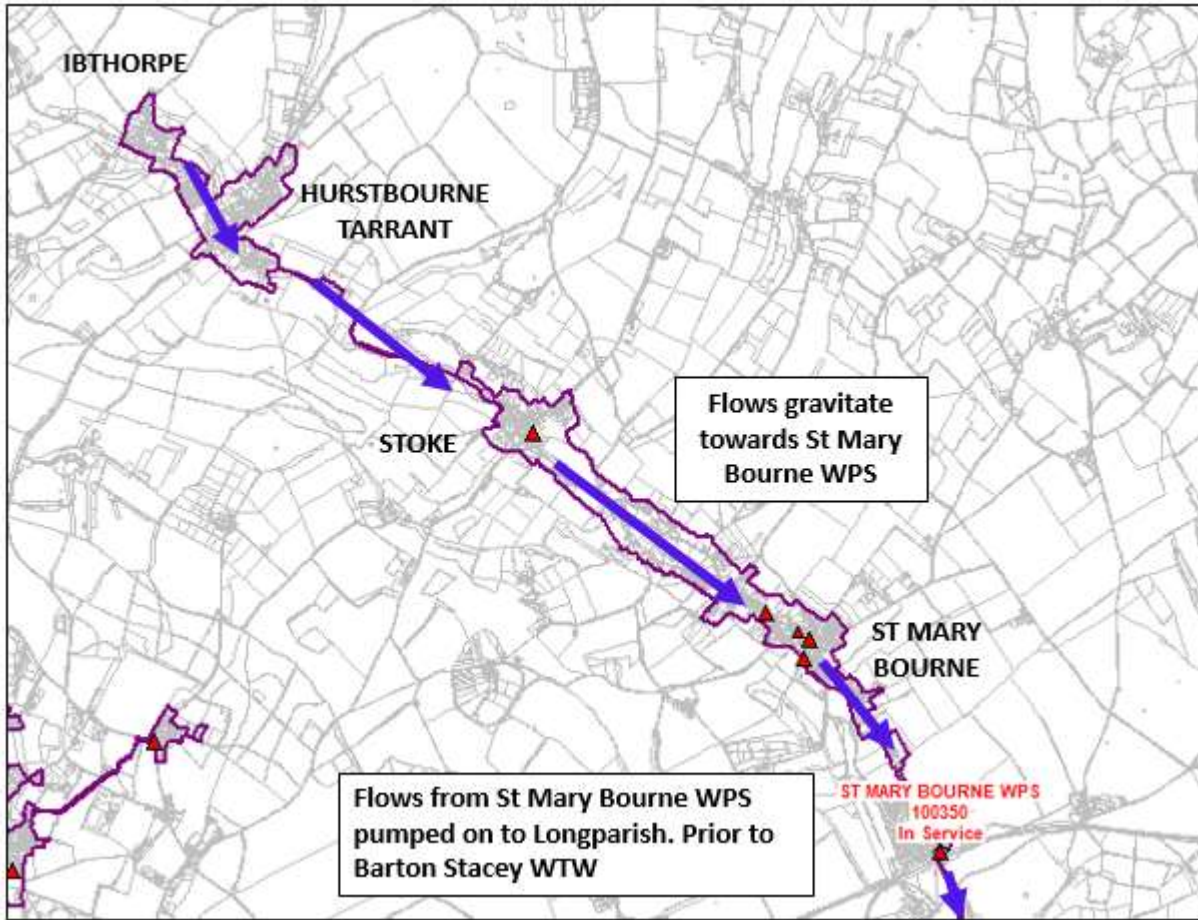


Figure 1.1 - Representation of the sewerage system for Barton Stacey catchment draining to St Mary Bourne WPS.

2. Groundwater Infiltration at St Mary Bourne

2.1. The significance of groundwater infiltration.

St Mary Bourne is a location within 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 over-pumping. Such mitigation measures are not sustainable, so during the last eight years 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 when tankers 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 2010.

A hydraulic model of the Barton Stacey catchment is available, that can be used to understand the performance of the system and determine options to address risks. However, SW is aware from historical reports of which properties are likely to be the first to suffer from the effects of flooding.

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.

