

# Infiltration Reduction Plan

## Chilbolton

July 2024  
Version 4



from  
**Southern  
Water** 

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## Document Control

<b>Format</b>	<b>Version</b>	<b>Date</b>
Chilbolton IRP	D1.0	July 2014
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Chilbolton IRP	V1.0	Nov 2016
Chilbolton IRP	V2.0	July 2018
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Chilbolton IRP	V2.2	September 2021
Chilbolton IRP	V3	January 2024
Chilbolton IRP	V4	July 2024

## 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  
NRV – non-return valve  
ODI – Outcome 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) in the Chilbolton catchment has been prepared in response to the Environment Agency's (EA) Regulatory Position Statement (RPS). Southern Water has been carrying out work for many years to survey and repair sources of infiltration in the catchment for Chilbolton Wastewater Treatment Works (WTW) in Hampshire.

Figure 1.1 shows the extent of the catchment between Wherwell and Chilbolton WTW. Flow gravitates to Wherwell Wastewater Pumping Station (WPS) and is then pumped to Chilbolton, where it joins gravity flows and enters Chilbolton Village WPS. Chilbolton Village WPS then pumps the resultant flow to Chilbolton Wastewater Treatment Works (WTW) in the south. Branksome Close Chilbolton WPS takes gravity flows from the west of the village and passes them forward to the WTW.

The repairs carried out by SW aim to 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,
- Test Valley Borough Council
- Chilbolton Parish Council

Southern Water has consulted with representatives of these parties as part of meetings with the local councils.

