Infiltration Reduction Plan
Offord

June 2021

Contents

Executive Summary

Offord Cluny is a village in Cambridge which is served by a combined sewerage system which pumps into Buckden WRC, approximately 2 miles west of the village. The pumping station overflow pipework runs along Station Lane besides the railway tracks into a drain. Following an extremely wet winter in 2020/21 the village suffered from very high groundwater levels and very high river levels causing the sewer network to become hydraulically overloaded. Due to the risk of flooding to the railway lines and its potential impact, a Local Enforcement Position Statement was granted from 19.02.21 to discharge straight from the sewer network at manhole 9702 on the High Street to the adjacent watercourse. This particular location was discharging under Regulation 40 of the Environmental Permitting Regulation (2016) from 08.02.21 to 15.02.21 due to the emergency situation to avoid danger to human health. No direct discharge to the environment was made after 15.02.21.

Investigations have confirmed that the main cause of the surcharging of the sewerage system was due the CSO at Offord Cluny Station Lane PS being almost fully submerged and therefore unable to operate as designed. In addition, large volumes of water had ponded on agricultural land to the north of the works and were allowed to enter the system via customer opening manholes to protect properties from surface water flooding. Minor infiltration was reported by operational team on a number of manholes, and investigations have identified a potential missing record of sewer relining.

The historic data demonstrates that river levels were the highest since 2013 due to high groundwater levels and exceptional rainfall. If no actions were taken, continued extreme weather and high river levels could cause the sewerage system in Offord Cluny to become overwhelmed, leading to:

- Increased external flood risk to properties on Station Lane.
- Prolonged loss of facilities to customer properties on the High Street, Station Lane and Asplins Lane.

A CSO is located at the Offord Cluny Station Lane pumping station which discharges to a drain just prior to the Great River Ouse. During the high river levels of early 2021 the CSO was submerged and as a result, it could not discharge freely.

Anglian Water is aware that whilst interventions are ongoing there is a risk of future instances of the sewerage system being overwhelmed. In these cases, it may be necessary to make future temporary discharges to the environment under an agreed Regulatory Position Statement (RPS), from Offord Cluny sewer network to the watercourse to protect customers. This may be necessary when:

- Excess rainfall has been prevalent in the area which has resulted in continuous running of the pumping station due to surface water ingress or fluvial flooding, with dilute sewage of less than 5mg/l ammonia.
- Excess flows have caused impacts to customers and where tankers are unavailable due to other environmental protection priorities.

To ensure that any temporary discharges do not adversely affect the environment, the following conditions will be met:

- The discharge shall occur at TL 21954 66799 (see black cross in image below)

- The discharge site will be visited by AW Operational staff daily as a minimum.
- The discharge will be screened at the outlet of the pumping hose via a mesh bag filter as a minimum, checked daily and replaced as required. Screening will be to 6mm maximum.
- Ammonia sampling will be carried out at least once daily at the pump discharge point, and both upstream and downstream of the watercourse providing it can be accessed safely.
- It is not possible to specify a maximum discharge rate as this is subject to a number of incident specific variables. The pump set up will be arranged as such to only discharge those flows that would adversely affect customers (either by using level controls or positioning of suction pipework)

Anglian Water are to inform the Environment Agency of any advance notice of discharges to be made, via ANGLIANOSMFAILURES@environment-agency.gov.uk and to inform of commencement of the discharge through the Agency's National Incident Communication Service. Notifications of the discharge will also be included on the Anglian Waters website on 'In Your Area' and communication made with locally impacted customers, Parish Councils, Local Authorities.

To reduce the need for temporary discharges, an investigation into the sources and severity of infiltration led to the completion of this infiltration reduction plan in June 21. This led to the following actions:

- CCTV sewers as risk of infiltration and along High Street (by 31/03/2022- now completed).
- Sewer and lateral lining to High Street, The Cranny and Park Way (by 31/03/2023- now completed)

This IRP was reviewed after a period of high groundwater to determine if any further remedial work is required. Hours run looked much improved over winter '22 (after lining completed) indicating that groundwater infiltration has been reduced in the network with

less duration of high hours and peaks less than those of 2018. And no customer issues related to high flows were reported. However, due to winter ’22 being particularly dry flows will continue to be monitored over the next wet period (winter ’23) to fully ensure the work has been successful.

Winter 2023 turned out to be exceptionally wet and although a few customers did suffer with loss of facilities/flooding the numbers were not as high as in 2021. The sewer network was again hydraulically locked by the river levels being so high that the CSO could not freely discharge.

During a review of the area in October 24, although Offord had seen some heavy rainfall throughout Sept, no further customer issues had been reported. AW recommend this plan currently be archived.

The next review date for this plan is March 2025.

