

Infiltration Reduction Plan

Sidlesham

August 2024
Version 5



from
**Southern
Water** 

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Document Control

Format	Version	Date
Sidlesham IRP	1.0	January 2017
Sidlesham IRP	1.2	September 2021
Sidlesham IRP	2	January 2023
Sidlesham IRP	3	January 2024
Sidlesham IRP	4	July 2024
Sidlesham IRP	5	August 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
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 Sidlesham 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 Sidlesham Wastewater Treatment Works (WTW) in Sussex.

The affected part of the catchment is shown in the map in Figure 1.1. Flow gravitates to Fletchers Lane WPS, from where it is pumped to Rotton Row WPS. After being pumped through several more pumping stations, flow is treated at Sidlesham WTW.

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,
- Chichester District Council,
- West Sussex District Council
- Sidlesham Parish Council

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

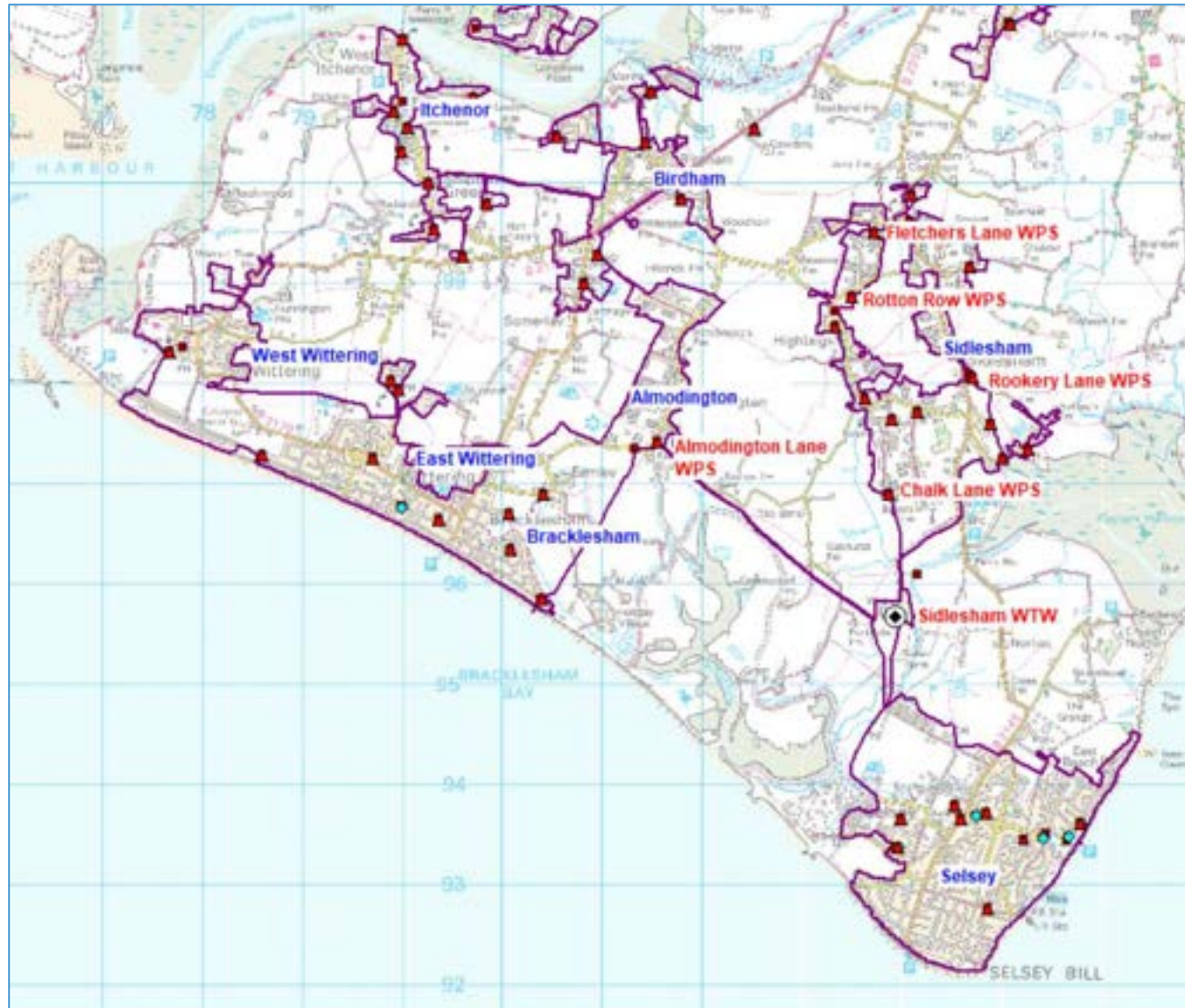


Figure 1.1 - Representation of the sewerage system in the vicinity of Sidlesham

2. Groundwater Infiltration at Sidlesham

2.1 The significance of groundwater infiltration.

The Sidlesham catchment is one of a number of areas in Southern Water’s operating area where, during wet winters, customers have been inconvenienced by the effects of groundwater infiltration. 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 is by the use of tankers however such measures are not sustainable and are disruptive to communities. Since 2014 SW has invested in carrying out major improvements to the integrity of the sewers and manholes in the vicinity of Sidlesham in order to minimise the occasions on which mitigation measures are required. The number incidents of flooding or restricted toilet use can be seen in Table 2.1.

Table 2.1 - Reported Flooding Incidents in Sidlesham

Year	External Flooding (properties / gardens)	External Flooding (Highways/Other)	Internal Flooding	Restricted Toilet Use	Total
2013	2	0	0	2	4
2014	0	7	0	2	9
2015	1	1	0	0	2
2016	0	0	0	0	0
2017	0	0	0	0	0
2018	0	0	0	0	0
2019	1	0	0	0	1
2020	1	2	0	0	3
2021	0	0	0	0	0
2023	1	0	0	1	2
2024	2	7	0	0	9
Total	8	17	0	5	30

