Infiltration Reduction Plan

Lavant Valley

August 2025
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
NRV – Non-return valve
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 Lavant Valley in the Lavant catchment has been prepared in response to the Environment Agency's (EA) Regulatory Position Statement (RPS). Southern Water (SW) has been carrying out work for many years to survey and repair sources of infiltration in the catchment for Lavant Wastewater Treatment Works (WTW) in Sussex.

This IRP covers the villages of East Dean, Charlton, Singleton, Binderton, West Dean, Mid Lavant and East Lavant. Figure 1 below is a schematic showing the area of concern.

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 (EA)
- West Sussex County Council
- Chichester District Council
- Lavant Parish Council
- Singleton Parish Council
- East Dean Parish Council
- West Dean Parish Council

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

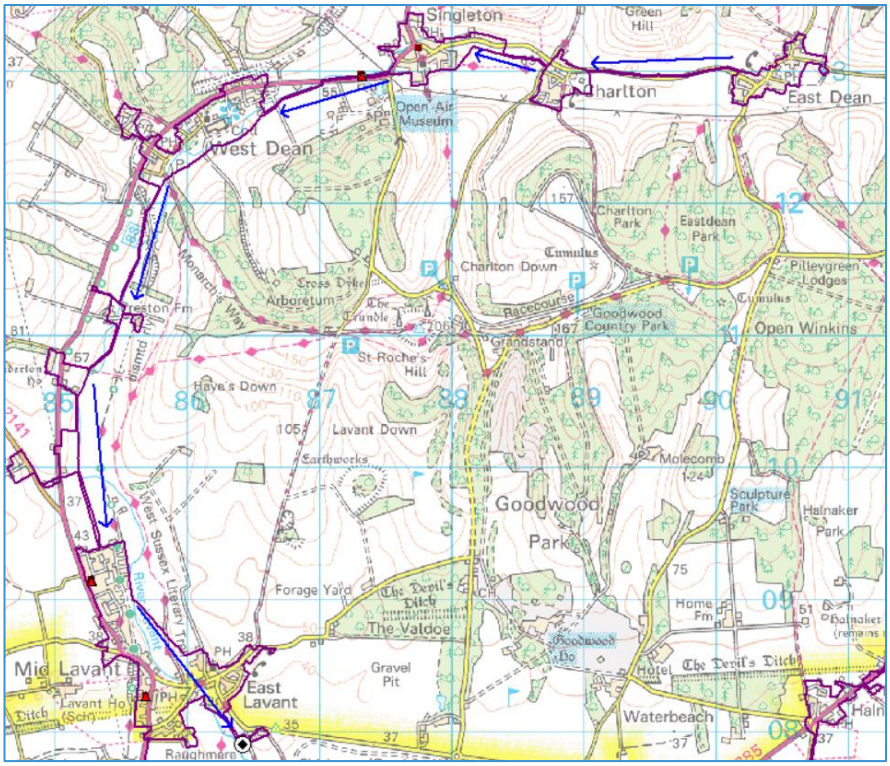

Figure 1 – schematic of Lavant sewerage system

2. Groundwater Infiltration at Lavant Valley

2.1. The significance of groundwater infiltration.

The Lavant Valley 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 Lavant Valley 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 these conditions, incidents of sewer flooding have been relatively infrequent this is due to the mitigation provided during times of high groundwater. Table 2.1 below shows reported incidents of sewer flooding since 2011. The villages worst affected are: East Dean, Charlton, Singleton and West Dean. Sewer flooding in Lavant is less frequent.

For context, until the winter of 2023/24, 2012/13 was the wettest year on record and 2013/14 was the wettest winter on record. Comparing incidents in 2013/14 with 2023/24 shows that over time the number of incidents affecting our customers has reduced which demonstrates that although the issue is not fully resolved, the investment being made in terms of sewer sealing and mitigation is making a difference. The total number of incidents is significantly lower than 2013/14 as seen in Table 2.1. The majority of events in 2021 were during summer storms and were not related to infiltration.

