



BRIGHT PLAN CIVILS

**WILMINGTON, ARUNDEL ROAD,
ANGMERING**

PROPOSED RESIDENTIAL DEVELOPMENT

Drainage Strategy Report

Prepared on Behalf of

Mr & Mrs B R Parsons

D1991/DS1.1

29 September 2021

DOCUMENT CONTROL

Project: Wilmington, Arundel Road, Angmering
Proposed Residential Development

Document: Drainage Strategy Report

Client: Mr & Mrs B R Parsons

Reference: D1991/DS1.1

Document Checking:

Author: LDF Date: 16/09/2021

Checked by: MJA Date: 22/09/2021

Approved by: MJA Date: 22/09/2021

Status:

Issue	Date	Status	Issued by
1.0	23/09/2021	FINAL	LDF
1.1	29/09/2021	FINAL	LDF

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1 INTRODUCTION

1.1 Background

- 1.1.1 Bright Plan Civils is instructed by Mr & Mrs B R Parsons to prepare a Drainage Strategy Report to support a planning application for a Proposed Residential Development at the property known as Wilmington, Arundel Road, Angmering.
- 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 the construction of a residential apartment building - as demonstrated within the preliminary site layout, contained within **Appendix A** of this report.
- 1.1.4 In preparing this report, Bright Plan Civils has referred to the following documents and information:
- Environment Agency Flood Maps for Planning
 - Long Term Flood Risk Information; Flood Risk Maps
 - Southern Water and Local Authority Drainage Records
 - British Geological Survey & Records
- 1.1.5 This document has been prepared to propose assess drainage constraints and propose a drainage strategy that is appropriate for the design life of the development, without causing offsite impacts from runoff in a design event.
- 1.1.6 This report has been prepared for the benefit of the named Client only.

1.2 Site Location and Description

- 1.2.1 The property is located to the north of the built up area area of Angmering, within the District of Arun, West Sussex. It is currently occupied by a dwelling with a large garden with stables, paddocks and woodland.
- 1.2.2 A topographical survey of the site has been undertaken and provided by the client. It is included in **Appendix B** of this report.
- 1.2.3 The topographical survey shows that the site falls from the eastern corner of the site at 20.17mAOD, to the south western corner at 11.30 AOD, as detailed in Drawing **PL002**.
- 1.2.4 The nearest watercourse is an ordinary watercourse north of the site, which runs south-westerly to discharge to the nearby Decoy Ponds.
- 1.2.5 The application boundary is approximately 0.83Ha. of which approximately 560m² is impermeable, as seen in Drawing **PL003**.

1.3 Ground Conditions

- 1.3.1 In the absence of a site-specific geotechnical investigation, reference has been made to the British Geological Survey (BGS) website.

- 1.3.2 The BGS geology viewer states that the bedrock geology is likely to consist of 'London Clay Formation – Clay, Silt and Sand', as seen in **Figure 1**.

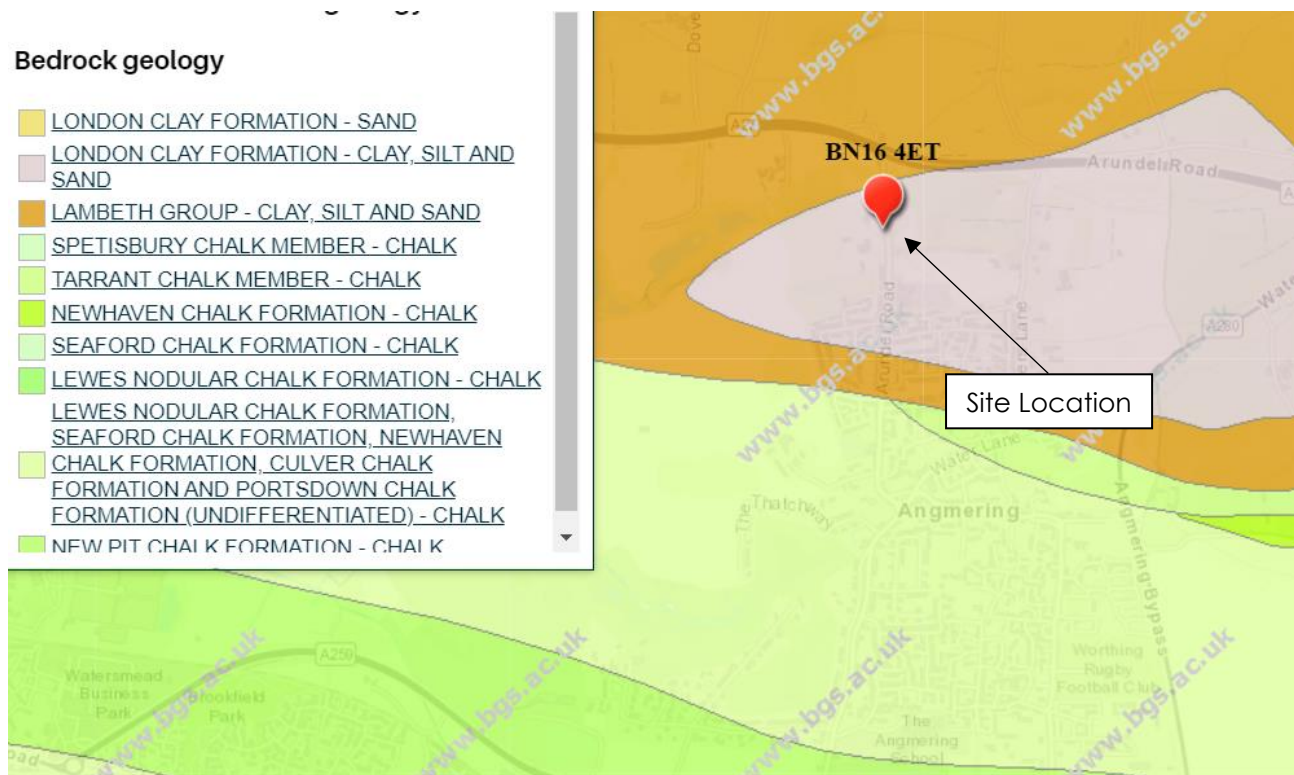


Figure 1. BGS website Bedrock geology

- 1.3.3 Superficial Deposits are recorded as None however very close by they are recorded as 'Head – Clay, Silt, Sand and Gravel', as seen in **Figure 2**.

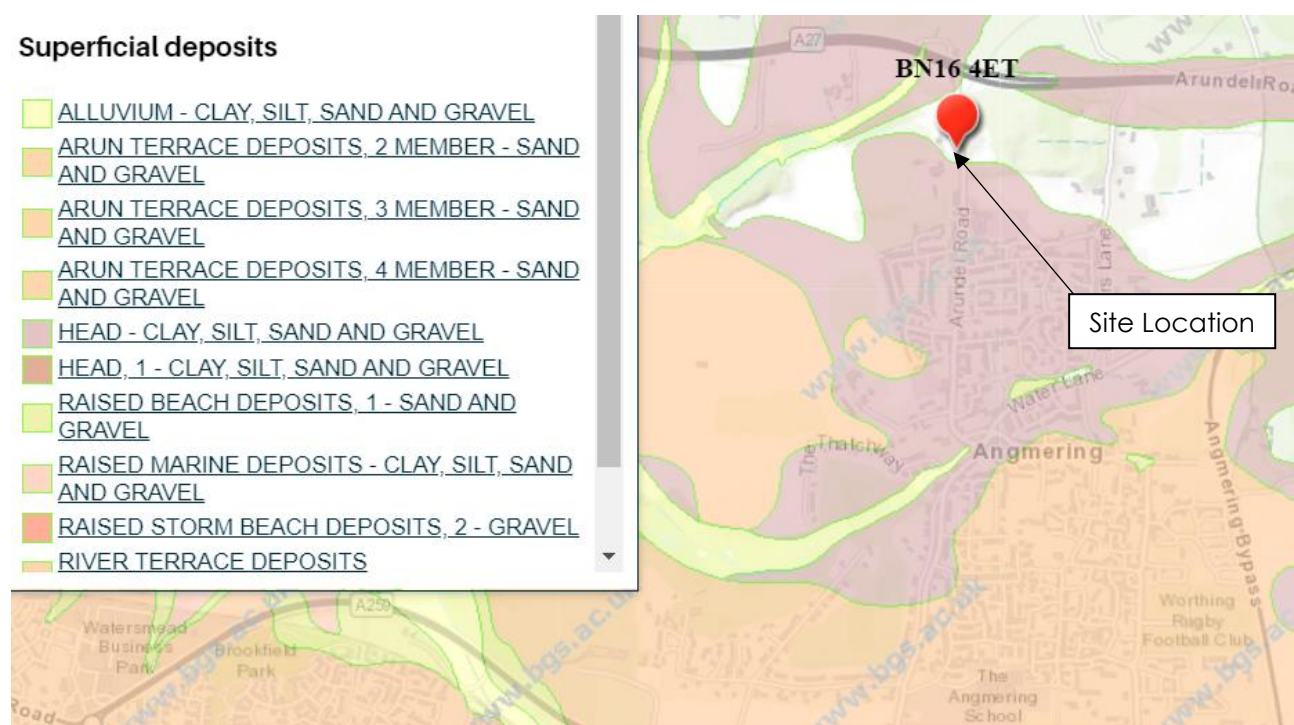


Figure 2. BGS website superficial deposits

- 1.3.4 Historic borehole records from the Single Onshore Boreholes Index (SOBI) on the BGS website have also been reviewed in the absence of a site-specific geotechnical investigation, as depicted in **Figure 3**.

