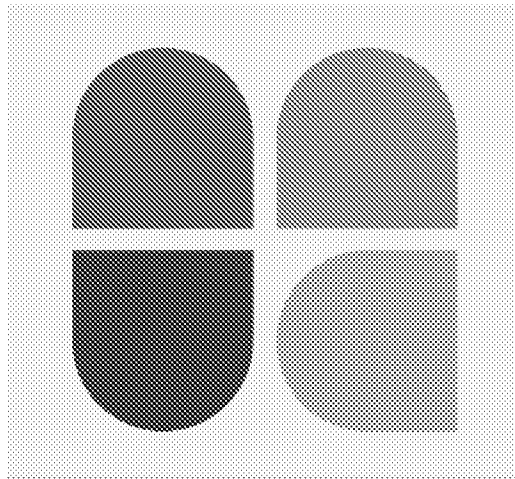




BRIGHT PLAN CIVILS

**GREEN GABLES, NORTHFIELDS LANE,
WESTERGATE, CHICHESTER PO20 3UH**

PROPOSED SINGLE UNIT NEW BUILD

Flood Risk Assessment & Drainage Strategy

Prepared on Behalf of

Mr D. Tobin

D2008/FRA1.1

September 2021

DOCUMENT CONTROL

Project: Green Gables, Northfields Lane, Westergate, Chichester PO20 3UH
 Proposed Single Unit New Build
 Document: Flood Risk Assessment & Drainage Strategy
 Client: Mr D. Tobin
 Reference: D2008/FRA1.1

Document Checking:

Author: SPB

Date: 07/10/2021

Checked by: MJA

Date: 07/10/2021

Approved by: MJA

Date: 07/10/2021

Status:

Issue	Date	Status	Issued by
1.0	29/09/2021	First issue	SPB
1.1	07/10/2021	FINAL	SPB

CONTENTS

1	INTRODUCTION	6
1.1	Background.....	6
1.2	Site Location and Description	6
1.3	Ground Conditions	7
1.4	Groundwater.....	10
1.5	Existing Drainage	12
2	PROBABILITY	14
2.1	Sources of Information	14
2.2	Flood Maps and Modelling	14
2.3	Strategic Flood Risk Assessment.....	20
2.4	Historic Flooding	20
2.5	Lidsey Surface Water Management Plan.....	20
2.6	Summary of Flood Risk.....	21
3	PROPOSED DEVELOPMENT	23
3.1	Description of Development	23
4	SEQUENTIAL AND EXCEPTION TESTS	24
4.1	Sequential Test	24
4.2	Exception Test	24
5	PROPOSED DRAINAGE STRATEGY	25
5.1	Surface Water	25
5.2	Treatment	26
5.3	Foul Water Drainage	27
5.4	Climate Change.....	27
5.5	Urban Creep	28
6	RESIDUAL RISK AND MITIGATION	29
6.1	Residual Risk.....	29
6.2	Mitigation.....	29
7	FLOOD RISK MANAGEMENT	31
7.1	Safe Access and Egress	31
7.2	Flood Warning	31
8	MAINTENANCE.....	32
8.1	Proposed Maintenance Regime	32

9	OFFSITE IMPACTS	34
10	SUMMARY.....	35

DRAWINGS

PL-100	Site Location Plan
PL-200	Impermeable Area Comparison
PL-300	Conceptual Drainage Strategy
PL-400	Existing and Proposed Overland Flows/Exceedance Routes

APPENDICES

Appendix A	Development Proposals
Appendix B	Topographic Survey
Appendix C	BGS Records
Appendix D	Southern Water Public Sewer Records
Appendix E	Environment Agency Product 4
Appendix F	Arun District Council SFRA Extracts
Appendix G	Wallingford Greenfield Run-off
Appendix H	Causeway Flow Calculations

1 INTRODUCTION

1.1 Background

- 1.1.1 Bright Plan Civils is instructed by Mr D. Tobin to prepare a Flood Risk Assessment & Conceptual Drainage Strategy to accompany a planning application for a new dwelling at Green Gables, Northfields Lane, Westergate, Chichester PO20 3UH.
- 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 single residential property, as demonstrated within the 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
 - Arun District Council, West Sussex County Council and Southern Water Drainage Records
 - British Geological Survey Records
- 1.1.5 This document has been prepared to assess drainage constraints and propose a drainage strategy that is appropriate for the design life of the development, without causing off-site impacts from run-off 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 proposed development is located to the rear of the existing property, Green Gables, located on Northfield Lane in Westergate. A site location (**D2008-PL-100 'Site Location Plan'**) has been prepared and is contained within this report.
- 1.2.2 A topographical survey has been conducted of the area of proposed development and is contained within **Appendix B**.
- 1.2.3 The topographical survey demonstrates levels in the range of 11.875m AOD and 11.479m AOD, with falls prevailing to the east and south-east.
- 1.2.4 **Figure 1**, below, demonstrates the wider topography in relation to the site.



Figure 1. Environment Agency Survey Open Data Index Catalogues (LIDAR)

- 1.2.5 The proposed development will replace an existing swimming pool located within the rear grounds of Green Gables. The area is not understood to be served by any formal drainage infrastructure, with infiltration and overland run-off prevalent as a means of surface water disposal.
- 1.2.6 There is an ordinary watercourse located beyond the eastern boundary of the site, which flows in a southerly direction. It has been stated by Arun District Council that this watercourse is to be re-graded by the adjacent Developer, whilst the culvert to the south-east of the site under the 'unmade' track is to also be upgraded. The client has confirmed that Taylor Wimpey has upgraded the culvert which runs underneath the access at Elderberry House, as was intended, as referred to by Arun District Council.
- 1.2.7 A 'Main River' is located on Northfield Lane, flowing in a southerly direction. This 'Main River' is located along the western side of Northfield Lane.
- 1.2.8 A watercourse is also present along the eastern side of Northfield Lane, to the west of the proposed development, also flowing in a southerly direction. Records indicate that this watercourse diverts east, along the boundary of 'The Croft' and 'Orchard Cottage', linking with the watercourse referred to in 1.2.5. The watercourse is culverted in sections, allowing for the private access construction to a number of properties on Northfield Lane.
- 1.2.9 The site totals 916m² (0.09Ha), inclusive of the access drive which is partially constructed as this serves the neighbouring property (Elderberry House). This access drive is to be extended to provide access to the proposed dwelling.
- 1.2.10 The area of proposed development has an existing impermeable totalling 162m² as demonstrated on drawing **D2008-PL-200 'Impermeable Area Comparison'**.

1.3 Ground Conditions

- 1.3.1 Site-specific geotechnical investigation has not been undertaken at this time, therefore reference has been made to the British Geological Survey (BGS) website in order to gain an understanding of the anticipated geology.
- 1.3.2 The BGS Geology of Britain Viewer indicates a Bedrock geology consisting of 'London Clay Formation – Clay, Silt and Sand', as demonstrated in **Figure 2**.

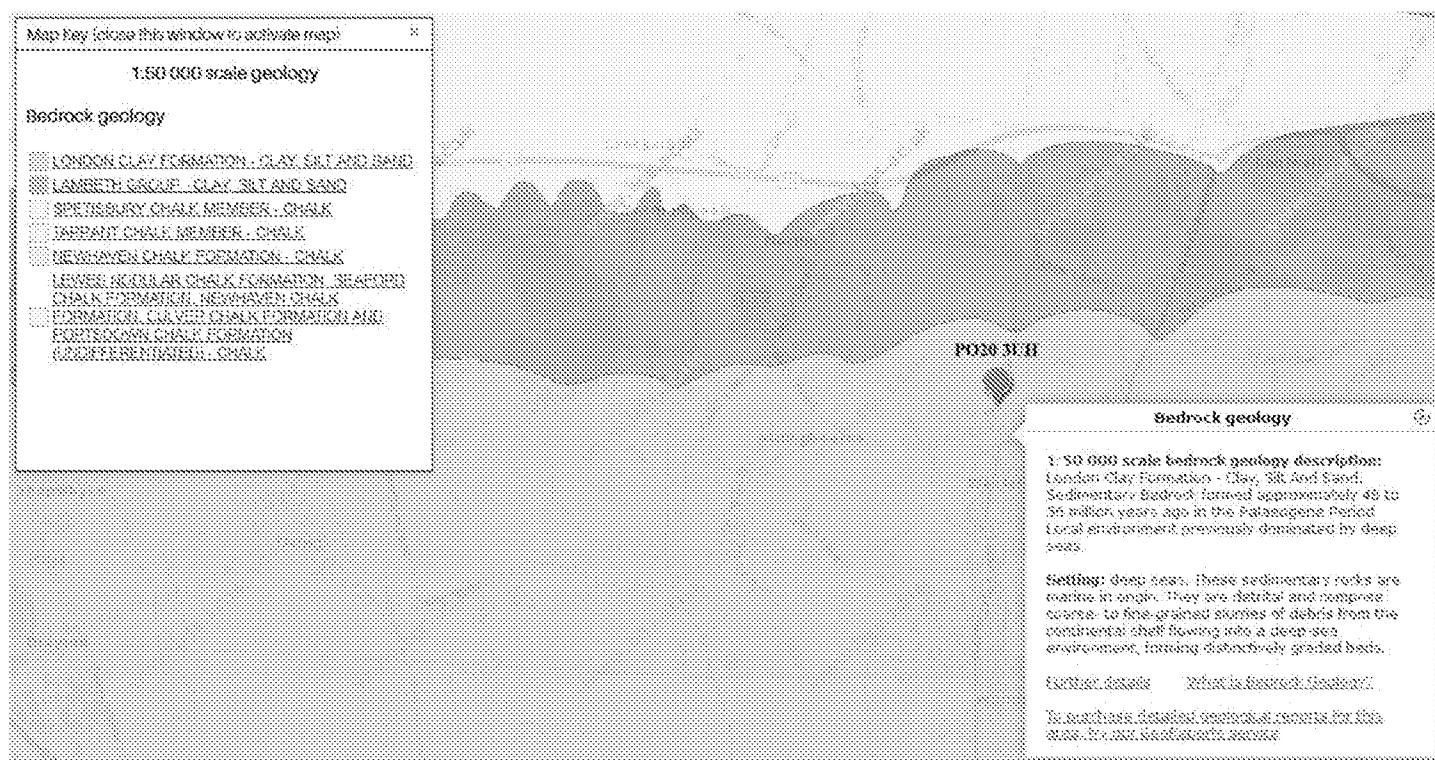


Figure 2. BGS Geology of Britain Viewer – Bedrock Geology

1.3.3 Superficial Deposits are recorded as 'Head – Gravel, Sand, Silt and Clay' as demonstrated in **Figure 3**.

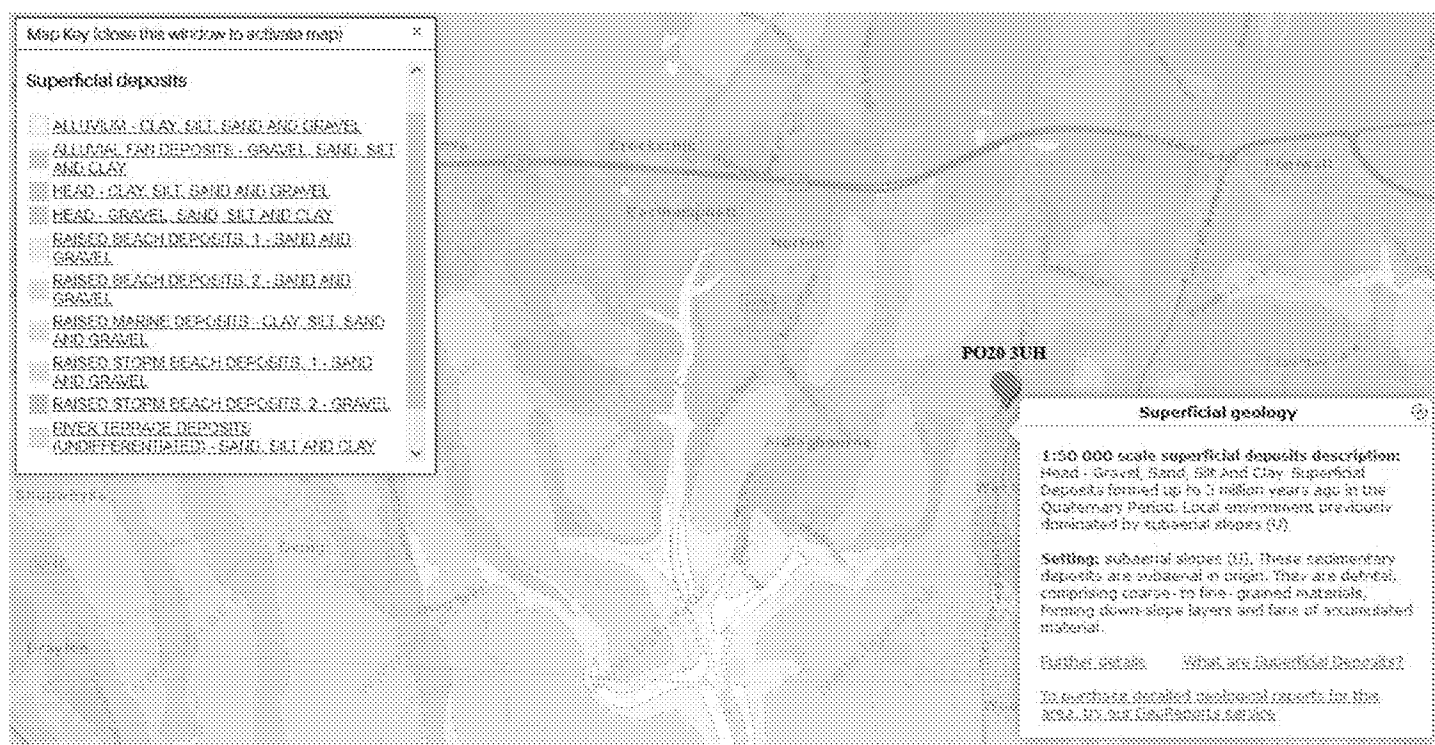


Figure 3. BGS Geology of Britain Viewer – Superficial Deposits

1.3.4 The BGS website provides access to the National Geoscience Data Centre's collection of onshore scanned boreholes, shafts and well records. In the absence of site-specific investigation, these records have also been referred to. **Figure 4**, below, demonstrates the locations of these boreholes.

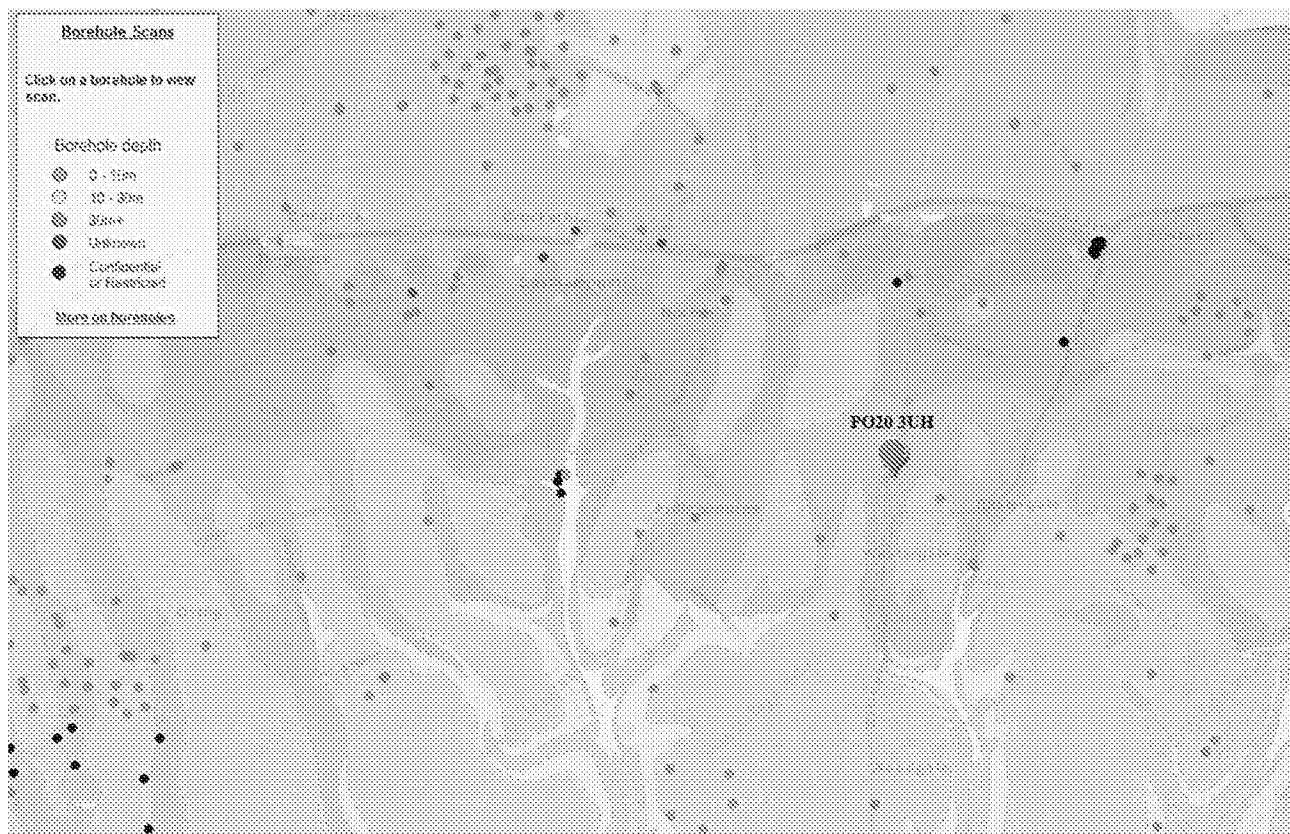


Figure 4. National Geoscience Data Centre Borehole Records (BGS)

- 1.3.5 As is evident from **Figure 4**, there are no boreholes located within the immediate vicinity of the site, specifically which fall within the same geological classification(s) as detailed in 1.3.2 and 1.3.3. The nearest borehole which falls within the same geological classification is located approximately 0.60km south-west of the site, as demonstrated in **Figure 5**.

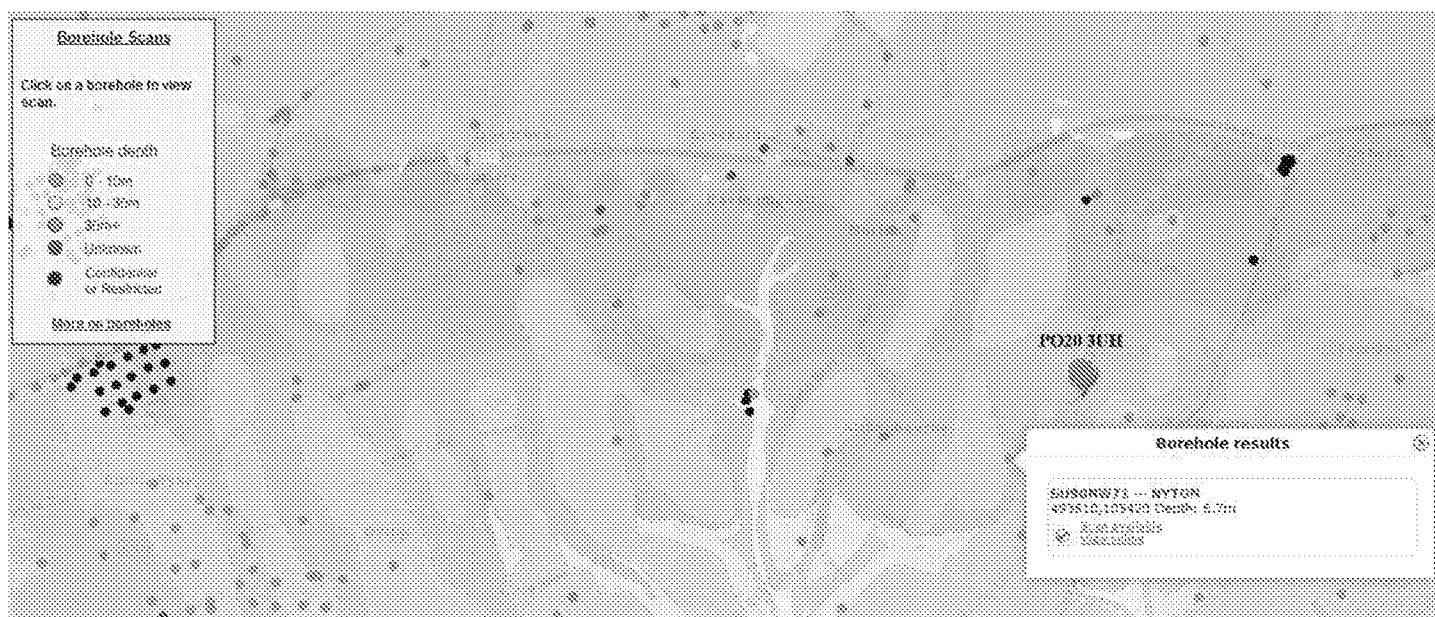


Figure 5. National Geoscience Data Centre Borehole Records (BGS)

- 1.3.6 The borehole in question (SU90NW71) has a recorded depth of 6.70m. The recorded geology is consistent with the anticipated strata, confirming 'Head Gravel' to depths of up to 4.40m below ground

level, in addition to 'London Clay' (5.70m to 6.70m below ground level). 'Raised Beach Deposits' were also encountered, at depths ranging from 4.40m to 5.70m below ground level.

- 1.3.7 Groundwater was encountered at a depth of 3.40m below ground level, with the surface level recorded as 11.60m AOD, which is at broadly the same level as the site. The works were undertaken in August, however, when it would be expected that groundwater levels would not be at their peak.
- 1.3.8 A copy of the BGS records reviewed can be found within **Appendix C** of this report.