Year	External Flooding	Internal Flooding	Restricted Toilet Use	Total
2010_2011				
2011_2012				
2012_2013	1		2	3
2013_2014	1		2	3
2014_2015				
2015_2016				
2016_2017				
2017_2018				
2018_2019				
2019_2020	2	1	3	6
2020_2021				
Grand Total	4	1	7	12

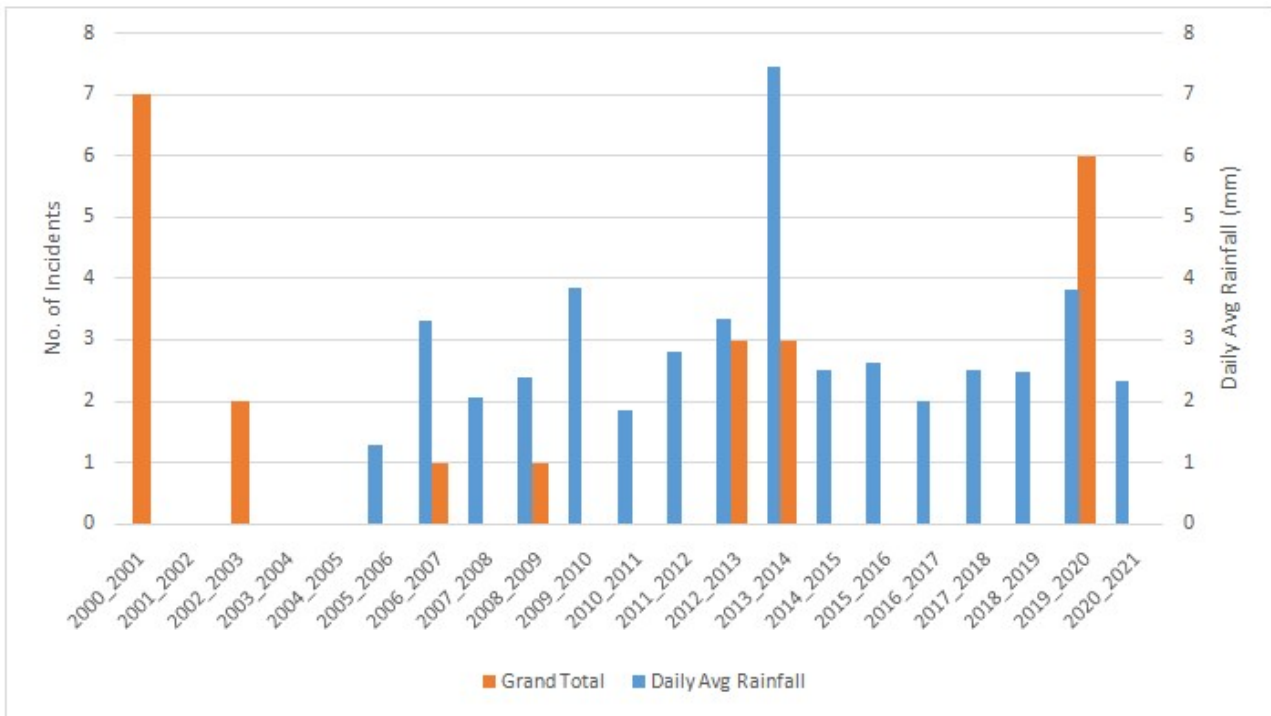


Figure 2.1 – Comparison of incidents against average daily rainfall

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 include 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 tankers.

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	7 th July to 14 th 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	9 th April to 6 th 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-February 2018	Completed
11.	Further surveys and subsequent repairs	Summer 2021 – Spring 2022	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 are planned in 2021-22, which could identify any new necessary sewer repairs.

4. Over-pumping

4.1. Circumstances that lead to over-pumping

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 over-pumping 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 in order 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. An option shown in Appendix B, would be to over-pump from Longparish WPS into the main channel of the River Test by running the discharge hose along the bed of the subsidiary which passes the WPS site. This arrangement would only be considered if a practical and economic level of tankering in St Mary Bourne and Longparish were unable to prevent sewer flooding in the villages.

Whilst over-pumping is not an ideal solution because of the introduction of a low concentration of effluent into the flow in the receiving watercourse, it would only occur at times when the flow in the River Test would be high. Consequently the diluted effluent, which would pass through a settling tank and filter before discharge, would be further diluted by the flow in the river. Water quality of the discharge would be monitored by SW and the quality of the receiving water would be monitored by both the EA and SW. Although overpumping 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 over-pumping;

- Between 11th March and 24th May 2020
- Between 7th January and 23rd April 2021

SW has mitigated against the option of over-pumping 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.