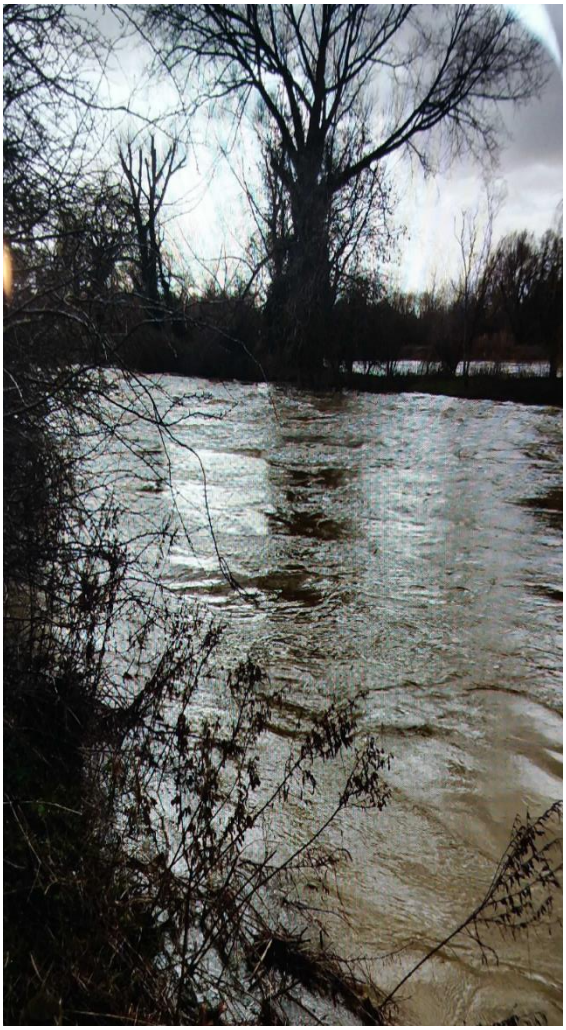
Background

The Significance of Groundwater infiltration at Offord catchment

Offord Cluny requires an infiltration investigation due to an LEP being granted, due to the risk of flooding, pollution and customer safety during the extreme weather in 2020/21. This plan aims to gain an understanding of the root cause of high flows in Offord Cluny and identify remedial work to eliminate the risk in future wet weather periods.

The location of the LEP overpumping set up at MH9702 circled on the High Street.

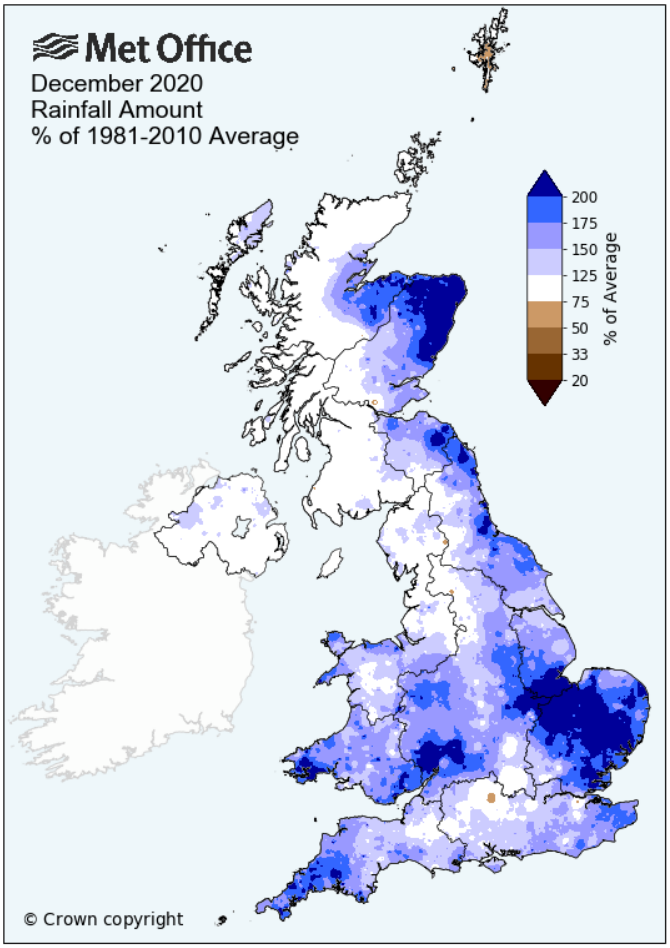
During the wet weather events this year, Offord experienced high ground water, poor land drainage, and high river and sewer levels - higher than we have observed in this catchment previously. Historically, the catchment has not experienced significant customer flooding issues. In this event, due to the high rainfall, customers along High Street, Asplins Lane and the new development by surrounding Whitwell Farm experienced loss of service for a number of days, with external flooding as a result of surface water to at least 8 properties (see photos below). Land drainage was a contributing factor of these events, however there are no LLFA schemes at this point in time. It has been confirmed that customers lifted manholes to allow surface water to drain directly into the foul sewer to mitigate against their properties flooding, adding to the network issues.



High river levels

Surface water external flooding along the High Street, Offord Cluny. Customer diverted water into the Anglian Water sewerage network to prevent internal flooding.

Extreme weather events, such as those seen at Offord Cluny during Jan-March are expected to become more frequent as a result of climate change. Rainfall patterns are changing with heavy rainfall more likely, and sea levels are rising. Since 1998, the UK has seen seven of the ten wettest years on record. The high rainfall in Offord (200% of averahe December rainfall) caused the river levels to rise to the highest they have been in over 8 years, shown in evidence in the following section.



What would happen if Anglian Water did not take action?

To protect properties from flooding and to mitigate any effects of sewage flooding to human health, requests can be made to the Environment Agency to discharge from a pumping station to a watercourse under Local Enforcement Position Statements (LEPs). These LEPs have been requested and granted on 19.02.2021 in OFFSSM, subject to compliance with the Environment Agency's (EA) Regulatory Position Statement (RPS). These requests were to discharge from an unpermitted Anglian Water site, the pumping station Offord Cluny – Station Road TPS to surface water at TL 21954 66792. The Environment Agencies EA's RPS sets out the requirements for Water and Sewerage Companies (WaSCs) which are aware of sewerage systems in their area that are vulnerable to infiltration, to submit Infiltration Reduction Plans to the EA for approval.

The EA recognise the need to minimise groundwater via improvement actions to protect the environment, whilst accepting that controlled discharges may be required to protect human health, maintain sewerage services to customers and protect critical infrastructure from infiltration. Compliance with this RPS mitigates the risk of enforcement action for discharges to the environment, providing they are made in accordance with the approved Infiltration Reduction Plan. This Infiltration Reduction Plan

is produced in accordance with this RPS. This plan will be reviewed 6 monthly, until such time as Anglian Water identifies the risk of infiltration and surface water entering the sewerage system to be sufficiently managed so as not to pose an unacceptable risk to customers and the environment.