1.4 Groundwater

- 1.4.1 Winter groundwater monitoring has not yet been undertaken at the site.
- 1.4.2 The borehole records reviewed in Section 1.3 'Ground Conditions' identified groundwater at a depth of 3.40m below ground level (at 8.20m AOD) although the investigative works were undertaken during a seasonally dry month (August), therefore not likely representing 'peak' groundwater levels.
- 1.4.3 In acknowledgement of nearby development within the immediate vicinity of the site, it is noted that information relating to groundwater investigation is publicly available on the Arun District Council Planning Portal, which has been referred to. It is acknowledged, however, that this information cannot be relied upon in the design of site-specific drainage proposals for the development for which this Flood Risk Assessment and Drainage Strategy has been prepared in relation to, although provides steer.
- 1.4.4 It is noted that groundwater was recorded at depths in the range of 600mm to 800mm below ground level within the immediate vicinity of the site.
- 1.4.5 In consultation with Arun District Council's Drainage Officers, it has been stated that 'Groundwater has a significant contribution to flooding in this area'.
- 1.4.6 Site-specific groundwater investigation and subsequent monitoring shall be undertaken during the winter period spanning from October to March in order to validate drainage proposals prepared for the site.
- 1.4.7 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.
- 1.4.8 The site is located within an 'Unproductive' Bedrock aquifer, as confirmed in **Figure 6**, and a 'Secondary A' bordering a 'Secondary (undifferentiated)' Superficial Drift aquifer as shown in **Figure 7**.

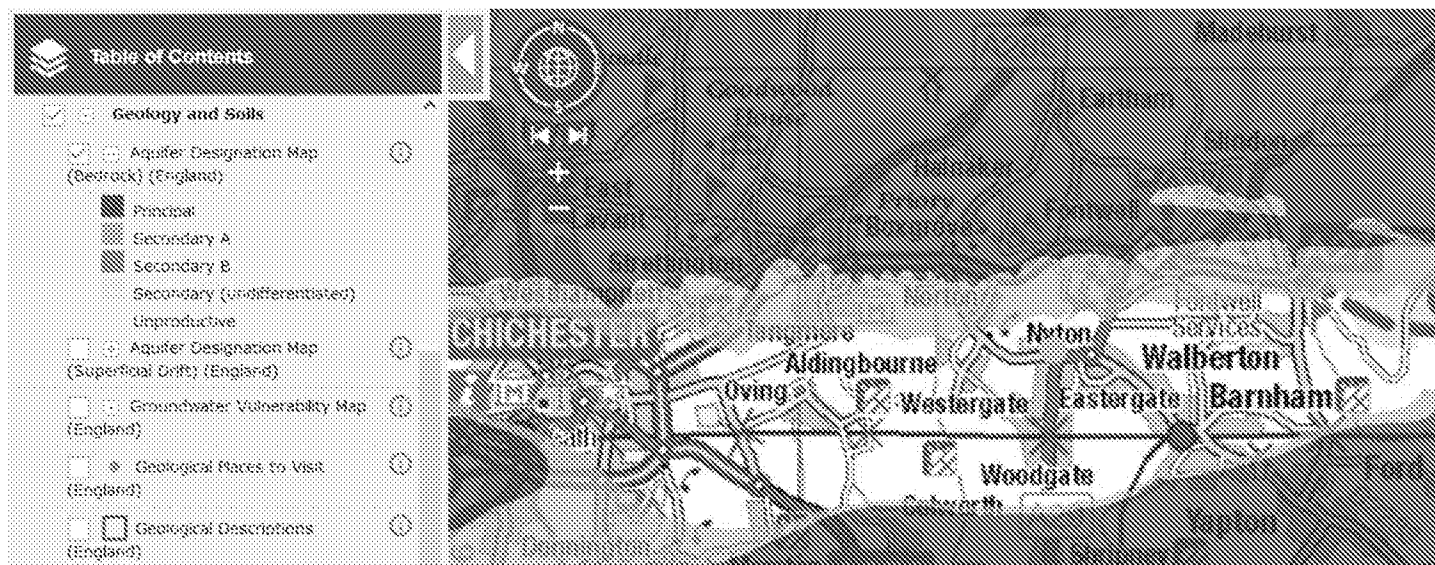


Figure 6. DEFRA - Bedrock Aquifer Designation Map

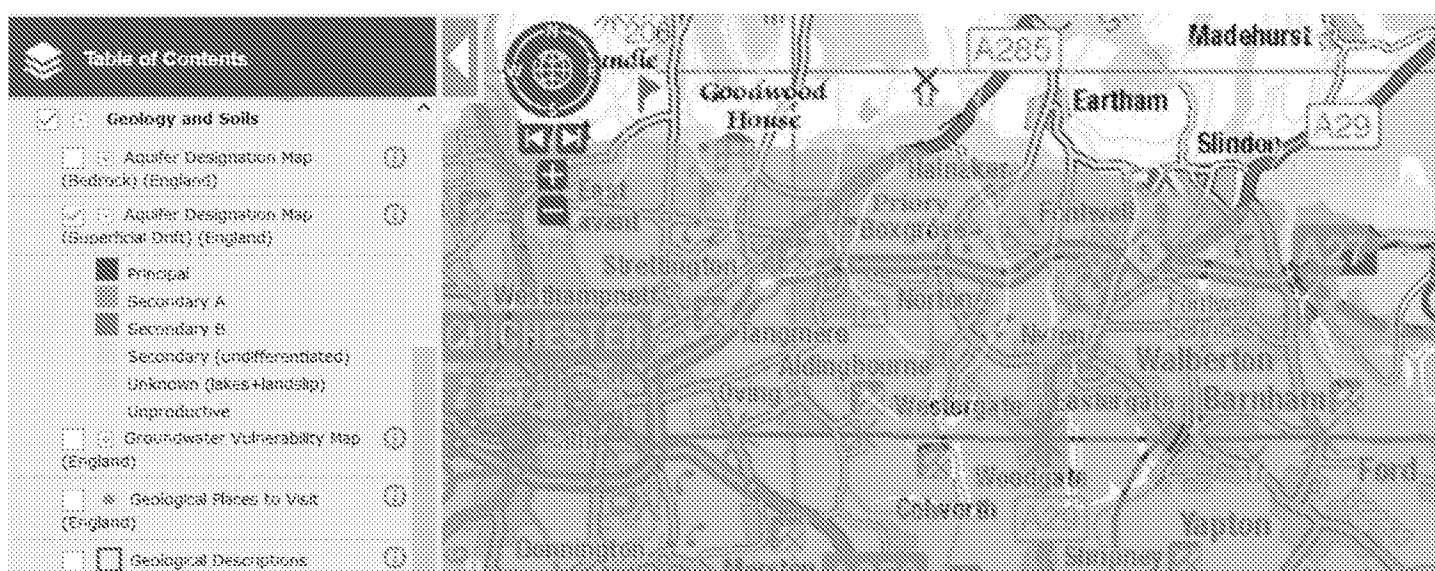


Figure 7. DEFRA – Superficial Drift Aquifer Designation Map

- 1.4.9 'Unproductive' aquifers are, largely, unable to provide usable water supplies, whilst 'Secondary A' aquifers are aquifers that comprise permeable layers that can support local water supplies and can also form an important source of base flow to rivers. 'Secondary (undifferentiated)' aquifers demonstrate variable characteristics and cannot be further defined.
- 1.4.10 The Groundwater Vulnerability Map (**Figure 8**) confirms that the site falls within a 'Low' Groundwater Vulnerability Zone. Such areas provide the greatest level of protection to groundwater from pollution, owing to the low-leaching characteristics of the associated soils.

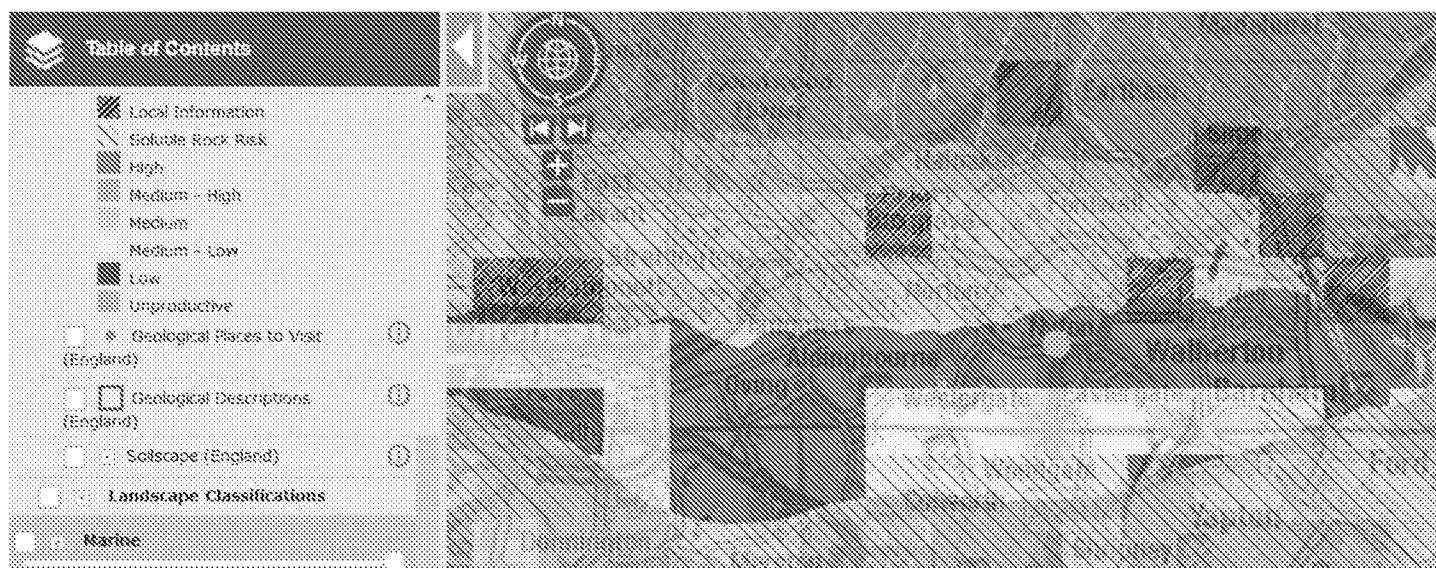


Figure 8. DEFRA Groundwater Vulnerability Map

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

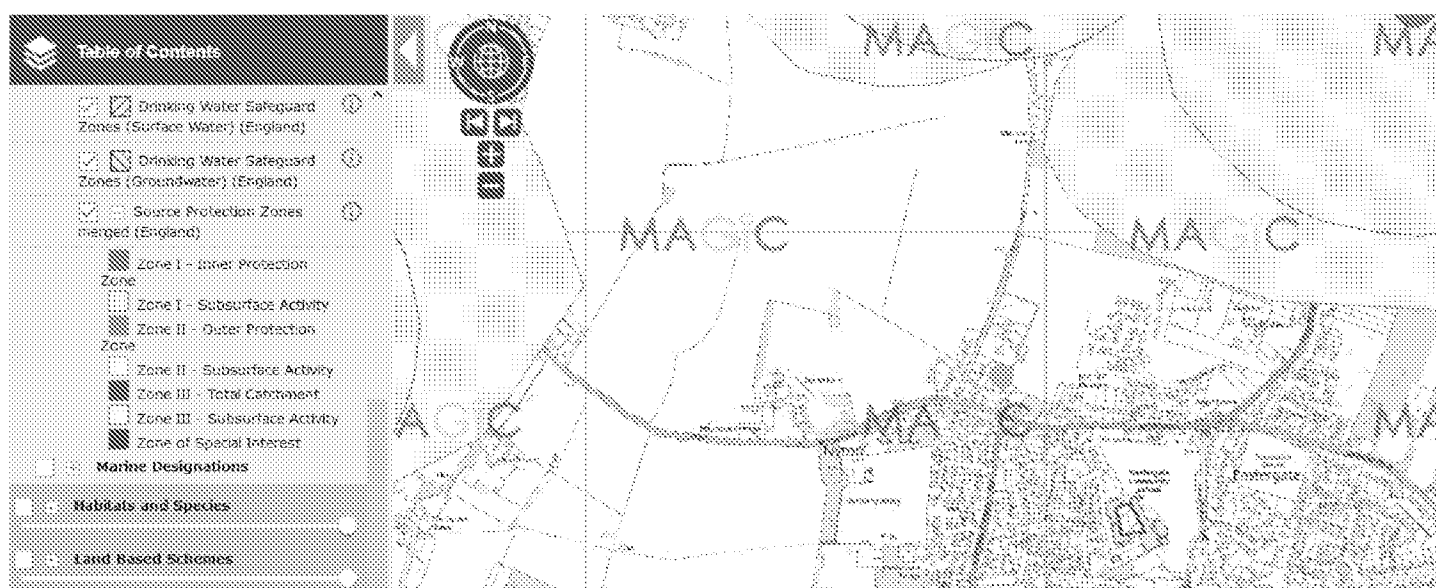


Figure 9. DEFRA Drinking Water Safeguard Zones and Source Protection Zone Map

1.5 Existing Drainage

1.5.1 The local Water Authority is Southern Water, who provide sewerage services within the area. Public sewer records have been obtained from Southern Water, as contained within this report in **Appendix D**.

1.5.2 Surface Water:

- i. The Southern Water public sewer records (**Appendix D**) show no public surface water sewers within the immediate vicinity of the site.

- ii. The nearest public surface water sewer is located south of the site, located in the carriageway of B2233, with a recorded depth of 960mm.
- iii. There is no existing formal drainage arrangement at the site where the proposed dwelling is to be located.
- iv. Run-off is understood to follow the natural topography, with infiltration also occurring, with the surrounding Main River and ordinary watercourse network offering the predominant means of surface water drainage in the local vicinity. It is understood that, downstream, the watercourse network communicates with the public sewer network.
- v. As already confirmed, a watercourse exists beyond the eastern boundary of the site which falls to the south. The adjacent developer, Taylor Wimpey, has recently undertaken works in relation to this watercourse, including upgrade works to the culvert at the access to Elderberry House (neighbouring property).
- vi. Greenfield runoff rate (Qbar) has been calculated to be 0.2l/s based on the site area of 916m². An assessment as to the run-off rate of the proposed positively drained area is confirmed within Section 3 – 'Proposed Development'.

1.5.3 Foul Water:

- The Southern Water public sewer records (**Appendix D**) show a 150mm dia. public foul water sewer located in Northfield Lane, falling in a southerly direction. This sewer diverts to the east along the boundary of 'The Croft' and 'Orchard Cottage', to the unnamed road off of which the proposed dwelling is to be constructed. The nearest point of connection (MH9602) has a recorded depth of 1.70m (invert level 9.13m AOD).

1.5.4 Highway Drainage:

- vii. Northfield Lane, to the west of the site, drains 'over the edge' to the adjacent verge, with run-off also being captured by the ordinary watercourses alongside the road.
- viii. The unnamed road off which the proposed property is to be constructed also drains 'over the edge', with no formal road gullies and/or piped network evident. The ordinary watercourse network provides the primary means of surface water drainage.
- ix. Arun District Council has confirmed that the adjacent Taylor Wimpey development will be undertaking improvement works to the ditch to the east of the proposed development in conjunction with wider construction works associated with that development. The client has confirmed that the culvert upgrade works at the access to Elderberry House have already been completed.

2 PROBABILITY

2.1 Sources of Information

2.1.1 The NPPF requires that all sources of flooding are considered being Tidal, Fluvial, Pluvial, Groundwater, Sewers and Man-made reservoirs/canals.

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

- Environment Agency Flood Maps for Planning
- Long Term Flood Risk Assessment Surface Water Flood Risk Maps
- Long Term Flood Risk Assessment Reservoir Flood Risk Maps
- Arun District Council/West Sussex County Council Strategic Flood Risk Assessments
- Consultation with Arun District Council (LPA) and West Sussex County Council (LLFA)

2.2 Flood Maps and Modelling

2.2.1 Flood Maps for Planning confirms that the site is located predominantly in Flood Zone 2, although the proposed access falls within Flood Zone 3. The extents of Flood Zone 3 have been confirmed as being classified as Flood Zone 3a, following review of the Arun District Council Strategic Flood Risk Assessment.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. 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 10. Flood Maps for Planning (Gov.uk)

- 2.2.2 In light of the site's flood zone classification, Product 4 data has been obtained from the Environment Agency. The Product 4 data can be found, in full, in **Appendix E**.
- 2.2.3 The Product 4 data demonstrates that the site is susceptible to flooding in the 0.1% AEP defended and undefended fluvial scenarios as per the modelled flood mapping provided (Flood Zone 2). The proposed access is susceptible to flooding in the 1% defended and undefended fluvial scenarios as demonstrated by the same mapping (Flood Zone 3).
- 2.2.4 The defended and undefended fluvial modelled flood outlines inclusive climate change mapping also supplied demonstrates increased susceptibility to the site in the 1% AEP + 45% and 1% AEP +105% undefended fluvial scenarios.
- 2.2.5 Modelled flood levels have been provided by the Environment Agency as part of the Product 4 response issued. In total, 2 No. nodes with associated levels have been provided. All levels are stated as having been taken from the Aldingbourne Flood Risk Mapping Study, completed in 2015 by JBA Consulting (Defended only), plus climate change allowances (2016).
- 2.2.6 The modelled flood level data provided by the Environment Agency is summarised, below;

Water Levels: Fluvial Undefended

Node Ref	NGR		Modelled Flood Levels in Metres AOD					
			Undefended Annual Exceedance Probability					
	Eastings	Northings	5%	1%	1% +CC (35%)	1% +CC (45%)	1% +CC (105%)	0.1%
1	493891	105690	-	-	-	-	11.81	-
2	493903	105685	-	-	-	-	11.85	-

Water Levels: Fluvial Defended

Node Ref	NGR		Modelled Flood Levels in Metres AOD					
	Eastings	Northings	Defended Annual Exceedance Probability					
			5%	1%	1% +CC (35%)	1% +CC (45%)	1% +CC (105%)	0.1%
1	493891	105690	-	-	-	-	11.81	11.77
2	493903	105685	-	-	-	-	11.85	11.83

- 2.2.7 The modelled flood level data confirms a level of 11.85m AOD in both the defended and undefended 1% AEP + 105% CC fluvial event.
- 2.2.8 When the modelled flood levels are considered in comparison to the topographical survey levels, there is potential for flooding to occur to depths of up to 371mm, based on the lowest level on site of 11.479m (south of the proposed dwelling).
- 2.2.9 The Long-Term Flood Risk Map for Rivers or the Sea (**Figure 11**) indicates the site and immediate surrounding areas are deemed to be at 'Medium' risk of flooding from such sources. A 'Medium' risk is defined as a 1% to 3.3% chance of flooding from such sources each year.



Figure 11. Long-Term Flood Risk Map – Rivers or the Sea (Gov.uk)

- 2.2.10 The Long-Term Flood Risk Map for Surface Water indicates a 'Very Low' to 'Low' risk of surface water flooding to the site, although within close proximity of areas defined as being at 'Medium' to 'High' risk of surface water flooding, as demonstrated in **Figure 12**. 'Very Low' risk areas carry a chance of flooding of less than 0.1% each year, whilst 'Low' risk is defined as 0.1% to 1% each year.

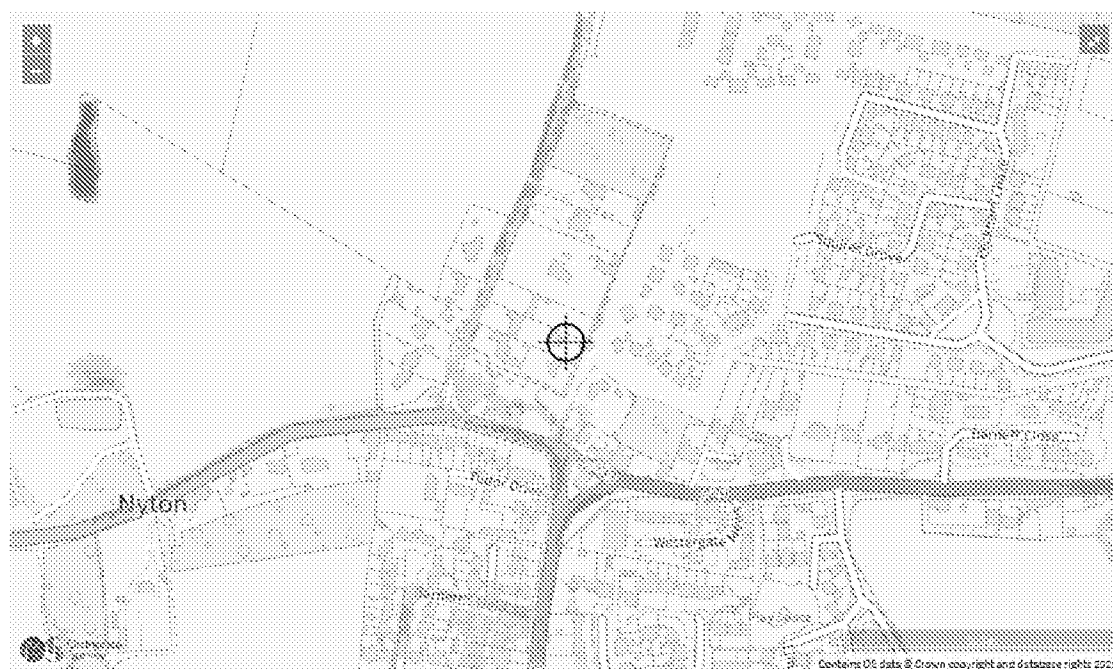


Figure 12. Long-Term Flood Risk Map – Surface Water (Gov.uk)

2.2.11 **Figures 13, 14 and 15** demonstrate the anticipated depths of surface water flooding in 'High', 'Medium' and 'Low' risk scenarios. The areas deemed to be at 'High' risk of surface water flooding have indicated depths of flooding of 'Below 300mm'. 'Medium' risk scenarios demonstrate isolated extents where anticipated depths of flooding increase, to '300 to 900mm', whilst in 'Low' risk scenarios the extents of flooding in the range of 'Below 300mm' to '300mm to 900mm' are increased.