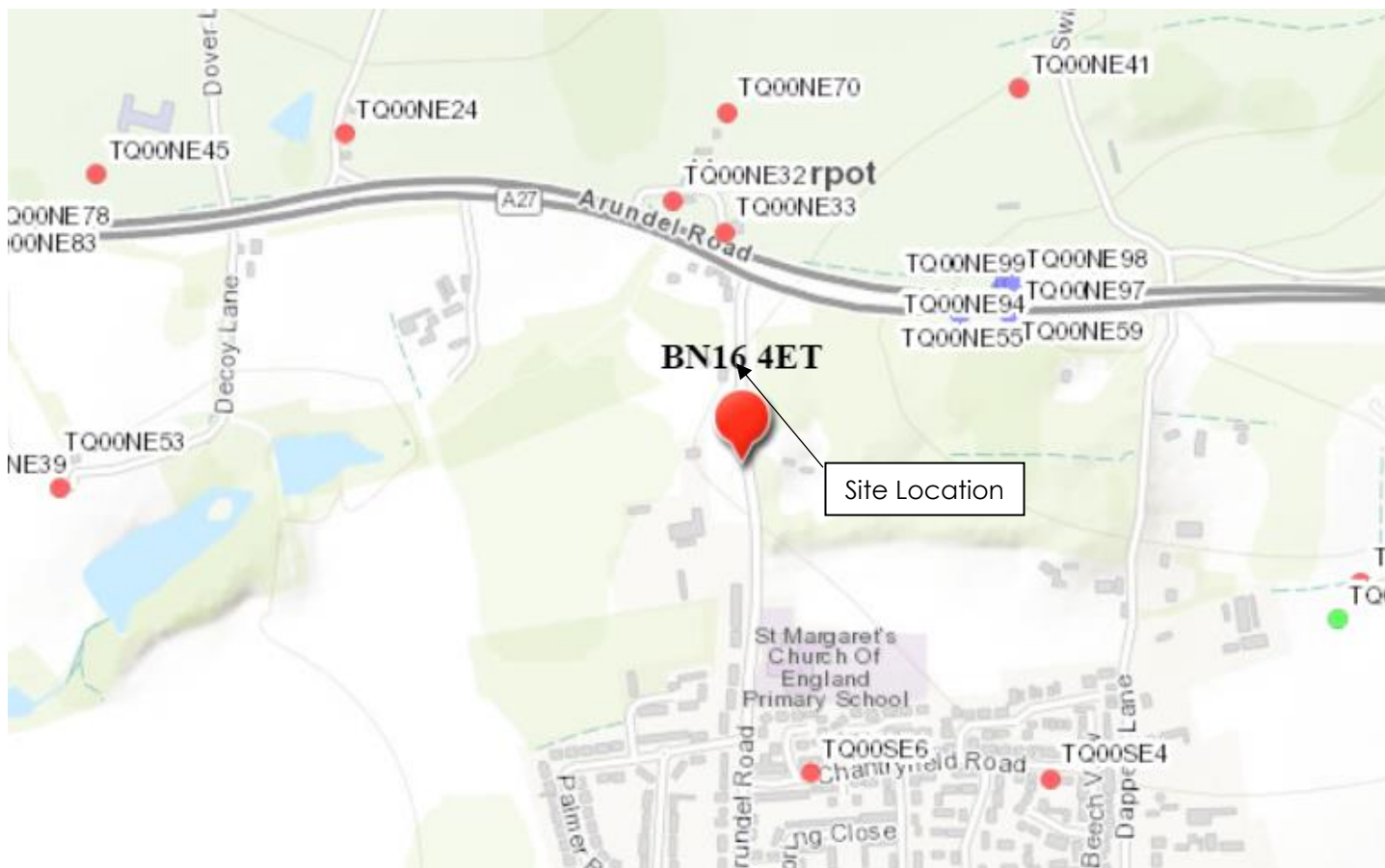


Figure 3. BGS website borehole locations

- 1.3.5 There are a number of boreholes along the line of the A27 trunk road with TQ00NE33 being the closest, however TQ00SE6 (Chantryfield Road) falls within similar recorded geology, as seen in **Figure 3**. This borehole has similar geotechnical strata according to the BGS online mapping.
- 1.3.6 The log at Chantryfield Road Road states that the geological composition encountered consisted of Drift deposits over London Clay.
- 1.3.7 A copy of the BGS records reviewed can be found within **Appendix C** of this report.
- 1.3.8 It is noteworthy that during the geotechnical investigation for a recent development to the south of this site, the trial pits demonstrated the soil to be London Clay to a depth of at least 2.5m.

1.4 Groundwater

- 1.4.1 The recorded BGS borehole at Chantryfield Lane recorded groundwater at 202ft bgl.
- 1.4.2 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.
- 1.4.3 The site is situated within a 'Secondary A' Aquifer for both Bedrock and Superficial Drift stratum, as seen

in **Figure 4**. This refers to drift deposits and bedrock geology that exhibit variable permeability and may provide groundwater storage or supply at a local or strategic level.

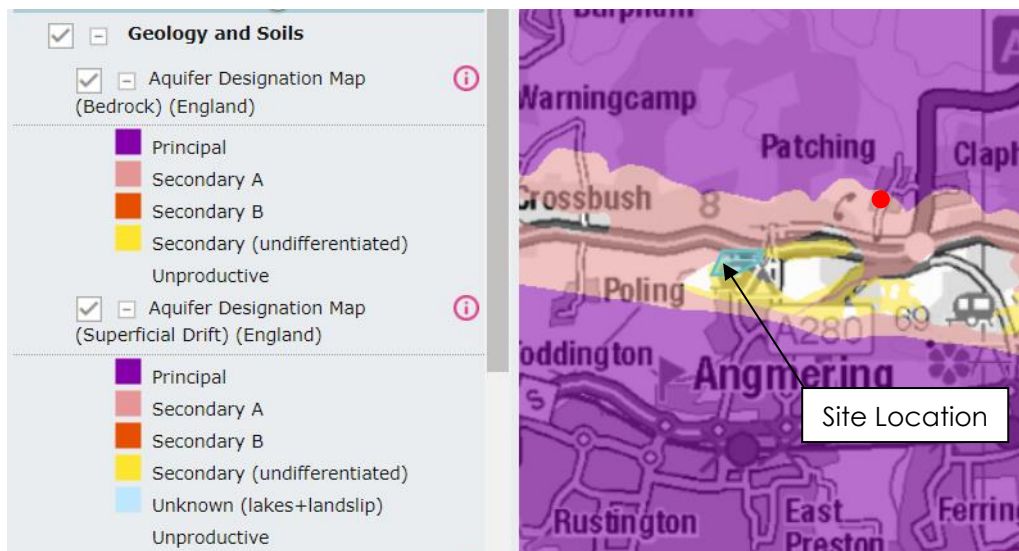


Figure 4. DEFRA Aquifer Designation Map

1.4.4 The Groundwater Vulnerability Map (**Figure 5**) confirms that the site falls within a 'unproductive' groundwater vulnerability zone.

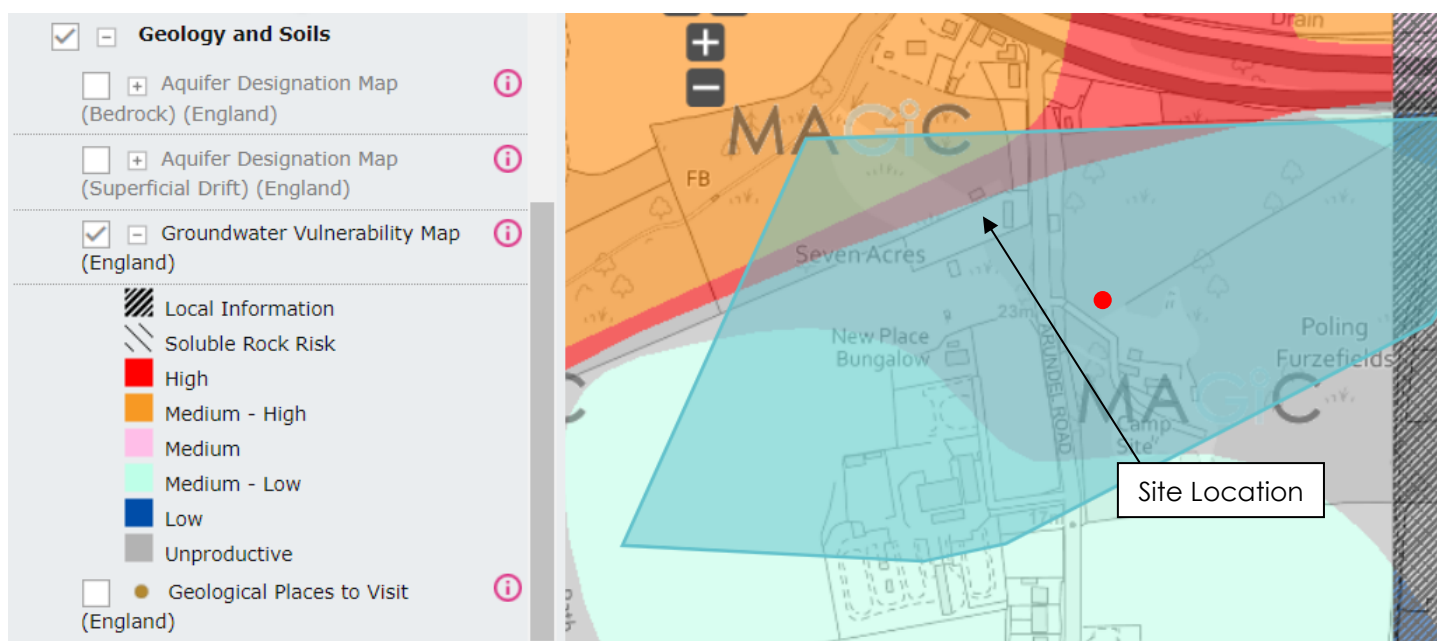


Figure 5. DEFRA Groundwater Vulnerability Map

1.4.5 The site is not indicated as within or in the vicinity of any Drinking Water Safeguard Zone or a Source Protection Zone.

1.5 Existing Drainage

1.5.1 The local Water Authority is Southern Water, who provide sewerage services within the district.

1.5.2 Surface Water:

- The Southern Water public sewer records (**Appendix E**) show no public surface water sewers within the vicinity of the site.
- The existing building is drained by rainwater pipes. The connection route of this drainage is not currently confirmed but it is believed that they drain naturally overground on to lower lying land.
- An man-made ornamental pond is present to the rear of the existing dwelling which overflows to a man-made ditch.
- The nearest watercourse appears is an ordinary watercourse to the north of the northern boundary, running southwest to the Decoy Ponds.
- Greenfield runoff rate (Q_{bar}) has been calculated using the Wallingford online tool to be 1.67l/s.

1.5.3 Foul Water:

- The Southern Water public sewer records show no existing public foul sewer in close proximity to the site. It is however understood that a foul sewer has recently been constructed for the adjacent development.
- The existing dwelling disposes of its wastewater via a private septic tank.

1.5.4 Highway Drainage:

- Arundel Road does not have any formal drainage within the vicinity of the site.

