CONDAIR (BROOKSIDE BUILDING), BROOKSIDE AVENUE, LITTLEHAMPTON

COMMERCIAL DEVELOPMENT

Flood Risk Assessment & Drainage Strategy

Prepared on Behalf of

Condair Limited

D2287/FRA1.2

July 2024

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DOCUMENT CONTROL

Project: Condair (Brookside Building), Brookside Avenue, Littlehampton
Commercial Development

Document: Flood Risk Assessment & Drainage Strategy

Client: Condair Limited

Reference: D2287/FRA1.2

Document Checking:

Author: S Burnett **Date:** 18/07/2024

Checked by: M Akmenkalns **Date:** 26/07/2024

Approved by: M Akmenkalns **Date:** 26/07/2024

Status:

Issue	Date	Status	Issued by
1.0	26/07/2024	DRAFT	SPB
1.1	22/11/2024	FINAL	SPB
1.2	11/12/2024	FINAL	SPB

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1 INTRODUCTION

1.1 Background

1.1.1 BP Civils is instructed by Condair Limited ('the client') to prepare a flood risk assessment and drainage strategy to accompany a planning application for the re-development of the Condair site (Brookside building) at Brookside Avenue, Littlehampton.

1.1.2 This report has been undertaken in accordance with National Planning Policy Framework (NPPF) and The Planning Practice Guidance on the use of SuDS for achieving sustainable development.

1.1.3 The proposed development will involve demolition of the Brookside building and construction of new commercial premises which is to include office space and storage facilities as demonstrated by the development proposals contained within **Appendix A**.

1.1.4 In preparing this report, BP Civils has referred to the following documents and information:

- British Geological Survey (BGS) Information and Records
- Arun District Council (ADC) Drainage Information and Records
- ADC Strategic Flood Risk Assessment (SFRA)
- Environment Agency (EA) Flood Maps for Planning
- Flood Estimation Handbook (FEH) Catchment Data
- Long Term Flood Risk Maps for Rivers or the Sea, Surface Water and Reservoirs
- Southern Water Public Sewer Records

1.1.5 This report has been prepared to assess flood risk at the site, and to advise of any mitigation which may be required in order to ensure that the proposed development remains safe for its design life in accordance with current design standards.

1.1.6 This report has been prepared for the benefit of the named client only.

2 SITE LOCATION AND DESCRIPTION

2.1.1 A site location plan has been prepared **(PL100)** and is included within this report.

2.1.2 The National Grid Reference for the site is TQ 05252 03139.

2.1.3 The site measures 1,578m^2 (0.16Ha) and is currently occupied by Condair Limited, specifically the Brookside building, and is accessible via Brookside Avenue.

2.1.4 The site is located on a wider industrial (business) park, surrounded by commercial premises.

2.1.5 A topographic survey has been undertaken at the site by ASP Surveys, dated July 2024. The survey is contained in **Appendix B**.

2.1.6 The topographic survey demonstrates levels in the range of 4.90m AOD to 5.50m AOD.

2.1.7 Drawing **PL200** (Existing Topography and Overland Flow Routes) has been prepared to demonstrate the general trends in topography at the site.

3 GROUND CONDITIONS

3.1.1 Intrusive ground investigation has been undertaken at the site by Soils Limited, inclusive of infiltration testing and groundwater invesitgation. Site works were undertaken on 25th and 26th March 2024.

3.1.2 The site works consisted of the following:

- 1 No. shallow infiltration test location (0.60m below ground level)
- 1 No. deeper infiltration test location (1.55m below ground level)
- 4 No. 5m deep windowless sampler boreholes
- 4 No. 6m super heavy dynamic probes
- 1 No. 5m deep groundwater monitoring well installation
- Contamination laboratory testing

3.1.3 Soil Limited has confirmed, in summary, ground conditions as follows:

Strata	Depth Encountered (m below ground level)		Typical Thickness (m)	Typical Description
	Top	Bottom		
Made Ground	0	0.40 – 1.50	1.20	Soft brown/brownish grey sandy gravelly CLAY with brick, clinker coal and plaster
River Terrace Deposits	0.40 – 1.50	1.55[1] – 4.30	1.55	Soft to firm yellowish brown sandy gravelly CLAY
New Pit Chalk Formation	1.95 – 4.30	>5.00[1]+	Not proven[2]	Structureless cream CHALK recovered as light brown stained, with angular to subangular, fine to coarse chalk clasts

[1] Final depth of explorary hole. [2] Base of strata not encountered. The depths given in this table are taken from the ground level on-site at the time of investigation

3.1.4 Soils Limited's report, inclusive of comprehensive exploratory logs, is contained within **Appendix C**.

3.1.5 In addition to the site specific intrusive works, reference has also been made to the BGS website.

3.1.6 The BGS Geology of Britain Viewer identifies a 'New Pit Chalk Formation' bedrock geology.

Figure 1. Geology of Britain Viewer – Bedrock Geology (BGS)

3.1.7 Superficial Deposits are recorded as 'River Terrace Deposits – Sand, silt and clay'.

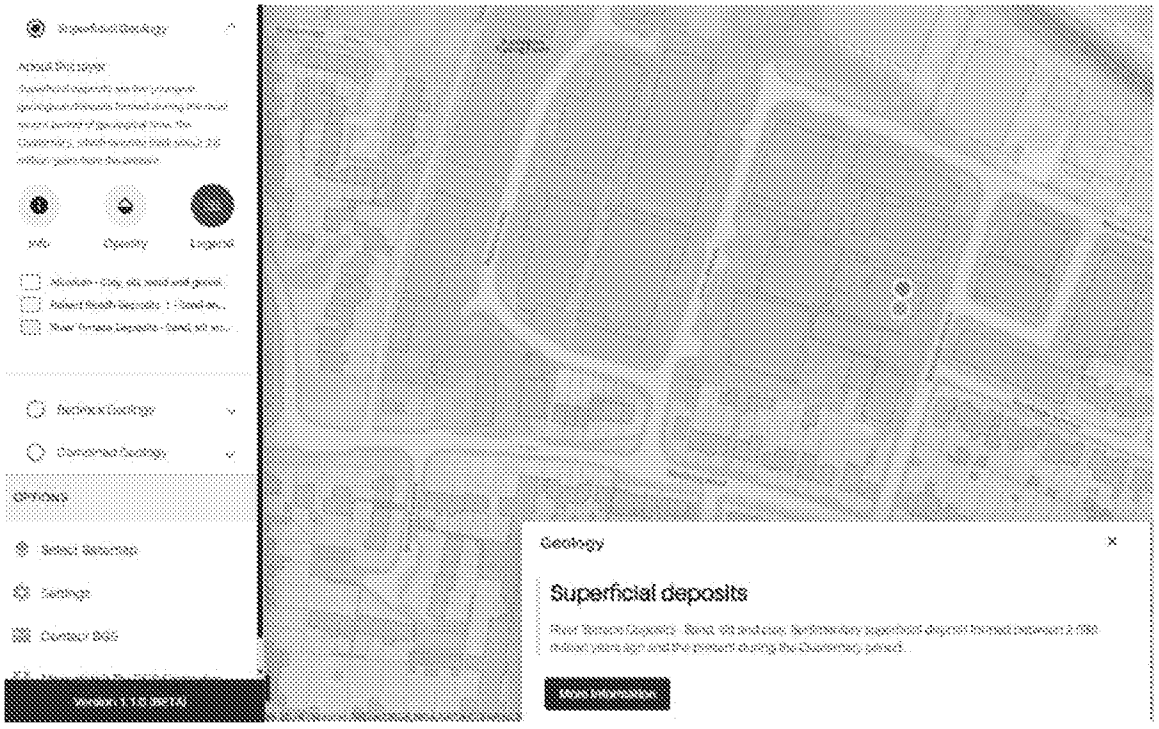

Figure 2. Geology of Britain Viewer – Superficial Deposits (BGS)

3.1.8 Historic borehole records are available on the BGS website (GeoIndex Onshore). A borehole has been identified to the north-west of the site, identified as 'WSS 0220A Brookside Ind Est Rustington 1' (TQ00SE83; Easting: 505225, Northing: 103190).