Historic Data

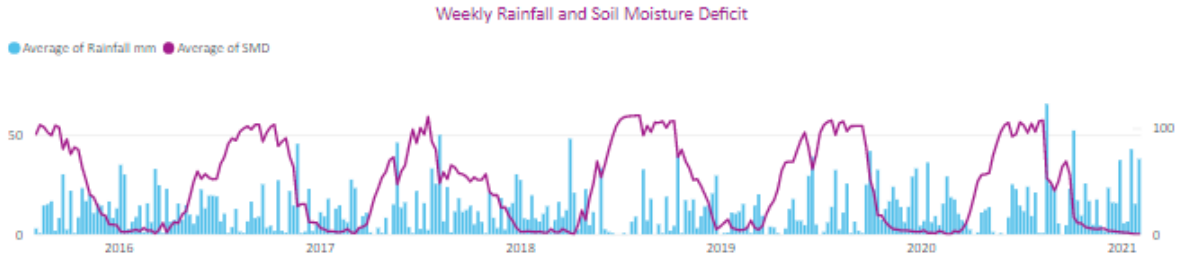
Catchment inputs

Impact on customers

Count of customer incidents due to sewer overload (therefore excluding cases of flooding due to blockage or collapse). Prior to 2021, Offord Cluny had not experienced loss of facilities as a result of hydraulic overloading of the sewerage system since 2005. In 2012, during another wet period, two external floodings were recorded. Other external floodings were reported during February 2021 however they were attributed to surface water flooding caused by land drainage.

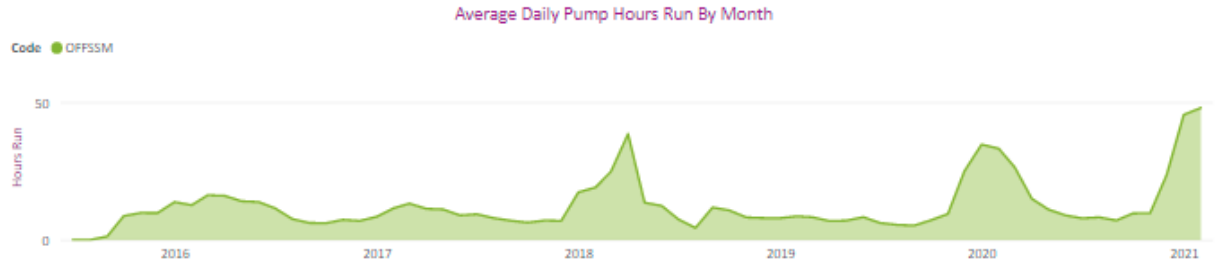
Year	External Flooding	Internal Flooding	Loss of WC Facility
2005	0	0	0
2006	0	0	0
2007	0	0	0
2008	0	0	0
2009	0	0	0
2010	0	0	0
2011	0	0	0
2012	2	0	0
2013	0	0	0
2014	0	0	0
2015	0	0	0
2016	0	0	0
2017	0	0	0
2018	0	0	0
2019	0	0	0
2020	0	0	0
2021	2	0	8

Rainfall data and Soil Moisture deficit



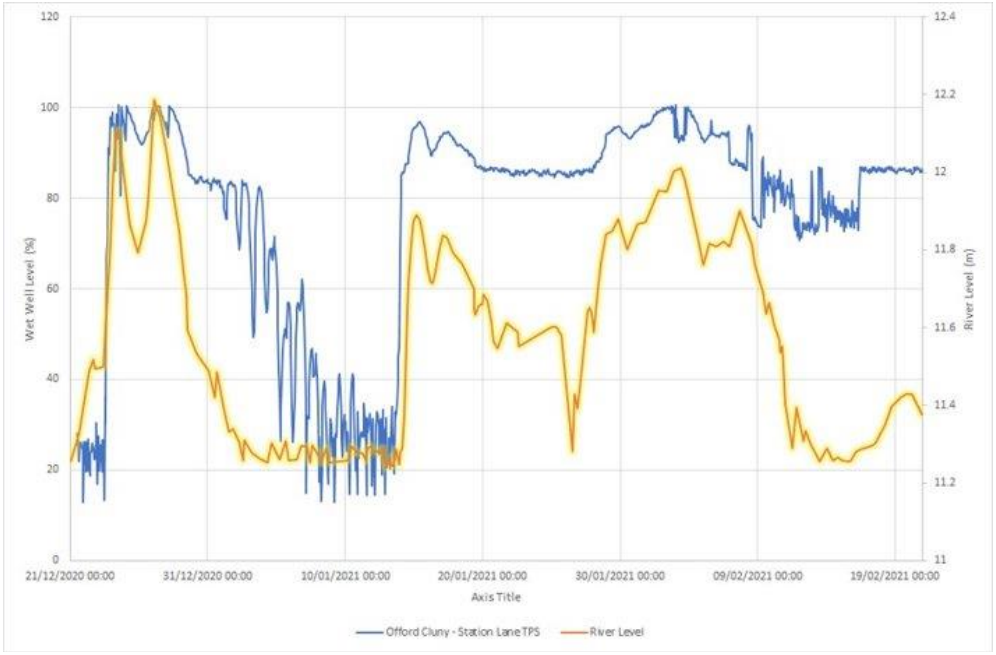
PS run hours

Offord Cluny – Station Road TPS shows significantly higher pump run hours during 2021, when compared with previous years. This corresponds to a period of sustained rainfall when the ground was already fully saturated (as showed in the rainfall data and soil moisture deficit graph above).