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

Despite the significant groundwater flow during these conditions, incidents of sewer flooding have been relatively infrequent. Table 2.1 below show reported incidents of sewer flooding since April 2013. The impact of this on the customers with respect to flooding and restricted toilet use is much less in the last 5 years. This may demonstrate the effectiveness to date of the sewer sealing work undertaken in the network.

The increase in flooding incidents in 2021_22 is influenced by the very wet weather experienced in November 2022. It is unlikely that these incidents occurred due to infiltration.

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 Sitlesham 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 Sitlesham

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

SW recently completed a major programme of survey and repairs to the sewers in the Sitlesham 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 Sitlesham Village and Environs

Step.	Description	Approx. Date	Status
1.	Manhole lifting followed by CCTV Investigation [990m of sewer surveyed]	April 2013	Completed
3.	Determination of required repairs	Autumn 2013	Completed
4.a.	Repairs [refer plans in Appendix A]	October 2013 – November 2013	Completed
5a.	Dry Weather Flow Survey	N/A	Not appropriate for small sub-catchments.
5b.	Wet Weather Flow Survey	N/A	Ditto
6.	Targeted follow up survey	2017/18	Completed
7.	Targeted Repairs	2018	Completed
8.	Monitoring or groundwater impact	From 2013	Ongoing.

Step.	Description	Approx. Date	Status
9.	Electroscan surveys of Birdham and Itchenor	Spring 2022	Completed
10.	Repairs of leaking joints identified in electroscan surveys	Summer 2023/24	In progress
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	In Progress
13.	Implement Pathfinder approach to address infiltration in public and private sewers	From April 2025	Planned

Further investigation work in Sidlesham village, was carried out in 2017/18. If infiltration remains an issue, the requirement for further repairs will be considered in relation to other locations which experience sewer flooding. Repair of a lateral drain with significant infiltration was also carried out during the year 2017/18.