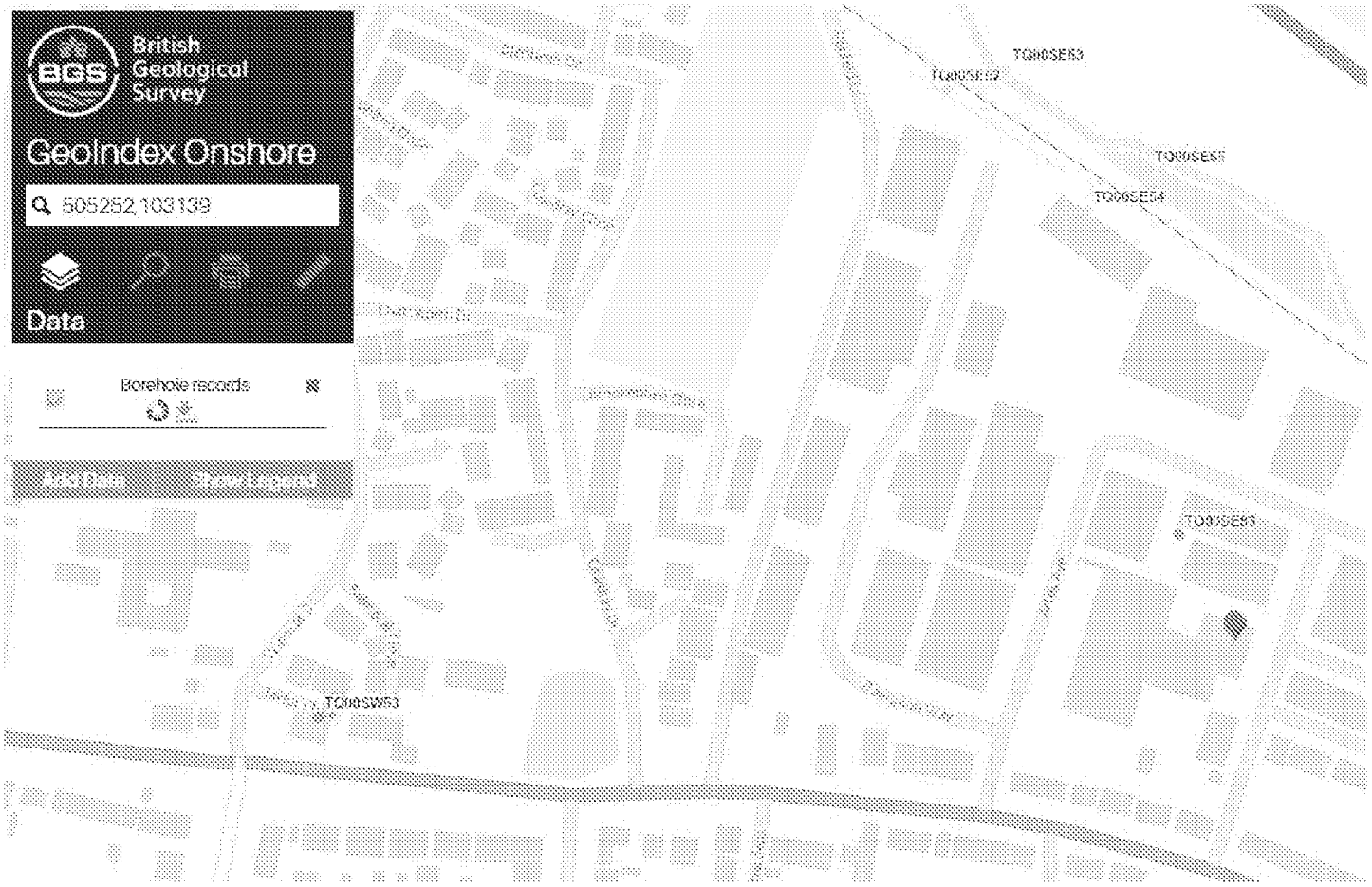

Figure 3. GeoIndex Onshore – Borehole Register (BGS)

3.1.9 The records relating to this borehole confirm Made Ground consisting of 'tarmac' and 'Light brown coarse sand and gravel' to a depth of c. 1.00m below ground level, underlain by 'Firm to stiff medium brown, orange sandy silty CLAY' to a depth of c. 1.45m. Beneath this, 'Initially stiff white very chalky CLAY with numerous fragments of intact chalk, grading into very clayey CHALK. Generally becoming more competent with depth' was recorded to a depth of c. 6.00m below ground level.

3.1.10 The BGS records reviewed can be found within **Appendix D**.

3.2 Infiltration Testing

3.2.1 BRE 365 compliant infiltration testing was undertaken on site at TP1 and TP2.

3.2.2 TP1 was excavated to a depth of 1.55m below ground level, with TP2 excavated to a depth of 0.60m below ground level.

3.2.3 A summary of the results of the infiltration testing undertaken on site is provided in the table below:

Exploratory Hole	Pit Depth (m below ground level)	Test Cycle	Infiltration Rate (m/sec)
TP1	1.55	1	1.87×10^{-5}
		2	$1.31 \times 10^{-5*}$
		3	1.12×10^{-5}
TP2	0.60	1	1.89×10^{-5}
		2	2.64×10^{-6}
		3	6.91×10^{-6}

Data for Test 2 in TP1 was extrapolated after 61st minute (test completed overnight)

3.2.4 Full results of the testing undertaken are contained within Soils Limited's report **(Appendix C)**.

3.3 Groundwater

3.3.1 Groundwater was observed within 4 No. exploratory holes across the site, with all other locations remaining dry during excavation.

3.3.2 A summary of groundwater observations during drilling is provided in the table below:

Exploratory Hole	Strike Depth (m below ground level)
WS1	3.20
WS2	4.50
WS3	3.80
WS4	3.20
TP1	Not encountered
TP2	Not encountered

3.3.3 A groundwater monitoring standpipe was installed within WS3.

3.3.4 Soil Limited returned to site on 11th April 2024 and recorded groundwater at 3.11m below ground level.

3.3.5 ADC has confirmed in pre-application consultation comments that the site is located within an area of 'High' groundwater flood risk.

3.3.6 Mapping managed by MAGIC (magic.defra.gov.uk) provides geographic information concerning the natural environment from across government. This mapping tool has been referred to in order to confirm whether the site is located within either any groundwater source protection zones or groundwater vulnerability zones.

3.3.7 The site is shown to be located within an area identified as being a 'Principal' bedrock aquifer, in addition to a 'Secondary A' superficial drift aquifer.

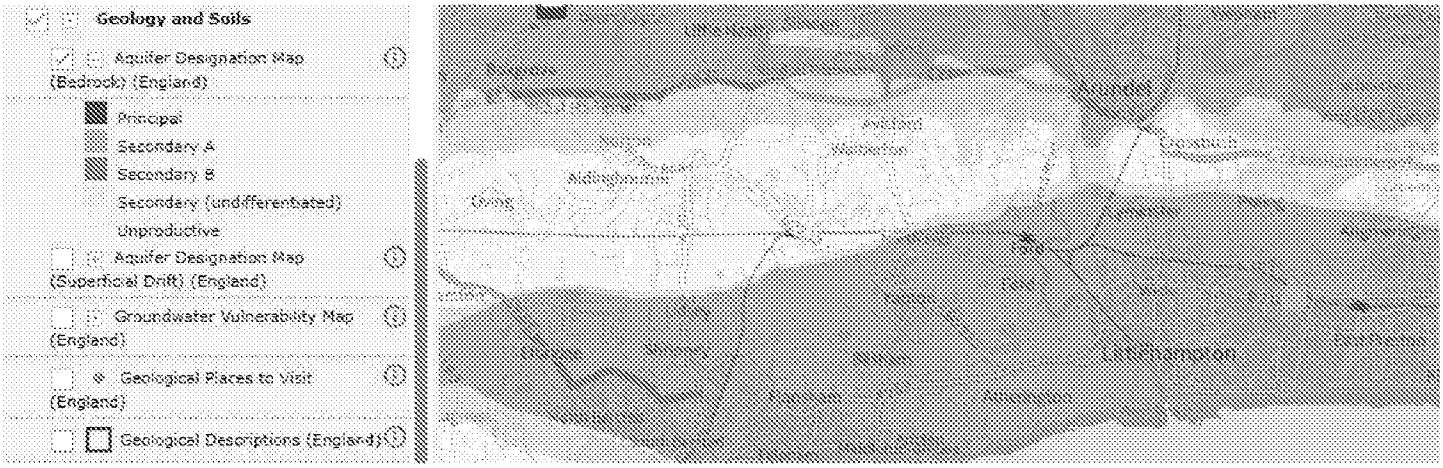

Figure 4. Aquifer Designation Map - Bedrock Aquifer (DEFRA)

Figure 5. Aquifer Designation Map – Superficial Drift (DEFRA)

3.3.8 Principal and secondary aquifers provide significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands. Secondary A aquifers comprise permeable layers that can support local water supplies, and may form an important source of base flow to rivers.

