Appendix A

S19-941

Wyberton West Road & Park Road, Boston

Section 19 Flood and Water Management Act 2010

Date Prepared – 30/07/2025

GeoSmart Information Ltd

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Executive summary

The purpose of this Section 19 (S19) Flood Investigation Report is to identify the cause of flooding which affected the property internally. The report will provide an overview of the problem, identify the flooding mechanisms, identify relevant Risk Management Authorities (RMAs) and stakeholders, and provide a list of recommendations. It is however important to note that this investigation report cannot provide designed or costed solutions and / or enforce those identified RMAs or persons to undertake any of the proposed recommendations.

This report was commissioned to consider internal flooding at 38 properties on Wyberton West Road and Park Road, Boston (Properties A to AM), which occurred as a result of substantial rainfall experienced in the early hours of 06 January 2025. The event involved an area of low pressure crossing South and Central England, which resulted in heavy rainfall and snowfall across areas of high ground throughout the East Midlands. This resulted in several stations across Lincolnshire recording their wettest January day on record (Met Office, 2025).

The evidence gathered within this report, including a Site visit on 12 March 2025, confirms that 38 properties in Boston experienced internal flooding following heavy rainfall on 06 January 2025. (Note that internal flooding could only be directly confirmed at 17 properties; two of the properties reported to have experienced internal flooding are understood to have experienced external or no flooding, whilst one additional property was confirmed to have experienced internal flooding.) Photograph evidence of the flooding has been provided within Section 3.5.

Flooding mechanism

Affected properties (Properties A to AL)

Properties A to AL are likely to have experienced internal flooding as a result of the overtopping of two wall sections along the southern bank of the South Forty Foot Drain (SFFD) in the late evening of 06 January 2025. The rise in water levels was generally driven by extreme rainfall and snowmelt in the Black Sluice catchment, with peak flows reaching the lower reaches of the SFFD during high tide (which prevented their discharge into the tidally influenced Haven).

The flooding experienced may have been exacerbated due to issues in the management of flood risk assets along the SFFD, particularly along Wyberton West Road. Possible exacerbating factors include:

- Decommissioning of the Black Sluice Pumping Station;
- Operational problems associated with the sluices at the Black Sluice Complex;
- Low points on the southern bank of the SFFD, adjacent to Wyberton West Road;
- Correlation of the flooding experienced in relation to the operation of the Black Sluice Emergency Response Plan.

The water ingress method for the properties is summarised below:

- Fluvial flows from the SFFD flowed in a southerly direction, causing internal flooding to Properties A to AB primarily via back doors, and spilling onto the highway to the south of the property via buildings, alleyways and driveways;
- Fluvial flows accumulated along the northern section of Park Road as this reflects a low point relative to the surrounding land, causing flooding to Properties AE to AL;
- Fluvial flows continued in a westerly direction along Wyberton West Road and accumulated in the driveways at Properties AC and AD, exceeding the front door threshold and causing internal flooding.

Road closure at Wyberton West Road

The road closure at Wyberton West Road occurred as a result of overtopping of the low wall sections due to high water levels on the SFFD, via the same mechanisms as identified for the affected properties (see above). Flood waters from the SFFD travelled in a southerly direction via gardens and dwellings before flowing in a westerly direction along the highway and primarily accumulating at the junction with Park Road.

Road closure at Chain Bridge Road

The road closure at Chain Bridge Road is understood to have occurred to reduce traffic along Wyberton West Road, as several residents had reported bow waves from vehicles were exacerbating the flooding experienced at their properties. It is also understood that flooding on Chain Bridge Road occurred during this incident.

Relevant RMAs (listed in alphabetical order)

In relation to this flood incident, Black Sluice Internal Drainage Board (IDB) and the Environment Agency (EA) are considered to be the relevant RMAs.

Recommendations

The residents of the affected properties should consider implementing flood resistance and resilience measures at their properties to reduce the possible impacts of flooding should it occur again in the future.

The residents of Wyberton West Road and Park Road, with support from Boston Borough Council and/or the Lincolnshire Resilience Forum (LRF), should consider producing a flood action plan (where not done so already) to ensure that they are suitably prepared should flooding occur again in the future.

The EA should consider reviewing the hydraulic modelling for the SFFD to ensure that it is reflective of the flooding experienced on 06 January 2025. Following this, the plan for mitigation within the Black Sluice Catchment should be reviewed to ensure it remains appropriate.

The EA should consider reviewing the potential for a Flood Warning service for the downstream reaches of the SFFD; should this be deemed unfeasible, consideration should be given to amending the wording of the Flood Alert for this area to reduce confusion regarding the potential for internal flooding and whether future warnings will be received.

The EA should consider a review of their processes for operating assets on the SFFD and Black Sluice IDB should consider reviewing their Emergency Response Plan, to ensure that lessons identified during January 2025 are implemented accordingly.

The EA should consider raising the two wall sections along Wyberton West Road so that they are at the same height as the adjacent sections of embankment, to reduce the potential for future overtopping in this location.

1. Introduction

1.1 Purpose and limitations of this flood investigation report

On Monday 06 January 2025, Lincolnshire County Council (LCC), in its capacity as Lead Local Flood Authority (LLFA) was notified of flooding to:

Table 1 – Properties covered as part of this investigation; * A neighbour indicated that Property A experienced external flooding only, but this has not been confirmed directly by the resident at this property

Address	Reference	Reported Extent	Confirmed Extent
[redacted] Wyberton West Road, Boston, [redacted]	Property A	Internal	N/A*
[redacted] Wyberton West Road, Boston, Boston, [redacted]	Property B	Internal	Internal
[redacted], Wyberton West Road, Boston, [redacted]	Property C	Internal	Internal
[redacted] Wyberton West Road, Boston, [redacted]	Property D	Internal	N/A
[redacted] Wyberton West Road, Boston, [redacted]	Property E	Internal	Internal
[redacted] Wyberton West Road, Boston, [redacted]	Property F	Internal	Internal
[redacted] Wyberton West Road, Boston, [redacted]	Property G	Internal	N/A
[redacted] Wyberton West Road, Boston, [redacted]	Property H	Internal	Internal
[redacted] Wyberton West Road, Boston, [redacted]	Property I	Internal	Internal
[redacted] Wyberton West Road, Boston, [redacted]	Property J	Internal	Internal
[redacted] Wyberton West Road, Boston, [redacted]	Property K	Internal	N/A
[redacted] Wyberton West Road, Boston, [redacted]	Property L	Internal	N/A
[redacted] Wyberton West Road, Boston, [redacted]	Property M	Internal	N/A

Address	Reference	Reported Extent	Confirmed Extent
[redacted] Wyberton West Road, Boston, [redacted]	Property N	Internal	Internal
[redacted] Wyberton West Road, Boston, [redacted]	Property O	Internal	Internal
[redacted] Wyberton West Road, Boston, [redacted]	Property P	Internal	N/A
[redacted] Wyberton West Road, Boston, [redacted]	Property Q	Internal	N/A
[redacted] Wyberton West Road, Boston, [redacted]	Property R	Internal	N/A
[redacted] Wyberton West Road, Boston, [redacted]	Property S	Internal	Internal
[redacted] Wyberton West Road, Boston, [redacted]	Property T	Internal	N/A
[redacted] Wyberton West Road, Boston, [redacted]	Property U	Internal	Internal
[redacted] Wyberton West Road, Boston, [redacted]	Property V	Internal	N/A
[redacted] Wyberton West Road, Boston, [redacted]	Property W	Internal	N/A
[redacted] Wyberton West Road, Boston, [redacted]	Property X	Internal	Internal
[redacted] Wyberton West Road, Boston, [redacted]	Property Y	Internal	N/A
[redacted] Wyberton West Road, Boston, [redacted]	Property Z	Internal	N/A
[redacted] Wyberton West Road, Boston, [redacted]	Property AA	Internal	Internal
[redacted] Wyberton West Road, Boston, [redacted]	Property AB	Internal	N/A
[redacted] Wyberton West Road, Boston, [redacted]	Property AC	Internal	N/A

Address	Reference	Reported Extent	Confirmed Extent
[redacted] Wyberton West Road, Boston, [redacted]	Property AD	Internal	Internal
[redacted] Wyberton West Road, Boston, [redacted]	Property AE	Internal	N/A
[redacted] Park Road, Boston, [redacted]	Property AF	Internal	N/A
[redacted] Park Road, Boston, [redacted]	Property AG	Internal	Internal
[redacted] Park Road, Boston, [redacted]	Property AH	N/A	Internal
[redacted] Park Road, Boston, [redacted]	Property AI	Internal	N/A
[redacted] Park Road, Boston, [redacted]	Property AJ	Internal	N/A
[redacted] Park Road, Boston, [redacted]	Property AK	Internal	N/A
[redacted] Park Road, Boston, [redacted]	Property AL	Internal	Internal
[redacted] Park Road, Boston, [redacted]	Property AM	Internal	No flooding
Chain Bridge Road, Boston, [redacted]	Chain Bridge Road	Road closure	N/A
Wyberton West Road, Boston	Wyberton West Road	Road closure	N/A

During a site visit to Boston, internal flooding within 16 properties was confirmed (Table 1); one further property (Property AH) was confirmed via a response to the LCC questionnaire. Two road closures were also reported.

Having regard to LCC's 'Guiding Principles' for Section 19 flood investigations, it was deemed necessary that a flood investigation report be undertaken pursuant to Section 19 of the Floods and Water Management Act 2010 (as amended).

The purpose of this Section 19 flood investigation report is to:

- Investigate reports of internal flooding to understand and determine the cause of flooding;
- Determine which Risk Management Authorities (RMAs) have relevant flood risk management functions;
- Propose recommendations that may alleviate potential future flooding events or if the affected properties or location should be considered as suitable for a capital project. It is however important to note that this investigation report cannot provide designed or costed solutions and / or enforce those identified RMAs or persons to undertake any of the proposed recommendations.

It should be noted that one property (Property AM) was confirmed as having not experienced any flooding during the Site visit; therefore, it has been discounted from the investigation. A neighbour indicated that Property A experienced external flooding only, but this has not been confirmed by the resident at Property A themselves; in any case, the flood mechanism would be the same as for the other properties on Wyberton West Road.

1.2 Sources of evidence

The information used to inform the conclusions of this S19 report is:

- Site visit, including conversations with residents at properties reported to have internally flooded, and observations of nearby watercourses and drainage assets;
- The results of a survey which LCC made available to residents affected by flooding;
- Review of the Environment Agencies (EA) Flood Map for Planning, Risk of Flooding from Surface Water mapping, and GeoSmart's FloodSmart Analytics mapping;
- Publicly available mapping, such as the EA's LiDAR elevation data and British Geological Survey geological data;
- River level gauge data covering the storm event;
- Mapping of LCC's known drainage assets;
- Mapping of Anglian Water's surface and foul sewer network (where available); and
- Relevant information provided by RMAs (where available).

Following receipt and assessment of this information, the likely flood mechanism was determined. Where respondents have not provided information regarding the timing and source of flooding, this has been inferred from Site walkovers as well as the available flood mapping and publicly available records.

Given the source of flooding, issues have been identified within the Site area which contributed to the flooding, and recommendations have been made to resolve these issues.

In the case of some Sites, flood mitigation measures have already been implemented following the flood event. Where this has occurred, an indication of whether this would provide satisfactory resolution of the issues has been provided.

Note that much of the data was provided from personal accounts. As such, the completion and accuracy of this information is variable, and in some cases there have been contradictions between nearby residents' accounts.

2. Background information

2.1 Site location

Properties A to AL are located in the town of Boston (Figure 1). They are situated within the Boston Borough area of Lincolnshire and the internal drainage district of Black Sluice Internal Drainage Board (IDB).

(Figure 1 – Location of the affected properties)

Properties A to AD are located along the northern side of Wyberton West Road, comprising a mix of terraced, semi-detached and detached properties. The South Forty Foot Drain (SFFD) forms the northern boundary of each residential plot and is located c. 10 to 40 m north of the dwellings themselves.

An additional property (AE) is located on the southern side of the junction between Wyberton West Road and Park Road, c. 80 m from the SFFD. Meanwhile, Properties AF to AL are located on both sides of the northern section of Park Road, c. 90 to 140 m from the drain.

The SFFD is an artificial channel, designated as a Main River, used to drain the Black Sluice District. The district comprises two catchments: 'upper', with elevated ground levels, where runoff accumulates within drainage channels within the district; and 'lower', low-lying primarily agricultural land. A map of the Black Sluice catchment is included within Appendix 7.5.

The drain 'flows' in an easterly direction through Boston prior to being discharged into the Haven, the tidal outfall channel for the River Witham, via gravity sluices (note: the Black Sluice

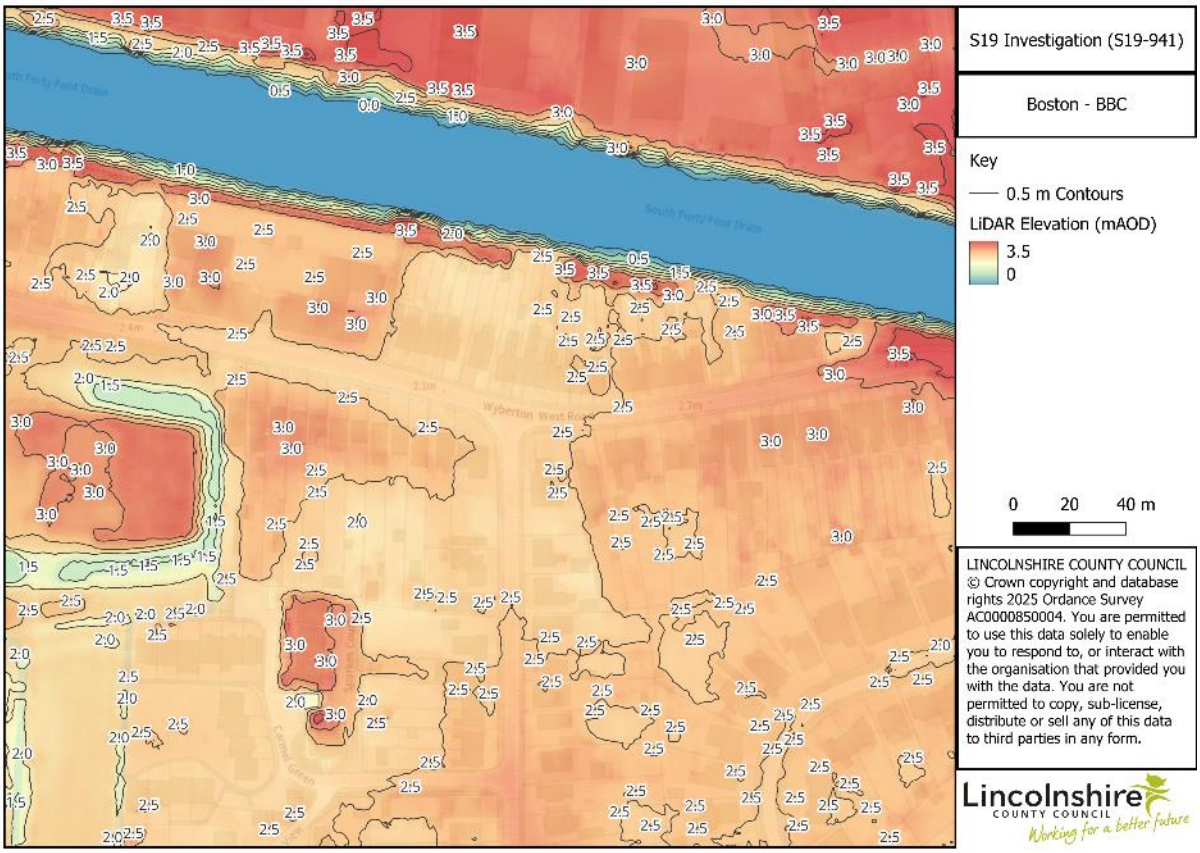
Pumping Station, which previously provided discharge at high tide, will be discussed further in Section 2.5). The Haven eventually discharges into the North Sea, c. 8 km south-east of the properties.