- Contribution 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

If despite the work carried out, the sewers are inundated by groundwater, surface water, or the combination of the two, some other measure will need to be taken to maintain sewerage services to customers. Over-pumping at Longparish would only be used if all other options have been exhausted, as protecting residents from direct flooding and harmful effects of sewage flooding remains SW’s top priority.

Figure 4.1 illustrates groundwater levels in the period 2013 to 2021. There is a strong correlation between the level at the Vernham Dean borehole, and flows arriving at Barton Stacey wastewater treatment works.

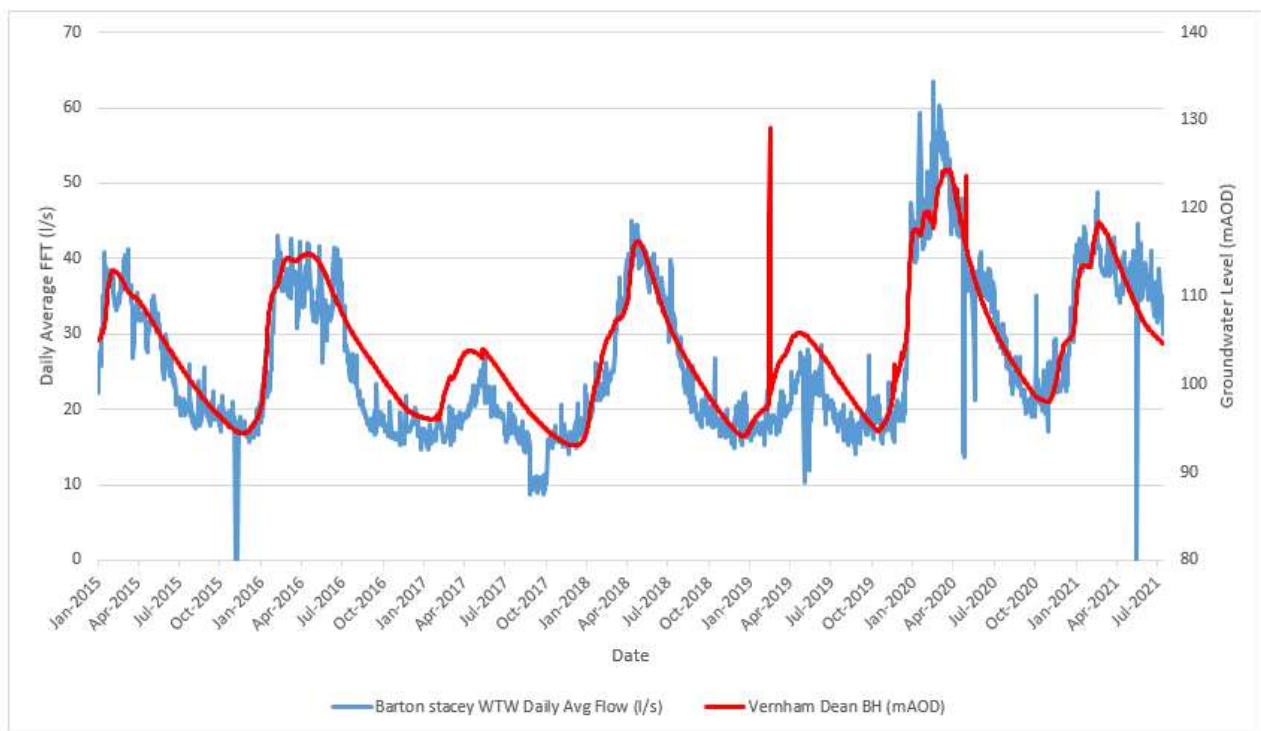


Figure 4.1 - Groundwater levels from 2012 to 2021, compared to Barton Stacey WTW flow data.

4.2. Steps to prevent discharges and alternatives to over-pumping

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).

Southern Water has undertaken investigations and sewer repairs over the past eight years. In addition to this work, SW also carries out other activities to minimise the requirement for discharges to watercourses.

4.3. Over-pumping arrangements (flow rates and minimisation of effect on watercourse)

A typical arrangement of an over-pumping setup is provided in the Generic Plan.

Over-pumping is not proposed in St Mary Bourne.

4.4. Steps to minimise the volume and duration of over-pumping

The Generic Plan outlines a detailed rationale behind the use of tankers and over-pumping, and summarises the benefits and disadvantages.