3.3.9 The site is located within a 'Medium' groundwater vulnerability zone, with a 'Soluble Rock Risk' also identified.

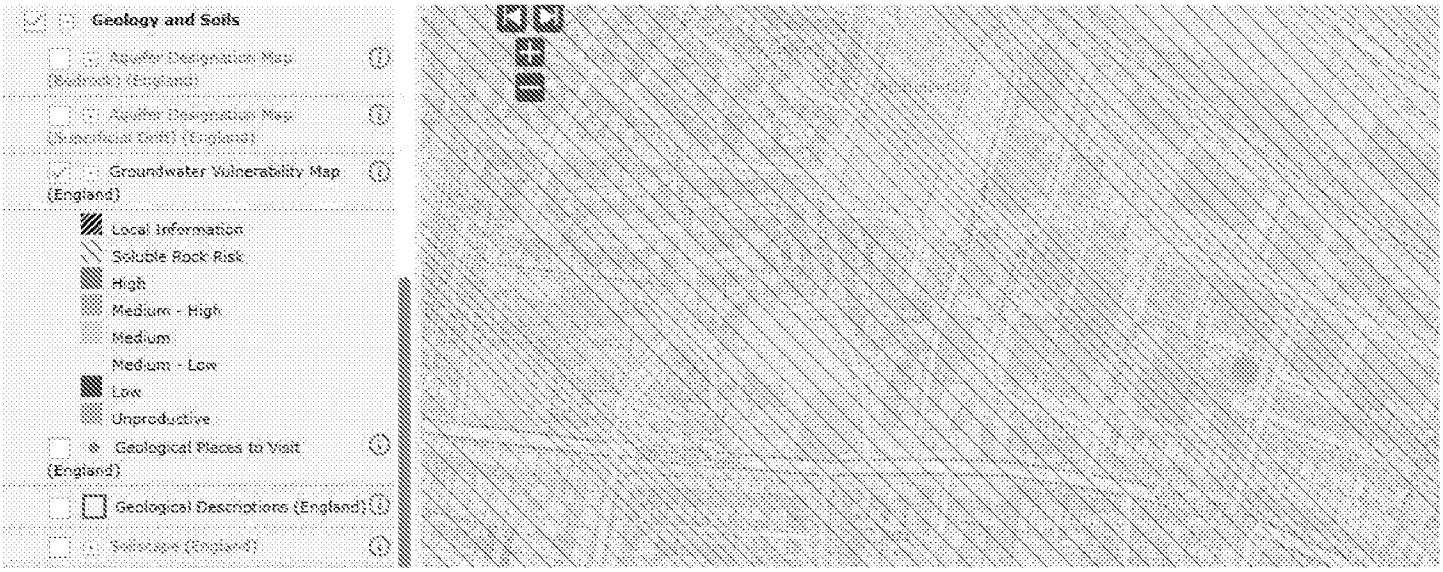

Figure 6. Groundwater Vulnerability Map (DEFRA)

3.3.10 'Medium' groundwater vulnerability zones are defined as areas that offer some groundwater protection. A 'Soluble Rock Risk' defines areas where solution features that enable rapid movement of a pollutant may be present.

3.3.11 The site does not fall within any drinking water protected areas (surface water), drinking water safeguard zones (surface water or groundwater) or source protection zones.

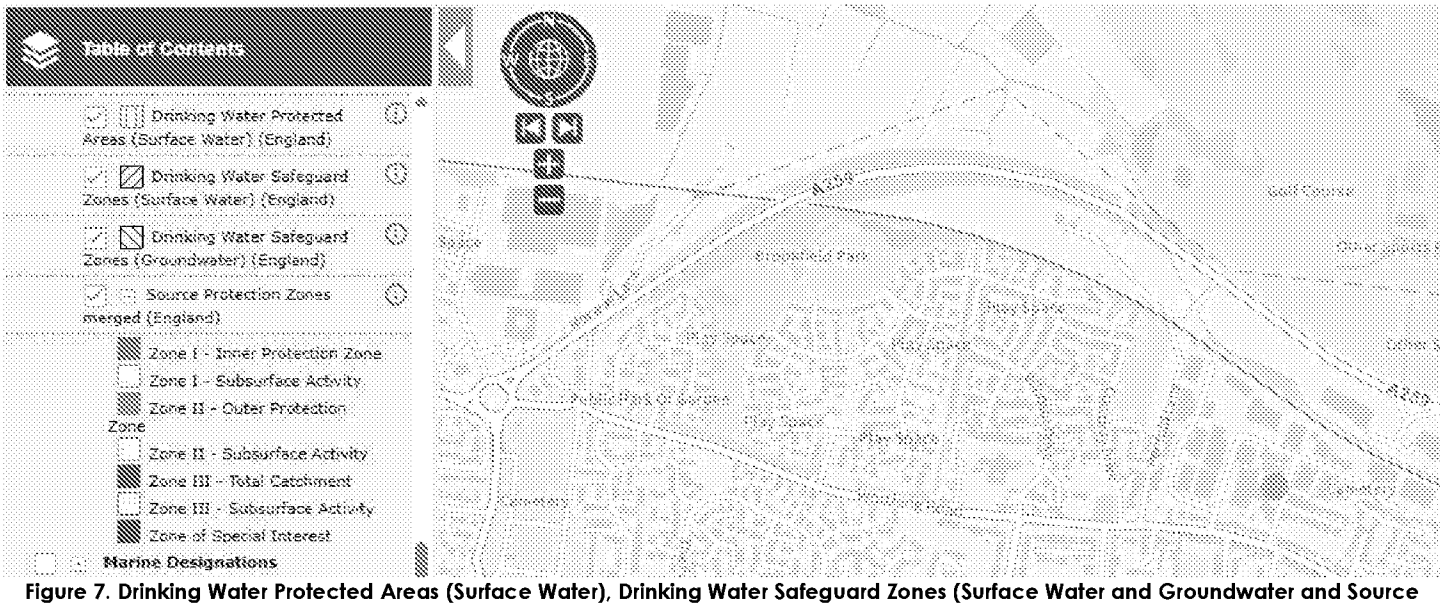

Figure 7. Drinking Water Protected Areas (Surface Water), Drinking Water Safeguard Zones (Surface Water and Groundwater and Source Protection Zone Map (DEFRA)

4 EXISTING DRAINAGE

4.1 Surface Water

4.1.1 The local sewerage authority is Southern Water. Public sewer records have been obtained from Southern Water, as contained within **Appendix E**.

4.1.2 Southern Water's public sewer records do not identify any public surface water sewers on the site, or within the wider vicinity of the site.

4.1.3 The site currently drains to the on-site foul drainage system, which discharges to the public foul water sewer in Brookside Avenue. The site also drains to the public highway drainage system also in Brookside Avenue.

4.1.4 There are no ordinary watercourses within the immediate vicinity of the site. The nearest such feature is located c. 160m north of the site, beyond the existing railway lines north of Brookside Avenue.

4.1.5 A greenfield run-off rates have been established in relation to the site area (1,578m^2) using HR Wallingford's 'Greenfield run-off rate estimation' tool.

4.1.6 Greenfield run-off rates have been calculated as follows;

- Q^{BAR} – 0.3 l/s
- 1 in 1 Year – 0.25 l/s
- 1 in 30 Year – 0.68 l/s
- 1 in 100 Year – 0.95 l/s
- 1 in 200 Year – 1.11 l/s

4.1.7 In view of the existing building(s) on site and the existing impermeable surfacing, the rate of run-off generated by the site will be greater than that of the greenfield rate established above.

4.1.8 Based on a flat rainfall rate methodology with a rainfall intensity of 50mm an hour, the impermeable area of 1,578m^2 will generate a rate of run-off totalling 21.91 l/s.

4.2 Foul Water

4.2.1 The site currently drains to Southern Water's public foul water sewer in Brookside Avenue.

4.2.2 Southern Water's public sewer records identify a 150mm dia. public foul water sewers to the east of the site, beneath Brookside Avenue.

4.2.3 The 150mm dia. public foul water sewer is indicated as being 1.52m deep at manhole 2101 as per Southern Water's public sewer records. The sewer is shown to flow in a northerly direction.

4.2.4 Southern Water has confirmed that the sewers within the vicinity of the site discharge to the Ford

wastewater treatment works.

4.3 Highway Drainage

4.3.1 Brookside Avenue is served by traditional road gullies along the eastern and western channel lines of the carriageway. These road gullies discharge to a 150mm dia. public highway drain.

5 PROBABILITY

5.1 Sources of Information

5.1.1 The National Planning Policy Framework (NPPF) requires that all sources of flooding are considered being tidal, fluvial, pluvial, groundwater, sewers and man made canals/reservoirs.

5.1.2 The likelihood of the site flooding has been established by reviewing the following information:

- Consultation with ADC
- Environment Agency Flood Maps for Planning
- Long-Term Flood Risk Map for Rivers or the Sea
- Long-Term Flood Risk Map for Surface Water
- Long-Term Flood Risk Map for Reservoirs
- ADC SFRA
- WSCC SFRA

5.2 Flood Map Analysis

5.2.1 The Environment Agency's Flood Maps for Planning identifies the site falling fully within Flood Zone 1.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 0.1% annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b).
Zone 2 Medium Probability	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding. (Land shown in light blue on the Flood Map).
Zone 3a High Probability	Land having a 1% or greater annual probability of river flooding; or land having a 0.5% or greater annual probability of sea. (Land shown in dark blue on the Flood Map).
Zone 3b The Functional Floodplain	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The idenfitication of function floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise:

	• Land having a 3.3% or greater annual probability of flooding, with any existing flood management infrastructure operating effectively; or • Land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability flooding). Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map).