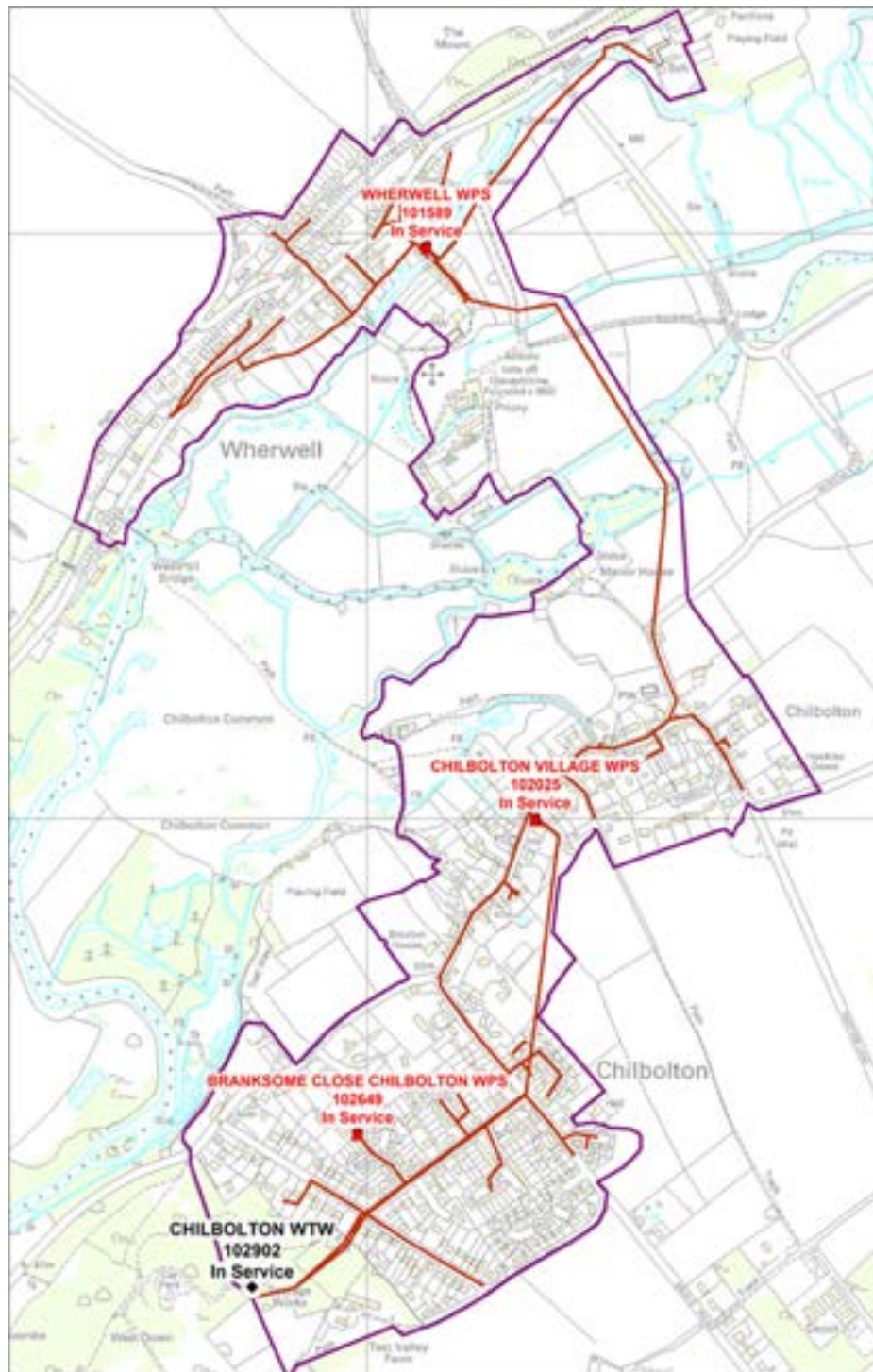


Figure 1.1 - Representation of the Chilbolton and Wherwell sewerage system in the Chilbolton WTW catchment

## 2. Groundwater Infiltration in Chilbolton

### 2.1. The significance of groundwater infiltration.

Chilbolton is 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).

SW strives to maintain services for customers by a programme of investigation, repair, maintenance, and mitigation. Mitigation measures include the use of tankers. Such mitigation measures are not sustainable, so during the last seven years SW has invested in carrying out major improvements to the integrity of the sewers and manholes in the vicinity of Chilbolton in order to minimise the occasions on which this is required.

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

Despite the significant groundwater flow through the valley during these conditions, incidents of sewer flooding have been relatively infrequent mainly due to the mitigation measures which are put in place. Table 2.1 below show reported incidents of sewer flooding since April 2010.

Table 2.1 shows that there have been three winter periods when external flooding has occurred since 2010; these were in 2013/2014, 2018/19 and 2023/24. By far the most impacting was the very wet and prolonged winter period of 2023/24 when 9 properties reported flooding external to their properties. This was due to hydraulic overload of the system in the groundwater season rather than blockages caused by rag or fats, oils & grease. Without proactive mitigation with the use of tankers these numbers would increase

**Table 2.1 - Reported Flooding Incidents in Chilbolton**

Reporting Year	External flooding incidents (properties & gardens)	External flooding incidents (Highways & others)	Internal flooding incidents	Restricted Toilet Use	Grand Total
2013	0	0	0	0	0
2014	1	0	0	0	1
2015	0	4	0	0	4
2016	0	0	0	0	0
2017	0	0	0	0	0
2018	0	0	0	0	0
2019	0	0	0	0	0
2020	2	0	1	0	3
2021	0	2	0	0	2
2022	0	0	0	0	0
2023	2	0	0	0	2
2024	9	0	0	0	9
<b>Grand Total</b>	<b>15</b>	<b>10</b>	<b>1</b>	<b>0</b>	<b>26</b>

## 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 Chilbolton are captured in Section 3.2 below, and includes the following elements:

- Manhole Inspections and CCTV Surveys
- Ongoing monitoring
- Manhole and Sewer Repairs
- Follow-Up Surveys and Repairs
- Sewer Level Monitors

### 3.2. Investigation and Repairs in the Chilbolton catchment

Groundwater infiltration into sewers has been a long-running issue in Chilbolton, which also suffers from surface water problems. SW has been making significant investments over many years to minimise infiltration and the need for over-pumping.

