

Land West of Bilsham Road

Flood Risk Assessment and Drainage Strategy



For
Landlink Estates Ltd.

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EXECUTIVE SUMMARY

CampbellReith has produced this Flood Risk Assessment (FRA) and Drainage Strategy to support a hybrid planning application for the proposed residential development at the Land West of Bilsham Road, Yapton. As part of the hybrid application, Phase 1 is for a full application for 30 residential dwellings, new access from Bilsham Road, public open space, landscaping, sustainable drainage and associated works. The outline planning application element is for further phases of up to 110 dwellings and associated infrastructure (with all matters reserved).

The Ryebank Rife, which is classified as an ordinary watercourse (as identified by the Environment Agency), flows along the western boundary of the site in a southwardly direction. There is a small area of Flood Zone 2 along the north-western boundary of the site associated with the Ryebank Rife, however, this area will contain landscape screening only. The entirety of the proposed operational development is within an area defined as Flood Zone 1 as identified by the Environment Agency. The site is generally at low or very low risk to flooding from all other sources. There is a medium risk associated with groundwater flooding within the wider Arun area while onsite groundwater monitoring and historical flood records suggest groundwater flood risk in the areas of the site where proposed development is focused to be low.

The geology of the site indicates gravel, sand, silt and clay over layers of chalk.

There is an existing public foul sewer running adjacent to the eastern site boundary. Taking account of site levels constraints, a combination of gravity and pumped systems are proposed to drain foul effluent from the site with a discharge into the existing Southern Water public sewer.

The proposed surface water drainage strategy seeks to utilise a combination of Sustainable Drainage Systems such as swales, permeable paving, below ground cellular storage, and a pond to provide attenuation and water quality improvements. The proposals also provide additional amenity and biodiversity benefits prior to a controlled discharge to the watercourse at greenfield runoff rates for all rainfall events up to and including 1 in 100 year + 40% climate change storm event.

The proposed development is located in an area which is at the lowest risk of flooding from any source. The proposed strategy will not increase flood risk on or off the site for the lifetime of the development.

1.0 INTRODUCTION

1.1. Brief

1.1.1. CampbellReith has been commissioned by Landlink Estates Ltd to prepare a Flood Risk Assessment (FRA) to inform the residential development at the Land West of Bilsham Road, herein referred to as 'the site'. The site location is contained in **Appendix A**.

1.1.2. This assessment is a qualitative report and has been based on readily available information.

1.1.3. The FRA has been prepared in support of a hybrid Planning Application for the above proposed development.

1.2. Project Overview

1.2.1. The project is a hybrid application including Phase 1 (full application) for 30 residential dwellings, new access from Bilsham Road, public open space, landscaping, sustainable urban drainage and associated works. Outline planning application for further phases of up to 110 dwellings and associated infrastructure (with all matters reserved).

1.3. Aims and Objectives

1.3.1. This report has been prepared in accordance with the National Planning Policy Framework (NPPF)¹ and the accompanying Planning Practice Guidance (PPG)².

1.3.1. This FRA aims to identify the sources of flooding related to the site whilst demonstrating the feasibility of residential development and how residual risks, if any, could be managed.

1.3.2. The objectives of this FRA are to:

- Establish whether the site is likely to be affected by current or future flooding from any source;
- Establish whether proposed future development will increase flood risk elsewhere;
- Establish whether the measures proposed to deal with these effects and risks are appropriate;
- Establish whether the Lead Local Flood Authority (LLFA) has records of flood risk on the site and within the surrounding area;
- Present the findings of the assessment through a site constraints plan;
- Demonstrate surface water can be managed on site by preparing an illustrative surface water drainage strategy.

¹ Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework. Ref: ISBN 978-1-5286-1033-9, CP 48.

² Department for Environment, Food & Rural Affairs and Environment Agency (2021) Planning Practice Guidance: Flooding and Coastal Change

2.0 PLANNING POLICY

2.1. National Planning Policy Framework (NPPF)

- 2.1.1. The NPPF as updated in July 2021 sets out the government's national planning policies to protect people and property from flooding from either now or in the future which all Local Planning Authorities (LPAs) are expected to follow. There are three main steps which should be followed to ensure that the risk of flooding from development is minimised; assess the flood risk, avoid flood risk and manage and mitigate the flood risk.
- 2.1.2. The NPPF recommends that new development adopts a sequential, flood risk-based approach to the location of development, taking into account climate change and its impact to or by current or future flood risk. Subject to the type of development proposed and the relative flood zone (Zone 1 being the least risk and Zone 3b the greatest risk) in which the development site is located, there can be a requirement for a sequential test and an exception test.
- 2.1.3. The aim of the sequential test is to steer development to areas considered to be at the lowest risk from sources of flooding. If this is not possible then the exception test would be required demonstrating that the development would provide wider sustainability benefits to the community that would outweigh the flood risk and that the development would be safe for its lifetime taking into account the vulnerability of the users without increasing flood risk elsewhere and where possible reducing the current risk of flooding.
- 2.1.4. The NPPF also states that major developments should incorporate sustainable drainage systems (SuDS) unless there is clear evidence that this would be inappropriate.

2.2. Flood Risk and Coastal Change Planning Practice Guidance (PPG)

- 2.2.1. A FRA is required when developments are:
- Located within a Flood Zone 2 or 3 including minor development and change of use;
 - More than 1 hectare (ha) in a Flood Zone 1;
 - Less than 1 ha in a Flood Zone 1, including a change of use in development type to a more vulnerable class (for example from commercial to residential), where they could be affected by sources of flooding other than rivers and sea (for example surface water, reservoirs); or
 - In an area within a Flood Zone 1 which has critical drainage problems as notified by the Environment Agency (EA).
- 2.2.2. Paragraph 66 (Table 2) of the PPG defines the various flood risk vulnerability classification and identifies the different types of development within each category. **Table 2.1** on the following page summarises the flood risk vulnerability and compatibility as extracted from Paragraph 67 of the PPG in relation to the above flood zones.

Table 2.1: Flood Vulnerability and Flood Zone Compatibility Table

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test Required	✓	✓	✓
Zone 3a†	Exception Test required†	✗	Exception Test Required	✓	✓
Zone 3b*	Exception Test required*	✗	✗	✗	✓*

Key ✓ Development is appropriate.

✗ Development should not be permitted.

† In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

* In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows and not increase flood risk elsewhere.

2.3. Roles and Responsibilities

- 2.3.1. The EA is a statutory consultee for planning applications. The EA is responsible for managing the risk of flooding from main rivers, reservoirs, estuaries and the sea.
- 2.3.2. The roles of the LLFAs were established following the Flood Risk Regulations (2009) and the Flood and Water Management Act (2010). They are responsible for developing, maintaining and applying a strategy for local flood risk management in their areas and maintaining a register of flood risk assets. They also have lead responsibility for managing the risk of flooding from surface water, groundwater and ordinary watercourses.

2.4. Climate Change³

- 2.4.1. The NPPF sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change. The EA provide guidance on the climate change allowances which should be considered when assessing the future risk of flooding.
- 2.4.2. The EA has produced a range of climate change allowances to be applied to the peak river flow based upon the river basin management catchment. Management catchments are sub-catchments of river basin districts. The site is located within the South East River Basin District and the Arun and Western Streams Management Catchment. **Table 2.2** shows the anticipated changes to peak flow, which should be considered for the area.

³ EA Climate Change Allowances: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

- 2.4.3. The range of allowances is based upon a statistical analysis above the 50th percentile, which is regarded as being the central category. The higher central is based upon the 70th percentile and the upper end is based on the 95th percentile.

Table 2.2: Peak River flow allowances by Arun and Western Streams Management Catchment within the South East river basin district (use 1961 to 1990 baseline)

Allowance Category	Total Potential Change Anticipated For The '2020s' (2015 to 2039)	Total Potential Change Anticipated For The '2050s' (2040 to 2069)	Total Potential Change Anticipated For The '2080s' (2070 to 2115)
Upper end	27%	36%	64%
Higher central	16%	19%	36%
Central	11%	13%	25%

- 2.4.4. Climate change allowances should be applied to the peak rainfall intensities. **Table 2.3** shows the anticipated change in extreme rainfall intensity in small and urban catchments. The central and upper allowances should be applied to assess the range of impact.

Table 2.3: EA Peak Rainfall Intensities

Applies Across All Of England	Total Potential Change Anticipated For The '2020s' (2015 to 2039)	Total Potential Change Anticipated For The '2050s' (2040 to 2069)	Total Potential Change Anticipated For The '2080s' (2070 to 2115)
Upper End	10%	20%	40%
Central	5%	10%	20%

3.0 LOCAL POLICIES AND GUIDANCE

3.1.1. The following documents have been reviewed to inform this assessment:

- Arun District Council (Adopted July 2018) Local Plan
- Arun District (January 2021) Design Guide
- Arun District Council (October 2016) Strategic Surface Water Management Study
- Arun District Council (November 2016) Level 1 and Level 2 Strategic Flood Risk Assessment
- Arun District Council (November 2019) Surface Water Drainage Proposal Checklist
- Arun District Council (June 2004) Land Drainage Byelaws
- West Sussex Lead Local Flood Authority (May 2011) Preliminary Flood Risk Assessment (PFRA)
- West Sussex Lead Local Flood Authority (November 2018) Policy for the Management of Surface Water
- Manhood Peninsula Surface Water Management Plan (July 2015)
- South Marine Plan (July 2018)

3.2. Local Flood Risk Policy

3.2.1. The site is within the jurisdiction of Arun District Council (ADC) and West Sussex County Council (WSCC). Arun District Council is responsible for the Local Plan which covers the 2011-2031 timeframe and has a number of policies relating to both flood risk and water, which guide planning and development decisions.

3.2.2. The following policies should be considered when assessing flood risk and surface water management of the site:

- Policy W SP1 – Water
- Policy W DM2 – Flood Risk
- Policy W DM3 – Sustainable Urban Drainage Systems
- Policy ECC SP1 – Adapting to Climate Change

3.3. Strategic Flood Risk Assessment (SFRA)

3.3.1. A Level 1 and Level 2 Combined SFRA was prepared by JBA Consulting for ADC in November 2016. The following sources of flood risk were identified within the study area:

- Fluvial
- Surface Water
- Groundwater
- Sewer
- Artificial Sources

3.3.2. Applicable maps and extracts are contained in **Appendix B**.

- 3.3.3. ADC have commissioned an update to the SFRA as part of their Local Plan Review, although it is understood that the local plan programme is currently on hold until May 2022.

- 3.4. **Preliminary Flood Risk Assessment (PFRA)**

- 3.4.1. WSCC prepared a PFRA in 2011 to assist in meeting its duties as LLFA to manage local flood risk and deliver the requirements of the Flood Risk Regulations. The PFRA provides a high level overview of flood risk from a variety and combination of sources.
- 3.4.2. This report and the data collected are to be used to identify local flood risk areas and areas where further information is required to better determine and understand local flood risk across Chichester and the wider area.

4.0 SITE CONTEXT

4.1. Site Location

- 4.1.1. The site is located at the Land West of Bilsham Road, Yapton, as illustrated in **Figure 4.1** below. The nearest postcode for the site is BN18 0LA and the National Grid Reference for the approximate centre of the site is 497488, 102433.

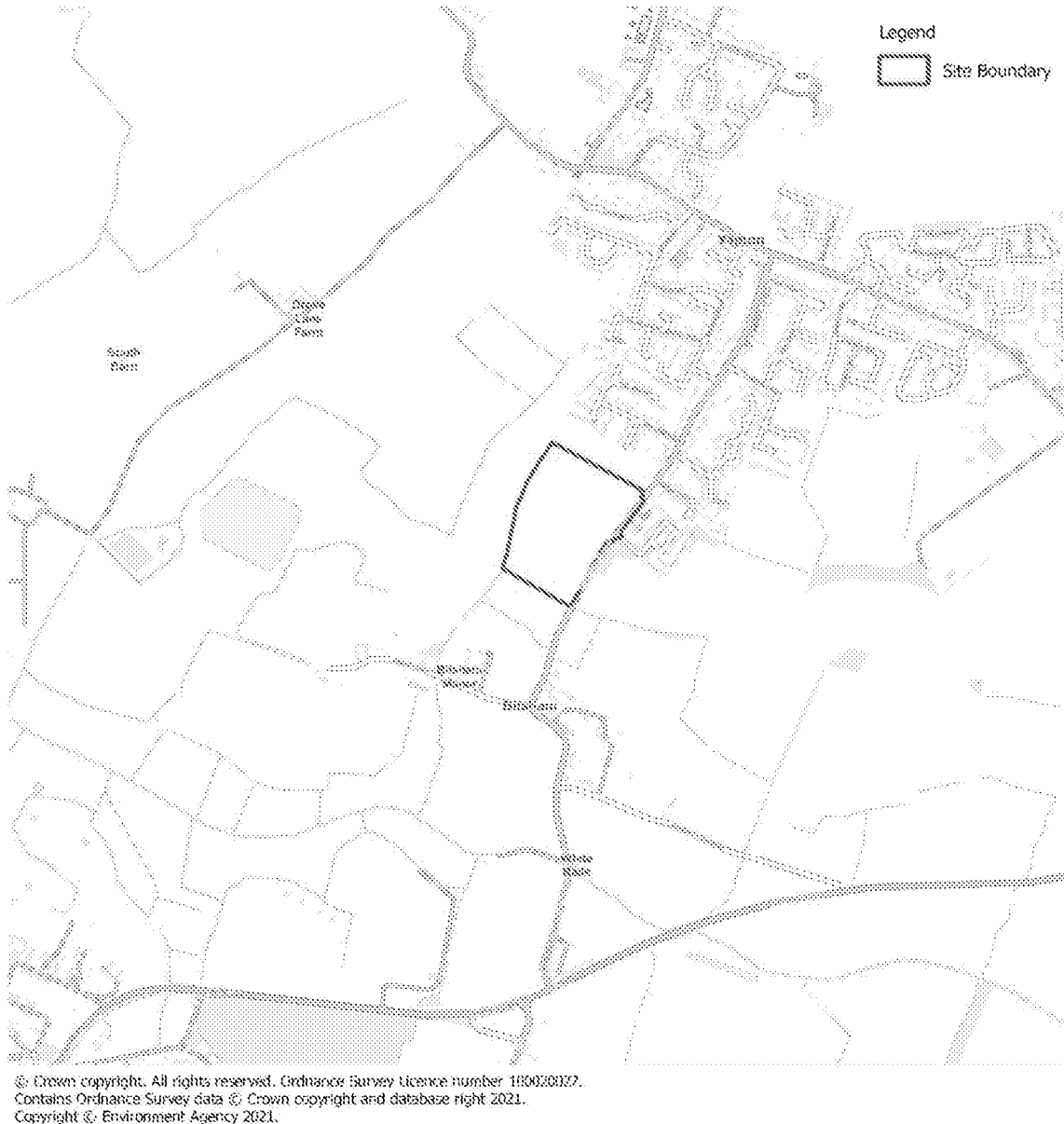


Figure 4.1: Site Boundary

- 4.1.2. The existing site is currently utilised as agricultural land. The Ryebank Rife, an ordinary watercourse, flows along the western boundary of the site. The site is bound by Bilsham Road to the east and agricultural land to the south and west. The land immediately north of the site is currently agricultural land while there is existing residential development further to the north.
- 4.1.3. Arun District Council is the Local Planning Authority (LPA) for the site and West Sussex County Council act as the LLFA for the area.

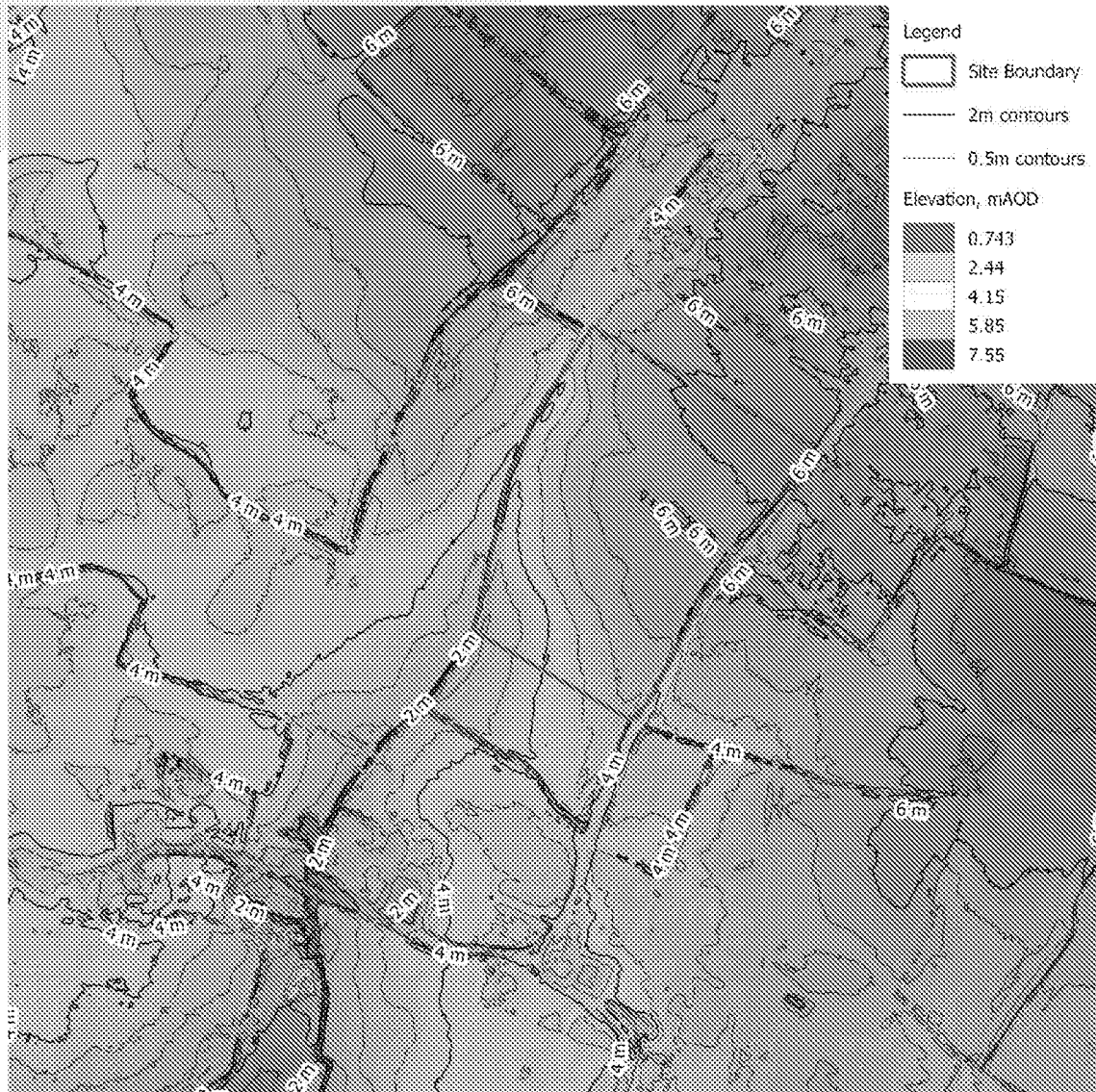
4.2. Site History

- 4.2.1. A Groundsure Report completed in July 2021 suggests that the site has no previous historical land use as shown within the aerial photographs dating back to 1999. Old Maps Online⁴ also exhibits the solely agricultural use of the site within maps dating back to 1896.

