Infiltration Reduction Plan

Goodworth Clatford

July 2024
Version 5

from Southern Water

Contents

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Version	Date
V1.0	October 2014
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V3.0	November 2015
V3.1	June 2016
V3.2	October 2021
V4	January 2024
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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
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) for Goodworth Clatford in the Fullerton WTW 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 infiltration in the catchment for Fullerton Wastewater Treatment Works (WTW) In Hampshire.

Figure 1.1 shows flows from Goodworth Clatford South Wastewater Pumping Station (WPS) and Goodworth Clatford Station WPS converge at Royal Oak WPS. The resultant flows are pumped onwards via Church Lane WPS to Fullerton WTW which also treats flows from Andover.

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,
- Test Valley Borough Council
- Goodworth Clatford Parish Council

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

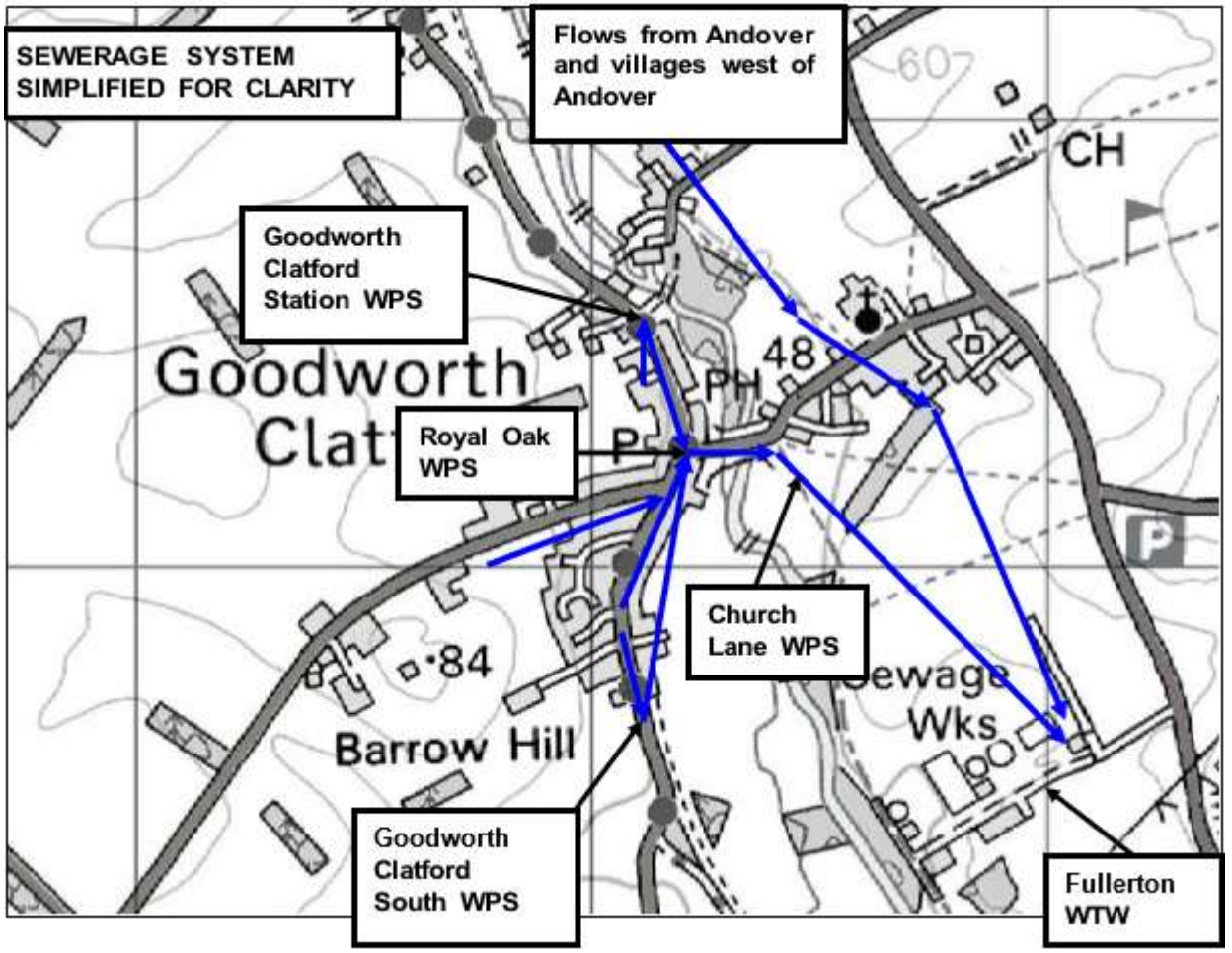

Figure 1.1 - Representation of the sewerage system for the Fullerton WTW catchment (locations of pumping stations is approximate)