4.5. 3rd Party Communications about over-pumping

Since the start of the Infiltration Reduction Programme in 2013, Southern Water has been proactive 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.

SW attends and convenes meetings with a number of local groups. In particular, during 2013-15 SW worked closely with the Technical Steering Group (TSG) and regularly attends meetings of the St Mary Bourne Flood and Emergency Group.

During the flooding of 2012/13 & 2013/14 and during the major work in 2016 SW had representatives who held customer drop-in sessions once or twice a week and visited customers where appropriate.

If as a last resort over-pumping at Longparish were to be required, SW will liaise with the local EA team, the EA National Incident Communication Service, local public and local authorities prior to, during and at the end of over-pumping. The Generic Plan provides more detailed arrangements around over-pumping.

From time to time, SW updates stakeholders about completed and planned work. During the winters since 2014/15, SW and the EA have held weekly conference calls to discuss the groundwater levels and current situation.

The latest version of the IRP approved by the EA, will be published on SW's website.

4.6. Monitoring quality of the downstream watercourse

The Generic Plan provides details of water quality monitoring that will be undertaken, should over-pumping be required.

5. Options to Reduce Infiltration

5.1. Sewer Rehabilitation Programme

SW acknowledges that infiltration reduction is on-going 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 are planned in 2021 through to Spring 2022 with any identified sewer rehabilitation to follow.

5.2. Property Level Protection

Non-return valves have always been part of Southern Water's armoury for dealing with infiltration, but they are only effective if infiltration is under control on both the lateral and the main sewer. Whilst there are no plans currently to install non-return valves, the potential benefit of property level protection will be investigated, if it is deemed appropriate following completion of the current repairs. During 2014, a number of properties in the centre of St Mary Bourne village deemed at risk were diverted to a new micro pumping station (MPS) to provide flood protection. This has proved successful.

5.3. Local Flow Control

In the winters of 2019/20 and 2020/21, tankering was used;

- Between 11th March and 24th May 2020
- Between 7th January and 23rd April 2021

5.4. Pumping Stations

During 2019, St Mary Bourne WPS was refurbished to ensure it was able to deliver the required optimum flow forward.

5.5. Monitoring

SW has set up a monitoring programme using current electronic data (e.g. EA borehole level data via telemetry links). In January 2015, SW commenced a weekly review of the ten locations in their region which are most at risk of sewer flooding due to groundwater, which includes St Mary Bourne. The monitoring uses 'real time' groundwater levels from local boreholes to predict when an early response might be necessary to mitigate the risk of flooding. These trigger levels promote on-site inspections and checks to assess current conditions within the sewer network. When the trigger level is breached this monitoring activity increases until such time that a decision is required to remove surplus effluent from the sewers.

The graph below, Figure 5.1, is an example of those used for predicting the earliest, average, and latest dates for when the trigger levels are forecast to be breached. This graph shows groundwater levels and an indication of flows.

SW will repeat this monitoring each winter. In 2015, the reporting commenced mid-September, running reports at monthly intervals initially, increasing to fortnightly, then weekly to suit the rise of groundwater levels. The forecast dates for reaching trigger levels is shared with the EA when it is produced.

The above approach can only be used during periods of rising groundwater. However it is important for SW to continue to monitor the integrity of the sewers through the drier months of the year.