4.3. Topography

- 4.3.1. Lidar data has been obtained as part of this assessment and is shown in **Figure 4.2**.
- 4.3.2. A topographical survey was undertaken by Survey Solutions in March 2021 (ref: 31703BWLS-04) and is contained in **Appendix C**.
- 4.3.3. Available data indicates a high point along the northern boundary of the site with levels falling predominantly south-west towards the watercourse. Existing ground levels are shown to range from approximately 6.50 metres above ordnance datum (mAOD) in the north-east to 1.60mAOD in the south-west.
- 4.3.4. A site walkover was undertaken in October 2021. Key images are contained in **Appendix C**.

⁴ Old Maps Online <https://www.oldmapsonline.org/>



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Figure 4.2: Lidar Data

4.4. Geology

- 4.4.1. The British Geological Survey (BGS) Online Geology Viewer⁵ notes the underlain bedrock for the site as Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation And Portsdown Chalk Formation (undifferentiated) – Chalk. Superficial deposits are noted as River Terrace Deposits (undifferentiated) - Sand, Silt And Clay.
- 4.4.2. Ground Investigations were undertaken by Harrison Group Environmental in May 2021 and are contained in **Appendix D**. The investigations confirmed the expected geology and have been summarised in **Table 4.1**.

⁵ British Geological Survey (BGS) Online Geology <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

Table 4.1: Site Geology

Strata	Expected Thickness (m)	Generalised Description
Aeolian Brickearth	2.0	Silt/clays with occasional gravel
Raised Beach Deposits/ River Terrace Deposits	1.5	Very clayey sandy gravel of flint/ very sandy and chalk silt
Upper Chalk Formation	≈275	Soft chalk with nodular flints, weathered at top

- 4.4.3. Further information can be found in the associated Land Quality Statement (ref: 13684-CRH-XX-XX-RP-GE-0001_LQS).

4.5. Hydrology

- 4.5.1. A desk-study review of Ordnance Survey (OS) mapping notes shows Ryebank Rife, an ordinary watercourse, flowing down the western boundary of the site eventually merging downstream with the main river section of the Ryebank Rife approximately 650m south of the site.
- 4.5.2. The watercourse is culverted in the north-western corner of the site. The 600mm diameter culvert terminates into an open channel via a large brick headwall structure. Site visits and surveys have confirmed that the watercourse is generally around 2m in depth with a top bank width of approximately 6m. There is currently a 3m wide crossing point mid-way along the watercourse enabled via a 300mm pipe.
- 4.5.3. There are no other surface water features on site.

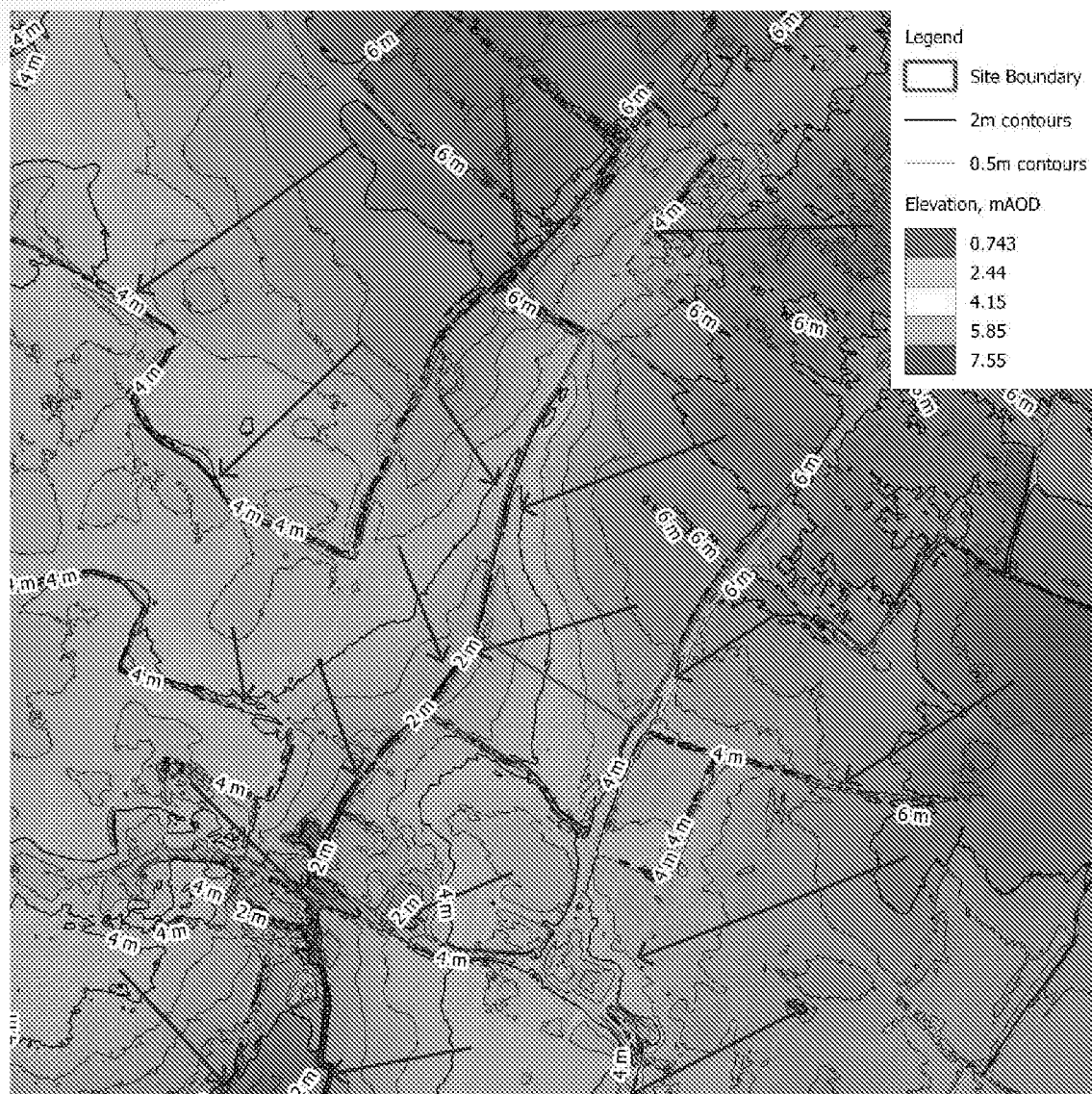
4.6. Hydrogeology

- 4.6.1. The site is not located within a Source Protection Zone (SPZ).
- 4.6.2. The site is situated above a Principal Aquifer. The superficial deposits are classified as a Secondary A Aquifer. The groundwater vulnerability for the site is Medium to High.
- 4.6.3. Groundwater monitoring at the site was undertaken in May 2021, with further return visits in June, October, November and December 2021 by Harrison Group Environmental. The groundwater levels beneath the site were generally found to range from around 1.2 to 2.4m below ground level (m bgl). A single shallowest level of 0.57 m bgl was recorded in October 2021 within WS01 beyond the south-western corner of the site.
- 4.6.4. Infiltration testing to BRE365 was attempted during the site investigations by Harrison Group Environmental. However, infiltration rates were found to be unproductive and tests were abandoned. Shallow percolation testing also revealed very low infiltration rates.
- 4.6.5. Further information can be found in the associated Land Quality Statement (ref: 13684-CRH-XX-XX-RP-GE-0001_LQS).

4.7. Existing Site Drainage

- 4.7.1. Southern Water is the incumbent sewerage utility provider for the area. A review of the Southern Water's Records, contained in **Appendix E**, confirms an existing 150mm diameter foul water sewer within Bilsham Road to the north-east of the site flowing north/southwards. There is also an existing 175mm diameter foul water sewer within Mill View Road beyond the northern boundary of the site.

- 4.7.2. The natural surface water flow paths have been devised from reviewing the available Lidar and topographical data and is shown on **Figure 4.3**.



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Figure 4.3: Surface Water Flow Paths

- 4.7.3. The Greenfield runoff rates for the site were calculated using the FEH method and are summarised in **Table 4.2**.

Table 4.2: Greenfield runoff rates

Storm Event	Greenfield Runoff Rate (litres/sec/ha)
Qbar	5.2
1 in 1 Year	4.4
1 in 30 Year	12.0
1 in 100 Year	16.6

5.0 EXISTING FLOOD RISK TO THE SITE

5.1. Fluvial Flood Risk

5.1.1. The EA Flood Zone Map shows the site is located primarily within Flood Zone 1, however marginal parts along the western boundary where the watercourse meets the northern and southern boundaries is noted to be within Flood Zone 2 as shown in **Figure 5.1**. The EA defines⁶ the Flood Zones from rivers or the sea as:

- Flood Zone 1 (Low Probability): Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3).
- Flood Zone 2 (Medium Probability): Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map).

5.1.2. The flood map data is not detailed enough to provide accurate assessment of the extent of the western boundary being part of Flood Zone 2. Although review of the site levels would indicate that this is mainly within the channel of the watercourse and does not affect the site itself.

5.1.3. As the vast majority of this site is located within a Flood Zone 1 the risk of fluvial flooding is deemed low.

⁶ Environment Agency & DEFRA (2014) Flood Zone Definition: <https://www.gov.uk/guidance/flood-risk-and-coastal-change/flood-zone-and-flood-risk-tables>



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Figure 5.1: Environment Agency Flood Zones

- 5.1.4. Site-specific flood level data for Ryebank Rife has been provided through the EA Product 4 report, contained in **Appendix F**, and are summarised in **Table 5.1**. Nodes 1, 2 and 3 are located along the watercourse running respectively from south to the north of the site with node 3 right on the northern site boundary. Node 4 is directly in the centre of the site.

Table 5.1: Environment Agency Flood Level Data

Node	Level (mAOD)					
	20yr	100yr	100yr+35%CC	100yr+45%CC	100yr+105% CC	1000yr
1	-	-	-	-	3.15	-
2	-	-	-	-	3.64	-
3	-	-	4.86	4.87	4.93	-
4	-	-	-	-	-	-

5.1.5. While the site does not benefit from formal raised flood defences, EA data shows that the site is protected by 'High Ground' around the watercourse with a culverted section to the north of the site. EA mapping shows no previous records of flooding events affecting the site. Comparison with the projected future flood level suggests that the high ground provides a standard of protection approximately equivalent to the 1 in 100 year + 105% climate change event.

5.1.6. The risk of fluvial flooding is therefore deemed to be low.

5.2. Tidal Flood Risk

5.2.1. The site is not identified to be at risk from tidal flooding.

5.3. Flood Alert Area

5.3.1. The site does not fall within a flood alert or flood warning area.

5.4. Surface Water Flood Risk

5.4.1. Unlike tidal and fluvial flood risk, surface water flood risk is not classified in terms of 'Flood Zones'. However, the EA classify surface water flood risk as follows:

- VERY LOW – the area has a chance of surface water flooding of less than 0.1%
- LOW – the area has a chance of surface water flooding of between 0.1% and 1%
- MEDIUM – the area has a chance of surface water flooding of between 1% and 3.3%
- HIGH - the area has a chance of surface water flooding of greater than 3.3%

5.4.2. The EA's Risk of Flooding from Surface Water (RoFSW) map is presented in **Figure 5.2**.

5.4.3. The surface water flood map shown in **Figure 5.2** shows the site to predominantly be at very low risk, however a very small area along the existing path of the watercourse running down the western boundary of the site has a medium to high risk of surface water flooding. Again this is associated with the channel of the watercourse and not within the site itself.

5.4.4. The Arun District Council SFRA Historic Flooding Map records a single surface water flooding incident on Bilsham Road beyond the eastern boundary of the site.

5.4.5. Surface water flow paths (shown in **Figure 4.3**) show that existing surface water drainage occurs across site towards the ordinary watercourse running down the western boundary. From the EA flood mapping it is clear any and all excess surface water in the event of a flood is contained within the existing channel of the ordinary watercourse.

5.4.6. The overall risk of surface water flooding to the site is regarded as low.

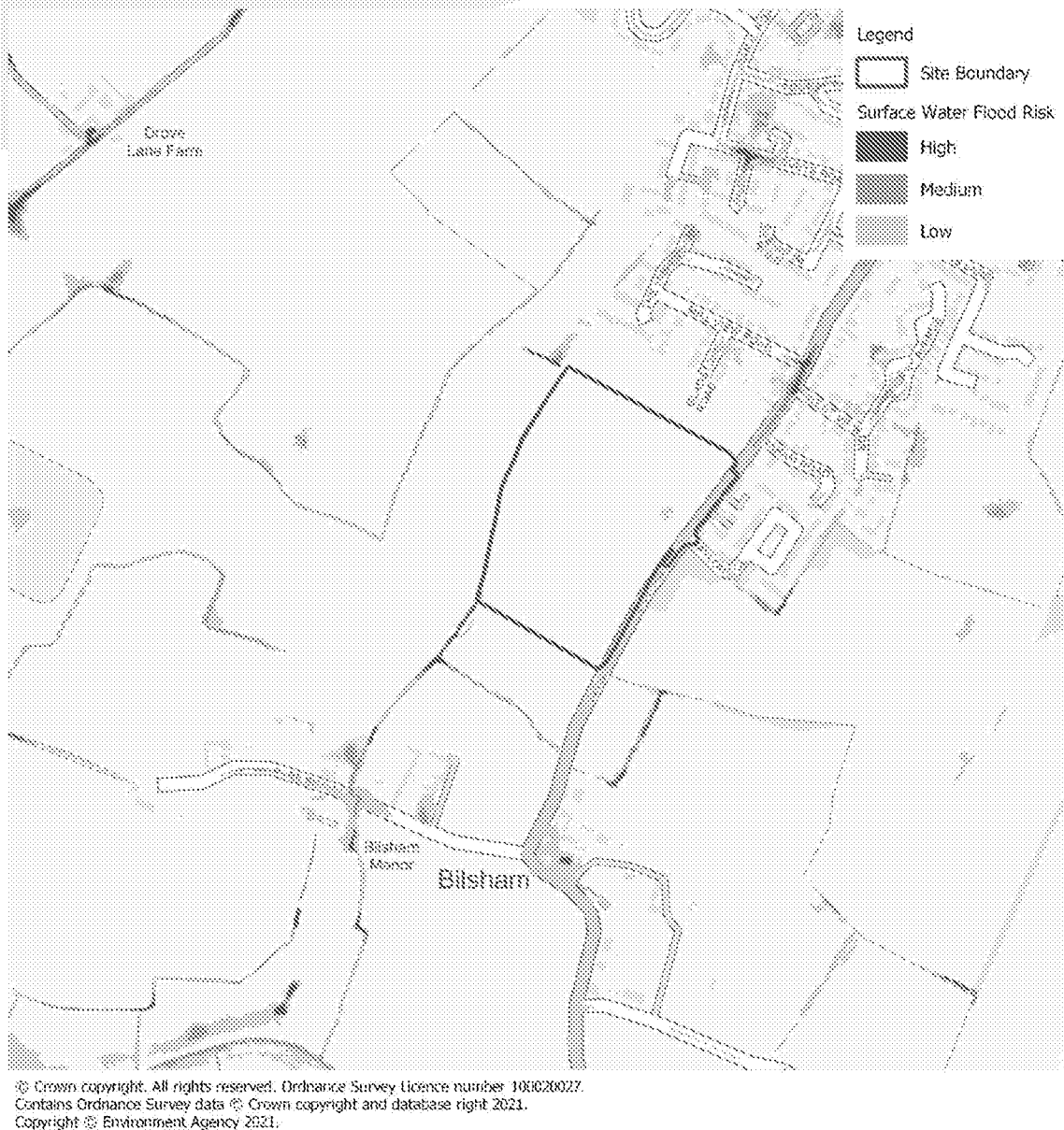


Figure 5.2: EA Updated Flood Map for Surface Water

5.5. Groundwater Flood Risk

- 5.5.1. A review of the Arun District Council SFRA confirms that the site falls within an area shown to have between 50% to 75% likelihood of groundwater emerging from the ground which indicates groundwater levels at or very near the ground surface. However, the resolution of SFRA mapping is low and is not suitable for identifying site specific risk.
- 5.5.2. The bedrock geology of the site is described as Chalk and is likely impermeable in nature.
- 5.5.3. Ground monitoring undertaken by Harrison Group Environmental between June and December 2021 (contained in **Appendix D**) show a range of levels for water strike depths with shallower recorded groundwater levels in the south and deeper levels in the north.
- 5.5.4. Levels in the north of the site show consistently deeper groundwater levels of around 2.20-2.40m bgl, with the shallowest occurrence recorded at 1.20m bgl within WS03. Beyond the southern site boundary, a single shallowest level of 0.57 m bgl was recorded in October 2021 in WS01. On all other monitoring occasions, levels in WS01 were between 0.90m and 1.32m bgl. It is possible

that groundwater level may be influenced by the adjacent watercourse. Therefore it can be concluded that the risk of groundwater emergence broadly decreases as one moves further north.