No reports of flooding or restricted toilet use have been reported in the last 12 months. However, this is due to a robust mitigation plan for the system which uses tankers to remove flow from the sewers before causing a level of service breach, in addition it has been necessary to utilise the storm overflows at the WTW and at Singleton, and in addition provide groundwater treatment by an overpumping arrangement at East Dean and Charlton as agreed by the EA.

Table 2.1 - Reported Flooding Incidents by Category, in Lavant Catchment

Year	External Flooding within property curtilage	External Flooding (Highway or other)	Internal Flooding	Restricted Toilet Use	Total
2011	0	0	0	0	**0**
2012	5	5	0	0	**10**
2013	7	8	0	1	**16**
2014	16	17	4	13	**50**
2015	0	1	0	2	**3**
2016	3	2	0	1	**6**
2017	0	0	0	0	**0**
2018	1	2	0	0	**3**
2019	0	5	0	0	**5**
2020	9	18	0	1	**28**
2021	3	4	0	1	**8**
2022	5	0	0	3	**8**
2023	7	8	1	1	**17**
2024	4	3	14	2	**23**
2025	0	0	0	0	**0**
Totals	**60**	**73**	**19**	**25**	**177**

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 Lavant Valley 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 the Lavant Valley

Groundwater infiltration into sewers has been a long-running issue for Lavant Valley. 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 Lavant Valley catchment. However, at times of very high groundwater there are still significant challenges with the drainage system and there is more work to do. 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 Lavant Villages and Environs

Step.	Description	Approx. Date	Status
1.	CCTV of East Dean, Charlton, Singleton, West Dean and Lavant villages. Inspection of sewers between villages.	Spring 2014 and 2015	Completed
2.	Dry Weather flow Monitoring.	Summer 2013 (17 July – 2 Sept)	Completed
3.	Repairs in East Dean, Charlton, Singleton, West Dean and Lavant villages as shown in Appendix A.	Spring 2014 - Spring 2015	Completed
4.	Investigate potential for property level protection	Autumn 2015 onwards	Completed
5.	Monitor flows in sewers with regards to groundwater levels.	Throughout 2016	Completed
6.	Planned: Follow up Surveys Completed	2016 / 2017	Completed
7.	Follow up Surveys Completed	2018/2019	Completed

Step.	Description	Approx. Date	Status
8.	CCTV Investigation	September 2016 – November 2018	Completed
9.	Sewer Rehabilitation	November 2016 – February 2019	Completed
10.	Further surveys and subsequent repairs	Summer 2021 – Autumn 2023	Completed – see Appendix A
11	Installation of sewer level monitors at strategic points	2023	Completed
12	Review of sewer level data to identify blockages and infiltration areas to target	From 2023	Ongoing
13	Implement Pathfinder approach in East Dean to address infiltration in public and private sewers in the village	Summer 2024	In Progress
14	Continue with Pathfinder approach across the remainder of the villages	From April 2025	Planned

Despite the previous repairs, significant mitigation measures were required in winter 2023/24 due to the highest groundwater levels recorded. The majority of interventions were to tanker excess flow from the sewerage system and to take these to Lidsey Wastewater Treatment Works for treatment.

Our investigations show that the locations where the main concentrations of infiltration occurring are in the villages rather than in the transfer sewers between villages. This was not surprising as there are many junctions in the pipework in villages and many connections from houses and we have found that joints in pipes are most often the weak point susceptible to leaks rather than the structural condition of the pipes themselves. SW has now completed the repairs identified from these surveys (details are in Appendix A).

Historically we have been dependent on waiting for groundwater to rise and leak into the system to allow us to find leaks. This gives a very small window of opportunity between leaks starting and pipes running full and this caused repairs to be undertaken reactively or after the groundwater had subsided. To overcome this during 2021/22 a new survey technique called Electroscan was introduced to the business. This method of surveying is advantageous over traditional CCTV inspection as it allows surveys to be undertaken during dry and wet conditions and also identifies leaking joints in pipes that a visual survey would not pick up. We surveyed 12 km of the sewer system in the villages East Dean, Charlton, Singleton and West Dean in 2021/22 as shown by the purple line in figures 3.1 to 3.6 below. These surveys identified sewers with leaking joints which will be addressed by sewer lining activity during 2023/24. This is discussed further in Section 5.