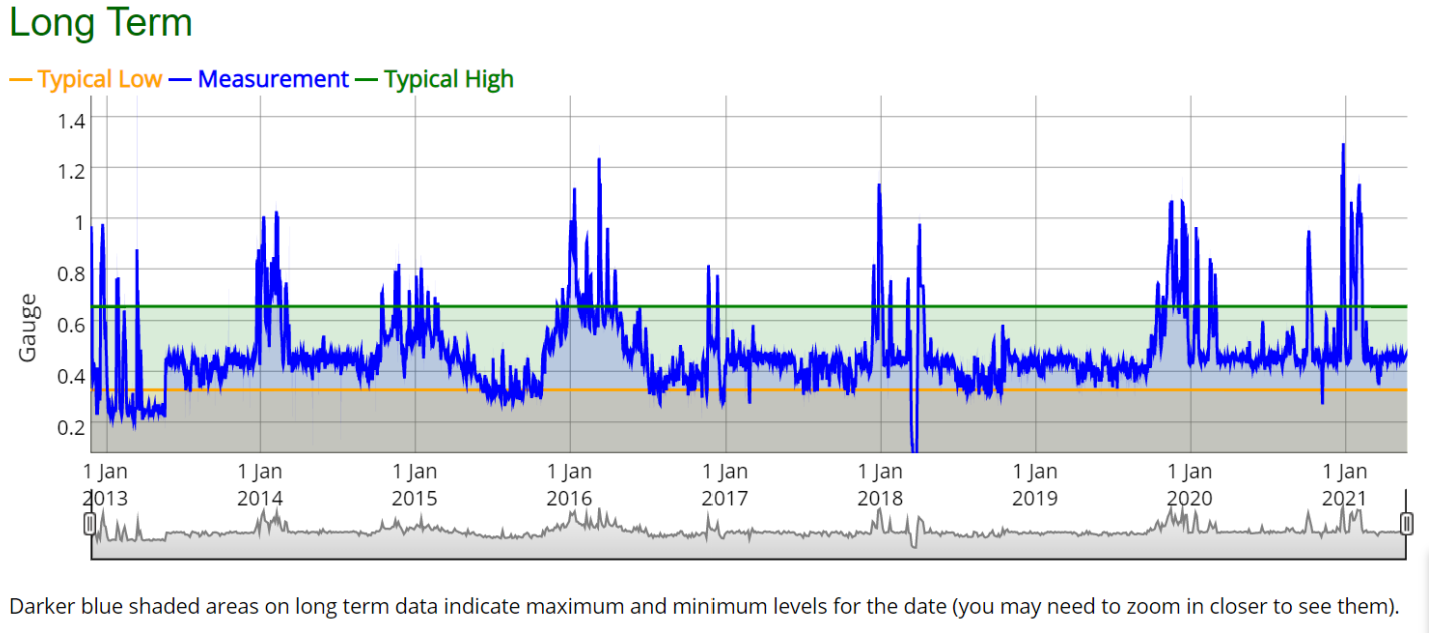


There is strong correlation between pumping station wet well levels and river levels, until direct discharge to the watercourse commenced under Regulation 40 from 08/02/2021. When this is combined with pictoral evidence of the CSO outfall at Offord Cluny – Station Road TPS being almost fully submerged (see below), the evidence is strongly suggestive that inundation from the watercourse into the Anglian Water system, led to the sewerage system being overwhelmed.

CSO outfall, Offord Cluny Station Lane TPS with water mark clearly demonstrating an almost fully submerged outfall.



River level data from the River Ouse (Diddington-Offord; EA location ID E24367) demonstrate high river levels occurred during the 2020/21 period. A detailed review of the raw river level data (see appendix) identified that 9 of the 20 highest daily river levels recorded since November 2012, occurred during the period 24th Dec 2020 – 4th February 2021. All 12 days prior to 8th Feb 2021 (when discharge under Regulation 40 commenced) are included in the highest 2% of daily river level recorded during this period, suggesting storm water was trapped in the Anglian Water system for a number of days.

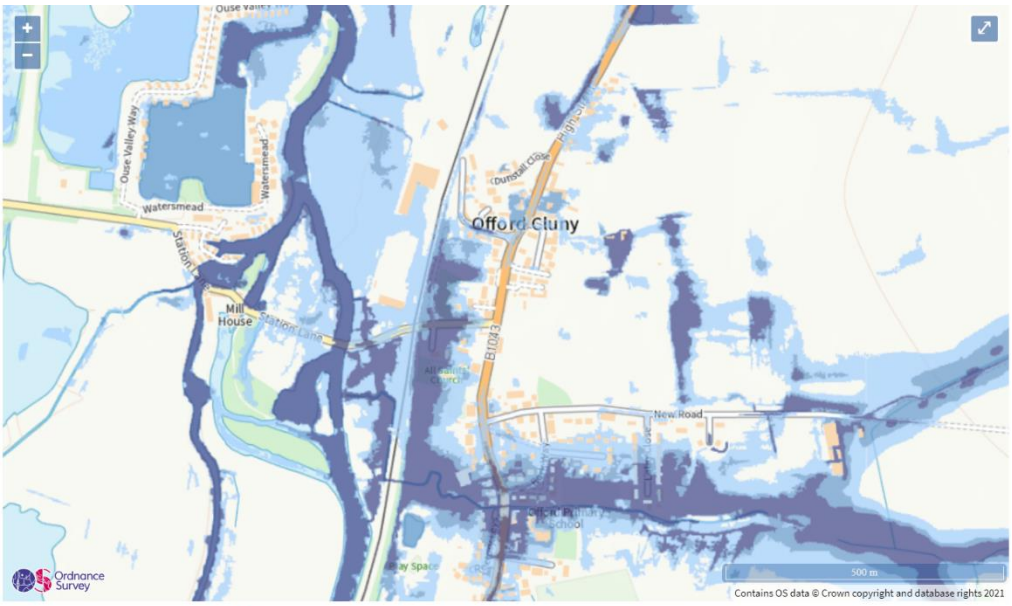


Darker blue shaded areas on long term data indicate maximum and minimum levels for the date (you may need to zoom in closer to see them).