- 5.5.5. Review of the borehole logs indicate that the upper geological layers across the site to be primarily clay. This has been further evidenced by the lack of any infiltration during the soakaway testing. The depth of the clay band also corresponds with the depth at which groundwater has been generally observed across the site.
- 5.5.6. The Groundsure report further notes that there is no recorded event of groundwater flooding within 250m of the site location, since records began in 1946.
- 5.5.7. Whilst the risk of groundwater flooding across the wider Arun area is considered to be medium, it is considered to be low for the majority of the developable area on the site itself.

5.6. Sewer Flood Risk

- 5.6.1. The Arun District Council SFRA contains a summary of the recorded incidents of sewer flooding across the borough. According to the DG5 Register, in the Arun District eight flood incidents were recorded within the BN18 0 Post Code area. A review of the historic flood map provided within the SFRA does not show any recorded sewer flood events within close proximity to the site.
- 5.6.2. The risk of sewer flooding for the proposed development is therefore deemed to be low.

5.7. Artificial Flood Risk

- 5.7.1. The EA's long term reservoir flood risk map (**Figure 5.3**) shows that none of the site is contained within an area susceptible to artificial flooding. The risk of artificial flooding can therefore be considered to be very low



Figure 5.3: EA Long Term Reservoir Flood Map

5.8. Flood Risk Summary

Table 5.2: Summary of existing flood risk

Flood Risk	Level of Risk
Fluvial	Low
Tidal	Very Low
Surface Water	Low
Groundwater	Medium*/Low
Sewer	Low
Artificial	Very Low

*for wider Arun area

5.9. Climate Change Impact

- 5.9.1. Climate change must be considered as an integral part of any site specific FRA in order to minimise the impact of future flooding and allow adequate consideration for resilience to alleviate the burden on potential future users of the proposed development.
- 5.9.2. Following EA guidance, for residential development, the central fluvial climate change allowance should be assessed for Flood Risk Assessments. Consideration should also be given to higher central and upper end allowances to appraise the effects of those more extreme scenarios.
- 5.9.3. In July 2021, the EA introduced bespoke climate change allowances for Management Catchments within the wider river basin district. Management Catchments assess climate change impacts on watercourses at a finer level of detail than the previous river basin allowances.
- 5.9.4. Under the new guidance the climate change allowance to be considered for the site should be 25%, 36% and 64% respectively for the central, higher central and upper end allowances. In this instance, modelling is not yet available for the Arun and Western Streams Management Catchment and, therefore, existing South East River Basin District data has been utilised to understand potential future flood risk to the site. Available EA data for the site provides modelling for 1 in 100 year peak flows with allowances for 35%, 45% and 105% climate change representing the central, higher central and upper end allowances respectively.
- 5.9.5. EA mapping for the Undefined Fluvial modelled flood outline indicates that the 1 in 100 year flood event with an allowance for 105% climate change will encroach further beyond the current day Flood Zone 2 boundary. However, allowances for the 35% and 45% climate change scenarios are equivalent or less than the current day Flood Zone 2 boundary.
- 5.9.6. As noted within the guidance notes relating to the use of climate change allowances for peak river flood flows, other than for essential infrastructure, for all other categories of development, only the central allowance should be considered for Flood Zones 2 and 3a. Which rules out consideration for either the 105% previous allowance for climate change or its current day higher central allowance of 64%.
- 5.9.7. It should be noted that the current climate change guidance for peak river flows in the Arun and Western Streams Management Catchment (as noted in **Table 2.2**) is significantly lower than the previously modelled South East River Basin District and therefore the projected future climate change flood flows and levels will be comparatively lower than those shown on EA mapping.

6.0 DEVELOPMENT PROPOSALS

6.1. Proposed Development Description

- 6.1.1. The proposed development is split into phases. Phase 1 (full planning application) comprising 30 residential dwellings, new access from Bilsham Road, public open space, landscaping, sustainable urban drainage and associated works. Outline planning application for further phases of up to 110 dwellings and associated infrastructure (with all matters reserved). The proposed development masterplan is contained in **Appendix G**.

6.2. Vulnerability of Development

- 6.2.1. Paragraph 66 of the PPG defines the different categories of development in terms of flood risk vulnerability. The proposed development is for residential purposes which is classified as 'More Vulnerable' in terms of flood risk. As indicated in **Table 2.1**, 'More Vulnerable' development is appropriate in Flood Zones 1 or 2.

6.3. Urban Creep Allowance

- 6.3.1. New developments should factor in the effect urban creep. This is the increase in impermeable area on developments due to potential future activities such as property extensions and paving of driveways.
- 6.3.2. For new housing, an additional increase of 10% to the proposed impermeable areas is considered the minimum allowance for urban creep where development density is less than 25 dwellings per hectare⁷.

6.4. Sequential Test

- 6.4.1. Based on the EA flood map for planning, the site is predominantly located within Flood Zone 1 with only small areas along the western boundary of the site classified as Flood Zone 2. However, no operational development is proposed within Flood Zone 2. The area that falls within Flood Zone 2 is also within the existing channel of Ryebank Rife. Therefore, as all of the proposed 'More Vulnerable' operational development including amenity public open space has been situated in the areas of lowest flood risk, a site specific sequential test is therefore not required.

6.5. Exception Test

- 6.5.1. As the sequential test is not required, an exception test is not necessary.

⁷ WSCC LLFA Policy for Management of Surface Water (Nov 2018)

7.0 SURFACE WATER MANAGEMENT

7.1. Overview

7.1.1. The surface water drainage system has been designed in accordance with the NPPF and the accompanying Guidance and Technical Standards for SuDS. It also complies with the requirements under Building Regulations Part H and the West Sussex LLFA Policy for the Management of Surface Water.

7.1.2. In line with the SuDS hierarchy under paragraph 80 of the PPG, surface water should be managed by:

- 1.) Infiltration to the maximum extent that is practical – where it is safe and acceptable to do so;
- 2.) Discharge to watercourses;
- 3.) Discharge to surface water sewer, highway drain or another drainage system;
- 4.) Discharge to combined sewers (last resort).

7.2. Site Constraints

7.2.1. A review of the site characteristics has informed the following site constraints:

- Presence of a watercourse along the western site boundary;
- Existing gas main running east-west across the site;
- Ground conditions suggest infiltration is not a feasible method of surface water disposal.

7.3. Existing and Proposed Impermeable and Permeable Areas

7.3.1. The existing and proposed impermeable and permeable areas are presented in **Table 7.1**.

Table 7.1: Existing and Proposed Impermeable and Permeable Areas

	Permeable (ha)	Impermeable (ha)
Existing	5.18	0
Proposed – Whole Site	2.71	2.47
Proposed – Detailed Area	0.47	0.63
Proposed – Outline Area	2.24	1.84
		(+ 10% urban creep) 2.72

7.3.2. As the site is currently greenfield, the proposed development will increase the total impermeable area compared to existing. An impermeable areas plan is attached in **Appendix H**.

7.4. Proposed Surface Water Runoff Rates

7.4.1. As stated previously in **Table 4.1**, the surface water catchment has been analysed and the Greenfield runoff rate (Q_{bar}) calculated as 5.2 l/s/ha. The proposed discharge rate for the site should therefore be limited to no more than Q_{bar} at 5.2 l/s/ha of hard standing/impermeable area in all storms up to and including the 1 in 100 year + 40% climate change event.

7.5. Surface Water Volume

- 7.5.1. When limited to Q_{bar} , the required surface water attenuation volume for the site has been calculated to be 944 m³/ha in the 1 in 100 year storm +40% climate change. Based upon the proposed site layout and impermeable areas, with allowance for urban creep and a discharge rate of 5.2 l/s/ha, the total required storage volume would therefore be in the region of 2560 m³ for the proposed developed site.

7.6. SuDS Strategy

- 7.6.1. The proposed drainage strategy layout presented in **Appendix I**, illustrates the SuDS features proposed to manage the surface water runoff from the site. The site has been split into several sub-catchments to help quantify local storage and understand water quality requirements.
- 7.6.2. The surface water drainage strategy aims to control runoff from impermeable areas at source and attenuate through SuDS features.
- 7.6.3. As noted in section 4.4, due to the geology on site, infiltration is not considered to be a viable option to drain the surface water runoff generated from site.
- 7.6.4. Whilst the percolation test has yielded very low permeability, it is possible that infiltration based systems such as permeable paving could contribute to the overall site discharge and help to reduce the overall required storage. However, for the purpose of this report, a worst-case scenario ignoring the contribution from use of infiltration systems has been adopted.
- 7.6.5. Therefore following the drainage discharge hierarchy, surface water discharge will be directed into the watercourse along the western boundary of the site.
- 7.6.6. The following SuDS features have been considered within the proposed surface water drainage strategy:
- Permeable Paving;
 - Swales;
 - Attenuation Basin;
 - Pond;
 - Cellular Storage Tanks.

7.7. Detailed Area – Phase 1

- 7.7.1. The overall drainage strategy seeks to keep the detailed and outline application areas separate to allow for phased construction of the site. Runoff from Phase 1 (Area A) is to be intercepted at source where possible using permeable paving and trapped gullies before being routed to an underground attenuation tank (Tank A1) in the soft landscaping to the west. Tank A1 has a capacity of approximately 250m³.
- 7.7.2. A controlled discharge would then be made from the tank to the watercourse at no more than Q_{Bar} (proportional to the corresponding impermeable area).
- 7.7.3. It has been calculated that permeable paving could provide additional attenuation within the detailed area. At an average sub-base depth of 450 mm and void ratio of 30%, an effective storage volume of around 210 m³ could be activated. As stated previously, there has been no allowance made for the effect of infiltration. A secondary, offline attenuation tank (Tank A2) with

a capacity of approximately 170m³ would be required to contain flows from larger storm events and could be located under a shared parking court to the north. The overall attenuation for Phase 1 has been summarised in **Table 7.2** below.

Table 7.2: Phase 1 - Summary of Attenuation Features

Parcel	SuDS Feature	Depth (m)	Storage Requirement (m ³)				Storage (m ³)
			Area (m ²)	Void Ratio	Length (m)	%	
Parcel A	Permeable Pave	0.45	1555	30%		33%	210
	Attenuation Tank A1	1.00	263	95%		39%	250
	Attenuation Tank A2	1.30	140	95%		27%	175
	Total Provided					100%	635

- 7.7.4. Groundwater levels have generally been recorded at around 2m bgl in the north of the site. However, floatation checks should be undertaken during detail design stage and suitable mitigation measures put in place to minimise risk of damage to underground attenuation tanks.
- 7.7.5. The surface water drainage strategy within Phase 1 of the development can effectively control runoff and restrict discharge to no more than the corresponding greenfield rates. The detailed application area can be entirely drained by the dedicated attenuation and flow control features within Phase 1 with no reliance on future development. Please refer to calculations enclosed in **Appendix I**.
- 7.7.6. If required, Tank A1 could also be sized to provide storage for a percentage of the future outline development in Area B and the flow control upgraded to suit.

7.8. Outline Area – Future Phases

- 7.8.1. The remainder of the site consists of the outline application areas B, C, D, E and F. Based upon the proposed site layout, preliminary calculations suggest that when limited to QBar, an overall storage volume in the region of 1960 m³ would be required for the outline area.
- 7.8.2. The surface water strategy seeks to drain surface water into a pond in the south west of the site via a combination of swales and piped systems. The pond would feature a controlled discharge into the watercourse at the respective QBar rate.
- 7.8.3. As with Phase 1, the outline areas will seek to maximise the principles of source control using permeable paving on driveways and shared access roads to provide additional attenuation and treatment. Roadside linear swales could also provide conveyance, treatment and attenuation of runoff.
- 7.8.4. Considering the above measures, a residual volume of around 245 m³ is likely to be required. The residual storage could be provided via an area of low-risk landscaping around the pond which could be locally profiled to act as a shallow dry basin in the case that the pond storage is exceeded. Alternatively, additional storage could be provided within upstream attenuation tanks. **Table 7.3** summarises the overall attenuation options for the outline area.

Table 7.3: Outline Area - Summary of Attenuation Features

Panel	SuDS Feature	Depth (m)	Storage Requirement (m³)				Storage (m³)
			Area (m²)	Void Ratio	Length (m)	%	
Outline Area	Permeable Pave	0.45	4500	30%		31%	608
	Pond	0.60	1600			49%	960
	Swale (effective vol)	0.40			450	8%	153
	Residual Attenuation (Shallow Basin)	0.15	1630			12%	245
	Residual Attenuation (Attenuation Tanks)	1.00	260	95%		12%	245
	Total Provided					100%	1966

- 7.8.5. At this stage, and subject to detailed design, the permanent pond water level has been set at 2.1 mAOD. This would allow a maximum “temporary” attenuation storage of up to 0.6 m depth equivalent to approximately 960 m³ prior to an overflow into the dry basin should water level exceed 2.7 mAOD. A permanent body of water to a depth of no more than 0.9m would also be present for biodiversity, amenity and water quality benefit. Exceedance flows over and above this level would be channelled safely down into the watercourse and away from the site. The pond would be lined to prevent ingress of groundwater and to allow for a permanent body of water to be retained. Relevant floatation checks should be undertaken at detail design stage.
- 7.8.6. Design of the pond will be undertaken in accordance with best practise outlined within the SuDS Manual and would incorporate shallow planted margins, a maximum side slope of 1:3. As mentioned previously, the pond could be surrounded by a shallow depression of up to 0.15m depth which would act as a dry basin in the case of exceedance flows during more extreme storm events. The area would have a maximum side slope of 1:5 and a flattened plateau with nominal fall towards the pond. The combined system would effectively act as a basin with a permanent body of water whilst enabling the public open space around the pond to be utilised to its full potential.
- 7.8.7. In its current location the pond is situated with a large area of public open space and is well overlooked by a number of proposed dwellings which increases public awareness and safety. Marginal planting could be used to provide a clearly identifiable visible border while informative signage could explain the function and purpose of the feature. As the pond could be designed to overtop and spill out into the wider basin area during more intense storms, it would therefore not necessarily be proposed to encircle the pond with a safety fence which may otherwise promote antisocial behaviour and impact the aesthetic of the pond⁸.
- 7.8.8. In addition to providing runoff volume control the inclusion of the pond within the drainage scheme will provide water quality improvements as well as enhancing biodiversity in the area and providing amenity benefit.
- 7.8.9. Additional upstream attenuation could be provided for the outline area in the form of permeable paving. It is proposed that permeable paving with an underdrain system could be utilised across

⁸ CIRIA (Nov 2013) The SuDS Manual Update: Paper RP992/17 - Health and safety principles for SuDS: framework and checklists

both private and shared driveways throughout the whole development. While the proposed site levels are relatively flat, to factor in the effects of localised sloping ground, only 75% of the total area of the permeable paving is assumed to be positively contributing to the onsite attenuation.

- 7.8.10. At a depth of 0.45m, assuming a 30% void ratio approximately 600m³ attenuation could be provided within the sub-base of the paving over the outline application area. A flow at the outfall from the permeable paving would maximise use of the paving for attenuation and reduce reliance on downstream storage. As noted above, the contribution of dispersal by infiltration has not been factored into the assessment.
- 7.8.11. Within the current proposed site layout, approximately 450 m of swales could be incorporated to directly intercept runoff from highway areas and provide conveyance to the pond in the south. Although the site is not excessively steep, check dams could be provided to maximise storage potential along the swales. Swales could provide around 150 m³ attenuation.
- 7.8.12. Flow leaving the site from cellular Tank A and the southern pond would be controlled by vortex flow controls at a restricted discharge of no more than the respective QBar rate in all events up to and including 1 in 100 year + 40% climate change storm, into the watercourse.
- 7.8.13. Consideration has also been given to the potential for a surcharged outfall during storm events where the water level in the ditch may be higher than the outfall from the development. To provide extra resilience, additional capacity has been allowed for within the pond and storage systems to cater for restricted flows during this period. This can be refined at detailed design phase.
- 7.8.14. The proposed surface water drainage layout in **Appendix I** has been annotated with indicative levels, size of the different drainage features and potential storage volumes. Subject to detail design the surface water drainage strategy will be refined and updated as necessary.
- 7.8.15. The proposed surface water drainage system can effectively control all runoff generated within the site and maintains pre-development Greenfield runoff, without increasing flood risk elsewhere.
- 7.8.16. The maintenance of SuDS is vital ensuring that they work as efficiently as they set out to do and is discussed in Chapter 9.