To 2024 our approach has been to address leaks on the public sewerage system for which Southern Water are responsible. However, in detailed investigations and trials in Hampshire it is evident that the private drainage systems are also not watertight and to eradicate the issue these sewers also require sealing. During Summer and Autumn 2024 we will start investigation and repair work on the sewers in East Dean and will continue this practice across the other villages from upstream to downstream from April 2025.

Due to the ongoing issues in this and other networks which are impacted by high groundwater and that data appears to show that high groundwater events are becoming more frequent, Southern Water included in its business plan for the period 2025 to 2030 an increased allowance specifically for the sealing of public and private sewers at risk of infiltration. The funding case was approved by OFWAT as a pilot study to trial and report the effectiveness of new sealing techniques delivered at scale. One of the systems included in the pilot study is Lavant. It is proposed that a high proportion of private and public sewers in the IRP area will be sealed in the period 2025 – 2027 with the anticipation that this will be effective in reducing the risk of the system becoming overwhelmed in wet winters and that tankering of flow in winter is only required in the most extreme conditions

4. Mitigation measures

4.1. Circumstances that lead to mitigation

Since 2013, SW has made significant investment to reduce infiltration into the public sewerage system and to protect specific properties at risk of flooding. The objective is to reduce the frequency of discharges to watercourses and the disruption caused by the need to tanker flows from the system to larger wastewater treatment centres.

Once groundwater levels have risen to a point where the sewerage system is below the water table groundwater will enter the system through leaking joints in both the public and private pipes and manholes. To ensure the sewerage system continues to function this excess flow must be removed from the network. Initially this is done by deploying tankers to the villages to extract flow and to tanker this, primarily groundwater, to larger WTW sites with capacity to treat the flow. If levels and flows continue to rise there comes a point where increased tankering is not viable due to available locations to extract from and the logistics relating to the number of tanker movements in small villages and the disruption this causes. Once this point is reached we will move to our action of last resort which is to install groundwater treatment equipment at strategic points. These local treatment sites will take excess flow from the sewerage system primarily groundwater, and the flow will be passed through a series of processes which will screening and filtering to remove solids, rag and other deposits, the residual liquid only will then be treated by ultra-violet light prior to discharge to the watercourse. The quality of treated effluent returned to the environment will be monitored to ensure that the flows are of a quality which not be harmful to the environment.

The locations for tankers and groundwater treatment are given in Appendix B.

There are two overflows in the Lavant system at Singleton and at the wastewater treatment works. As sewer levels rise, the Singleton Relief CSO and the overflow at the WTW will operate and these will continue to operate until groundwater levels and flow in the system reduce back to normal levels. If flows continue to increase, measures such as tankering at other locations will be required. From previous experience, the villages of Charlton and Singleton are likely to be the first impacted by higher flows. The requirement for tankering will be driven by levels in the manholes locally but based on previous experience, groundwater treatment is likely to be required if the total flow to the Lavant Wastewater Treatment Works is above 38l/s. In 2024 improvements have been undertaken at the WTW to increase the capacity of the works so that up to 74 l/s can be treated before the WTW overflow operates.

The groundwater level and the depth and rate of flow in the sewerage system are monitored continuously. This has led us to identify the level which groundwater needs to attain before we see issues in the sewerage system. Figure 4.1 below plots the groundwater profile against the sewer flow data and against rainfall. It can be seen that there is a definite seasonal trend in flows with flow reaching the maximum treated flow of 34 l/s when the groundwater is around 68mAOD. From this graph it can also be seen that rainfall events in summer periods do not cause an increase in flow which suggests that the sewerage system is largely a foul only system with little direct rainwater input.

Using the groundwater and sewer level data we have established a Trigger Level of 60 mAOD as a point where we need to be taking steps to prepare for mitigation measures. We have also identified that if groundwater increases to 65 mAOD it is very likely that we will need to commence tankering operation and if the levels continue to rise to 67 mAOD we will need to consider the deployment of groundwater treatment. These can be seen in Figure 4.1 below.