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 Birdham and Itchenor in 2021/22 as shown in Appendix A as work completed. The leaking joints identified are in the process of being sealed. The locations of ongoing sealing in Birdham and Itchenor can be seen in Appendix C.

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. 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.

If flows continue to increase, as groundwater levels rise, mitigation measures at certain locations will be required. Using previous experience, areas likely to be the first affected are identified. The requirement for tankering will be driven by levels in the manholes locally. The locations where flow will be extracted by tankers when required are shown in Appendix B.



Figure 4.1 - Groundwater levels from 2015 to 2024

4.2. Steps to prevent discharges to the environment

The Generic Plan details the typical activities that Southern Water undertakes to minimise the requirement for discharges to watercourses. Since 2014/15, 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 (as 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.

5. Steps to minimise the volume and duration of tankering

5.1. 3rd Party Communications about tankering

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. Dialogue with representatives of these groups was influential in helping to shape the IRP. During the winters of 2014/15 and 2015/16, SW and the EA held weekly conference calls to discuss locations where total flows in the sewers were reaching the point where SW would need to respond imminently with tankering.

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

6. Options to Reduce Infiltration

6.1. Sewer Rehabilitation Programme

SW acknowledges that infiltration reduction is on-going process. Since 2013, SW has undertaken surveys and repairs at Sidlesham. The major repair work was completed in 2013. Repair of a lateral drain with significant infiltration was also carried out during the year 2017/18.

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 March 2016 to August 2018, which led to Sewer rehabilitations from March 2016 to January 2019.

As stated in Section 3 some 12 km of sewer was surveyed using a new technique called electro scan during 2022. These surveys have identified where there is potential for leaking joints in the system. These potential leaks will be further investigated in 2023 and where necessary sewers will be lined to prevent groundwater from entering the system.

Action	Km of sewer
Length Surveyed by CCTV	54.31
Length Surveyed by Electroscan	8.53
Length with no work required	51.36
Length Sealed	4.71
Length to be sealed	6.77
Manholes sealed	9
Manholes to be sealed	3

Table 6.1 below is a summary of work done in Sidlesham since 2013.

Reporting Year	Surveyed (km)	Sewers Sealed (km)	Manholes Sealed
Pre 2014	40.5	0.3	7
2014	0.2	0.2	0
2015	0.2	0.1	0
2016	4.8	0.1	0
2017	3.2	1	0
2018	4.5	0.2	2
2019	0.3	0.6	0
2020	0	0.1	0
2021	0	0m	0
2022	9.1	0.1	0
2023	0	0m	0
2024	0	2	0
Post 2024	0	6.7	3

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

6.2. Property Level Protection

Non-return valves (NRV's) 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. There are no NRV's currently installed in Sidlesham, and no plans currently to install any, but the potential benefit of property level protection will be investigated, if it is deemed appropriate.

6.3. Local Flow Control

Tankering was used on selected dates between December 2020 and February 2021.

6.4. Pumping Stations

Due to the flatness of the terrain, there is an abundance of wastewater pumping stations in the villages in the Sidlesham sewerage catchment. Indeed, 15 pumping stations are required to convey the flows to Sidlesham Wastewater Treatment Works, located just to the north of Selsey. In order to minimise the effects of infiltration, SW is continuing to ensure that design discharges are maintained at pumping stations, by carrying out some major work at key stations.

At Rotton Row WPS, in the north of the village, the pumps were replaced in August 2014. At Fletchers Lane WPS, also in the north, both pumps were replaced in January 2013, followed by improvements to pipework and controls in 2015. At Highleigh Road WPS, both pumps were replaced in 2013. As part of SW's monitoring programme, regular checks are carried out to ensure that pumps are operating at design flows; indeed, maintenance visits have been enhanced for several of the stations, with quarterly visits increased to monthly visits.