7.9. Surface Water Quality

- 7.9.1. The SuDS components within the surface water drainage strategy have been designed in accordance with the guidance set-out in the SuDS Manual.
- 7.9.2. Treatment within SuDS components is essential for frequent low intensity and duration rainfall events, where urban contaminants are being mobilised and washed off urban surfaces and the aggregated contribution to the total pollutant load to the receiving surface water body is potentially high. For rainfall events greater than the 1 in 1 return period, the pollutants become diluted and the environmental risks will be reduced which means that the SuDS treatment process becomes less crucial. Treatment effectiveness is strongly linked to the hydraulic control of runoff, in particular velocity control and retention time.
- 7.9.3. Table 26.2 of the CIRIA SuDS Manual provides the pollution hazard indices for different land use classifications as shown in **Table 7.4** below.

Table 7.4: CIRIA Pollution hazard indices for different land use classifications

Land use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Residential Roofs	Very Low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads, car parks with infrequent change	Low	0.5	0.4	0.4

7.9.4. Taking into account the proposed land use, the level of pollution associated with the proposed development is regarded as Low and Very Low.

7.9.5. **Table 7.5** summarises the treatment efficiency of different SuDS components discharging to surface waters as detailed in Chapter 26 of the SuDS Manual.

Table 7.5: CIRIA Indicative SuDS Mitigation Indices for Discharges to surface water

Type of SuDS Component	Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Swale	0.5	0.6	0.6
Permeable Pavement	0.7	0.6	0.7
Pond	0.7	0.7	0.5

7.9.6. Where multiple drainage features are used, the efficiency of the secondary system to treat water is reduced. By using a swale discharging into a pond the combined mitigation indices is as follows:

Table 7.6: Mitigation Indices for Proposed Combined Drainage System

	Mitigation Indices		Total Mitigation
	TSS	Metals	
	0.5 + 0.5(0.7)	0.6 + 0.5(0.7)	0.85
	0.6 + 0.5(0.7)	0.6 + 0.5(0.5)	0.95
	0.6 + 0.5(0.5)		0.85

7.9.7. Additionally, as stated in Section 26.2 and Table 26.7 of the SuDS Manual, proprietary drainage systems such as gullies are classified as being suitable as part of SuDS components close to the source as primary treatment. Catchpits will also be installed prior to storage features to intercept silt and prolong the lifetime of the drainage features.

- 7.9.8. It is considered that the combined use of the proposed SuDS features and proprietary drainage features provides adequate treatment to effectively remove potential pollutants before discharging into the existing watercourse.

7.10. Foul Water Strategy

- 7.10.1. As noted in Section 4.7, the incumbent foul drainage provider is Southern Water.
- 7.10.2. There is an existing 150mm diameter public foul sewer system running along the eastern boundary of the site within Bilsham Road.
- 7.10.3. Following guidance within the Sewerage Sector's Design and Construction Guidance (DCG), a daily peak load of 4,000 L/prop/day can be used to calculate a total peak foul flow rate for 140 houses at 6.48 l/s.
- 7.10.4. A 150mm diameter pipe laid at minimum gradient to achieve self-cleansing velocity has a carrying capacity in excess of 13l/s.
- 7.10.5. Taking into account the topography of the site and location and invert levels of the existing public foul sewer, it is anticipated that foul water will be required to be pumped for the whole development site.
- 7.10.6. For phased development, a temporary pumping station could be located at the north of the site to serve Phase 1 with a permanent pumping station at the south to service the remainder of the site.
- 7.10.7. Subject to detail design it is anticipated that the foul drainage from the development site can be discharged into Southern Water network at the same or through a smaller diameter pipe, subject to a Section 106 agreement to connect into an existing public sewer.
- 7.10.8. Following changes brought by Ofwat, where the proposed development site can communicate directly to an existing public sewer system at no more than the existing pipe diameter, there is no requirement to undertake any capacity survey and the proposed new connection would be subject to the infrastructure charges.
- 7.10.9. Southern Water publishes their revised infrastructure charges annually and this would have to be agreed with Southern Water at the time of the application, together with the proposed development delivery schedule.
- 7.10.10. The foul water strategy and calculations are presented in the Proposed Drainage Strategy and is contained in **Appendix I**.

8.0 FLOOD RISK FROM THE PROPOSED DEVELOPMENT

8.1. Fluvial Flood Risk

- 8.1.1. All proposed development is located outside of the current and future flood zones. Surface water runoff from the proposed development is to be controlled to no more than QBar in all storm events up to and including the 1 in 100 year plus climate change. Therefore the proposed development is unlikely to increase the fluvial flood risk on or off the site.

8.2. Tidal Flood Risk

- 8.2.1. The proposed development will not increase the tidal flood risk on or off the site.

8.3. Surface Water Flood Risk

- 8.3.1. The majority of the site is in an area currently at very low risk from surface water flooding and the proposed development is entirely located in an area of low or very low surface water flood risk.
- 8.3.2. The drainage strategy has been devised to best mimic natural flow paths across the site and to suit the existing topography. Surface water from the development will be managed in a dedicated SuDS network and is to be restricted to no more than QBar in all storm events up to and including the 1 in 100 year plus climate change.
- 8.3.3. Therefore the proposed development is not considered likely to increase the surface water flood risk on or off the site.

8.4. Groundwater Flood Risk

- 8.4.1. The proposed development is for residential development which would have little to no impact to natural groundwater movements. Operational development is focused in the north of the site where groundwater levels are understood to be deepest (at around 2m below ground) and the risk of flooding is lowest. The proposed development will therefore not increase the groundwater flood risk to the site off site.

8.5. Sewer Flood Risk

- 8.5.1. The proposed development is unlikely to increase the sewer flood risk on or off the site.

8.6. Artificial Flood Risk

- 8.6.1. The proposed development will not increase the artificial flood risk on or off the site.

8.7. Climate Change Impact

- 8.7.1. The impact of climate change has been adequately factored into the proposed drainage design in line with all current best practice and guidance.

9.0 SCHEDULE OF MAINTENANCE

9.1. Introduction

9.1.1. The maintenance of SuDS features is vital ensuring that they work as efficiently as they set out to do. Maintenance activities can be broadly defined as:

- Regular maintenance – basic tasks carried out regularly;
- Occasional maintenance – tasks that are required periodically but on a much less frequent basis; and
- Remedial maintenance – tasks required when a fault needs rectifying and often includes unforeseen events.

9.1.2. The proposed drainage system is to remain private and maintained by a third party management company to be set up post-construction. However, the system should be designed and constructed to an adoptable standard to enable potential future adoption by the sewerage undertaker.

9.1.3. Maintenance requirements for each SuDS feature has been outlined below.

9.2. Swales

Construction

9.2.1. Construction vehicles and equipment not directly involved in the construction of the rills and swales should be kept away from these areas. Excavations for the swales should aim to be undertaken in times of dry weather, when possible, to prevent mobilisation of sediments from exposed surfaces. Exposed surfaces after rill or swale excavations should be stabilised as soon as possible with grass seed and straw mulch. Perimeter controls should be installed prior to construction to protect watercourses.

Maintenance Schedule

9.2.2. The table below shows the operation and maintenance requirements for the swale, taken from the CIRIA C753 SuDS Manual.

Table 9.1: Operation and maintenance requirements for swales (CIRIA C753, 2015)

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass - to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly

Maintenance Schedule	Required Action	Typical Frequency
	Inspect inlets for silt accumulation, establish appropriate silt removal frequencies	Half yearly
	Inspect check dams for blockages and failure.	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseedling	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

9.3. Permeable Paving

Construction

- 9.3.1. Construction vehicles and equipment not directly involved in the construction of the pervious pavements will be kept away from these areas. Silt fences, staged excavation works and temporary drainage swales/bunds to divert runoff away from exposed areas will be utilised, as appropriate, to manage the risks associated with, and to intercept the discharge of sediment laden runoff. Landscaping activities will be carefully designed and carried out to prevent deposition of topsoil, turf and other materials on the surface of the pavement. Infiltration surfaces will not be compacted and will be protected at all times. Excavations for the pervious pavement installation should aim to be undertaken in times of dry weather, when possible, to prevent mobilisation of sediments from exposed surfaces during rainfall events. Surfaces exposed as part of the pervious paving installation works should be stabilised as soon as possible. Perimeter controls should be installed prior to construction to protect watercourses.

Maintenance Schedule

- 9.3.2. The table below shows the operation and maintenance requirements for the pervious pavements which are in accordance with the CIRIA C753 SuDS Manual.

Table 9.2: Operation and maintenance requirements for pervious pavements (CIRIA C753, 2015)

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations - pay particular attention to areas where water runs onto pervious surfaces from adjacent impervious areas as these areas are most likely to collect the most sediment
	Stabilise and mow contributing and adjacent areas	As required
Occasional maintenance	Removal of weeds or management using Glyphosate applied directly onto the weeds by an applicator rather than spraying	As required - once per year on less frequently used pavements
	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
Remedial Actions	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
	Initial inspection	Monthly for three months after installation
Monitoring	Inspect for evidence of poor operation and/or weed growth - if required, take remedial action	Three-monthly, 48 hrs after large storms in first six months
	Assess silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

9.4. Ponds

Construction

- 9.4.1. Construction vehicles and equipment not directly involved in the construction of the pond will be kept away from these areas. Silt fences, staged excavation works and temporary drainage swales/bunds to divert runoff away from exposed areas will be utilised, as appropriate, to manage the risks associated with, and to intercept the discharge of, sediment laden runoff prior to its

discharge to nearby watercourses. Excavations for the pond should aim to be undertaken in times of dry weather when possible, to prevent mobilisation of sediments, during rainfall events. Surfaces exposed as part of the detention basin construction should be stabilised as soon as possible, by the use of hydro seeding or an alternative approved approach. Perimeter controls should be installed prior to construction to protect watercourses. Perimeter controls should be installed prior to construction to protect watercourses.

Maintenance Schedule

- 9.4.2. The table below shows the operation and maintenance requirements for ponds, taken from the CIRIA C753 SuDS Manual.

Table 9.3: Operation and maintenance requirements for ponds (CIRIA C753, 2015)

Maintenance Schedule	Required Action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass - public areas	Monthly (during growing season)
	Cut the meadow grass	Half yearly (spring, before nesting season, and autumn)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework etc. for evidence of blockage and/or physical damage	Monthly
	Inspect silt accumulation rates in the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options	Half yearly
	Check any mechanical devices, e.g. penstocks	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base; include maximum 25% of pond surface)	Annually
	Remove 25% of bankside vegetation from water's edge to a minimum of 1m above water level	Annually
	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
Occasional maintenance	Remove sediment build up	As required
Remedial actions	Repair erosion or other damage	As required
	Replant, where necessary	As required

Maintenance Schedule	Required Action	Typical frequency
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair/rehabilitate inlets, outlets and overflows.	As required

9.5. Attenuation Tanks

Construction

- 9.5.1. Construction vehicles and equipment not directly involved in the construction of the attenuation tank will be kept away from these areas. Silt fences, staged excavation works and temporary drainage swales/bunds to divert runoff away from exposed areas will be utilised, as appropriate, to manage the risks associated with, and to intercept the discharge of, sediment laden runoff prior to its discharge to nearby watercourses. Excavations for the attenuation tank should aim to be undertaken in times of dry weather when possible, to prevent mobilisation of sediments during rainfall events. Perimeter controls should be installed prior to construction to protect watercourses.

Maintenance Schedule

- 9.5.2. The table below shows the operation and maintenance requirements for the Attenuation tanks, taken from the CIRIA C753 SuDS Manual.

Table 9.4: Operation and maintenance requirements for attenuation storage tanks (CIRIA C753, 2015)

Maintenance Schedule	Required Action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	Remove sediment from catchpits/ gullies/ sumps.	Annually, or as required
Occasional Maintenance	Removal of sediment from tank via vacuum pumping (if appropriate)	As required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

9.6. Proprietary Treatment Systems

- 9.6.1. The proprietary treatment systems include conventional pipework, gullies, catch pits, manholes, channels and headwalls.

Construction

- 9.6.2. During construction the principal contractor must ensure that preventative measures have been put in place as to not allow the construction runoff drain into the system. Measures must be taken to ensure debris from the construction site does not block the components. Routine inspections should be undertaken ensuring that the drainage is functioning properly. Outfalls must be constructed to the correct level and all joints must be correctly sealed. During construction backfill should be correctly installed as specified as per the manufactures' recommendations.

Maintenance Schedule

- 9.6.3. The maintenance schedule for the aforementioned SuDS has been adopted from the SuDS Manual C753 and are summarised in the table below.

Table 9.5: Maintenance and Operation of Proprietary Treatment Systems (CIRIA C753, 2015)

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Monitoring	Inspect monthly
Occasional maintenance	Sediment management	Annually or as required
Remedial maintenance	Structure rehabilitation/repair	As required

10.0 CONCLUSION

- 10.1.1. CampbellReith has been commissioned to prepare a Flood Risk Assessment and Drainage Strategy in accordance with the National Planning Policy Framework to inform the proposed development located at the Lane West of Bilsham Road, Yapton.
- 10.1.2. The full phase 1 application is for 30 residential dwellings, new access from Bilsham Road, public open space, landscaping, sustainable urban drainage and associated works. The outline planning application is for further phases of up to 140 dwellings and associated infrastructure (with all matters reserved).
- 10.1.3. An ordinary watercourse, Ryebank Rife, runs down the western boundary of the site in a southwardly direction. The whole of the operational development proposed is located within Flood Zone 1 and is considered at low risk from fluvial flooding. Surface water flood risk will be mitigated and managed on site through levels design and as such is considered to be a low residual risk. The wider Arun area is at medium risk of flooding from groundwater. Development on the site is focused in the north of the site where deeper groundwater levels have been recorded and hence areas of lower flood risk reside. The site is at low or very low risk from all other sources.
- 10.1.4. Available information suggests that the site is underlain by gravel, sand, silt and clay over layers of chalk. Groundwater was encountered at circa 1.6 – 3.5 m bgl. Soakage testing on the site was not favourable and infiltration is not considered to be a viable method of surface water discharge.
- 10.1.5. The proposed SuDS strategy involves the use of swales, permeable paving, below ground storage and a pond/dry basin to manage surface water runoff generated from site. Surface water will be captured via the aforementioned SuDS features and conveyed towards the tank at the northern end of the site and the pond at the southern end of the site where it will be stored prior to controlled discharge at no more than QBar to the watercourse running along the western site boundary.
- 10.1.6. Due to the level of the existing offsite drainage infrastructure, foul water from the site is proposed to discharge by pumping into the existing public foul sewer network in Bilsham Road. A temporary pumping station in the north-west of the site is proposed to drain Phase 1 while a larger, adoptable pumping station is proposed to drain the outline area.
- 10.1.7. The Phase 1 foul and surface water strategy will be self-contained with no reliance on future development.
- 10.1.8. The maintenance of SuDS is vital to ensuring that they work as efficiently as they are intended to.
- 10.1.9. The proposed drainage strategy will not increase flood risk from any sources on or off the site and is considered appropriate for the proposed development in its current location.

Appendix A: Site Location



Legend

 Site Boundary

Drove
Lane
Farm

Yapton

Bilsham
Manor

Bilsham

White
Rails

0 250 500 750 1000 m



Land west of Bilsham Road

Client: Landlink Estates Ltd

Site Location

Scale: 1:50000@84
CampbellReith OS Copyright: © Crown copyright. All rights reserved. Licence number 100027027
Contains Ordnance Survey data © Crown copyright and database right 2021.
Job Number: 13884
Drawn by - Checked by: RLF - RF
Dwg No - Status/Revision: 13884-CRH-XS-XS-FG-G-7010 - PS
File location: \\red-data1\gis-data\13509 - 13749\13684 P - Land Field\Project_Workspaces\FRA (pdf in Outputs)
Date (Revision History): 09/12/2021 (P1, First Issue, 05/07/21, RLF, P2, Client Name, 22/07/21, RLF, P3, Client Logo, 29/07/21, RLF, P4, Boundary, 03/12/21, RP)
ARUN DISTRICT COUNCIL V3/22/OUT

CampbellReith
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Appendix B: SFRA Map Extracts



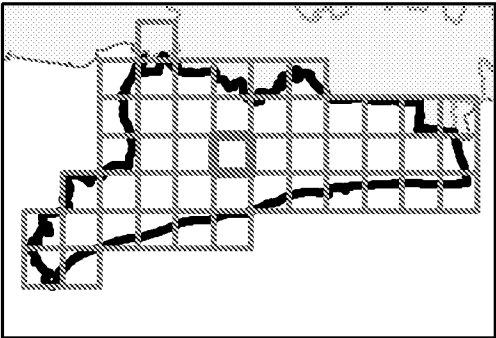
Notes

The Areas Susceptible to Groundwater Flooding (ASiGWf) is a strategic scale map showing groundwater flood areas on a 1km square grid. The data was produced to annotate Indicative Flood Risk Areas for Preliminary Flood Risk Assessment (PFRA) studies and allow the Lead Local Flood Authorities (LLFAs) to determine whether there may be a risk of flooding from groundwater.