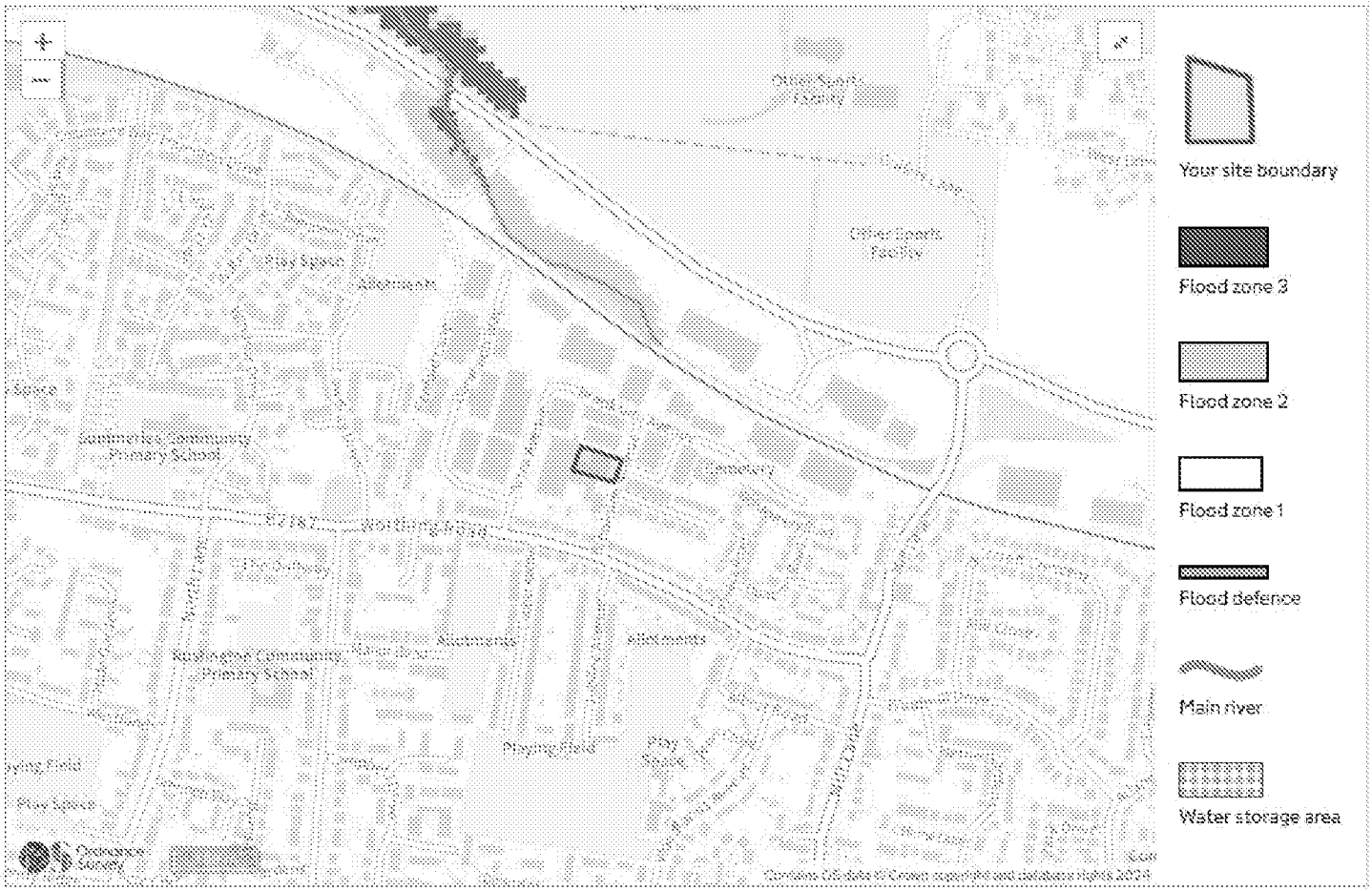

Figure 8. Flood Maps for Planning (Gov.uk)

5.2.2 The Long-Term Flood Risk Map for Rivers or the Sea does not identify the site as being at risk of flooding from such sources.

Figure 9. Long-Term Flood Risk Map – Rivers or the Sea (Gov.uk)

5.2.3 The Long-Term Flood Risk Map for Surface Water identifies the site as largely being at 'Very Low' risk of surface water flooding, with the exception of the corridor along the existing southern elevation and the neighbouring building to the south of the site, which is identified as being at 'Low' risk of surface water flooding.

5.2.4 Within the immediate vicinity of the site, Brookside Avenue is identified as being at 'Very Low' risk of surface water flooding.

5.2.5 The Long-Term Flood Risk Map for Surface Water identifies extents at risk of surface water flooding to the southern extent of Brookside Avenue as well as at the northern extent of Brookside Avenue. The risk of surface water flooding in these two locations range from 'Low' to 'High'.

Figure 10. Long-Term Flood Risk Map – Surface Water (Gov.uk)

5.2.6 The anticipated depth of flooding has been assessed in relation to the area of the site identified as being at 'Low' risk of surface water flooding (refer to 5.2.3). The anticipated depth of surface water flooding for the area identified as being at 'Low' risk of surface water flooding on site is shown to be '30cm to 90cm'.

5.2.7 The areas of Brookside Avenue identified as being at 'Low' risk of surface water flooding have anticipated depths of flooding in the range of 'Below 30cm' and '30cm to 90cm'.

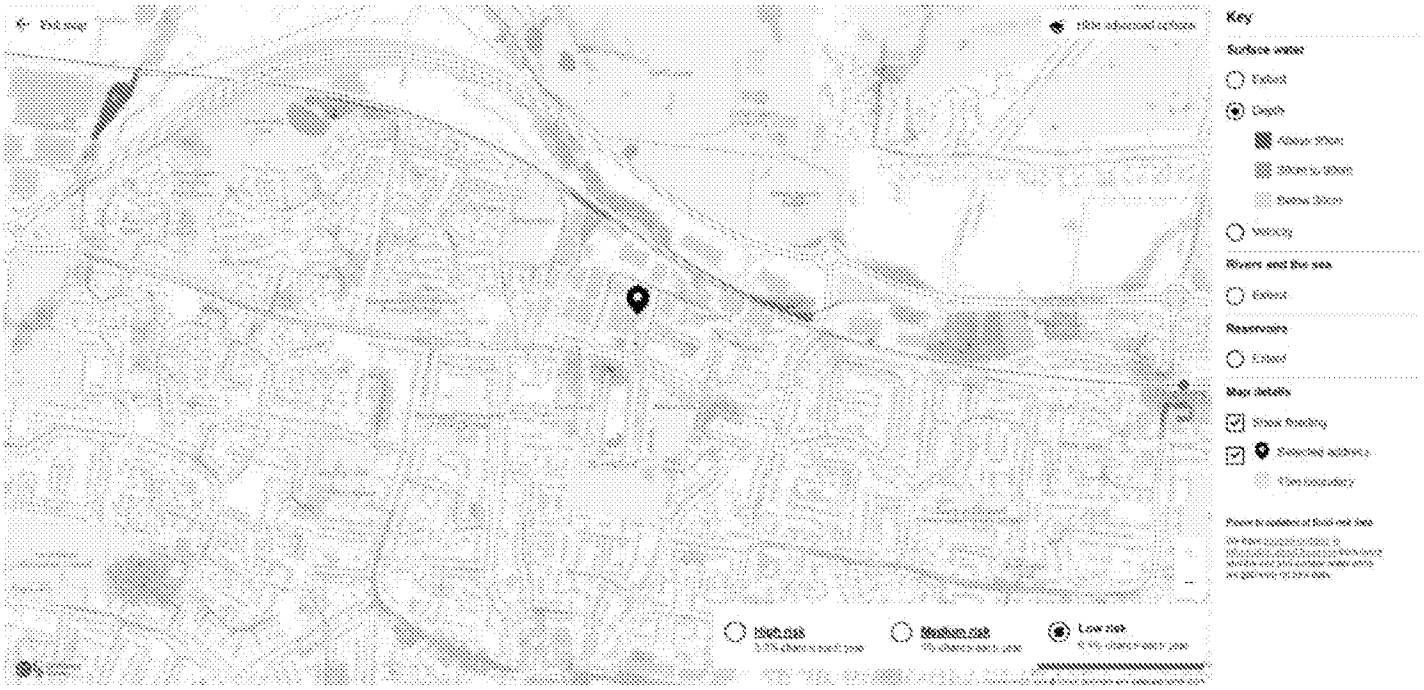

Figure 11. Long-Term Flood Risk Map – Surface Water, 'Low' Risk Depths (Gov.uk)

5.2.8 In 'Medium' risk scenarios, the area of Brookside Avenue to the north of the site identified as being at risk of surface water flooding, has anticipated depths of flooding ranging from 'Below 30cm' to '30cm to 90cm'.