6.5 Monitoring

In addition to their programme of rehabilitation works, SW set up a monitoring programme in January 2015, using telemetry data. SW started with a weekly review of the ten locations in their region which are most prone to sewer flooding. The monitoring used 'real time' data e.g. groundwater levels from local boreholes to predict when it might be necessary to respond to mitigate the effects of flooding. Trigger levels were identified for each location. The trigger levels are not the levels at which tankering started historically. When a trigger level is reached, SW increases activity to ensure that the sewers are running clearly. Levels in the manholes are also checked, as it is this, not groundwater levels that determine when surplus effluent needs to be removed from the sewers.

Whilst Sidlesham is not one of the locations monitored; the forecasting identifies areas which are likely to flood before Sidlesham.

The graph below, in Figure 6.1, 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 levels at a sewer level monitor (SLM). There appears to have been a data issue with the SLM in 2020, which led to some erroneously high readings.

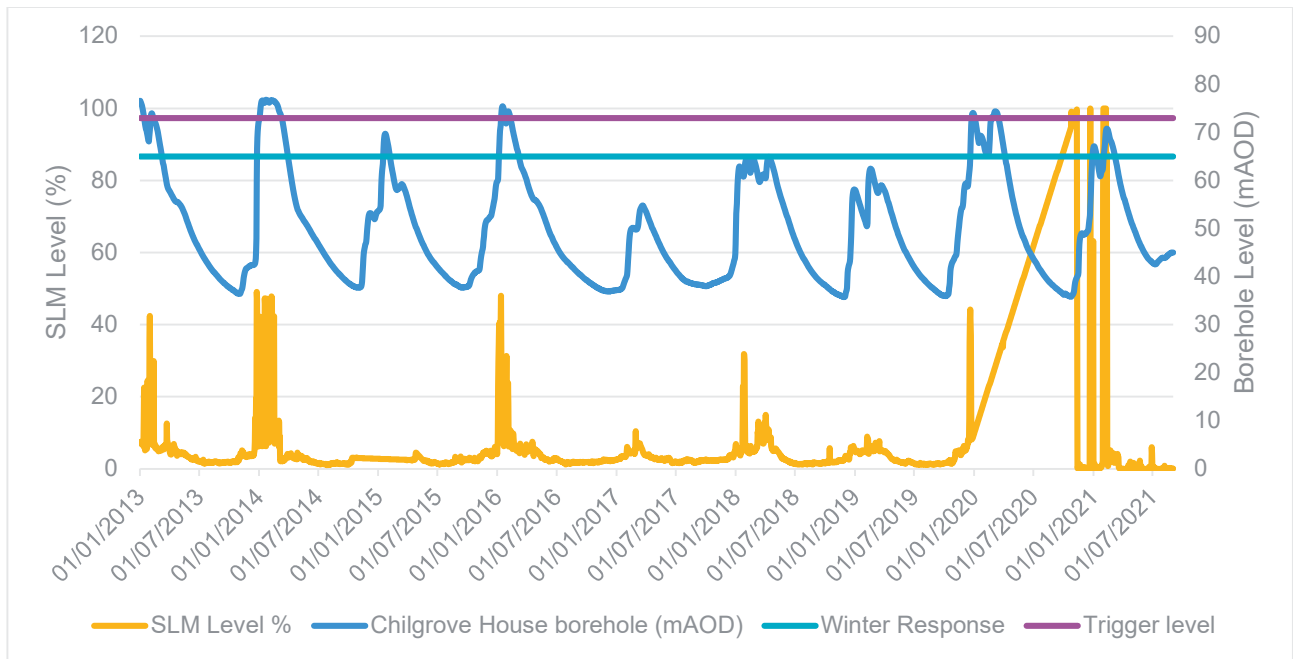


Figure 6.1 – Forecasting of Trigger Dates

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.

Figure 6.2 shows the groundwater levels at Chilgrove House borehole plotted against flows to Bremere Lane, Highleigh. Linear regression lines are also included for each set of data. These give an indication of the difference between average conditions for 'before' and 'after' repairs.