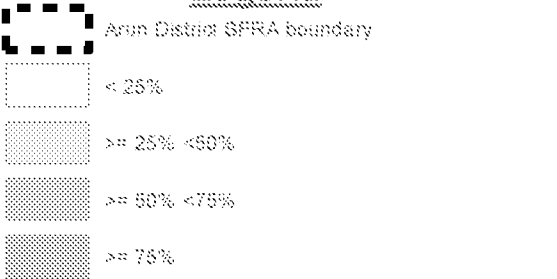
This data shows the proportion of each 1km grid square where geological and hydrogeological condition show that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring. It does not take account of the chance of flooding from groundwater rebound. This dataset covers a large area of land, and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding.

The ASiGWf data should be used only in combination with other information, for example local data or historic data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale where finer resolution datasets exist.

Key Plan



Legend



REF	Date	Comments
A	June 2012	-
B		
C		

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LEVEL 1 SFRA: APPENDIX F AREAS SUSCEPTIBLE TO GROUNDWATER

Sheet No. 23 of 48 Index Number: AGC_23

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Appendix C: Topographical Survey

[illegible]

Certain types of services such as plastic or concrete pipes, some conduit and ducting where direct access can not be achieved for tracing may not be shown and alternative locating methods should be used.

Survey Solutions has used all reasonable care to research available service records, but the completeness or use of the service records supplied to or by Survey Solutions cannot be guaranteed. Therefore Survey Solutions cannot be held responsible for any features annotated as taken from records' (TFR).

Depths obtained using electro-magnetic or GPR are effected by ground conditions and should be treated as indicative only. Electro-magnetic depths to utilities and services are generally taken to the centre of a feature, GPR depths to the top of a feature and drainage depths shown to inverts, unless otherwise indicated.

Drainage pipe sizes will be obtained without entering the chamber and therefore should be treated as approximate. Pipe dimensions which have not been obtained visually will be taken from records when available.

All services, drainage and utilities routes are assumed straight between access points, unless otherwise stated. The numbers of cables in runs will not be shown unless specifically requested. All services are below ground unless indicated.

Services, utilities and features may not have been surveyed if obstructed or not reasonably visible or accessible at the time of survey.

Survey Solutions accept no responsibility for the completeness or accuracy of either the topographical survey or base mapping on this project.

All critical dimensions and measurements should be checked and verified with

any errors or discrepancies notified to Survey Solutions immediately. The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work.

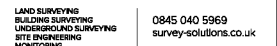
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Do not scale from this drawing.

UTILITY	AVAILABILITY	UTILITY COMPANY PROVIDER
SEWER	NO	N/A
WATER MAIN	NO	N/A
GAS MAIN	NO	N/A
TELECOM	PUBLIC	BRITISH TELECOMS
CABLE TV	NO	N/A
ELECTRICITY	NO	N/A
OIL PIPES	NO	N/A
OTHER	NO	N/A

UTILITY	AVAILABILITY	UTILITY COMPANY PROVIDER
SEWER	NO	N/A
WATER MAIN	NO	N/A
GAS MAIN	NO	N/A
TELECOM	PUBLIC	BRITISH TELECOMS
CABLE TV	NO	N/A
ELECTRICITY	NO	N/A
OIL PIPES	NO	N/A
OTHER	NO	N/A

REV	DESCRIPTION	DRAWN	CHECKED	APPR	SURVEY DATE
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PSWICH BRETHOOD COVENTRY GLASGOW NORWICH NOTTINGHAM YEOML

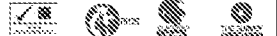
PROJECT TITLE
BILSHAM ROAD, YAPTON, ARUNDEL,
WEST SUSSEX, BN14 9 0JT

DRAWING DETAIL
UTILITIES AND DRAINAGE SURVEY.

SHEET 2 OF 10	
CLIENT LANDLINK ESTATES LTD	SCALE 1:200

SURVEYOR	SURVEY DATE	CHECKED BY	APPROVED BY	DWG STATUS
LJT	21/04/2021	SJH	GSB	FINAL

DRAWING NUMBER	REVISION	ISSUE DATE
31703BWJG-02		28/04/2021





UTILITIES COMMENT BOX
(GENERAL NOTES)

All below ground data sets have been classified from above ground based on excavations. Survey Solutions use electro-magnetic and sound ground penetrating radar (GPR) methods to investigate for underground utilities, services and structures. The GPR method is used to detect and map the location of underground excavations are carried out to confirm any identification, positions and depths.

Any areas on the drawing where services or features have not been shown are not necessarily clear of services or features but it is an indication that no firms have been able to locate them. It is not a guarantee that there are no services or features. Good practice should still be employed during design and construction processes.

Certain types of services such as plastic or concrete pipes, some conduit and ducting where direct access can not be achieved for tracing may not be shown and additional tracing methods may be required.

Survey Solutions have no legal or reasonable care or research available service records. But the contractors or sub-contractors service records supplied by Survey Solutions cannot be guaranteed. Therefore Survey Solutions cannot be held responsible for any features indicated as being located from (TYP).

Depths obtained using electro-magnetic or GPR are estimated to ground surface. The depths of services or features are not guaranteed. The depths of utilities and services are generally taken to the centre of a feature, GPR depths to the top of a feature and drainage depths shown to inverts, unless otherwise indicated.

[illegible]

UTILITY	AVAILABILITY	UTILITY COMPANY/ PROVIDER
SEWER	NO	N/A
WATER MAIN	NO	N/A
GAS MAIN	NO	N/A
TELECOM	PUBLIC	BOSTON TELECOM
CABLE TV	NO	N/A
ELECTRICITY	NO	N/A
OIL PIPES	NO	N/A
OTHER	NO	N/A

REV	DESCRIPTION	DRAWN	CHECKED	APP'D	APPROVAL DATE



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DRAWING DETAIL
 UTILITIES AND DRAINAGE SURVEY.
 SHEET: 5 OF 10

CLIENT
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SCALE
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DRAWING NUMBER		REVISION	ISSUE DATE
31703BWJG-05			28/04/2021



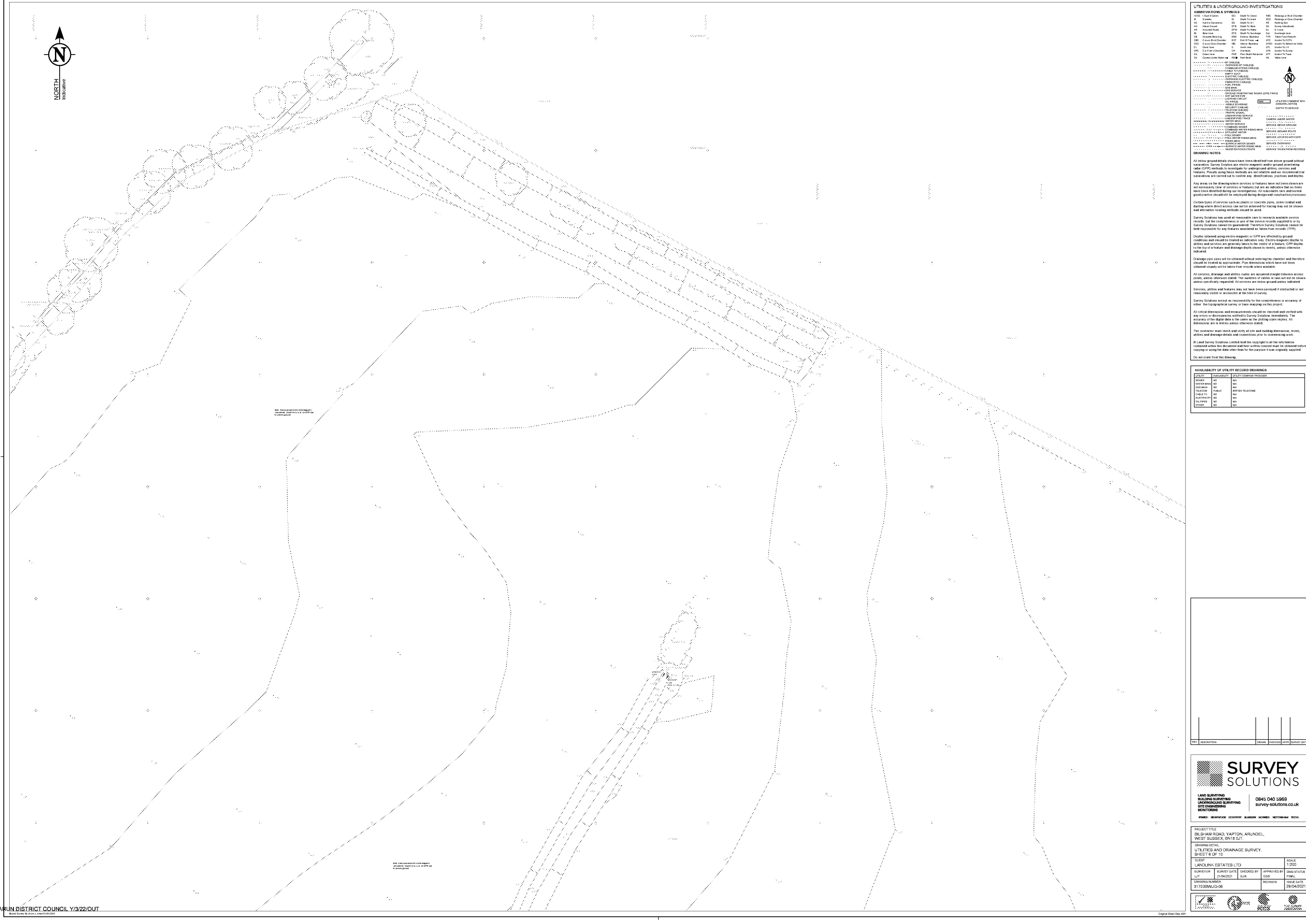
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SCIENCE



TECHNOLOGY



DRAWING NOTE

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[illegible]

DRAWING DETAIL
UTILITIES AND DRAINAGE SURVEY.

74





DRAWING NOTES

All above ground details shown have been derived from above ground without the aid of geophysical or geotechnical data. The drawing is a ground penetrating radar (GPR) methods to investigate for underground utilities, services and features. Results using these methods are not reliable and we recommend that all services and features be located by other means.

Any areas on the drawing where services or features have not been shown are not necessarily clear of services or features but it is an indication that no features were detected by the GPR. The absence of features does not necessarily mean good practice should not be employed during design and construction processes.

Certain types of services such as plastic or concrete pipes, some conduit and cables may not be detected by GPR. Therefore, tracing may not be shown and alternative locating methods should be used.

Survey Solutions will not be responsible for any research available service records, but the completeness or use of any service records supplied to us by the client is not our responsibility. We will not be held responsible for any features indicated as taken from records (TFR).

Details obtained using electro-magnetic or GPR are likely to give ground details and not necessarily the true details of the services and features. GPR details for utilities and services are generally taken to the centre of a feature. GPR details for cables, drains, features and drainage details shown to invert, unless otherwise indicated.

Drainage pipe sizes will be obtained without entering the chamber and therefore should not be treated as accurate. Pipe dimensions which have not been checked will be given as best as possible.

All services, drainage and utilities records are assumed draught between them and, unless otherwise stated. The numbers of cables in runs will not be shown unless otherwise indicated. All services are assumed to be underground, unless indicated.

Services, utilities and features may not have been surveyed if obstructed or not reasonably visible or accessible at the time of survey.

Survey Solutions accept no responsibility for the completeness or accuracy of their topographic survey or map plotting on this drawing.

All critical dimensions and measurements should be checked and verified with other means. Survey Solutions will not be responsible for the accuracy or the accuracy of the digital data it is sent as the plotting scope requires. All dimensions are in millimetres unless otherwise stated.

The contractor must check and verify all data and building dimensions, levels, utilities and drainage details and connections prior to commencing work.

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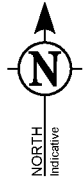
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GAS MAIN	NO	N/A
TELECOM	PUBLIC	BRITISH TELECOM
CABLE TV	NO	N/A
ELECTRICITY	NO	N/A
OIL PIPES	NO	N/A
OTHER	NO	N/A

REV	DESCRIPTION	DRAWN	CHECKED	APPR	SURVEY DATE
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PROJECT TITLE BILSHAM ROAD, YAPTON, ARUNDELL, WEST SUSSEX, BN18 0JT.			
DRAWING DETAIL UTILITIES AND DRAINAGE SURVEY. SHEET 8 OF 10			
CLIENT LANDLINK ESTATES LTD			SCALE 1:200
SURVEYOR LJT	SURVEY DATE 21/04/2021	CHECKED BY SJH	APPROVED BY GSS
DRAWING NUMBER 317 03RMJG-G-08			REVISION DATE 28/04/2021





UTILITIES & UNDERGROUND INVESTIGATIONS			
ABBREVIATIONS & SYMBOLS			
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97 AC 1 Dual 15 Cables	SD 1 Death To Cables	SSC 1 Residue at Risk Character	
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99 AC 1 Dual 15 Cables	SD 1 Death To Cables	SSC 1 Residue at Risk Character	
100 AC 1 Dual 15 Cables	SD 1 Death To Cables	SSC 1 Residue at Risk Character	

DRAWING NOTES

All below ground details shown have been identified from above ground without excavation. Survey Solutions use electro-magnetic and/or ground penetrating radar (GPR) methods to investigate for underground utilities, services and features. Results using these methods are not infallible and we recommend that excavations are carried out to confirm any identification, positions and depths.

Any areas on the drawing where services or features have not been shown are not necessarily clear of services or features but are an indication that no items have been identified during our investigations. At reasonable care and normal good practice should still be employed during design and construction processes.

Certain types of services such as plastic or concrete pipes, some conduit and ducting where direct access can not be achieved for tracing may not be shown and alternative locating methods should be used.

Survey Solutions has used all reasonable care to research available service records, but the completeness or use of the service records supplied to or by Survey Solutions cannot be guaranteed. Therefore Survey Solutions cannot be held responsible for any features associated as taken from records (TFR).

Depths obtained using electro-magnetic or GPR are effected by ground conditions and should be treated as indicative only. Electro-magnetic depths to utilities and services are generally taken to the centre of a feature. GPR depths to the top of a feature and drainage depth shown to invert, unless otherwise indicated.

Drainage pipe items will be obtained without entering the chamber and therefore should be treated as approximate. Pipe dimensions which have not been obtained visually will be taken from records where available.

All services, drainage and utilities routes are assumed straight between access points, unless otherwise stated. The numbers of cables in sets will not be shown unless specifically requested. All services are below ground unless indicated.

Services, utilities and features may not have been surveyed if obstructed or not reasonably visible or accessible at the time of survey.

Survey Solutions accept no responsibility for the completeness or accuracy of either the topographic survey or their mapping on this project.

All critical dimensions and measurements should be checked and verified with any errors or discrepancies notified to Survey Solutions immediately. The accuracy of the depth data is the same as the plotting scale applies. All dimensions are in metres unless otherwise stated.

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work.

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Do not scale from this drawing.

AVAILABILITY OF UTILITY RECORD DRAWINGS		
UTILITY	AVAILABILITY	UTILITY COMPANY PROVIDER
SEWER	NO	NA
WATER MAIN	NO	NA
GAS MAIN	NO	NA
TELECOM	PUBLIC	BRITISH TELECOM
CABLE TV	NO	NA
ELECTRICITY	NO	NA
TELEPHONE	NO	NA
OTHER	NO	NA

REV	DESCRIPTION	DATE	DESIGNED	APPROVED	SURVEY DATA

**SURVEY SOLUTIONS**

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PROJECT TITLE 28 SHAM ROAD, YAPTON, ARUNDEL, WEST SUSSEX, BN15 0JT.			
DRAWING DETAIL UTILITIES AND DRAINAGE SURVEY. SHEET 9 OF 10			
CLIENT LANDLINK ESTATES LTD	SCALE 1:200		
SURVEYOR LUT	SURVEY DATE 21/04/2021	CHECKED BY SH	DATE STATUS FINAL
DRAWING NUMBER 31703BWJG-09	REVISION	ISSUE DATE 28/04/2021	





DRAWING NOTES

All above ground details shown have been derived from above-ground without the aid of geophysical or geotechnical data. The following ground penetrating radar (GPR) methods to investigate for underground utilities, services and features. Results using these methods are not reliable and we recommended that all services and features be located by direct means.

Any areas on the drawing where services or features have not been shown are not necessarily clear of services or features but are an indication that no features were detected. The absence of features does not constitute a warranty of clear ground practice should still be employed during design and construction processes.

Certain types of services such as plastic or concrete pipes, some conduit and cables may not be detected by GPR. Therefore, tracing may not be shown and alternative locating methods should be used.

Survey Solutions cannot be held responsible for any research available service records, but the completeness or use of any service records supplied to us by the client is not our responsibility. We cannot be held responsible for any features indicated as taken from records (TFR).

Details obtained using electro-magnetic or GPR are intended to give ground indication of the presence of services and features. Survey Solutions cannot be held responsible for any errors resulting from the use of GPR. GPR depths to utilities and services are generally taken to the centre of a feature. GPR depths to the top of a feature and drainage depths shown to invert, unless otherwise indicated.

Drainage pipe sizes will be obtained without entering the chamber and therefore should be treated as approximate. Pipe dimensions which have not been checked will carry a liability to the client.

All services, drainage and utilities records are assumed draught between sections, unless otherwise stated. The numbers of drains in a row will not be shown unless otherwise specified. All services are assumed to be correctly indicated.