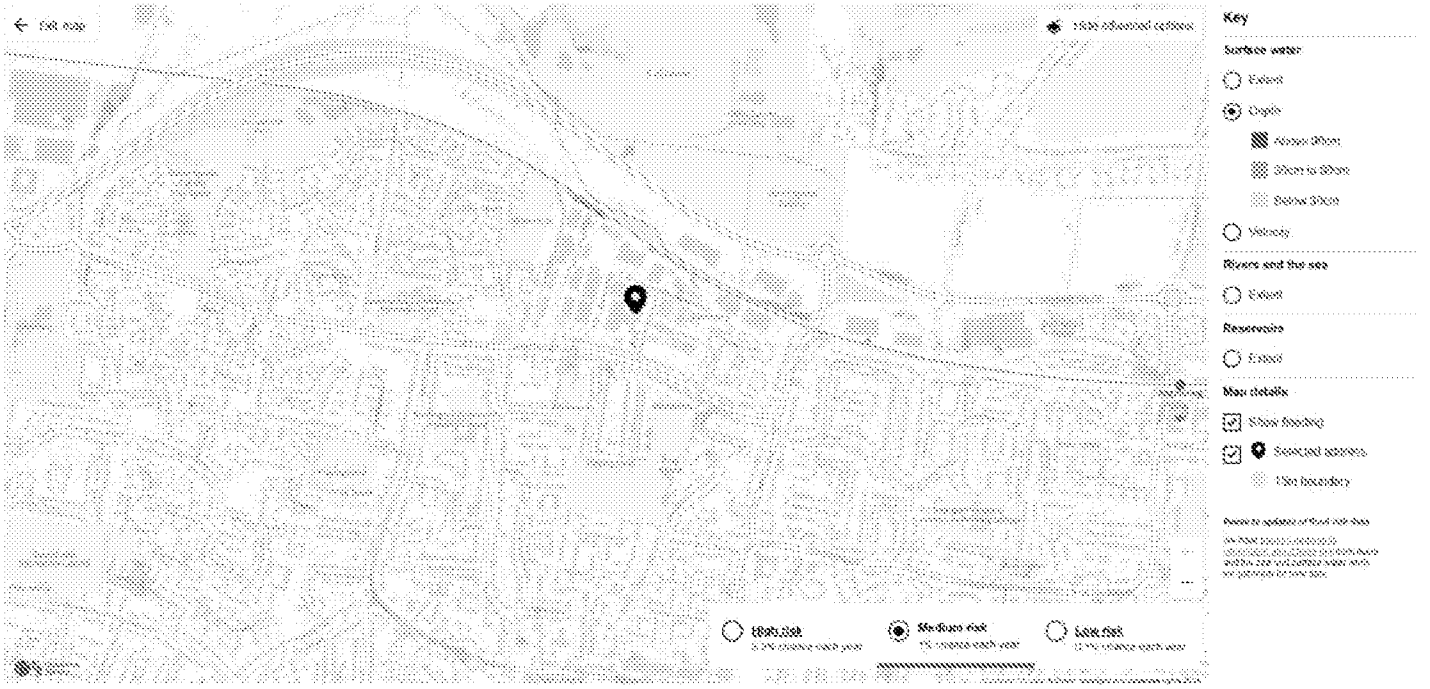

Figure 12. Long-Term Flood Risk Map – Surface Water, 'Medium' Risk Depths (Gov.uk)

5.2.9 In 'High' risk scenarios, the area of Brookside Avenue to the north of the site identified as being at risk of surface water flooding, has anticipated depths of 'Below 30cm'.

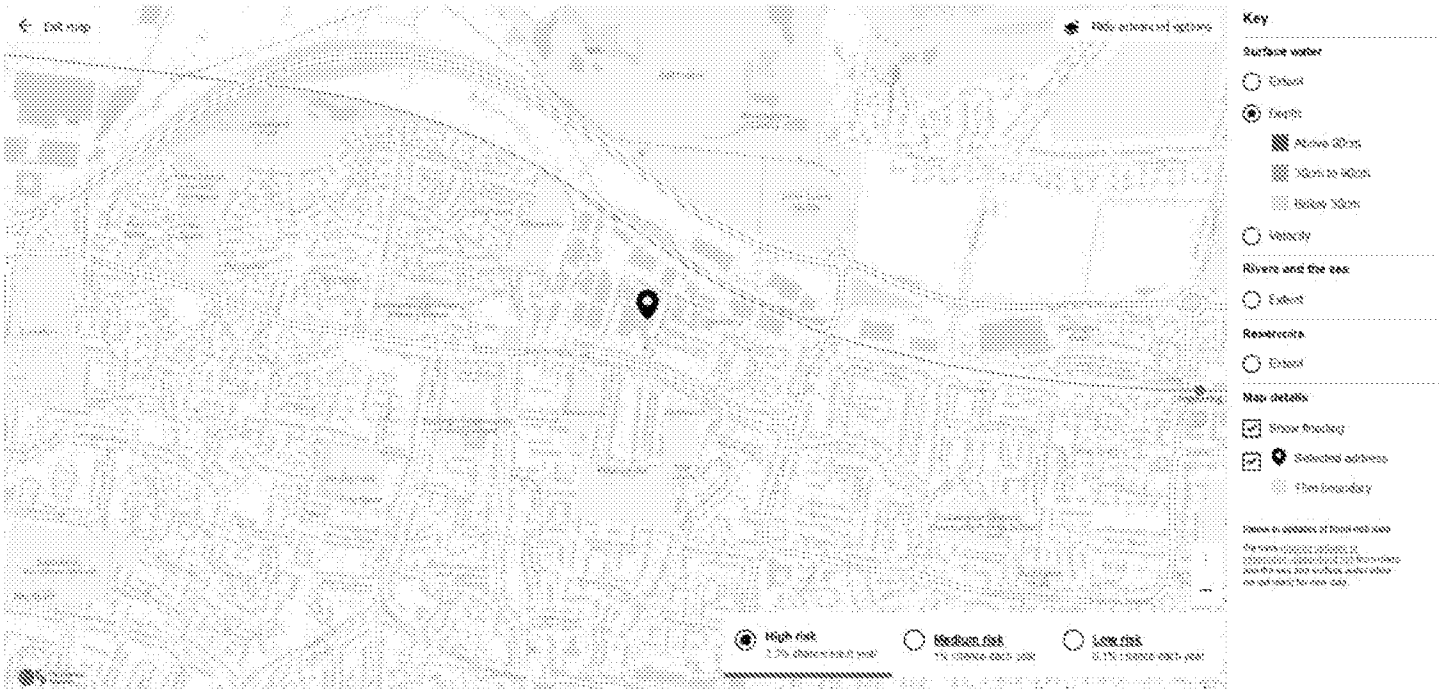

Figure 13. Long-Term Flood Risk Map – Surface Water, 'High' Risk Depths (Gov.uk)

5.2.10 The Long-Term Flood Risk Map for Reservoirs does not identify the site as being at risk of flooding from such sources.

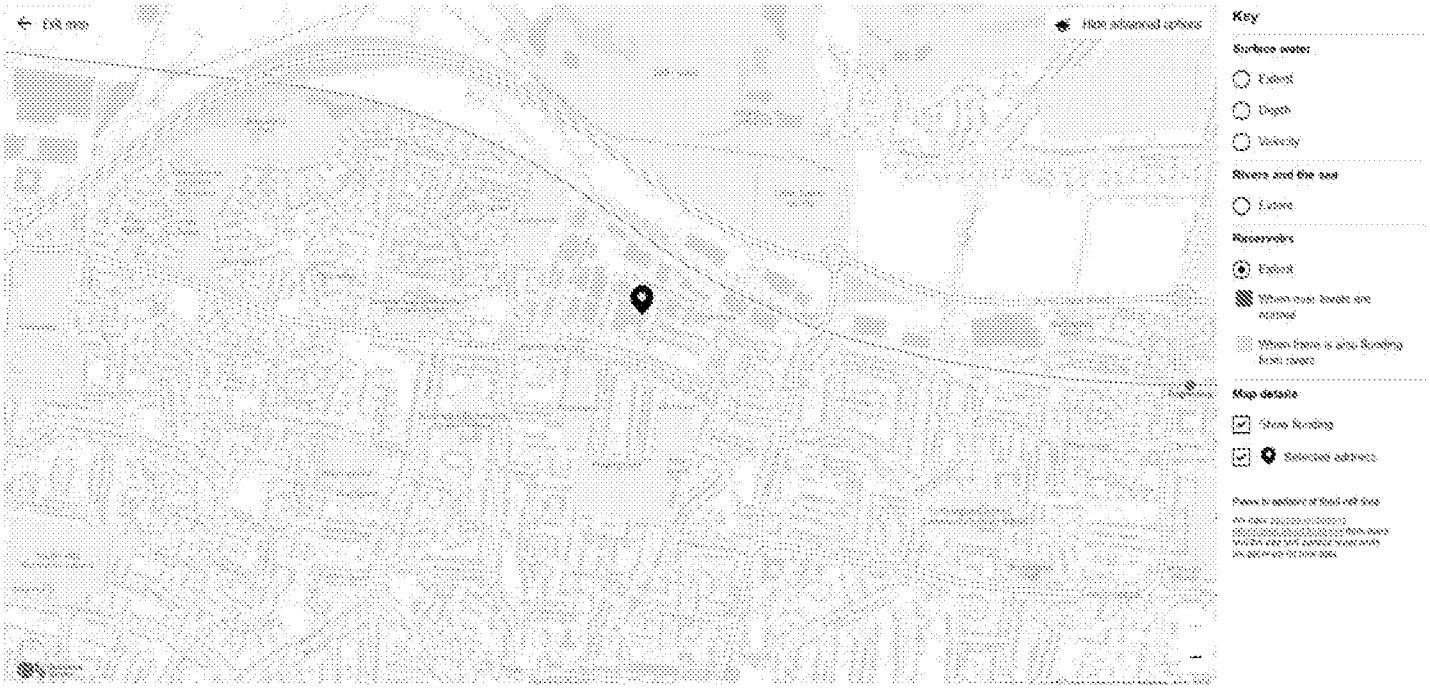

Figure 14. Long-Term Flood Risk Map – Reservoirs (Gov.uk)

5.3 Historic Flooding

5.3.1 No instances of historic flooding have been identified at the site, upon review of the information available at the time of undertaking this flood risk assessment.