2 FLOOD RISK

2.1 Flood Maps and Modelling

2.1.1 The Environment Agency's on-line Flood Maps for Planning (rivers and sea) show that the site is located within Flood Zone 1, and not in the vicinity of any other flood zones. Flood Zone 1 is defined as 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)

2.1.2 **Figure 6** also shows that the site is not at risk of flooding from rivers or sea.

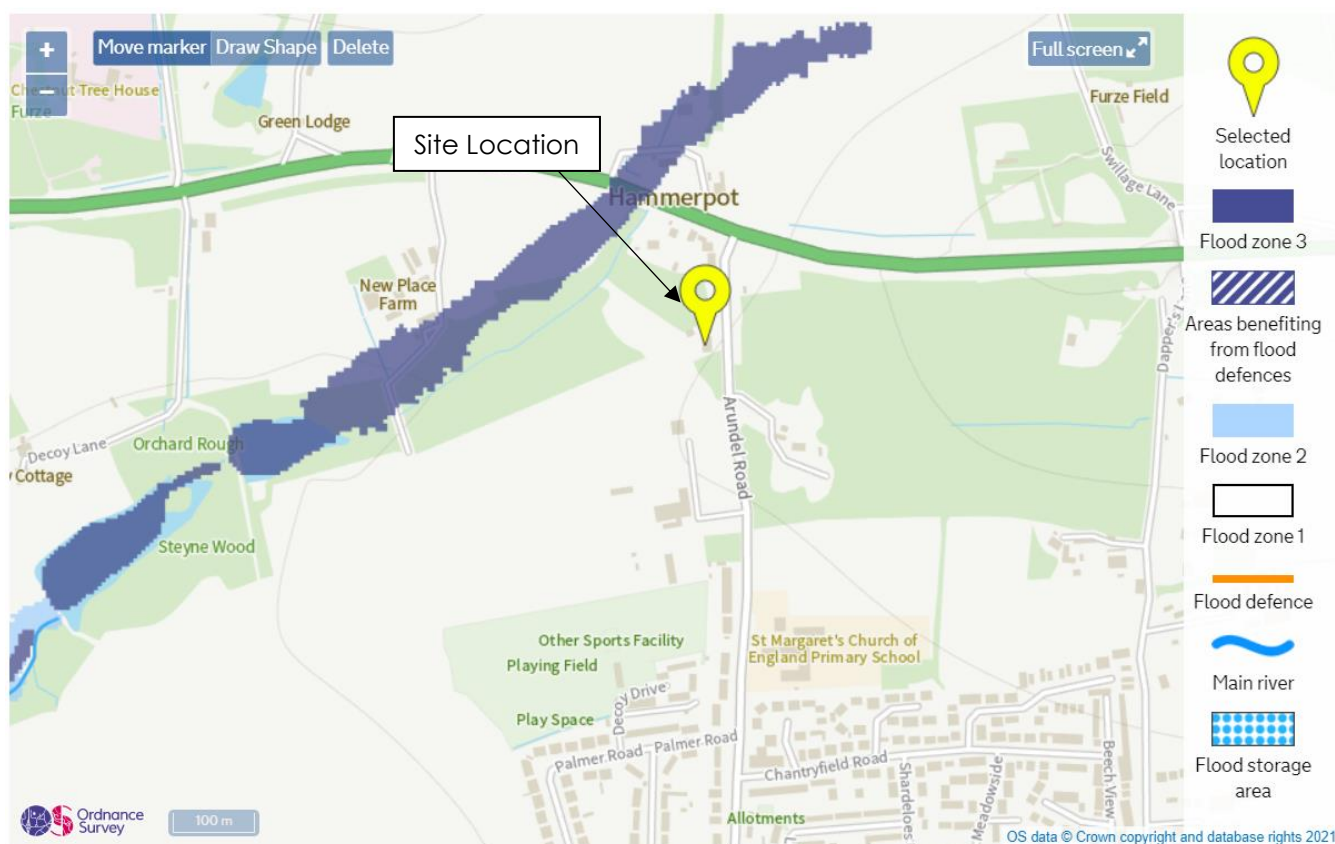


Figure 6. Long Term Flood Risk Map; Flood risk from rivers or the sea

2.1.3 **Figure 7** shows that the site at 'very low' risk of surface water flooding, and the adjacent highway to the west is at 'very low' to 'low' risk of surface water flooding. There is therefore not expected to be any surface water flooding within the site.

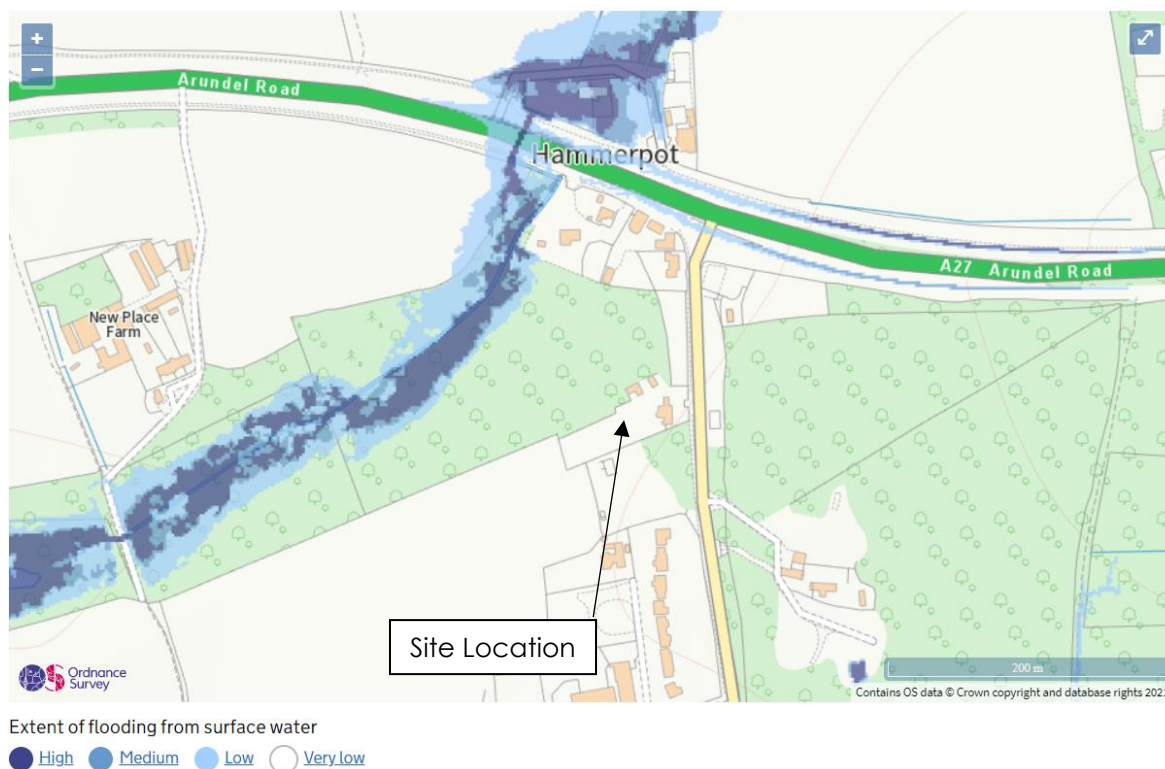
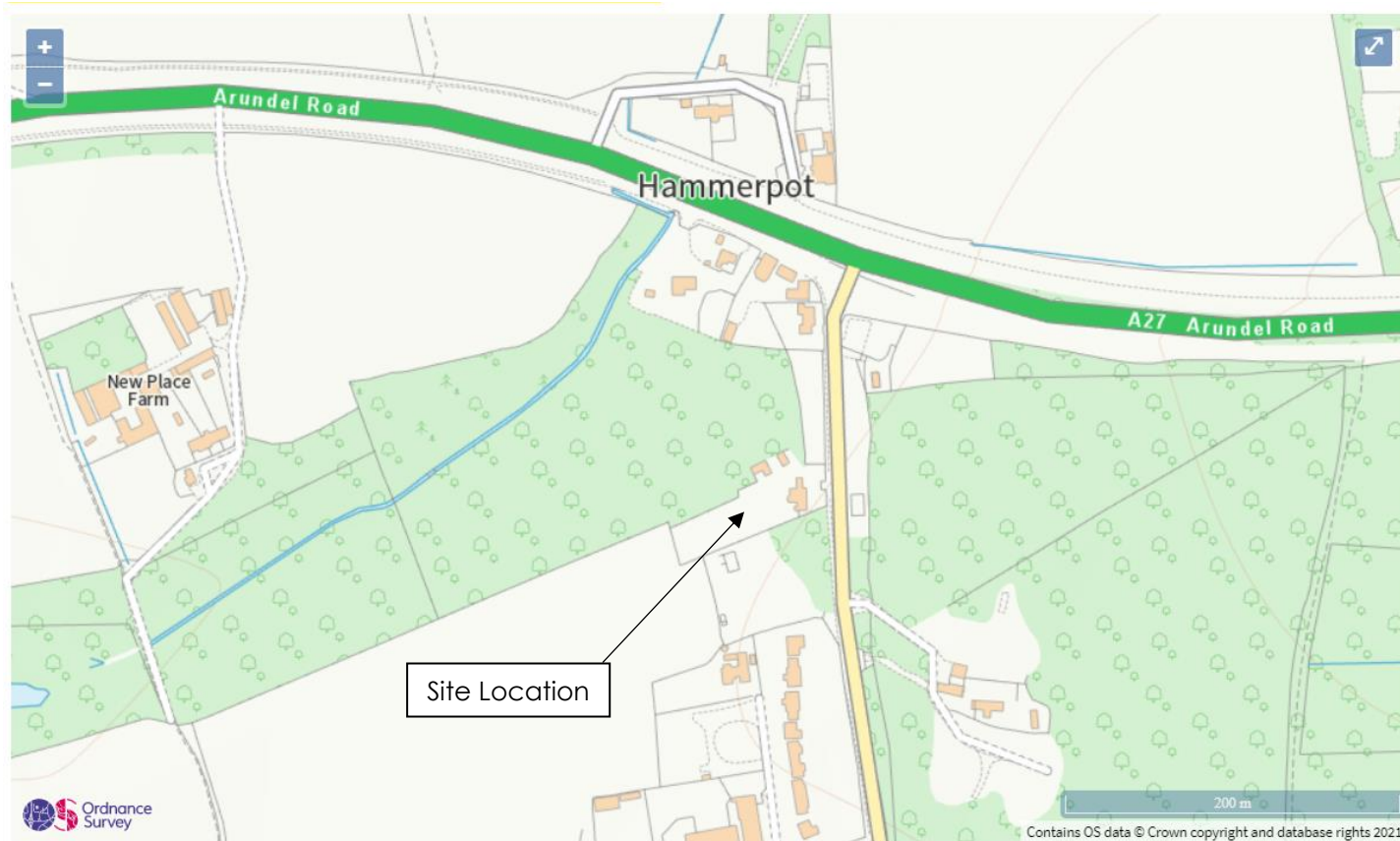


Figure 7. Long Term Flood Risk Map; Flood risk from surface water

2.1.4 **Figure 8** shows that the site is not at risk of flooding from reservoirs.