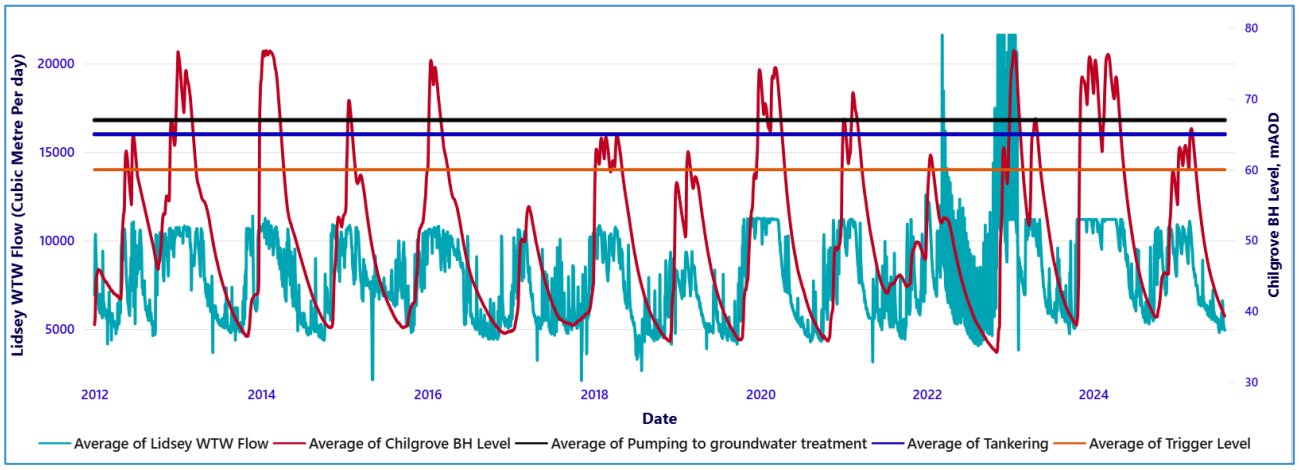

Figure 4.1 - Groundwater levels from 2012 to 2025 including trigger levels

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.

4.3. Groundwater treatment arrangements

A typical arrangement of groundwater treatment setup is given in Appendix B.

The locations where tankering has been used in recent years and groundwater treatment is proposed 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. Dates of historic tankering and groundwater treatment are also provided in Appendix B.
To manage flows in this 2024/25 high groundwater season it was necessary to utilise the groundwater treatment sites as agreed with the EA at East Dean and Charlton.

5. Steps to minimise the volume and duration of groundwater treatment

5.1. 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.

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.

6. Options to Reduce Infiltration

6.1. Sewer Rehabilitation Programme

It is recognised that infiltration reduction is on-going process. Since 2013, SW has undertaken surveys and repairs to the public sewers in the Lavant Valley. In recent activity in systems prone to high groundwater in Hampshire and Sussex we have undertaken more investigation into the contribution of flows from the private sewer network. We have established through the Pathfinder projects that groundwater is just as likely to be entering the system through leaking private pipes and manholes as the public system. This is probably not surprising as the systems would have originally been laid at the same time using the same techniques, the only difference is that as a rule the private sewers are likely to be at a shallower depth and groundwater has to rise slightly higher for infiltration to start. Now that the majority of the identified leaks on the public system have been addressed we will need to start sealing sewers in the Private system and this will be trialled in summer 2024 in East Dean village.

Appendix A contains details of all sewer inspection and remedial work undertaken to date.

Following the successful electroscan surveys undertaken in 2022 as described in Section 3, further pipes have been identified for investigation and rehabilitation. This work is to be undertaken in 2023/24/25 the extent of the planned work is shown in Appendix A. The electroscan survey shows that the majority of the system surveyed has no leakage, this demonstrates the effectiveness of the sewer sealing programme undertaken over the last 10 years. However, as groundwater is still getting into the sewers it highlights that the problem is chronic affecting more than just the public sewerage system and work to address private drainage may be required in the future to fully resolve this issue.