5.3.2 Mapping contained within the ADC SFRA does not identify any historic flood events on site, or within the immediate vicinity of the site. The nearest historic flood event recorded, as detailed within the ADC SFRA, was to the south-west of the site, at the junction between Artex Avenue and Worthing Road. The cause is recorded as surface water flooding.

5.4 Strategic Flood Risk Assessment

5.4.1 ADC has published a combined Level 1 and Level 2 SFRA, dated November 2016.

5.4.2 The site is not specifically referenced within the SFRA.

5.4.3 Mapping within the SFRA has been reviewed, and commentary is provided below.

5.4.4 The site is confirmed as being located within Flood Zone 1 within ADC's SFRA, and is not identified as being at future risk of flooding in view of climate change.

5.4.5 The surface water flood risk mapping contained within the ADC SFRA is consistent with the Long-term Flood Risk Map for Surface Water, in relation to which commentary on surface water flood risk is provided in 5.2.3 – 5.2.9.

5.4.6 As already confirmed by ADC, the site is located in an area identified as being at 'High' risk of groundwater flooding. This is consistent with the mapping containd within the ADC SFRA.

5.4.7 The site is not located within a Flood Warning Area and no historic flood events have been recorded affecting the site or areas within the immediate vicinity of the site.

5.4.8 There are no flood defences within the vicinity of the site.

5.4.9 Mapping extracts from ADC's SFRA relevant to the site are contained within **Appendix F**.

5.5 Summary of Flood Risk

5.5.1 The potential sources of flooding are:

Source of Flooding	Level of Risk
Rivers and Coastal	**Very Low** The site is located fully within Flood Zone 1 and is not identified as being at risk of flooding from such sources.
Surface Water	**Very Low / Low** The Long-Term Flood Risk Map indicates that the site is largely at 'Very Low' risk of surface water flooding, with the exception of the corridor along the existing southern elevation and the neighbouring building to the south of the site, which is identified as being at 'Low' risk of surface water flooding.
Groundwater	**High** ADC has confirmed that the site is located in an area identified as being at 'High' risk of groundwater flooding. Ground investigation undertaken by Soils Limited has confirmed groundwater at a peak of 3.11m below ground level at WS3 on 11th April 2024 in relation to the investigation undertaken to date.
Sewers	**Very Low** Southern Water's public sewer records do not identify any public surface water sewers within the vicinity of the site. A 150mm dia. foul water sewer is located to the east of the site, beneath Brookside Avenue. This sewer is identified as being 1.52m deep at manhole 2102, and is shown to flow in a northerly direction.
Artificial Sources	**None** The site is not identified as being at risk of flooding from such sources.

5.5.2 The site has been assessed as being at 'Very Low' or 'Low' risk of flooding from all of the potential sources of flooding as identified in the above table, with the exception of groundwater flooding ('High' risk). The stated risk of groundwater flooding is identified by ADC in both correspondence as well as detailed within the SFRA.

5.5.3 The drainage design for the proposed development should ensure that capacity up to the design event is provided whilst potential exceedance routes should also be considered, so as to not increase the risk

of surface water flooding on or off the site.

5.5.4 Existing overland flow routes shall also be considered through the design process to ensure that potential groundwater flooding, should this occur, is not compounded.

6 PROPOSED DEVELOPMENT

6.1 Description of Development

6.1.1 The proposed development will involve demolition of the Brookside building and construction of new commercial premises which is to include office space and storage facilities as demonstrated by the development proposals contained within **Appendix A**.

6.1.2 The type of development proposed falls within the "Less Vulnerable" flood risk vulnerability classification (Annex 3: Flood risk vulnerability classification, NPPF) and is appropriate in Flood Zone 1 (Flood Risk and Coastal Change Table 2).

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	**Highly Vulnerable**	**More Vulnerable**	**Less Vulnerable**	**Water Compatible**
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	Exception Test Required	✓	✓	✓
Flood Zone 3a†	Exception Test Required †	✗	Exception Test Required	✓	✓
Flood Zone 3b*	Exceptions Test Required *	✗	✗	✗	✓*
✓ = Development is appropriate ✗ = Development should not be permitted					

6.1.3 The site, as existing, is a 'brownfield' location, which is fully impermeable.

6.1.4 The post-development impermeable area will amount to 1,453m^2 (0.15Ha), resulting in a reduction to the order of 125m^2 (7.92%).

6.1.5 The use of SuDS methods and techniques, where site conditions and constraints allow, will be utilised to assist in the management of surface water run-off generated by the proposed development, whilst adhering to the SuDS hierarchy as stated within Building Regulations (Part H) and The SuDS Manual (C753).

6.1.6 The specific surface water and foul water drainage proposals are detailed in **Chapter 8** of this report ('Proposed Drainage Strategy').

7 SEQUENTIAL AND EXCEPTION TESTS

7.1 Sequential Test

7.1.1 The Sequential Test ensures that a sequential, risk-based approach is followed to steer new development to areas with the lowest risk of flooding, taking all sources of flood risk and climate change into account.

7.1.2 Where it is not possible to locate development in low-risk areas, the Sequential Test should look to compare reasonably available sites within medium risk areas, and then only where there are no reasonably available sites in low and medium risk areas, within high-risk areas.

7.1.3 The site is located fully within Flood Zone 1, and has been assessed as being at 'Very Low' or 'Low' risk of flooding from all of the potential sources of flood risk considered, with the exception of groundwater flooding in relation to which a 'High' risk of flooding has been identified by ADC in both correspondence and as detailed within the ADC SFRA.

7.2 Exception Test

7.2.1 The Exception Test requires two additional elements to be satisfied, as set out in paragraph 164 of the NPPF before development can be permitted in situations where suitable sites at lower risk of flooding are not available following application of the Sequential Test.

7.2.2 The Exception Test requires the applicant to demonstrate that;

i. development that has to be in a flood risk area will provide wider sustainability benefits to the community that outweigh flood risk, and;

ii. the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

7.2.3 Flood Risk and Coastal Change, Table 2 (see 6.1.2) confirms that "Less Vulnerable" development is acceptable in Flood Zone 1, and therefore application of the Exception Test is not required.

8 PROPOSED DRAINAGE STRATEGY

8.1 Surface Water

8.1.1 The SUDS Manual (CIRIA C753) and Building Regulations, Approved Docuyment H (Drainage and Waste Disposal) set out a hierarchy of drainage methods to ensure that developments maximise the use of sustainable drainage techniques. The hierarchy favours infiltration methods of disposal over other methods such as watercourse and sewers, as detailed below;

i. Utilise infiltration techniques

ii. Attenuate rainwater in ponds or open water features for gradual release

iii. Attenuate rainwater by storing in tanks or sealed water features for gradual release

iv. Discharge rainwater direct to a watercourse

v. Discharge rainwater to a surface water sewer/drain

vi. Discharge rainwater to a combined sewer

SUDS Technique	Suitable	Comments
Living Roof	No	Not suitable in view of development proposals.
Basins and Ponds (such as Wetlands, Balancing Ponds, Detention Basins, Retention Ponds)	No	Insufficient space available on site in view of existing development as well as proposed layout
Filter strips and swales	No	Not suitable in view of development proposals
Infiltration Devices - Soakaways - Infiltration trenches and basins	No	Soils Limited has undertaken intrusive ground investigation at the site in addition to infiltration testing. Made Ground has been encountered across the site which is restrictive in terms of infiltration viability (owing to potential leaching of possible contaminants as well as consolidation). Chalk has been identified at varying depths underlying the River Terrace Deposits encountered on site and Soils Limited has advised that soakaways should therefore be located at least 10.00m away from existing and

		proposed buildings/structures. Owing to spatial constraints, this requirement cannot be accommodated therefore infiltration is not viable.
Permeable surfaces and filter drains (such as gravelled areas and porous block paving)	Yes	Techniques such as permeable paving will be unable to infiltrate owing to the constraints outlined above, however, could be tanked to provided attenuated storage.
Tanked systems (such as oversized pipes or cellular tanks)	Yes	No initial constraints, however higher-ranking drainage opportunities should be prioritised and considered before such measures are proposed.