Data from https://riverlevels.uk/ - at **Environment Agency Location ID:** E24367. **Stage Datum:** 10.8m AOD

High risk locations for surface water flooding

The below surface water flood map shows a number of properties in Offord Cluney at risk of flooding due to surface water which corresponds to the pictoral evidence of surface water flooding and location where surface water was directed into the Anglian Water sewerage system by customer.



Source: Environment Agency website

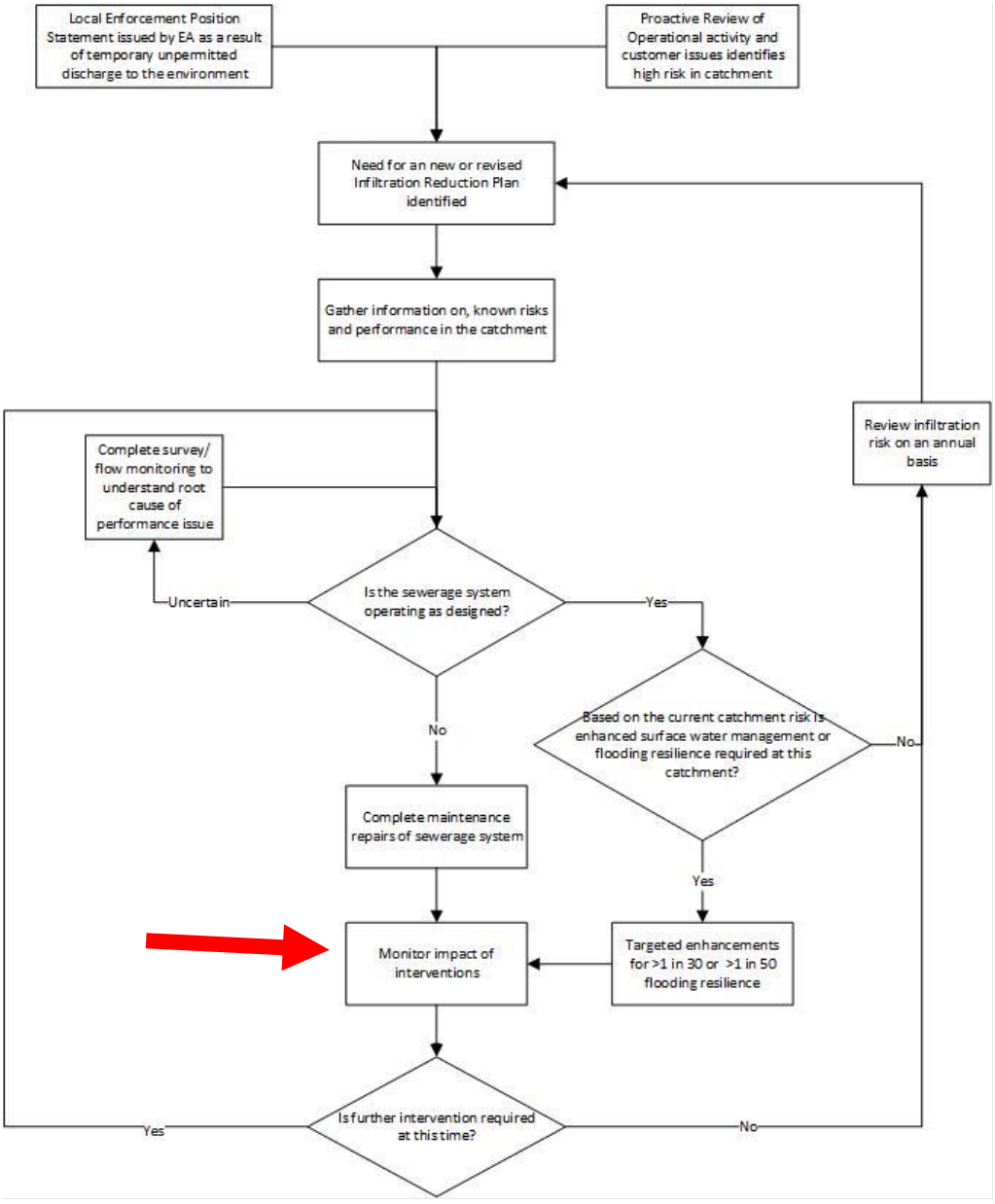
<u>Summary of Historic data</u>

This data shows the Offord's experience a period of sustained wet weather leading to saturated ground conditions and the highest river levels recorded at least since 2012. The river levels directly impacted the CSO's ability to discharge as it was visibly submerged (see pictures in section above) which meant storm water could not escape from the sewerage system. Similarly, the pumping station wet well levels directly correlate with the river level, particularly at the peaks, such as the 27.01.21 where the river levels dramatically increase (and then remain high for 12 days) which coincides with when the CSO could no longer discharge and pumped discharge to the environment under Regulation 40 commenced. Surface water run off also led to 8 properties being externally flooded, which aligns with the area identified by the EA as being at high risk of surface water flooding. This water was directed into the Anglian Water sewerage system, which further amplified the inundation of the Anglian Water sewerage system.