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

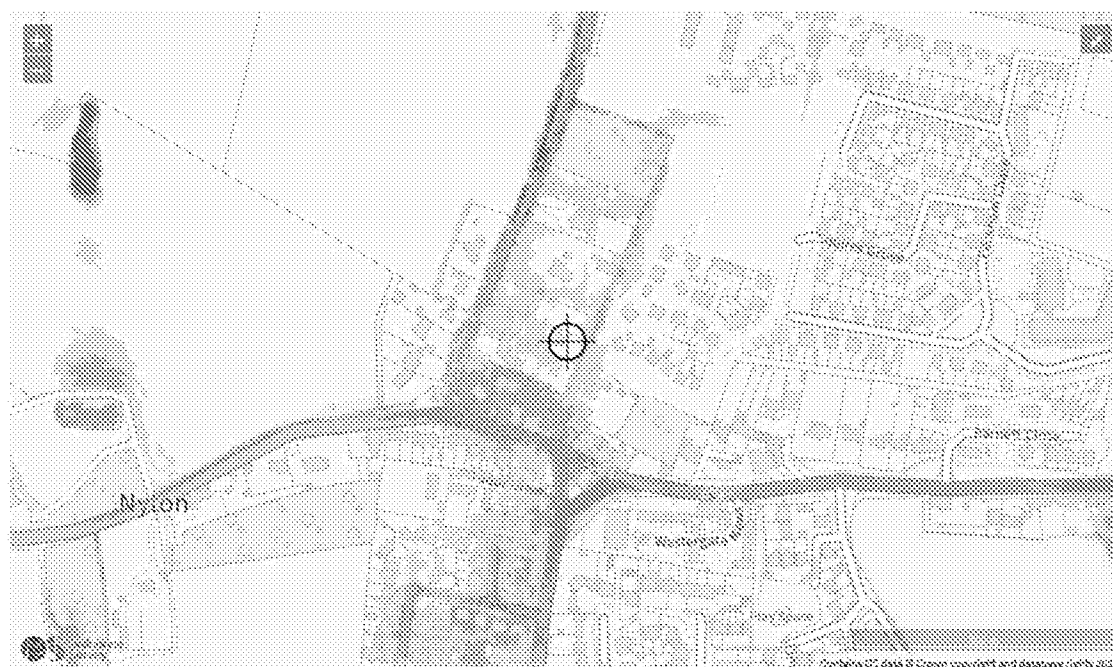


Surface water flood risk: water depth in a medium risk scenario

Flood depth (millimetres)

Over 900mm 300 to 900mm Below 300mm Location you selected

Figure 14. Long-Term Flood Risk Map – Surface Water; 'Medium' Risk Scenario (Gov.uk)



Surface water flood risk: water depth in a low risk scenario

Flood depth (millimetres)

Over 900mm 300 to 900mm Below 300mm Location you selected

Figure 15. Long-Term Flood Risk Map – Surface Water; 'Low' Risk Scenario (Gov.uk)

2.2.12 The site is not shown to be at risk of flooding from reservoirs.

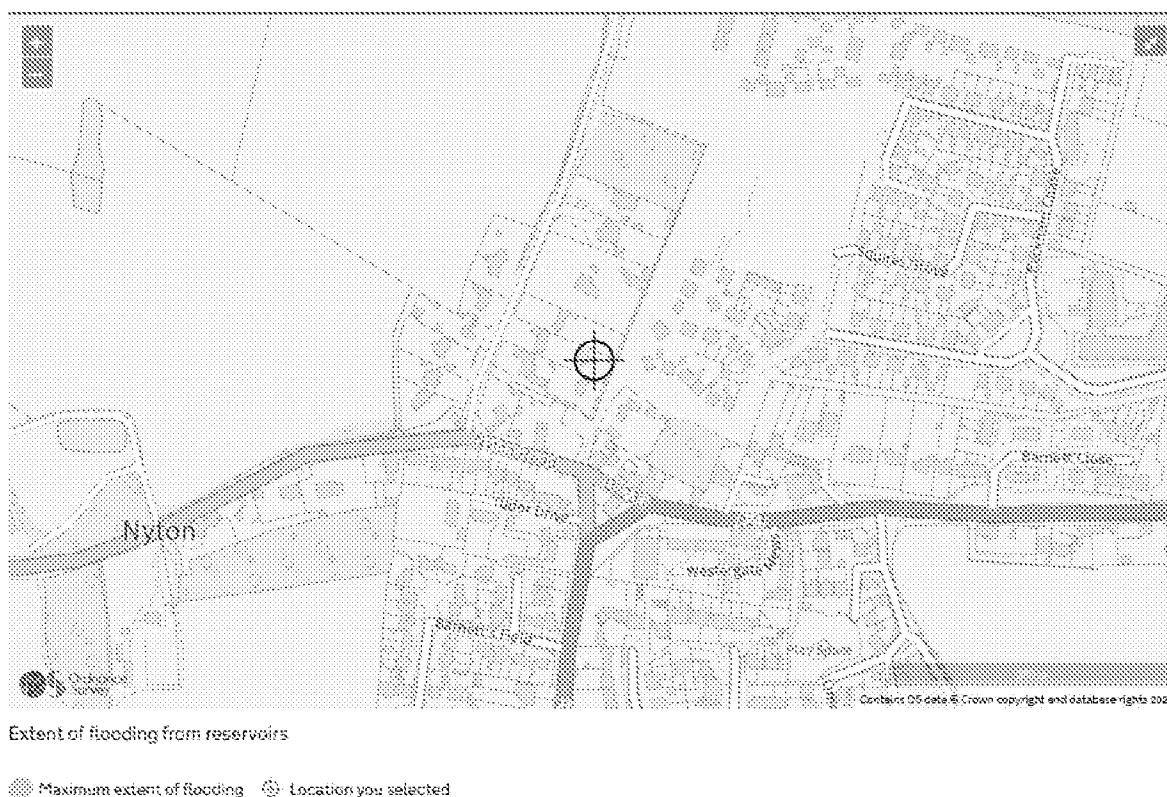


Figure 16. Long-Term Flood Risk Map – Reservoirs (Gov.uk)

2.3 Strategic Flood Risk Assessment

- 2.3.1 Arun District Council has published a Level 1 Strategic Flood Risk Assessment, dated August 2016.
- 2.3.2 The SFRA confirms that 8 No. properties flooded in Northfield Lane in February 2014. In consultation, Arun District Council Engineers confirm that it is not known whether flood water entered any of the properties.
- 2.3.3 Mapping contained within the SFRA confirms that the site is located in Flood Zone 3a.
- 2.3.4 Additional mapping confirms that the site and wider area is deemed to be highly susceptible to groundwater flooding (>75%), a fact reaffirmed by Arun District Council Engineers, who have confirmed that groundwater has a significant contribution to flooding in the area.
- 2.3.5 As the site falls within Flood Zone 2, with the access passing through Flood Zone 3, a Sequential Test is required. This has been undertaken by Neame Sutton Chartered Town Planners.
- 2.3.6 Extracts and mapping from the Arun District Council SFRA can be found, along with correspondence with Arun District Council Engineers, within **Appendix F**.

2.4 Historic Flooding

- 2.4.1 As confirmed in 2.3.2, it is noted that flooding has occurred in Northfield Lane and the surrounding areas historically.
- 2.4.2 8 No. properties are confirmed as having been affected by flooding associated within groundwater in February 2014.
- 2.4.3 As part of the Environment Agency's Product 4 response, it has been confirmed that the Environment Agency do not hold any records affecting the site directly, although acknowledge their records are not comprehensive, as the Lead Local Flood Authority's or Local Planning Authority's are recognised as being.
- 2.4.4 Despite the Environment Agency holding no records of historic flooding affecting the site directly, a nearby event was recorded in the area in 1060 (Flood Event Code: 1977). The source of flooding was 'drainage' related.

2.5 Lidsey Surface Water Management Plan

- 2.5.1 The site is covered by the Lidsey Surface Water Management Plan, falling within Southern Water's Lidsey Wastewater Treatment Works (WWTW) Catchment.
- 2.5.2 The Lidsey SWMP makes reference again to historic groundwater flooding within the area.

2.6 Summary of Flood Risk

2.6.1 The potential sources of flooding are:

Source of Flooding	Level of Risk
Rivers and Coastal	'Medium' The site is located predominantly within Flood Zone 2, although the proposed access falls within Flood Zone 3. The Long-Term Flood Risk Map for Rivers or the Sea indicates that the site and surrounding areas is deemed to be at 'Medium' risk of flooding from such sources. There is a 'Main River' in Northfield Lane, along the western side of the road. It is stated in the Lidsey SWMP that when this river overtops, it overloads the adjacent land drainage system, and is also exacerbated by high groundwater levels.
Surface Water	'Very Low' to 'Low' The Long-Term Flood Map for Surface Water indicates the site as being at 'Very Low' to 'Low' risk of flooding from surface water, although within the vicinity of areas deemed to be at increased risk ('Medium' to 'High' risk). The topographical survey levels provided indicate fall to the east/south-east, away from the proposed dwelling/site. Improvements are proposed in relation to the watercourse to the east, to be undertaken by the adjacent developer. Improvements (upgrade works) have already been completed in relation to the culvert at Elderberry House.
Groundwater	'High' Groundwater is identified as contributing heavily towards flooding in this location, with mapping suggesting the site is heavily susceptible to groundwater flooding, as per mapping contained within the Arun District Council SFRA. Historic flooding, linked to groundwater, has also been recorded nearby. Groundwater also impacts upon the nearby 'Main River', which in turn can overtop and then place additional strain on the surrounding land drainage network.

Sewers	'Low' It is understood the that local drainage network (ordinary watercourse) discharges to the Southern Water public sewer network to the south of the site. There are no known instances of sewer flooding within this location, therefore the risk of sewer flooding is deemed to be 'Low'.
Artificial Sources	None The site is not shown to be at risk of flooding due to artificial sources.

- 2.6.2 The site is most susceptible to groundwater flooding of all of the sources assessed. It is acknowledged that groundwater issues impact upon flooding from other sources. The 'Main River' in Northfield Lane is impacted by fluctuating groundwater levels, and if/when the river overtops, this has a detrimental impact upon the ordinary watercourse network which provides land drainage functionality within the vicinity of the site.
- 2.6.3 The drainage system for the proposed development shall be designed to provide capacity up to the design event and also consider potential exceedance routes, as so not to increase the risk of flooding on-site, or off-site. The constraints associated with the risks of flooding from the sources assessed shall also be considered in preparing a suitable drainage system.

3 PROPOSED DEVELOPMENT

3.1 Description of Development

- 3.1.1 The proposed development will involve the construction of a single residential property, to the rear of the existing property, 'Green Gables'. The proposed development is demonstrated in the architectural development proposals contained 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 2 (Flood Risk and Coastal Change Table 3). The proposed access will require traversing an area designated as Flood Zone 3.

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

- 3.1.3 The proposed development will increase the areas of hardstanding impermeable surfacing at the site, however, the introduction of SuDS 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 area has been determined to be 170m² (0.02Ha).
- 3.1.5 The above stated post-development impermeable area represents a negligible increase of 8m² – less than 5%.
- 3.1.6 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.
- 3.1.7 The specific Surface Water and Foul Water drainage proposals are detailed in **Section 4** of this report.

4 SEQUENTIAL AND EXCEPTION TESTS

4.1 Sequential Test

- 4.1.1 The site falls predominantly within Flood Zone 2, although the access will be located within Flood Zone 3, therefore meaning that a Sequential Test should be undertaken.
- 4.1.2 The site has been set out sequentially as so to position the building wholly within Flood Zone 2 and located within an area of the site at the highest point of elevation possible.
- 4.1.3 A Sequential Test has been undertaken by Neame Sutton Chartered Town Planning Consultants which has concluded that there are no suitable alternative sites available which are at a lower risk of flooding (i.e. located within Flood Zone 1).

4.2 Exception Test

- 4.2.1 Table 3 within Paragraph 067 of Flood Risk and Coastal Change confirms that developments classified as "More Vulnerable" require an Exception Test for Flood Zone 3a. Parts of the proposed development site fall within Flood Zone 3a, specifically the proposed access.
- 4.2.2 Paragraph 164 of NPPF confirms that the Exception Test should be informed by a strategic or site-specific flood risk assessment, and that two parts of the test apply. Both elements of the Exception Test should be satisfied for development to be allocated or permitted;
 - i. The development would 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.
- 4.2.3 At present, Arun District Council is unable to demonstrate that it is able to fulfil its 5 Year Housing Land Supply, meaning that the provision of this additional single dwelling will provide wider sustainability benefits to the community.
- 4.2.4 In view of the risk(s) of flooding to the site, and the flood zone classification (Flood Zone 2 and 3) mitigation is proposed to ensure that the development is safe for its lifetime, without increasing flood risk elsewhere, and reducing flood risk overall. Full details of the mitigation proposed are detailed within Section 6 – 'Residual Risk and Mitigation'.

5 PROPOSED DRAINAGE STRATEGY

5.1 Surface Water

5.1.1 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	No	Not suitable in view of client's development proposals.
Basins and Ponds (such as Wetlands, Balancing Ponds, Detention Basins, Retention Ponds)	No	Proposed arrangement unlikely to allow the inclusion of such features, whilst also not realistically in keeping with the size and scale of the development (1 No. unit).
Filter strips and swales	Yes	No initial constraints identified.
Infiltration Devices - Soakaways - Infiltration trenches and basins	No*	Groundwater is acknowledged as being present at shallow depths (likely to be 600mm to 800mm below ground level), although monitoring is yet to be undertaken at the site. It is not anticipated that infiltration will be viable given the shallow depths at which groundwater is understood to be present at.
Permeable surfaces and filter drains (such as gravelled areas and porous block paving)	Yes	Although infiltration may not be viable, it may be possible to introduce such measures (permeable surfacing) in order to provide shallow attenuation, if tanked.

Tanked systems (such as oversized pipes or cellular tanks)	Yes	No initial constraints, although highest ranking options in terms of drainage hierarchy should be considered as a priority.
--	-----	---

- 5.1.2 Although it is anticipated that groundwater will be present at shallow depths, the use of infiltration methods and techniques shall still be implemented where constraints will allow.
- 5.1.3 It is proposed that a 'hybrid' solution will be introduced to serve the new dwelling.
- 5.1.4 With groundwater assumed at a depth of 600mm to 800mm below ground level (winter monitoring is to be undertaken to confirm this) it is proposed that the access drive will be of 'free draining' gravel construction, serving its own area only. It is proposed that the drive will be left to infiltrate.
- 5.1.5 The roof and remaining areas of hardstanding will be served by a shallow cellular (tank) storage system, with a controlled discharge to the watercourse to the front (east) of the proposed dwelling.
- 5.1.6 It is proposed that a Permavoid 'tank' (or similar) measuring 8.00m x 2.00m x 0.400m will be introduced providing a storage volume of 6.08m³ (based on 95% voids).
- 5.1.7 The provision of a Permavoid 'tank' will allow storage to be provided with minimum cover depths where vehicular loading will occur, as is required given the shallow nature of the system, dictated by the outfall depth (ordinary watercourse). If alternative solutions are to be sought, minimum cover depths and loading shall be required in relation to alternative products, to ensure compliance.
- 5.1.8 Flows will be restricted to a rate of 2l/s in order to reduce blockage within the system.
- 5.1.9 The connection to the adjacent watercourse will be subject to Ordinary Watercourse Consent from Arun District Council. Clearance works and additional improvements shall be considered as part of the post-planning Ordinary Watercourse Consent application, however must be co-ordinated with the works proposed by the adjacent developer (Taylor Wimpey).
- 5.1.10 The proposed surface water drainage arrangement is shown on drawing **D2008-PL-300 'Conceptual Drainage Strategy'**.
- 5.1.11 Allowances have been made for both climate change (40%) and urban creep (10%) with a 1-in-100-year storm event also being accommodated.
- 5.1.12 The strategy above will ensure that there is no increase in the rate of run-off leaving the site, therefore no increase in the risk of flooding from this source.

5.2 Treatment

- 5.2.1 The use of permeable, free-draining gravel construction for the drive will ensure that the associated run-off will receive a level of treatment required by the SuDS manual, with hydrocarbons being filtered by the aggregate layer(s).
- 5.2.2 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).
- 5.2.3 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.

5.2.4 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).

5.2.5 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

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

- Permeable Gravel Drive – TSS=0.7/M=0.6/H=0.7

5.2.7 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.

5.3 Foul Water Drainage

5.3.1 It is proposed that the new dwelling will connect to a dedicated foul water drain laid in the neighbouring property's rear garden (Elderberry House), which has downstream connectivity with Southern Water's public sewer network. This foul water drain is already in place.

5.3.2 Post development, there will be an estimated increase in peak foul water flows to 0.046 l/s (based on Design and Construction Guidance - DCG).

5.3.3 Recent 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.

5.4 Climate Change

5.4.1 In July 2021 the Environment Agency updated 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.

- 5.4.2 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%

- 5.4.3 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.

5.5 Urban Creep

- 5.5.1 The West Sussex County Council Lead Local Flood Authority Policy for the Management of Surface Water confirms the requirement where allowances for urban creep is concerned.
- 5.5.2 In view of Table 5.2 ('Impermeable Area Allowances for Urban Creep'), an allowance of 10% has been considered in relation to the proposed development.

6 RESIDUAL RISK AND MITIGATION

6.1 Residual Risk

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

- i. Flooding of buildings within flood zone
- ii. Increased flow through watercourses as a result of climate change causing flooding to the site
- iii. Blockage of watercourses as a result of debris or otherwise, causing flooding to the site
- iv. Extreme rainfall events that exceed the design criteria used for the drainage system causing surface water flooding
- v. Blockage/failure of the proposed drainage system causing flooding to the site
- vi. Groundwater flooding to the site caused by groundwater levels exceeding the ground surface level
- vii. Surface water flooding of proposed buildings

6.2 Mitigation

6.2.1 Consideration has been taken to the residual risks stated in Section 6.1, and the following mitigation measures are proposed:

- i. The Environment Agency Product 4 response indicates that the maximum modelled flood level for the 1% + CC (105%) event is 11.85m AOD. In view of such, it is proposed that the FFL for the plot will be set at a minimum of 11.995m AOD. The FFL of the building will therefore be set above the modelled flood level, with freeboard (at least 145mm) meaning the development will be safe for its design life. Flood resilient construction methods are suggested, to further safeguard the property from potential future flooding.
- ii. As referred to above, the Environment Agency Product 4 response confirms a modelled flood level of 11.85m AOD for the 1% + CC (105%) event. The proposed FFL of the property will be set above this level – providing freeboard, at a minimum of 11.995m AOD. This will ensure that the development is safe for its design life. Additional flood resilient construction methods are suggested to provide further mitigation.

- iii. The adjacent developer has agreed improvements with Arun District Council in relation to watercourse located to the east of the proposed dwelling, whilst further improvements (including any necessary clearance works) shall be confirmed in relation to an Ordinary Watercourse Consent application to be submitted, post planning for this construction of the dwelling relating to this FRA. Section 8 – 'Maintenance' also confirms actions that shall be undertaken to mitigate the risk of blockage to the watercourse which could result in flooding, or an increased risk of flooding, at the site. The site should also be proactive in undertaking Riparian responsibilities in relation to the watercourse.
- iv. The drainage strategy has been developed to capture run-off up to a 1 in 100-year critical rainfall event, with 40% allowance for climate change as well as an allowance for urban creep (10%). However, should a more extreme rainfall event occur, there is the potential for the drainage system to be exceeded. The existing topography of the site has been reviewed and the existing overland flow routes assessed. Flows currently follow the existing topography – falling to east/south-east towards the watercourse. Existing and proposed drainage infrastructure should also be considered which can intercept run-off in an exceedance event, including gullies and channel drains.
- v. The proposed drainage system will attenuate and store run-off up to the design event. Blockage of the drainage system has the potential to cause flooding on the site. Surcharged flows will likely travel overland to the existing drainage system and watercourse, however maintenance measures proposed in Section 8 'Mitigation' will mitigate the risk of the system becoming blocked.
- vi. The site is known to fall within an area where groundwater, and associated flooding, is known to be prominent. Monitoring has not yet been undertaken at the site itself, although groundwater levels are anticipated as being present at shallow depths – at 600-800mm below ground level. Groundwater flooding would follow the natural topography at the site, falling away from the property to the east/south-east. The FFL of the property is also to be raised above the existing ground level – and modelled flood level, set at a level of at least 11.995m AOD.
- vii. The risk of surface water flooding is to be mitigated through the raising of the FFL above existing ground level but also above the modelled flood level of 11.85m AOD (FFL set at a minimum of 11.995m AOD). The topography of the site sees levels falling away from the proposed dwelling, whilst the current Long-Term Flood Risk Map for Surface Water indicated the site being at 'Low' to 'Very Low' risk of surface water flooding. The area of the site where the proposed dwelling is to be located is currently shown to be at 'Very Low' risk of surface water flooding.
- viii. Flood resilient construction methods are suggested to provide further mitigation and safeguarding in the event of flooding, such measures may include;
 - o Flood doors and/or flood barriers (where flood doors cannot be installed)
 - o Anti-flood airbricks
 - o Non-return valves on foul and surface water connection points
 - o Raised electrics
 - o Kitchens and bathrooms (where located at ground floor) to be installed using water resistant materials such as polymer boards and stainless steel
 - o Tiled floors where possible
 - o Closed cell insulation
 - o Raised appliances (including boilers and electricals)

7 FLOOD RISK MANAGEMENT

7.1 Safe Access and Egress

- 7.1.1 In order to access the site, persons will be required to traverse an area designated as Flood Zone 3. The proposed dwelling is located within Flood Zone 2.
- 7.1.2 It is not possible to provide a 'dry' route of escape in the event of flooding, and as such, this represents a residual risk.
- 7.1.3 Should flooding occur, and persons are able to leave the site, it is demonstrated that occupants can remain 'safe' within the property – the FFL of the house is to be set at least 145mm above the modelled flood level (11.85m – demonstrative of the 1% + CC 105% flood event). Ground floor levels would remain 'dry' above this level, whilst the upper floor(s) of the dwelling could also be utilised until a time when flood levels reside and it is safe to leave the property. It is not anticipated that the potential flood depths would impede emergency vehicle access.

7.2 Flood Warning

- 7.2.1 The site is at risk of fluvial and surface water flooding therefore there is a need for a Flood Evacuation Plan (FEP). This should consider the provision of a Flood Warning System.

8 MAINTENANCE

8.1 Proposed Maintenance Regime

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

8.1.2 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
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

8.1.3 Maintenance activities will be the responsibility of the owner/occupier of the new dwelling.

HydroBrake (Flow Control Chamber)

8.1.4 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.

8.1.5 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.

8.1.6 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

8.1.7 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.

Accidental Spillages

8.1.8 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.

- 8.1.9 Minor spillages of fuels and oils will be dealt with by the permeable gravel drive by bio-degrading and collecting the hydrocarbons respectively.

Future Alterations to the Development

- 8.1.10 Any future alterations to the development and specifically the drainage system should be confirmed by a specialist.

