Flood Investigation Report

Woodbrook Road
Project number: 60624359

Royal Borough of Greenwich

April 2023

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Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
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Table of Contents

Figures

Tables

Executive Summary

This report has been produced by AECOM, on behalf of the Royal Borough of Greenwich (RBG), who has commissioned the assessment of property level flooding experienced on Woodbrook Road (SE2 0PE) and Waterdale Road (SE2 0XT) during 6th November 2022.

RBG, as the Lead Local Flood Authority (LLFA), has a responsibility to record and report flood incidents in accordance with Section 19 of the Flood and Water Management Act (2010):

(1) On becoming aware of a flood in its areas, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate -
  (a) Which Risk Management Authorities (RMAs) have relevant flood risk management functions, and
  (b) Whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.

(2) Where an authority carries out an investigation under subsection (1) it must -
  (a) Publish the results of its investigation, and
  (b) Notify any relevant Risk Management Authorities.

British Standards BS 85600:2017 has established guidance for Section 19 post-event flood assessments, which can be found in Appendix A.

The aim of this Section 19 flood investigation was to investigate the possible causes of property level flooding that occurred on Woodbrook Road and Waterdale Road in November 2022. The report includes accounts and photographs provided by resident(s) and RBG, and desk-based information including the Level 1 Strategic Flood Risk Assessment (2017) and Level 2 Strategic Flood Risk Assessment (2019).

The flood investigation identified that the properties are susceptible to flooding due to the geology, topography and close proximity to a main river called Marsh Dykes (Woolwich). Upstream of the properties, the Marsh Dykes (Woolwich) watercourse enters a culvert known as Butts Canal. According to the public sewer records, Butts Canal is owned and maintained by Thames Water Utilities Limited (TWUL). A vertical screen positioned at the inlet of Butts Canal is reported to have become blocked with debris causing a blockage to the culvert and subsequently flooded nearby properties.

Using Met Office data, the site conditions prior to the flooding were reasonably dry with mild temperatures (October 2022). At the time of flooding the area experienced high levels of precipitation which is likely to have resulted in increased water levels within the Marsh Dykes. Late leaf fall may have contributed to debris accumulation.

No maintenance regime is known for the culvert, open channel or screen. The Level 1 SFRA (2017) identifies riparian ownership as the responsible party for screen clearance.

A number of recommendations has been identified under three main categories (asset ownership, maintenance and condition). Each ‘Recommended Action’ has a corresponding outcome and proposed parties with responsibility to enable the action to be implemented.

1. Introduction

Purpose of this Report

1.1 AECOM has been commissioned by the Royal Borough of Greenwich (RBG), the Client, to assess flooding experienced on Woodbrook Road and Waterdale Road (SE2 0PE) on the 6th of November 2022.

1.2 RBG, as the Lead Local Flood Authority (LLFA), has a responsibility to record and report flood incidents in accordance with Section 19 of the Flood and Water Management Act (2010):

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(2) Where an authority carries out an investigation under subsection (1) it must -

(a) Publish the results of its investigation, and

(b) Notify any relevant risk management authorities.

1.3 British Standards BS 85600:2017 has established criteria guidance for Section 19 post-event flood assessments, the details of which can be found in Appendix A.

2. Background

Site Location

2.1 Property flooding was recorded at Woodbrook Road and Waterdale Road on the 6th November 2022. All properties are located within the RBG administrative boundary. The key features of the area, including the screen/grille and Marsh Dykes (Woolwich) watercourse discussed in this report can be seen below in Figure 1, with the red and purple points representing the properties that were reported to have experienced internal and external flooding.

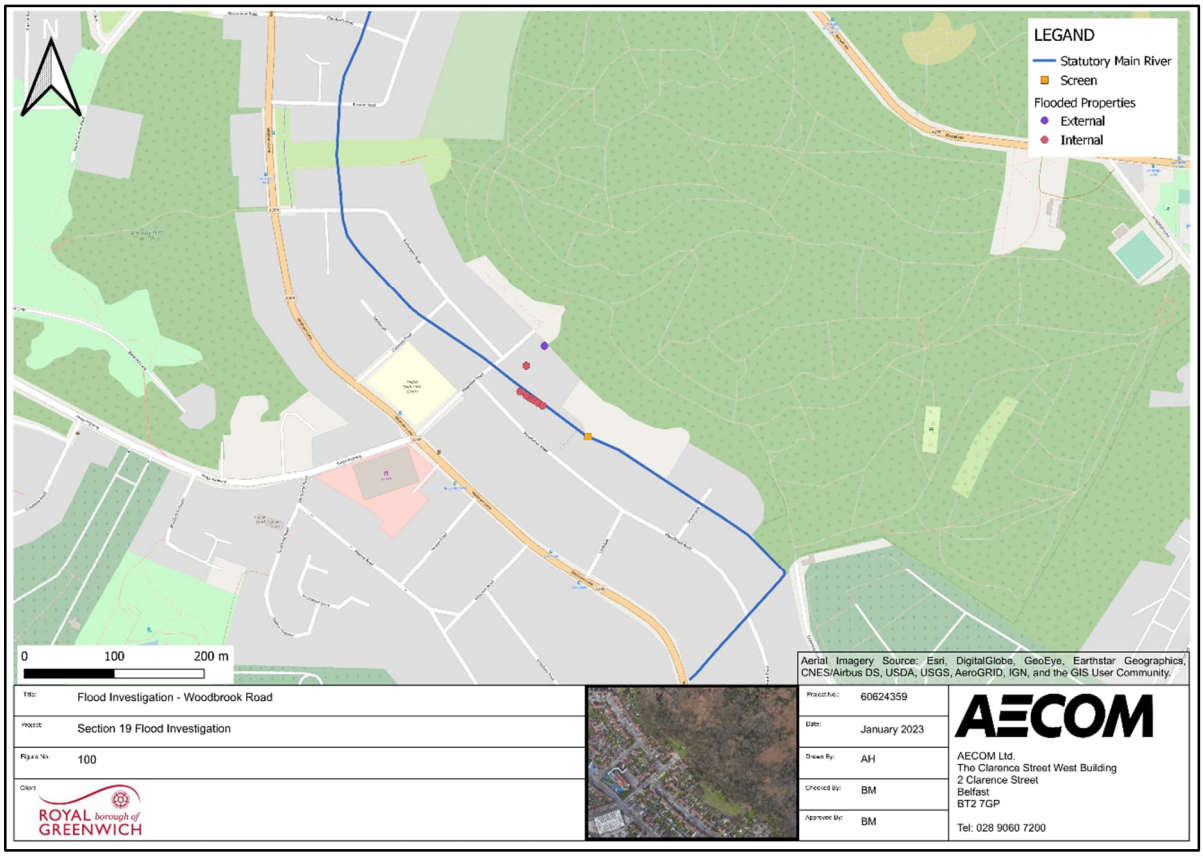


Figure 1 Site location of Property Flooding

2.2 The wooded area, to the north of Woodbrook Road and Waterdale Road is known as Bostall Heath and Woods. Bostall Heath and Wood is a steep woodland with natural occurring streams and covers an area of 159.1 hectares which is owned and maintained by RBG.

2.3 Access to the identified screen on the Marsh Dykes (Woolwich) watercourse is obtained from Woodbrook Road (51.479, 0.1061) by an alleyway which leads towards Bostall Woods. Access is required through two locked gates operated by RBG.

2.4 The RBG Level 1 Strategic Flood Risk Assessment (L1 SFRA) (2017)[1] identifies three culverted ordinary watercourses slightly upstream of the flooded area. One of the ordinary watercourses originates from Bostall Woods and joins Marsh Dykes (Woolwich) at the location of the screen (see Figure 2).