The lower SFFD catchment (which includes the affected properties) is generally underlain by superficial deposits comprising Tidal Flat Deposits, which consist of clay and silt (BGS, 2025) and are classified as Unproductive Strata (EA, 2025). The underlying bedrock is variable but generally comprises mudstone with an associated Unproductive Strata classification.

The underlying clayey setting is likely to reduce the possible infiltration of rainfall, even under optimal conditions, with the model report for the Black Sluice Catchment noting that saturation of the soils in the upper catchment can occur rapidly (Mott MacDonald, 2016).

An IDB maintained watercourse is located c. 5 m to the east of Property AD, with an outfall into the SFFD; however, at this stage it is not considered relevant to the flooding that occurred on 06 January 2025.

Properties A to AD are located in a local topographic low relative to the surrounding land (Figure 2). Wyberton West Road falls towards the junction with Park Road from both directions, while Park Road itself falls in a northerly direction. The affected properties are generally located on lower ground compared to adjacent unimpacted properties, with the highway falling towards Properties A to AD. Properties AF to AL are also noted to be located at a lower elevation than Park Road.

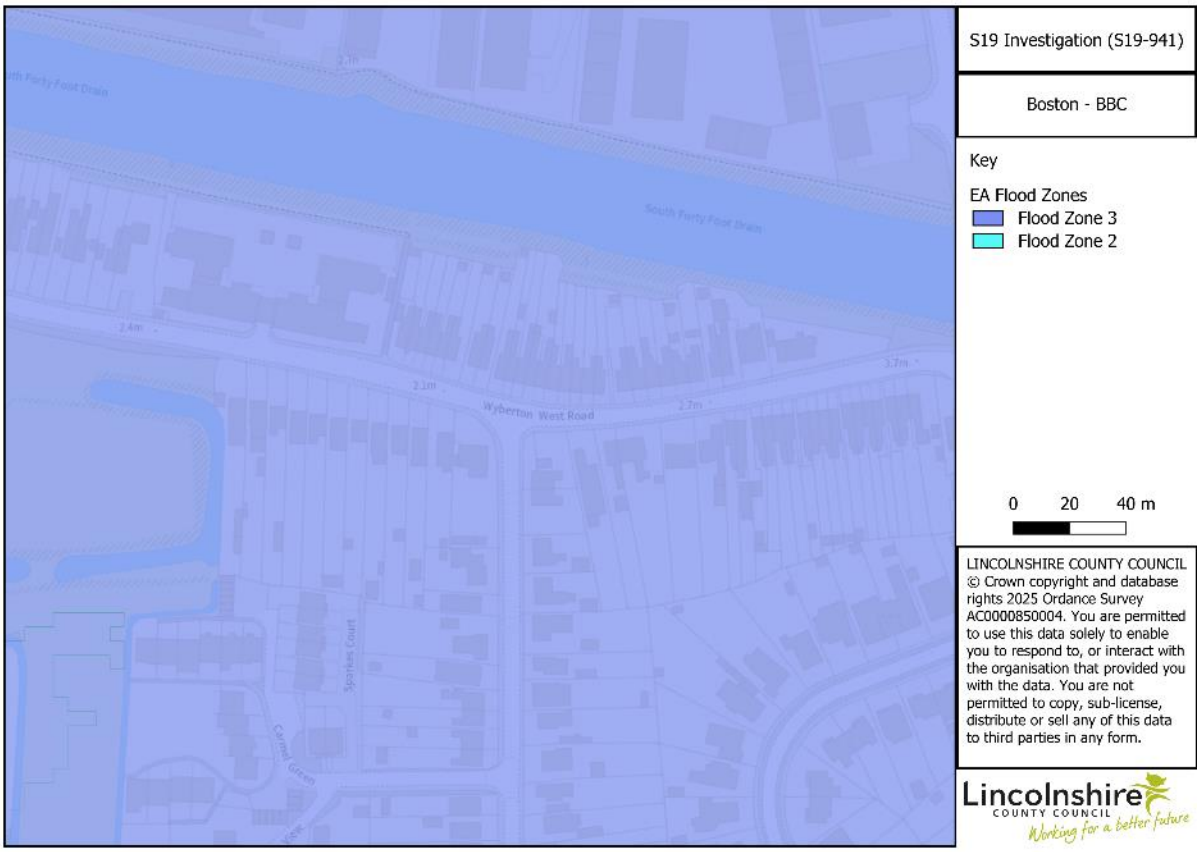


(Figure 2 – LiDAR elevation data for the affected area)

High ground associated with the southern bank of the SFFD is located along the northern boundary of the residential plots for Properties A to AD, with notable decreases in this level at Properties R to U and D to F.

2.2 Flood risk overview

According to the EA's Flood Map for Planning Purposes, the properties are located in the EA's tidal Flood Zone 3, which indicates it has a High probability of tidal flooding (Figure 3).



(Figure 3 – Flood zone mapping for the properties and surrounding area)

According to the EA's Risk of Flooding from Rivers and the Sea (RoFRS) mapping, the properties occupy land that have a Low risk of fluvial and tidal flooding.

According to the national scale Risk of Flooding from Surface Water (RoFSW) mapping, the area surrounding the properties has a variable present day risk of flooding from surface water, ranging from Very Low to High. However, as the January flood event was caused by fluvial flooding, further consideration of surface water flood risk is not considered relevant in this context.

According to GeoSmart's FloodSmart Analytics mapping, the properties and surrounding area are all at Very Low risk of groundwater flooding.

The RoFRS and national scale RoFSW mapping uses the following classifications:

- High risk – an area has an annual chance of flooding greater than 3.3%;
- Medium risk – an area has an annual chance of flooding of between 1% and 3.3%;

- Low risk – an area has an annual chance of flooding of between 0.1% and 1%; and
- Very Low risk – an area has an annual chance of flooding less than 0.1%.

It should be noted that the above analysis carries the following disclaimer (EA, 2025):

> *"All information, particularly the likelihood of surface water flooding, is a general indicator of an area's flood risk. As such, it is not suitable for identifying whether an individual property will flood. This service uses computer models to assess an area's long-term flood risk from rivers, the sea, surface water and some groundwater. It does not include flood risk from sources such as blocked drains and burst pipes."*

2.3 Drainage arrangements

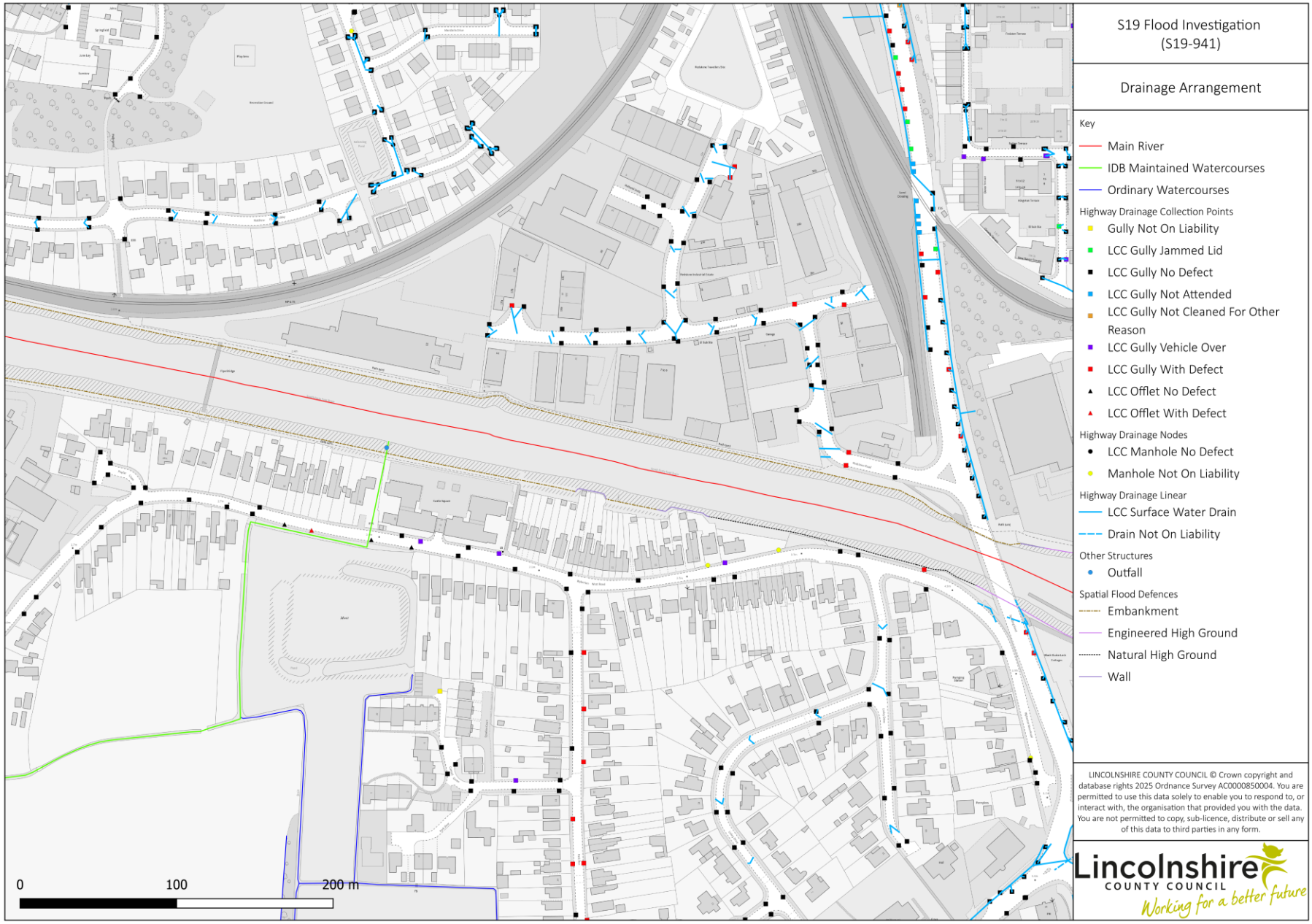
Highway and public sewer asset data were reviewed as part of the investigation. However, as there is no supporting evidence to indicate that they were a significant contributory factor to the observed internal flooding, they are not deemed relevant and therefore have not been assessed further.

Flood defences are present on the southern bank of the SFFD (as indicated within Figure 4). These defences comprise a mixture of walls, embankments and natural high ground:

- Natural high ground is located adjacent to Property B, with an effective crest level of 3.84 mAOD. The defences are estimated to provide protection up to a 1 in 20 year (5% AEP) event and are recorded as having a condition grade of 3 ('fair');
- Two sections of flood walls are located adjacent to Properties B to F and P to U, with effective crest levels between 2.80 and 2.88 mAOD (Photographs 1 to 3 in Appendix 7.3). These crest levels are validated by a post-incident flood wall survey undertaken by the EA as part of their review of the flood event (see Section 3.3). The defences are estimated to provide protection up to a 1 in 20 year (5% AEP) event and are recorded as having condition grades of 3 ('fair') to 4 ('poor');
- The remainder of defences along this section of the SFFD comprise embankments with effective crest levels between 2.90 and 3.03 mAOD; The defences are estimated to provide protection up to a 1 in 20 year (5% AEP) event and are recorded as having a condition grade of 4 ('poor').

Consultants from GeoSmart Information Ltd visited the properties and surrounding area on 13 and 14 March 2025. As part of the visit, the drainage network on Wyberton West Road and Park Road was inspected, which confirmed that gullies and offlets are present along both highways in the same arrangement as included within LCC records.

A linear drain was observed along the kerb line between Properties O and T, which appeared blocked with silt in places (Photograph 7 in Appendix 7.3).



(Figure 4 - Known drainage assets included within LCC records along Wyberton West Road at the time of publication)

An inspection of the defences along the southern bank of the SFFD indicates that they are present in the recorded arrangement. The EA's asset information, including the post-incident wall survey undertaken as part of the review of the flood event (see Section 3.3), suggests that the sections of flood wall are only c. 0.1 to 0.3 m lower than the adjacent sections of embankment. It should be noted that several residents reported that the wall had been sealed subsequent to the 06 January 2025 flood event (Photograph 4 in Appendix 7.3), which is also discussed within the EA's review of the flood event (see Section 3.3).

At the time of the Site visit in March 2025, the SFFD had a water level c. 3 m lower than the bank height and appeared to have a modest flow.

2.4 Previous flood incidents

Whilst several S19 flood investigations have been conducted within Boston, none of these are within close proximity to the affected properties; therefore, they are not considered relevant to the 06 January 2025 flood event. The properties were not impacted during the 2013 tidal surge event (which caused widespread flooding along the River Witham).

Numerous reports of blocked drains and previous flooding along Wyberton West Road have been made. The majority of these reports relate to blocked drains on the highway, which is not considered relevant to the flood investigation and therefore have not been analysed further. The following relevant reports have been identified:

- Sinking of the bank along the SFFD was reported adjacent to Wyberton Road in October 2016 (ref: 240325). The bank was reported to be safe and secure, but the enquiry was noted for future monitoring.
- Regular flooding was reported in the rear garden at Property AF in February 2024 (ref: 4190412). The enquiry was listed as having a job raised and committed, although it is not known what subsequent actions (if any) were taken.