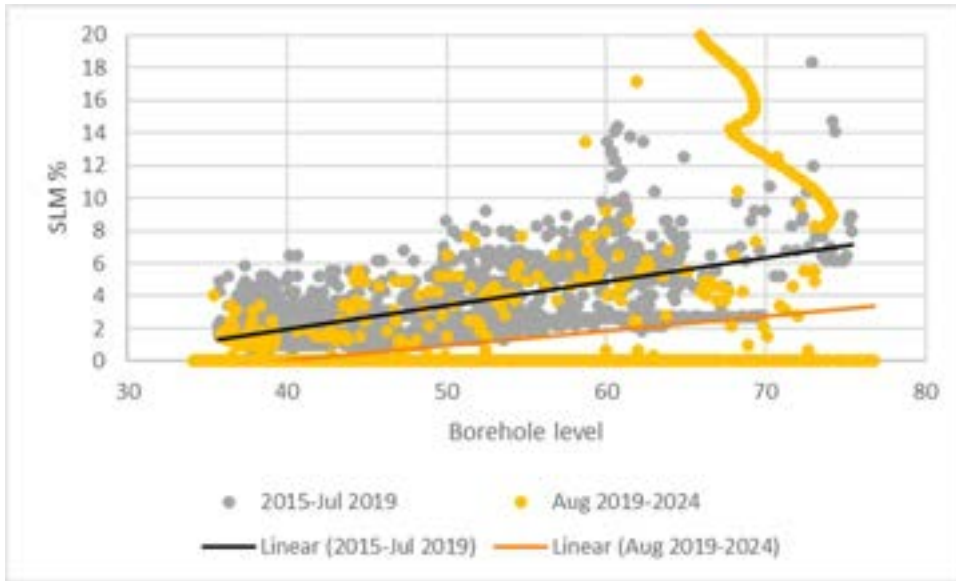


Figure 6.2 – Groundwater levels vs Flow to Bremere Lane

For a given groundwater level, the corresponding flow is lower after the repairs. This confirms that the repair work has been effective.

7. Action Plans

A significant amount has been achieved in the Sidlesham 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 7.1 and 7.2 cover the actions by SW and by other parties, respectively, to reduce infiltration. Tables 7.3 and 7.4 summarise mitigation of the effects of flooding (communication and other activities).

SW is committed to continuing to pursue infiltration to reduce the frequency of 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.	N/A	Not appropriate for small sub-catchments.
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.	N/A	Not appropriate for small sub-catchments.
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.	April 2013	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	Autumn 2013	Structural integrity of sewers restored.
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 2017. Re-issued 2020.

Ref.	Item	Actions	Timescale and Status	Outcomes
1.8a	Maintain IRP as a live document	Review Tables 6.1 to 6.4 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	Complete – no alternative means of addressing the infiltration
1.10	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.
1.11	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	Complete
1.12	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.	Autumn/Winter 2021	Complete
1.13	Survey results review	Review results of surveys undertaken in 1.16 to determine sewer sealing work.	Autumn/winter 2021	Complete

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Ref.	Item	Actions	Timescale and Status	Outcomes
1.14	Undertake required sewer sealing	Seal sewers and manholes by most appropriate technique	Spring/summer 2024	In progress
1.15	Review effectiveness of any sealing work	Analyse monitoring data and groundwater data to determine benefit of investment	From Autumn 2024	Planned post latest repairs
1.16	Review further options for property protection and alternative tanker points	Consider further improvements	From spring 2025	Planned

Table 7.2. 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	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.	District Councils to continue to consult with SW on development applications.	District Councils, 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 District Councils.
		SW to determine threshold above which they require to be consulted.	District Councils, Ongoing. SW wish to be consulted on all proposed development.	
		Sewerage materials for new developments	SW & District Councils, 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	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

** 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).
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.
4.4	Flooding Management Plan	Develop plan to address the flooding issues caused by high groundwater. Implement recommendations.	District Councils with inputs from SW, EA, and Parish Council.	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 in order to minimise surface flooding, which results in inundation of manholes to the sewerage system.
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.

Appendix

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