Extent of flooding from reservoirs

● Maximum extent of flooding

Figure 8. Long Term Flood Risk Map; Flood risk from reservoirs

2.2 Summary of Flood Risk

2.2.1 The potential sources of flooding are:

Source of Flooding	Level of Risk
Rivers and Coastal	Very Low The site is within Flood Zone 1 as is the surrounding area. The site is not in the vicinity of any watercourses or tidal sources.
Surface Water	Very Low The long-term flood risk for surface water is classified as 'very low' across the site location. Surface water flooding within the adjacent highway is also 'very low' to 'low' with depths indicated to be a maximum of 300mm, which not impact access or egress.
Groundwater	Low BGS records found the site to be situated above variable permeability strata, however nearby borehole logs did not find any presence of shallow groundwater.
Sewers	Low There are no surface water sewers within the area, no reports of sewer flooding found and no areas of surface water flooding that would indicate areas of highway drainage at risk of being surcharged. In view of this information the risk of flooding from this source is deemed to be 'Low'.
Artificial Sources	None The site is not shown to be at risk of flooding due to artificial sources.

2.2.2 The site is not considered to be vulnerable to flood risk from any of the above assessed sources, however the proposed drainage system for the proposed development should be designed in order to provide capacity up to the design event and provide consideration of potential exceedance routes, so as to not increase the risk of surface water flooding on or off the site.

3 PROPOSED DEVELOPMENT

3.1 Description of Development

- 3.1.1 The proposed development will involve retaining the existing dwelling and the construction of 7 dwellings, with associated landscaping as demonstrated within **Appendix A**.
- 3.1.2 The type of development falls within the 'More Vulnerable' classification (Flood Risk and Coastal Change Table 2) and is appropriate in Flood Zone 1 (Flood Risk and Coastal Change Table 3).
- 3.1.3 The proposed development will increase the hardstanding area of the site; however SuDS measures will be used where possible in order to prevent any increase in the rate of run-off generated by the site.
- 3.1.4 The post-development impermeable/hardstanding area (excluding existing dwelling) has been determined to be 2,207m² (0.22Ha).
- 3.1.5 The use of Sustainable Drainage System (SuDS) methods and techniques (where site conditions and constraints allow) within the bounds of the site (whilst adhering to the SuDS hierarchy as stated within Building Regulations (Part H) and The CIRIA SuDS Manual C753) will be used to provide a betterment of surface water run-off compared to the existing site.
- 3.1.6 The specific Surface Water and Foul Water drainage proposals are detailed in **Section 4** of this report.

4 PROPOSED DRAINAGE STRATEGY

4.1 Surface Water

4.1.1 The SUDS manual and Building Regulations 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	Yes	No initial constraints, however pitched roof proposed any may not be consistent with architects proposals.
Basins and Ponds (such as Wetlands, Balancing Ponds, Detention Basins, Retention Ponds)	Yes	Viable, however other constraints limit the available land.
Filter strips and swales	Yes	Viable.
Infiltration Devices - Soakaways - Infiltration trenches and basins	No	Underlying ground conditions are ivery unlikely to be suitable for infiltration methods. Investgations for the adjacent development concluded unsatisfactory infiltration rates..
Permeable surfaces and filter drains (such as gravelled areas and porous block paving	Yes	As above, and permeable surfaces would also provide a source of treatment and shallow attenuation.
Tanked systems (such as oversized pipes or cellular tanks)	Yes	No initial constraints, would provide considerable attenuation volume.

4.1.2 It is not considered that infiltration measures are viable, given BGS borehole records in the vicinity which indicate underlying Clay from below the surface to bedrock level. Permeable surfacing will capture rainfall however and attenuate surface water in order that it can be discharged at a reduced

controlled rate.

- 4.1.3 It is proposed to construct a "seepage trench" into which the run off will be discharged. This trench will be located on the lower parts of the site and once full will allow flows to travel overland, mimicking greenfield conditions, to the existing watercourse.
- 4.1.4 The proposed drainage system include 1024m² of permeable block paving with a minimum sub-base thickness of 350mm (107m³), together with 2 cellular storage tanks of approximately 115m³ with a controlled outflow to the seepage trench via a Hydrobrake of 3.50l/s, as detailed in Drawing **PL301**.
- 4.1.5 It is proposed that all captured runoff from the proposed hardstanding areas is captured up to the 100-year event including 40% climate change without exceedance.

4.2 Treatment

- 4.2.1 The use of permeable paving will ensure that run-off from the site receives a level of treatment required by the SuDS manual, with hydrocarbons being filtered by the aggregate and geotextile layers.
- 4.2.2 In accordance with the CIRIA SuDS Manual C753 regarding methods for managing pollution risks, the risk posed by surface water runoff 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).
- 4.2.3 The simple index approach considers whether SuDS techniques are appropriate for the site. The 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.
- 4.2.4 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).
- 4.2.5 In accordance with C753 Table 26.2, the proposed land uses at the site are categorised as follows:
 - Residential Roofs and non-trafficked areas – very low/TSS=0.2/M=0.2/H=0.05
- 4.2.6 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
- 4.2.7 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.

4.3 Foul Water Drainage

- 4.3.1 The public sewer records show that there are no public sewers in close proximity to the site, however it is understood that a new sewer is being construction for the adjacent development.
- 4.3.2 The proposed dwellings will discharge wastewater to an onsite pumping station, which has been designed to be adoptable. The pumping station will discharge offsite to the closest foul sewer.
- 4.3.3 Post development, there will be an estimated increase in peak foul water flows to 0.37 l/s (based on Water UK: Design and Construction Guidance).
- 4.3.4 Changes to infrastructure and connection charges (OFWAT Charging Rules) place the onus on the sewerage undertaker to reinforce their network should there no longer be sufficient capacity to serve the new development. Funding for this is provided by revised charging arrangements for infrastructure and connection charges for each dwelling constructed comprising a Network Reinforcement Charge and Site-Specific Charges. The revised charging arrangement (funded by the developer) covers alterations to the Existing Sewer Network and the sewerage undertaker remains responsible for the cost of reinforcing their Strategic Assets. The developer is responsible for connecting the development to the public sewer network.

4.4 Climate Change

- 4.4.1 In February 2017 the Environment Agency updates the latest climate change allowances (available online at <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>), which supports the NPPF in making an allowance for climate change within flood risk assessment. The allowances provide predictions of anticipated change for peak river flow by river basin district and peak rainfall intensity.
- 4.4.2 The table below shows the anticipated changes in extreme rainfall intensity. For flood risk assessments, both the central and upper end allowances should be assessed to understand the range of impact.

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%

- 4.4.3 Based on the latest allowances, an increase of 20% should be applied to peak rainfall to this development, with a review undertaken to determine the impact of a 40% increase.

4.5 Urban Creep

- 4.5.1 In order to cater for urban creep a 10% allowance has been included in the surface water calculations.

5 MAINTENANCE

5.1 Proposed Maintenance Regime

- 5.1.1 Maintenance is required to ensure the long-term operational performance of the proposed surface water drainage system.
- 5.1.2 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

- 5.1.3 The responsibility for implementing the maintenance regime will lie with a management company who will be responsible for the maintenance of all of the communal parts of the development.

Permeable Paving / Diffuser Units

- 5.1.4 The areas of permeable paving are designed to allow infiltration of surface water run-off through the joints in the block paving surface course and into the subbase below. The water is then collected and discharged into the positive drainage system.
- 5.1.5 As part of the permeable paving system, diffuser units are used to discharge surface water run-off from roof areas into the sub-base, as well as forming links between areas of permeable paving. These diffuser units are small heavy-duty cellular units which allow more efficient discharge of surface water into the sub-base base of the permeable paved areas.
- 5.1.6 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)

- 5.1.7 The HydroBrake flow control system 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.
- 5.1.8 The flow control device has two measures encase 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.
- 5.1.9 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

- 5.1.10 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.
- 5.1.11 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

- 5.1.12 It is not envisaged that any materials are to be stored onsite 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.
- 5.1.13 Minor spillages of fuels and oils will be dealt with by the permeable paving and deep trapped gullies, by bio-degrading and collecting the hydrocarbons respectively.

Future Alterations to the Development

- 5.1.14 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.

6 OFFSITE IMPACTS

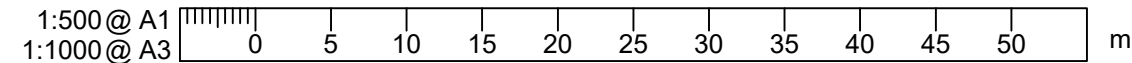
- 6.1.1 The proposed development will not result in any increase in runoff from the site, and therefore will not cause an increase in flood risk offsite.
- 6.1.2 Post development foul water flows will contribute an increase to the sewer network compared to the previous use – it is expected that the foul sewer flow will be 0.05l/s.
- 6.1.3 The effects of climate change have been considered in the design of the proposed surface water drainage system, to ensure there is no off-site impact.

7 SUMMARY

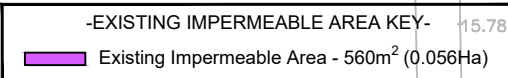
- 7.1.1 This site-specific drainage strategy report is based on Flood Maps, Public Sewer Records, BGS records, site-specific geotechnical information, and consultation with the Lead Local Flood Authority.
- 7.1.2 The existing site consists of a dwelling, paddocks and woodland.
- 7.1.3 The site falls from the eastern corner of the site at 20.17mAOD, to the south western corner at 11.30 AOD.
- 7.1.4 The application boundary area is 0.83Ha of which 0.056Ha is impermeable, this will increase to 0.22Ha as a result of the development.
- 7.1.5 The proposed development comprises the retention of the existing dwelling and the construction of 7 new dwellings.
- 7.1.6 The development lies within Flood Zone 1 (low risk), and is at low risk of flooding from all other sources
- 7.1.7 Post-development surface water run-off will be managed through sustainable drainage measures, with the installation permeable paving and a cellular storage tank, with discharge via a "seepage trench" overland to an existing watercourse. The discharge rate will be controlled by a Hydro-brake to 3.5l/s.
- 7.1.8 The wastewater from the proposed development will discharge to the public foul sewer network via a new pumpinmg station.
- 7.1.9 The completion of the development will not increase flood risk on or off the site.
- 7.1.10 In conclusion, this development is suitable with regards to flood risk and surface water drainage.