Services, utilities and features may not have been survey physically obstructed or not reasonably visible or accessible at the time of survey.

Survey Solutions accept no responsibility for the completeness or accuracy of their topographic survey or map mapping on this project.

All critical dimensions and measurements should be checked and verified with the client. All discrepancies should be noted on the drawing. The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in millimetres.

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work.

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Do not scale from this drawing

UTILITY	AVAILABILITY	UTILITY COMPANY PROVIDER
SEWER	NO	NA
WATER MAIN	NO	NA
GAS MAIN	NO	NA
TELECOM	PUBLIC	BRITISH TELECOMS
CABLE TV	NO	NA
ELECTRICITY	NO	NA
OIL PIPES	NO	NA
OTHER	NO	NA

REV	DESCRIPTION	DRAWN	CHECKED	APPR	SURVEY DATE
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PROJECT TITLE BILSHAM ROAD, YAPTON, ARUNDELL, WEST SUSSEX, BN18 9JT.			
DRAWING DETAIL UTILITIES AND DRAINAGE SURVEY. SHEET 10 OF 10			
CLIENT LANDLINK ESTATES LTD			SCALE 1:200
SURVEYOR LJT	SURVEY DATE 21/04/2021	CHECKED BY S/H	APPROVED BY GSB
DRAWING NUMBER 317039WJG-10			ISSUE DATE 28/04/2021
REVISION			FINAL



Appendix D: Ground Investigation

Land West of Bilsham Road

Land Quality Statement

For:

Landlink Estates Ltd

Project Number:

13684

December 2021

Campbell Reith Hill LLP
Raven House
29 Linkfield Lane
Redhill
Surrey RH1 1GG

Document History and Status

Revision	Date	Purpose/Status	Author	Check	Review
F01	Sep 2021	For Information	R. Ashmore M. Powell	P. Wright	
F02	Dec 2021	For Information	P. Wright	P. Wright	

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EXECUTIVE SUMMARY

SITE LOCATION AND PROPOSED DEVELOPMENT	Site is situated just south of Yapton, West Sussex centred on National Grid Reference (NGR) SU 67516 02428. The nearest post code to site is BN18 0LA and covers approximately 17ha. The site is proposed to be developed for residential use, representing a High end user sensitivity.
CURRENT USE AND HISTORY	The site has comprised agricultural land from the earliest historical maps (1876). A drainage ditch borders the western boundary running roughly NE to SW.
ENVIRONMENTAL SETTING	The site lies at approximately 6m Above Ordnance Datum (AOD) with the general elevation reducing towards the ditch roughly falling towards the southwest. The site is underlain by a Secondary A aquifer (superficial deposits) and Principal Aquifer (Chalk). - Hydrogeology: High sensitivity - Hydrology: High sensitivity
GROUND CONDITIONS	The site strata comprises a cover of topsoil, underlain by firm (locally soft) gravelly sandy clays and loose to medium dense clayey fine to coarse sands over weathered structureless chalk (Grade Dm). High groundwater was encountered across the site.
GEOTECHNICAL HAZARDS	- Compressible ground - Shallow / perched groundwater - Soils susceptible to frost heave - Chalk dissolution features - Volume change potential soils - Low permeability soils - Aggressive conditions to buried concrete - Obstructions (i.e. flint bands)
CONTAMINATION ISSUES	The site has limited identified sources of contamination and the ground investigation did not identify Made Ground or contamination of concern on the site. Generally risks associated with contamination on the site were identified to be VERY LOW. Ground gas monitoring on the site indicates that ground gas protection measures are not required.
GEOTECHNICAL RECOMMENDATIONS	Dissolution Features No evidence of dissolution features was encountered during the ground investigations. However, the presence of such features cannot be fully ruled out. The presence of shallow groundwater across the site should be acknowledged, suitably controlled and measures should be in place to ensure drainage is not susceptible to damage. Excavations Difficulties in excavating the swales and foundations are not anticipated due to the soft nature of the superficial deposits. Owing to the high groundwater, measures should be in place to pump water and accommodate the high water table. Support or battering of the excavation faces may be required where man entry is necessary. Foundations Should shallow traditional foundations be considered additional investigation work is recommended to further evaluate the risk of chalk dissolution features on site and variability of superficial deposits. Issues with trench instability, groundwater ingress, heave and soil softening would also need to be addressed. Piled foundations may be required for some areas of site. The piles will need to consider the potential for chalk dissolution and pile locations should be suitably investigated for potential dissolution features. Additional investigative work will also be required should piled foundations be the chosen solution. Drainage Soakaway and percolation testing indicates the superficial material is not suitable for infiltration drainage.

	Drainage infrastructure should be protected from the occurrence of settlement with flexible service connections and should be designed to mitigate against damage to prevent the egress of water into the chalk thereby forming dissolution features. Drainage should be wrapped in geotextiles to prevent the ingress of fines and silting up. Floor slabs Suspended floor slabs are recommended. Road Pavements A preliminary CBR of 2% is recommended where pavements is constructed in areas of soft and compressible material. The sub-grade for any pavement should be inspected prior to construction. Buried Concrete Buried concrete should be designed to Design Sulphate Class DS-1 and AC-1. Further Investigation Further investigation is recommended, this should include; further exploratory holes into the chalk to reach sufficient depth to enable pile design and better delineate the weathering profile of the bedrock across site, large scale infiltration, sulphate testing of soils and water samples for buried concrete assessment, and TRL DCP testing and/or remoulded CBR testing.
ENVIRONMENTAL RECOMMENDATIONS	Remediation works and gas protection measures are not required. A watching brief for hitherto unforeseen ground conditions should be maintained throughout future phases of work and any potential contamination encountered should be assessed in accordance with Land Contamination: Risk Management online guidance. Any re-use of soils on the site should be conducted under a Materials Management Plan (MMP), or appropriate waste exemption.



Land west of Bilsham Road
Client: Landlink Estates Ltd

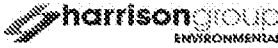
Figure 6:
Exploratory Hole Location Plan

Scale: 1:2500@A3
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Job Number: 13684
Drawn by - Checked by: RLF/RP - RA/PW
Drg No - Status/Revision: 13684-CRH-XX-FG-G-7017 - P5
File location: \\red-data\gis-data\13500 - 13749\13684 R - Lamb Field\Project_Workspaces\LQS (pdf in Outputs)
Date (Revision History): 01/12/2021 (P1, First Issue, 15/07/21, RLF; P2, Client Logo, 29/07/21, RLF; P4, GI update, 17/09/21, RP; P5, Site Boundary, 01/12/21, RLF)

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				Groundwater Monitoring Results																							
Project ID: GL24212				Client: Landlink Estates Limited								Weather conditions: Cloudy and dry															
Date: 25/05/2021				Location: Lamb's Field								Ground conditions: -															
1 = All (m) depth measurements are recorded as meters from the top of the installation cover.												2 = I: Inertial, S: Submersible, B: Bailer, P: Peristaltic Pump.				3 = Purge volume standardisation: 50mm standpipe = 6 x water column, 35mm = 3.5 x water column, 19mm = 1 x water column.											
Field engineer(s): W. Atkins				Remarks:																							
Location ID	Monitoring Pipe and Diameter	Date Monitored	Time	Surface Elevation (maOD)	LNAPL Depth ¹ (mbgl)	LNAPL Depth (maOD)	Water Level ¹ (mbgl)	Water Level (maOD)	DNAPL Depth ¹ (mbgl)	DNAPL Depth (maOD)	Depth to base ¹ (mbgl)	Depth to base (maOD)	Readings:										Sampling Method ² (I, S, B, P)	Water Column (m)	Purged Volume ³ (L)	Sample Ref	Comments: (e.g. problems encountered, standpipe conditions, unusual odours, colour, turbidity, sheens)
													Barometric Pressure (mB)	Air Temp (°C)	Downhole Temp (°C)	pH	Electrical Conductivity (µS/cm)	DO (%)	Redox Potential (mV)	Resistivity (Ohm-cm)	Salinity (psu)	Density (g/cm³)					
WS01	PIPE1 (50mm)	25/05/2021	11:07:00	1.87	N/E		1.20	0.67	N/E		2.68	-0.81												1.48			Interface meter recorded a solid beep from 1.88m, possibly due to increased turbidity.
WS02A	PIPE1 (50mm)	25/05/2021	10:44:00	4.94	N/E		2.27	2.67	N/E		4.07	0.87												1.80			Interface meter recorded a solid beep from 2.95m, possibly due to increased turbidity.
WS03	PIPE1 (50mm)	25/05/2021	10:30:00	6.08	N/E		2.33	3.75	N/E		5.05	1.03												2.72			Interface meter recorded a solid beep from 3.04m, possibly due to increased turbidity.
WS04	PIPE1 (50mm)	25/05/2021	11:26:00	4.29	N/E		1.58	2.71	N/E		3.05	1.24												1.47			Interface meter recorded a solid beep from 2.27m, possibly due to increased turbidity.

				Groundwater Monitoring Results																											
Project ID: GL24212				Client: Landlink Estates Limited								Weather conditions: Sunny and dry																			
Date: 08/06/2021				Location: Lambs Field								Ground conditions: -																			
¹ = All (m) depth measurements are recorded as meters from the top of the installation cover.												² = I: Inertial, S: Submersible, B: Bailer, P: Peristaltic Pump.						³ = Purge volume standardisation: 50mm standpipe = 6 x water column, 35mm = 3.5 x water column, 19mm = 1 x water column.													
Field engineer(s): J. Blyth												Remarks:																			
Location ID	Monitoring Pipe and Diameter	Date Monitored	Time	Surface Elevation (maOD)	LNAPL Depth¹ (mbgl)	LNAPL Depth (maOD)	Water Level¹ (mbgl)	Water Level (maOD)	DNAPL Depth¹ (mbgl)	DNAPL Depth (maOD)	Depth to base¹ (mbgl)	Depth to base (maOD)	Barometric Pressure (mB)	Air Temp (°C)	Downhole Temp (°C)	pH	Electrical Conductivity (µS/cm)	DO (%)	Redox Potential (mV)	Resistivity (Ohm-cm)	Salinity (psu)	Density (g/cm³)	TDS (ppt)	Water Pressure (psl)	Sampling Method² (I, S, B, P)	Water Column (m)	Purged Volume³ (L)	Sample Ref	Comments: (e.g. problems encountered, standpipe conditions, unusual odours, colour, turbidity, sheens)		
WS01	PIPE1 (50mm)	08/06/2021	11:10:00	1.87	N/E		1.32	0.55	N/E		2.80	-0.93														1.48					
WS02A	PIPE1 (50mm)	08/06/2021	10:30:00	4.94	N/E		2.33	2.61	N/E		4.12	0.82														1.79					
WS03	PIPE1 (50mm)	08/06/2021	10:00:00	6.08	N/E		2.39	3.69	N/E		5.01	1.07														2.62					
WS04	PIPE1 (50mm)	08/06/2021	10:50:00	4.29	N/E		1.68	2.61	N/E		3.23	1.06														1.55					

				Groundwater Monitoring Results																							
Project ID: GL24212				Client: Landlink Estates Limited							Weather conditions: Sunny and dry																
Date: 16/06/2021				Location: Lambs Field							Ground conditions: -																
1 = All (m) depth measurements are recorded as meters from the top of the installation cover.										2 = I: Inertial, S: Submersible, B: Bailer, P: Peristaltic Pump.					3 = Purge volume standardisation: 50mm standpipe = 6 x water column, 35mm = 3.5 x water column, 19mm = 1 x water column.												
Field engineer(s): J. Blyth				Remarks:																							
Location ID	Monitoring Pipe and Diameter	Date Monitored	Time	Surface Elevation (maOD)	LNAPL Depth ¹ (mbgl)	LNAPL Depth (maOD)	Water Level ¹ (mbgl)	Water Level (maOD)	DNAPL Depth ¹ (mbgl)	DNAPL Depth (maOD)	Depth to base ¹ (mbgl)	Depth to base (maOD)	Readings:										Sampling Method ² (I, S, B, P)	Water Column (m)	Purged Volume ³ (L)	Sample Ref	Comments: (e.g. problems encountered, standpipe conditions, unusual odours, colour, turbidity, sheens)
													Barometric Pressure (mB)	Air Temp (°C)	Downhole Temp (°C)	pH	Electrical Conductivity (µS/cm)	DO (%)	Redox Potential (mV)	Resistivity (Ohm-cm)	Salinity (psu)	Density (g/cm ³)					
WS01	PIPE1 (50mm)	16/06/2021	11:30:00	1.87	N/E		1.30	0.57	N/E		2.70	-0.83											B	1.40		EW1-SP1	Slightly cloudy, white/orange.
WS02A	PIPE1 (50mm)	16/06/2021	11:00:00	4.94	N/E		2.38	2.56	N/E		4.11	0.83											B	1.73		EW1-SP1	Slightly cloudy, white/orange.
WS03	PIPE1 (50mm)	16/06/2021	10:30:00	6.08	N/E		2.41	3.67	N/E		5.06	1.02											B	2.65		EW1-SP1	Cloudy, light orangish brown.
WS04	PIPE1 (50mm)	16/06/2021	12:00:00	4.29	N/E		1.84	2.45	N/E		3.24	1.05											B	1.40		EW1-SP1	Cloudy, light orangish brown.

				Groundwater Monitoring Results																									
Project ID: GL24212				Client: Landlink Estates Limited				Weather conditions: Sunny and dry																					
Date: 22/10/2021				Location: Lambs Field				Ground conditions: -																					
¹ = All (m) depth measurements are recorded as meters from the top of the installation cover.								² = I: Inertial, S: Submersible, B: Bailer, P: Peristaltic Pump.				³ = Purge volume standardisation: 50mm standpipe = 6 x water column, 35mm = 3.5 x water column, 19mm = 1 x water column.																	
Field engineer(s): J. Blyth								Remarks:																					
Location ID	Monitoring Pipe and Diameter	Date Monitored	Time	Surface Elevation (maOD)	LNAPL Depth ¹ (mbgl)	LNAPL Depth (maOD)	Water Level ¹ (mbgl)	Water Level (maOD)	DNAPL Depth ¹ (mbgl)	DNAPL Depth (maOD)	Depth to base ¹ (mbgl)	Depth to base (maOD)	Readings:										Sampling Method ² (I, S, B, P)	Water Column (m)	Purged Volume ³ (L)	Sample Ref	Comments: (e.g. problems encountered, standpipe conditions, unusual odours, colour, turbidity, sheens)		
													Barometric Pressure (mB)	Air Temp (°C)	Downhole Temp (°C)	pH	Electrical Conductivity (µS/cm)	DO (%)	Redox Potential (mV)	Resistivity (Ohm-cm)	Salinity (psu)	Density (g/cm ³)						TDS (ppt)	Water Pressure (psi)
WS01	PIPE1 (50mm)	22/10/2021	10:30:00	1.87	N/E		0.57	1.30	N/E		2.48	-0.61												1.91					
WS02A	PIPE1 (50mm)	22/10/2021	10:10:00	4.94	N/E		1.80	3.14	N/E		4.00	0.94												2.20					
WS03	PIPE1 (50mm)	22/10/2021	10:00:00	6.08	N/E		1.20	4.88	N/E		5.01	1.07												3.81					
WS04	PIPE1 (50mm)	22/10/2021	10:20:00	4.29	N/E		1.02	3.27	N/E		3.04	1.25												2.02					

				Groundwater Monitoring Results																									
Project ID: GL24212				Client: Landlink Estates Limited								Weather conditions: Cloudy and dry																	
Date: 25/11/2021				Location: Lambs Field								Ground conditions: -																	
¹ = All (m) depth measurements are recorded as meters from the top of the installation cover.												² = I: Inertial, S: Submersible, B: Bailer, P: Peristaltic Pump.						³ = Purge volume standardisation: 50mm standpipe = 6 x water column, 35mm = 3.5 x water column, 19mm = 1 x water column.											
Field engineer(s): L. Jeffery				Remarks:																									
Location ID	Monitoring Pipe and Diameter	Date Monitored	Time	Surface Elevation (maOD)	LNAPL Depth¹ (mbgl)	LNAPL Depth (maOD)	Water Level¹ (mbgl)	Water Level (maOD)	DNAPL Depth¹ (mbgl)	DNAPL Depth (maOD)	Depth to base¹ (mbgl)	Depth to base (maOD)	Barometric Pressure (mB)	Air Temp (°C)	Downhole Temp (°C)	pH	Electrical Conductivity (µS/cm)	DO (%)	Redox Potential (mV)	Resistivity (Ohm-cm)	Salinity (psu)	Density (g/cm³)	TDS (ppt)	Water Pressure (psl)	Sampling Method² (I, S, B, P)	Water Column (m)	Purged Volume¹ (L)	Sample Ref	Comments: (e.g. problems encountered, standpipe conditions, unusual odours, colour, turbidity, sheens)
WS01	PIPE1 (50mm)	25/11/2021	14:10:00	1.87	N/E		1.05	0.82	N/E		2.43	-0.56														1.38			
WS02A	PIPE1 (50mm)	25/11/2021	13:48:00	4.94	N/E		2.15	2.79	N/E		4.00	0.94														1.85			
WS03	PIPE1 (50mm)	25/11/2021	13:43:00	6.08	N/E		2.28	3.80	N/E		5.02	1.06														2.74			
WS04	PIPE1 (50mm)	25/11/2021	13:57:00	4.29	N/E		1.52	2.77	N/E		3.06	1.23														1.54			