2. Groundwater Infiltration at Goodworth Clatford

2.1. The significance of groundwater infiltration.

Goodworth Clatford is a region 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 historically groundwater treatment though groundwater treatment intervention is no longer undertaken. Such mitigation measures are not sustainable, so during the last 12 years SW has invested in carrying out improvements to the integrity of the sewers and manholes in the vicinity of Goodworth Clatford in order to minimise the occasions on which tankering 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 due to the monitoring of groundwater levels and the proactive use of tankers . Table 2.1 below show reported incidents of sewer flooding since April 2012.

Reporting Year	External flooding incidents (properties & gardens)	External flooding incidents (Highways & others)	Internal flooding incidents	Restricted Toilet Use	Grand Total
2011-2012	0	0	0	0	0
2012-2013	0	0	0	0	0
2013-2014	7	0	0	1	8
2014-2015	0	0	0	1	1
2015-2016	0	0	0	0	0
2016-2017	0	0	0	0	0
2017-2018	0	0	0	0	0
2018-2019	0	0	0	0	0
2019-2020	0	0	0	0	0
2020-2021	0	0	0	0	0
2021-2022	0	0	0	0	0
2022-2023	4	0	0	0	4
2023-2024	6	1	1	0	8
Grand Total	**17**	**1**	1	**2**	21

Table 2.1 - Reported Flooding Incidents by Category, in Goodworth Clatford.

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 Goodworth Clatford are captured in Section 3.2 below, and includes the following elements:

- Manhole Inspections, CCTV and Electroscan Surveys
- Manhole and Sewer Repairs
- Follow-Up Surveys and Repairs

3.2. Investigation and Repairs in Goodworth Clatford

Groundwater infiltration into sewers has been a long-running issue for Goodworth Clatford. SW has been making significant investments over many years to minimise infiltration and the need for over-pumping.

SW recently completed a programme of survey and repairs to the sewers in the Goodworth Clatford 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 Goodworth Clatford and Environs

Step.	Description	Approx. Date	Status
1.	Sewer Joints sealed. (~120m length) at Longstock Road, near Goodworth Clatford Station WPS	2001/2002	Completed
2.	MH sealed at Junction of Longstock Road and Cottage Green	2001/2002	Completed
3.	Sewer Joints sealed. (~110m length) at Longstock Road, in the vicinity of Meadow Drive		Completed
4.	Sewer Joints sealed. (~30m length) at Longstock Road, near Goodworth Clatford South WPS		Completed
5.	Sewer Joints sealed. (~90m length) at Longstock Road, near Goodworth Clatford Station WPS	2001/2002	Completed
6.	Sewer Joints sealed. (~80m length) at Church Lane, in the vicinity of The Warren		Completed
7.	Sewer Joints sealed. (~20m length) at Yew Tree Cottage	2012/2013	Completed
8.	Sewer Joints sealed. (~135m length) at Longstock Road, south from Goodworth Clatford Station WPS	2012/2013	Completed

Step.	Description	Approx. Date	Status
9.	Sewer Joints sealed. (~75m length) at Longstock Road, south from Goodworth Clatford Station WPS	2012/2013	Completed
10.	CCTV Investigation	December 2016 – February 2017	Completed
11.	Sewer Rehabilitation	July 2016 – February 2019	Completed
12.	Ongoing monitoring	Commences each year	Ongoing
13.	Further electroscan surveys	2023/24	Completed
14.	Repairs following surveys	Post 2024	Dependent on survey findings
15	Installation of sewer level monitors at strategic points	2023	Completed
16	Review of sewer level data to identify blockages and infiltration areas to target	From 2023	Ongoing
17	Continue with Pathfinder approach across the remainder of the village	From April 2025	Planned

The list in Table 3.1 summarises work carried out between 2000 and 2023 amounting to over 600 metres of sewer repaired.