DRAWINGS

- 001** Existing Topography & Overland Flow Routes
- 002** Impermeable Areas Comparison
- 301** Conceptual Drainage Strategy
- 004** Site Location Plan



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NOTES

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2. Bright Plan accepts no responsibility for inaccuracies in data provided by third parties such as topographic surveys or Ordnance Survey mapping.
3. Do not scale, work to figured dimensions only. All dimensions are in millimeters unless noted otherwise and all levels are in metres from the topographic survey datum.
4. Any information given regarding existing underground services is given in good faith after consultation with the relevant authority however accuracy is not certain.

****NOT FOR CONSTRUCTION****

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Rev.	Amendments	Date



Drawing Status	PLANNING
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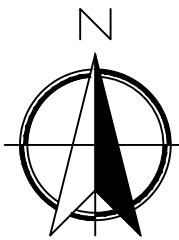
Client **Mr & Mrs B R Parsons**

Project Land at Wilmington
Arundel Road, Angmering

Drawing Title
Impermeable Area Comparision

Scale 1:500	Date Aug' 2021	Drawn By LDF	Checked MJA
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Drawing No.	Rev.
D1991-PL002	-



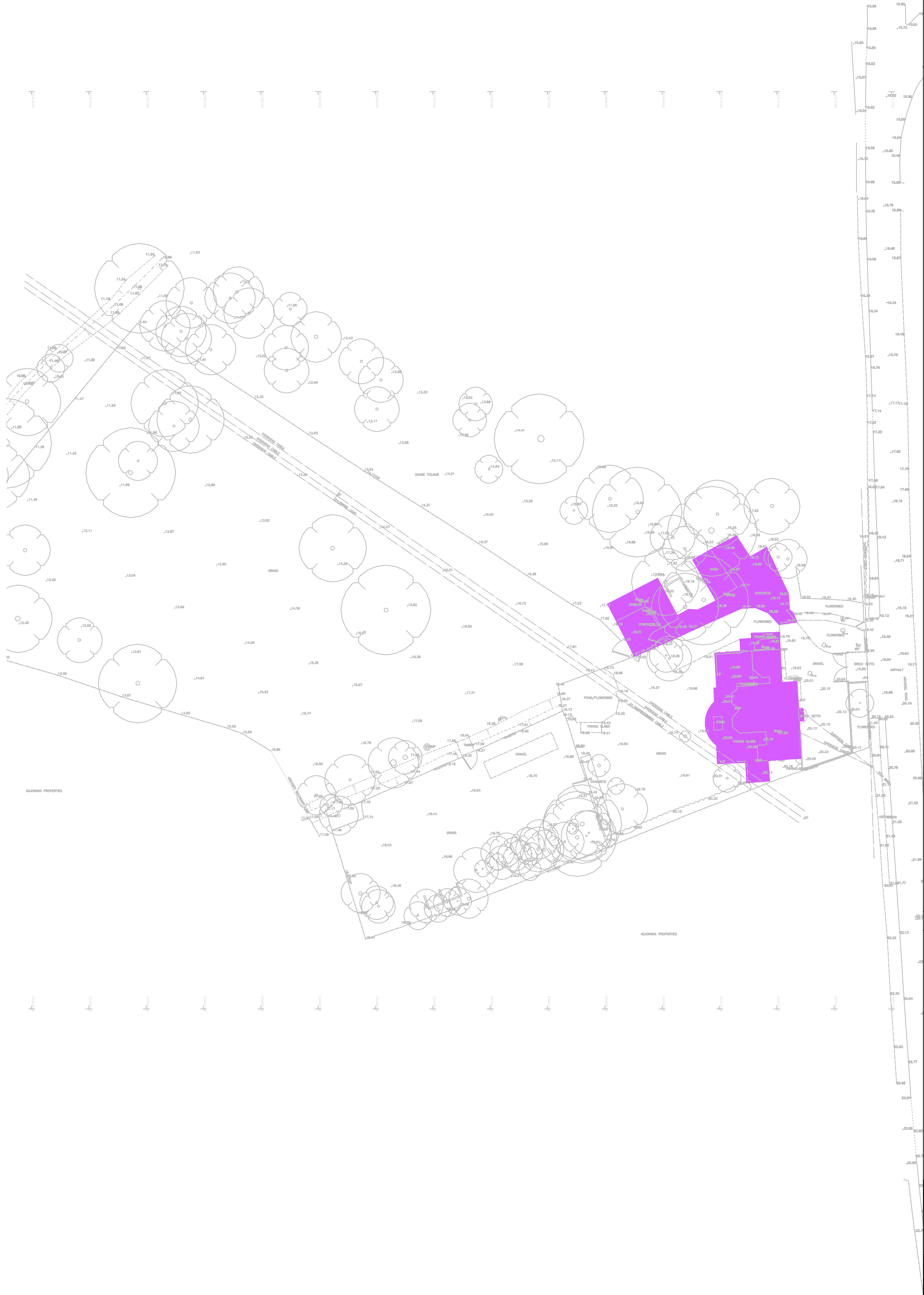
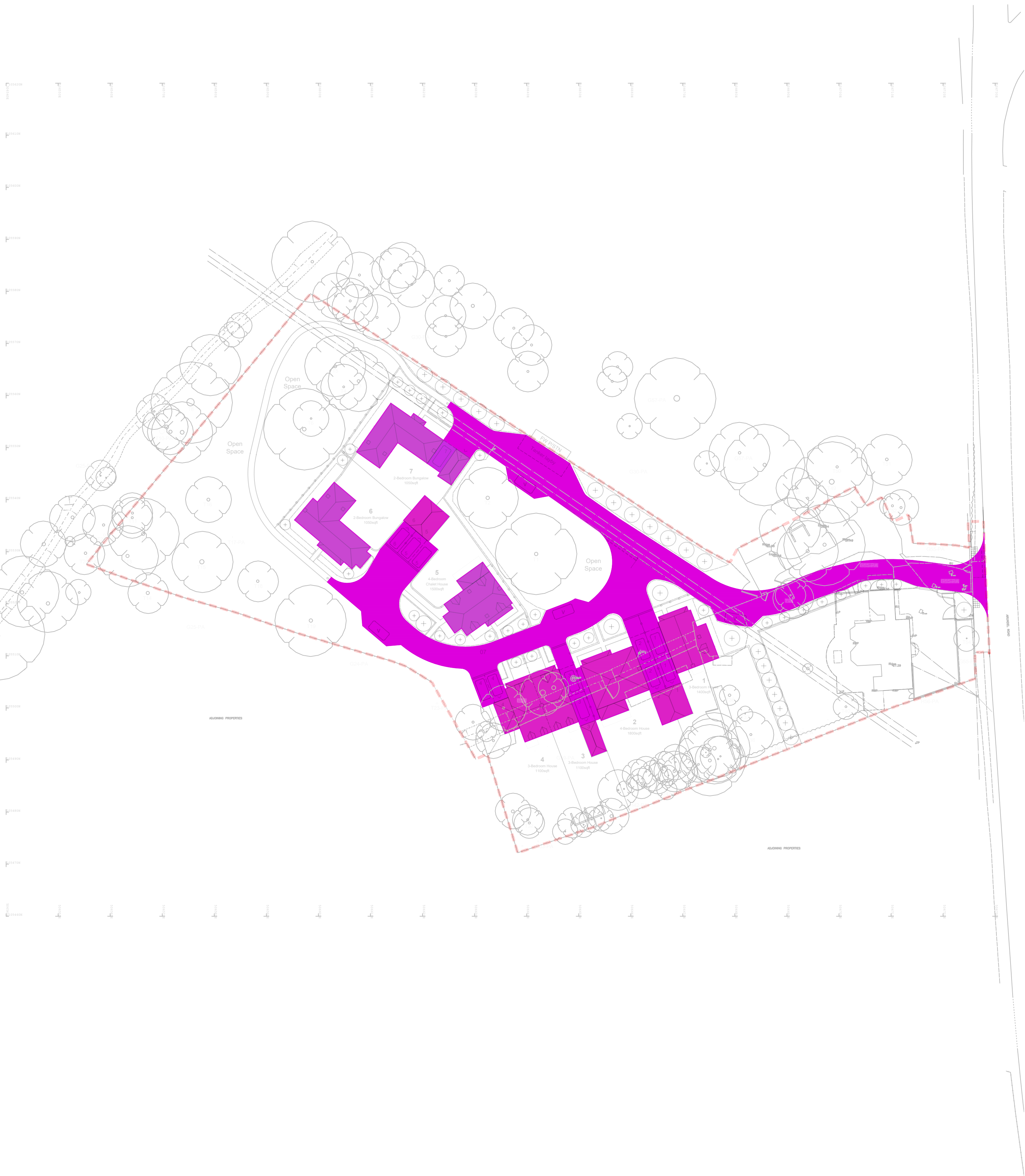
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-EXISTING IMPERMEABLE AREA KEY-
Proposed Impermeable Area - 2200m² (0.22Ha)

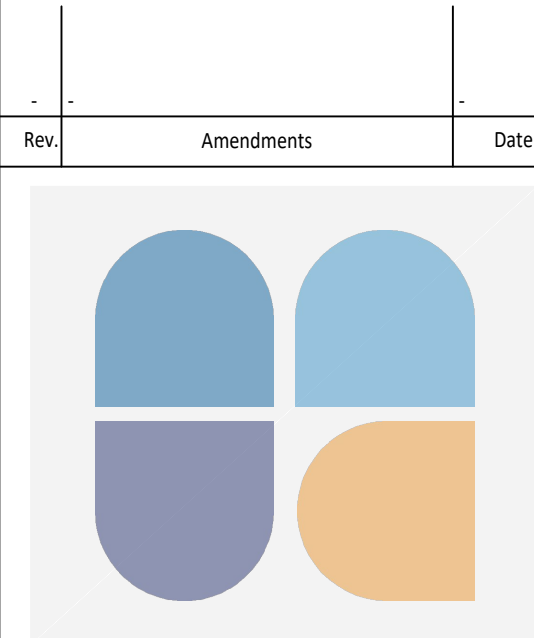
-EXISTING IMPERMEABLE AREA KEY-
Existing Impermeable Area - 560m² (0.056Ha)