According to the EA's Historical Flood Map, no fluvial or tidal flood incidents have previously affected the Site.

The South East Lincolnshire SFRA (South East Lincolnshire Joint Strategic Planning Committee 2017) does not include any information regarding historical flood incidents within the vicinity of the properties.

Anecdotally, during the Site visit, the residents all reported that their properties had not previously experienced flooding, and that the wall along the southern bank of the SFFD had not previously overtopped. One resident (at Property F) indicated that they had previously experienced flooding in their garden, which was also mentioned within the EA's review of the flood event (EA, 2025) as a result of seepage through the right bank of the SFFD.

2.5 Control structures for the SFFD

The SFFD discharges into the Haven c. 300 m east of the properties. At present this occurs by gravity using sluices; in the past, a pumping station also contributed to this. These assets,

sometimes referred to collectively as the Black Sluice complex, are discussed in more detail in Sections 2.5.1 and 2.5.2. Further discussion of the upstream assets is provided in Section 2.5.3.

Information regarding the control structures has been obtained from the EA's reporting on the Black Sluice Catchment Works, including a Summary Report (2013), Stage 3a – Options shortlisting (2015), Consultation Document (2015), Black Sluice Internal Drainage Board Joint Position Statement (2015), Consultation Response Document (2016), Economic Appraisal (2016) and Black Sluice Catchment briefing note (2019). Information regarding the upstream pumping stations has been obtained from Black Sluice IDB's Emergency Response Plan (2024).

The operation of each flood structure on 06 January 2025 is discussed separately within Sections 3.3, 3.4 and 3.5.

2.5.1 Gravity sluices

At present, flows from the SFFD are discharged into the Haven via two tidal sluices (Photograph 13 in Appendix 7.3). These sluices can discharge up to 45 m^3/s each and are designed to operate automatically when the river is higher than the tidal level. During typical conditions, Gate 1 is used to discharge flows; during periods of high river flows, Gate 2 (which doubles as a navigational lock) is also used. £1 million was spent in inspecting and refurbishing the sluices so they were fit for purpose in 2020.

2.5.2 Black Sluice Pumping Station (BSPS)

The BSPS was constructed in 1946 with three pumps; two further pumps were installed in 1966 (Photograph 12 in Appendix 7.3). The BSPS was used to discharge flows from the SFFD during periods where extreme flows coincide with high tide and was operated by the EA.

The Black Sluice Catchment Works Study began in 2012 as an appraisal into how to effectively manage flood risk within the Black Sluice catchment into the future. However, a storm surge occurred in December 2013, which resulted in three of the five pumps at the BSPS being damaged beyond repair; the estimated cost for repairing the remaining two pumps and refurbishing the pumping station was estimated at £15 to 20 million.

As part of subsequent works, the appraisal found that the BSPS was used for 2-3 days per year (i.e. when high tide coincides with extreme flows on the SFFD). Modelling was undertaken, which indicated that the decommissioning of the BSPS would result in a modest increase in flooding of agricultural land but would not result in an increase in flood risk to property. The appraisal noted the pumping station does not provide protection to properties because:

- The fourth and fifth pumps (commissioned in 1966) were designed to accommodate the additional flows associated with the proposed widening of the SFFD channel, which did not occur;
- The BSPS is used less than 1% of the time, with the sluices able to accommodate the flows for the majority of the time;
- When the BSPS is used, discharging flows via the sluice is delayed.

Several options for managing flows on the SFFD were shortlisted, including decommissioning the pumping station (with either maintenance or armouring existing low points on the SFFD)

and refurbishing two of the five pumps, with their transfer to Black Sluice IDB (also with maintenance and/or bank reinforcements). An economic appraisal found that decommissioning the pumping station with the continuation of maintenance had the highest average benefit cost ratio, with decommissioning the pumping station and sustaining the banks considered to be the best option. Refurbishing the pumping station was not considered to be economically viable.

A consultation was conducted, which indicated that most residents supported refurbishment of the BSPS and its transfer to the IDB. There was also support for armouring low points on embankments.

Following the appraisal, the decision to decommission the BSPS, paired with reinforcing low points on the banks, was made in 2018. As of 2019, works to support this included de-silting of the channel, bank armouring works, natural flood management in the upper catchment, and a pilot study into how the classification of the SFFD could be changed to ordinary watercourse which would result in the SFFD falling under the jurisdiction of Black Sluice IDB.

2.5.3 Upstream pumping stations

Upstream of Boston, water levels on the SFFD are controlled by 32 pumping stations, which pump water from tributaries and lowland drainage ditches into the channel.

During periods of high river levels, Black Sluice IDB (who have responsibility for water level management on ordinary watercourses within the Black Sluice catchment) implements an Emergency Response Plan when levels at Black Hole Drove Pumping Station reach 2.3 mAOD. As part of this, when the water level at Black Hole Drove Pumping Station exceeds 2.7 mAOD, the pumping stations along the SFFD are switched to their emergency profile (The SFFD is considered to be at risk of overtopping its banks if the water level at the same station reaches 2.7 mAOD.).

Through correspondence with Black Sluice IDB it is understood that implementation of the emergency pumping profiles results in approximately 70% of the pumping stations being switched off, although it is worth noting that this is not a binary outcome, i.e., pumps on or off. Due to the introduction of telemetry levels are instead maintained within 300mm of highest known levels thereby reducing (but not eliminating) inflow into the SFFD whilst also minimising the risk of overtopping of upstream catchments.

3. Flood event

3.1 Conditions prior to the flooding

Prior to the flooding event, rainfall conditions were normal across the wider Lincolnshire area.

During November 2024, the Lincolnshire and Northamptonshire area received an average rainfall of 58mm (equivalent to 103% of the long term average) which was classified as within normal range.

Normal conditions continued through December 2024. During this month, the Lincolnshire and Northamptonshire area recorded an average rainfall of 67mm (equivalent to 120% of the long term average). Groundwater levels remained normal or higher following the normal levels of rainfall the Lincolnshire and Northamptonshire area had received. During the month, soil moisture deficits had also decreased, indicating that in general Lincolnshire was slightly wetter than normal for the time of year (EA, 2025).

Following on from this, an Atlantic low-pressure system brought significant rainfall and snowfall across Lincolnshire on 05 and 06 January 2025 (Met Office, 2025). Some locations within Lincolnshire received over 50 mm of rain, equivalent to a whole-month's average rainfall over a two-day period. On 05 January, several weather stations recorded their wettest January day on record including Cranwell, (30.8mm, 111 years of recorded data) and Coningsby (33.2mm, 60 years of recorded data).

Temperatures overnight on 05 and 06 January 2025 were around 0°C, which meant that in many cases the surface of the ground was frozen and covered with a layer of snow. These factors likely resulted in an increase in runoff rates as rainfall was less able to infiltrate into the ground, causing increased overland flow and subsequent rapid rising of river levels.

High tide occurred at 10:38 and 22:59 on 06 January 2025.

To gather more information regarding the antecedent conditions and events of 06 January 2025, the Environment Agency, Black Sluice IDB and Boston Borough Council were contacted. Information provided by the Environment Agency is included within Sections 2.5 and 3.3.

3.2 Rainfall and telemetry analysis

3.2.1 Rainfall analysis

The closest available rainfall gauge is the Frampton Gauge (ref: E46361), c. 3.6 km south of the properties. Rainfall data from this gauge for 05 to 08 January 2025 has been considered as part of this investigation (Figure 5).

The rainfall data was captured by the Met Office's Radar technology and made available from the Meniscus Analytics Platform. Annual chance events were calculated using the FEH2013 DDF model (c). The result of these calculations is summarised within Table 2.

This rainfall data indicates that low intensity rainfall occurred on the morning of 05 January 2025, with occasional rainfall in the afternoon. Intense rainfall then began around 23:00 on 05 January 2025, reaching a peak intensity of c. 8 mm/hr around midnight. Rainfall continued with bursts of high intensity rainfall until c. 11:00 on 06 January, following which rainfall decreased in intensity. Rainfall ceased around 15:00. The result of these calculations is summarised within Table 2.

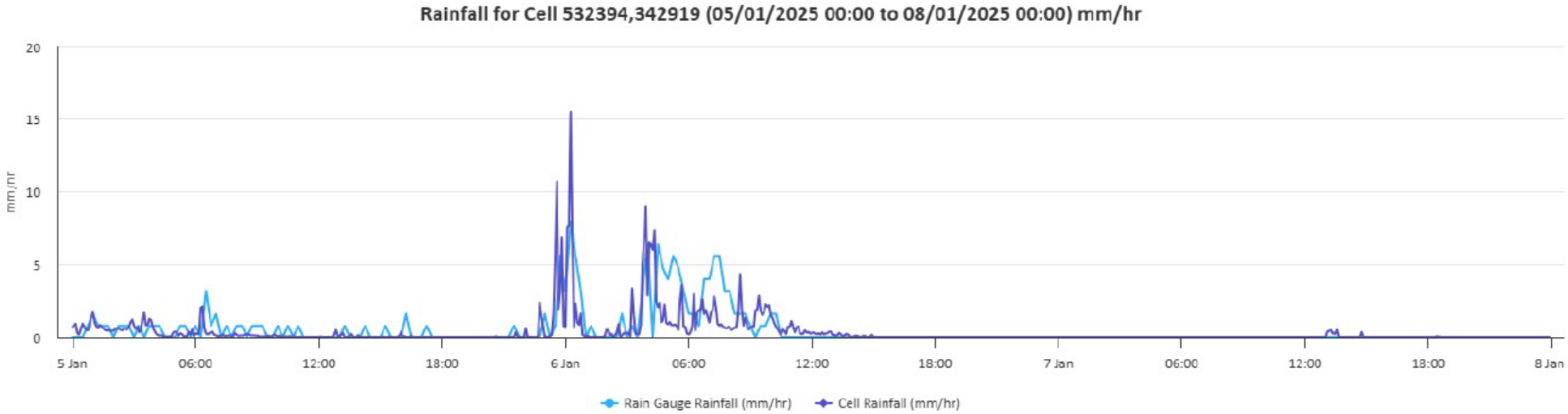
Analysis of the rainfall data indicates that the rainfall event was equivalent to a 1 in 1.9 annual chance rainfall event (53% Annual Exceedance Probability).

To provide further context regarding the catchment, rain gauges in the upper SFFD catchment were also considered (Osbournby, ref: E1606; and Guthram Gowt, ref: E25041). These gauges generally recorded a similar timing of rainfall as Frampton Gauge, with rainfall beginning around 23:00 on 05 January 2025. Modest differences in rainfall intensity are noted, with Osbournby Gauge recording more intense rainfall earlier in the day on 05 January compared to other gauges.

Note that rainfall intensities and depths vary across an area, and therefore the rainfall data included should be used as an indicative guide only. Additionally, the rainfall data does not fully account for the snowfall and snowmelt experienced across high ground in Lincolnshire. Vegetation cover is also noted to be at its lowest level during the winter months, which reduces the proportion of rainfall intercepted by trees and plants and contributes to increased runoff within the catchment.

Table 2 – Summary of available rainfall data for the properties; *Calculated via the FEH13 Annual Maximum method.

Rainfall duration (hours)	Rainfall depth (mm)	AEP*
34	35	1 in 1.9 (53%)



(Figure 5 – Rainfall intensities for Cell 532394, 342919, between 05 and 08 January 2025.)

3.2.2 River level and flow analysis

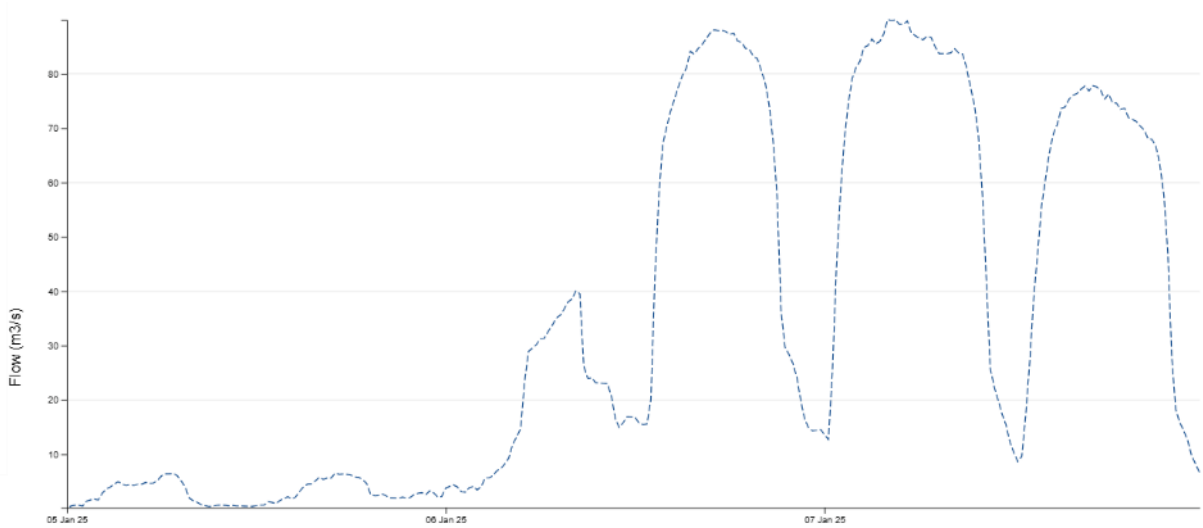
Several EA-operated monitoring stations are located on the SFFD or associated tributaries. River flow data from these gauges has been analysed as part of this investigation.

Hubberts Bridge monitoring station is located on the SFFD, c. 5 km west of the properties, at grid reference 526930, 343640. This monitoring station indicates that flows in the lower catchment of the SFFD have synchroneity with the tides; the greatest flows occur at low tide, as this is when flows can be discharged via the gravity sluice.