In spring 2014, a survey was carried out in the village of Goodworth Clatford which identified a number of sources of infiltration in manholes and sewers adjacent to Cottage Green and in Longstock Road (south of Meadow Drive). Using the results of the survey, repairs were carried out in Longstock Road during 2014/15. The plans in Appendix A show the extent of surveys, significant infiltration and completed repairs.

Southern Water took advantage of the high groundwater levels in 2014 to carry out CCTV surveys (Spring 2014) and completed rehabilitation work to improve the situation in March 2015. Further rehabilitation works were scheduled for year 1 AMP 6 (April 2015 – March 2016). Further CCTV Investigations were carried out from December 2016 to February 2017, which led to Sewer rehabilitations from July 2016 to February 2019. In 2023 all public sewers in the village were surveyed by electroscan to identify potential leaking joints. The results of these surveys are being reviewed with a view to undertaken any sewer repairs after April 2025.

During the winter of 2013/14 (the wettest winter on record), tankering and groundwater treatment was used extensively to reduce levels in sewers and to maintain services for customers. Without these measures, there would have been more extensive flooding.

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.

The graph in Figure 4.1 shows the groundwater level measured at Clanville Gate borehole near Andover.

The dark horizontal lines show tankering and pumping which was required at a peak of 92.6m AOD in March 2014. This peak was significantly higher than the long term average of approximately 85m for March. On the basis of the information from the last few winters, a trigger level of 90 m AOD (grey line) has been proposed based on groundwater levels at Clanville Gate borehole. The trigger level will be reviewed following other high groundwater events. Because groundwater levels change so rapidly, pumps and tankers will not be deployed at specific groundwater levels, but the decision will be influenced by current and forecast conditions.

Overpumping was started on 01/03/2014 and stopped on the 07/05/2014 during the winter of 2013/14. There was no overpumping in the winter of 2012/13, although tankering was used to remove excess flows. During winter 2014/15, overpumping equipment was moved into Goodworth Clatford Station WPS as a precaution against rising groundwater levels, but not used. There are no proposals to use this as a form of mitigation in the future. Where mitigation is required this will be by tankering flow from the sewers and for this flow to be taken a nearby WTW with capacity to treat prior to discharge.