8.1.2 Infiltration is not viable owing to the presence of Made Ground, in addition to underlying chalk strata which dictates a 10.00m offset where soakaways are concerned in relation to existing and proposed buildings/structures.

8.1.3 There are no ordinary watercourses and/or Main Rivers within the vicinity of the site to which run-off could be discharged to.

8.1.4 Post development, flows will drain to the public highway drain in Brookside Avenue. Pre-development, surface water flows discharge to both the Southern Water public foul sewer network as well as the public highway drainage system.

8.1.5 It is proposed that the development will provide 816m^2 of permeable paving in relation to the access and parking areas at ground level on site.

8.1.6 Flows will be restricted to a rate of 2.00 l/s – providing a betterment of 90% compared within existing brownfield run-off rates for the 1-in-2-year return period.

8.1.7 It is proposed that all captured run-off from the proposed hardstanding areas is captured up to the 100-year event including 45% climate change without exceedance.

8.1.8 The strategy above will ensure that there is a reduction increase in the rate of run-off leaving the site, therefore no increase in the risk of flooding from this source.

8.2 Treatment

8.2.1 In accordance with the CIRIA SuDS Manual C753 regarding methods for managing pollution risks, the risk posed by surface water run-off to the receiving environment depends on the pollution hazard at the site (the source), SuDS treatment techniques (the pathway), and the sensitivity of the environment (the receptor).

8.2.2 The simple index approach considers whether SuDS techniques are appropriate for the site. This states that for SuDS components to deliver adequate treatment, the total pollution mitigation index for each contaminant type should equal or exceed the pollution hazard index.

8.2.3 The SuDS Manual outlines three categories of pollution hazard identification, which vary depending on proposed land use, which are as follows:

- Total Suspended Solids (TSS).
- Metals (M).
- Hydrocarbons (H).

8.2.4 In accordance with C753 Table 26.2, the proposed land uses at the site are categorised as follows:

- Other roofs (typically commercial/industrial roofs) – Low/TSS=0.3/M=0.2/H=0.05
- Non-residential car parking with infrequent change (e.g. schools, offices) i.e. < 300 traffic movements / day - Low/TSS=0.5/M=0.4/H=0.4

8.2.5 In accordance with C753 Table 26.3, the values of SuDS Mitigation indices are provided for permeable paving:

- Permeable Pavement – TSS=0.7/M=0.6/H=0.7

8.2.6 As the pollution hazard index does not exceed any pollution mitigation index for any contaminant type, the proposed SuDS methods will provide sufficient treatment for the proposed development.

8.3 Foul Water Drainage

8.3.1 It is proposed that the site will continue to drain to the public foul water sewer in Brookside Avenue.

8.3.2 The existing on-site lateral is to be retained, subject to confirmation of its condition.

8.4 Climate Change

8.4.1 Gov.uk provides guidance for local planning authorities preparing strategic flood risk assessments and developers and their agents preparing flood risk assessments for planning applications, and development consent orders for nationally significant infrastructure projects.

8.4.2 Climate change allowances are predictions of anticipated change for peak river flow, peak rainfall intensity, sea level rise and offshore wind speed and extreme wave height.

8.4.3 Allowance for climate change shall be provided in the undertaking of site-specific flood risk assessments where new development is proposed to minimise vulnerability and provide resilience to flooding and coastal change.

8.4.4 The 'Peak Rainfall Allowances Map' shows anticipated changes in peak rainfall intensity.

8.4.5 Based on the latest allowances, for the 3.3% annual exceedance rainfall event, an increase of 40% should be applied to peak rainfall in relation to the proposed development.

8.4.6 For the 1% annual exceedance rainfall event, an increase of 45% should be applied to peak rainfall in relation to the proposed development.

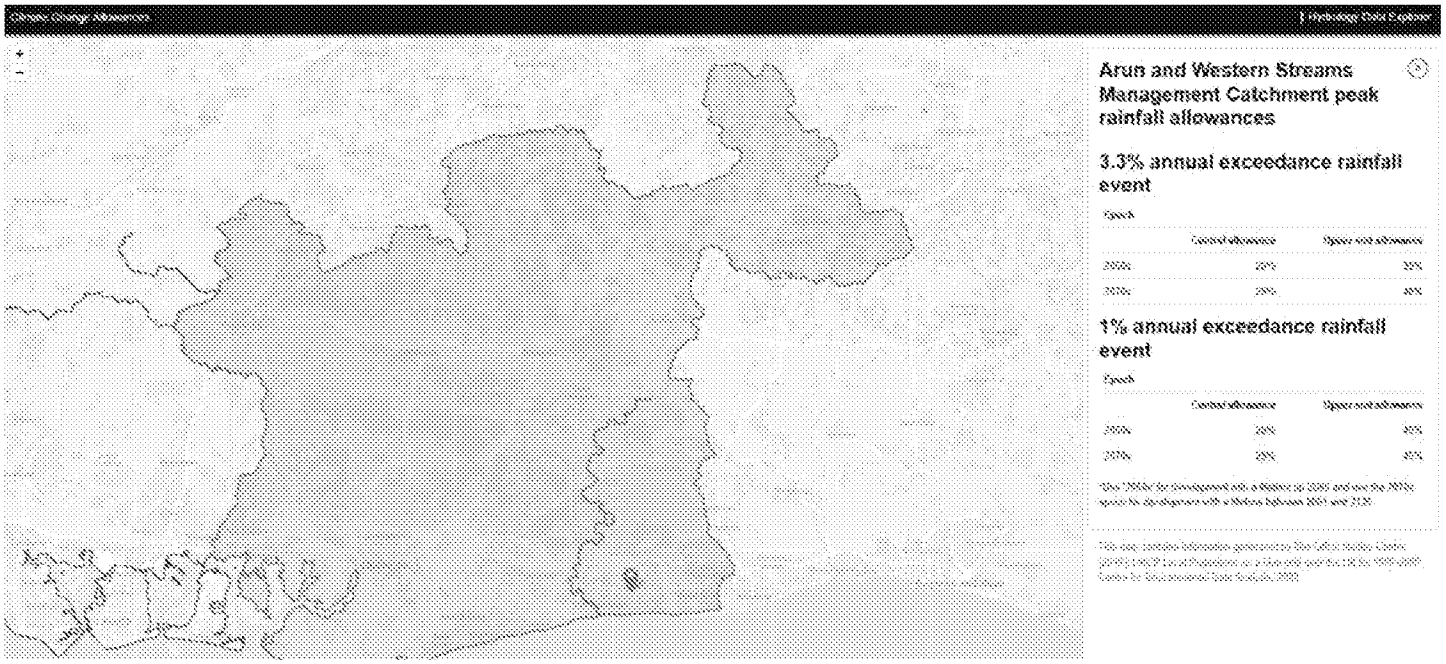

Figure 15. Climate Change Allowances – Peak Rainfall Allowances (Gov.uk)

8.5 Urban Creep

8.5.1 WSCC's Policy for the Management of Surface Water confirms that consideration of urban creep is only required in relation to residential development only.

8.5.2 As the proposed development is not residential, no allowance has been made in relation to urban creep within the calculations prepared in association with the surface water drainage design.

9 RESIDUAL RISK AND MITIGATION

9.1 Residual Risk

9.1.1 The following residual risks have been identified in relation to the proposed development:

i. Extreme rainfall events that exceed the design criteria used for the drainage system causing surface water flooding

ii. Blockage/failure of the proposed drainage system causing flooding to the site

iii. Groundwater flooding to the site caused by groundwater levels exceeding the ground surface level

iv. Surface water flooding of proposed buildings

9.2 Mitigation

9.2.1 Consideration has been taken to the residual risks stated in Section 9.1, and the following mitigation measures are proposed:

i. The surface water drainage design has considered the current design standards and is able to accommodate a 1 in 100-year storm event, inclusive of an allowance of 45% for the potential impacts of climate change. Should a more extreme storm event occur, the system will be exceeded. In exceedance events, run-off will follow the topography of the site. Exceedance flow routes are indicated on drawing PL500.

ii. Maintenance plays a vital role in managing and reducing flood risk. The proposed surface water drainage system is able to accommodate a 1 in 100-year storm event, inclusive of an allowance of 45% for the potential impacts of climate change. Should blockage or failure of the system occur, it is possible that flooding may occur at the site. Maintenance that is required in order for the system to operate as intended through its design is detailed within Chapter 11 – 'Maintenance'.

iii. Groundwater has been recorded on site at a depth of 3.11m below ground level at WS3 on 11th April 2024 (current peak based on investigation undertaken to date). A monitoring standpipe has been left in situ. ADC has stated that the site is within an area identified as being at 'High' risk of groundwater flooding in pre-application advice, which is also evident as per ADC's SFRA mapping. Should groundwater emergence occur, there is potential for groundwater flooding to occur. Should groundwater emerge on site, flood waters would follow the topography of the site.

iv. The site has been assessed as being at 'Very Low' risk of surface water flooding with the exception of the corridor along the existing southern elevation and the neighbouring building to the south of the site. The proposed finished floor level is to be elevated above the external ground level to reduce the risk of surface water flooding at the site, specifically in relation to the proposed building. The proposed loading bay / level access to the rear of the building has potential to compromise this. Drainage provision shall be considered to intercept run-off.