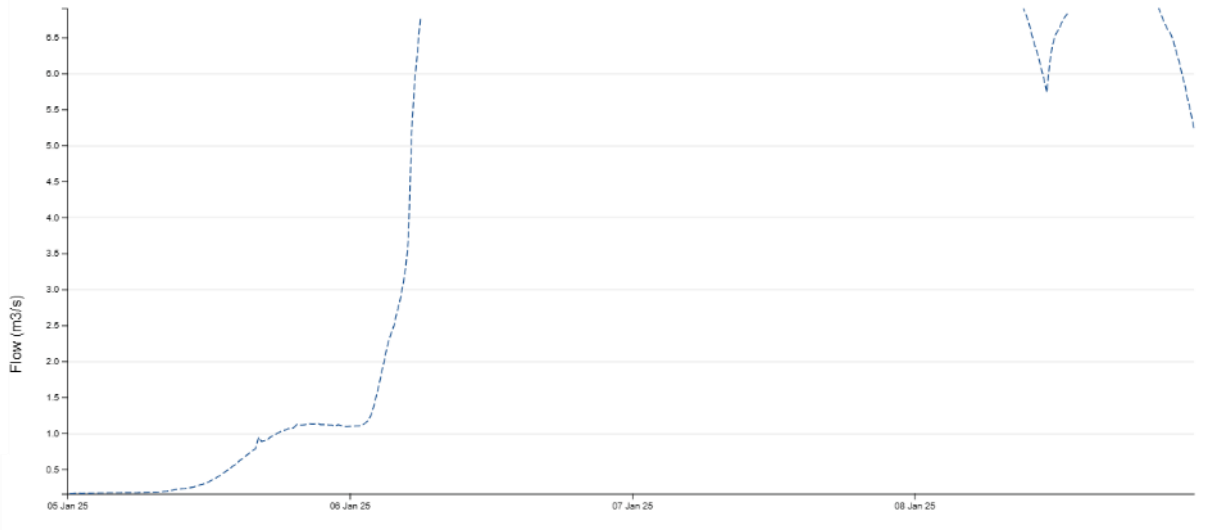
Flows began to increase in the early hours of 06 January 2025, peaking at 40 m^3/s at 08:00 (flows were c. 3 m^3/s at midnight) (Figure 6). The drop in flows (and lower rate of increase of flows) is noted to occur c. 0.5 hours after Gates 1 and 2 were fully opened (see Section 3.3). Flows reached a low of 15 m^3/s at 11:00 then rose to 88 m^3/s at 18:00, oscillating with the tide. Subsequent lows in the flow occurred at 23:00 on 06 January and 12:00 on 07 January, and highs were recorded at 04:00 and 16:00 on 07 January.

Rippingale monitoring station is located on the Rippingale Running Dyke, a tributary of the SFFD, c. 26 km south-west of the properties. This gauge provides context regarding the behaviour of flows in the upper reaches of the SFFD.

This indicates that flows in the Rippingale Running Dyke began to increase rapidly at 02:00 on 06 January; the peak flow cannot be identified as it exceeded the maximum measurable flow for this gauge (Figure 7). Flows fell within the recordable range briefly on 08 January and fell across 09 January.



(Figure 6 – River flows in the lower reaches of the SFFD between 05 and 08 January 2025, as measured at Hubberts Bridge Gauge.)



(Figure 7 – River flows at Rippingale Running Dyke, a tributary of the SFFD, between 05 and 08 January 2025, as measured at Rippingale Gauge.)

3.3 EA review of flood event

Following the 06 January 2025 flood event, the EA have conducted their own review of the events of flooding.

The EA's review indicated that a maximum flood level of 3.02 mAOD was recorded at the closest point to the properties (Chain Bridge Pumping Station), at 00:00 on 07 January 2025. The recorded level is understood to be greater than the 1 in 1000 year (0.1% AEP) flood level identified during the earlier SFFD modelling, including an allowance for climate change.

The EA held a routine inspection for the flood defences adjacent to the affected properties in June 2024, which indicated that there had been settlement and joint failures in these walls; these issues had not been resolved prior to the flood event. The EA also noted that seepage through the right bank of the SFFD has occurred since 2021, with standing water in gardens during periods of high river levels. As such the EA identified that seepage through the walls (as well as overtopping) likely occurred during the 06 January 2025 flood event. It should be noted that resealing works occurred between the flood event and prior to the Site visit for this S19 flood investigation (i.e. between mid-January and early March) (Photograph 4 in Appendix 7.3).

The two sections of wall were surveyed as part of the EA review, which indicated that the walls have respective minimum crest levels of 2.80 and 2.88 mAOD, up to 0.22 m beneath the nearest measured flood level, confirming that overtopping occurred.

In December 2024, the automatic controls for Gate 2 (one of the two sluices used to discharge flows from the SFFD into the Haven) was being relocated, which meant that the sluice needed to be manually operated. On 16 December 2024, Gate 1 experienced a gear box issue; the part to fix this was estimated to take at least one month to arrive. As such, it was kept closed, with Gate 2 (in manual mode) used to control flows. Gate 1 was manually opened fully at 07:45 on 06 January, and 04:13 for Gate 2; the EA concluded this allowed discharge from both gates for a full tidal cycle before peak flows reached Boston.

The EA reviewed the details of the emergency response plan for Black Sluice IDB, and noted that due to the extreme rainfall in January 2025, most pumping stations continued to pump water into the SFFD to avoid local flooding and as such the EA recommended that the emergency response plan be reviewed as part of long-term strategic planning.

It should be noted that the EA confirmed within the review that fluvial Flood Warnings for the SFFD are not available as it passes through Boston, due to the absence of any trigger thresholds.

3.4 Black Sluice IDB review of flood event

Black Sluice IDB undertook an investigation of the flood event, the results of which were shared with affected residents. This report has been reviewed to help inform the conclusions of this S19 flood investigation.

Black Sluice IDB enacted their Emergency Plan at 08:32 on 06 January 2025, once the water level on the SFFD exceeded a critical threshold. As part of this, the pumping stations along the SFFD undertook emergency profiles for pumping to mitigate the flooding.

A flood alert was first issued at 02:06 on 06 January 2025 for minor watercourses of the SFFD, with flood warnings issued for various sections of the SFFD and associated discharge channels throughout the day. No flood warning was issued to Boston.

The report indicated that critical levels were reached on the SFFD in Boston in the late evening of 06 January, surpassing the maximum Storm Henk level of 2.6 mAOD at 22:27. Flood waters were witnessed on Wyberton West Road and Chain Bridge Road at 23:40. Tidal lock conditions were in place between 19:00 and 24:00, preventing discharge from the Black Sluice complex during this time. Once the sluice began discharging flows around 24:00, the IDB noted that water levels fell quickly.

The IDB undertook a simple quantitative analysis of the possible impacts that the two pumps at BSPS could have had, should they have been operational on 06 January 2025. This calculation concluded that 540,000 m^3 of water could have been discharged during the period of tidal locking by the two pumps, potentially lowering the water level by up to 1.23 m. Although, having said the above, it was noted by the EA that these calculations did not account for inflows from the channel upstream so the lowering of water levels by up to 1.23m could not have been achieved.

The IDB flagged that the sluices by BSPS were not fully open until c. 06:00 on 06 January; they therefore concluded that water levels on the SFFD were not as low as they could have been prior to the flood event.

3.5 Flooding mechanism(s) and causation

3.5.1 Reported flooding

Consultants from GeoSmart Information Ltd visited the properties and surrounding area on 13 and 14 March 2025. During this visit, conversations were held with residents of the properties to confirm the timing, extent and depth of flooding, with residents available to

speak to at 15 properties (c. 40% of those affected). Information provided within responses to the LCC questionnaire made available to residents affected by flooding has also been used, with five responses received. Photographic evidence of the flooding is provided later in this section (Figures 8 to 12).

The residents generally had consistent accounts of the flooding, with the majority of properties first flooding around 23:00 to 24:00 on 06 January 2025. Flood waters remained in the properties for any time between 1 hour and 2+ days, with the most commonly reported duration being 2-3 hours.

Flood waters entered the properties through a variety of means: doors, floors, air bricks, and internal drains were all reported as entry methods. The most common method of water entry for Properties A to AB (immediately to the south of the SFFD) was the back door (as shown in Photograph 8 in Appendix 7.3), with flood waters reported to be flowing in a southerly direction towards the highway. Several residents also reported surcharging of toilets, baths and drains. Meanwhile, flood waters more commonly entered via the front door for Properties AF to AL, along Park Road.

Flood depths within the dwellings themselves were also variable, with maximum depths between carpet level seepage and 0.30 m reported within the buildings themselves. Higher depths were reported externally, with many of the properties having an outbuilding or garage that was also impacted. Flood depths in the gardens generally reached 0.30 to 0.60 m on Wyberton West Road, with a maximum depth of 1 m reported; depths of 0.25 to 0.30 m were reported within gardens along Park Road. These depths are consistent with those reported within the EA's review of the flood event. There is no obvious correlation between internal flood depth and location.

50% of the properties experienced a power cut, with 25% reporting problems with toilets or drainage systems. Approximately 33% of the properties were reported to not have had any problems with utilities.

33% of residents reported they were unable to leave their properties during the flood event, with 47% reporting that they could only leave by wading through flood waters. The remaining 20% of residents reported that they were able to leave their homes. It should be noted that, according to information provided by Boston Borough Council, the majority of residents chose to remain in their homes throughout the flood event.

The source of flooding was unanimously attributed to high levels on the SFFD, with the closure of the BSPS frequently cited as contributing factor. Residents along Wyberton West Road reported overtopping at two wall sections adjacent to Properties B to F and P to U. This led to floodwaters flowing southward from the SFFD towards the highway, inundating Properties A to AB from the rear. Several residents also noted that flood waters travelled via alleyways between properties, contributing to flooding along Wyberton West Road with flows generally moving westward.

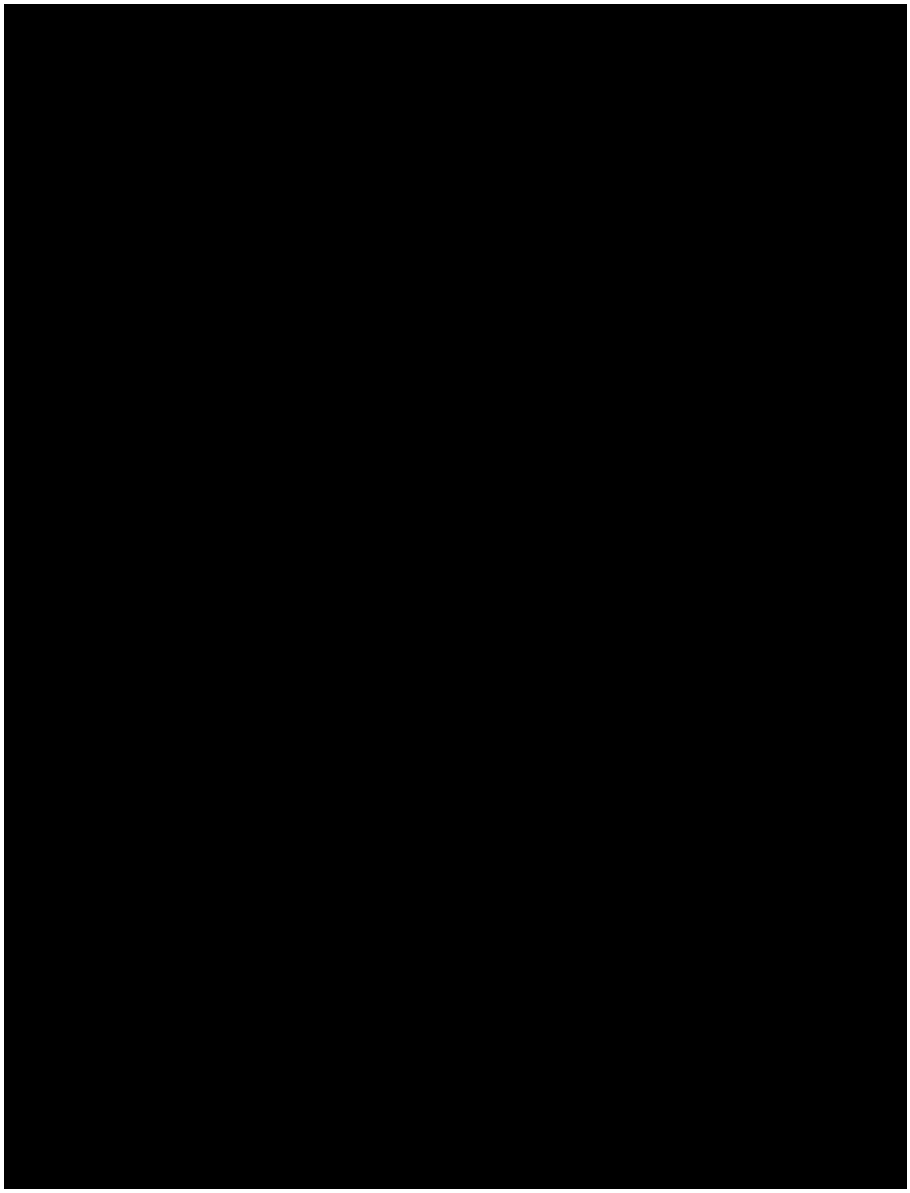
The residents along Park Road reported that flood waters also flowed down this highway towards their properties (Figure 9). The resident at Property AG indicated that flood waters also flowed through the garden and indicated that flooding may have initially come from this direction. The resident at Property AL indicated that the speed bump adjacent to them on

Park Road caused flows to be diverted in their direction (and prevented water from continuing south).