SW recently completed a major programme of survey and repairs to the sewers in the Chilbolton 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 Chilbolton**

Step.	Description	Approx. Date	Status
1.	Manhole lifting followed by CCTV Investigation	June 2014	Completed
2.	Repairs – [refer to plans in Appendix A]	2014	Completed
3.	Anti-FOG campaign	2014	Completed
4.	Scheduled maintenance visits to key pumping stations prior to winter weather	Annually	Ongoing
5.	Further CCTV survey	Spring 2015	Completed
6.	Tankering	March 2014 (Single Day)	Completed
7.	Ground water treatment	February 2014 – April 2014	Completed
8.	Repairs	March 2016	Completed



Step.	Description	Approx. Date	Status
9.	Ongoing monitoring	Commences each year	Ongoing
10.	Further electro scan surveys	2023/24	Complete
11.	Repairs following surveys	Post 2024	Pending survey results
12.	Installation of sewer level monitors at strategic points	2023	Completed
13	Review of sewer level data to identify blockages and infiltration areas to target	From 2023	Ongoing
14	Continue surveys and sealing across the remainder of the catchment as required.	From April 2025	Planned

Heavy jetting in various parts of the village in 2014 discovered fat build up, leading to sewer blockages. Shortly after this discovery, Southern Water launched an anti-FOG campaign in Chilbolton – the first of its type in Hampshire. With the help of the Parish Council and the Village Shop, fat funnels were made available to every household in the village. These blue plastic funnels screw into used plastic bottles so that fat, oil and grease (FOG) - from a fried breakfast or roast dinner – can be easily stored for recycling or disposed of with household waste.

SW also investigated the performance of the wastewater pumping station and, early in 2014, raised the status of the alarm, in order to provide faster response times.

A further CCTV survey in the spring of 2015 led to a 33m section of sewer being repaired - refer to the plan in Appendix A.

In addition to physical investigations on site, SW has instigated a long-term monitoring programme in critical catchments, including the Chilbolton catchment. Sewer level monitors were installed in 2023 as part of a wider programme to detect blockages. These SLMs use machine learning to build up a pattern dependant on flows, data will be used to help identify sources of infiltration.

An extensive survey of the system by electroscan (a technique to locate potential leaking joints which can be undertaken at times of low groundwater) was completed in 2023/24. The results of this survey will inform future sewer sealing work to be undertaken post April 2025.

## 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.

Using previous experience, areas likely to be the first affected, are identified. Should high groundwater cause issues with the drainage system such as restricted toilet use or flooding then we will deploy tankers to the villages to extract the excess water from the sewerage system and take this to nearby wastewater treatment works for full treatment prior to discharge of final effluent to the environment. The requirement for tankering will be driven by levels in the manholes locally. Based on experience in 2014, tankering could be expected to be required when the groundwater level at Clanville Gate borehole reaches 92m. However, to allow time for investigation and preparation, SW is using lower 'trigger levels' in the winter planning report. A trigger level of 88.0m is currently being used.

Figure 4.1 shows the groundwater level at Clanville Gate borehole since 2012. Tankering was required for a single day on 31/03/2014; Ground water treatment was required from 13/02/2014 to 11/04/2014 with repairs being completed in March 2016. Since 2014 no ground water treatment has been required, tankering will be used instead to manage infiltration. Due to the rainfall in 2020 there was a requirement for tankering in March 2020 but no interventions were required in the winter 2020/21 or 2021/22. Tankering was required in 2023/24.