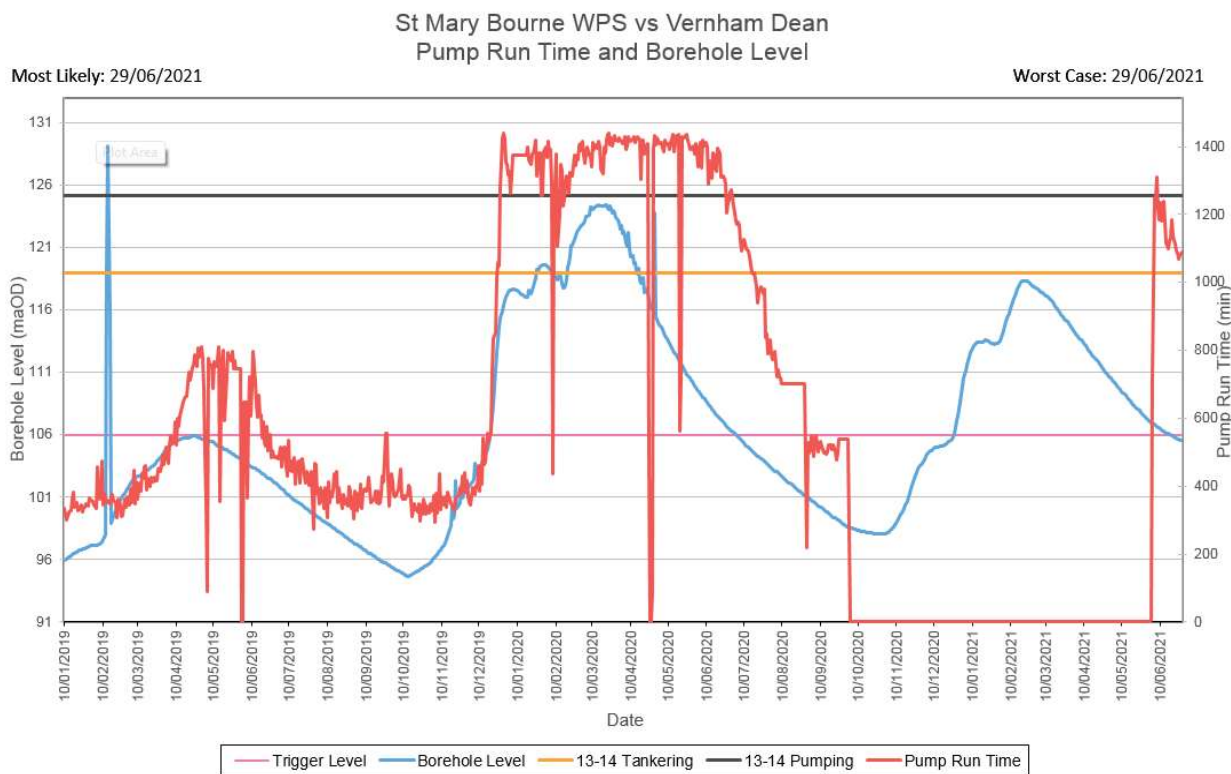


Figure 5.1 – Forecasting of Trigger Dates

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.

The graph in Figure 5.2 shows groundwater levels and flows to Barton Stacey treatment works in the January 2015 to April 2017 period. Whilst Figure 5.2 is not conclusive, analysing the data points separately for prior to June 2016 and after June 2016, shows the benefit more clearly. The benefit does not show for higher flows/ groundwater levels (above flows of 28 l/s). This is partly due to there being less high groundwater points since June 2016, but also with increased capacity pumps at St Mary Bourne are pumping higher flow rates at higher groundwater levels. As noted above improved pump capacities may explain the apparent dis-benefit of the repairs at higher groundwater levels.

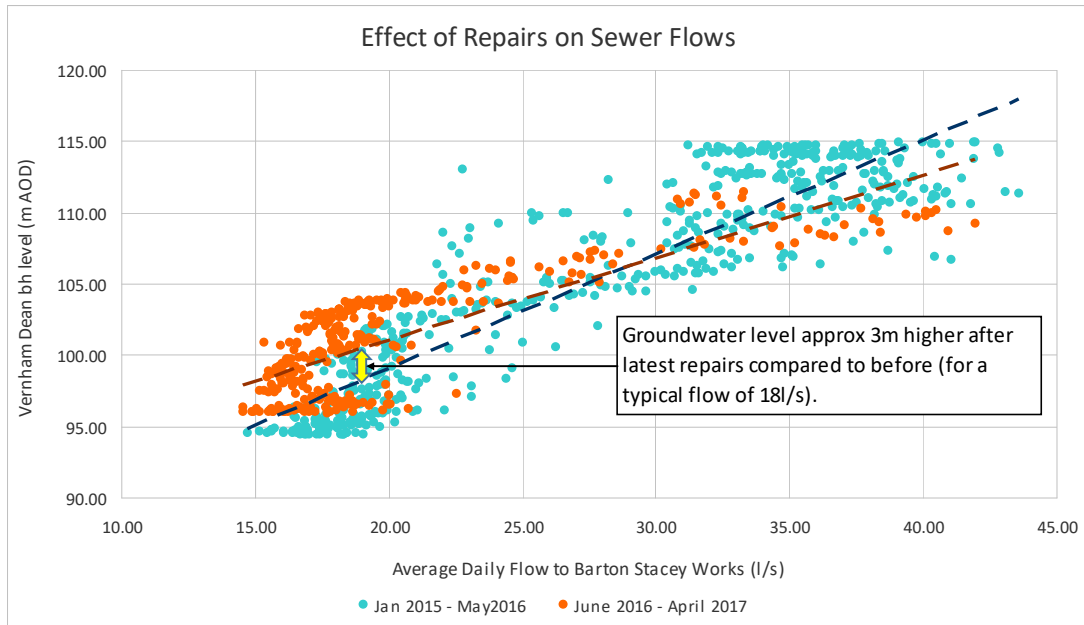


Figure 5.2 – Long Term Monitoring (Jan 2015 to Apr 2017)