Investigation process

Anglian Waters Infiltration Reduction Process

Anglian Water's capital intervention process includes the following stages: identification of risk, root cause analysis, intervention, review, and lessons learned. To align this process with the Environment Agency's Regulatory Position Statement on discharges made from groundwater surcharged sewers, Anglian Water have clarified how our process is applied to the investigation and remediation of catchments with high infiltration risk in the below process diagram. The red arrow indicates where Offord is within the investment process.



Interventions to date

Operational response

The Local Enforcement Position statement was approved 19.02.21 following the temporary pumping of excess water from the sewer to the adjacent watercourse under Regulation 40 from 8th Feb – 15th Feb 2021. We set this up using a 4" overpump and only for as long as necessary to allow the pumps at OFFSSM to beat the incoming flows. The discharge was routinely monitored on a daily basis. Strainers were fitted to the overpump pipework to screen debris from the water. The water in the sewer was visually clear with an ammonia content of 3 mg/l or lower.

Work type	Work detail	Date complete
Maintenance investigation	Minor infiltration identified on upstream sewer prior to pumping station from manhole.	May 2020
LEP	LEP approved to respond to wet weather event	Feb 2021

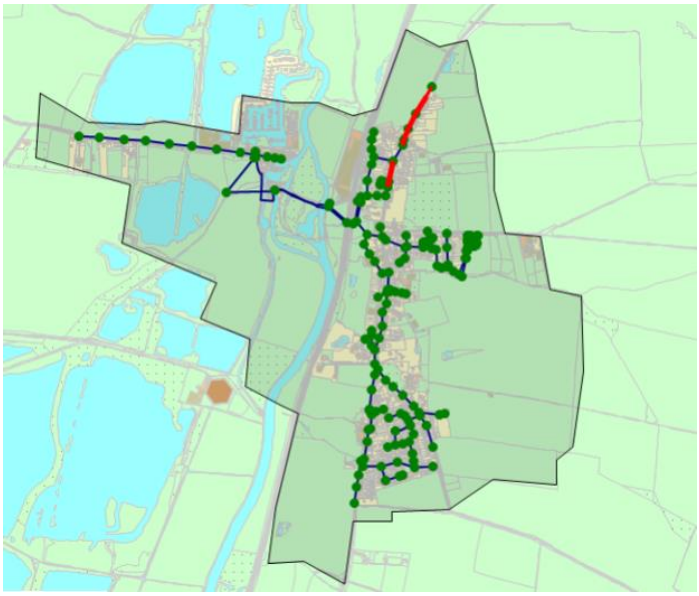
Investigations and Capital Maintenance interventions

Inspections include visual inspections, CCTV, flow monitoring to understand the problem. Capital maintenance interventions include sewer relining and pumping station maintenance.

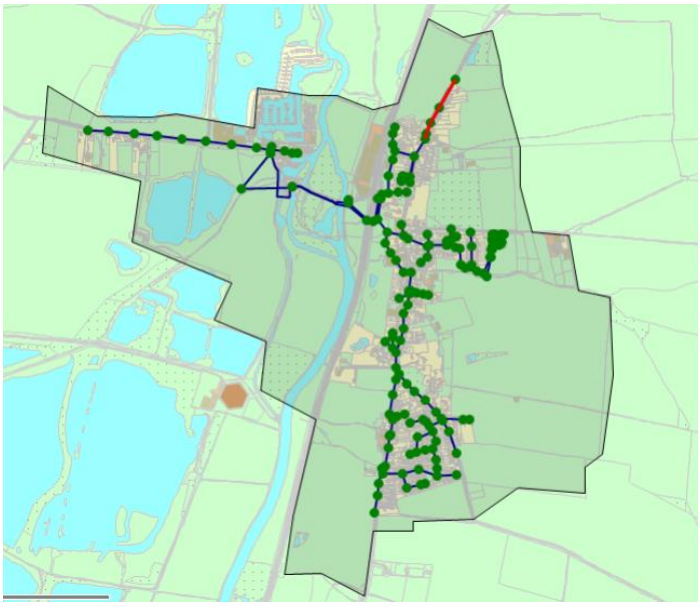
Work type	Work detail	Date complete
CCTV	390m CCTV survey along the top end of the High Street and infiltration identified. Local teams believe this was also relined but we do not have records of this.	2013
Pump refurbishment	Pumps were refurbished by IOS primarily focusing on upgrading the pumps to reduce blockage risk.	June 2020

Historic CCTV completed- sewers shown in red

The green spots on the plans below are manholes on the gravity sewer network.



Infiltration found from historic CCTV- sewers shown in red



<u>Intervention Summary</u>

There has been very little historic work completed in Offord due to no incidents of customer issues. Historic CCTV was completed along the top of the high street 3 lengths were identified as having infiltration. Lining of the sewer was possibly done here as a result of the CCTV survey in 2013, however it has not been updated on the system so this is currently unconfirmed. We recommend surveying this line again to confirm whether this was complete. This area flooded in recent wet weather events so we will recommend a CCTV survey here to understand if there is further infiltration, as operational teams have also identifed clear water entering a number of manholes.