[1] AECOM, August 2017, Royal Borough of Greenwich Strategic Flood Risk Assessment

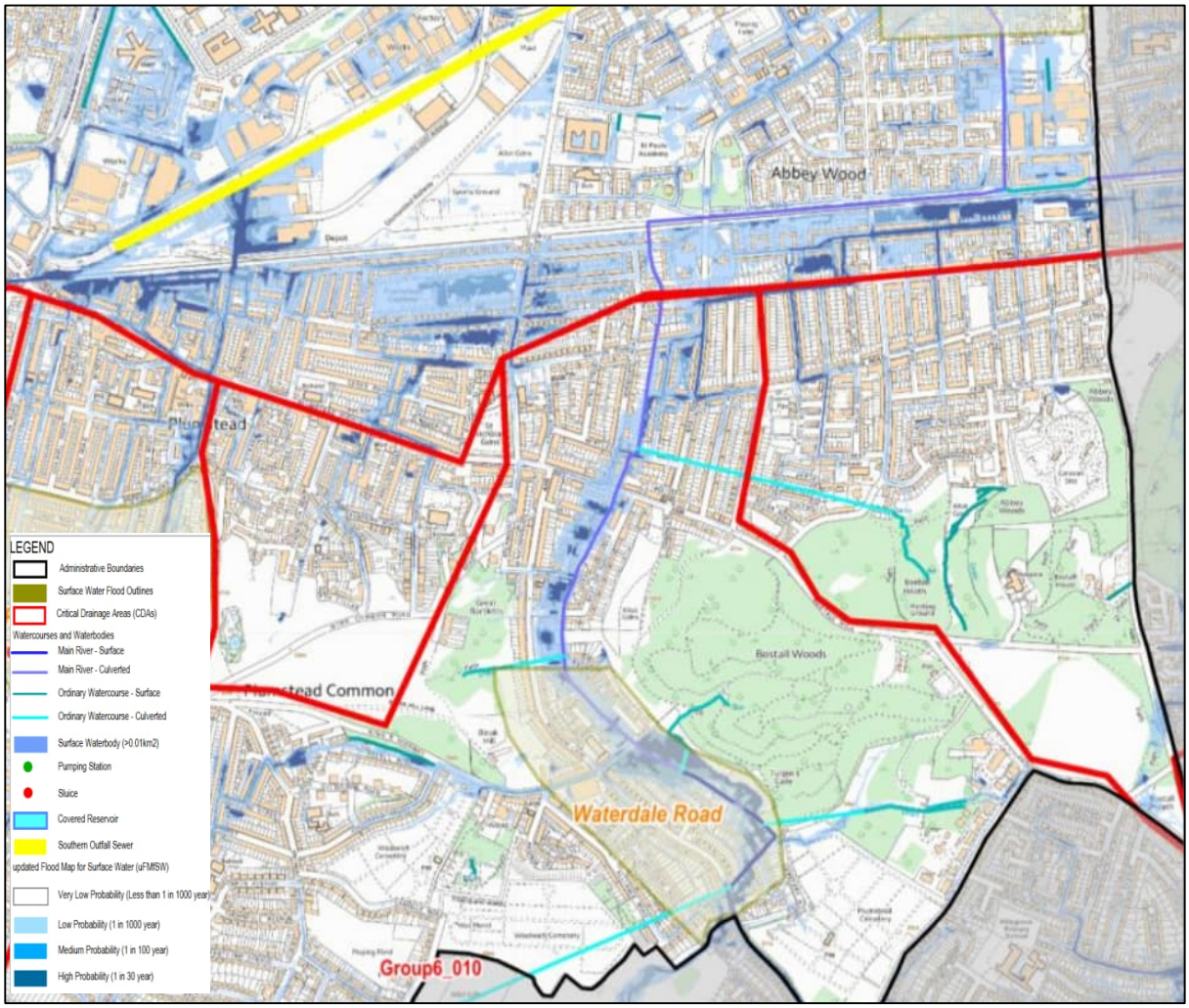


Figure 2 Marsh Dykes and Ordinary Watercourses at Risk of Flooding from Surface Water Map (Level 1 SFRA, 2017)

Reported Flooding

2.5 RBG received complaints from residents regarding the stream on the 3rd October and 3rd November 2022.

2.6 Public sewer records published on DigDat suggested TWUL as the screen owner, according to RBG. Further reports of concern were submitted to TWUL on the 4th November 2022 and as a result TWUL inspected the screen at 9pm on the same date. The TWUL technician identified that the screen was flowing freely.

2.7 On the 6th November residents of one property on Woodbrook Road reported leaving the dwelling at 10am but were contacted by neighbours at 11am to say external flooding had occurred and internal flooding was beginning to occur at their property.

2.8 The RBG Emergency Planning Unit (EPU)recorded that on the 6th of November they received a call at 2:11pm and was advised of the flooding on Woodbrook Road. RBG Street Services attended the location and advised that a sluice gate was causing the main issue and debris had been cleared from the trash screens. The term ‘sluice gate’ has been queried with RBG who have confirmed the Street Services officer was referring to the inlet of the watercourse culvert. TWUL informed RBG EPU that it was not within their responsibility.

2.9 London Fire Brigade (LFB) also attended the location and advised RBG EPU at 3:01pm that debris was cleared, and the flood waters were slowly receding. LBF also advised that they had contacted UK Power to ensure the area was safe.

2.10 It has since been reported one residential property on Waterdale Road experienced external flooding, while six residential properties on Woodbrook Road and one on Waterdale Road experienced internal property flooding.

3. Responsible Authorities and Landowners

Lead Local Flood Authority

3.1 The Lead Local Flood Authority in this area is RBG. Their responsibilities include a role as a RMA in coordinating management of local flood risk from surface water, groundwater and ordinary watercourses in the borough.

Environment Agency

3.2 The Environment Agency (EA) is one of the RMAs as defined by the Flood and Water Management Act 2010. Protecting the river environment and managing flood risk is part of their remit. The EA is the RMA for flooding from main rivers.

Water and Sewage Companies

3.3 Water and sewerage companies, such as TWUL, are RMAs and manage the risk of flooding to water supply and sewerage facilities and flood risks from the failure of such infrastructure.

Residents / Landowners

3.4 Residents have a responsibility to take measures to protect themselves and their property during a storm event.

3.5 Riparian owners are responsible for keeping watercourses clear of debris, including clearing silt traps and reed growth.

4. Flood Risk Review

4.1 A desktop review of available flood risk mapping data has been undertaken to determine the existing flood risk to the site and whether or not landscape, topography and location may result in a natural flood risk to the site. Flood mapping shows the area is not at risk from Artificial sources, so only fluvial, surface water and groundwater sources have been further assessed.

Fluvial

4.2 According to the EA's Long Term Flood Risk Service portal, available on the gov.uk website, Marsh Dykes (Woolwich) is classified as 'main river', and the area is defined to be at very low risk of flooding from rivers (less than 1 in 1000 year or 0.1% AEP) while the risk of tidal flooding is within Flood Zone 1 (< 0.1% AEP). However, the EA's Flood Map for Planning Service indicates the area to be within Flood Zone 3 and therefore has a high probability of flooding (see Figure 3).

4.3 According to RBG, the residents of the Woodbrook Road area have in the past received a letter from the EA confirming the watercourse is 'main river'.

Figure 3: Fluvial flood risk (EA, 2022)

Surface Water

4.4 According to the Risk of Flooding from Surface Water mapping, available on the gov.uk website, much of the area is at high risk of surface water flooding (3.3% Annual Exceedance Probability (AEP)) (see Figure 4). Surface water flow pathways of medium to high risk (between 1% to 3.3% AEP) are shown to flow and pond at topographical low points.