10 FLOOD RISK MANAGEMENT

10.1 Safe Access and Egress

10.1.1 Access to the site will via Brookside Avenue.

10.1.2 Within the immediate vicinity of the site and proposed access, Brookside Avenue is identified as being at 'Very Low' risk of surface water flooding.

10.1.3 An increased risk of surface water flooding has been identified on Brookside Avenue, to the north of the site. It is not anticipated that flooding to this area would impact upon safe access and egress from the site and proposed development.

10.1.4 The southern extent of Brookside Avenue, at the junction with Worthing Road, is identified as being at 'Low' risk of surface water flooding, with anticipated depths of 'Below 30cm' appearing to be confined to the carriageway.

10.1.5 The site is located fully within Flood Zone 1 and is not identified as being at future risk of flooding as a result of the realisation of climate change considerations, as confirmed by mapping within the ADC SFRA.

10.1.6 The site is identified as being at 'Very Low' risk of surface water flooding, with the exception of the corridor between the existing southern elevation of the existing building on site, and the neighbouring building to the south of the site. Owing to development proposals at the site, this corridor will be removed, removing the risk of surface water flooding currently identified by the surface water flood mapping.

10.1.7 The site is identified as being in an area identified as being at 'High' risk of groundwater flooding. Should groundwater emerge at ground level, it is reasonable to assume that groundwater will follow existing topographic flow paths indicated by surface water flood risk mapping.

10.1.8 In view of the above statements, it is considered that safe access and egress can be achieved in view of the proposed development.

10.2 Flood Warning

10.2.1 The site is located fully within Flood Zone 1 as has been assessed as being at 'Very Low' or 'Low' risk of flooding from all of the sources of potential flood risk considered in the undertaking of this flood risk assessment, with the exception of groundwater flooding ('High' risk, as stated by ADC). As such, there is no requirement for a Flood Warning System, Flood Plan or Flood Evacuation Plan to be provided in relation to the site and/or the proposed development, although the owner/occupier may still wish to consider preparing a Flood Plan for the development/site.

11 MAINTENANCE

11.1 Proposed Maintenance Regime

11.1.1 Maintenance is required to ensure the long-term operational performance of the proposed surface water drainage system.

11.1.2 The drainage system has been designed to minimise maintenance requirements; however a number of key tasks will need to be undertaken so that the system remains in optimal condition. These operations are summarised in the table below, along with the required frequency of works.

Drainage System feature	Proposed maintenance / remedial works	Required frequency of works
Permeable Paving	Surface sweeping to reduce silt and debris accumulation.	Every 8 to 12 weeks
	Removal / management of weed growth	At least once a year
	Silt removal from permeable surfaces, possibly involving raking out of joints, redressing, removal and remedial works.	As required / to be specified by manufacturer
Diffuser units & catch pits, gully sumps and drains	Inspection and additional cleansing as required.	Annual
	Desilting	Year 1, Year 3, then every 5 years
Pipework	Jetting to clear blockages	As required

11.1.3 A detailed maintenance document shall be established prior to occupation of the development in order to detail the roles and responsibilities where maintenance is concerned.

11.1.4 The responsibility of the maintenance regime will be determined by the client.

Permeable Paving / Diffuser Units

11.1.5 The areas of permeable paving are designed to allow run-off to percolate through the joints in the block paving surface course and into the sub-base below. The water is then collected and discharged into the positive drainage system.

11.1.6 The areas of permeable paving will require additional maintenance measures to ensure they operate as designed. Failure in carrying out this maintenance, could increase the risk of flooding. The additional measures are as follow:

- Periodic surface sweeping to reduce silt and debris accumulation. The permeable surfaces should be swept at least every 8 to 12 weeks with additional sweeps in the autumn to clear fallen leaves

- Removal / management of weed growth, as required. Typically, once or twice a year for regularly used areas

- Periodic silt removal from permeable surfaces as described by the manufacturer. If any areas are showing signs of ponding, they shall be dealt with by raking out the joints and redressing. The entire surface shall be monitored and when there are signs of excessive siltation resulting in

poor drainage over the whole area, the blocks shall be taken up and a replacement of bedding layer and geotextile shall be undertaken

- Redressing of joints on the block paving as required

- Catchpits upstream of diffuser units, should be emptied and inspected on the same regime as all catchpits specified previously set out in this document

HydroBrake (Flow Control Chamber)

11.1.7 A HydroBrake flow control unit is self-activating, relying on upstream hydraulic head to generate an air-filled vortex within the centre of the casing. Once the vortex is initiated water drains down through a small opening in the back of the device at the designed restricted flow rate.

11.1.8 The flow control device has two measures in case of emergency (i.e. blockage). The first is a door situated in the front of the unit itself, this can be operated from the surface by a release cable situated just under the manhole cover which closes under its own weight and does not require any mechanism to operate. The second is a high-level overflow pipe situated with the flow control manhole. Both measures allow the system to drain down freely, until the blockage can be cleared.

11.1.9 The HydroBrake flow control chamber will require additional maintenance measures to ensure it operates as designed. The additional measures are as follows:

- The sump within the flow control chamber should be monitored for build-up of silts and should be emptied, as a minimum, on the same regime as specified for catchpits previously within this document

- The drain down door located on the centre of the unit will require inspection and opening annually, to ensure it is operating as intended.

Remedial/Repair Actions

11.1.10 Significant storm events may cause considerable damage to SuDS and their associated components. As such, it may be necessary to inspect and carry out essential recovery works to return the feature to full working order.

11.1.11 Resetting of uneven blocks by lifting block area, removing bedding material and relaying to match original design are all actions which may need to be undertaken.

Accidental Spillages

11.1.12 It is not envisaged that any materials are to be stored on site once the development has been completed, which could cause major spills and potential pollution issues within the drainage system. If this situation alters in the future consultation with a specialist will be required in order to confirm if any upgrades to the existing system are necessary.

11.1.13 Minor spillages of fuels and oils will be dealt with by the permeable paving, by bio-degrading and collecting the hydrocarbons respectively.

Future Alterations to the Development

11.1.14 Any future alterations to the permeable paving should be confirmed by a specialist. Where possible any future services are to avoid being located through areas of permeable paving. If new services are required to run through areas of permeable paving, services should be installed below the depth of permeable paving with the permeable system reinstalled above.

12 OFFSITE IMPACTS

12.1.1 Surface water will discharge to the public highway drain in Brookside Avenue, at a restricted rate. At present, surface water run-off from the site drains to both Southern Water's public foul water sewer network as well as the highway drainage system. The proposed strategy will provide attenuation – where as none is currently provided – as well as removing surface water flows from the foul sewer network.

12.1.2 Flows will be restricted to a rate of 2.00 l/s which represents a betterment of 90% compared to existing 'brownfield' run-off rates for the 1-in-2-year return period.

12.1.3 Foul water will continue to drain to the Southern Water public foul water sewer located in Brookside Avenue.

13 SUMMARY

13.1.1 The site measures 1,578m^2 (0.16Ha) and is currently occupied by Condair Limited, specifically the Brookside Building, and is accessible via Brookside Avenue.

13.1.2 The site topographic survey demonstrates levels in the range of 4.90m AOD to 5.50m AOD.

13.1.3 Pre-development (existing) surface water run-off drains to Southern Water's public foul water sewer network as well as the public highway drain in Brookside Avenue.

13.1.4 An existing 'brownfield' run-off rate has been established as 21.91 l/s.

13.1.5 The site is located in Flood Zone 1 and is identified as being at 'Very Low' and/or 'Low' risk of surface water flooding.

13.1.6 ADC has stated a 'High' risk of groundwater flooding, as also indicated by mapping contained within the ADC SFRA. On-site groundwater investigation has identified groundwater at 3.11m below ground level (11th April 2024).

13.1.7 No historic flooding has been identified at the site, or in the immediate vicinity of the site.

13.1.8 Post development, the site will drain to the public highway drain in Brookside Avenue. Flows will be restricted to 2.00 l/s.

13.1.9 816m^2 of permeable paving is proposed on site.

13.1.10 The proposed surface water drainage strategy will remove surface water flows from Southern Water's public foul water sewer network.

13.1.11 Foul water will continue to drain to Southern Water's public foul water sewer in Brookside Avenue. The existing on-site lateral will be retained, subject to confirmation of condition.

13.1.12 The completion of the development will not increase flood risk on or off the site.

13.1.13 In conclusion, the development is suitable with regard to flood risk and surface water drainage.