9 OFFSITE IMPACTS

- 9.1.1 The proposed development will not result in any increase in run-off from the site, and therefore will not cause an increase in flood risk off-site.
- 9.1.2 Attenuation will be provided to restrict the rate of run-off leaving the site.
- 9.1.3 Improvement works have been undertaken within the vicinity of the site in relation to the ordinary watercourse network by the adjacent developer (Taylor Wimpey). This has included the improvement (upgrade) of the existing culvert at the access to Elderberry House.
- 9.1.4 Post development foul water flows will contribute an increase within the public sewer network– it is expected that the foul sewer flow will be 0.046l/s. The responsibility is on the sewerage undertaker (Southern Water) to ensure that capacity exists in order to support new development though.
- 9.1.5 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 whilst urban creep and the potential for an increase in flows generated by the site has also been incorporated within the design considerations.

10 SUMMARY

- 10.1.1 This site-specific flood risk assessment and drainage strategy report is based on Environment Agency Flood Maps for Planning, Long-Term Flood Risk Maps, Arun District Council, West Sussex County Council and Southern Water Drainage Records and British Geological Survey Records.
- 10.1.2 The proposed development is located to the rear of the existing property, Green Gables, located on Northfield Lane in Westergate. The dwelling is to be located in the grounds (rear garden) of Green Gables.
- 10.1.3 The topographical survey demonstrates levels in the range of 11.875m AOD and 11.479m AOD, with falls prevailing to the east and south-east.
- 10.1.4 The proposed development will replace an existing swimming pool located within the rear grounds of Green Gables. The area is not understood to be served by any formal drainage infrastructure, with infiltration and overland run-off prevalent as a means of surface water disposal.
- 10.1.5 The site totals 916m² (0.09Ha), inclusive of the access drive which is partially constructed as this serves the neighbouring property (Elderberry House). This access drive is to be extended to provide access to the proposed dwelling.
- 10.1.6 The existing impermeable area totals 162m², following completion of the works, the impermeable area will amount to 170m².
- 10.1.7 The majority of the site is located within Flood Zone 2, including the proposed dwelling, although the proposed access route passes through Flood Zone 3.
- 10.1.8 There is a varying susceptibility to surface water flooding, ranging from 'Very Low' to 'Low', although within the wider area within the immediate vicinity of the site, there is an increased risk of flooding from this source (at a lower lying level), deemed to be 'Medium' to 'High' risk.
- 10.1.9 Groundwater monitoring has not yet been undertaken at the site, although it is anticipated that groundwater will be present at depths in the range of 600mm to 800mm below ground level. Groundwater and associated flooding are identified as being problematic within the local area.
- 10.1.10 It is proposed that the access drive will form a continuation of the neighbouring gravel construction, which will be 'free-draining'.
- 10.1.11 The roof area and remaining area(s) of hardstanding will be served by a Permavoid 'tank' (or similar) measuring 8.00m x 2.00m x 0.400m, with flows discharging to the adjacent ordinary watercourse.
- 10.1.12 Flows to the watercourse will be restricted to 2.00l/s.
- 10.1.13 Allowances have been made for both climate change (40%) and urban creep (10%).
- 10.1.14 Mitigation is provided in view of modelled flood levels, with the FFL to be set at a minimum of 11.995m AOD – 145mm above the 'peak' modelled flood level of 11.85m AOD (1% + CC 105% flood event).
- 10.1.15 The wastewater from the proposed development will discharge to the public foul sewer network, with connection arrangement to be confirmed subject to site investigation.
- 10.1.16 The completion of the development will not increase flood risk on or off-site.
- 10.1.17 In conclusion, this development is suitable with regards to flood risk and surface water drainage.



NOTES

A3

1.

This drawing is to be read in conjunction with all other BPC drawings, and with all relevant Architect's and Engineer's drawings and specification. Any discrepancies found are to be reported immediately to the Engineer.

2.

BPC 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.

PLANNING

This map is based on or reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the controller of Her Majesty's Stationary Office (c)
Crown Copyright. Licence Number: 100022432

This drawing is based upon Ordnance Survey mapping. Bright Plan Civils accept no liability for any inaccuracies with the data.

Original issue

27/09/2021

Rev.

Amendments

Date

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 enquiries@bpcivils.co.uk

Drawing Status

PLANNING

Client

Mr D. Tobin

Project

Green Gables, Northfields Lane,
Westergate, Chichester PO20 3UH

Drawing Title

Site Location Plan

Scale

1:500

Date

Sept. '21

Drawn By

SPB

Checked By

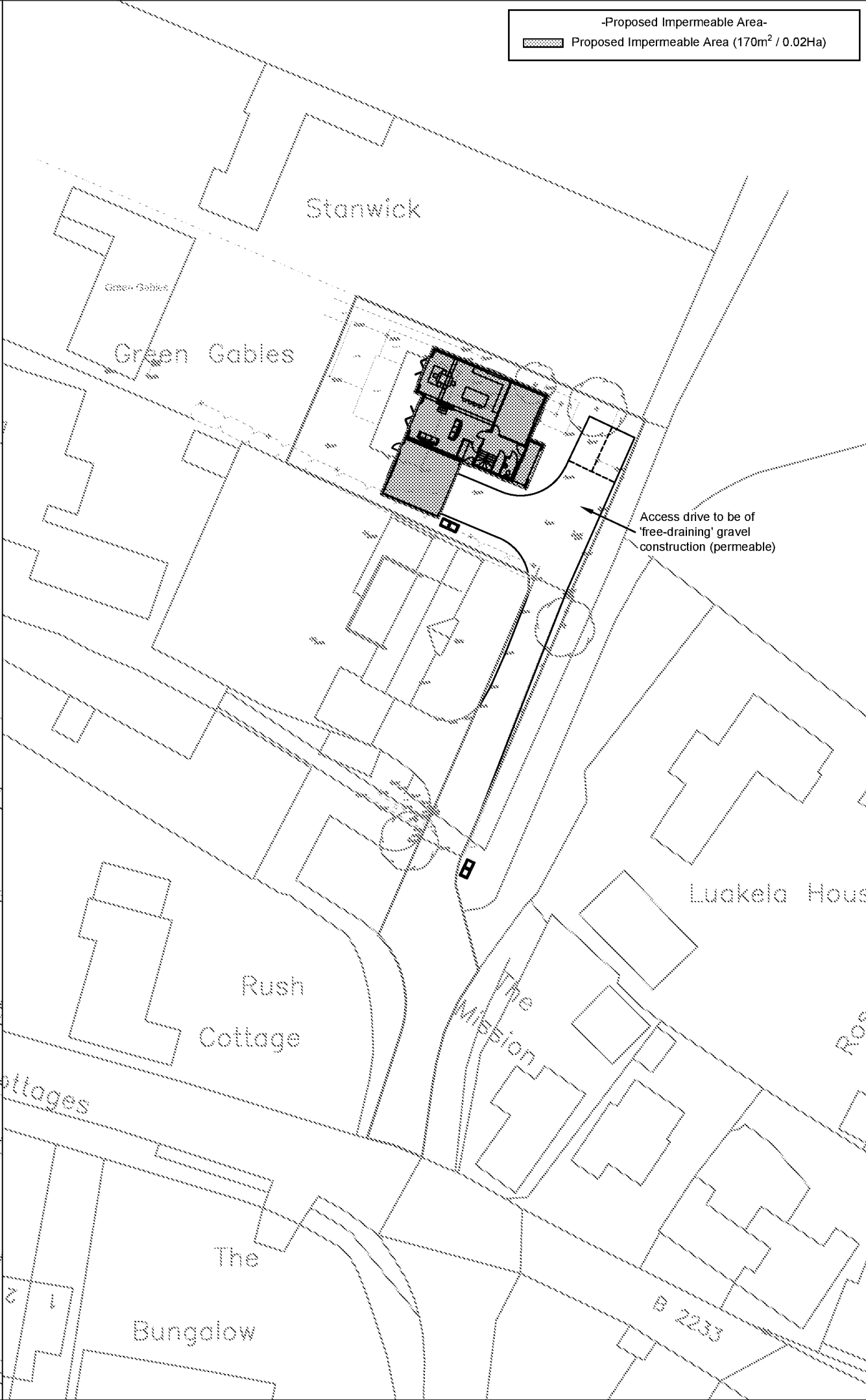
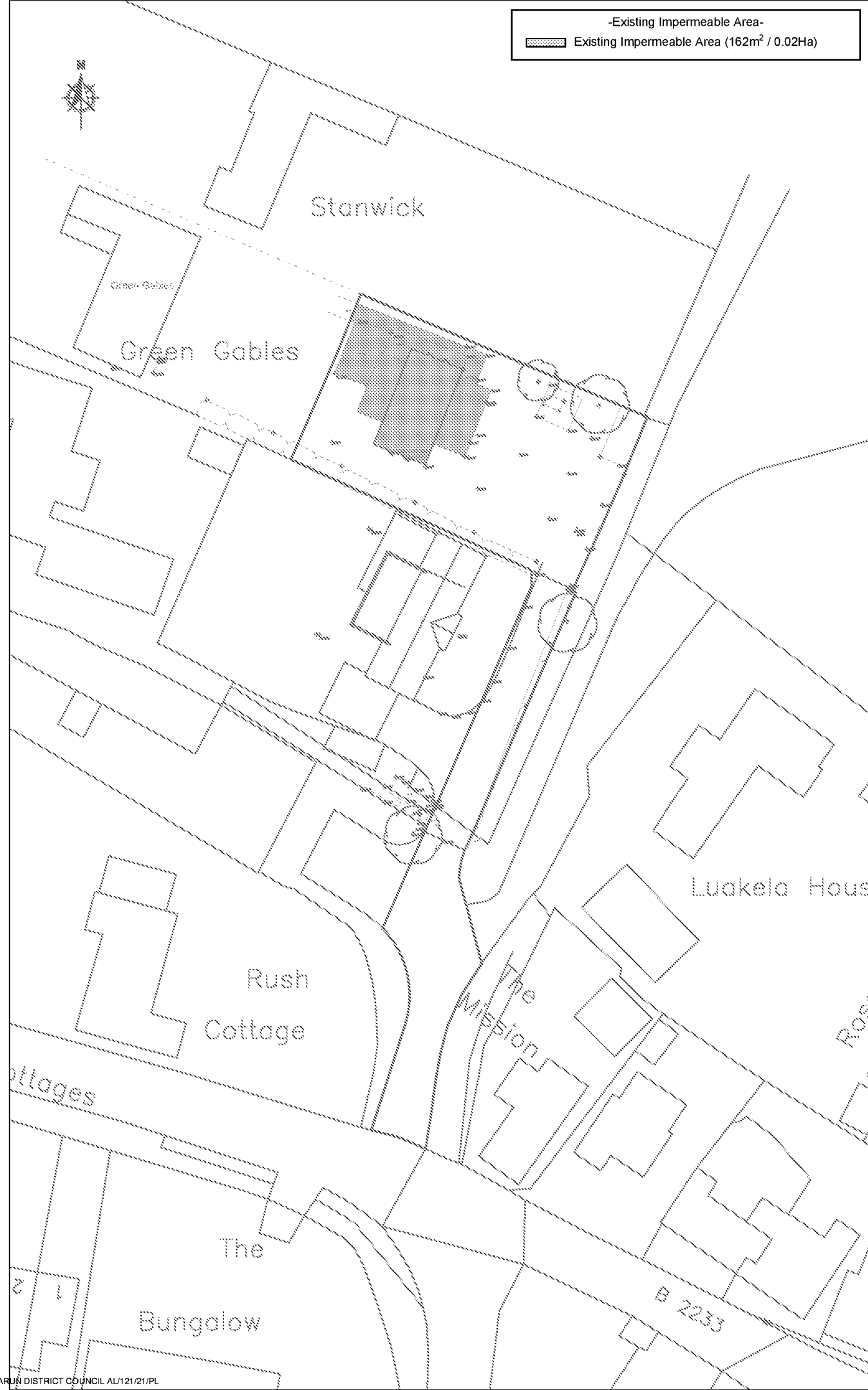
MJA

Drawing No.

D2008-PL-100

Rev.

-



NOTES

A3

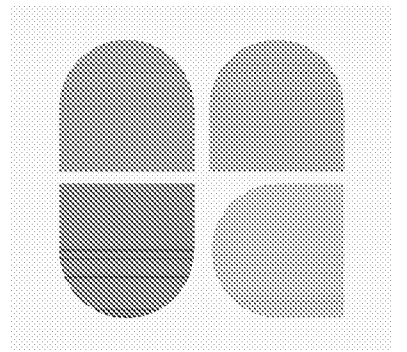
1. This drawing is to be read in conjunction with all other BPC drawings, and with all relevant Architect's and Engineer's drawings and specification. Any discrepancies found are to be reported immediately to the Engineer.
2. BPC accepts no responsibility for inaccuracies in data provided by third parties 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.

PLANNING

This map is based on or reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the controller of Her Majesty's Stationary Office (c)
Crown Copyright. Licence Number: 100022432

This drawing is based upon Ordnance Survey mapping. Bright Plan Civils accept no liability for any inaccuracies with the data.

	Original issue	27/09/2021
Rev.	Amendments	Date



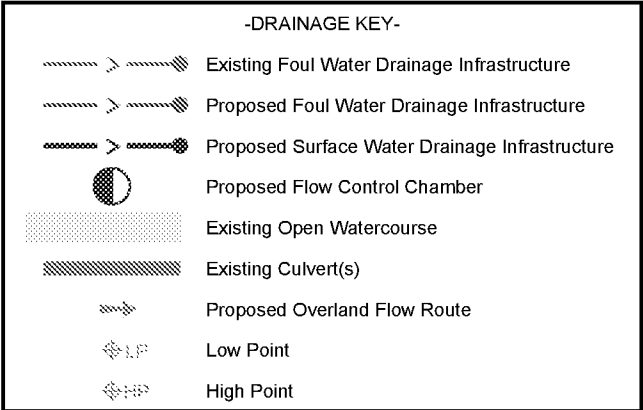
BRIGHT PLAN CIVILS
Transport Planning and Infrastructure Design Consultants
2 West Barn, Norton Lane, Chichester, West Sussex PO20 3AF
Tel: 01243 210418
www.bpcivils.co.uk enquiries@bpcivils.co.uk

Drawing Status	PLANNING		
Client	Mr D. Tobin		
Project	Green Gables, Northfields Lane, Westergate, Chichester PO20 3UH		
Drawing Title	Impermeable Area Comparison		
Scale	1:500	Date	Sept. '21
Drawn By	SPB	Checked By	MJA
Drawing No.	D2008-PL-200		Rev.
		-	



- Allowances have been made for both climate change (40%) and urban creep (10%) with a 1-in-100-year storm event also being accommodated.

- Foul water disposal should adhere to the following hierarchy;
 1. Public Sewer
 2. Private Treatment Plant
 3. Septic Tank and Drainage Field
 4. Cesspool
- It is proposed that, post-development, foul flows generated by the site will outfall to the public foul water sewer network, located to the south of the site.
- The client has confirmed a new drainage run has been installed to the rear of the neighbouring property (Elderberry House) for the proposed dwelling to utilise, providing an 'indirect' connection to the public foul water sewer network.
- A S106 application will be required, and approval will need to be obtained from Southern Water prior to new flows being connected.
- Post development 'peak' foul flows will amount to 0.046l/s (based on Sewerage Sector Guidance; Construction Design Guidance - 4000l/day, per dwelling).



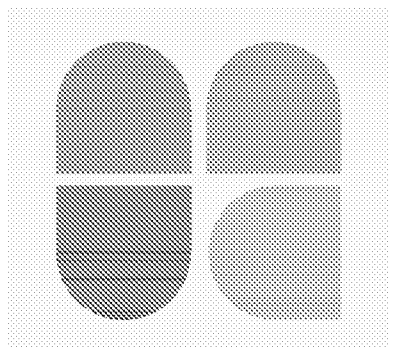
1. This drawing is to be read in conjunction with all other BPC drawing, and with all relevant Architect's and Engineer's drawings and specification. Any discrepancies found are to be reported immediately to the Engineer
2. BPC accepts no responsibility for inaccuracies in data provided by third parties 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

PLANNING

This map is based on or reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the controller of Her Majesty's Stationary Office (c)
Crown Copyright. Licence Number: 100022432

This drawing is based upon Ordnance Survey mapping.
Bright Plan Civils accept no liability for any inaccuracies with the data.

A -	Foul routing confirmed by client Original issue	13/10/2021 27/09/2021
Rev.	Amendments	Date



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 enquires@bpcivils.co.uk

Drawing Status		PLANNING	
Client		Mr D. Tobin	
Project		Green Gables, Northfields Lane, Westergate, Chichester PO20 3UH	
Drawing Title		Conceptual Drainage Strategy	
Scale	Date	Drawn By	Checked By
1:500	Sept. '21	SPB	MJA
Drawing No.			Rev.
D2008-PL-300			A



NOTES

A3

1.

This drawing is to be read in conjunction with all other BPC drawings, and with all relevant Architect's and Engineer's drawings and specification. Any discrepancies found are to be reported immediately to the Engineer.

2.

BPC 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.

PLANNING

This map is based on or reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the controller of Her Majesty's Stationary Office (c)
Crown Copyright. Licence Number: 100022432

This drawing is based upon Ordnance Survey mapping. Bright Plan Civils accept no liability for any inaccuracies with the data.

Original issue

27/09/2021

Rev.

Amendments

Date

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 enquires@bpcivils.co.uk

Drawing Status

PLANNING

Client

Mr D. Tobin

Project

Green Gables, Northfields Lane,
Westergate, Chichester PO20 3UH

Drawing Title

Existing Overland Flow Routes

Scale

1:500

Date

Sept. '21

Drawn By

SPB

Checked By

MJA

Drawing No.

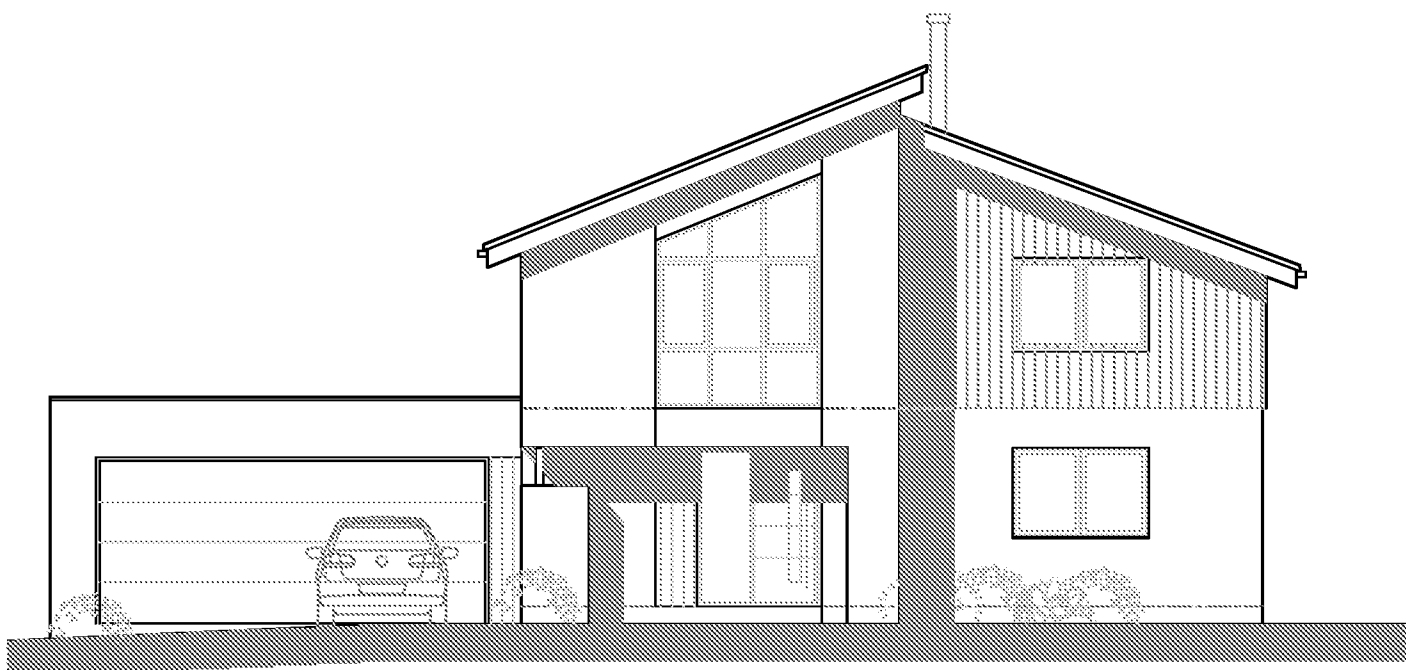
D2008-PL-400

Rev.