4.5 A review of LiDAR levels indicates the properties flooded are situated in a slight depression (Appendix D). Without mitigation, this potentially allows surface water to naturally pond in the north-eastern regions of the area.

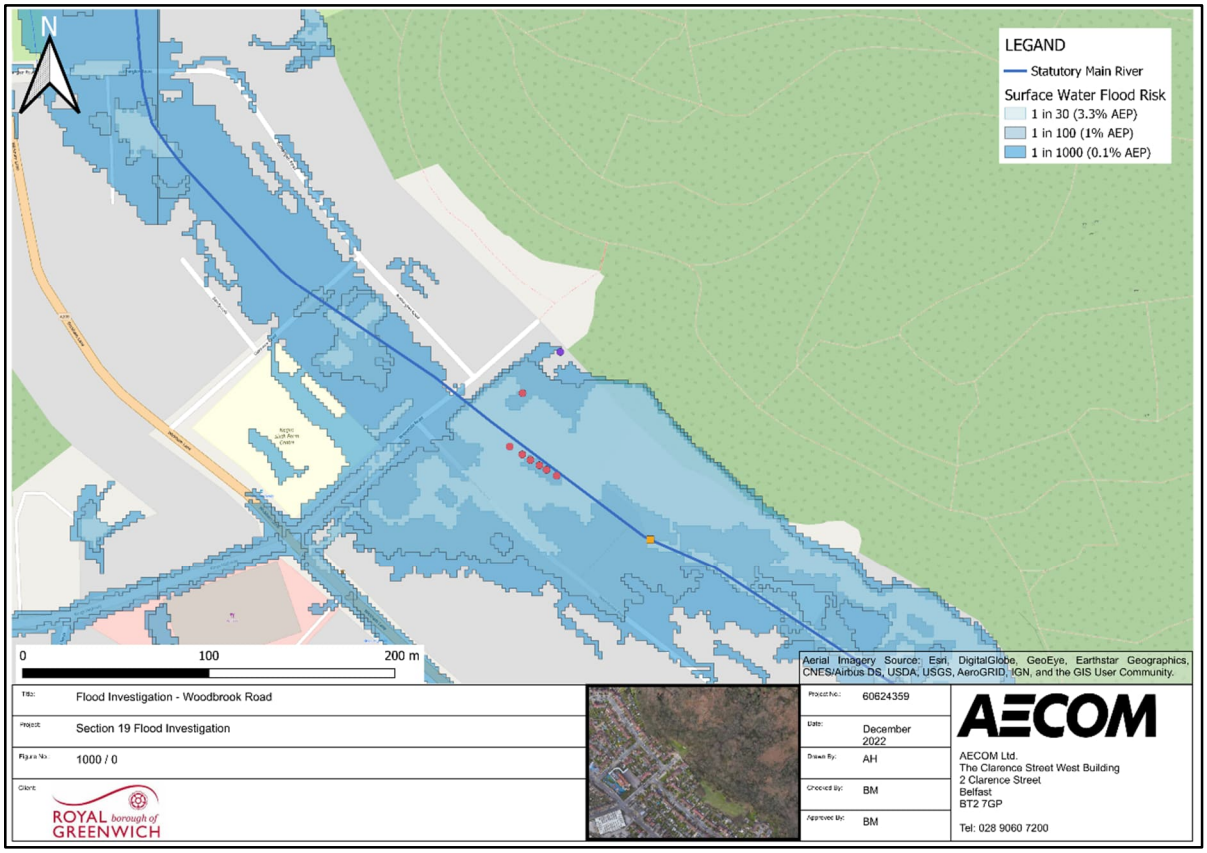


Figure 4: Surface Water Flood Risk

4.6 As referenced in Section 2.4, an ordinary watercourse joins the main river (Marsh Dykes (Woolwich)) at the location of the screen. Due to the topography is it assumed that during intense rainfall, the ordinary watercourse can increase the water levels within the main river.

4.7 According to RBG data, records show a connecting pipe from the adjacent playing fields and ordinary watercourse sourced from the wooded area to the main river, as shown in Figure 5. In November 2022, TWUL investigated the Butts Canal culvert using a CCTV survey and concluded that there were ‘no connections/linkages’ from the play fields area into the culvert.

Figure 5 Mapping abstract of RBG asset data (RBG internal GIS Application)

4.8 The L1 SFRA (2017) risk of flooding surface water map shows the indicative drainage path and flood extent of the Butts Canal. The flood extents do not account for the capacity of the culvert and is therefore indicative of flooding in the event of a culvert blockage.

4.9 The L1 SFRA (2017) identifies Waterdale road area as a system that responds quickly to rainfall and that the trash screens must be maintained to allow free flow of water to reduce the risk of flooding.

Groundwater

4.10 The EA Groundwater Vulnerability Map indicates the internally flooded properties lie within an area classified as medium to high vulnerability while the externally flooded properties are situated within both 'medium to high' and 'high' vulnerability areas. Figure 6 below illustrates the groundwater vulnerability mapping with the internally flooded properties area annotated in red and the externally flooded properties area in blue.

4.11 British Geological Society (BGS) mapping shows that the area has a bedrock geology comprising of Lewes Nodular Chalk and Thanet sand, which is largely permeable. BGS mapping indicates the area lies on a small area of sand and gravel superficial deposits. This does not indicate a risk of groundwater flooding, however, shows the vulnerability of groundwater based on the hydrological, geological and other parameters.

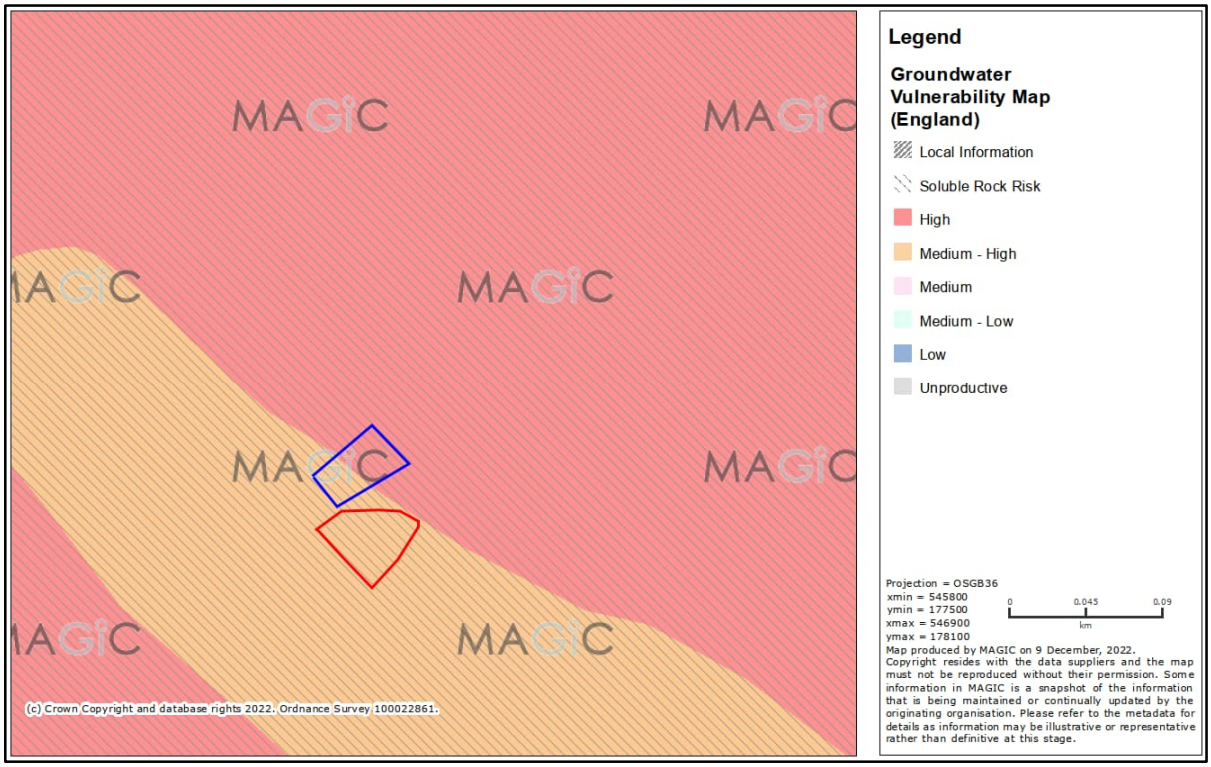


Figure 6: Groundwater Vulnerability Map (Defra MAGIC, 2022)