NOTES

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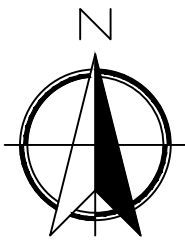


PRELIMINARY
NOT FOR CONSTRUCTION



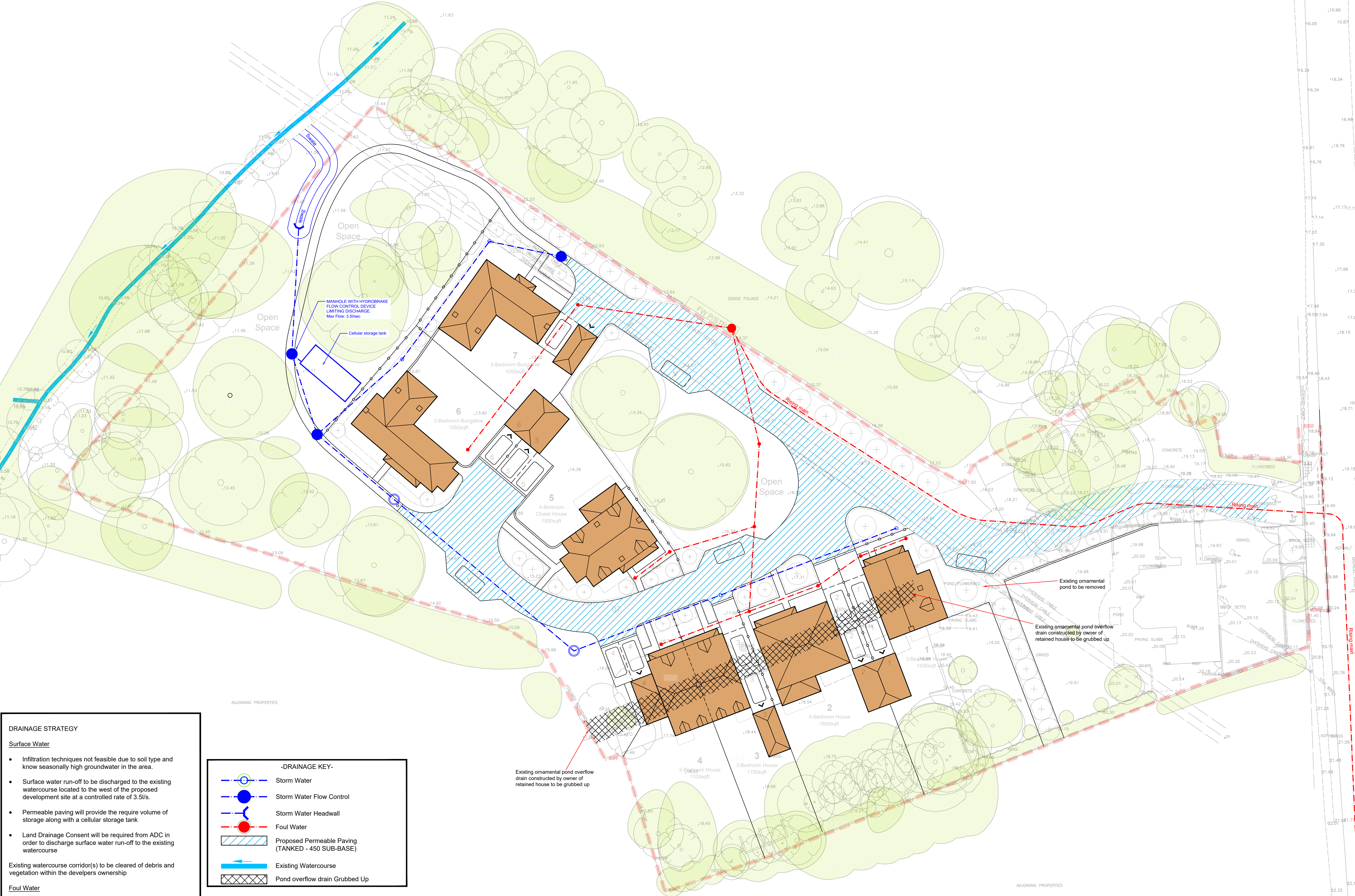
BRIGHT PLAN CIVILS
Transport Planning and Infrastructure Design Consultants
2 West Barn, Norton Lane, Chichester, West Sussex PO20 3AF
Tel: 01243 210418
www.bpcivils.co.uk

Drawing Status	PLANNING		
Client	Mr & Mrs B R Parsons		
Project	Land at Wilmington Arundel Road, Angmering		
Drawing Title	Impermeable Area Comparison		
Scale	Date	Drawn By	Checked By
1:500	Aug 2021	LDF	MJA
Drawing No.	D1991-PL002		
Rev.	-		



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1:250 @ A1
1:500 @ A3
0 4 8 12 16 20 24 m



DRAINAGE STRATEGY

Surface Water

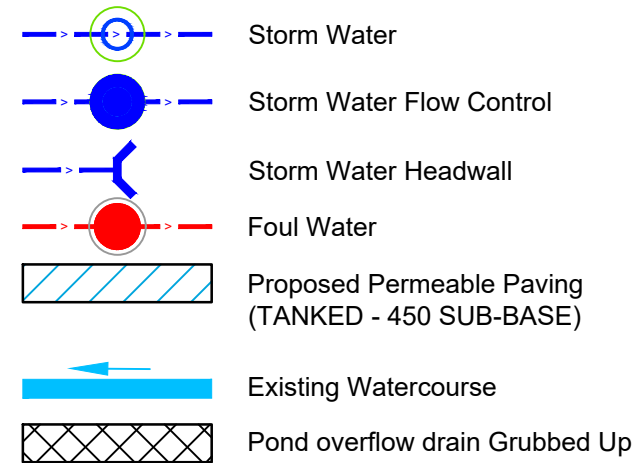
- Infiltration techniques not feasible due to soil type and know seasonally high groundwater in the area.
- Surface water run-off to be discharged to the existing watercourse located to the west of the proposed development site at a controlled rate of 3.5l/s.
- Permeable paving will provide the require volume of storage along with a cellular storage tank
- Land Drainage Consent will be required from ADC in order to discharge surface water run-off to the existing watercourse

Existing watercourse corridor(s) to be cleared of debris and vegetation within the developers ownership

Foul Water

- Foul water will be disposed of via a new pumping station the existing public foul water sewer located to the east of the development site in Arundel Road
- A Section 106 Application to connect to a public sewer will be required, pursuant to the Water Industry Act 1991.

-DRAINAGE KEY-



Existing ornamental pond overflow drain constructed by owner of retained house to be grubbed up

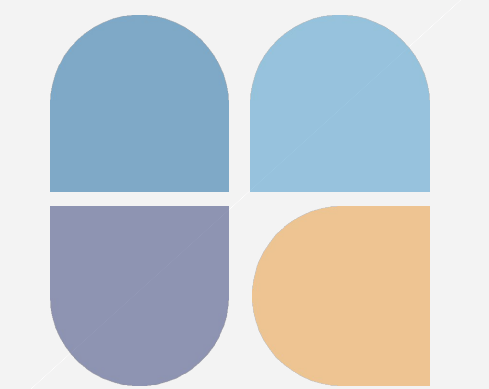
NOTES

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- Any information given regarding existing underground services is given in good faith after consultation with the relevant authority, however accuracy is not certain.

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Rev.	Amendments	Date
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Drawing Status	PLANNING
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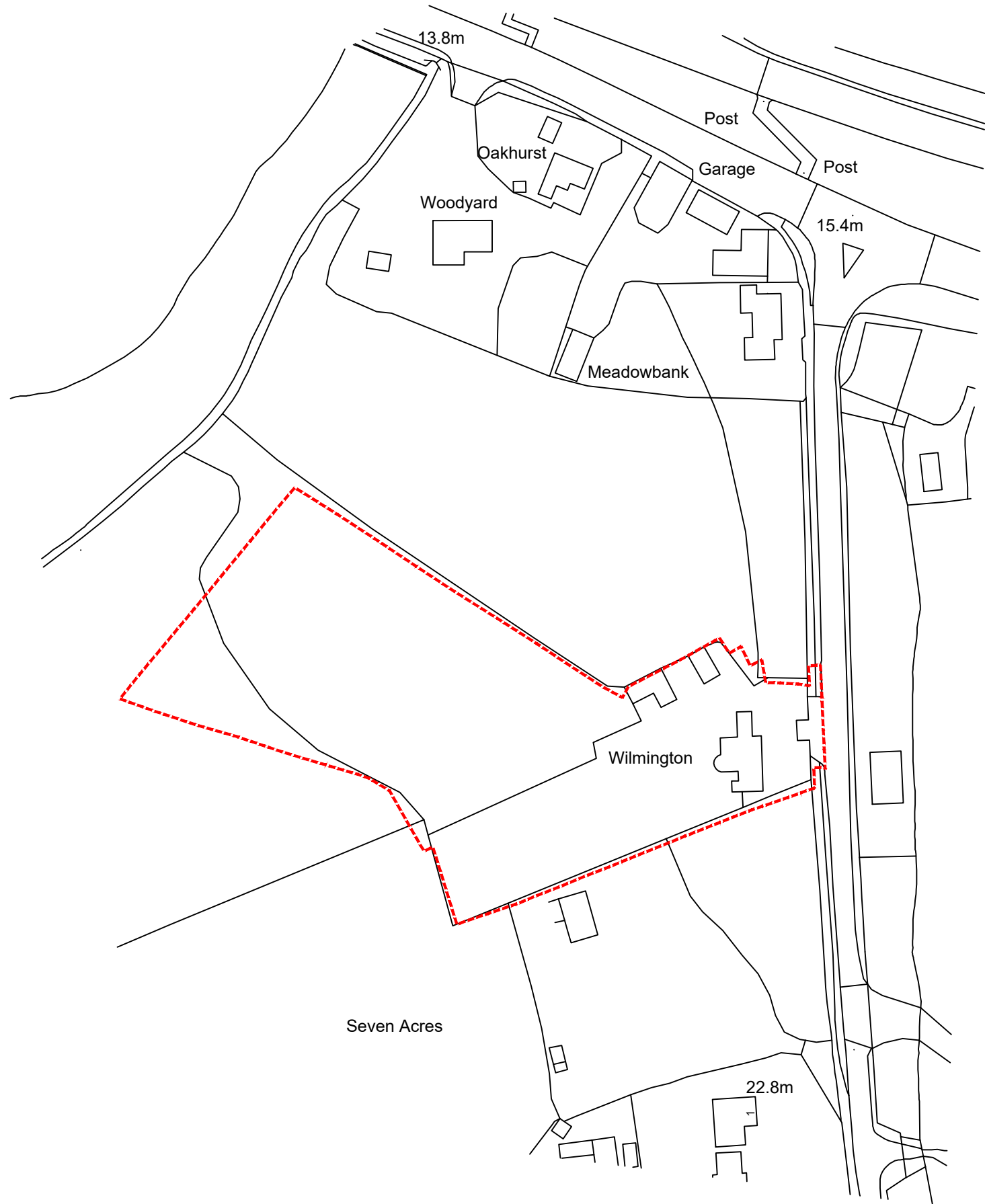
Client	Mr C Wiggins
--------	--------------