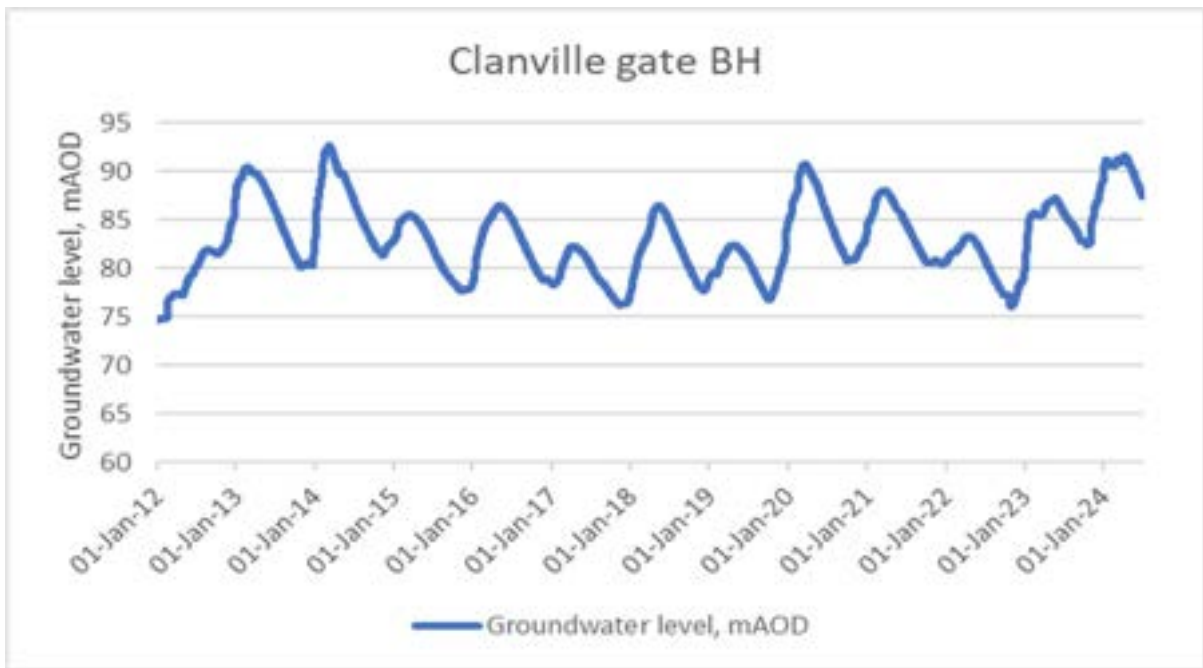


Figure 4.1 - Groundwater levels from 2012 to 2024

The details of where tankering has been necessary in the past are given in Appendix B. The repairs carried out, combined with the winter preparation checks, are expected to minimise the number of tankers that would be required. However, because of a consequence of repairs and potentially other factors outside SW's control (such as the severity of the weather), the hydraulics may dictate that mitigation measures are deployed at

other locations to the sites described in Appendix B. Where this is the case then Southern Water will communicate that to all parties prior to deployment.

### 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.

## 4.2. 3rd Party Communications

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.

## 5. Options to Reduce Infiltration

### 5.1. Sewer Rehabilitation Programme

A significant amount of survey work has been undertaken in the Chilbolton catchment in the last 10 years. Table 5.1 summarises the amount of survey and sealing work undertaken on the public sewers since 2013 and what is planned to be undertaken, table 5.2 gives an annual breakdown. As infiltration only causes issues in this system very occasionally the amount of sewer sealing work here has been a lower priority than other areas which have received a much greater focus. This is evident by the lower volume of work delivered.

Appendix A contains details of all sewer inspection and remedial work undertaken to date. In addition to CCTV surveys we have surveyed the whole of the public sewerage system by electroscan which is a technique developed to identify potential leaking joints. The survey results have been reviewed to identify further sewer sealing work required.