4.12 The aquifer designation map defines the area as a Principal aquifer. This would indicate that the site is situated on rock deposits that have high permeability and may present a high level of water storage.

Site Visits

4.13 As previously stated in Section 2.5, TWUL carried out a visual inspection of the screen on the 4th November 2022 at 9pm. The screen was declared as clear. It has not been confirmed whether TWUL cleared the screen of any debris during that site visit.

4.14 Upon reporting of property level flooding, clearance works were carried out on the screen by LFB and RBG on the 6th November 2022.In addition, LFB prevented flooding to the electrical sub-station location at the rear of Woodbrook Road.

4.15 RBG carried out a site visit on the 7th November 2022 and were accompanied by TWUL. Markings of where flood levels reached were noted to be approximately 400 to 500 mm at the rear of the internally flooded properties.

4.16 RBG Parks and Open Space team cleared the screen on the 21st November 2022.

4.17 RBG returned for a second site visit on the 28th November 2022. The objective of the site visit was to determine how the adjacent flooded field currently drains.

4.18 On the 6th December 2022 a maintenance contractor was requested to revisit the area by the RBG flood team to complete additional clearance works to the screen and desilt the channel based on the findings from the visit on the 28th November 2022.

4.19 As noted in Section 7, in November 2022 TWUL conducted a CCTV Survey on the Butts Canal culvert and concluded the asset was in ‘good order and free flowing with no restrictions/blockages’.

5. Other Supporting Information

Asset Ownership

5.1 According to RBG, no defined maintenance regime of the open channel, screen or culvert has been established by any RMA's. This may be due to the uncertainty surrounding the ownership and/or responsibility for maintaining the screen and watercourse.

5.2 The Marsh Dykes (Woolwich) watercourse is designated by the EA as 'main river'. This would indicate that the EA is responsible for managing flood risk from the main river. The EA permissive powers allow them to enter land and carry out maintenance works on main rivers, but they do not have a duty or responsibility to do so.

5.3 The EA Asset Management system, available on Data.GOV, names the culverted section downstream of the screen as Butts Canal and the 'asset maintainer' to be the Local Authority. No asset maintainer is named for the open channel section upstream of the screen.

5.4 The L1 SFRA (2017) states that Butts Canal poses an increased flood risk as a result of blockage and siltation. While the EA have permissive powers to access and maintain the silt traps, trash screens and reed growth, riparian ownership was identified as the responsible party for such maintenance.

5.5 As referenced in Section 2.5, TWUL were identified as the potential asset owner of the screen. Services information sourced for this report showed TWUL as the asset owner of the culvert downstream of the open channel. The culvert is identified on the public sewer records as a surface water sewer running parallel to the residential properties on Woodbrook Road (Appendix D). TWUL have a responsibility to manage and maintain the public sewer assets.

5.6 According to Land Registry records, the playing field land adjacent to Woodbrook Road, is in ownership of London County Council which has since become devolved to RBG. In terms of riparian ownership, this would fall to RBG and private landowners.

Rainfall Data

5.7 Monthly total rainfall data was collected using Met Offices 'Historic station data' download. The two stations used for this report is Heathrow (-0.44904, 51.47872) and Eastbourne (0.28543, 50.76167), approximately 37 km and 80 km from the site respectively.

5.8 According to Heathrow data obtained from the Met Office, November 2022 experienced 123.8 mm of rainfall. This was exceptionally high as only six other events exceeded this record since the station was installed in 1948.

5.9 The Eastbourne station began recording rainfall data in 1959, November 2022 was the highest ever for the months of November. November 2022 recorded an unprecedented level of 269.7 mm.

5.10 Using the Met Office Weather Observations Website (WOW) daily rainfall data from independently operated observation sites can be extracted. An observation site called 'Erith, Kent - G4MHJ' is approximately 3km from the flooded area and a rainfall depth of 44.2 mm was recorded between 9:26 am to 12:26 pm on the 6th November 2022 and reached a peak rainfall rate of 6.60 mm/hr.

Temperature Data

5.11 Photographic evidence and anecdotal reports provided by RBG indicated that fallen leaves and tree branches were the prominent debris obstructing the screen. Therefore, a late fall of leaves due to high temperatures during the month of October may have contributed to the acceleration of the screen blockage. To support this theory, mean daily maximum temperature (tmax, C) data was abstracted from the Met Offices 'Historic station data' using both Heathrow (-0.44904, 51.47872) and Eastbourne (0.28543, 50.76167) stations as done previously.

5.12 Both Heathrow and Eastbourne climate stations recorded the highest mean temperatures since the stations were installed in the month of October 2022, 18.3 ^{o}C and 17.9^{o}C respectively. The temperatures then dropped to 13.2 ^{o}C (Heathrow) and 14.1^{o}C (Eastbourne) for the month of November 2022.

Fly Tipping

5.13 RBG have also reported that fly tipping has been a recurring issue in the area.

6. Conclusions and Recommendations

6.1 The properties have been identified to be within an area susceptible to flooding due to the geology and topography. Met Office data showed that Southeast England experienced unusually high temperatures in October 2022 while November 2022 experienced high levels of precipitation. This would have increased water levels and discharge within the Marsh Dykes with late leaf fall contributing to debris accumulation on the screen.

6.2 The Marsh Dykes (Woolwich) watercourse is classified as 'main river' by the EA. The culvert section downstream of the screen is known as Butts Canal and is owned by TWUL. An ordinary watercourse which originates from Bostall Wood joins the Marsh Dykes 'main river' slightly upstream of the culvert inlet.

6.3 While no maintenance regime is known for the culvert, open channel or screen, the L1 SFRA (2017) identifies riparian ownership as the responsible party for clearance of the screen.

6.4 A number of recommendations have been identified in Table 1; these are subdivided into three main categories (asset ownership, maintenance and condition). Each 'Recommended Action' has a corresponding outcome and proposed parties with responsibility to enable the action to be implemented.