Project	Land at Wilmington Arundel Road, Angmering
---------	---

Drawing Title	Proposed Drainage Strategy
---------------	----------------------------

Scale	1:250	Date	Aug 2021	Drawn By	LDF	Checked By	MJA
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Drawing No.	D1991-PL301	Rev.	-
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NOTES

A3

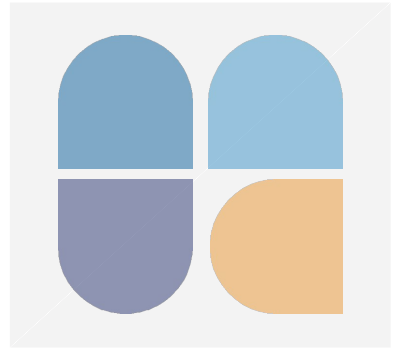
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	Original issue	29/01/2020
Rev	Amendments	Date



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Drawing Status	PLANNING		
Client	Mr & Mrs B R Parsons		
Drawing Title	Site Location Plan		
Project	Land at Wilmington Arundel Road, Angmering		
Scale	1:1250	Date	Aug 21
Drawn By	LDF	Checked By	MJA
Drawing No.	D1991-PL004		Rev.
		-	

APPENDICES

Appendix A Architects Site Plan



Accommodation Schedule			
Existing Dwelling	Wilmington	4-Bedroom House	
Plot 1	New-Build	3-Bedroom House	c. 1400sqft
Plot 2	New-Build	4-Bedroom House	c. 1800sqft
Plot 3	New-Build	3-Bedroom House	c. 1100sqft
Plot 4	New-Build	3-Bedroom House	c. 1100sqft
Plot 5	New-Build	4-Bedroom House	c. 1500sqft
Plot 6	New-Build	2-Bedroom Bungalow	c. 1050sqft
Plot 7	New-Build	2-Bedroom Bungalow	c. 1050sqft
Total;		7 Dwellings	
Car Parking;		2 spaces per 2-Bedroom Dwelling 3 spaces per 3 / 4-Bedroom Dwelling [incl. garages] 5 visitor spaces	

A	06.08.21	Updated	AK	AK
Rev	Date	Revision Details	Dr	Ch



London: 76 Great Suffolk Street
London, SE1 0BL
T 0207 928 2773 E london@eearchitecture.com

Sussex: Brooklyn Chambers, 11 Goring Road
Worthing, West Sussex, BN12 4AP
T 01903 248777 E sussex@eearchitecture.com

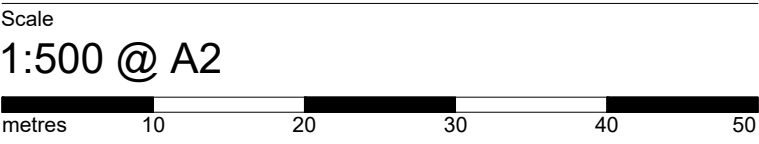
Bristol: Westworks, Colston Tower
Colston Street, Bristol, BS1 4XE
T 0117 214 1101 E bristol@ecwestworks.com

ECE Architecture
www.eearchitecture.com

Client's Name
Mr C Wiggins

Job Title
Land at Wilmington,
Arundel Road, Angmering

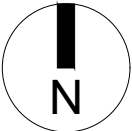
Drawing Title
Illustrative Site Plan



Drawn	Checked	Date
AK	AK	20.05.21

Job No	Drawing No	Rev
MP/CW/WM	001	A

Status
PRELIMINARY



Appendix B Topographic Survey

[illegible]

Appendix C BGS Borehole Logs

RECORD of WELL or BORING

317

TA 00 SE 16
Survey No. 317
P.N.S. 317
1° OS

at (house or farm) Chantryfield Nurseries, Arundel Rd
Twp, Village, &c. Angmering County Sussex Six-inch map III.B.E
Exact site (unless a tracing from a map is supplied, give distance and direction from parish church, cross-roads, or other object shown on map) 700 yds. North of Church Popular edition Sheet
753 + 18 one-inch map 3 square
Surface level of ground 42 ft. above Ordnance Datum. Well or Bore commenced at 0 ft. below surface level of ground.
Sunk 226 ft. diameter 6 in., at bottom 42 in.
Details of lining tubes (internal diameters preferred) 6" I.D. Tubes surface to 137'0"
42" " " from 133' to 163'0"
Water struck at depths of (feet) 202'0"
Rest-level of water below top of well or bore 44 ft. Pumping level ft. Time of recovery hours.
Suction at 100 ft. depth. Yield: (i) on test 2,000 galls. per hr., (ii) normal galls. per
Quality (attach copy of analysis if available)
Made by Alke & Cockenden Ltd for Mr. J. B. Knaggs Date of boring Dec. 1938
Information from Alke & Cockenden Ltd., Artesian Well Engineers, London & Littlehampton.

(For Survey use only.)
GEOLOGICAL
CLASSIFICATION.

NATURE OF STRATA.
(and any additional remarks)

THICKNESS.

DEPTH.

		Feet.		Inches.		Feet.		Inches.	
Drift	Gravel	18	0			18	0		
13'	Brown clay	3	0			21	0		
	Gravel	2	0			23	0		7-0
London clay	Blue Clay	36	0			59	0		18-0
36'	Sandy Clay	47	0			106	0		
Reading Beds	Stiff Clay	28	0			134	0		
97'	Mottled Clay	13	0			147	0		
Upper Chalk	Clay and Gravel	9	0			156	0		47-5 + 50-0
70'	Chalk and flints	70	0			226	0		69-9

(Id.) F.W.E.
6.1.39

TA 00 SE/b
0 684 0498

Recd. 6/1/39
Letter on
6,000 Gen.

Solid on 6" square 63NE.W
OD 52

Visited 27.2.41

Pumping equipment prevents measurement R.W.L.
In use for nursery. Visited 17.10.54.

GEOLOGICAL SURVEY AND MUSEUM,
SOUTH KENSINGTON,
LONDON, S.W.7.

For Survey use only.

Date received.	G.S.M.	M. of H. notified.	Site marked on 1" map.
6/1/39	647		

(24750C) Wt 2000/200 5,000 11/20
H. J. R. & L. Ltd. Op 816

Unk. -95

Appendix D Greenfield Runoff Calculations

Greenfield runoff rate estimation for sites

Registration successful. You are now logged in.

www.uksuds.com | Greenfield runoff tool

Calculated by:

Site name:

Site location:

Site Details

Latitude:

Longitude:

Reference:

Date:

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach

Site characteristics

Total site area (ha):

Methodology

Q_{BAR} estimation method:

SPR estimation method:

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	760	760
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	1.67	1.67
1 in 1 year (l/s):	1.42	1.42
1 in 30 years (l/s):	3.83	3.83
1 in 100 year (l/s):	5.31	5.31
1 in 200 years (l/s):	6.23	6.23

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix E Public Sewer Records



(c) Crown copyright and database rights 2021 Ordnance Survey 100031673 Date: 24/09/21 Scale: 1:1250 Map Centre: 506710,105511 Data updated: 20/09/21 Our Ref: 657004 - 1 Wastewater Plan A3

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2021 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

searches@bpcivils.co.uk

Wilmington



Appendix F Surface Water Drainage Calculations



Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	250.0
Additional Flow (%)	10	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	0.650
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.024	5.00	17.717	1200	506669.890	105521.848	0.457
12	0.005	5.00	17.674	1200	506667.570	105520.966	0.813
2	0.034	5.00	16.880	1200	506645.873	105512.690	1.118
3	0.018	5.00	16.152	1200	506625.841	105505.092	0.819
8	0.045	5.00	13.707	1200	506604.352	105528.726	0.800
4	0.034	5.00	13.660	1500	506601.277	105525.782	2.660
9	0.020	5.00	12.841	1800	506624.109	105558.970	1.741
10	0.020	5.00	12.393	1500	506614.294	105561.023	1.400
11	0.020	5.00	12.709	1800	506602.374	105544.917	1.743
5	0.000		12.731	1200	506590.758	105534.642	1.887
6	0.000		11.933	1200	506587.318	105545.651	1.137
7			11.750	1200	506586.408	105549.030	0.969

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	12	2.482	0.600	17.260	16.861	0.399	6.2	100	5.01	60.5
1.001_1	12	2	23.222	0.600	16.861	15.812	1.048	22.1	100	5.25	59.5
1.001	2	3	21.425	0.600	15.762	15.333	0.429	49.9	150	5.50	58.4
1.002	3	4	32.116	0.600	15.333	12.860	2.473	13.0	150	5.69	57.6
2.000	8	4	4.257	0.600	12.907	12.860	0.047	90.6	150	5.07	60.3
1.003	4	5	13.753	0.600	11.000	10.919	0.081	169.8	225	5.92	56.7
3.000	9	10	10.027	0.600	11.100	10.993	0.107	93.7	750	5.06	60.3
3.001	10	11	20.037	0.600	10.993	10.966	0.027	742.1	750	5.39	58.9
3.002	11	5	15.508	0.600	10.966	10.844	0.122	127.1	300	5.57	58.1
1.004	5	6	11.534	0.600	10.844	10.796	0.048	240.3	300	6.11	55.9