Action	Km of sewer
Length Surveyed	4.289
Length with no work required	2.13
Length Sealed	0.033
Length to be sealed	2.159
Manholes sealed	4
Manholes to be sealed	0

Table 5.1

Year	Surveyed (km)	Sewers sealed (km)	Manholes sealed
2014	0m	0m	0
2015	0m	0m	0
2016	32.47m	33.12m	4
2017	0m	0m	0
2018	0m	0m	0
2019	0m	0m	0
2020	0m	0m	0
2021	0m	0m	0
2022	4286m	0m	0
2023	0m	0m	0
2024	0m	0m	0
Post 2024	0m	2159m	0

Table 5.2 – annual summary of work completed

## 5.2. Property Level Protection

Non-return valves (NRVs) have always been part of the 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.

## 5.3. 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. Groundwater treatment will no longer be used in Chilbolton, tankers will be utilised to mitigate groundwater, full details are given in Appendix B.

## 5.4. 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.

## 5.5. Monitoring

The Chilbolton 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 is required. The Generic Plan has more detail on the overall monitoring strategy.

The graph in Figure 4.2, is used to predict the timing of an operational mitigation activity to reduce the risk of flooding and pollution incidents.

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.

An analysis was performed using long term data obtained from the Chilbolton catchment. Specifically, the relationship between groundwater levels from Clanville Gate borehole and flows to Chilbolton WTW was analysed, this can be seen in Figure 5.1 below. Higher groundwater levels can be expected to result in greater infiltration, and therefore higher flows in the sewerage system. This analysis indicated that the repairs carried out since 2013/14 have had some effect in reducing infiltration and despite the high and prolonged wet winter of 2023/24 the flow to treatment was less than at similar high groundwater levels. However, this may be influenced by the tankering operation that was ongoing at the time.

SW will continue to obtain data so that similar analyses can be performed in the future.