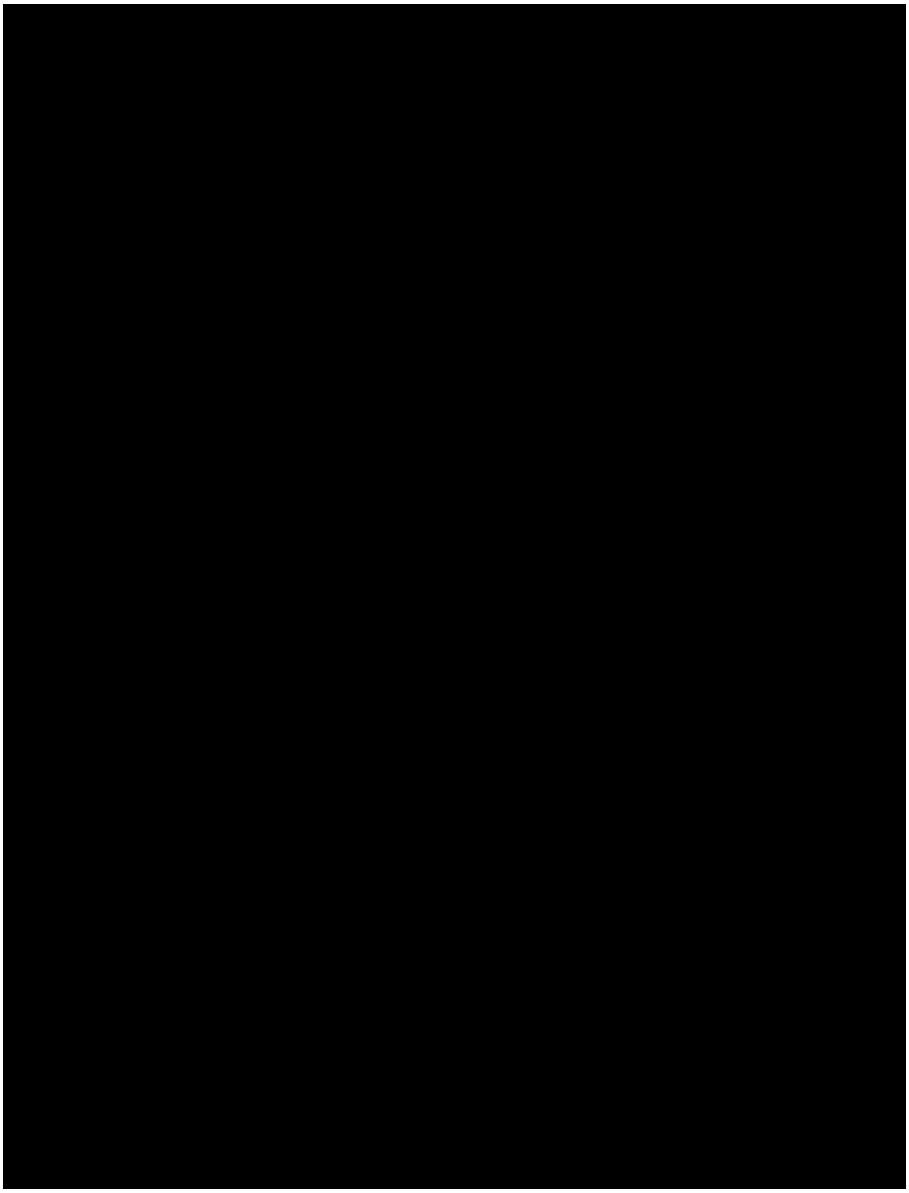
The resident at Property AD, which is located c. 90 m west of the majority of the affected properties on Wyberton West Road, indicated that flood waters flowed in a westerly direction along the highway and accumulated in their driveway (Figure 12). This resulted in flood waters entering via their front door. They confirmed that overtopping of the flood embankment did not occur adjacent to their property.

Numerous enquiries to LCC on 07 January 2025 (including refs: 2828996, 2829146, 4200027 and 4200093) indicate that residents were concerned that flooding would re-occur at subsequent high tides, requesting sand bags as a result.

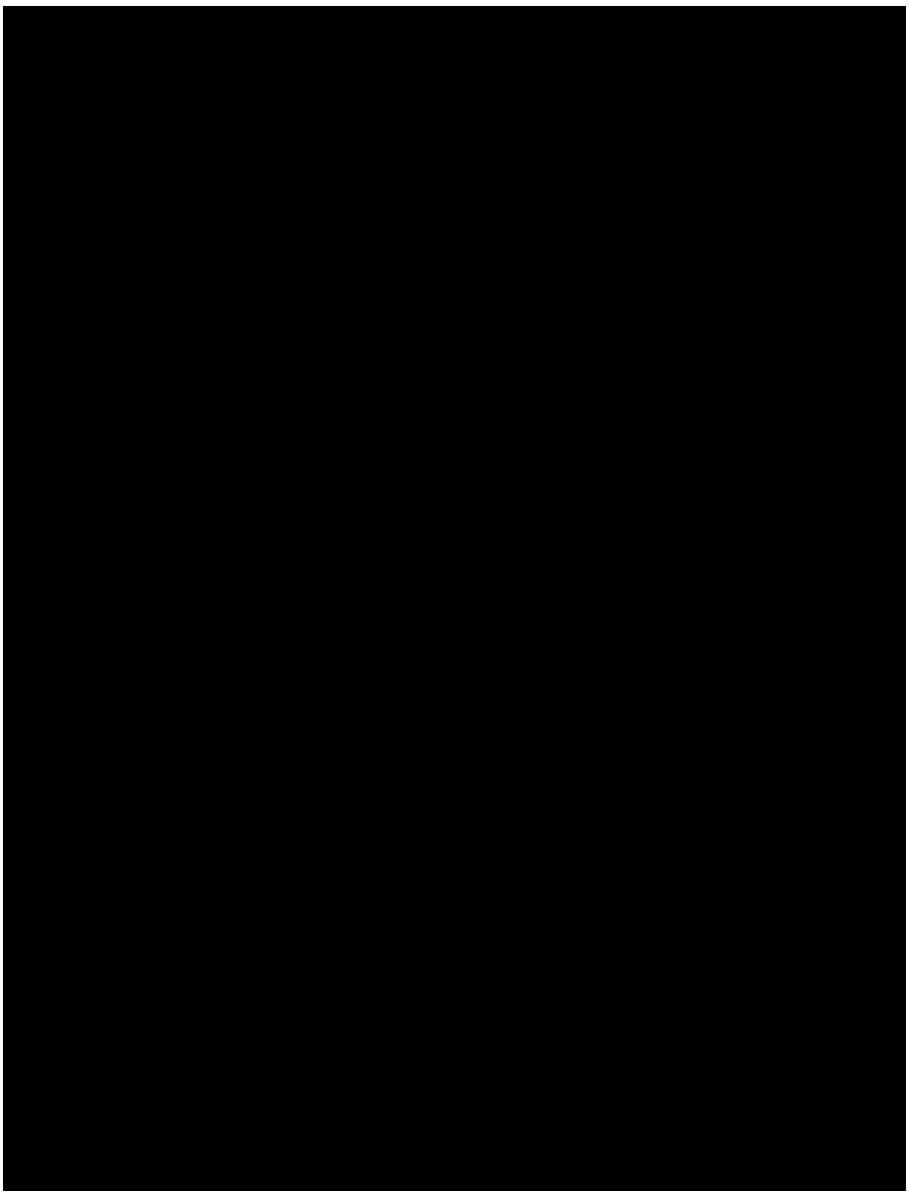
The residents were generally positive about the involvement of Boston Borough Council during the flood event, noting that councillors attended the scene on the night of 06 January 2025 to check on and assist residents. The fire brigade carried out pumping operations to remove flood waters from Wyberton West Road. Feedback on the delivery of sandbags by LCC was mixed; one resident reported that that they were mistakenly delivered to the wrong address on Park Road, leaving the affected properties without them.



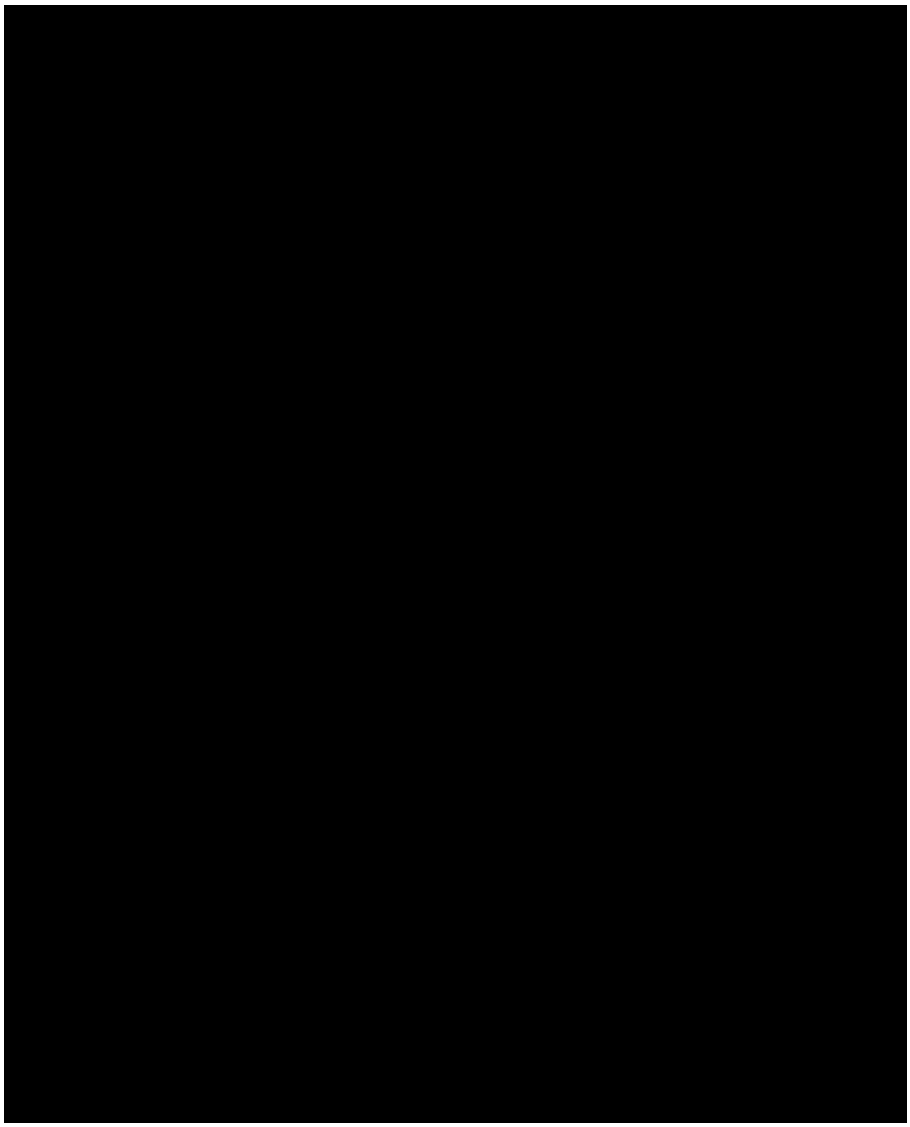
(Figure 8 – Flooding at Property B, as provided by the resident)



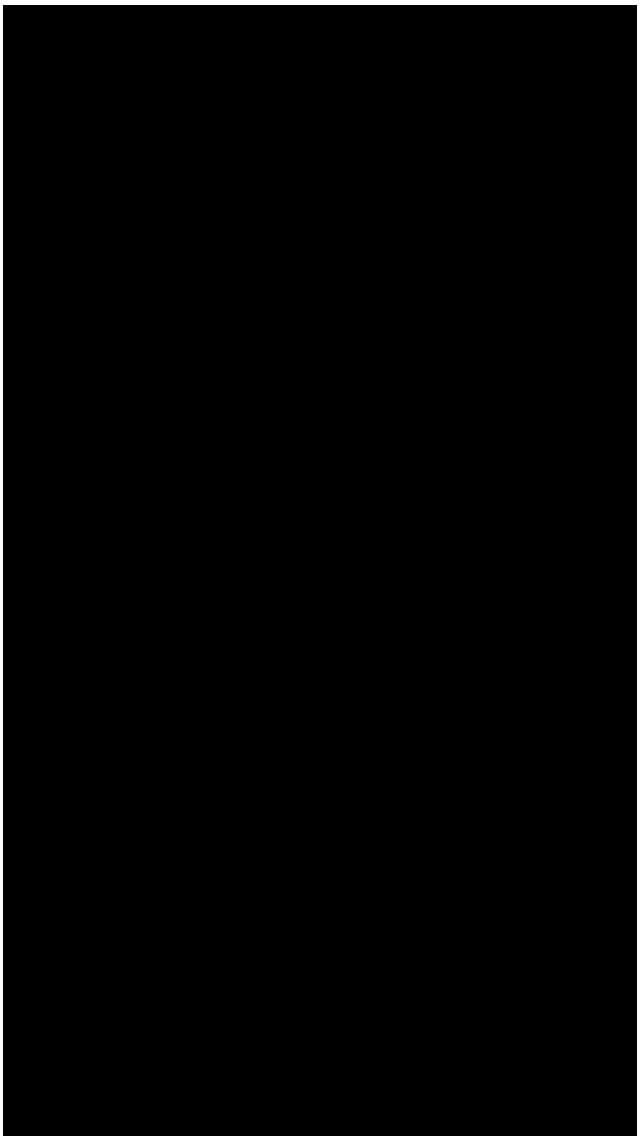
(Figure 9 – Flooding along Park Road, as provided by the resident of Property AL; facing north)



(Figure 10 – Flooding in the driveway at Property AL, as provided by the property resident)



(Figure 11 – Internal flooding at Property B, as provided by the resident)



(Figure 12 – Flooding at Property AD, as provided by the resident; facing north)

3.5.2 Investigation findings and conclusions

From information provided by the residents of the affected properties, an inspection of the properties and surrounding area, and the EA and IDB's review of the flood event, it can be deduced that flood waters were primarily derived from the SFFD, with the water level driven by intense rainfall. Flooding may have been exacerbated by issues in the management of flood assets in the surrounding area (as discussed later in this section).

During the night of 05 January 2025 and early hours of 06 January, the Black Sluice catchment experienced intense rainfall, estimated as equivalent to a 1 in 1.9 year (53% AEP) event. This, paired with frozen ground (preventing infiltration) and snow melt, resulted in excess runoff to enter the channel and produced high flows along the SFFD (to which the land within the Black Sluice catchment drains).

The high flows reached the lowest section of the SFFD in the evening of 06 January coinciding with high tide. Tidal locking conditions were in place between c. 19:00 and 24:00, preventing discharge of flows from the SFFD into the Haven via the sluice gates. As a result, water levels continued to increase within the channel.

When water levels on the SFFD reached a sufficient level, they exceeded the height of the two wall sections on Wyberton West Road, which reflect the lowest point on the bank. The EA measured the minimum crest levels of the walls to be 2.80 to 2.88 mAOD, compared to a maximum water level of 3.02 mAOD at the closest point to the properties (Chain Bridge Pumping Station) at 00:00 on 07 January 2025. Therefore, the two sections of wall were overtopped, causing flooding within the gardens.

The residential plots on the north side of Wyberton West Road (Properties A to AB) are generally set at the same level. As such, fluvial flows were able to travel in a southerly direction, entering dwellings via the rear door and causing flooding to outbuildings within the gardens. Flood waters were able to flow through the ground floor of the affected properties, exiting via the front door (where this was above the external adjacent flood level) as well as passing around some of the dwellings via the side alleyways and driveways.

Fluvial flood waters then filled up the low point in Wyberton West Road, with residents generally reporting that flood waters flowed in a westerly direction (i.e. towards the low point at the junction with Park Road). Flows continued in a southerly direction down Park Road, causing flooding to the northern properties on this highway (Properties AF to AL). It is also possible that some flood waters passed through rear and side gardens to cause flooding to properties, in addition to flows along the highway.

In the case of Properties AC and AD, flows from Wyberton West Road continued in a westerly direction and accumulated in their front driveway. The highway to the west of the junction with Park Road is fairly level and as such ponding could occur in this area; overspilled water could then travel towards these properties, which are located on particularly low land and whose driveways fall steeply away from the highway. Flood waters were able to accumulate adjacent to the property thresholds and pass over them once flood depths were sufficiently high.