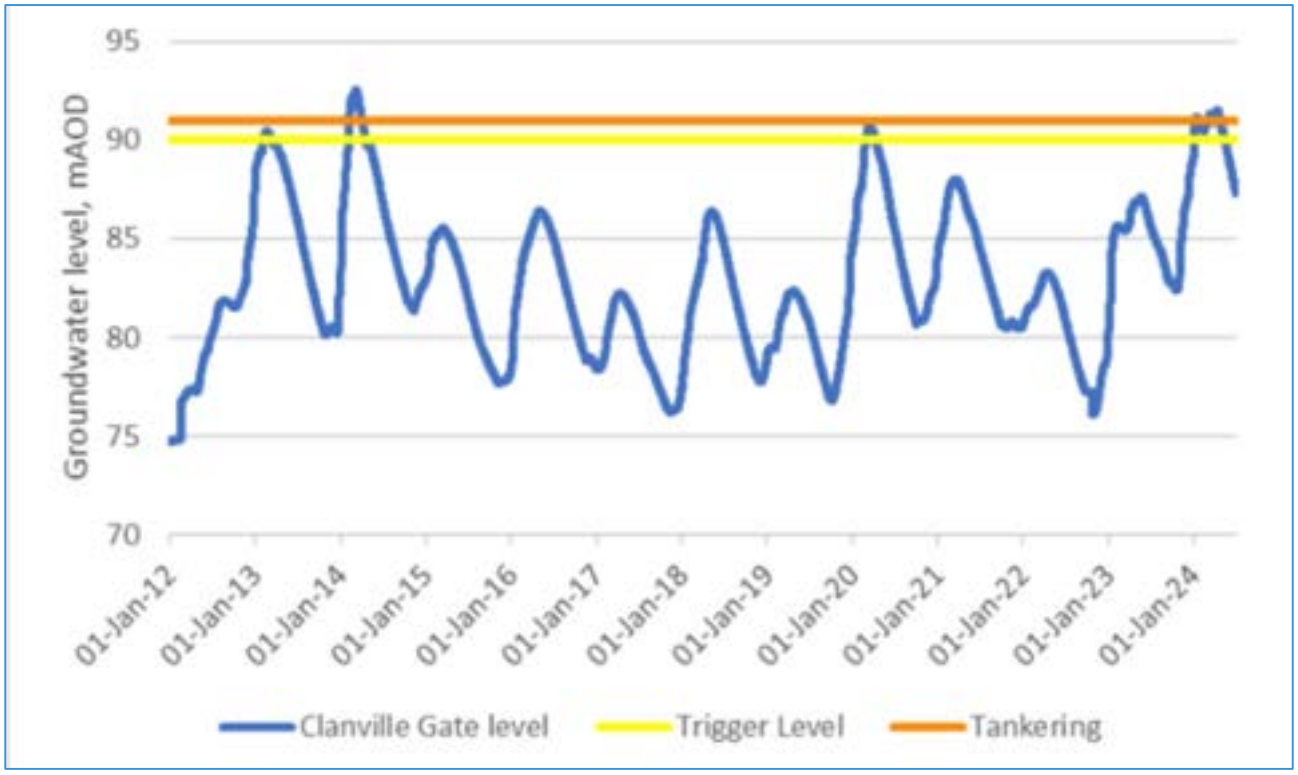

Figure 4.1 - Groundwater levels across the years

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 locations where tankering would be required. However, as a consequence of repairs and potentially other factors outside SW's control (such as the severity of the weather), the hydraulics may dictate that over-pumps are required at other locations either in place of, or in addition to, the sites described in Appendix B.

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 2014, 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. In addition to this work, SW also carries out other activities to minimise the requirement for discharges to watercourses.

The locations where tankering has been used in recent years are shown in Appendix B. These locations were effective in restoring service to customers and are the default locations should the situation re-present itself.

4.3. 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.

SW attends and convenes meetings with a number of local groups. In particular the meetings with local council representatives have been influential in helping to shape the IRP. SW liaised with the local flood action group and local residents about siting and daily management of the tankers to minimise disruption. 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

SW acknowledges that infiltration reduction is on-going process. Since 2013, SW has undertaken surveys and repairs at Goodworth Clatford. The major repair work was completed in 2013, and the critical pumping stations in Goodworth Clatford received special health check visits in January 2015 to ensure they are functioning in their optimum conditions. As infiltration only causes issues in this system 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.

However, on a company-wide basis, 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 for AMP6 (2015 – 2020). Further CCTV Investigations were carried out from December 2016 to February 2017, which led to Sewer rehabilitations from July 2016 to February 2019. Recently a new survey technique called electroscan has been adopted by Southern Water as its survey method of choice for infiltration issues. This is because the equipment can be used to determine potential leaking joints during summer periods and we don't need to wait for the high groundwater season to begin. This survey work was completed in 2024 and the results are now being analysed to identify any further sewer repairs required. Appendix B contains details of the work completed to date including the recent electroscan surveys. Table 5.1 below summarises the CCTV survey and lining work completed with an annual breakdown in Table 5.2.

Work type	Km of Sewer
Length surveyed (CCTV & Electroscan)	3.5
Length with no work required	0.9
Length sealed	1.8
Length to be sealed	0.8
Manholes sealed	3
Manholes to be sealed	2

Table 5.1 – summary of work done in the catchment

Year	Surveyed (Km)	Sewers Sealed (Km)	Manholes repaired
Pre 2014	1.292	0.786	1
2014	0.268	0	0
2015	0	0	0
2016	0.194	0.101	0
2017	0.154	0.111	2
2018	0	0	0
2019	0	0.192	0
2020	0	0	0
2021	0	0	0
2022	1.592	0	0
2023	0	0	0
2024	0	0.609	0

Table 5.2 – annual summary of work completed

5.2. Property Level Protection

Non-return valves have always been part of SW's approach 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.

5.3. Local Flow Control

As noted in Section 4.1 overpumping was started on 01/03/2014 and stopped on the 07/05/2014 during the winter of 2013/14. There was no overpumping in the winter of 2012/13, although tankering was used to remove excess flows. Neither tankering or over-pumping were required in 2019/20 or 2020/21 but tankering was required in the winter of 2023/24. There are no proposals to use groundwater treatment and overpumping as a form of mitigation in the future.