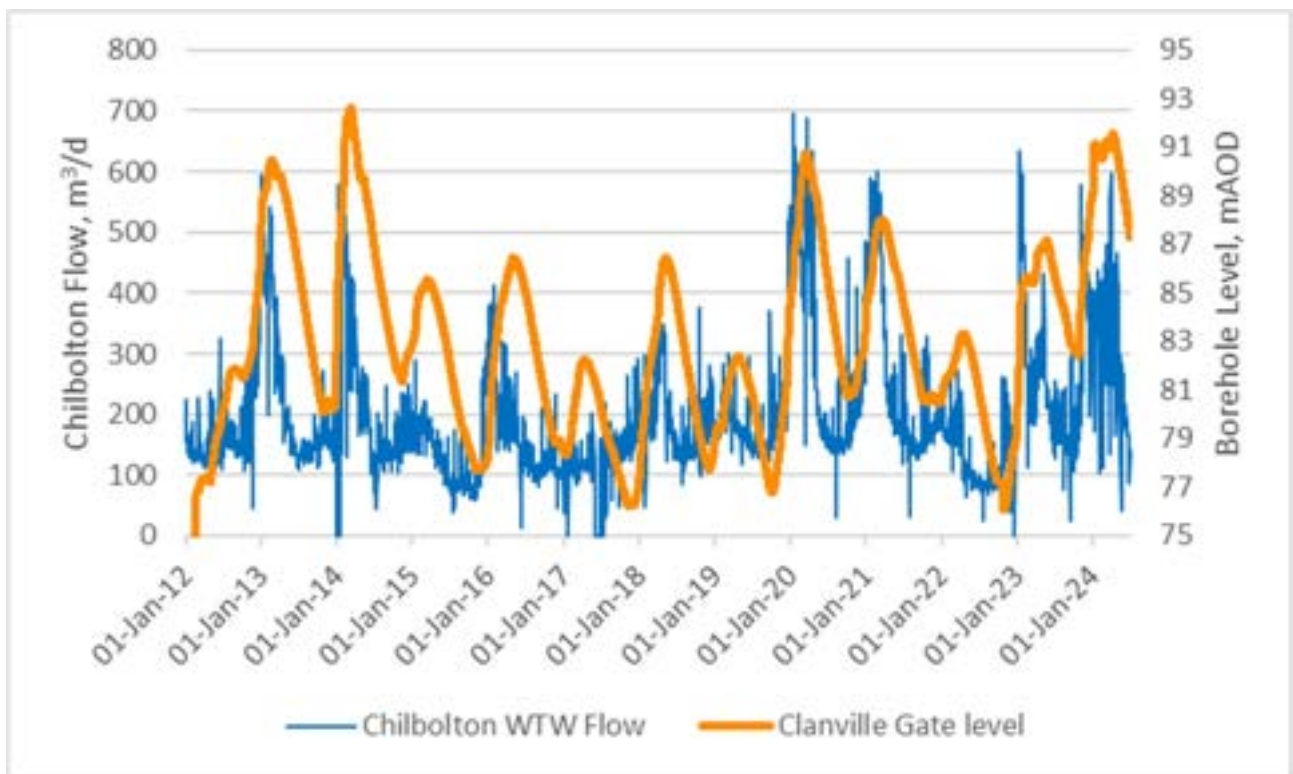


Figure 5.1 - Forecasting of Trigger Dates (trigger at 88m AOD)

## 6. Action Plans

A significant amount has been achieved in the Chilbolton 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 6.1 and 6.2 cover the actions by SW and by other parties, respectively, to reduce infiltration. Tables 6.3 and 6.4 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 6.1 - Southern Water Current Activities to Reduce Groundwater Infiltration**

Ref.	Item	Actions	Timescale and Status	Outcomes
1.1	Develop an approach for reduction of infiltration and maintenance of reduced levels of infiltration.	Refer to Section 3 above and the report in Appendix A.	Summer 2013 - Complete	The steps are being followed to deliver results.
1.2	'Dry weather' flow surveys (to measure background levels of infiltration during low groundwater periods)	Identify suitable measurement points, carry out survey over four week period in Summer, match rainfall records with flow data.	July - September 2013 – Complete	Groundwater infiltration is greater than would be expected for summer conditions.
1.3	'Wet weather' flow surveys (to identify remaining areas of infiltration following initial sewer rehabilitation/repair).	Identify suitable measurement points, carry out survey over four week period, match rainfall records with flow data.	May/June 2014 - Complete	The wet and dry weather flow survey results were compared to identify potential areas of infiltration.
1.4	CCTV etc. survey of sewers	Identify Strategic Manholes, survey manholes to identify clear flow and infiltration. Carry out CCTV survey where clear flow was identified.	Spring 2013 and Spring 2014 - Manhole surveys and CCTV survey of sewers - Complete	Sources of infiltration were identified to determine scope of rehabilitation work.
1.5	Carry out sewer rehabilitation work	Use various techniques to seal infiltration points in manholes and sewers	Summer/Autumn 2014: - Completed in 2014/15, apart from one repair scheduled to be undertaken in January 2016.	Rehabilitation will restore structural integrity of sewers restored
1.6	Further sewer rehabilitation work, if required, in areas where surveys carried out.	As above, use various techniques to seal infiltration points in manholes and sewers	As required dependent on survey results; none currently scheduled.	Rehabilitation will restore structural integrity of sewers restored
1.7A	Maintain IRP as a live document	Update IRP as appropriate to describe work carried out and/or developments	Annually – on anniversary of submission to EA for approval	Up-to-date IRP