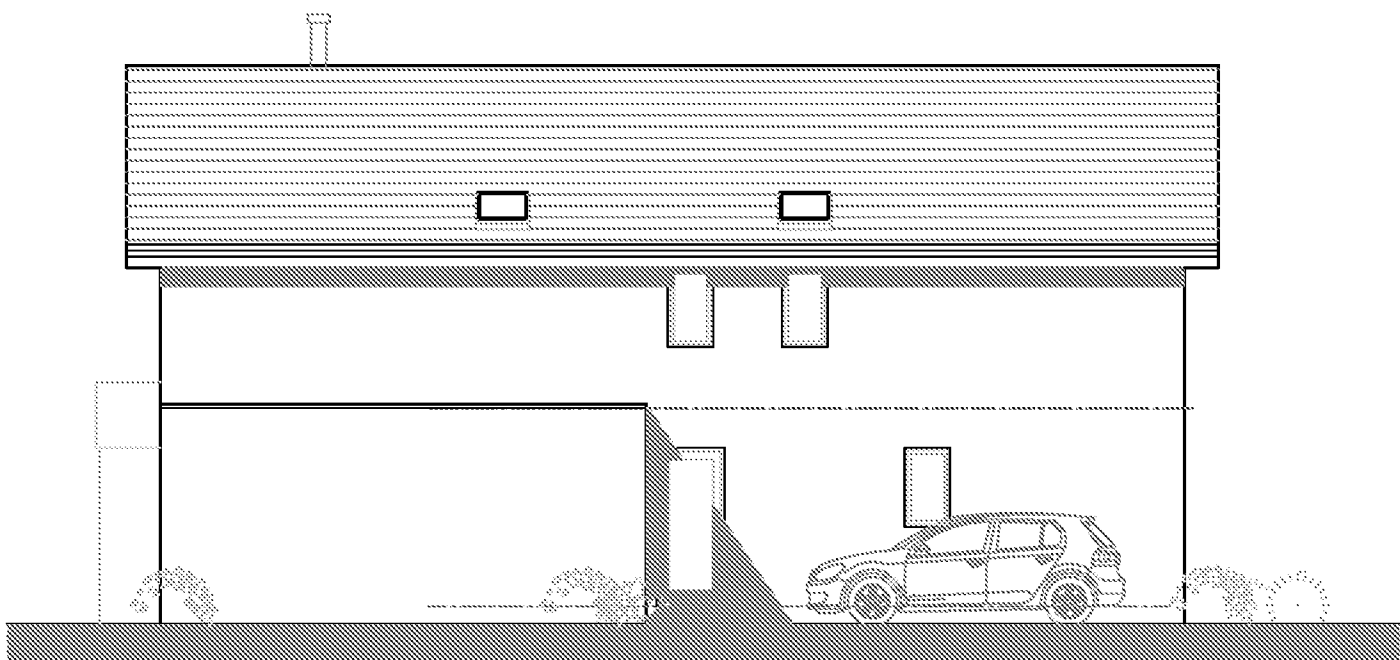
-

APPENDICES

Appendix A Development Proposals



East Elevation (front)



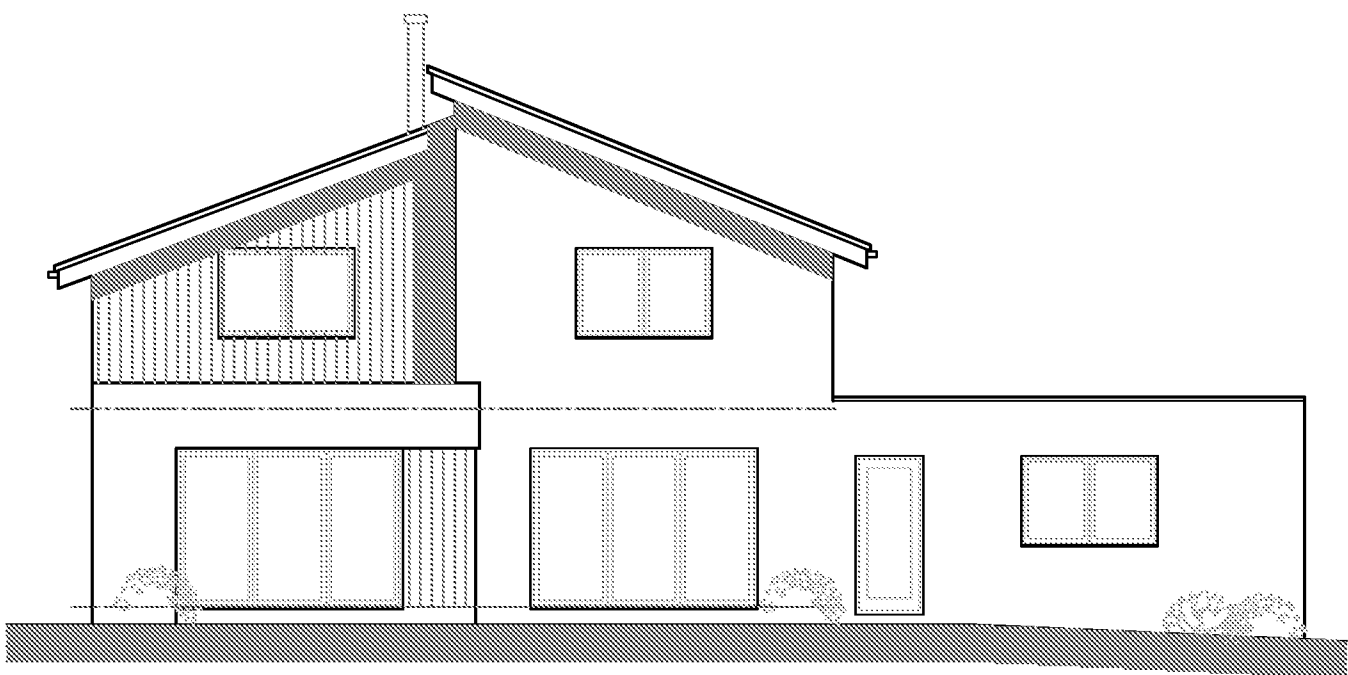
South Elevation

External Materials

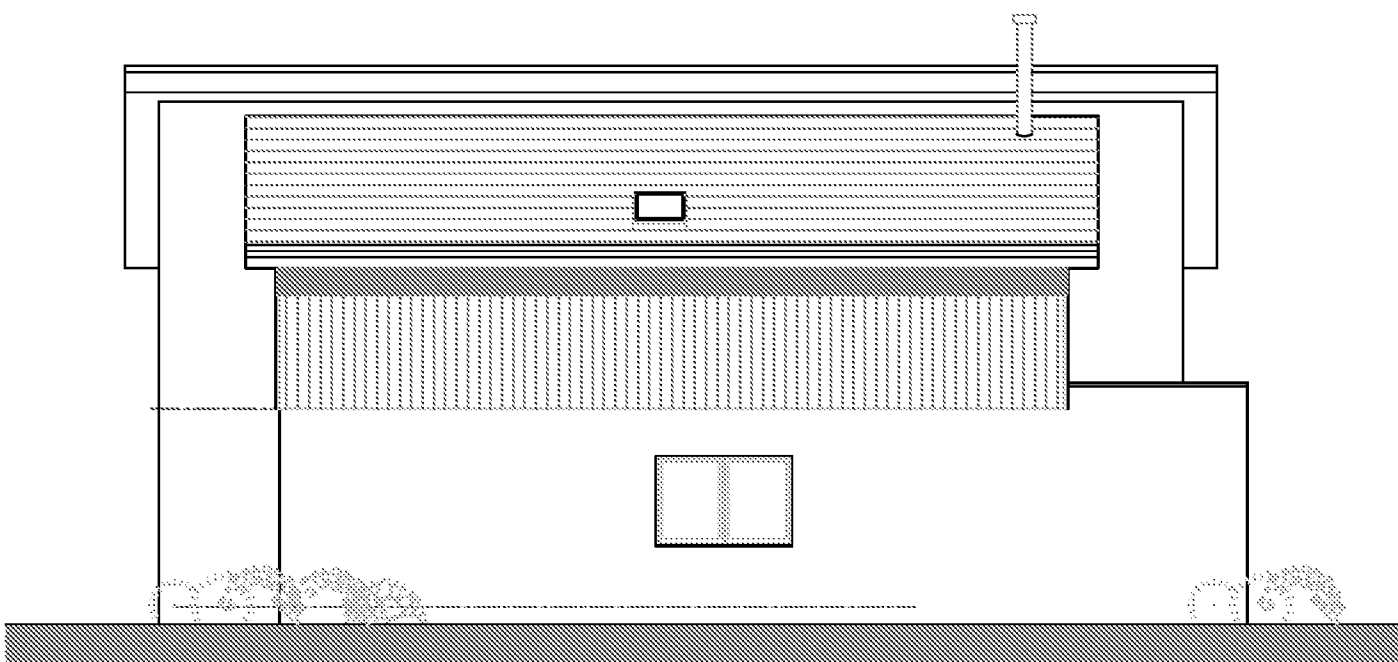
Roof
New pitched roof to be clad with artifucial slates
Areas of flat roof to be formed with grey GRP
or single ply polymeric membrane

Walls
Walls to be finished externally with through colour
render in white
Where indicated on elevations walls clad with
cedar or Fibre cement boarding

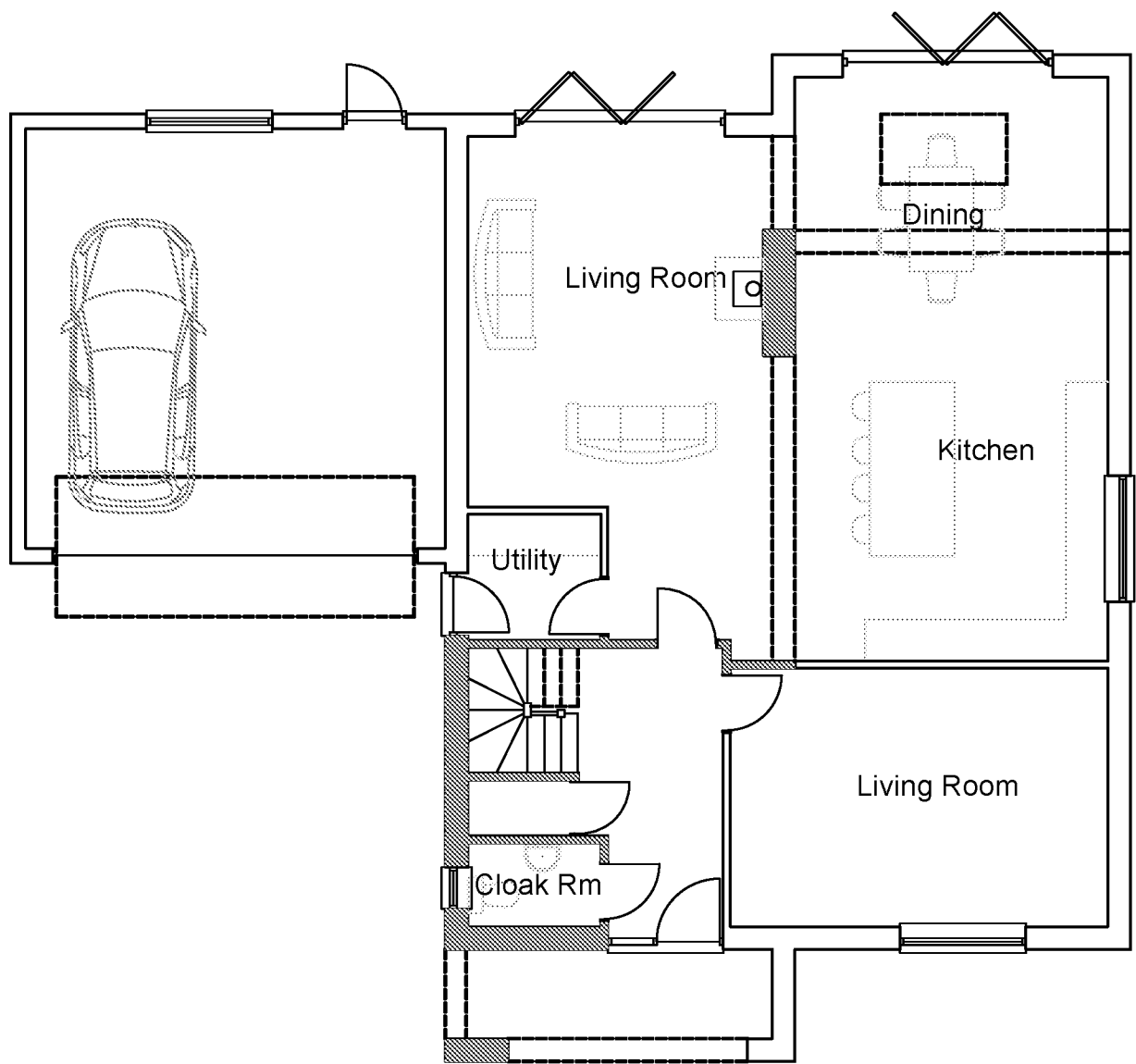
Doors and windows
Doors and windows to be grey UPVC or
powder coated aluminium



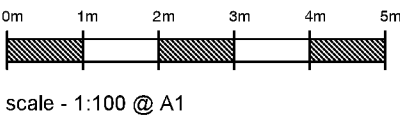
West Elevation



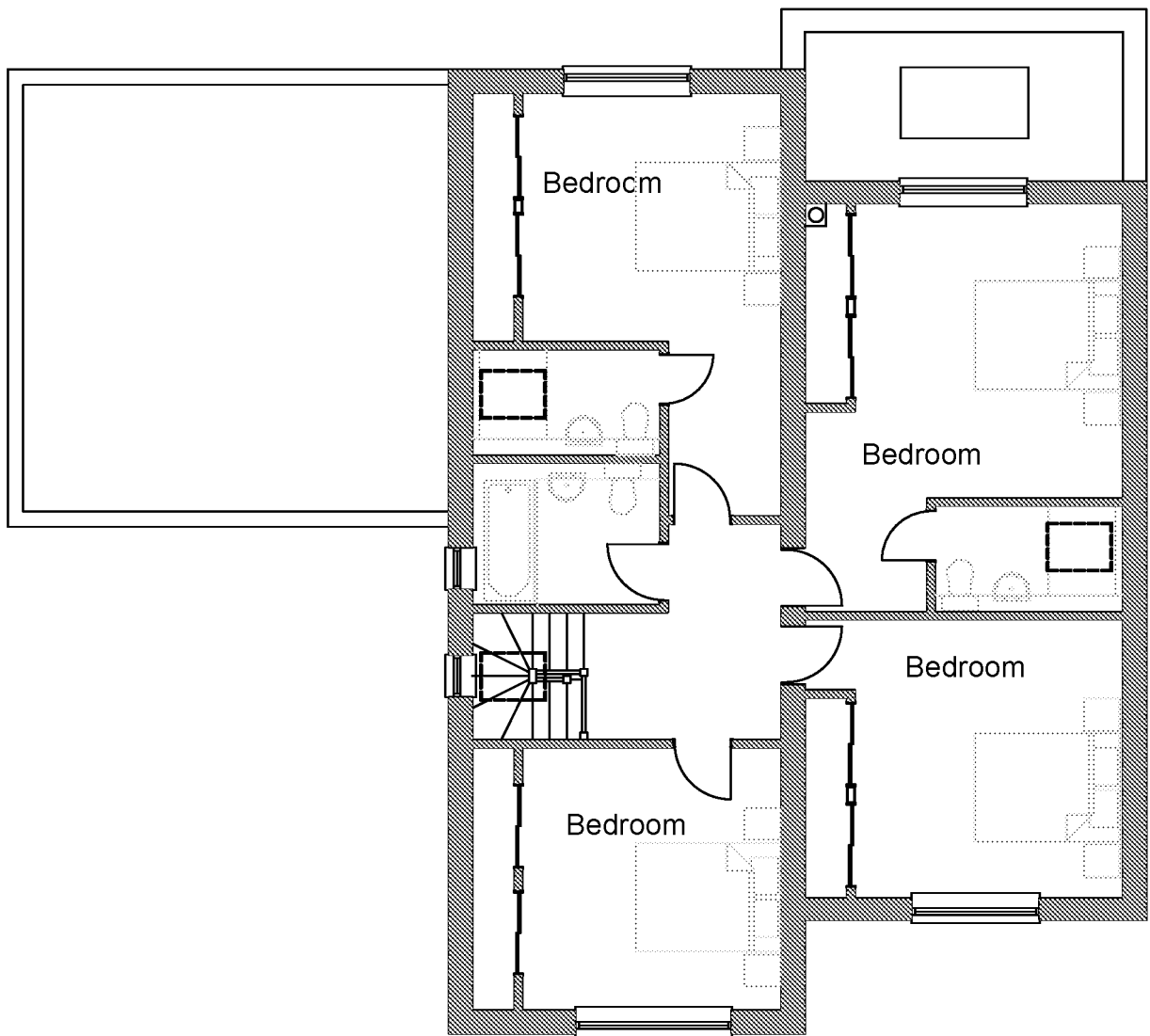
North Elevation



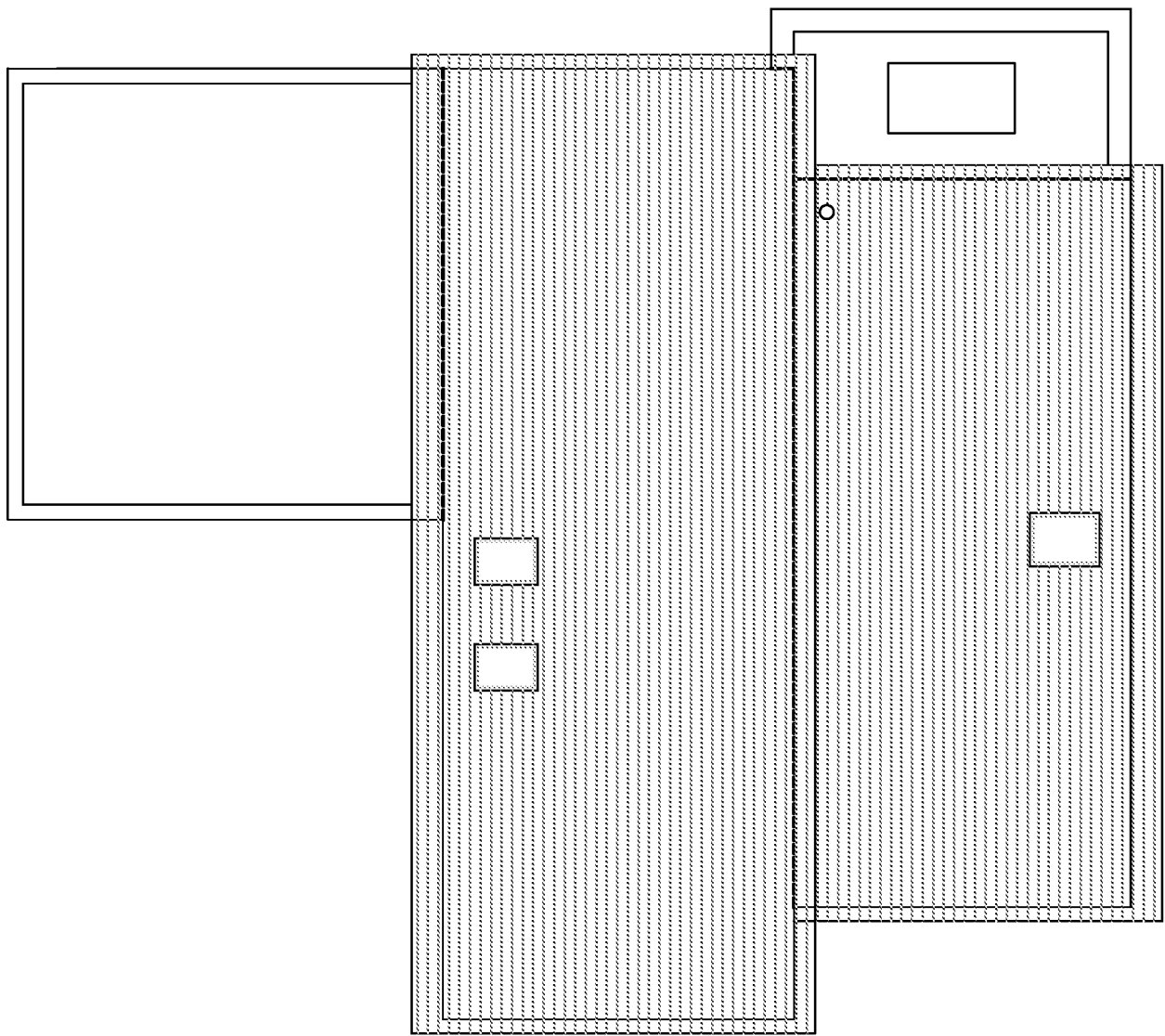
Ground Floor



scale - 1:100 @ A1



First Floor

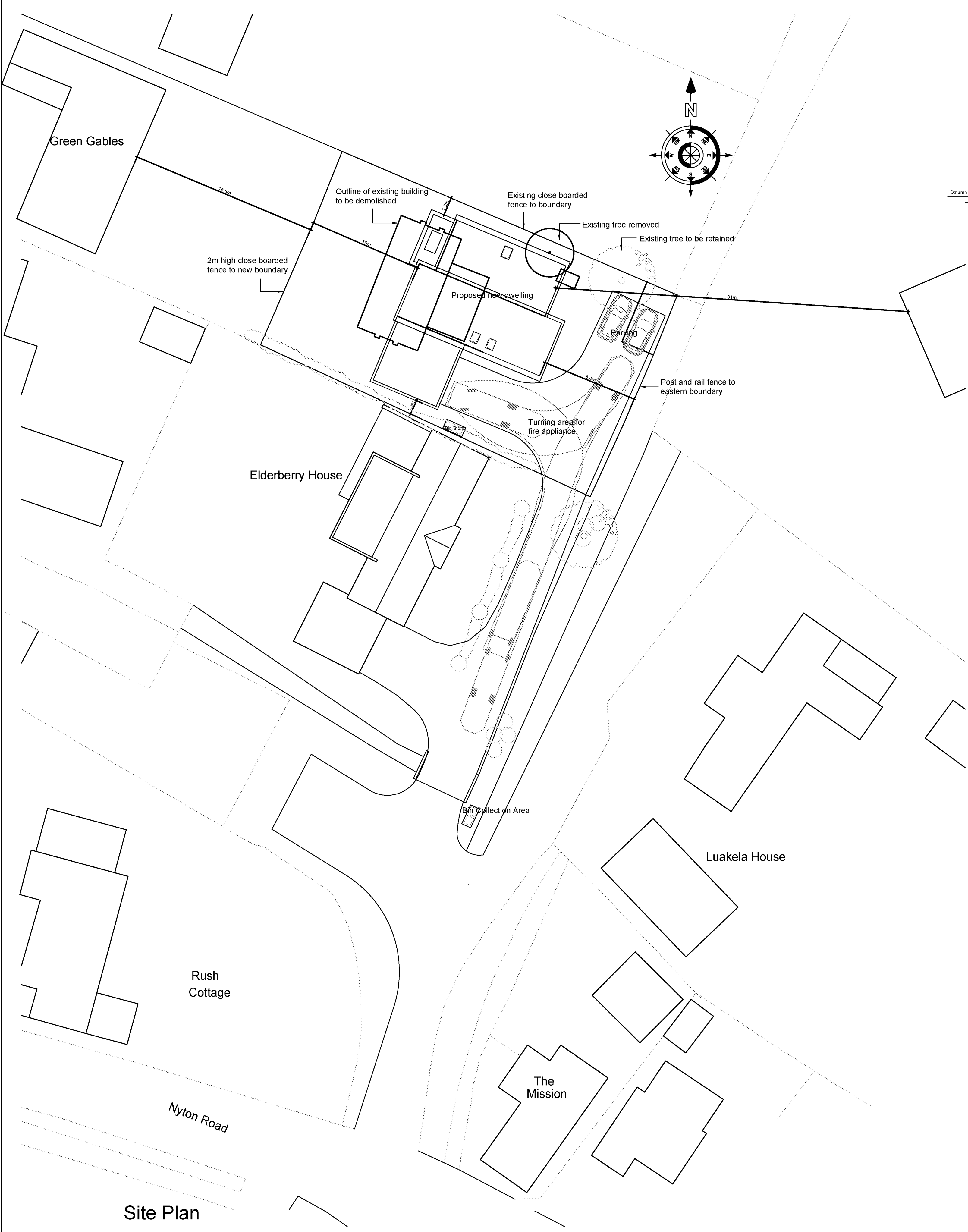


Roof Plan

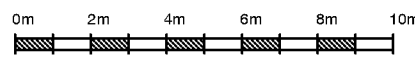
NOTES

DO NOT SCALE OFF THIS DRAWING EXCEPT FOR PLANNING
PURPOSES
ALL DIMENSIONS SHOULD CHECKED ON SITE PRIOR TO
COMMENCEMENT OF WORK
ALL GOODS MATERIALS AND WORKMANSHIP MUST CONFORM
WITH CURRENT BUILDING REGULATIONS, BRITISH
STANDARDS AND CODES OF PRACTICE
COPYRIGHT OF THIS DRAWING IS RETAINED BY GARRY
MOUNT CHARTERED ARCHITECTURAL TECHNOLOGIST AND
IT MUST NOT BE REPRODUCED WITHOUT WRITTEN CONSENT