The difference in groundwater level between the lines is approximately 3m. In other words, for a given groundwater level, the corresponding flow is lower after the repairs. This confirms that the repair work completed to date has been effective.

6. Action Plans

A significant amount has been achieved in the St Mary Bourne catchment in the last eight 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 6.1 and 6.2 cover the actions by SW and by other parties, respectively, to reduce infiltration. Tables 6.3 and 6.4 summarise mitigation of the effects of flooding (communication and other activities).

SW is committed to continuing to pursue infiltration to reduce the frequency of tanker activity or over-pumping. 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 6.1. 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 3.1 in 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.
1.5	Consider alternative solutions	Investigate unconventional options or new technologies when available	2020	Ongoing.

Ref.	Item	Actions	Timescale and Status	Outcomes
1.6	Identification of lengths of sewer to survey or resurvey in the period 2021-25	Review sewer records with available ground water profile data	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	Planned
1.8	Survey result review	Review results of surveys undertaken in 1.16 to determine sewer sealing work.	Autumn/winter 2021	Planned
1.9	Undertake required sewer sealing	Seal sewers and manholes by most appropriate technique	From Autumn 2021 as conditions allow	Planned
1.10	Review effectiveness of any sealing work	Analyse monitoring data and groundwater data to determine benefit of investment	From winter 2021	Planned
1.11	Review further options for property protection and alternative tanker points	Consider further improvements	From Summer 2021	Planned

Table 6.2. 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 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	Local councils with support from SW, 2014 onwards. To be pursued as and when required.	Reduced flow of surface water (if connections are 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 local councils where required, 2014 onwards. To be pursued as and when required.	Reduced flow of surface water (if connections are found).
2.3	Consider effects of proposed new developments on infiltration.	Local Council to continue to consult with SW on development applications.	Local Council, Ongoing.	Developments in areas which would be detrimental to sewer flooding, to have conditions recommended by SW and applied, as appropriate, by the Parish and Local Councils.
		SW to determine threshold above which they require to be consulted.	Local Council, Ongoing. SW wish to be consulted on all proposed development.	
		Sewerage materials for new developments	SW & Local Council, when developments	

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Ref.	Item	Actions	Owner, Timescale and Status	Outcomes
			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. Local Councils would only be able to instigate action under Section 59 of the Building Act where proof/evidence is provided of the defect.

Table 6.3. 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
3.4	Implement local campaign to discourage misconnections	Publicise through parish councils. Include article in Parish magazines. **	Local Councils, Summer 2014 Complete	

** 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 6.4. 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	Monitor trigger levels by comparing historic customer complaints and tankering with BH levels (or other reference). Review trigger levels as improvements are made.
4.2	Tankering arrangements	Investigate options for improving location of tankers	SW, Spring 2014, Reviewed 2021	Potentially less disruption to residents when tankering is essential.
4.3	Maximise the capacity of the sewerage system and pumping stations	Review capacity of St Mary Bourne WPS	SW, July 2014 for capacity determination. Trial - if and when - the sewers are surcharged	Completed upgrade at WPS
4.4	Flooding Management Plan	Develop plan to address the flooding issues caused by high groundwater. Implement recommendations.	Local Councils with inputs from SW, EA.	Plan including actions for participating authorities, that in unison will reduce the extent of flooding and the impact of flooding.
4.5	Maintenance of watercourses	Riparian owners to carry out their responsibilities to maintain adequate flow through watercourses by clearing vegetation, desilting, etc	Riparian owners with input from District and Parish Councils – ongoing responsibility	Maximise the flow along watercourses to minimise surface flooding, provide free outlet for ground water .
4.6	Review of utilisation of a control structure	Investigate the possible use of a fixed control structure to relieve hydraulic overloading of sewers.	SW	No current plans to progress this option.