The infiltration of groundwater into the sewerage system is chronic throughout the sewer network including private drainage systems. This has resulted in the overflow from Lavant WTW operating very frequently in the last 12 months including on days with no rainfall but where groundwater remains high. It is priority for SW to address this issue and as a result a more holistic approach has been adopted for this system. Working from the upstream end at East Dean and heading downstream through the villages to the West, a manhole lifting and sewer sealing team has been on site for the last 18 months chasing down leaking manholes and sewers and repairing on identification. It is anticipated that this approach will address the issues in the catchment in the next 12 – 18 months. As this is very much a live ongoing situation it has not been possible to fully update the maps in Appendix A to show the work completed. These will be updated once the team has completed the work and it is expected that this will eliminate the need for tankering and overpumping in the future.

Table 6.2. below details the work undertaken in the system since 2014.

Reporting Year	Surveyed (km)	Sewers Sealed (km)	Manholes Sealed
2014	2.54	0.13	3
2015	0.10	1.35	19
2016	1.04	0.29	14
2017	0.63	0.24	0
2018	0.03	0.24	0
2019	0	0.11	0
2020	0	0	0
2021	5.41	0	0
2022	0	0	0
2023	0	0	0
2024	0	0.55	0
Post 2024	0	0	0
2025	1.52	2.19	0
Total	11.27	5.10	36

6.2. Property Level Protection

NRVs 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.

6.3. 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. Full details are given in Appendix B.

6.4. 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.

6.5. Monitoring

The Lavant Valley 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 4.1, 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.

7. Action Plans

A significant amount has been achieved in the Lavant Valley 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	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.	Summer 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 – Survey complete Analysis - complete	Wet Weather and Dry Weather flow monitoring data used in hydraulic model completed in December 2014.
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.

Ref.	Item	Actions	Timescale and Status	Outcomes
1.5	Carry out sewer rehabilitation work	Use various techniques to seal infiltration points in manholes and sewers	Initial Repairs – Completed in 2013 Majority of repairs – Completed in 2014	Structural integrity of sewers restored.
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 September 2016 – November – 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	2016/17 – Completed November 2016 – February 2019 – Completed	Reduced infiltration, leading to reduced requirement for tankers.
1.8	Property level protection	Investigate potential for property level protection	Complete	Determine scope and carry out further protection if identified as required as per investigation results.
1.9a	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 2025. Re-issued 2025.
1.9b	Maintain IRP as a live document	Review Tables 7.1 to 7.4 and as appropriate amend to show progress on individual activities.	Quarterly	Up to date tables of Actions

Ref.	Item	Actions	Timescale and Status	Outcomes
1.10	Consider alternative solutions that involve some risk	Investigate unconventional options such as vacuum sewers or consider conventional combined sewer overflows	2020	Ongoing.
1.11	Install Property Level Protection to Vulnerable properties.	Survey and install NRVs at vulnerable properties.	Complete	The aim is that protection to vulnerable properties restricts tankering to those properties only as opposed to more significant sewer pumping.
1.12a	Groundwater treatment 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.
1.12b	Groundwater 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.
1.13	Standards for emergency discharges	SW to discuss with EA about best practice set up for Groundwater treatment arrangements.	SW, 2014, included in this IRP	Agree with EA acceptable treatment for discharges and acceptable flow rates.
1.14	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, West Sussex CC, Chichester DC and local Parish Councils acceptable arrangements for future emergency discharges.

Ref.	Item	Actions	Timescale and Status	Outcomes
1.15	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.
1.16	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	Complete
1.17	Surveys by CCTV or Electro Scan lengths of sewer potentially at risk	Compare historical survey coverage with results of 1.15 and produce a survey schedule.	Summer/Autumn 2021	Complete
1.18	Survey result review	Review results of surveys undertaken in 1.16 to determine sewer sealing work.	Autumn/winter 2021	Complete
1.19	Undertake required sewer sealing	Seal sewers and manholes by most appropriate technique	From Autumn 2021 as conditions allow	Ongoing
1.20	Review effectiveness of any sealing work	Analyse monitoring data and groundwater data to determine benefit of investment	From Spring 2024	Ongoing

Ref.	Item	Actions	Timescale and Status	Outcomes
1.21	Review further options for property protection and alternative tanker points	Consider further improvements	From Spring 2024	Planned

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).
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).
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.
		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

A Survey Findings and Completed and Planned Rehabilitation

B Mitigation measures