				Groundwater Monitoring Results																									
Project ID: GL24212				Client: Landlink Estates Limited								Weather conditions: Cloudy and dry																	
Date: 14/12/2021				Location: Lambs Field								Ground conditions: -																	
¹ = All (m) depth measurements are recorded as meters from the top of the installation cover.										² = I: Inertial, S: Submersible, B: Bailer, P: Peristaltic Pump.					³ = Purge volume standardisation: 50mm standpipe = 6 x water column, 35mm = 3.5 x water column, 19mm = 1 x water column.														
Field engineer(s): L. Jeffery										Remarks:																			
Location ID	Monitoring Pipe and Diameter	Date Monitored	Time	Surface Elevation (maOD)	LNAPL Depth ¹ (mbgl)	LNAPL Depth (maOD)	Water Level ¹ (mbgl)	Water Level (maOD)	DNAPL Depth ¹ (mbgl)	DNAPL Depth (maOD)	Depth to base ¹ (mbgl)	Depth to base (maOD)	Readings:										Sampling Method ² (I, S, B, P)	Water Column (m)	Purged Volume ³ (L)	Sample Ref	Comments: (e.g. problems encountered, standpipe conditions, unusual odours, colour, turbidity, sheens)		
													Barometric Pressure (mB)	Air Temp (°C)	Downhole Temp (°C)	pH	Electrical Conductivity (µS/cm)	DO (%)	Redox Potential (mV)	Resistivity (Ohm-cm)	Salinity (psu)	Density (g/cm³)						TDS (ppt)	Water Pressure (psl)
WS01	PIPE1 (50mm)	14/12/2021		1.87	N/E		0.90	0.97	N/E		2.50	-0.63													1.60				
WS02A	PIPE1 (50mm)	14/12/2021		4.94	N/E		2.00	2.94	N/E		4.02	0.92													2.02				
WS03	PIPE1 (50mm)	14/12/2021		6.08	N/E		2.00	4.08	N/E		5.00	1.08													3.00				
WS04	PIPE1 (50mm)	14/12/2021		4.29	N/E		1.40	2.89	N/E		3.03	1.26													1.63				

Appendix E: Existing Site Drainage

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
0702	F	0.00	0.00	
0703	F	0.00	0.00	
0704	F	0.00	0.00	
0705	F	0.00	0.00	
0706	F	0.00	0.00	
0707	F	0.00	0.00	
0708	F	0.00	0.00	
0801	F	6.25	4.12	
0802	F	7.44	4.75	
0803	F	7.40	4.64	
0804	F	7.47	4.43	
0901	F	6.53	3.91	
0902	F	6.50	3.90	
6601	F	5.09	3.25	
6701	F	5.91	4.63	
6702	F	5.68	2.90	
6703	F	5.38	2.78	
6704	F	5.32	2.73	
6705	F	5.67	4.75	
6707	F	5.57	3.11	
6708	F	5.33	3.76	
6709	F	5.26	3.14	
6710	F	0.00	0.00	
6711	F	0.00	0.00	
6712	F	0.00	0.00	
6713	F	0.00	0.00	
6714	F	0.00	0.00	
6715	F	0.00	0.00	
6801	F	0.00	0.00	
6802	F	0.00	0.00	
6805	F	0.00	0.00	
6806	F	0.00	0.00	
6807	F	0.00	0.00	
7301	F	0.00	0.00	
7401	F	5.61	0.00	
7402	F	5.51	4.76	
7403	F	10.25	8.99	
7404	F	10.16	8.85	
7405	F	10.24	8.68	
7406	F	10.11	0.00	
7601	F	6.37	4.75	
7602	F	6.30	4.36	
7701	F	5.48	3.90	
7702	F	5.42	4.00	
7703	F	5.96	0.00	
7704	F	6.00	0.00	
7705	F	5.92	0.00	
7706	F	0.00	0.00	
7707	F	0.00	0.00	
7708	F	0.00	0.00	
7709	F	0.00	0.00	
7710	F	0.00	0.00	
7711	F	0.00	0.00	
7712	F	0.00	0.00	
7713	F	0.00	0.00	
7714	F	0.00	0.00	
7715	F	0.00	0.00	
7801	F	0.00	0.00	
7802	F	0.00	0.00	
7803	F	0.00	0.00	
7804	F	0.00	0.00	
7805	F	0.00	0.00	
7806	F	0.00	0.00	
7807	F	0.00	0.00	
7808	F	0.00	0.00	
7809	F	0.00	0.00	
7810	F	0.00	0.00	
7811	F	0.00	0.00	
7812	F	0.00	0.00	
8501	F	5.65	4.17	
8502	F	5.60	3.98	
8503	F	5.48	3.80	
8504	F	5.64	4.13	
8601	F	6.13	4.21	
8602	F	5.37	3.67	
8603	F	5.52	3.60	
8701	F	6.17	4.72	
8702	F	0.00	0.00	
8703	F	0.00	0.00	
8704	F	0.00	0.00	
8706	F	0.00	0.00	
8707	F	0.00	0.00	
8708	F	0.00	0.00	
8709	F	0.00	0.00	
8711	F	0.00	0.00	
8712	F	0.00	0.00	
8713	F	0.00	0.00	
8801	F	0.00	0.00	
8802	F	0.00	0.00	
8803	F	0.00	0.00	
9401	F	6.08	4.63	
9501	F	6.25	4.27	
9502	F	5.84	4.41	
9503	F	6.06	4.11	
9601	F	5.99	3.24	
9701	F	6.28	4.69	
9702	F	6.22	4.34	
9710	F	0.00	0.00	
9711	F	0.00	0.00	
9712	F	0.00	0.00	
9713	F	0.00	0.00	
9714	F	0.00	0.00	
9715	F	0.00	0.00	
9716	F	0.00	0.00	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
6650	S	4.99	3.18	
6651	S	5.41	4.53	
6750	S	5.95	3.71	
6751	S	5.59	3.44	
6752	S	5.23	3.30	
6753	S	5.55	3.68	
6754	S	5.34	3.78	
6756	S	0.00	0.00	
6759	S	4.86	2.98	
6760	S	4.68	2.64	
6761	S	5.33	0.00	
7750	S	6.41	5.45	
7751	S	5.96	4.46	
7752	S	6.04	4.64	
7753	S	5.95	4.81	
7754	S	5.90	4.94	
7756	S	5.52	0.00	
7850	S	0.00	0.00	
8750	S	6.17	5.04	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
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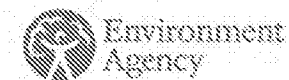
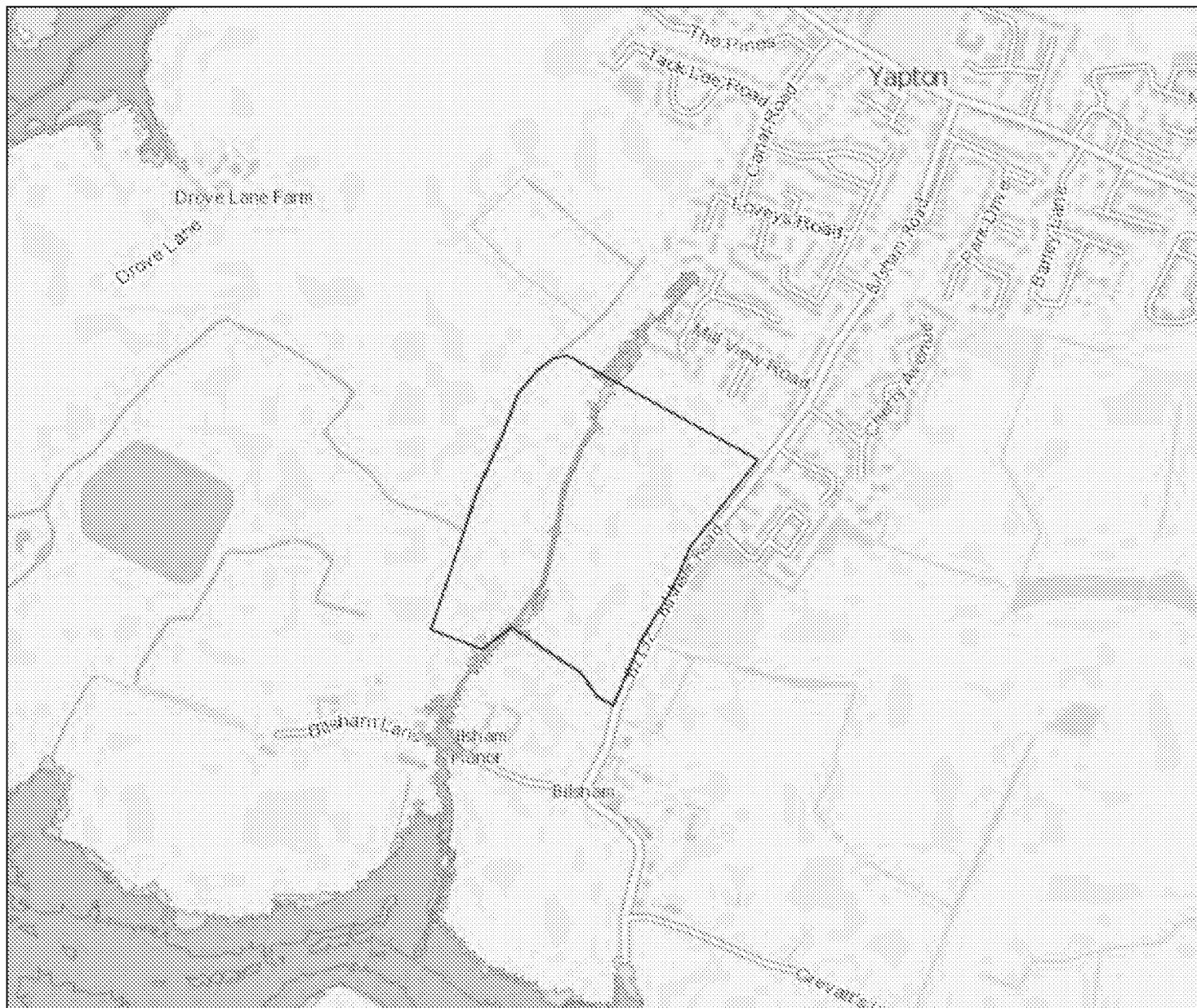
Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
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Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
-------------------	-------------	-------------	--------------	-----------------

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
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Appendix F: EA Product 4 Report

Flood Map for Planning (Rivers and Sea). Centred BN18 0LA. Created 03/08/2021.



1: 10,000

0 Metres 250



Flood Map for Planning (Rivers & Sea)

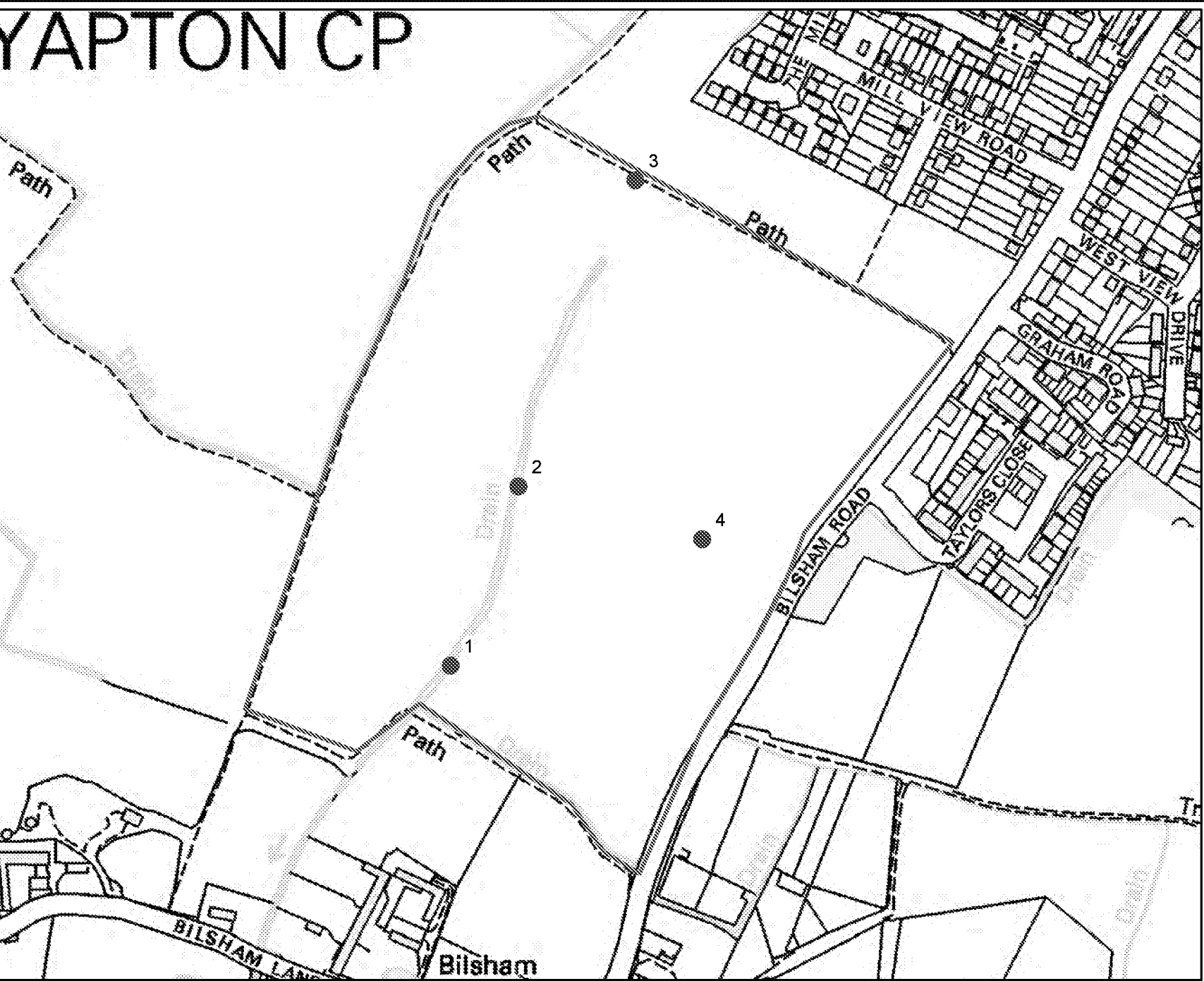
- Defences
- Flood Storage Areas
- Areas benefiting from flood defences
- Flood Zone 3
- Flood Zone 2

Flood Map Areas (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.





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Legend

- Site Nodes
- Site Boundary

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:4,000

00.0750.15

Kilometers

Product 4 Flood Risk Data Requested by: CampbellReith

Site: Lambs Field, Yapton, BN18 0LA

Table 1: Water Levels: Fluvial Undefended

Node Ref	NGR		Modelled Flood Levels in Metres AOD					
	Eastings	Northings	Undefended Annual Exceedance Probability					
			5%	1%	1% +CC (35%)	1% +CC (45%)	1% +CC (105%)	0.1%
1	497399	102264	-	-	-	-	3.15	-
2	497450	102398	-	-	-	-	3.64	-
3	497538	102627	-	-	4.86	4.87	4.93	-
4	497588	102359	-	-	-	-	-	-

Table 2: Water Levels: Fluvial Defended

Node Ref	NGR		Modelled Flood Levels in Metres AOD					
	Eastings	Northings	Defended Annual Exceedance Probability					
			5%	1%	1% +CC (35%)	1% +CC (45%)	1% +CC (105%)	0.1%
1	497399	102264	-	-	-	-	3.15	3.10
2	497450	102398	-	-	-	-	3.64	3.60
3	497538	102627	-	4.83	-	4.85	4.92	4.90
4	497588	102359	-	-	-	-	-	-

Table 3: Water Depths: Fluvial Undefended

Node Ref	NGR		Modelled Flood Depths in Metres					
	Eastings	Northings	Undefended Annual Exceedance Probability					
			5%	1%	1% +CC (35%)	1% +CC (45%)	1% +CC (105%)	0.1%
1	497399	102264	-	-	-	-	0.28	-
2	497450	102398	-	-	-	-	0.17	-
3	497538	102627	-	-	0.50	0.50	0.56	-
4	497588	102359	-	-	-	-	-	-

Table 4: Water Depths: Fluvial Defended

Node Ref	NGR		Modelled Flood Depths in Metres					
	Eastings	Northings	Defended Annual Exceedance Probability					
			5%	1%	1% +CC (35%)	1% +CC (45%)	1% +CC (105%)	0.1%
1	497399	102264	-	-	-	-	0.28	0.17
2	497450	102398	-	-	-	-	0.17	0.18
3	497538	102627	-	0.47	-	0.48	0.56	0.54
4	497588	102359	-	-	-	-	-	-

All levels taken from: Aldingbourne Flood Risk Mapping study (2015) (Defended only) with updated climate change allowances (2016)

Produced on: 03/08/2021

There is no additional information or health warnings for these levels/depths or the model from which they have been produced.