Table 1: Recommended Actions

Information	Recommended Actions	Outcome	Responsible
Asset Ownership	• The RMAs to identify the appropriate asset owner for the culvert, open channel, and screen • A review of the 'main river' status and adequate flood modelling data to ensure the culvert capacity and merging watercourses are accounted for	• Clearly identify the responsible parties and establish a clear reporting mechanism for residents • Further understand the flood risk posed to the area	• RBG • Environment Agency • TWUL
Asset Maintenance	• Creation of an annual and weather permitting maintenance regime • Establish an inspection regime for the culverted section and screen	• Ensure the assets are clear of debris to reduce the risk of a blockage and subsequent flooding	• RBG • Environment Agency • TWUL • Riparian Owners
Asset Condition	• An assessment of the current trash screens to ensure compliance and safe maintenance	• A review of the existing screen to determine if compliant and fit for purpose	• RBG • Environment Agency

Appendix A – British Standard 85600:2017

A.1 British Standard BS 85600:2017 Section 4

The following are guideline thresholds for determining the need for an investigation, but can vary depending on whether the area(s) affected is rural or urban and whether there is any ambiguity as to the source of the flooding:

1. Flooding of significant infrastructure (hospital, school, utilities, treatment works, etc.);
2. Flooding of a key transport link, e.g. primary routes (A-roads and motorways), key rail links;
3. Internal flooding of one or more premises on more than one occasion in the past five years (excluding gardens and detached garages/out-buildings, but including integral garages); and
4. Internal flooding of five or more properties in close proximity during a single incident.

If any of the criteria are met then a flood investigation should be commenced, taking account of the severity and extent of flooding (to inform timescales and resources). If the criteria are not met, then this fact and the decision not to investigate should be recorded. The recorded incidents should determine the initial scope and methodology for the survey(s) (one incident might involve several different surveys), and the decision as to whether the survey will involve a desk study and/or a site visit. This should involve identifying the means of capturing the data and in what format they should be recorded and stored to ensure the information can be viewed and shared for use by any relevant parties in the future.

Appendix B – Photographs from Site Visits

Photograph 1 Water level approximately 300 mm from ground level, reported by RBG (07.11.2022)

Photograph 2 Rear of property on Woodbrook Road (07.11.2022)

Photograph 3 Pre screen clearance (07.11.2022)

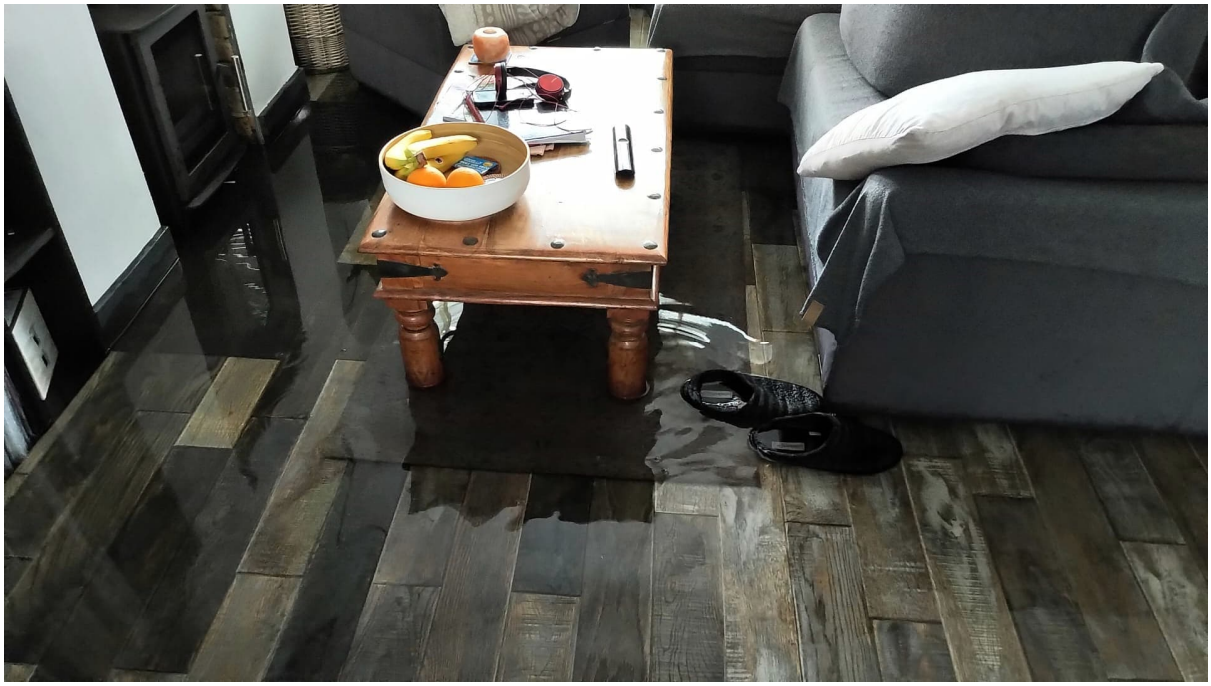
Photograph 4 Post screen clearance (07.11.2022)

Photograph 5 Debris build up on the screen (29.11.2022)

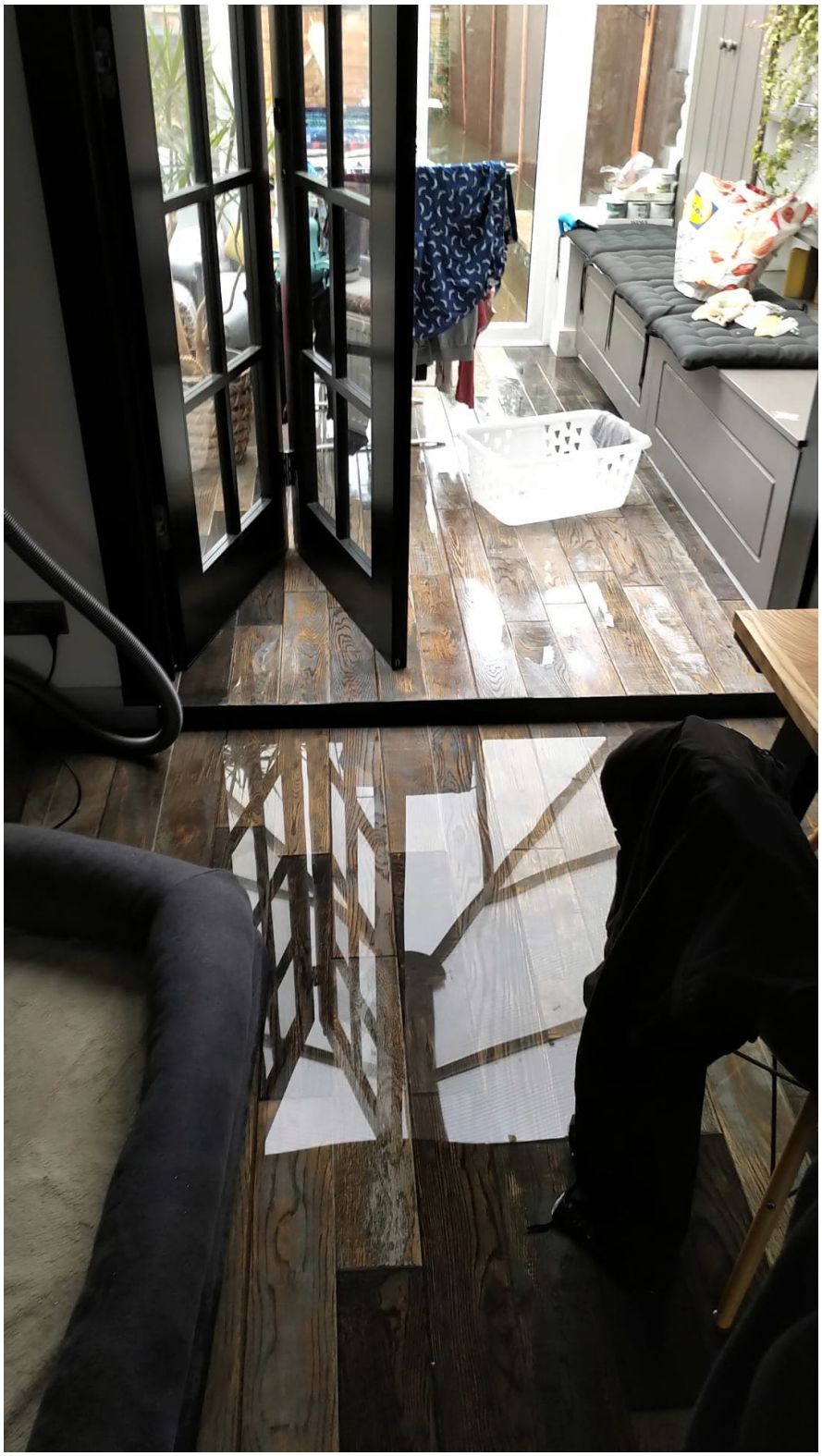
Photograph 6 Alternative view of screen (29.11.2022)