Future Initiatives

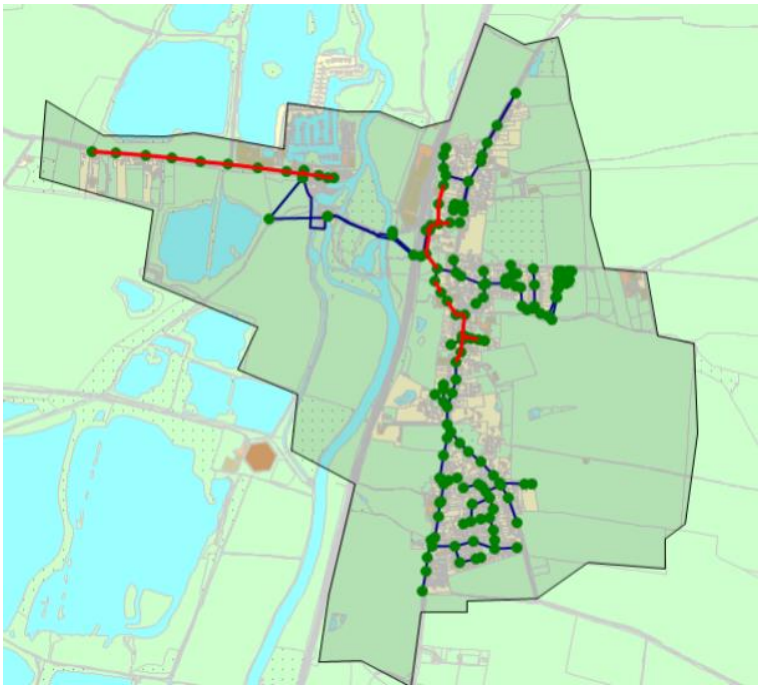
A combination of surface water flooding and inundation of the Anglian Water sewerage system from the River Ouse led to a discharge to the environment being made under Regulation 40.

The inundation of the sewerage network, when the river floods or are unusually high, or in times of exceptional rain and surface run off due to ground saturation, are not factors to be addressed by Anglian Water. A collaborative approach with the, local land owners, Lead Local Flood Authority (LLFA) and the Environment Agency will be required to address the primary root causes of the events in Offord this winter.

Capital Intervention Plan

Whilst we are satisfied that Anglian Water asset condition was not responsible for the discharges made direct to watercourse during February 2021, our investigation has highlighted some high risk locations for infiltration & evidence of infiltration into manholes. Along with a resurvey of the sewer length potentially relined in 2013, it is therefore recommended that the below sewers at risk of infiltration are CCTV'd to identify if there are any sewer defects which may be allowing groundwater to enter the system. In addition to the below sewers at risk of infiltration, the length CCTV along Silver Street, Buckden (downstream of the Offords) will also be surveyed (as part of proactive catchment maintenance).

Potential sewers at risk from infiltration (in red)



CCTV of at risk sewers including along High Street, Asplins Lane, Whitwell Close and part of Station Road. Due to the high infiltration risk, aligned with the customer properties that were affected during the wet weather period and potential infiltration points identified by operations.

Benefits Tracking

How will we measure success of interventions?

We will monitor the CCTV footage to be able to put forward solutions to eliminate any infiltration found to be entering the sewerage system. However, as this event points towards a surface water issue, this is not an issue that should be managed by Anglian Water.

A collaborative approach with the, local land owners, Lead Local Flood Authority (LLFA) and the Environment Agency will be required to address the primary root causes of the events in Offord this winter.

Review period

This infiltration reduction plan will be reviewed after the CCTV to determine any infiltration sources have been identified, and confirm timescale for any subsequent maintenance activities.

Reviews meeting between Anglian Water and the Environment Agency have been scheduled to run bi-annually in the months of April and October each year, where this plan will be review until such time as the catchment risk is considered to be resolved.

Review Period	Findings	Outcome
31/03/22	CCTV survey results	Many infiltration points identified along High Street, The Cranny and Park Way.

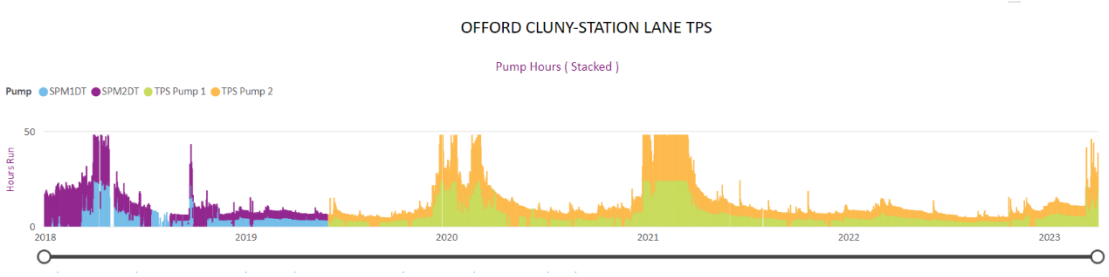
Conclusions

For this incident we have enough evidence to be confident that this event was due to the high rainfall and surface water runoff, resulting in high river levels, the CSO being unable to discharge, and the impact of people on the network (lifting manholes to allow groundwater to discharge directly into the network). To resolve this from reoccurring in the future, it would require third parties, such as LLFA's, local land owners, and EA, to work together in partnership with Anglian Water.

Anglian Water operational teams have identified some signs of infiltration through lifting manhole lids. Whilst this is not believed to be a significant factor in the 2020/21 event we will investigate this using CCTV surveys, including at risk sewers to identify and eliminate any sources of infiltration. Maintenance activities on the Anglian Water network will not prevent a repeat incident, if a future similar wet weather event were to occur. It is, however, recommended that the IRP be considered complete at the point at which any identified infiltration maintenance is carried out.

Work detail	To be completed by
CCTV sewers as risk of infiltration and along High Street.	31/03/22 (completed 25/02/22)
Sewer and lateral lining to High Street, The Cranny and Park Way.	31/03/23 (completed 20/10/22)
Manhole sealing to prevent customers opening them in future events.	31/03/23 (completed 20/10/22)
Investigate options to prevent submergence of CSO	31/03/23
Monitor flow reduction over winter 23	31/03/24

The CCTV completed in early 2022 identified numerous points of infiltration in the Offords, much of the infiltration was identified on customer laterals and manholes. The work to line the sewers and laterals has now been completed and pump hours run in the catchment show a reduction in length of peaks, indicating that flows in the catchment have reduced and the work has been successful. However due to winter '22 being particularly dry, flows will be continued to be monitored over a further wet period (winter '23).