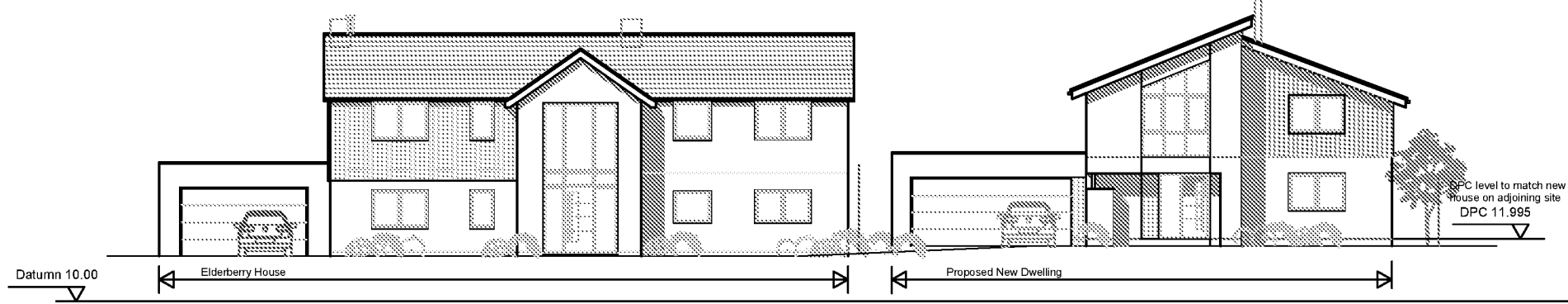
A	Sept 2021	GM	Garage width amended
REV	DATE	BY	AMENDMENT
CLIENT			
Mr & Mrs Tobin			
JOB TITLE			
New dwelling on site to rear of Green Gables, Northfields Lane, Westergate			
DRAWING TITLE			
Proposed Plans and Elevations			
DATE	SCALE		DRAWN BY GM
Aug 21	1:100 @ A1		CHECKED BY
JOB NO.	DRAWING NO.	REVISION	
21-09	2.01	A	
Garry Mount MCIAT Chartered Architectural Technologist 57 Highfield Crescent Brighton East Sussex BN1 8JD Tel : 07951 332812 email : garrymount@gmail.com			



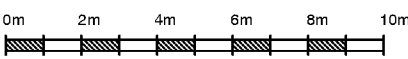
Site Plan



scale - 1:200 @ A1



Street Elevation



scale - 1:200 @ A1



Location Plan

scale - 1:1250 @ A1



Block Plan

scale - 1:500 @ A1

NOTES

DO NOT SCALE OFF THIS DRAWING EXCEPT FOR PLANNING PURPOSES
ALL DIMENSIONS SHOULD CHECKED ON SITE PRIOR TO COMMENCEMENT OF WORK
ALL GOODS MATERIALS AND WORKMANSHIP MUST CONFORM WITH CURRENT BUILDING REGULATIONS, BRITISH STANDARDS AND CODES OF PRACTICE
COPYRIGHT OF THIS DRAWING IS RETAINED BY GARRY MOUNT CHARTERED ARCHITECTTURAL TECHNOLOGIST AND IT MUST NOT BE REPRODUCED WITHOUT WRITTEN CONSENT

A	Sept 2021	GM	Garage width amended
REV	DATE	BY	AMENDMENT

CLIENT
Mr & Mrs Tobin

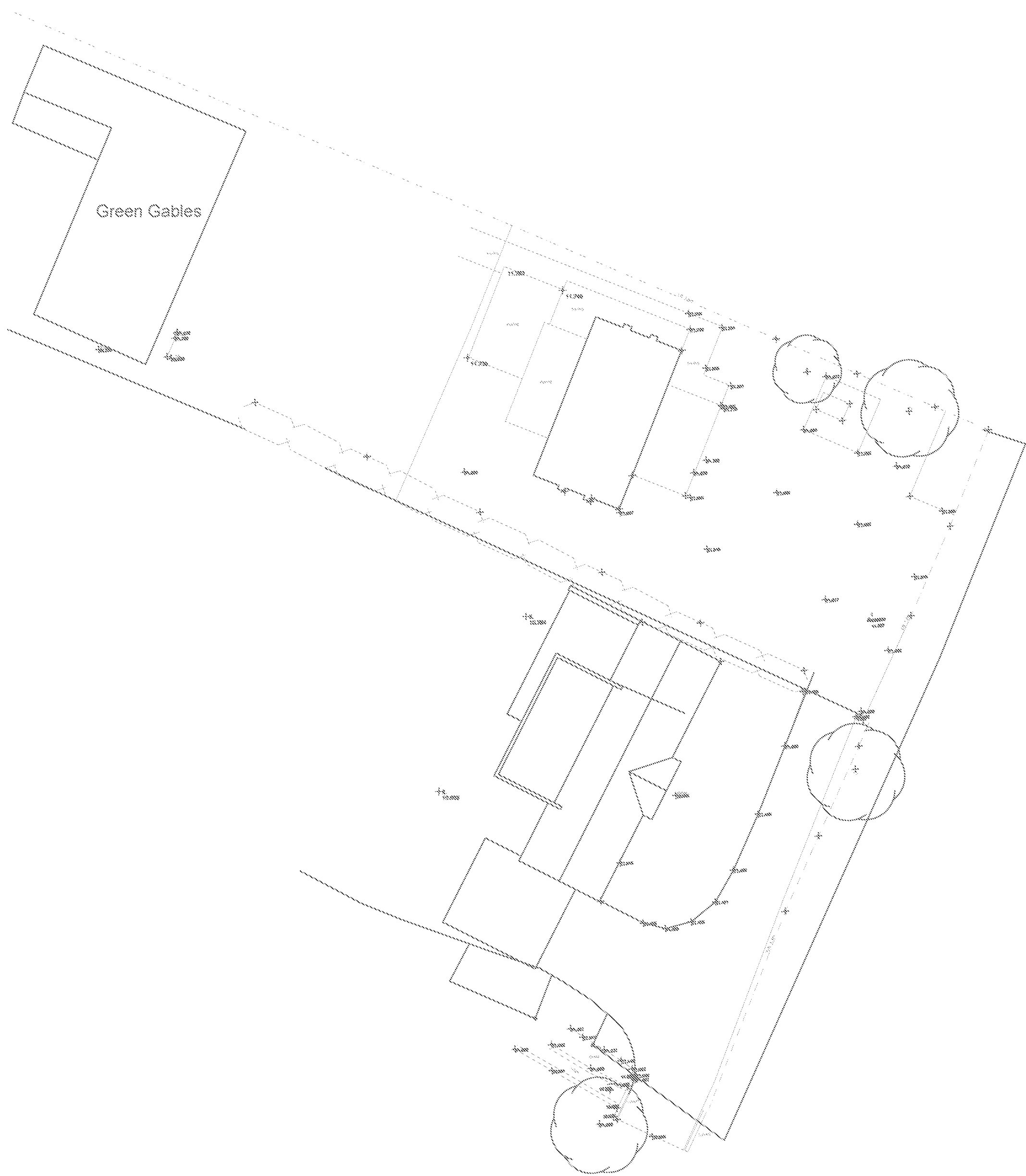
JOB TITLE
New dwelling on site to rear of Green Gables, Northfields Lane, Westergate

DRAWING TITLE		
Site Plan and Location Plan		

DATE	SCALE	DRAWN BY
Aug 21	As shown	GM
JOB NO.	DRAWING NO.	REVISION
21-09	2.02	A

Garry Mount MCIAT
Chartered Architectural Technologist
57 Highfield Crescent
Brighton
East Sussex
BN1 8JD
Tel : 07951 332812 email : garrymount@gmail.com

Appendix B Topographic Survey



Appendix C BGS Records

Surface level +11.6 m
Water struck at +8.2 m
August 1981

Overburden 3.4 m
Mineral 2.3 m
Bedrock 1.0 m+

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.2	0.2
Head Gravel (on S. - 10 m)	Silt, sandy, with rootlets	0.8	1.0
	Clay, silty, with chalk	0.2	1.2
	Clay, greyish brown, with chalk and angular flint pebbles, becoming more silty, with rootlets, near base	1.8	3.0
	Silt, sandy, chalky, light brown	0.4	3.4
	a "Very clayey" sandy gravel Gravel: fine with coarse, angular to sub-rounded; flint (some white, porous) and some rock fragments Sand: coarse and fine with medium Fines: clay	1.0	4.4
Raised Beach Deposits (younger)	b "Clayey" pebbly sand on sandy gravel Gravel: fine and coarse, angular to well rounded; flint with some chalk and other rock fragments Sand: fine with coarse and some medium	1.0	5.7
London Clay	Clay, grey, silty near top	1.0+	6.7

GRADING

	Mean for deposit percentages			Depth below surface (m)	Percentages											
	Fines	Sand	Gravel													
					Fines				Sand				Gravel			
					-4	+4 -2	+2 -1	+1 -4	+4 -15	+15 -64	+64 mm					
a	25	40	35	3.4-4.4	25	12	7	21	25	10	0					
b	8	63	28	4.4-5.0	12	71	2	2	4	5	0					
				5.0-5.7	5	26	9	16	28	16	0					
				Mean	8	47	6	10	18	12	0					
a+b	16	53	32	3.4-5.7	16	22	6	14	20	12	0					

COMMERCIAL IN CONFIDENCE

U.S. 1549 (1-59) 2000 1/28

Institute of Geological Sciences

Sheet 1 of

Borehole Reg No: **SU90NW/71**
 Temp borehole No: **SU90/26**
 Nat Grid Ref: **SU 93510542**
 Locality: **S. of Nylon Fm, by Nylon Spiney**
 Surface level: **11.6 m O.D. (H.O.D.)**
 Drilled by: **Sondalores**
 Drill type:
 Hole diameter: **8"**
 Depth(s) bailed:
 Date started: **18/8/81**
 Date finished:
 Recorded by: **PHAN**

Classification
of ground

Thickness
m

Nature

O.B.

3.4

silt + pebbly clay

Min

2.3

sandy gravel +
pebbly sand

bedrock

5.7 to 6.7

London Clay

Remarks

Explanation

▽ Groundwater depth
first encountered
a▽ Morning water level
p▽ Evening water level

--- Casing depth
--- Borehole depth
W Water sample

U, sample; solid ornament
shows fraction recovered
• Spot disturbed sample
Bulk sample

GRT Standard Penetration Test

Geological Classification	Description of Strata	Sampling	Sample Nos	Water level	Drilling and Casing progress
Winchworth	Soil				
	sandy silt with rootlets.				
	silty clay with chalk 1.0				
	chalky gravelly clay 2.0				
	light brown chalky sandy silt 3.0				
	Sandy gravel 3.4 C. gr. 10% J. gr. 20% C. sand 65% P. " others 5%	3.4 to 4.4	CCB 008		
London clay	fine sand 95% - a little clay, no pebbles	4.4 to 5.0	CCB 009		
	pebbly sand 5.0 C. gr. 5% J. gr. 10% C. sand 65% P. " others 20%	5.0 to 5.7	CCB 010		
	grey clay, silty on top 6.0	5.7 to 6.7	CBSS 010		
					end @ 6.7

Appendix D Southern Water Public Sewer Records



(c) Crown copyright and database rights 2021 Ordnance Survey 100031673 Date: 24/09/21 Scale: 1:1250 Map Centre: 493865,105695 Data updated: 20/09/21 Our Ref: 656989 - 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
D2008 Green Gables



Appendix E Environment Agency Product 4

Mark Akmenkalns
Bright Plan Civils
2 West Barn,
Norton Lane,
Chichester,
PO20 3AF

Our ref: SSD232596
Date: 09/09/2021

Dear Mark Akmenkalns,

Enquiry Regarding Product 4 for Flood Risk Assessment for Green Gables, Westergate, PO20 3UH.

Thank you for your enquiry which was received on 17 August 2021.

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

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

The site is in an area located within Flood Zone 3 as shown on our Flood Map for Planning (Rivers and Sea).

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

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

Flood Defences

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

Model Information

The model used was Aldingbourne Flood Risk Mapping Study, completed in 2015 by JBA Consulting (Defended only), plus updated climate change allowances (2016).

Flood History

We hold no record of flooding events affecting this site, but a nearby area was previously flooded in 1960 (Flood Event Code: 1977). The source of the flooding was drainage.

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

FRA advisory text

Name	Product 4
Description	Detailed Flood Risk Assessment Map for Green Gables, Westergate, PO20 3UH.
Licence	Open Government Licence
Information Warnings	The flood risk data provided is based on existing EA hydraulic models with an allowance for climate change. Please note the climate change allowances provided are not up to date. These were updated on 27 July 2021. You should refer to 'Flood risk assessments: climate change allowances' for the most up to date allowances. You will need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.
Information Warning - OS background mapping	<i>The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.</i>
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. Contains Ordnance Survey data © Crown copyright 2021 Ordnance Survey 100024198.

Data Available Online

Many of our flood datasets are available online:

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

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

Yours sincerely,

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





Environment
Agency

N
▲

Legend

- Site Nodes
- Site Boundary

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

Scale: 1:1,000

00.02250.045

Kilometers

Product 4 Flood Risk Data Requested by: Bright Plan Civils

Site: Green Gables, Westergate, PO20 3UH

Table 1: Water Levels: Fluvial Undefended

Node Ref	NGR		Modelled Flood Levels in Metres AOD					
			Undefended Annual Exceedance Probability					
	Eastings	Northings	5%	1%	1% +CC (35%)	1% +CC (45%)	1% +CC (105%)	0.1%
1	493891	105690	-	-	-	-	11.81	-
2	493903	105685	-	-	-	-	11.85	-

Table 2: Water Levels: Fluvial Defended

Node Ref	NGR		Modelled Flood Levels in Metres AOD					
			Defended Annual Exceedance Probability					
	Eastings	Northings	5%	1%	1% +CC (35%)	1% +CC (45%)	1% +CC (105%)	0.1%
1	493891	105690	-	-	-	-	11.81	11.77
2	493903	105685	-	-	-	-	11.85	11.83

Table 3: Water Depths: Fluvial Undefended

Node Ref	NGR		Modelled Flood Depths in Metres					
			Undefended Annual Exceedance Probability					
	Eastings	Northings	5%	1%	1% +CC (35%)	1% +CC (45%)	1% +CC (105%)	0.1%
1	493891	105690	-	-	-	-	0.19	-
2	493903	105685	-	-	-	-	0.24	-

Table 4: Water Depths: Fluvial Defended

Node Ref	NGR		Modelled Flood Depths in Metres					
			Defended Annual Exceedance Probability					
	Eastings	Northings	5%	1%	1% +CC (35%)	1% +CC (45%)	1% +CC (105%)	0.1%
1	493891	105690	-	-	-	-	0.19	0.15
2	493903	105685	-	-	-	-	0.24	0.10

All levels taken from:

Aldingbourne Flood Risk Mapping Study, completed in 2015 by JBA Consulting (Defended only), plus climate change allowances (2016).

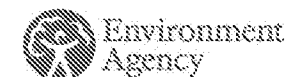
Produced on: 09/09/2021

*** The flood risk data provided is based on existing EA hydraulic models with an allowance for climate change. Please note the climate change allowances provided are not up to date. These were updated on 27 July 2021.**

You should refer to 'Flood risk assessments: climate change allowances' for the most up to date allowances. You will need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.

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

Flood Map for Planning (Rivers and Sea). Centred on PO20 3UH. Created 09/09/2021.



1: 10,000

0 Metres 250



Flood Map for Planning (Rivers & Sea)

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

Flood Map Areas (assuming no defences)

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

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

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

Risk of flooding from Surface Water. Centred on PO20 3UH. Created 09/09/2021.



1: 10,000

0 Metres 250



Likelihood of flooding from Surface Water

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

Likelihood of flooding from Surface Water

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

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

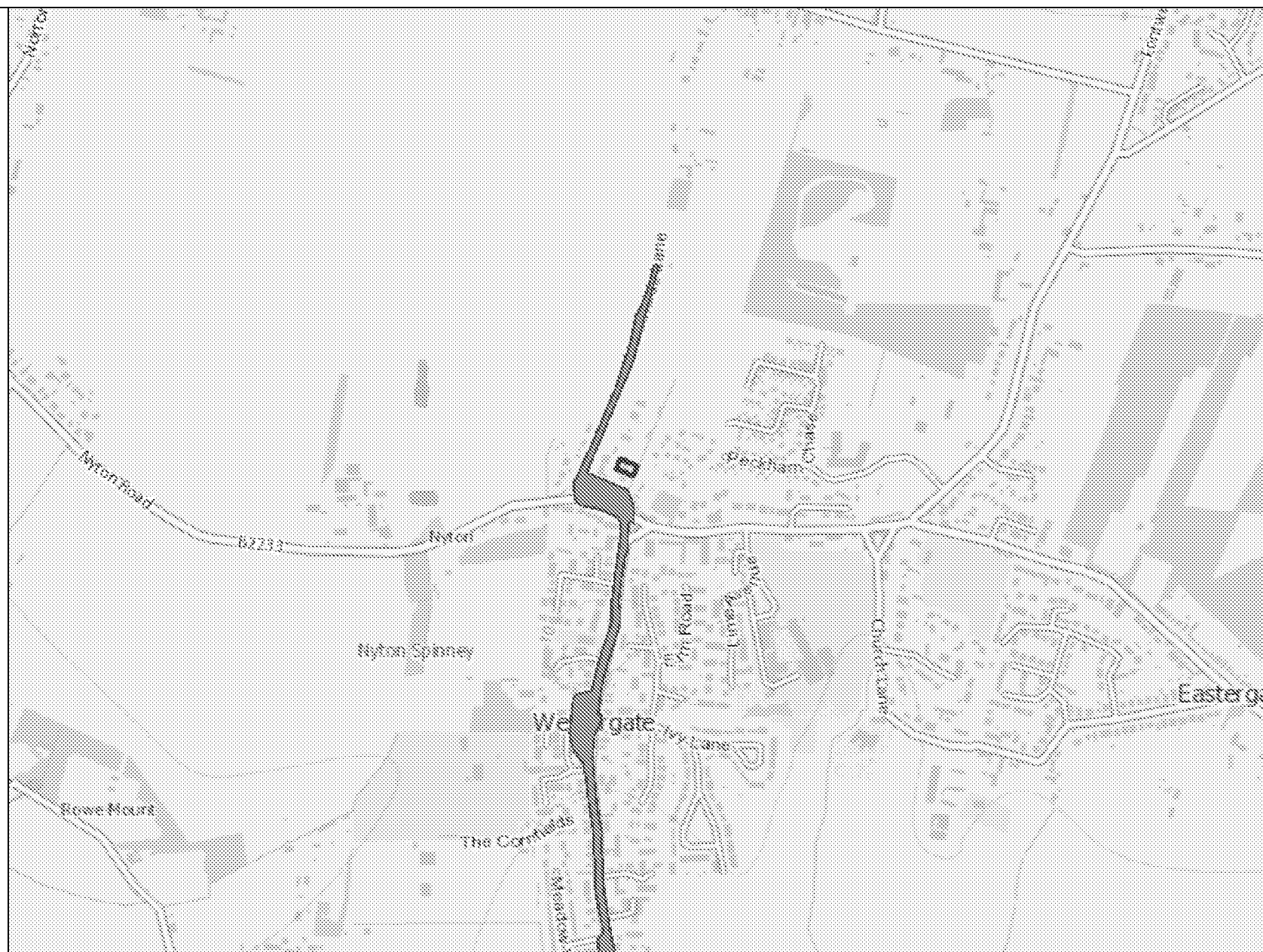
© Crown Copyright and database rights 2021 Ordnance Survey 100024198

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

Recorded Flood Outlines. Centred on PO20 3UH. Created 09/09/2021.