The inferred extent of flooding and possible flow routes are shown in Figure 13.

(Figure 13 – Inferred flood mechanism and associated flood extent at the properties. It should be noted that the flood extent has been inferred using a combination of residents' accounts, photographs and LiDAR elevation data; the exact extent of flooding has not been confirmed.)

Flooding on 06 January 2025 may have been exacerbated by the following factors:

- Intense rainfall coinciding with frozen antecedent conditions;
- Tidal locking conditions;
- Decommissioning of the Black Sluice Pumping Station;
- Operational problems associated with the sluices at the Black Sluice Complex;
- Low points on the southern bank of the SFFD, adjacent to Wyberton West Road;
- Correlation of the flooding experienced in relation to the operation of the Black Sluice Emergency Response Plan.

It should be noted that the EA concluded that the flood event was greater than the 1 in 1000 year (0.1% AEP) + climate change modelled scenario event and therefore, if representative of the flooding experienced, is outside of the typical design requirements for flood defences. (The nearest peak flood level at Hubbert's Bridge was 3.19 mAOD, compared to 2.76 mAOD in the modelled 1 in 1000 year + CC event.) From the available modelling it is unclear to what extent the impact of tidal conditions has been taken into account by the EA, with the model report not discussing this in any detail (Mott MacDonald, 2016), and the flow distribution not aligning with what was witnessed during January 2025.

Intense rainfall coinciding with frozen antecedent conditions

The Black Sluice catchment experienced intense rainfall, estimated as equivalent to a 1 in 1.9 year (53% AEP) event, during to the flood event. The rainfall event occurred at a period of low overnight temperatures, meaning that much of the land within the Black Sluice catchment was frozen; as such, minimal infiltration was able to occur.

Additionally, snowfall occurred within the Black Sluice catchment overnight on 05 January 2025; this snowmelt would also have contributed to runoff but was not necessarily fully accounted for within rainfall gauge data due to it being a more localised feature on high ground.

Both these factors resulted in additional runoff entering the SFFD compared to warmer conditions, resulting in more extreme flows.

It should, however, be noted that the catchment is clay-dominated, which reduces possible infiltration even under optimal conditions, and rainfall across much of the catchment is likely to reduce the effects of frozen ground.

Tidal locking conditions

High levels on the SFFD peaked around 00:00 on 07 January 2025, during a period of high tide. Tidal locking conditions were in place between c. 19:00 on 06 January and 00:00 on 07 January; during this period, the two sluice gates at the Black Sluice complex were unable to discharge fluvial water (due to the level in the SFFD being lower than that on the Haven). As such, fluvial levels continued to rise immediately upstream on the SFFD, resulting in overtopping at low points at around 23:40 on the same day.

Should the peak levels on the SFFD have coincided with low tide, the two sluice gates would have been able to discharge fluvial waters, dropping the water level in the lower catchment and potentially preventing overtopping. However, it is acknowledged that the water level on the SFFD reached high levels (within 0.5 m) at the next high tide on 07 January due to the inflows into the system being high for a longer time period and therefore there is no guarantee that fortunate timing between the peak flows and tidal conditions would prevent overtopping in the future.

Decommissioning of the Black Sluice Pumping Station

The Black Sluice Pumping Station (BSPS) was decommissioned in 2018 after a long review, including economic appraisal, modelling and consultation, which concluded that it had minimal impact on flood levels and did not warrant the cost required for its refurbishment.

However, during the Site visit, residents commonly attributed the flooding that occurred on 06 January 2025 to the closure of the pumping station. This is because of the timing of flooding, which coincided with high tide; the pumps at the BSPS would have been usable during tidal locking conditions and would likely have resulted in a decrease in the water level along the SFFD.

Whether the action of pumping would have been enough to lower the water level sufficiently to prevent overtopping is unclear. Simple calculations undertaken by Black Sluice IDB

indicated that the use of two pumps could have lowered the water level by up to 1.23 m, but hydraulic modelling of the flood event would be required to confirm this, especially when considering the comments of the EA outlined in Section 3.4. However, it is possible that should pumps have been operational during the flood event, flood levels on the SFFD may have been lower than what was experienced.

Operational problems associated with the sluices at the Black Sluice Complex

Prior to the flood event, both sluice gates at the Black Sluice Complex were in manual operation (as opposed to automatic) (see Sections 3.3 and 3.4). Gate 2's automatic controls were being relocated, and Gate 1 experienced a gear box issue which required a new part; therefore, both sluices were operational but required manual changes to control the flows. This meant that the sluice gates were not as responsive to changes in the water level on the SFFD.

However, according to the EA, both gates were opened by 07:45 on 06 January 2025, which was c. 16 hours prior to overtopping occurring. The opening of the gates coincided with the initial rise in water levels, and a brief deceleration in the rise in water levels is recorded around their opening time. This did not prevent water levels from continuing to rise.

Whilst a lower water level may have been in place prior to the start of the flood event, based on the available information it seems unlikely that this would have caused a sufficient decrease in water levels to prevent overtopping of the SFFD.

Low wall sections on the southern bank of the SFFD, adjacent to Wyberton West Road

Two low wall sections were identified by residents as the location of overtopping on the SFFD (adjacent to Properties B to F and P to U, as shown within Photographs 1 to 3 in Appendix 7.3). The wall section was identified as having a minimum crest level of 2.80 to 2.88 mAOD, compared to a maximum water level of 3.02 mAOD at Chain Bridge Pumping Station; this could have resulted in up to 0.22 m of overtopping.

It is unclear why there are two wall sections along the southern bank of the SFFD, with no residents aware of their construction, and the EA assuming they were constructed in the 1960s. However, the fact that these sections are lower than the adjacent embankment is considered to be the primary factor why the properties on Wyberton West Road flooded.

The EA indicated that settlement and joint failures had been reported within the wall sections in June 2024, but these had not been resolved by the January 2025 flood event. (The wall sections had been resealed between the flood event and Site visit in March 2025; see Photograph 4 in Appendix 7.3.).

Additionally, the EA reported that seepage through the right embankment of the SFFD has previously occurred, which has resulted in flooding in rear gardens along Wyberton West Road. The EA indicated that this seepage contributed to the observed flooding in January 2025.

However, significant overtopping occurred. As such, whilst seepage through the walls and embankment could have contributed to flooding, these are considered unlikely to be significant factors given the depth of flooding observed.

Correlation of the flooding experienced in relation to the operation of the Black Sluice Emergency Response Plan

A final possible contributing factor is the implementation of the Black Sluice Emergency Response Plan during the January 2025 flood event.

During periods of extreme river levels, the Black Sluice Emergency Response Plan is undertaken, which involves switching the pumping stations on the SFFD to their emergency profiles (which results in approximately 70% of the pumping stations being switched off, although it is worth noting that this is not a binary outcome, i.e., pumps on or off. Due to the introduction of telemetry levels are instead maintained within 300mm of the highest known levels thereby reducing (but not eliminating) inflow into the SFFD whilst also minimising the risk of overtopping of upstream catchments).

It is acknowledged that the management of the Black Sluice catchment is complex, and pumping was required to prevent flooding of properties upstream. It is also not known whether such flooding was avoided (or to the extent of damages that were prevented). Therefore, it cannot conclusively be determined whether the operation of the Black Sluice Emergency Response Plan during the flood event contributed to flooding in Boston or had a net benefit for the catchment.

3.6 Road closures

3.6.1 Wyberton West Road

During the January flood event, a road closure occurred along Wyberton West Road, adjacent to the affected properties, which is understood to have been in place between c. 01:50 on 07 January and 14:20 on 09 January 2025. According to the enquiry trace form for the road closure (ref: 1818583), the road closure was requested by Fire & Rescue due to the flooding of nearby properties and manhole covers surcharging, posing a danger to road users.

The flood mechanism behind the flooding on Wyberton West Road is the same as for the affected properties along this highway (as discussed further within Section 3.5). The water level of the SFFD exceeded the crest level of two wall sections on its southern bank (adjacent to Wyberton West Road), causing overtopping. Fluvial flood waters then flowed in a southerly direction, broadly following the topography of the area and filling the low-lying land adjacent to the overtopped wall. The highway (paired with the adjacent properties) forms a low point which was therefore impacted, with one resident placing the flood depth in the highway at 0.3 m adjacent to their property (H).

Whilst Wyberton West Road was likely impassable to most vehicles at the height of the flood event, residents at two properties reported that bow waves from passing vehicles contributed to internal flooding. It is therefore assumed that the earlier closure of the road would have reduced this mode of water ingress.

3.6.2 Chain Bridge Road

During the flood event, Chain Bridge Road was also closed, with the enquiry trace form for the road closure (ref: 1818589) indicating a closure was in place between 15:10 on 07 January and 14:20 on 09 January 2025.

According to conversations with the councillor for the ward, Chain Bridge Road may have been closed to prevent vehicles from accessing the flooded area of Wyberton West Road. This is understood to have been partially implemented to reduce these vehicles creating bow waves and exacerbating the flooding at the properties.

From the available information, it is also understood that Chain Bridge Road flooded during this incident.

4. Risk management authorities

In relation to this flood event, the following RMAs have relevant flood risk management functions:

- Black Sluice IDB
- Environment Agency

A record as to whether the above RMAs have exercised or are proposing to exercise those functions in response to the flood shall be monitored through the existing Joint Lincolnshire Flood Risk and Water Management Partnership.

The residents of each property also have a responsibility with regards to the resilience and resistance measures implemented at their property.

For the avoidance of doubt, the ordering of the above relevant RMAs is alphabetical and as such is not necessarily reflective of the number of relevant flood risk management functions associated with each RMA in this instance.

5. Recommendations for consideration

Based on the findings of this investigation, the following recommendations for consideration by the relevant parties have been made. For the avoidance of doubt, these recommendations are listed in alphabetical order.

5.1 Flood resistance and resilience measures

Flood resistance and resilience measures should be considered for the properties.

Consideration could be given to the use of a flood barrier or door at the building thresholds for all the properties.

Potential resilience measures include:

- Replacing ground floor carpets with hard flooring;
- Installing uPVC skirting boards;
- Raising furniture and appliance on the ground floor of each dwelling on plinths;
- Chemical waterproofing of the walls around the perimeter of each dwelling;
- Installing non return valves on air bricks and utility pipework;
- Installing a sump pump or puddle pump; and
- Storing valuable items above ground level.

The responsibility for the implementation of flood resilience measures would fall to the residents of the properties, with support from the EA and LLFA, where appropriate.

5.2 Implementation of flood action plan for Wyberton West Road and Park Road (where not done so already)

It is understood that Boston Borough Council already has an Emergency Response Plan, and documents shared as part of this investigation indicate a generally prompt and effective response.

However, it is recommended that a flood action plan is arranged by the residents of Wyberton West Road and Park Road to ensure that occupants are suitably prepared for any future flooding. This should include actions to take should a Flood Alert be issued, possible safe evacuation routes, and a method of securing the home to minimise flood damage. This should be supported by Boston Borough Council to ensure it is consistent with their emergency plans.

The responsibility for the creation of a flood action plan would fall to the residents of the property, with support from Boston Borough Council and Lincolnshire Resilience Forum as appropriate.

5.3 Review of EA modelling for SFFD

Given that the observed extent of flooding on 06 January 2025 did not fully align with the flood extents derived from the existing SFFD model, it is recommended that consideration be given by the EA for the reviewing and calibration of the model against the experienced flooding (it is noted that the EA have proposed to create a new SFFD model within their review of the flood event).

As part of the model review, it should be confirmed that the model appropriately takes into account the impacts of sea level rise, which will increase the impacts of tidal locking on water levels in the future. The model should also take into account the timing of rainfall relative to high tide.

Following the model review, it is recommended that the plan for mitigation within the Black Sluice Catchment is reviewed to ensure it remains consistent with the model results.

5.4 Review of Flood Warning service for the downstream reaches of the SFFD

During the flood event, residents received Flood Alerts from the EA, which indicated that flooding is possible for isolated properties and villages in low lying areas east of the SFFD, but did not mention Boston, and indicated that flooding inside properties is not likely. No Flood Warning was subsequently received (with the EA reporting that these cannot be provided for fluvial flooding on the SFFD in Boston). This caused confusion with the residents, who did not anticipate internal flooding.

Therefore, consideration should be given to implementing Flood Warnings in the downstream reaches of the SFFD through Boston. (It is noted that these works are proposed within the EA's review of the flood event.)

Where the implementation of a Flood Warning service is deemed unfeasible, consideration should be given to amending the wording of the standard Flood Alert, to ensure that residents are aware that no further warnings will be given.

The responsibility for implementing a Flood Warning service for the lower reaches of the SFFD through Boston would fall to the EA.

5.5 Review of operation of EA and Black Sluice IDB assets during heavy rainfall events

Given that both sluice gates at the Black Sluice Complex required manual operation during the 06 January 2025 flood event, it is recommended that the EA reviews their processes for operating assets along the SFFD during future rainfall events. Particular consideration should be given to ensuring that parts can be easily and quickly procured should there be a fault with an asset. (It is noted that the EA's review of the flood event included a recommendation to consider these processes further.)

Any lessons identified from the EA regarding the flood event should be implemented more widely throughout the Lincolnshire area.

Additionally it is recommended that Black Sluice IDB considers reviewing their Emergency Response Plan to incorporate any lessons identified as a result of January 2025.

5.6 Wall raising at the low points along the SFFD

Given that the two wall sections along Wyberton West Road experienced overtopping during the flood event, consideration should be given by the Environment Agency to raising the wall sections to match the level of the adjacent bank. This could form part of the wider bank armouring efforts proposed as part of the Black Sluice Catchment Works in 2018.

As part of these works, the walls could be replaced to ensure there are no possible stability issues relating to the wider embankment. The earth embankment along Wyberton West Road should also be reviewed to ensure that any seepage issues are appropriately dealt with.

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7. Appendices

7.1 Definitions

Coastal / tidal flooding – Flooding which occurs due to extreme coastal conditions. May occur due to high tide levels, surges and wave action.

Culvert – Where a watercourse flows through a pipe, often underground.

External flooding – Flooding affecting spaces outdoors. Includes flooding in highways, open land, gardens and driveways.

Flap valve – Hinged valve placed on a pipe outlet into a river. Stays open during normal flow but closes when it is submerged, to prevent flow from backing up the pipe.

Foul sewer – Sewer which carries wastewater (e.g. from toilets, sinks, showers and kitchen appliances) to a sewage works for treatment.

Groundwater flooding – Flooding which occurs when sub-surface water emerges from the ground at the surface or into Made Ground and structures. Occurs due to persistent rainfall that recharges aquifers until they are full; or may be as a result of high river levels, or tides, driving water through near-surface deposits.