5.4. Pumping Stations

The critical pumping stations in Goodworth Clatford receive regular checks; they receive special health check visits pre groundwater season to ensure they are functioning in their optimum state, so that they achieve their design pass forward flow rate.

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5.5. Monitoring

The Goodworth Clatford 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.
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.

6. Action Plans

A significant amount has been achieved in the Goodworth Clatford catchment in the last 10 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 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	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.	Mid-September 2015 - 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 – Survey complete	Wet Weather and Dry Weather flow monitoring data used in hydraulic model
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.	Summer 2014 - Complete	Identify major sources of infiltration to determine scope of rehabilitation work.
1.5	Carry out sewer rehabilitation work	Use various techniques to seal infiltration points in manholes and sewers	March 2015 – Completed	Structural integrity of sewers restored.

Ref.	Item	Actions	Timescale and Status	Outcomes
1.6	Further surveys (CCTV or alternative techniques), if required, where 'wet weather' flow surveys show areas of high infiltration remaining	Further surveys in areas where high infiltration flows remain.	2015 – Completed December 2016 – February 2017 – Completed	Determine scope and carry out further rehabilitation if identified as required from the survey results.
1.7	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	April 2015 – March 2016 complete July 2016 – February 2019 – Completed	Reduced infiltration, leading to reduced requirement for tankers.
1.8	Maintain IRP as a live document	Review text of the IRP and update if appropriate to describe work carried out and/or developments	Annually	Reviewed/Updated IRP. Last issued for review 2015. Re-issued 2024
1.8a	Maintain IRP as a live document	Review Tables 6.1 to 6.5 and as appropriate amend to show progress on individual activities.	Quarterly	Up to date tables of Actions
1.9	Consider alternative solutions that involve some risk	Investigate unconventional options such as vacuum sewers or consider conventional combined sewer overflows	2020	Complete
1.10	Install Property Level Protection to Vulnerable properties.	Survey and install NRVs at vulnerable properties where required		The aim is that protection to vulnerable properties restricts tankering to those properties only as opposed to more significant sewer pumping. No NRVs required

Ref.	Item	Actions	Timescale and Status	Outcomes
1.11	Over-pumping Sites: improve effluent quality	Investigate potential for improved screening and basic treatment at points of discharge into watercourse.	SW, Summer/Autumn 2014	Improved arrangements for discharges when required.
1.12	Over-pumping 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, included in this IRP	Agree with EA acceptable treatment for discharges and acceptable flow rates.
1.13	Flow, location, screening arrangements for emergency discharges	Determine potential flow rates and screening arrangements and most appropriate locations,	SW, included in this IRP	Agree with EA, Hampshire County Council, Test Valley Borough Council and local Parish Councils acceptable arrangements for future emergency discharges.
1.14	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.
1.15	Identification of lengths of sewer to survey or resurvey in the period 2021-25	Review sewer records with available ground water profile date	Post 2022	Complete

Ref.	Item	Actions	Timescale and Status	Outcomes
1.16	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.	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	Dependent on findings from 1.17
1.19	Review effectiveness of any sealing work	Analyse monitoring data and groundwater data to determine benefit of investment	Post 2024	Planned
1.20	Review further options for property protection and alternative tanker points	Consider future improvements	Post 2024	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 Parish Councils, Ongoing	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.	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 City 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.	

*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 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	Communication from SW to stakeholders about reducing groundwater infiltration into the sewerage system	Send comms 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. **	Parish and Borough Councils, Complete	Article included in Council magazine.

** 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	Develop trigger levels by comparing historic customer complaints and tankering with BH levels (or other reference).
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	Flooding Management Plan	Develop plan to address the flooding issues caused by high groundwater. Implement recommendations. This is being addressed by the Little Stour, Nailbourne and Petham Bourne Flood Management Group Action Plan.	Hampshire County Council with inputs from SW, EA, and Parish Councils	Plan including actions for participating authorities, which in unison will reduce the extent of flooding and the impact of flooding.
4.4	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 Parish Council – ongoing responsibility	Maximise the flow along watercourses in order to minimise surface flooding, which results in inundation of manholes to the sewerage system.

Appendix