Appendix C – Photographs from Residents

Resident 1 – Photograph 1



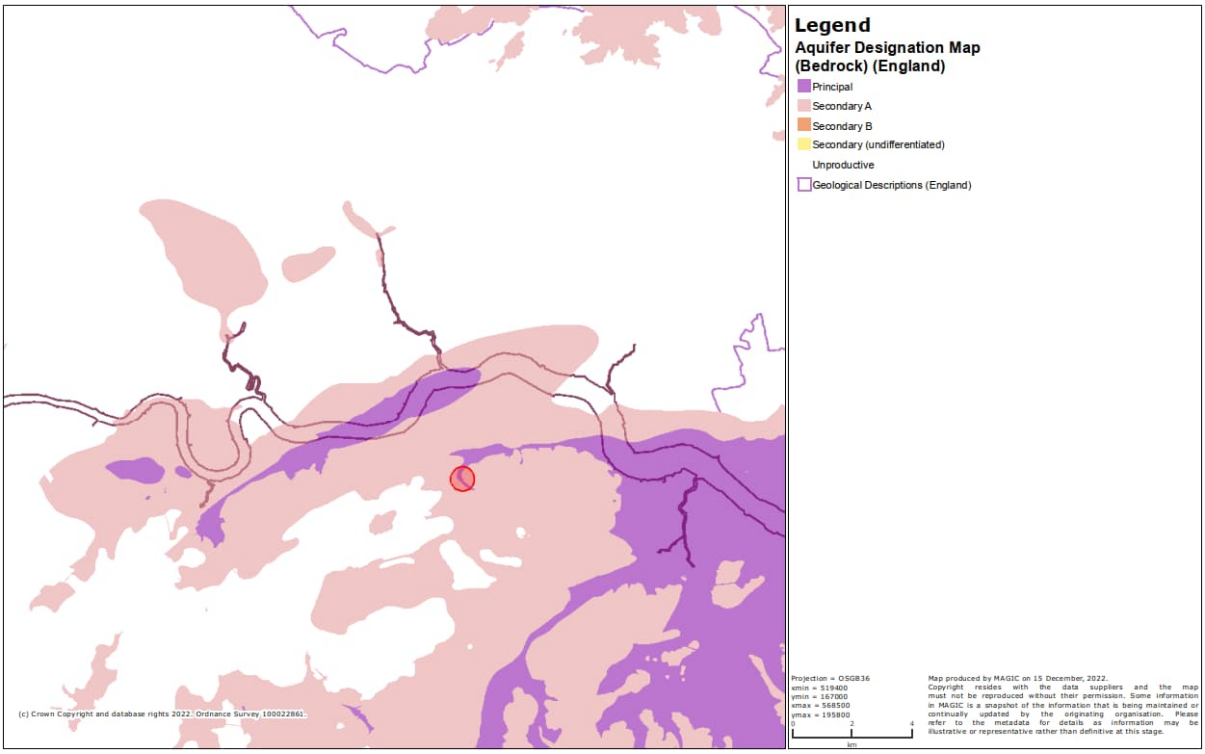
Resident 1 – Photograph 2



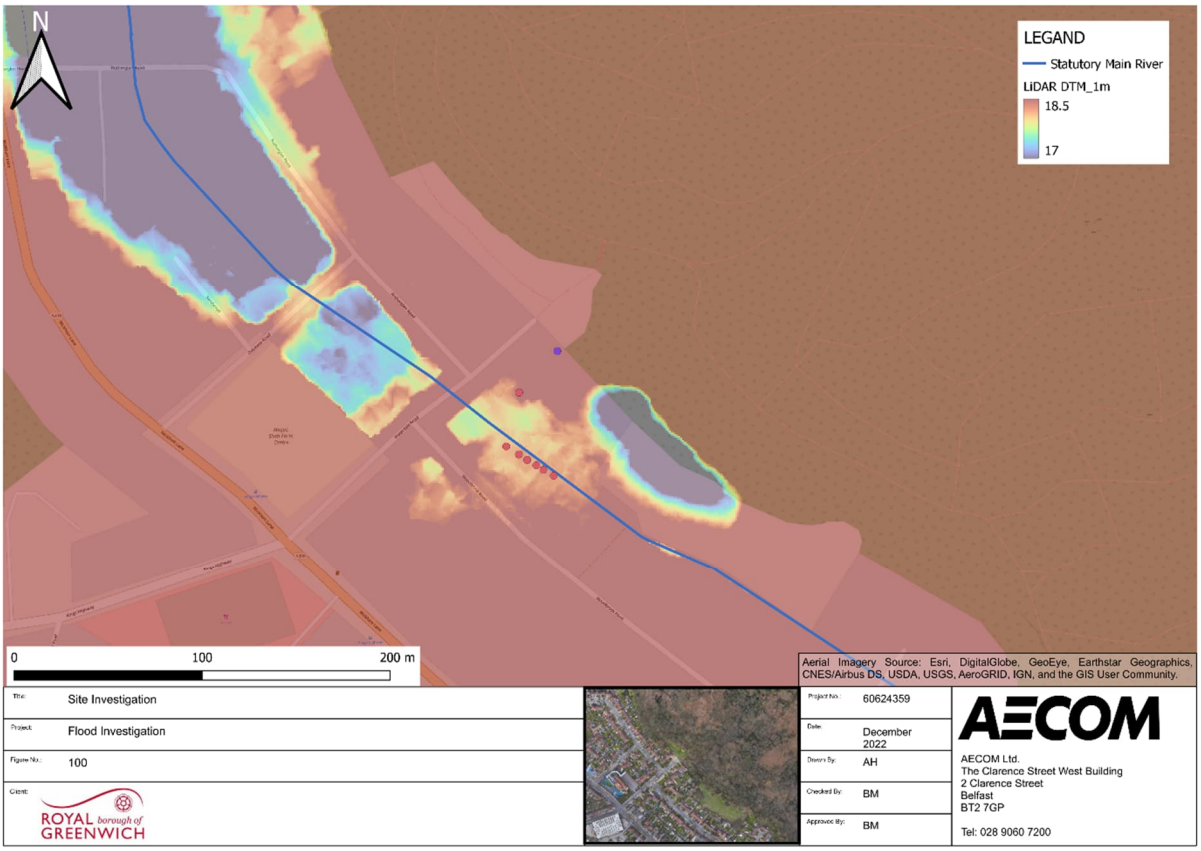
Resident 1 – Photograph 3

Resident 1 – Photograph 4