Gully – Drainage pit covered by an open metal grate, located at the edge of a road. Drains rainwater from the road into either the surface water sewer or into nearby watercourses.

HYRAD – Real-time radar display system for weather.

Internal Drainage Boards – A public authority that managed water levels within an Internal Drainage District.

Internal flooding – Flooding which affected the living/business space inside of a building.

Lead Local Flood Authority - County councils and unitary authorities which lead in managing local sources of flood risk (i.e. flooding from surface water, groundwater and ordinary watercourses)

LiDAR – A remote sensing technique that allows ground elevation to be determined over a regional area.

Main river - A watercourse shown as such on the main river map for England and includes any structure or appliance for controlling or regulating the flow of water into, or out of, the channel which –

a) Is a structure or appliance situated in the channel or in any part of the banks of the channel; and
b) Is not a structure or appliance vested in or controlled by an internal drainage board.

The Environment Agency has permissive powers to maintain and carry out improvements on main rivers, to manage flood risk.

Ordinary Watercourse - A watercourse that does not form part of a main river. Lead local flood authorities, district councils, and internal drainage boards can carry out flood risk management work on ordinary watercourses.

Public sewer – Sewers owned and maintained by a Sewerage Company (e.g. Anglian Water). Are usually located in roads or public open spaces by may run through private gardens.

Riparian owner – The owner of land that is next to a watercourse or has a watercourse running through or beneath it.

River (fluvial) flooding – Flooding that occurs during times of heavy rainfall or snow melt when watercourses' capacity can be exceeded, over topping the banks and flood defences.

Soil moisture deficit – The difference between the amount of water actually present in the soil and the amount of water which the soil can hold.

Surface water (pluvial) flooding – Flooding which occurs when intense rainfall exceeds the infiltration capacity of the ground and overwhelms the drainage systems.

Surface water sewer – Sewer which carries rainwater directly to a watercourse.

Telemetry – Instruments used to monitor the level of water in a watercourse.

Weir – A small dam structure built across a watercourse to raise the water level or to divert flow.

7.2 Authorities with flood risk management functions

The following Risk Management Authorities (RMA) have flood risk management functions within Lincolnshire:

- **Lead Local Flood Authority (LLFA): Lincolnshire County Council** - Responsible for coordinating the mitigation of risk of flooding from surface water, groundwater and ordinary watercourses (non-main rivers). The LLFA is also responsible for developing, maintaining and applying a strategy for local flood risk management in its area and for maintaining a register of flood risk assets. The LLFA also has a statutory duty to investigate significant flood events to the extent it considers necessary.
- **Environment Agency** - Tasked with the protection and conservation of the water environment in England, the natural beauty of rivers and wetlands and the wildlife that lives there. Its responsibilities include: water quality and resources; fisheries; conservation and ecology; and operational responsibility for managing the risk of flooding from main rivers (usually large streams and rivers), reservoirs, estuaries and the sea. Flood risk management work can include: constructing and maintaining 'assets' (such as flood banks or pumping stations) and works to main rivers to manage water levels and make sure flood water can flow freely; operating flood risk management assets during a flood; dredging the river; and issuing flood warnings. The Environment Agency can also do work to prevent environmental damage to watercourses, or to restore conditions where damage has already been done.
- **Internal Drainage Boards** (IDBs) - Independent public bodies, established in areas of special drainage need, known as drainage districts. The IDB is responsible for the supervision of land drainage, water level management and flood risk management works and regulation of ordinary watercourses within its Drainage District. IDBs play an important role in the areas they cover (approximately 10% of England at present), working in partnership with other authorities to actively manage and reduce the risk of flooding.
- **Highways Authority: Lincolnshire County Council** - Responsible for maintaining the highway drainage system to an acceptable standard and ensuring that road projects do not increase flood risk.
- **Water and Sewage Company: Anglian Water** - Responsible for the provision of wastewater collection and treatment systems, including for managing the risks of flooding from surface water and foul or combined public sewer systems providing drainage from buildings and yards.
- **District Councils** - including borough and city councils, have powers to carry out works to manage flood risk from ordinary watercourses (outside the internal drainage district of Internal Drainage Boards) and the sea. They are also planning authorities, responsible for developing a local plan, which must have regard to national planning policy and work with Lead Local Flood Authorities and others to ensure decisions on development in their area effectively manage the risks from flooding. Additionally, those District Councils that are next to the sea are also designated coast protection authorities. This role includes leading on coastal erosion risk management activities, leading and supporting coastal groups, and leading the production of shoreline management plans.

In addition to the above, the other parties that may have responsibilities include:

- **Riparian Landowners** - Riparian landowners who own land or property crossed by or next to a river, stream or ditch (including where this runs through a pipe or culvert) have rights and responsibilities over the management of the land including: a responsibility to let water flow through the land without any obstruction, pollution or diversion which affects the rights of others; keeping banks clear of anything that could cause an obstruction and increase flood risk; maintaining the bed and banks of the watercourse; and keeping structures clear of debris.
- **Residents, Businesses and Property Owners** - Should find out about any flood risk in their area, sign up for the Environment Agency's free flood warnings and make a written plan of how they will respond to a flood situation. Business owners should also make a flood plan for their business. There are measures that can be taken to reduce the amount of damage caused by flooding and properties at risk should be insured. Local residents can find out if their property is at risk, prepare for flooding, get help during a flood and get help after a flood.

7.3 Photographs from Site visit

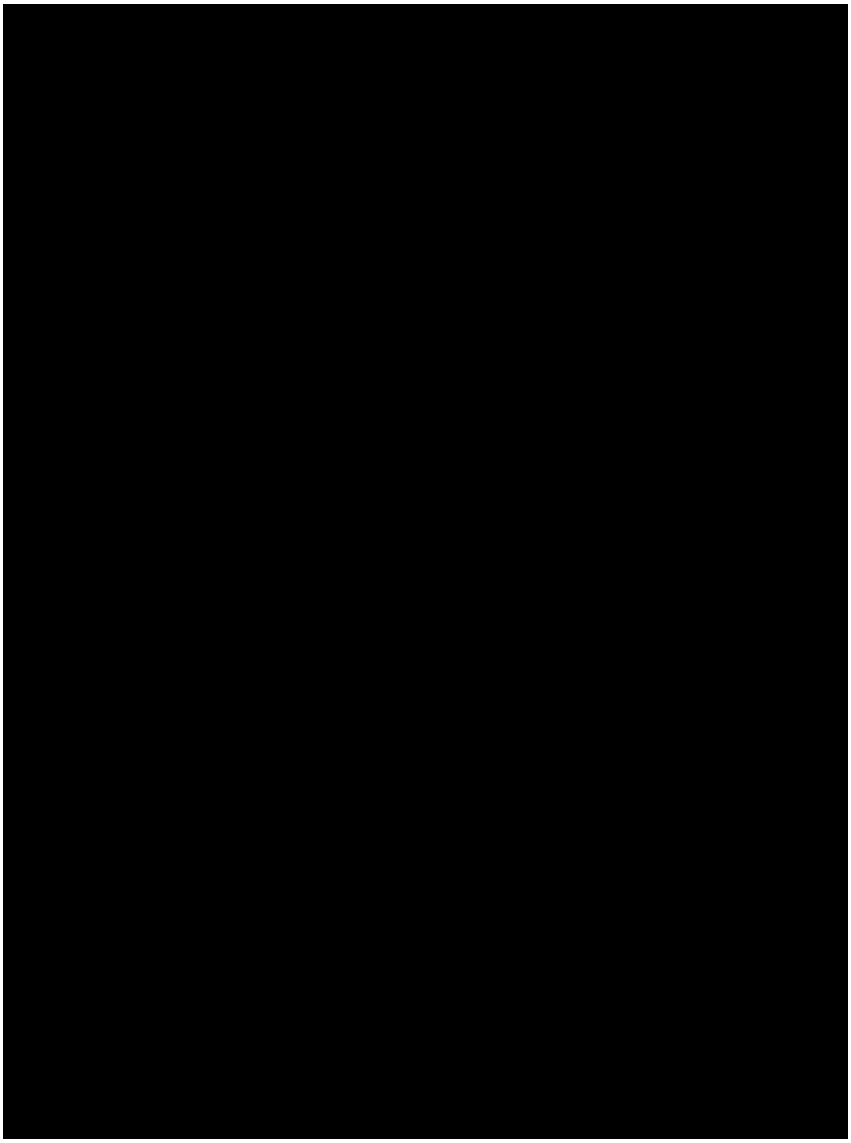
A selection of photographs taken during the Site visit on 13 and 14 March 2025 have been provided below.

(Photograph 1 – Western section of EA flood wall structure along the southern bank of the SFFD; facing east)

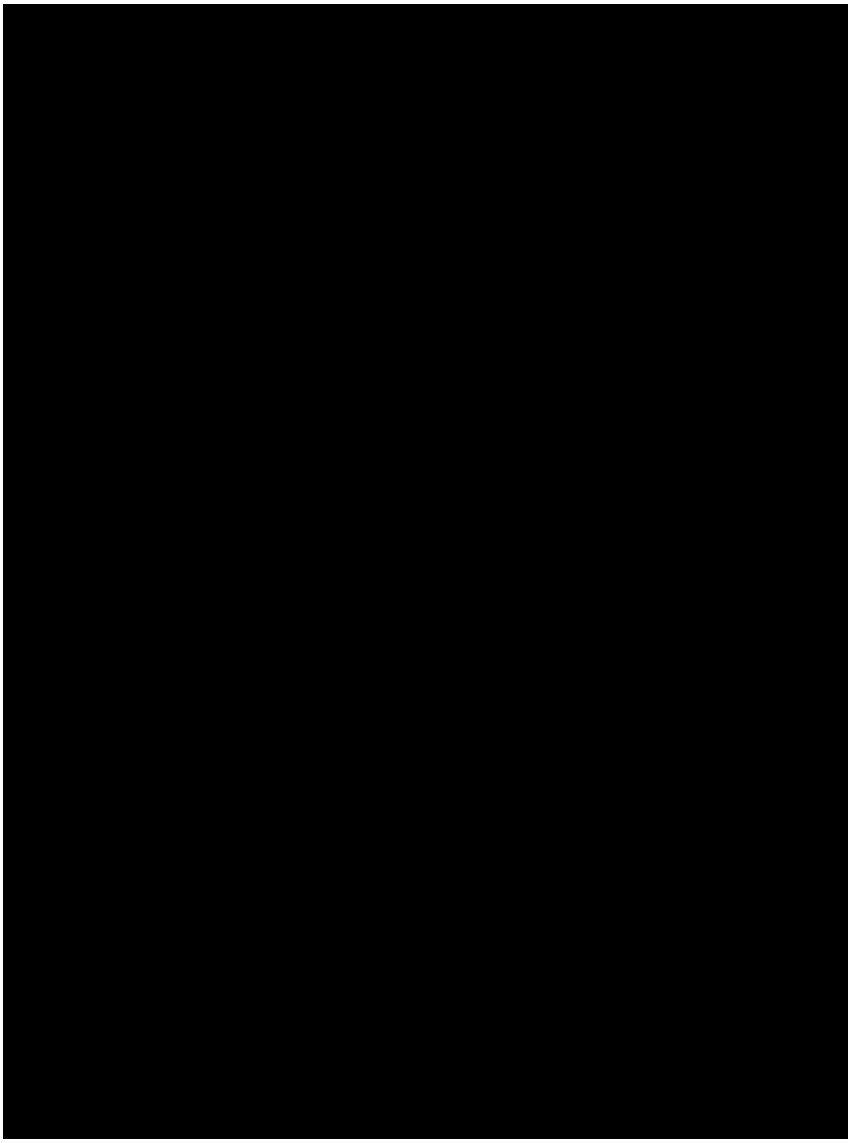
(Photograph 2 – Western section of EA flood wall along the southern bank of the SFFD; facing west)

(Photograph 3 – Eastern section of EA flood wall along the southern bank of the SFFD; facing east)

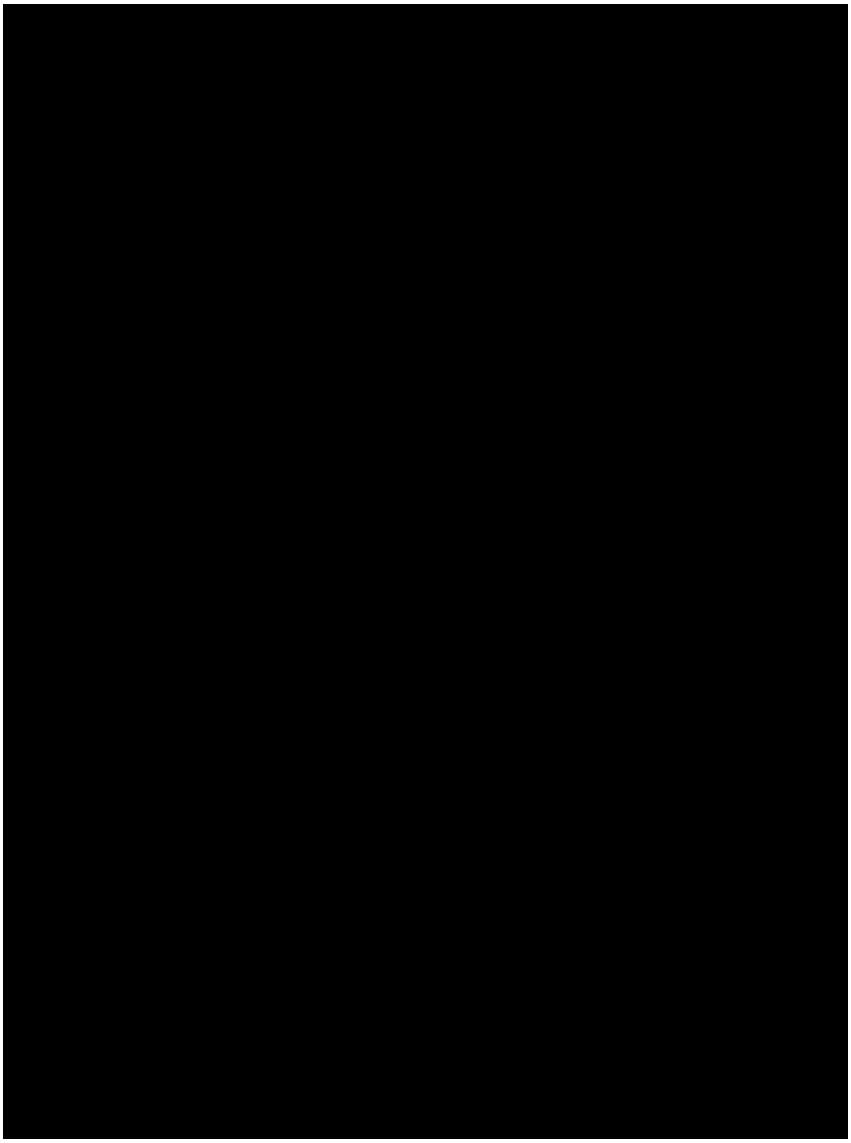
(Photograph 4 – Replaced seal on the eastern section of flood wall along the SFFD)