Ref.	Item	Actions	Timescale and Status	Outcomes
1.7B	Quarterly progress reports	A progress report on infiltration reduction work related to this catchment will be submitted to the Environment Agency	Quarterly (December, March, June, September)	Keep the Environment Agency informed of progress on a regular basis
1.8	Strategy for inflows via private drains	Southern Water to propose a strategy for dealing with infiltration via private drains*	SW 2014. Complete	Southern Water's 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.
1.9	Long-term monitoring	SW will monitor sewer flow to identify significant increases in inflows.	SW, 2014 onwards	Early identification of areas where infiltration has increased.
1.10	Ground water treatment Sites: improve effluent quality	Investigate potential for improved screening and biological treatment at points of discharge into watercourse.	SW, 2014, Complete	Improved arrangements for discharges when required.
1.11	Ground water treatment Sites: minimise flow	Add level control to pumps to reduce durations for pumping	SW, 2014, Complete	Establish whether seasonal discharge (s) will be necessary in order to maintain use of sewerage services for customers during periods of very high groundwater levels.
1.12	Standards for emergency discharges	SW to discuss with EA about best practice set up for over-pumping arrangements.	SW, 2014, Complete	Agree with EA acceptable standards for discharges and acceptable flow rates.
1.13	Action Plans	Develop SW action plans documenting set up of pumps, tankers, etc. for emergency situations.	SW, Summer 2014 - Complete	Action Plan available for planning sessions with other authorities in preparation for repeat flooding events. Engagement with the local community about the potential arrangements for dealing with excess flows into sewers to mitigate disruption to customers.

Ref.	Item	Actions	Timescale and Status	Outcomes
1.14	Consider alternative solutions that involve some risk	Investigate unconventional options such as vacuum sewers or consider conventional combined sewer overflows	2020	Sewer sealing work is the preferred solution
1.15	Identification of lengths of sewer to survey or resurvey in the period 2021-25	Review sewer records with available ground water profile data	2023	Complete
1.16	Surveys by CCTV or Electrosan lengths of sewer potentially at risk	Compare historical survey coverage with results of 1.15 and produce a survey schedule.	2023 /24	Complete
1.17	Survey result review	Review results of surveys undertaken in 1.16 to determine sewer sealing work.	2024	In progress
1.18	Undertake required sewer sealing	Seal sewers and manholes by most appropriate technique	Post 2024	To be progressed on completion of survey review
1.19	Review effectiveness of any sealing work	Analyse monitoring data and groundwater data to determine benefit of investment	Post 2024	To be progressed as required

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Ref.	Item	Actions	Timescale and Status	Outcomes
1.20	Review further options for property protection and alternative tanker points	As required	Post 2024	To be progressed as required

**Table 0.2 - Multi-Agency Activities to Reduce Groundwater Infiltration**

Ref.	Item	Actions	Owner, Timescale and Status	Outcomes
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	HCC (for highways) and Test Valley Borough Council (for domestic connections) to investigate and pursue as 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 Borough Council 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.	Parish Council to continue to consult with SW on development applications.	Parish Council, Ongoing.	Developments in areas which would be detrimental to sewer flooding, to have conditions recommended by SW and applied, as appropriate, by the Borough and Parish Councils.
		SW to determine threshold above which they require to be consulted.	Parish Council, Ongoing. SW wish to be consulted on all proposed development.	
		Sewerage materials for new developments	SW & Parish 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. Parish Council would only be able to instigate action under Section 59 of the Building Act where proof/evidence is provided of the defect.

**Table 0.3 - 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.	Regular meetings are not planned, but SW will attend with other agencies as required.	Inform the local population of progress and planned activities and receive feedback.
3.2	Liaise with other agencies as appropriate.	Discuss and agree actions to reduce requirements for tankering and emergency discharges to watercourses.	On-going – further liaison as required	Improved understanding of issues 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 0.4 - 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 over-pump units for future events. e.g. by use of longer hoses/ pumping	SW, Spring 2014, Complete	Potentially less disruption to residents when tankering / pumping is essential.
4.3	Integrated Flood Risk Management	Develop a multi-agency approach to the management of flood risk within catchments as it relates to the impact on public sewers.	County Council/Parish Council, with inputs from SW, EA, Parish Council and local flood action groups.	Actions for participating authorities that in unison will reduce the extent of flooding and the impact of flooding.

# Appendix

- A Survey Findings and Completed and Planned Rehabilitation
- B Mitigation measures