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	3.121	24.5	4.3	0.357	0.713	0.024	0.0	29	2.358
1.001_1	1.647	12.9	5.1	0.713	0.968	0.029	0.0	44	1.559
1.001	1.427	25.2	11.0	0.968	0.669	0.063	0.0	69	1.381
1.002	2.810	49.7	13.9	0.669	0.650	0.081	0.0	54	2.417
2.000	1.056	18.7	8.1	0.650	0.650	0.045	0.0	69	1.018
1.003	1.000	39.8	27.0	2.435	1.587	0.160	0.0	137	1.074
3.000	2.891	1277.2	3.6	0.991	0.650	0.020	0.0	28	0.648
3.001	1.019	450.3	7.0	0.650	0.993	0.040	0.0	64	0.384
3.002	1.393	98.5	10.4	1.443	1.587	0.060	0.0	65	0.913
1.004	1.010	71.4	36.7	1.587	0.837	0.220	0.0	153	1.017



Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.005	6	7	3.499	0.600	10.796	10.781	0.015	233.3	300	6.17	55.7

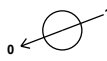
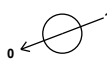
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.005	1.025	72.4	36.6	0.837	0.669	0.220	0.0	151	1.027

Pipeline Schedule

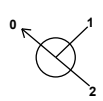
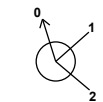
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	2.482	6.2	100	Circular_Default Sewer Type	17.717	17.260	0.357	17.674	16.861	0.713
1.001_1	23.222	22.1	100	Circular_Default Sewer Type	17.674	16.861	0.713	16.880	15.812	0.968
1.001	21.425	49.9	150	Circular_Default Sewer Type	16.880	15.762	0.968	16.152	15.333	0.669
1.002	32.116	13.0	150	Circular_Default Sewer Type	16.152	15.333	0.669	13.660	12.860	0.650
2.000	4.257	90.6	150	Circular_Default Sewer Type	13.707	12.907	0.650	13.660	12.860	0.650
1.003	13.753	169.8	225	Circular_Default Sewer Type	13.660	11.000	2.435	12.731	10.919	1.587
3.000	10.027	93.7	750	Circular_Default Sewer Type	12.841	11.100	0.991	12.393	10.993	0.650
3.001	20.037	742.1	750	Circular_Default Sewer Type	12.393	10.993	0.650	12.709	10.966	0.993
3.002	15.508	127.1	300	Circular_Default Sewer Type	12.709	10.966	1.443	12.731	10.844	1.587
1.004	11.534	240.3	300	Circular_Default Sewer Type	12.731	10.844	1.587	11.933	10.796	0.837
1.005	3.499	233.3	300	Circular_Default Sewer Type	11.933	10.796	0.837	11.750	10.781	0.669

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	12	1200	Manhole	Adoptable
1.001_1	12	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	4	1500	Manhole	Adoptable
2.000	8	1200	Manhole	Adoptable	4	1500	Manhole	Adoptable
1.003	4	1500	Manhole	Adoptable	5	1200	Manhole	Adoptable
3.000	9	1800	Manhole	Adoptable	10	1500	Manhole	Adoptable
3.001	10	1500	Manhole	Adoptable	11	1800	Manhole	Adoptable
3.002	11	1800	Manhole	Adoptable	5	1200	Manhole	Adoptable
1.004	5	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
1.005	6	1200	Manhole	Adoptable	7	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
1	506669.890	105521.848	17.717	0.457	1200					
						0	1.000	17.260	100	
12	506667.570	105520.966	17.674	0.813	1200		1	1.000	16.861	100
						0	1.001_1	16.861	100	
2	506645.873	105512.690	16.880	1.118	1200		1	1.001_1	15.812	100
						0	1.001	15.762	150	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
3	506625.841	105505.092	16.152	0.819	1200		1	1.001	15.333	150
						0	1.002	15.333	150	
8	506604.352	105528.726	13.707	0.800	1200		0	2.000	12.907	150
4	506601.277	105525.782	13.660	2.660	1500		1	2.000	12.860	150
						2	1.002	12.860	150	
						0	1.003	11.000	225	
9	506624.109	105558.970	12.841	1.741	1800		0	3.000	11.100	750
10	506614.294	105561.023	12.393	1.400	1500		1	3.000	10.993	750
						0	3.001	10.993	750	
11	506602.374	105544.917	12.709	1.743	1800		1	3.001	10.966	750
						0	3.002	10.966	300	
5	506590.758	105534.642	12.731	1.887	1200		1	3.002	10.844	300
						2	1.003	10.919	225	
						0	1.004	10.844	300	
6	506587.318	105545.651	11.933	1.137	1200		1	1.004	10.796	300
						0	1.005	10.796	300	
7	506586.408	105549.030	11.750	0.969	1200		1	1.005	10.781	300

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	✓
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.300	Check Discharge Rate(s)	✓
Summer CV	0.750	Check Discharge Volume	✓
Winter CV	0.840	100 year 360 minute (m³)	
Analysis Speed	Normal		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
10	0	0	0
100	40	10	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m³)	

Node 9 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	11.100	Product Number	CTL-SHE-0126-8000-1400-8000
Design Depth (m)	1.400	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	8.0	Min Node Diameter (mm)	1200

Node 4 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	11.000	Product Number	CTL-SHE-0135-1200-2600-1200
Design Depth (m)	2.600	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	12.0	Min Node Diameter (mm)	1500

Node 5 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	10.844	Product Number	CTL-SHE-0078-3500-1800-3500
Design Depth (m)	1.800	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.5	Min Node Diameter (mm)	1200

Node 2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	15.762	Product Number	CTL-SHE-0114-6000-1100-6000
Design Depth (m)	1.100	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	6.0	Min Node Diameter (mm)	1200

Node 1 Online Orifice Control

Flap Valve	x	Invert Level (m)	17.260	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.030		

Node 1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	17.260	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	182	Depth (m)	0.450
Safety Factor	2.0	Width (m)	4.100	Inf Depth (m)	0.450
Porosity	0.32	Length (m)	58.300		

Node 8 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	13.107	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	72	Depth (m)	0.600
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.32	Length (m)	45.000		

Node 2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	16.280	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	25	Depth (m)	0.600
Safety Factor	2.0	Width (m)	4.500	Inf Depth (m)	
Porosity	0.32	Length (m)	57.000		

Node 5 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	10.844
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	44.0	0.0	1.200	44.0	0.0	1.210	0.0	0.0

Node 3 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	15.565	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.450
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	1.00	Length (m)	45.000		

Node 9 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	12.241	Slope (1:X)	100.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.600
Safety Factor	2.0	Width (m)	4.100	Inf Depth (m)	
Porosity	0.32	Length (m)	57.000		

Node 10 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	10.993
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	



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Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	50.0	0.0	1.200	50.0	0.0	1.210	0.0	0.0

Results for 10 year Critical Storm Duration. Lowest mass balance: 97.61%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	1	48	17.478	0.218	3.3	2.8986	0.0000	FLOOD RISK
15 minute winter	12	11	16.887	0.026	1.9	0.0324	0.0000	OK
15 minute winter	2	13	16.309	0.546	10.2	1.0113	0.0000	SURCHARGED
15 minute winter	3	10	15.381	0.048	10.5	0.0747	0.0000	OK
30 minute winter	8	26	13.256	0.349	10.1	2.5752	0.0000	SURCHARGED
30 minute winter	4	26	13.254	2.254	24.9	4.5608	0.0000	SURCHARGED
180 minute winter	9	148	11.297	0.197	1.3	0.5463	0.0000	OK
180 minute winter	10	176	11.278	0.285	5.3	14.8240	0.0000	OK
180 minute winter	11	172	11.278	0.312	4.0	0.8649	0.0000	SURCHARGED
180 minute winter	5	172	11.278	0.434	9.5	18.6212	0.0000	SURCHARGED
240 minute winter	6	136	10.839	0.043	2.8	0.0485	0.0000	OK
120 minute summer	7	80	10.821	0.040	2.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	1	Orifice	12	0.8				
15 minute winter	12	1.001_1	2	1.9	0.899	0.145	0.1095	
15 minute winter	2	Hydro-Brake®	3	6.0				
15 minute winter	3	1.002	4	10.4	2.204	0.210	0.3564	
30 minute winter	8	2.000	4	8.8	0.967	0.469	0.0749	
30 minute winter	4	Hydro-Brake®	5	11.0				
180 minute winter	9	Hydro-Brake®	10	1.3				
180 minute winter	10	3.001	11	-3.0	0.199	-0.007	3.2689	
180 minute winter	11	3.002	5	-2.7	0.351	-0.027	1.0921	
180 minute winter	5	Hydro-Brake®	6	2.8				
240 minute winter	6	1.005	7	2.8	0.485	0.039	0.0203	67.6

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 97.61%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	1	96	17.685	0.425	5.5	10.1251	0.0000	FLOOD RISK
15 minute winter	12	10	16.899	0.038	4.0	0.0480	0.0000	OK
60 minute winter	2	47	16.586	0.824	14.9	8.2356	0.0000	FLOOD RISK
15 minute winter	3	10	15.392	0.059	16.3	0.0956	0.0000	OK
120 minute winter	8	92	13.655	0.748	15.6	25.0760	0.0000	FLOOD RISK
120 minute winter	4	92	13.654	2.654	19.7	5.4349	0.0000	FLOOD RISK
480 minute winter	9	464	12.395	1.295	1.7	5.1943	0.0000	SURCHARGED
480 minute winter	10	368	12.393	1.400	8.1	63.1634	2.1093	FLOOD
480 minute winter	11	368	12.393	1.427	7.6	3.9914	0.0000	SURCHARGED
480 minute winter	5	368	12.393	1.549	10.6	52.1210	0.0000	SURCHARGED
480 minute winter	6	448	10.842	0.046	3.3	0.0522	0.0000	OK
480 minute winter	7	448	10.823	0.042	3.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	1	Orifice	12	1.2				
15 minute winter	12	1.001_1	2	3.9	0.958	0.302	0.1224	
60 minute winter	2	Hydro-Brake®	3	6.0				
15 minute winter	3	1.002	4	16.3	2.287	0.328	0.3865	
120 minute winter	8	2.000	4	8.5	0.900	0.455	0.0749	
120 minute winter	4	Hydro-Brake®	5	11.1				
480 minute winter	9	Hydro-Brake®	10	1.4				
480 minute winter	10	3.001	11	-7.2	0.183	-0.016	8.8187	
480 minute winter	11	3.002	5	-7.0	0.230	-0.072	1.0921	
480 minute winter	5	Hydro-Brake®	6	3.3				
480 minute winter	6	1.005	7	3.3	0.507	0.045	0.0226	114.8