During a review of the area in October 24, although Offord had seen some heavy rainfall throughout Sept, no further customer issues had been reported. AW recommend this plan currently be archived.

As an approved EA IRP if temporary discharges are required Anglian Water are to inform the Environment Agency of any advance notice of discharges to be made, via ANGLIANOSMFAILURES@environment-agency.gov.uk and to inform of commencement of the discharge through the Agency's National Incident Communication Service. Notifications of the discharge will also be included on the Anglian Waters website on 'In Your Area' and communication made with locally impacted customers, Parish Councils, Local Authorities.

APPENDIX

LEP Data

Table showing NH3 results as well as changes of Copasacs and pump run hours.

Sample Date	Sample Time	NH3 Reading (crude wet well/manhole) mg/l	NH3 Reading (discharge point) mg/l	NH3 reading (down-stream) mg/l	NH3 down-stream distance (metres)	Notes
08/02/21	14:20		1.33	0.29	15m	
09/02/21	11:30		1.63	0.97	7m	
10/02/21	22:31		1.63	0.76	10m	
11/02/21	09:49		1.63	1.6	10m	
12/02/21	12:40		1.23	0.9	10m	
13/02/21	14:30		2	0.85	10m	
14/02/21	08:40		3.12	1.05	10	
15/02/21	09:36		4.05	3.05	20	
16/02/21	11:00		Pumps off - Reading in MH = 3.34	0	10m	
17/02/21	08:50		Pumps off - Reading in MH = 4.5	0	10m	
18/02/21	09:11		Pumps off - Reading in MH = 3.81	0		
19/02/21	09:11		Pumps off - Reading in MH = 5.03	0		
20/02/21	13:22		Pumps off - Manhole (inet 5.25)	0		
21/02/21	12:00		Pumps off - Manhole (inet 7.3)	0	5m	
22/02/21	09:00		Pumps Off - 0	0.1	10m	Site checked in the morning; job raised but moved off tablet needs to check if this is done in standby 22.02.21.
23/02/21	09:11		Pumps off - reading in MH = 6.04	0		
26/02/21	Pumps removed		Pumps Removed	Pumps Removed		
27/02/21	Pumps removed	Pumps removed	Pumps Removed	Pumps Removed		

Highest River level recorded from the River Ouse (Diddington-Offord; EA location ID E24367) since November 2012. Dark orange shows the 12 days prior to 8th Feb when a discharge under Regulation 40 was made. Highlighted data shows all dates from 24th December – 8th Feb.

Date	Min_level	Avg_level	Max_level
27/12/2020	1.229	1.297	1.339
10/03/2016	1.16	1.239	1.29
24/12/2020	0.939	1.174	1.267
26/12/2020	0.962	1.033	1.246
28/12/2020	1.014	1.122	1.227
09/03/2016	0.59	0.904	1.21
28/12/2017	0.983	1.138	1.193
13/12/2019	0.807	1.065	1.186
27/12/2017	0.694	1.027	1.183
03/02/2021	1.108	1.137	1.175
02/02/2021	1.11	1.125	1.163
11/03/2016	1.06	1.095	1.16
13/03/2016	1.1	1.139	1.16
12/01/2016	1.03	1.121	1.15
25/12/2020	0.965	1.035	1.143
12/03/2016	1.06	1.095	1.14
30/12/2017	1.074	1.102	1.124
01/02/2021	1.075	1.107	1.119
10/03/2014	0.42	0.59	1.11
04/02/2021	0.927	1.016	1.106
14/12/2019	1.014	1.063	1.101
11/01/2016	0.97	1.024	1.1
19/11/2019	1.02	1.066	1.098
18/11/2019	1.047	1.066	1.094
15/01/2021	0.962	1.067	1.092
15/11/2019	1.037	1.064	1.079
31/12/2017	1.056	1.066	1.075
01/01/2018	0.911	1.005	1.075
14/01/2021	0.478	0.907	1.075
29/12/2017	0.943	0.984	1.071
07/02/2014	0.84	1	1.07
08/02/2014	0.98	1.03	1.07
07/02/2021	0.985	1.023	1.064
14/11/2019	0.89	0.933	1.053
17/12/2019	0.656	0.884	1.049
17/11/2019	1.025	1.028	1.048
29/01/2021	1.002	1.023	1.047
31/01/2021	1.011	1.036	1.047
16/12/2019	1.021	1.032	1.046
08/02/2021	0.905	0.998	1.044
15/12/2019	1.014	1.029	1.043
17/01/2021	0.986	1.027	1.041
04/01/2016	0.95	0.994	1.04
30/01/2021	0.963	0.981	1.038

16/11/2019	1.025	1.028	1.031
10/02/2014	0.48	0.98	1.03
11/02/2014	0.96	1.01	1.03
03/04/2018	0.905	0.981	1.024
16/01/2021	0.908	0.928	1.022
09/01/2014	0.99	1.01	1.02
02/04/2018	0.729	0.845	1.018
29/12/2020	0.731	0.853	1.013
13/01/2016	0.96	0.994	1.01
21/12/2019	0.95	0.982	1.007
28/01/2021	0.764	0.897	1.002
26/11/2012	0.94	0.96	1
25/12/2012	0.95	0.98	1
10/01/2014	0.93	0.98	1
03/01/2018	0.744	0.886	0.999
06/02/2021	0.973	0.984	0.994
08/10/2020	-10.807	-4.167	0.991
09/02/2014	0.95	0.97	0.99
14/01/2016	0.98	0.986	0.99
05/02/2021	0.926	0.966	0.989