Legend

 All recorded flood outlines



1: 10,000

0 250

Metres



Legend

 Please see page 2 for asset
 symbology



Structures

-  Control Gate
-  Draw Off Tower
-  Fish Pass
-  Hydrobrake
-  In Channel Stoplogs
-  Inspection Chamber
-  Jetty
-  Outfall
-  Screen
-  Spillway
-  Stilling Basin
-  Weir

Beach Structures

-  Breakwater
-  Ramp
-  Slipway
-  Steps
-  Groyne

Instruments

-  Active Monitoring
-  Passive Monitoring

Channel Crossings

-  Bridge
-  Utility Services

Aids to Navigation

-  Beacon
-  Buoy
-  Dolphin
-  Signage
-  Signal

Building Assets

-  Pump House

Major Civils

-  Abutment
-  Central Pier

Defences

-  Embankment
-  Wall
-  Flood Gate
-  Demountable defence
-  Bridge abutment
-  High Ground
-  Beach
-  Barrier Beach
-  Promenade
-  Quay
-  Cliff
-  Dunes

Channels

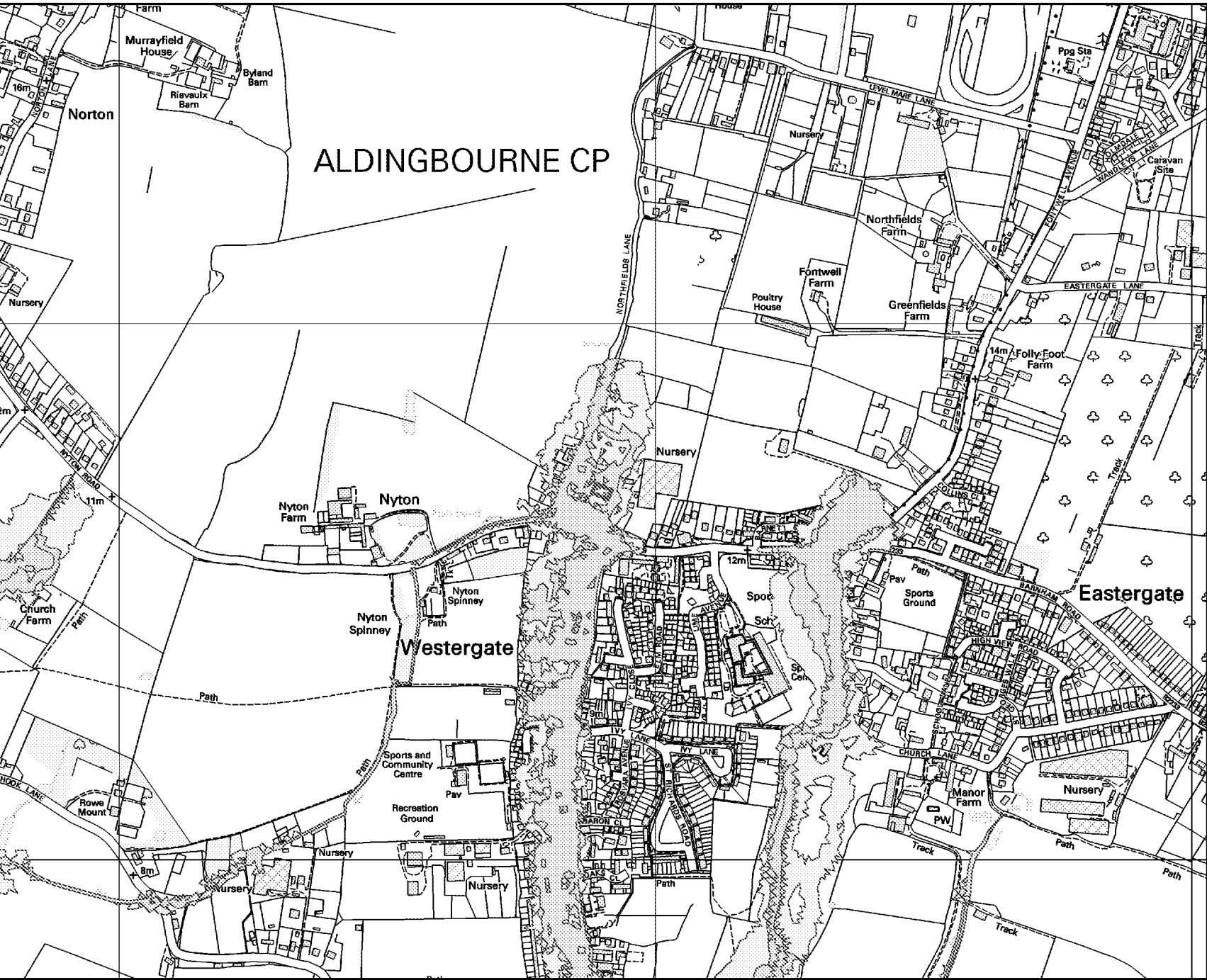
-  Open channel
-  Simple culvert
-  Complex culvert

Land

-  Mudflats
-  Saltmarsh
-  Washland

Sites

-  Amenity
-  Control Structure
-  Erosion Protection
-  General
-  Harbour
-  Monitoring
-  Navigation Lock
-  Pumping Station
-  Reservoir
-  Tidal Barrier





Environment
Agency



N

Legend

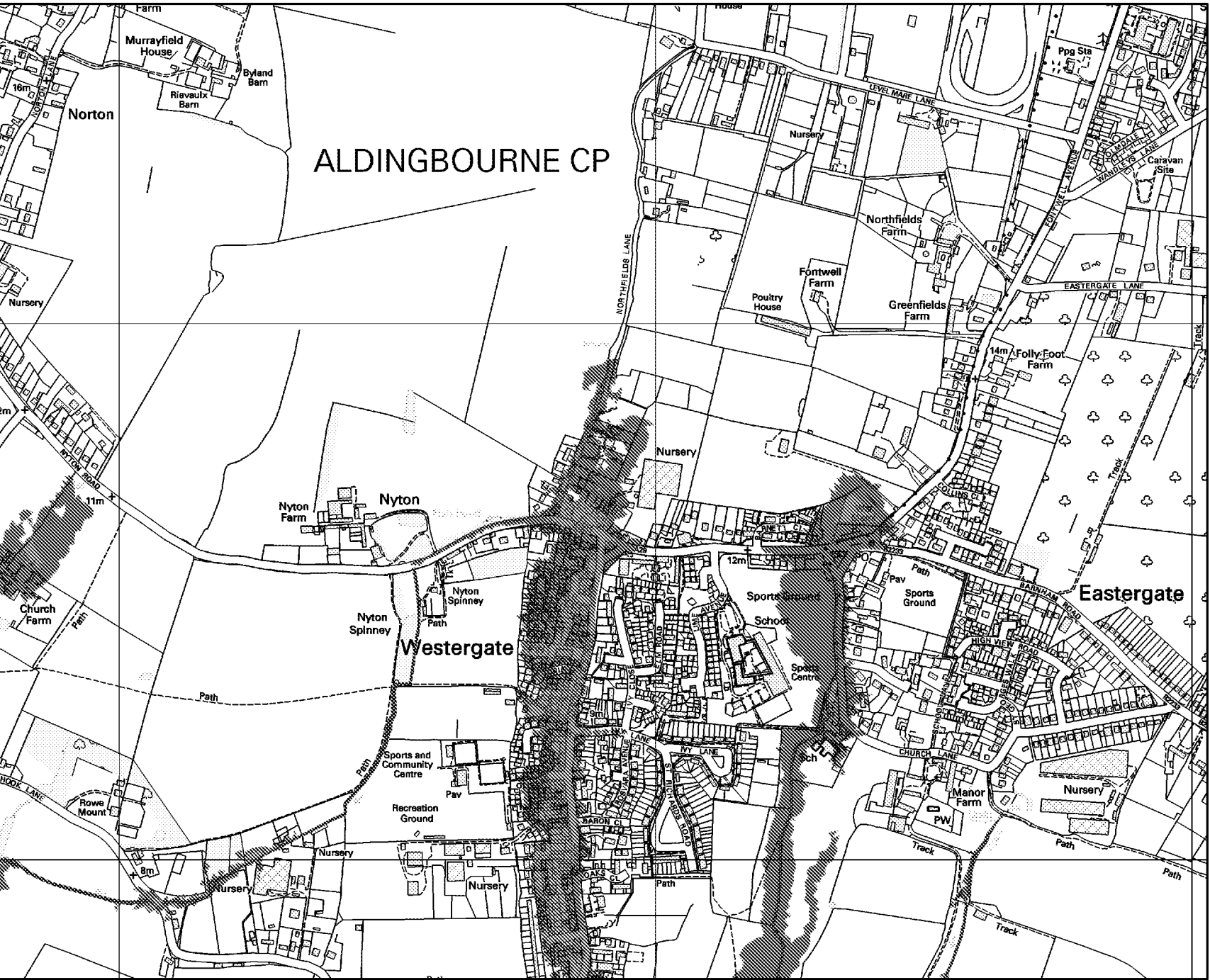
-  Site Boundary
-  1% AEP +35% (Un defended Fluvial)
-  1% AEP +45% (Un defended Fluvial)
-  1% AEP +105% (Un defended Fluvial)

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

Scale: 1:10,000



00.2250.45
Kilometers





Environment
Agency



Legend

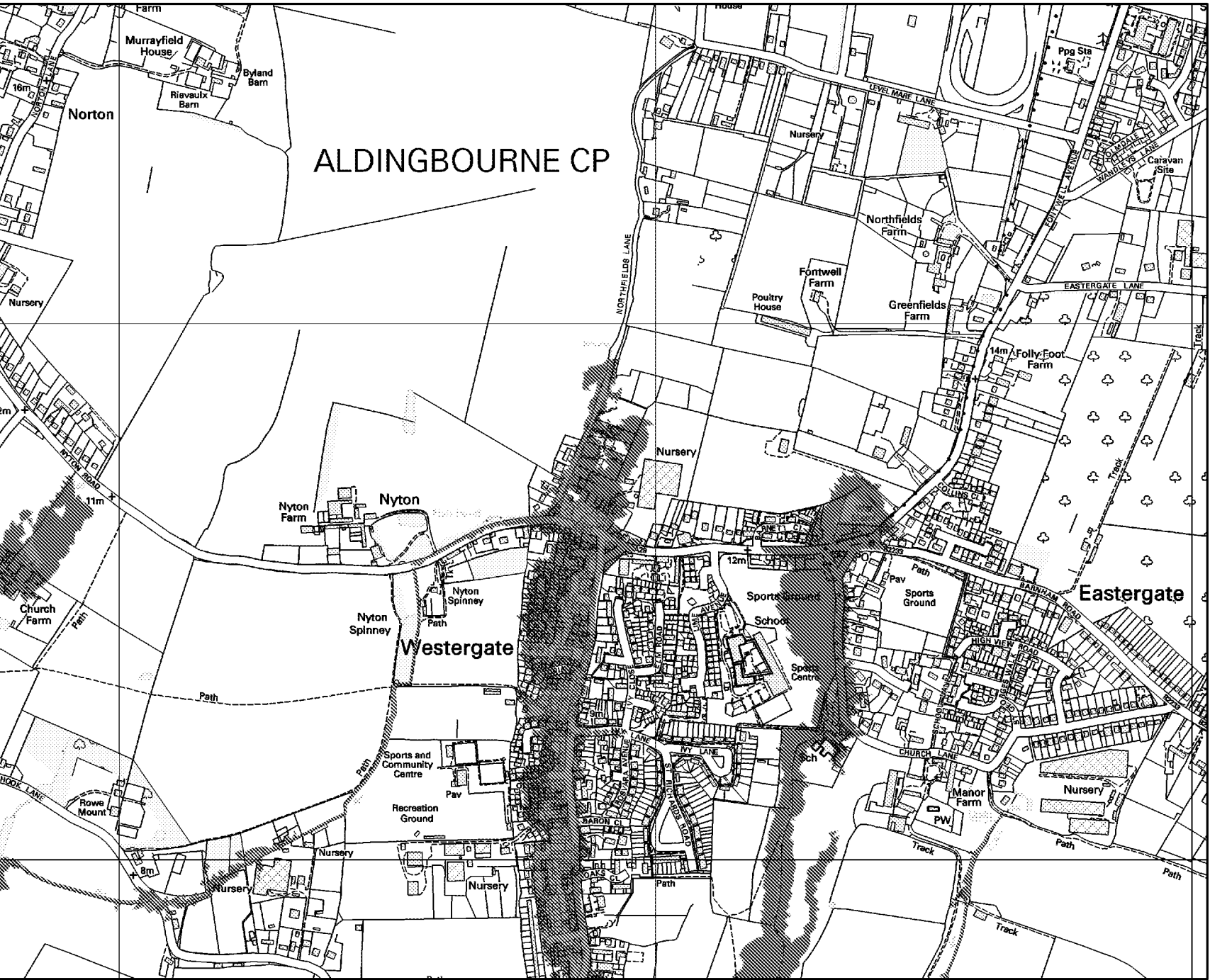
-  Site Boundary
-  5% AEP (Defended Fluvial)
-  1% AEP (Defended Fluvial)
-  0.1% AEP (Defended Fluvial)

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

Scale: 1:10,000



00.2250.45
Kilometers





Environment
Agency

N
▲

Legend

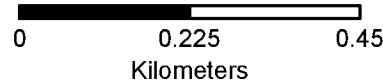
Site Boundary

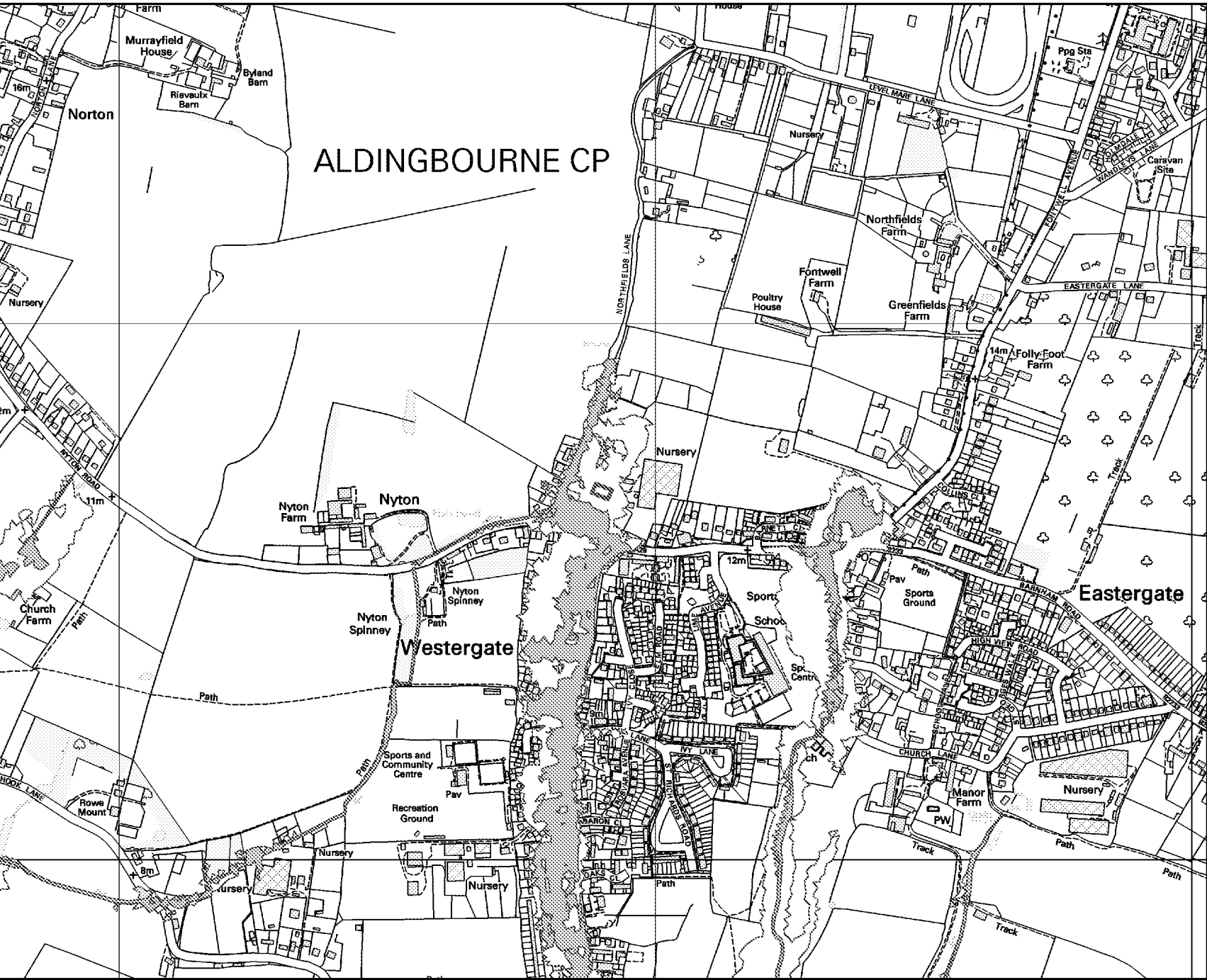
1% AEP (Un defended Fluvial)

0.1% AEP (Un defended Fluvial)

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

Scale: 1:10,000







Environment Agency

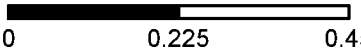


Legend

-  Site Boundary
-  1% AEP +35% (Defended Fluvial)
-  1% AEP +45% (Defended Fluvial)
-  1% AEP +105% (Defended Fluvial)

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

Scale: 1:10,000



0 0.225 0.45
Kilometers

Appendix F Arun District Council SFRA Extracts

From: Bright Plan Civils
Sent: 17 August 2021 11:45
To: Arun District Council/West Sussex County Council
Subject: D2008 - Green Gables, Westergate - FRA/DS Enquiry

We are preparing a Flood Risk & Drainage Strategy for the above site and would be grateful if you could provide us with any relevant information you have as per our drainage checklist below:

Flood Zones

- Please confirm the Flood Zones for this area. Flood zone 2/3
- Please confirm surface water, reservoir flooding, sewer flooding. Please provide plans and depth data from your GIS UFMSW for 30yr, 100yr & 1000yr as applicable (OS Datum). Surface water flood map enclosed – further information can be obtained from EA data.
- Please confirm mapping and records for any surface water assets owned or maintained. See attached.
- Please confirm if there are any future drainage improvements proposed for this area. Yes. Eastern boundary ditch to be re-graded by adjacent developer (Taylor Wimpey). Culvert under unmade track south east of property in process of being upgraded by Taylor Wimpey.
- Please confirm details of existing or planned flood alleviation and defences in this area. See above
- Please confirm if you are aware of any historic flooding within the confines of the site. Northfields Lane has certainly flooded – unsure if flood water entered the property boundary.
- Please confirm if you are aware of any historic flooding in close vicinity and/or on the public highway. Yes, Nyton Road. Also refer to WSCC.

Groundwater

- Please confirm details of any groundwater flooding issues in the area, including flood levels, flood extents and any available anecdotal information. Groundwater has a significant contribution to flooding in this area. Flood levels unknown. Flood extents not fully known but surrounding roads and properties have been subject to flooding.

Assets

- Please confirm mapping and records for any surface water assets owned or maintained. See attached.
- Please confirm if there are any historic culverted watercourses within or in close vicinity to the site. Please provide map records where available. See attached.
- Please can you provide any map records denoting the highway drainage network. Is this a piped system or soakaways? Piped system – to ditches/public surface water sewer.

Policy/Future

- Please confirm the most recent Strategic Flood Risk Assessment (SFRA). 2016 – on our website
- Please confirm if there are any future drainage improvements proposed for this area. See above. A great deal of work has also been carried out in the past.
- Please confirm if any drainage studies and/or SWMP have/are being assess for this area. Lidsey SWMP.

[illegible]

Production Date: 17 June 2021





Arun District Council

Level 1
Strategic Flood Risk
Assessment

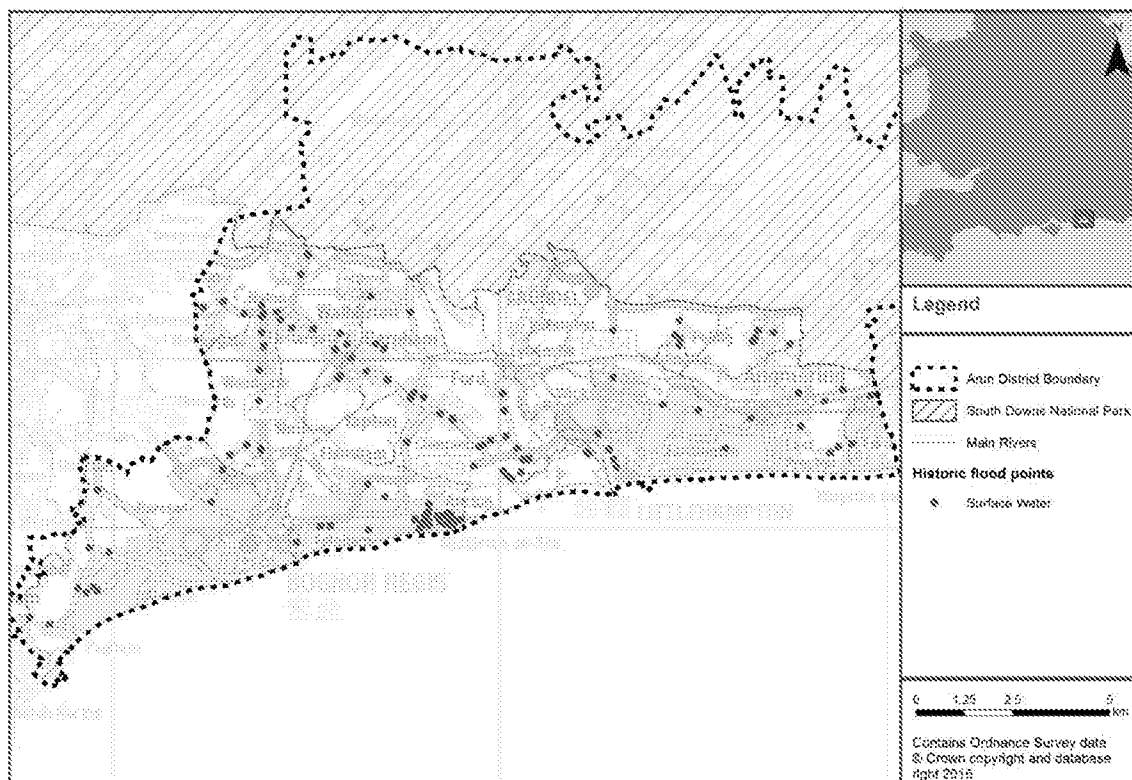
Final Report

August 2016

Arun District Council
Civic Centre
Maltravers Road
LITTLEHAMPTON
West Sussex
BN17 5LF



Figure 5-6: Surface water flooding records



5.7 Groundwater flooding

Compared with other sources, current understanding of the risks posed by groundwater flooding is limited and mapping of flood risk from groundwater sources is in its infancy. Under the Flood and Water Management Act (2010), LLFAs have powers to undertake risk management functions in relation to groundwater flood risk. Groundwater level monitoring records are available for areas on Major Aquifers. However, for low lying valley areas, which can be susceptible to groundwater flooding caused by a high water table in mudstones, clays and superficial alluvial deposits, very few records are available. Additionally, there is increased risk of groundwater flooding where long reaches of watercourse are culverted as a result of elevated groundwater levels not being able to naturally pass into watercourses and be conveyed to less susceptible areas. Section 5.2.2 reports on the bedrock geology and superficial deposits within the district, and summarises that the geology of the district indicates susceptibility to groundwater emergence and flooding, a fact identified in the historical record.

As part of the SFRA deliverables, mapping of the whole District has been provided showing the Areas Susceptible to Groundwater Flooding (ASStGWF). This information is provided in Appendix F. The ASStGWF is a strategic-scale map showing groundwater flood areas on a 1km square grid. The data was produced to annotate indicative Flood Risk Areas for Preliminary Flood Risk Assessment (PFRA) studies and allow the LLFAs to determine whether they may be at risk of flooding from groundwater. This data shows the proportion of each 1km grid square, where geological and hydrogeological conditions indicate that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring, nor does it take account of the chance of flooding from groundwater rebound (rising groundwater levels resulting from a reduction in abstraction rates from groundwater). This dataset covers a large area of land, and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding.