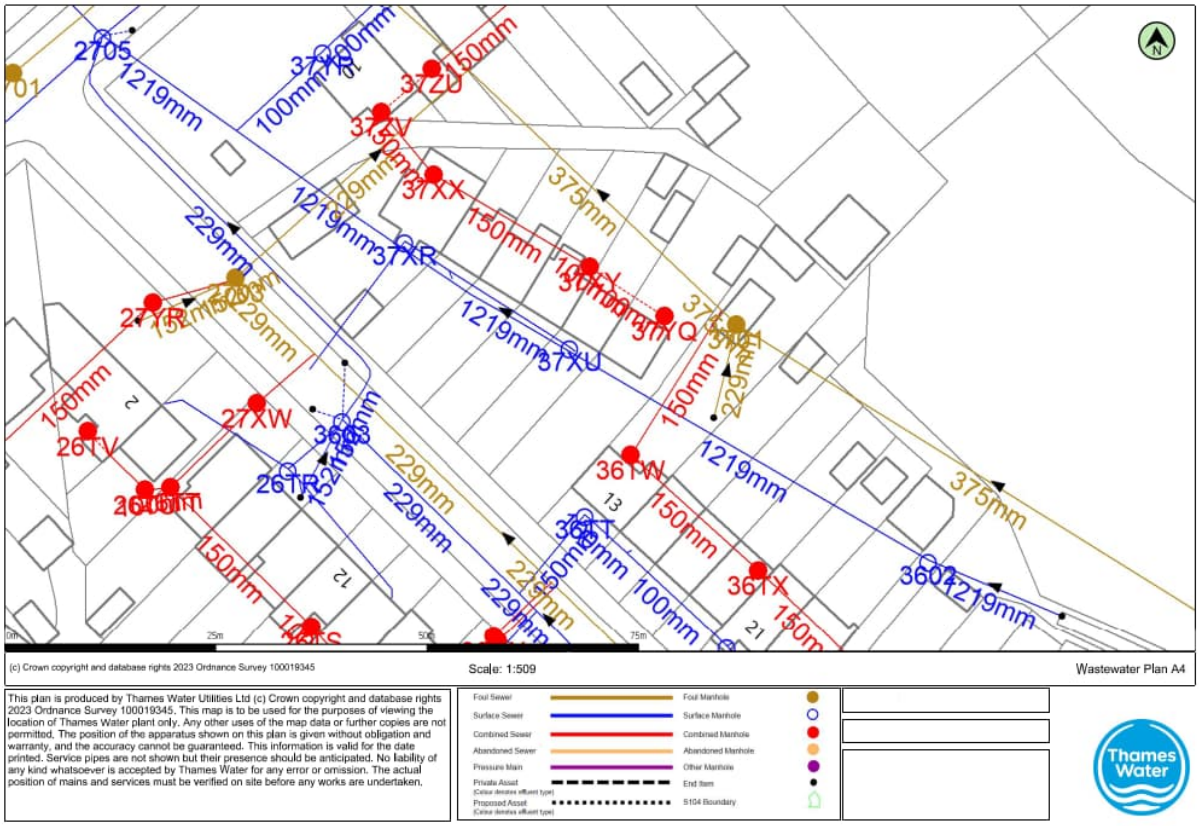
Appendix D – Additional Mapping & Information



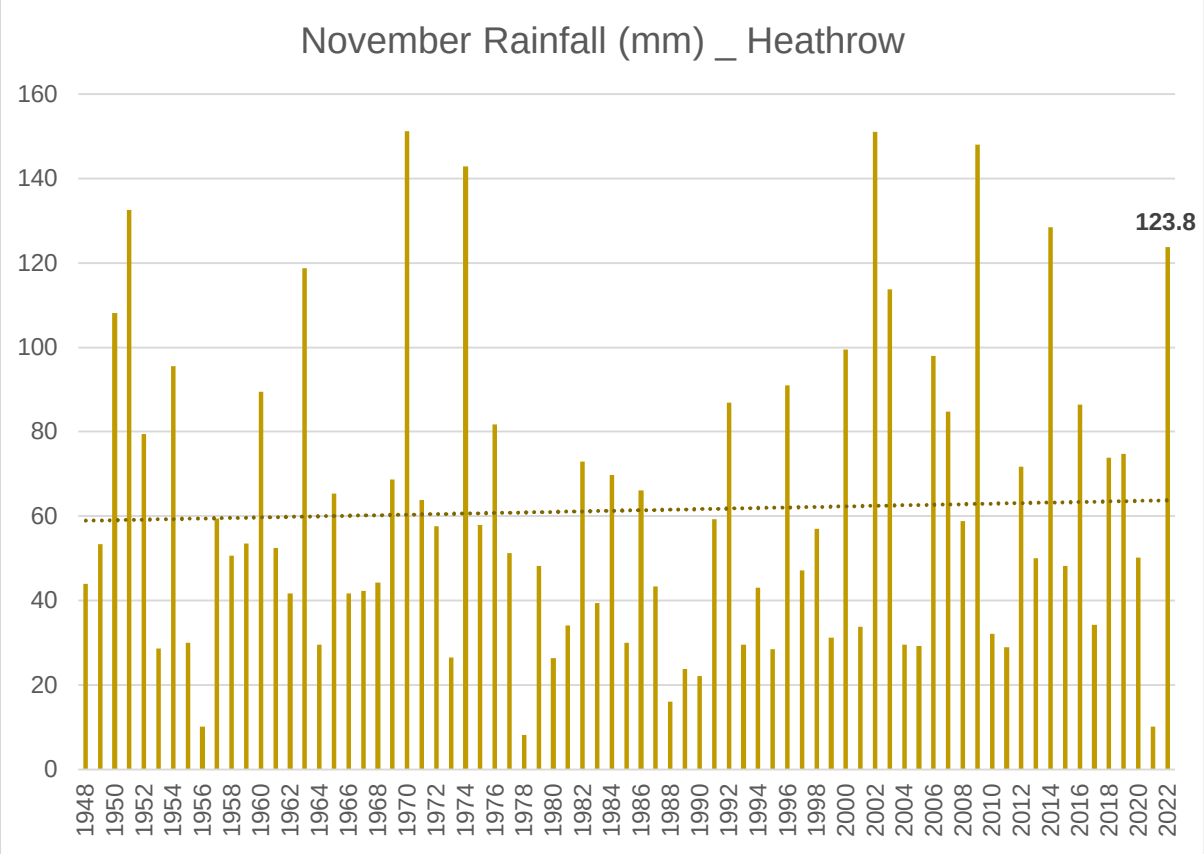
Map 1. Aquifer Designation Map (Bedrock) (England) Source: MAGIC, December 2022