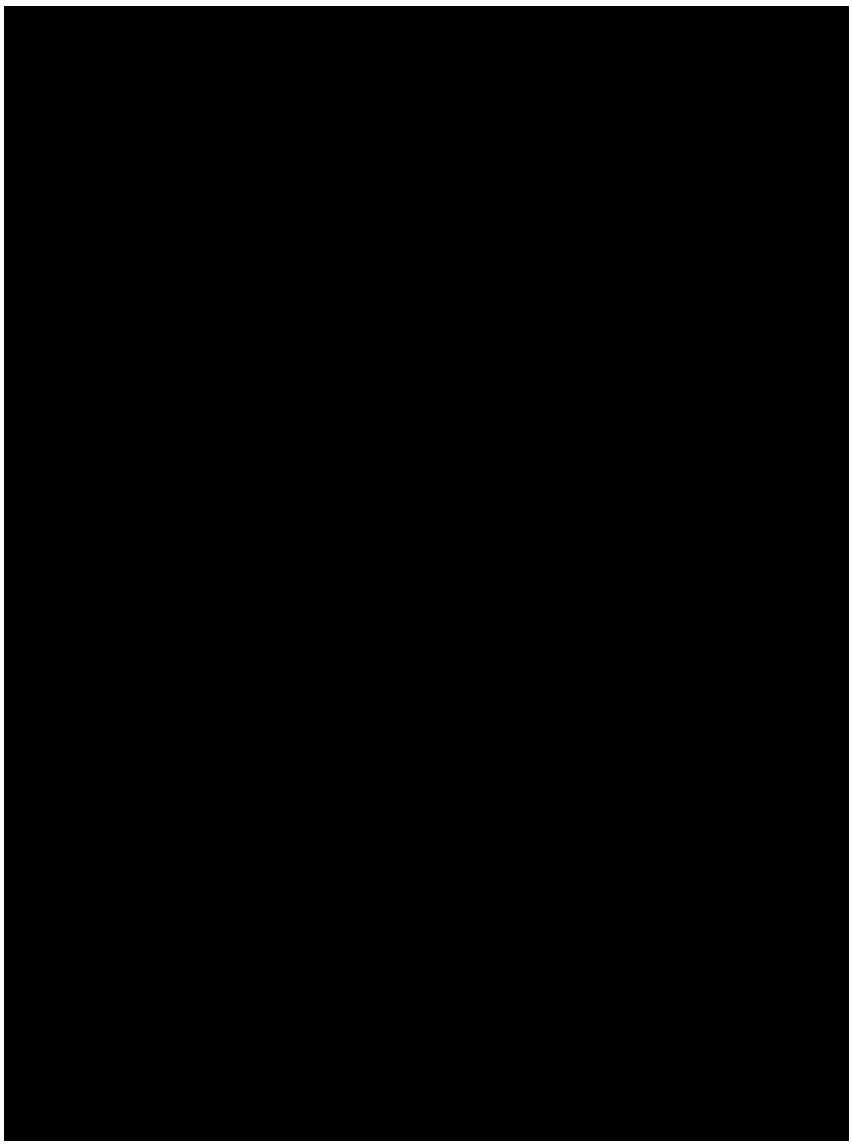
(Photograph 5 – Wyberton West Road, as viewed adjacent to Properties W to Y; facing west)



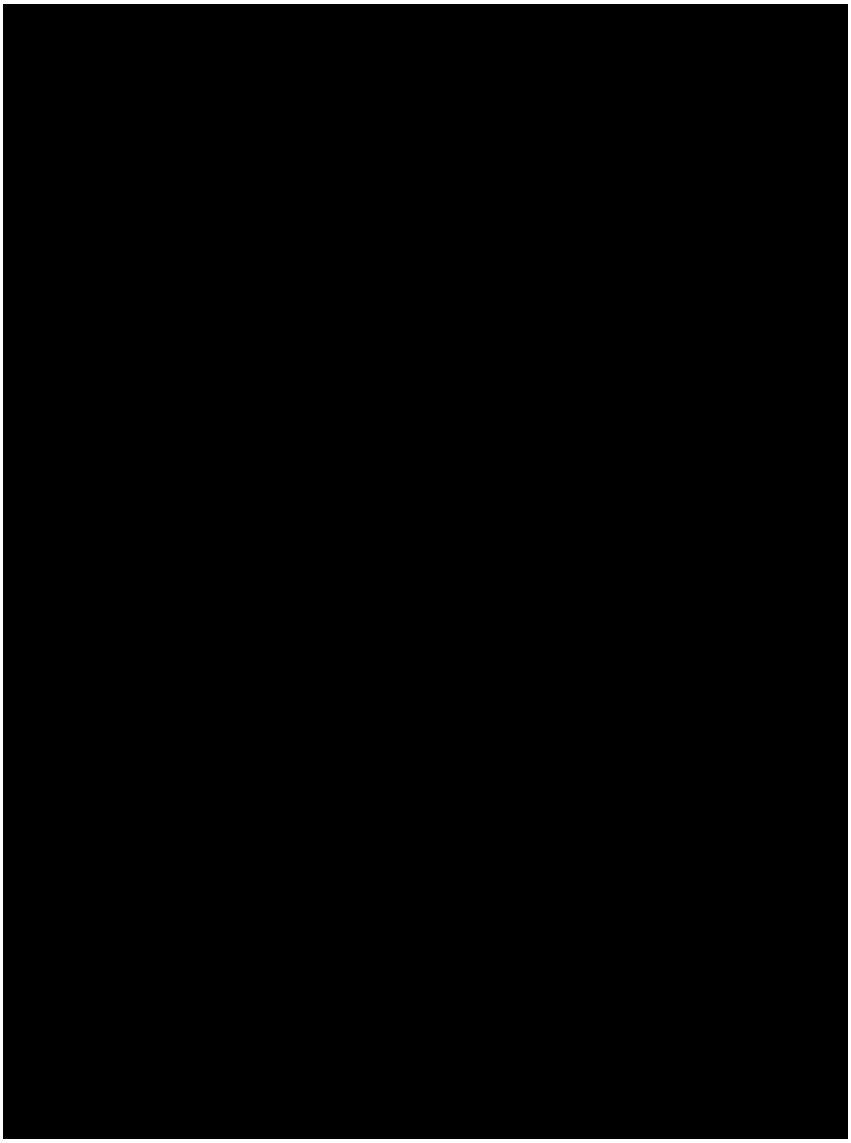
(Photograph 6 – Wyberton West Road, as viewed adjacent to Property AB, with the junction with Park Road visible to the rear; facing west)



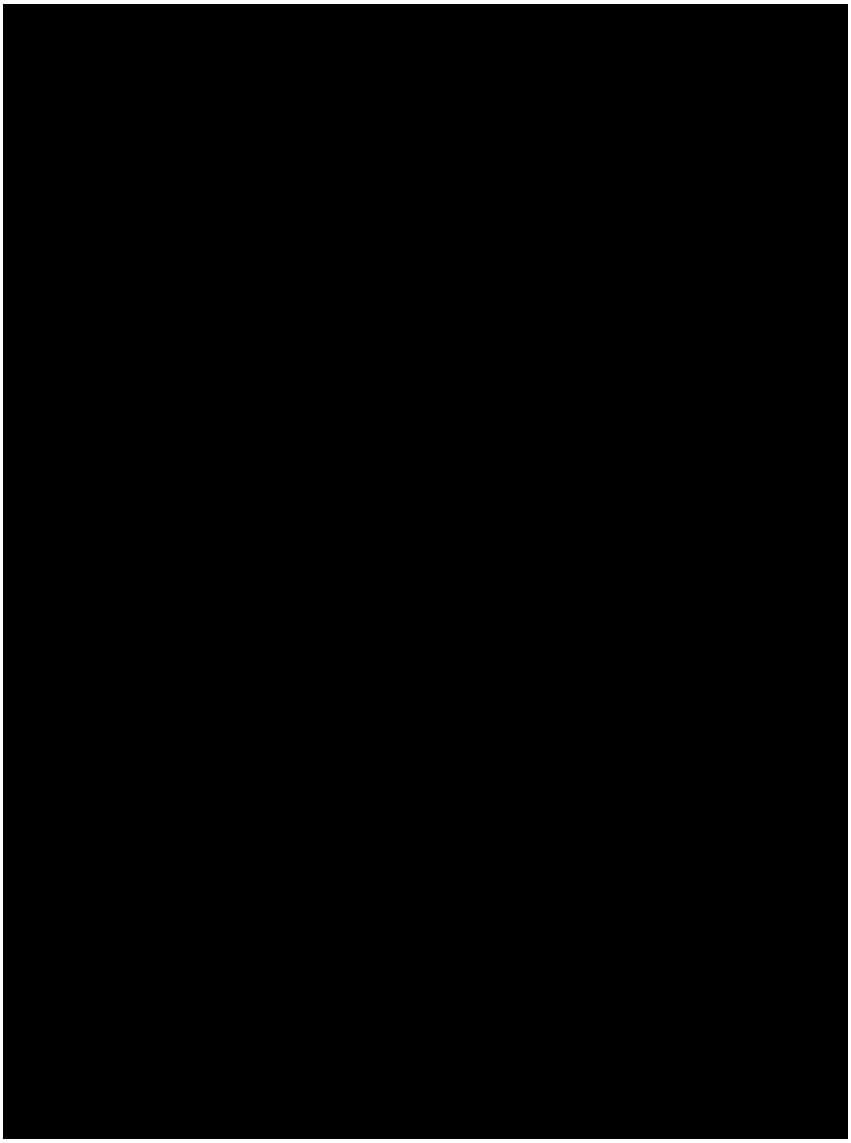
(Photograph 7 – Linear drain adjacent to Properties O and T; facing west)



(Photograph 8 – Sand bags and water line at the back door at Property O)



(Photograph 9 – Blocked gully along Park Road with noticeable ponding; facing south)

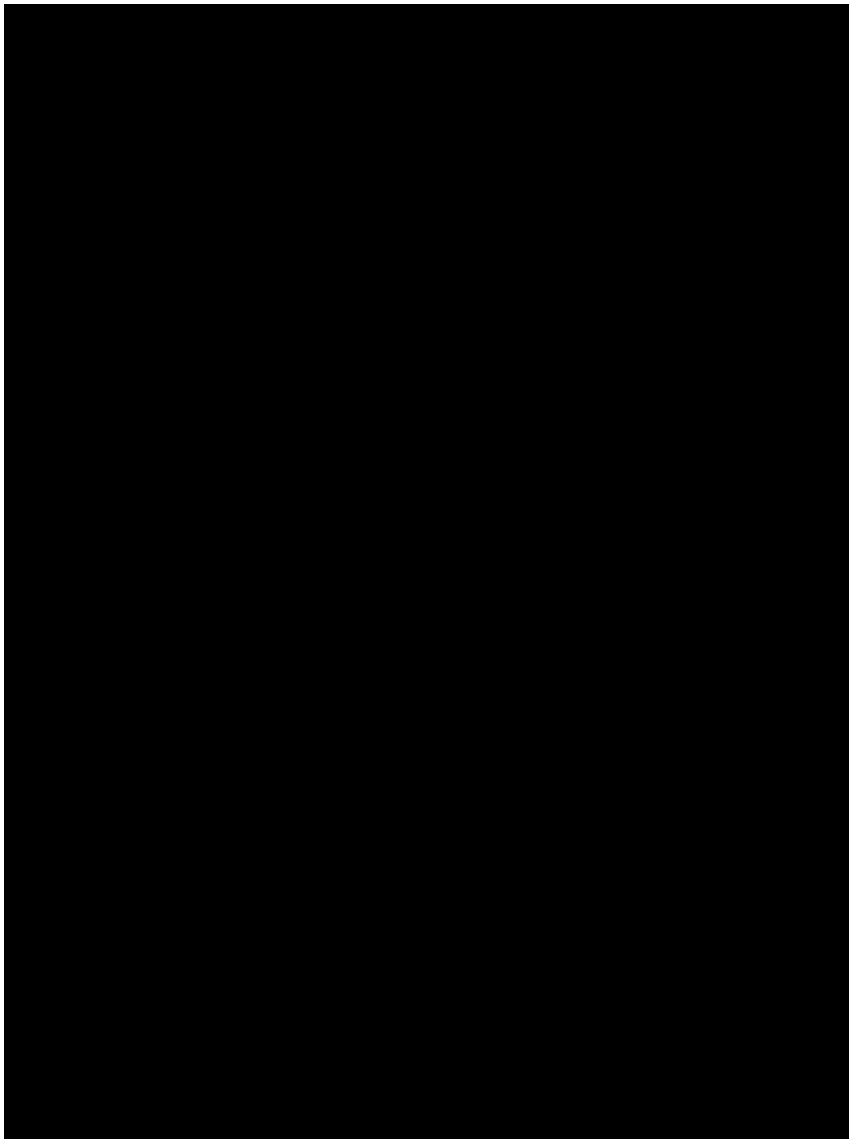


(Photograph 10 – Park Road; facing north)

(Photograph 11 – South Forty Foot Drain, as viewed during the Site visit downstream of the properties; facing north-east)

(Photograph 12 – Black Sluice Pumping Station, with sluice gates to the right; facing north-east)

(Photograph 13 – Sluice gate, also used as a navigational lock, at Black Sluice Complex; facing east)



(Photograph 14 – Embankment and wall sections on the southern side of the SFFD adjacent to the affected properties on Wyberton West Road, as viewed from its northern side; facing south)

7.4 LCC questionnaire responses

The following responses to the LCC questionnaire have been provided by the residents of the properties. These responses have been used to establish the extent, depth and cause of flooding on 06 January 2025:

- SRS000347 (Properties B & C)
- SRS000344 (Property N)
- SRS000348 (Property X)
- SRS000350 (Property AD)
- SRS000345 (Property AL)

7.5 Map of Black Sluice catchment

A map of the Black Sluice catchment, taken from the EA's Black Sluice Catchment Works, Stage 3a – Options Shortlisting (Mott MacDonald, 2015), has been included for reference below.

Figure 1.1: BSCW Project Area/South Forty Foot Drain (SFFD) catchment