The ASStGWF data should be used only in combination with other information, for example local or historical data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale where finer resolution datasets exist. It should be noted that although an area may be designated as susceptible to groundwater flooding, this does not mean

that groundwater flooding will definitely be a problem within these areas, rather it provides an indication of potential risk.

Significant events of groundwater flooding reported in West Sussex⁴⁴ are reported to have occurred in:

- 1974
- Winter 1993–1994
- Winter 2000–2001
- Winter 2002–2003
- 2012 – Westergate/Barnham area
- 2013/14 – Westergate/Barnham area
- 2014 – Northfields Lane/Nyton Road/Level Mere Lane, Aldingbourne

It was observed that the extensive groundwater flooding of winter 2000 / 2001 followed a period of exceptionally high rainfall, but the direct source was not identified and therefore it may be that flooding was caused by a burst underground pipe rather than flooding from hard rock aquifers or superficial deposits⁴⁵. Developers planning to build within groundwater emergence zones should still investigate whether groundwater flooding is likely to be a problem locally.

The Lidsey SWMP identified that groundwater flooding has been reported in Elm Grove in Barnham, Northfields Lane/Nyton Road in Westergate, and Wandleys Lane in Eastergate⁴⁶.

The Elmer Sands SWMP identified that the high water table during the winter period is the primary trigger for flooding in this area⁴⁷, and therefore this area may be susceptible to flooding from this source.

5.8 Flooding from artificial sources

5.8.1 Flooding from foul and surface water sewers

Sewer flooding occurs when intense rainfall overloads the sewer system capacity (surface water, foul or combined), and/or when sewers cannot discharge properly to watercourses due to high water levels. Sewer flooding can also be caused when problems such as blockages, collapses or equipment (such as pumps) failure occur in the sewerage system. Surface water inundation of manhole openings, entry of soil or groundwater into the sewer system via faults within the fabric of the sewerage system, is another cause of sewer flooding. Infiltration is often related to shallow groundwater, and may cause high flows for prolonged periods of time. The Lidsey SWMP identifies that information supplied by Southern Water described flooding predominantly resulted from hydraulic overload of sewers due to infiltration of groundwater⁴⁸.

Since 1980, the Sewers for Adoption guidelines have meant that most new surface water sewers have been designed to have capacity for a rainfall event with a 1 in 30 chance of occurring in any given year, although until recently this did not apply to smaller private systems. Arun District Council manages the permitted inflows to sewers at new developments through discharging of conditions on planning applications (which are encouraged to use sustainable urban drainage systems). Where these are not appropriate and connection to the public sewer system is needed then Southern Water largely apply restriction to flows. However, even where sewers are constructed to required specifications, they can still be overwhelmed by larger events of the magnitude often considered when looking at river or surface water flooding (e.g. a 1 in 100 chance of occurring in any given year). Existing sewers can also become overloaded as new development adds to their catchment, even with restrictions in place on permitted discharge, or due to incremental increases in roofed and paved surfaces at the individual property scale (urban creep).

Historical incidents of flooding are detailed by Southern Water in their DG5 register. This database records incidents of flooding relating to public foul, combined or surface water sewers and identifies

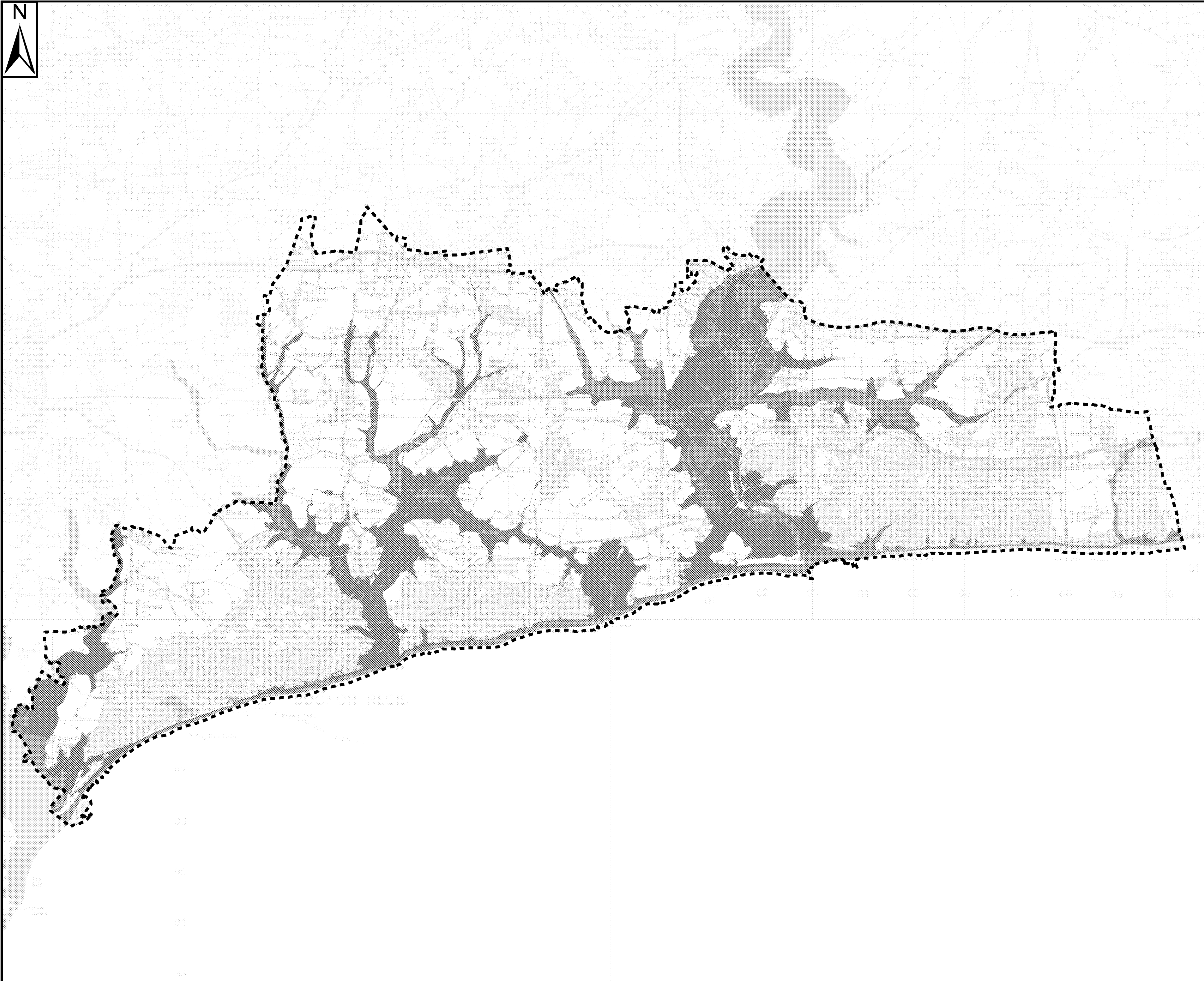
⁴⁴ Arun District Council: Strategic Flood Risk Assessment Vol II Technical Report (February 2008)

⁴⁵ Arun District Council: Strategic Flood Risk Assessment Vol II Technical Report (February 2008)

⁴⁶ West Sussex County Council: Lidsey SWMP (October 2014)

⁴⁷ Southern Water: Elmer Sands, Bognor Regis SWMP Report (January 2014)

⁴⁸ West Sussex County Council: Lidsey SWMP (October 2014)



Notes

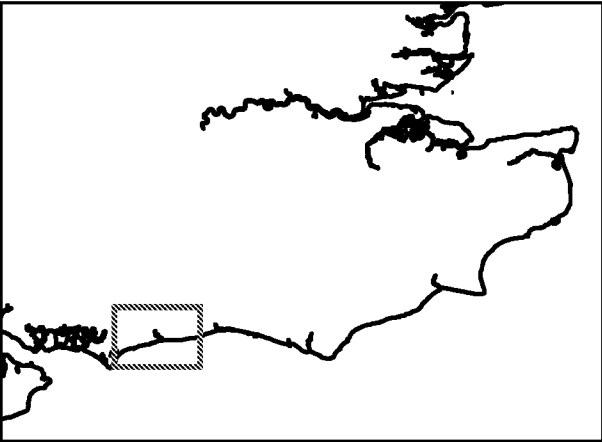
Zone 1: Comprised of land having a less than 1 in 1,000 annual probability of river or sea flooding in any year

Zone 2: Comprised of land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding or 1 in 200 and 1 in 1,000 annual probability of sea flooding in any year

Zone 3a: This zone comprises land assessed as having a greater than 1 in 100 annual probability of river flooding or a greater than 1 in 200 annual probability of flooding from sea in any year

Zone 3b: This zone comprises land where water has to flow or be stored in times of flood (the functional floodplain). The SFRA identified this Flood Zone as land which would flood with an annual probability of 1 in 20 years, where detailed modelling exists. In the absence of detailed hydraulic model information, a precautionary approach has been adopted with the assumption that the extent of Flood Zone 3b would be equal to Flood Zone 3a. If development is shown to be in Flood Zone 3a, further work should be undertaken as part of a detailed site specific

Key Plan



Legend

- Arun District SFRA boundary
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

REF	Date	Comments
A	June 2016	-

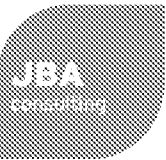


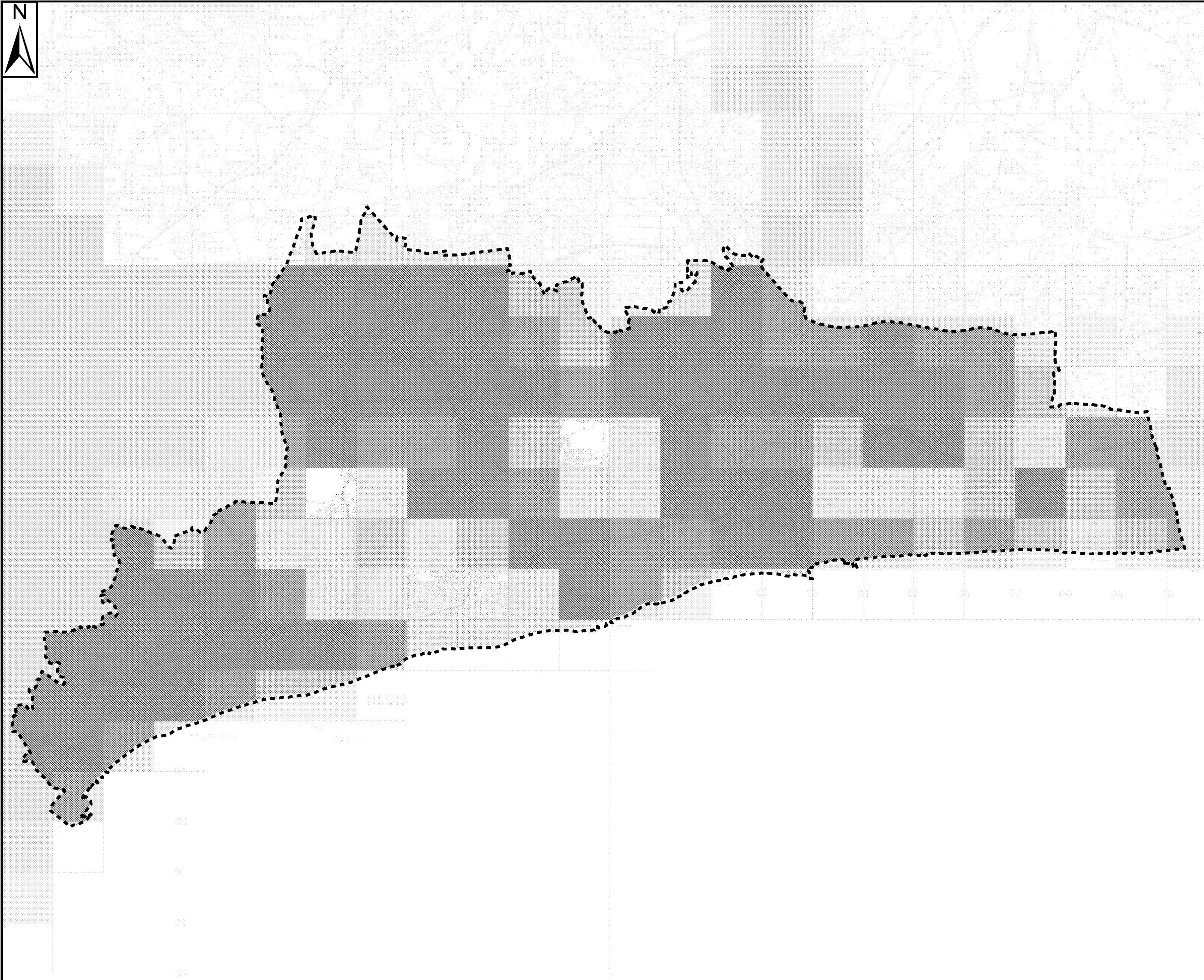
This map is based upon Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. 100018461

ARUN DISTRICT COUNCIL

SFRA: APPENDIX C FLOOD ZONES

This document is the property of Jeremy Benn Associates Ltd. It shall not be reproduced in whole or in part, nor disclosed to a third party, without the permission of Jeremy Benn Associates Ltd





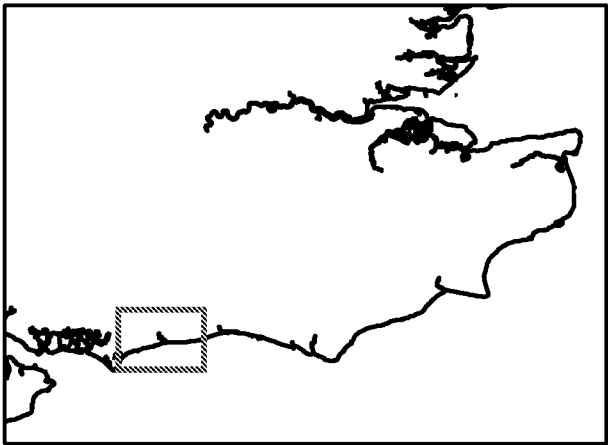
Notes

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

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

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

Key Plan



Legend

- Arun District SFRA boundary
- Areas Susceptible to Groundwater Flooding**
- Classification
- < 25%
 - >= 25% <50%
 - >= 50% <75%
 - >= 75%

REF	Date	Comments
A	June 2016	-



This map is based upon Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. 100019461

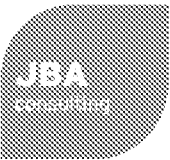
ARUN DISTRICT COUNCIL

SFRA: APPENDIX F

AREAS SUSCEPTIBLE TO

GROUNDWATER FLOODING

This document is the property of Jeremy Benn Associates Ltd. It shall not be reproduced in whole or in part, nor disclosed to a third party, without the permission of Jeremy Benn Associates Ltd



Appendix G Wallingford Greenfield Run-off

Greenfield runoff rate estimation for sites

Registration successful. You are now logged in.

www.uksubs.com | Greenfield runoff tool

Calculated by: Stuart Burnett

Site name: Green Gables

Site location: Northfield Lane, Chichester

Site Details

Latitude: 50.84316° N

Longitude: 0.66794° W

Reference: 1860452022

Date: Sep 28 2021 09:45

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 IH124

Site characteristics

Total site area (ha): 0.1

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

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): 0.2 0.2

1 in 1 year (l/s): 0.17 0.17

1 in 30 years (l/s): 0.46 0.46

1 in 100 year (l/s): 0.64 0.64

1 in 200 years (l/s): 0.75 0.75

We use cookies on this site to enhance your user experience

Ok, I agree

More in

By clicking the Accept button, you agree to us doing so.

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.

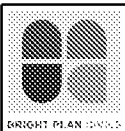
We use cookies on this site to enhance your user experience

Ok, I agree

More info

By clicking the Accept button, you agree to us doing so.

Appendix H Causeway Flow 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)	1.500
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	1.000	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)
6	0.004	5.00	11.845		-940.463	450.972	0.500
5	0.007	5.00	11.845	450	-934.273	465.726	0.607
4	0.007	5.00	11.845	450	-918.890	459.271	0.718
3			11.845	450	-920.784	454.855	0.750
2			11.725		-917.017	453.065	0.700
1			11.600	1200	-914.225	451.738	0.596

Links

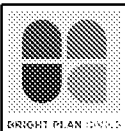
Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	6	5	16.000	0.600	11.345	11.238	0.107	150.0	150	5.33	68.4
1.001	5	4	16.682	0.600	11.238	11.127	0.111	150.0	150	5.67	66.5
1.002	4	3	4.805	0.600	11.127	11.095	0.032	150.0	150	5.76	66.0
1.003	3	2	4.171	0.600	11.095	11.025	0.070	59.6	150	5.82	65.8
1.004	2	1	3.091	0.600	11.025	11.004	0.021	150.0	150	5.88	65.4

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	0.818	14.5	1.1	0.350	0.457	0.004	0.0
1.001	0.818	14.5	2.9	0.457	0.568	0.011	0.0
1.002	0.818	14.5	4.7	0.568	0.600	0.018	0.0
1.003	1.305	23.1	4.7	0.600	0.550	0.018	0.0
1.004	0.818	14.5	4.7	0.550	0.446	0.018	0.0

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	16.000	150.0	150	Circular	11.845	11.345	0.350	11.845	11.238	0.457
1.001	16.682	150.0	150	Circular	11.845	11.238	0.457	11.845	11.127	0.568
1.002	4.805	150.0	150	Circular	11.845	11.127	0.568	11.845	11.095	0.600
1.003	4.171	59.6	150	Circular	11.845	11.095	0.600	11.725	11.025	0.550

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	6		Junction		5	450	Manhole	Adoptable
1.001	5	450	Manhole	Adoptable	4	450	Manhole	Adoptable
1.002	4	450	Manhole	Adoptable	3	450	Manhole	Adoptable
1.003	3	450	Manhole	Adoptable	2		Junction	



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)
1.004	3.091	150.0	150	Circular	11.725	11.025	0.550	11.600	11.004	0.446

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.004	2		Junction		1	1200	Manhole	Adoptable

Manhole Schedule

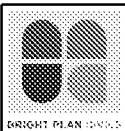
Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
6	-940.463	450.972	11.845	0.500			0	1.000	11.345	150
5	-934.273	465.726	11.845	0.607	450		1	1.000	11.238	150
4	-918.890	459.271	11.845	0.718	450		0	1.001	11.238	150
							1	1.001	11.127	150
3	-920.784	454.855	11.845	0.750	450		0	1.002	11.127	150
							1	1.002	11.095	150
2	-917.017	453.065	11.725	0.700			0	1.003	11.095	150
							1	1.003	11.025	150
1	-914.225	451.738	11.600	0.596	1200		0	1.004	11.025	150
							1	1.004	11.004	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

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 %)
2	0	0	0
30	40	10	0
100	40	10	0

Node 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	11.004	Product Number	CTL-SHE-0073-2000-0596-2000
Design Depth (m)	0.596	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node 2 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	11.025	Depth (m)	0.400
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	36	Inf Depth (m)	
Safety Factor	1.0	Pit Width (m)	2.000	Number Required	1
Porosity	0.95	Pit Length (m)	8.000		



Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	6	11	11.370	0.025	0.9	0.0040	0.0000	OK
15 minute summer	5	11	11.279	0.041	2.5	0.0162	0.0000	OK
15 minute summer	4	11	11.183	0.056	4.0	0.0199	0.0000	OK
15 minute summer	3	11	11.139	0.044	4.0	0.0070	0.0000	OK
30 minute summer	2	23	11.088	0.063	3.5	0.9598	0.0000	OK
30 minute summer	1	23	11.088	0.084	1.8	0.0953	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)
15 minute summer	6	1.000	5	0.9	0.309	0.062	0.0473	
15 minute summer	5	1.001	4	2.4	0.489	0.168	0.0832	
15 minute summer	4	1.002	3	4.0	0.771	0.274	0.0248	
15 minute summer	3	1.003	2	4.0	1.202	0.173	0.0202	
30 minute summer	2	1.004	1	1.8	0.326	0.122	0.0266	
30 minute summer	1	Hydro-Brake®		1.7				2.2



Results for 30 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	6	10	11.388	0.043	2.7	0.0077	0.0000	OK
15 minute summer	5	10	11.313	0.075	7.4	0.0308	0.0000	OK
30 minute summer	4	26	11.260	0.133	10.8	0.0498	0.0000	OK
30 minute summer	3	26	11.259	0.164	10.7	0.0261	0.0000	SURCHARGED
30 minute summer	2	26	11.259	0.234	10.7	3.5538	0.0000	SURCHARGED
30 minute summer	1	26	11.258	0.254	2.6	0.2876	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)
15 minute summer	6	1.000	5	2.7	0.414	0.184	0.1039	
15 minute summer	5	1.001	4	7.2	0.648	0.500	0.1875	
30 minute summer	4	1.002	3	10.7	0.930	0.742	0.0820	
30 minute summer	3	1.003	2	10.7	1.133	0.462	0.0734	
30 minute summer	2	1.004	1	2.6	0.394	0.178	0.0544	
30 minute summer	1	Hydro-Brake®		2.0				6.8



Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	6	10	11.395	0.050	3.5	0.0087	0.0000	OK
60 minute summer	5	47	11.353	0.115	6.5	0.0474	0.0000	OK
60 minute summer	4	46	11.352	0.225	10.6	0.0842	0.0000	SURCHARGED
60 minute summer	3	46	11.351	0.256	9.7	0.0408	0.0000	SURCHARGED
60 minute summer	2	46	11.351	0.326	9.0	4.9531	0.0000	SURCHARGED
60 minute summer	1	46	11.350	0.346	2.5	0.3917	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)
15 minute summer	6	1.000	5	3.4	0.439	0.238	0.1261	
60 minute summer	5	1.001	4	6.5	0.609	0.448	0.2675	
60 minute summer	4	1.002	3	9.7	0.906	0.673	0.0846	
60 minute summer	3	1.003	2	9.0	1.069	0.390	0.0734	
60 minute summer	2	1.004	1	2.5	0.365	0.171	0.0544	
60 minute summer	1	Hydro-Brake®		2.0				11.2