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Legend



Site Boundary



1% AEP + 35% (Un defended Fluvial)



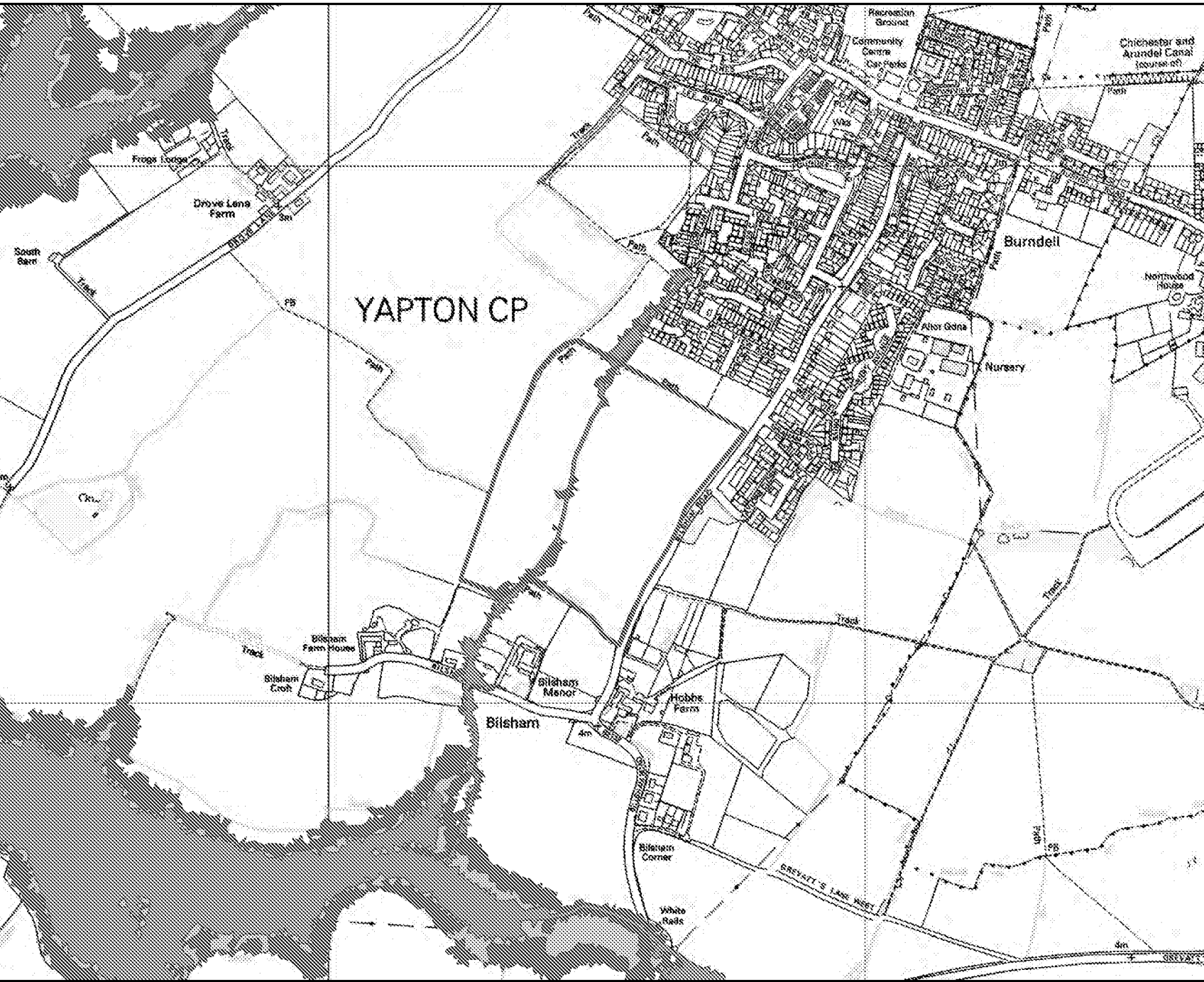
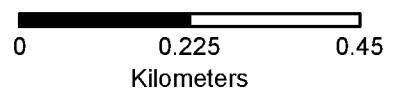
1% AEP + 35% (Un defended Fluvial)



1% AEP + 105% (Un defended Fluvial)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:10,000



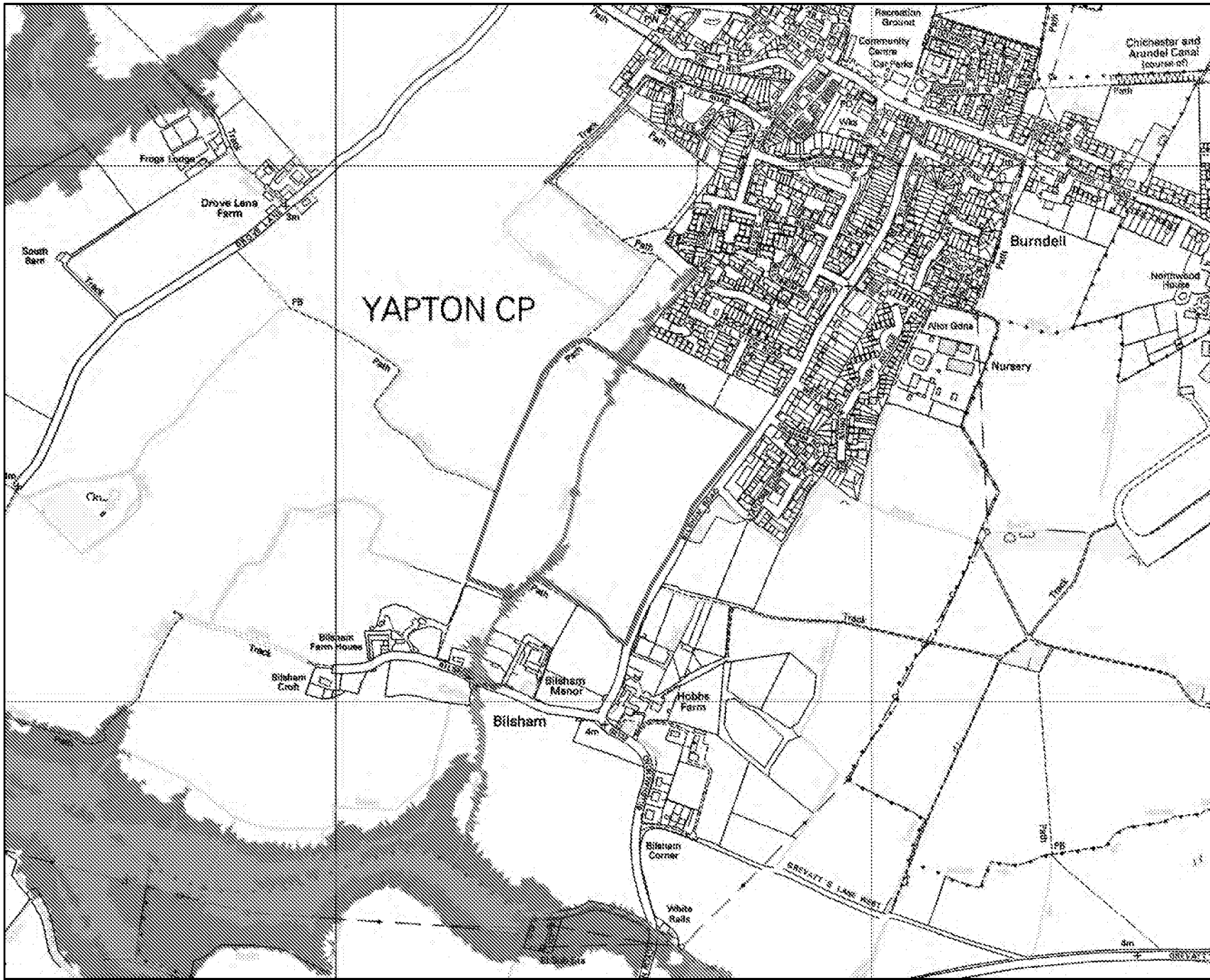
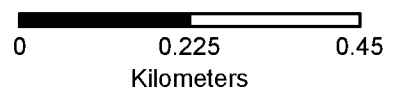


Legend

- Site Boundary
- 1% AEP (Un defended Fluvial)
- 0.1% AEP (Un defended Fluvial)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

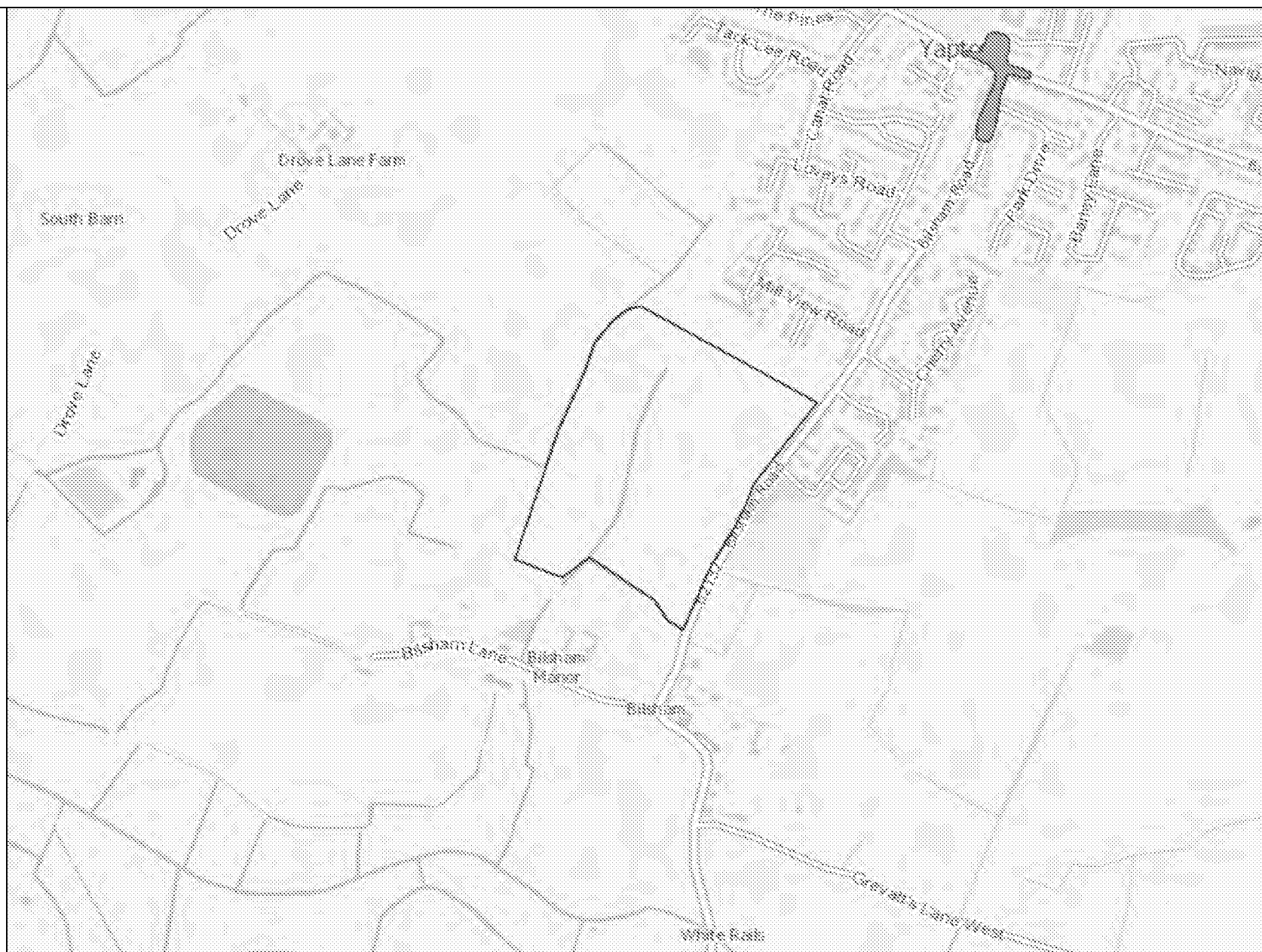
Scale: 1:10,000



Recorded Flood Outlines. Centred BN18 0LA. Created 03/08/2021.

Legend

 All recorded flood outlines



1:10,000

0 250

Metres



Risk of flooding from Surface Water. Centred BN18 0LA. Created 03/08/2021.



1: 10,000

0 Metres 250



Likelihood of flooding from Surface Water

- High ($\geq 3.3\%$)
- Medium (3.3% - 1%)
- Low (1% - 0.1%)
- Very Low
- Flood Extent 1 in 30
- Flood Extent 1 in 100
- Flood Extent 1 in 1000

Likelihood of flooding from Surface Water

- High:** Greater than or equal to 3.3% (1 in 30) chance in any given year
- Medium:** Less than 3.3% (1 in 30) but greater than or equal to 1% (1 in 100) chance in any given year
- Low:** Less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1,000) chance in any given year
- Very Low:** Less than 0.1% (1 in 1,000) chance in any given year

This information is shown on the Risk of Flooding from Surface Water map on GOV.UK.

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Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). E-mail: enquires@environment-agency.gov.uk



RE: SSD226962 Product 4 Data - Lambs Field, Yapton, BN18 0LAPSO West Sussex to
ruthfletcher@campbellreith.com 03/08/2021 16:13
Cc "SSD Enquiries"

1 Attachment



Product 4 Data.zip

Dear Ruth,

Thank you for your Product 4 request for **Lambs Field, Yapton, BN18 0LA**. Please find attached the flood risk data. Unfortunately we do not have any suitable Product 8 data for this site.

For FRA and pre-planning advice please see attached 'FRA Advisory Text' and 'SSD Pre-app advice note September 2019'.

For information on flooding from other sources such as surface water please contact the Lead Local Flood Authority, West Sussex County Council.

Guidance on climate change allowances and how to use them in Flood Risk Assessments can be found [here](#).

For future reference, detailed flood information and maps can be viewed using the [Long Term Flood Risk Information](#) service and [Flood Map for Planning](#) service. Flood and Coastal Risk Management asset information, and details of all planned maintenance activities can be viewed using the [Asset Management](#) Service.

If you have any further queries about this request, please do not hesitate to contact us at psowestsussex@environment-agency.gov.uk.

Kind regards,

Edward Conway

Partnership and Strategic Overview West Sussex

Environment Agency | Guildbourne House, Chatsworth Road, Worthing, BN11 1LD

PSOWestSussex@environment-agency.gov.uk

National Customer Contact Centre: 03708 506506



From: [REDACTED]
Sent: 09 July 2021 09:36
To: Enquiries, Unit <[REDACTED]>
Cc: [REDACTED]
Subject: Ref 210712/ALC12 Lambs Field, Yapton - Product 4 and Product 8 Data Request

Good Morning

We are currently undertaking a Flood Risk Assessment (FRA) for a site located at Lambs Field off Bilsham Road in Yapton. Please see attached Site location plan for reference.

We would like to request Flood Levels/ Flood depth data; any Historic, breach or relevant information to accompany a FRA (Product 4). Can we please also request Product 8 data to inform a breach analysis for the FRA.

We intend to follow the Site-Specific Flood Risk Assessment checklist found in the Planning Practice Guidance and would like to confirm from the EA if there are any particular issues that need to be addressed. We would be grateful if you can advise on the scope of the FRA and if there are any constraints to the development that we are currently not aware of.

Please do not hesitate to contact me at the details below to discuss further or request additional information.

Ruth Fletcher
Graduate Civil Engineer

[REDACTED]
No. 1 Marsden St,
Manchester
M2 1HW

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Ruth Fletcher
CampbellReith
No. 1 Marsden St,
Manchester,
M2 1HW

Our ref: SSD226962
Date: 03/08/2021

Dear Ruth Fletcher,

Enquiry Regarding Product 4 for Flood Risk Assessment for Lambs Field, Yapton, BN18 0LA.

Thank you for your enquiry which was received on 09 July 2021.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004. The information is attached.

The information on Flood Zones in the area relating to this address is as follows:

The site is in an area located within Flood Zones 1 & 2 as shown on our Flood Map for Planning (Rivers and Sea).

Note - This information relates to the area that the above named property is in and is not specific to the property itself as it is influenced by factors such as the height of door steps, air bricks or the height of surrounding walls. We do not have access to this information and is not currently used in our flood modelling.

Flood Zone definitions can be found at www.gov.uk/guidance/flood-risk-and-coastal-change#Table-1-Flood-Zones

Flood Defences

There are no formal raised flood defences in the vicinity of the site.

Model Information

The model used was the Aldingbourne Flood Risk Mapping study which was completed by JBA Consulting in 2015, with updated climate change allowances, completed in 2016.

Flood History

We hold no record of previous flooding events affecting this site.

Please note our records are not comprehensive and may not include all events. I recommend contacting the Lead Local Flood Authority, **West Sussex County Council** or the Local Authority, **Arun District Council** for a more comprehensive flood history check.

FRA advisory text

Name	Product 4
Description	Detailed Flood Risk Assessment Map for Lambs Field, Yapton, BN18 0LA.
Licence	<u>Open Government Licence</u>
Information Warnings	The flood risk data provided is based on existing EA hydraulic models with an allowance for climate change. Please note the climate change allowances provided are not up to date. These were updated on 27 July 2021. You should refer to 'Flood risk assessments: climate change allowances' for the most up to date allowances. You will need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.
Information Warning - OS background mapping	<i>The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.</i>
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. Contains Ordnance Survey data © Crown copyright 2021 Ordnance Survey 100024198.

Data Available Online

Many of our flood datasets are available online:

- Flood Map For Planning ([Flood Zone 2](#), [Flood Zone 3](#), [Flood Storage Areas](#), [Flood Defences](#), [Areas Benefiting from Defences](#))
- [Risk of Flooding from Rivers and Sea](#)
- [Historic Flood Map](#)
- [Current Flood Warnings](#)

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Yours sincerely,

Edward Conway
Partnership & Strategic Overview - West Sussex
Environment Agency - Guildbourne House, Chatsworth Road, Worthing, BN11
1LD

Environment Agency - Guildbourne House - Chatsworth Road - Worthing - BN11 1LD