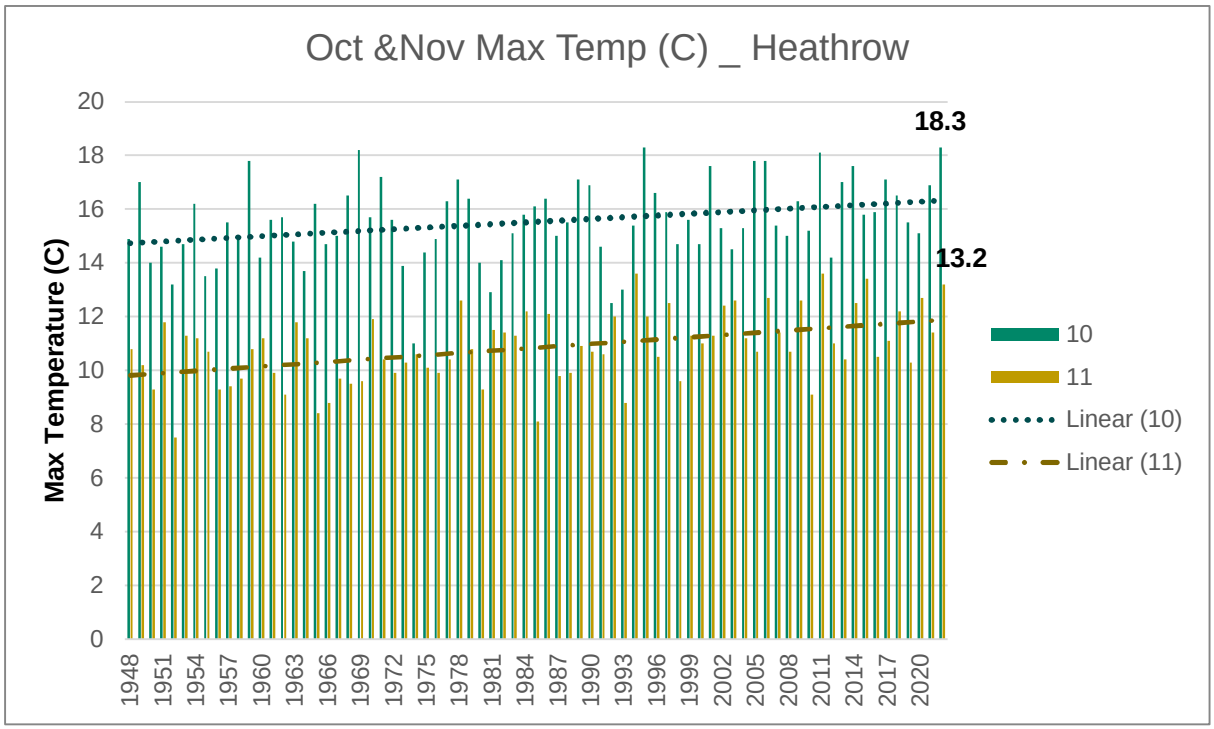
Map 2. LiDAR Source: GOV, December 2022



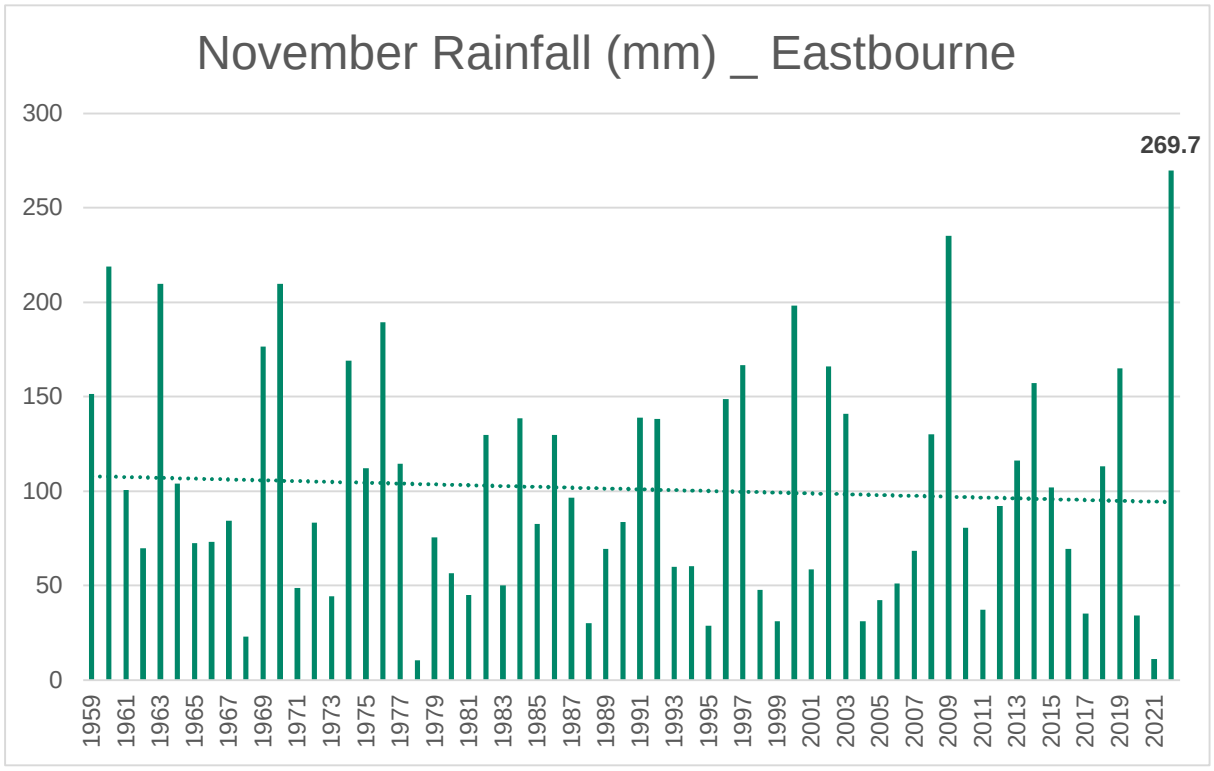
Map 3. Thames Water Utilities Source: Digdat Utilities, January 2023



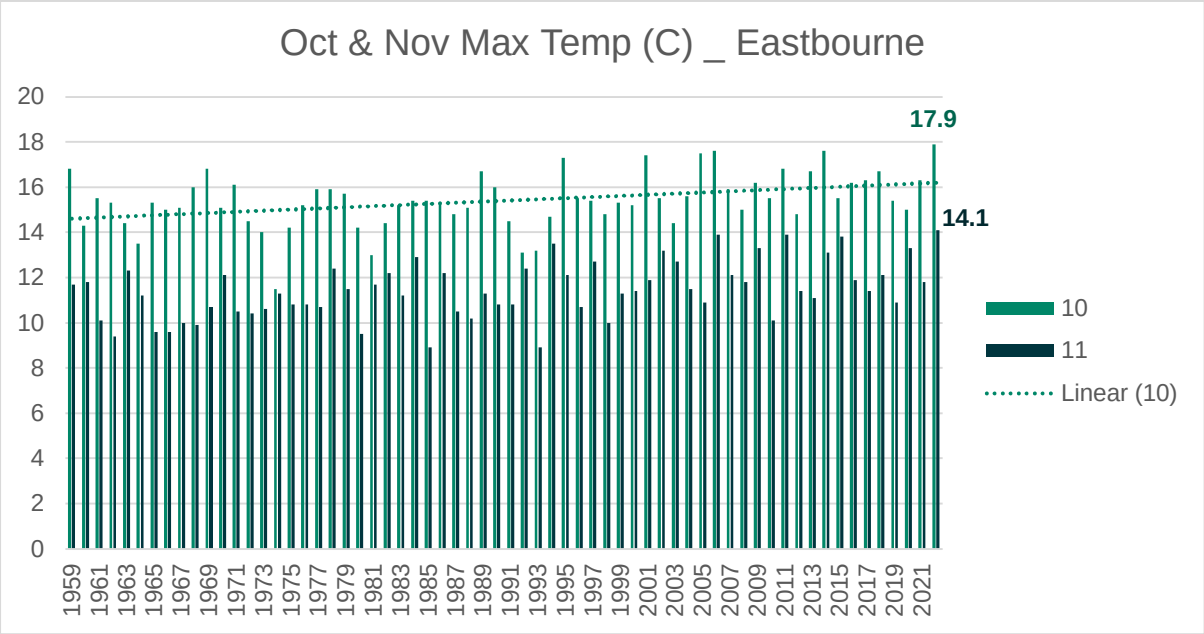
Graph 1 Heathrow Station – November total rainfall (1948 to 2022), Source Met Office, December 2022



Graph 4 Heathrow Station – October and November Mean Max Temp (1948 to 2022), Source: Met Office December 2022



Graph 3 Eastbourne Station – November total rainfall (1959 to 2022), Source: Met Office, December 2022



Graph 4 Eastbourne Station – October and November Mean Max Temp (1959 to 2022), Source: Met Office December 2022