

**SUNNY CORNER, WALBERTON BN18
0QS**

RESIDENTIAL DEVELOPMENT

Flood Risk Assessment

Prepared on Behalf of

Mr & Mrs Holden

2016/D1271/FRA1.0

22 August 2017

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1 INTRODUCTION

1.1 Background

- 1.1.1 RGP Design Ltd (RGP) is instructed by Mr & Mrs Holden to prepare a Site-Specific Flood Risk Assessment (FRA) to support a planning application for a residential development Sunny Corner, Walberton BN18 0QS.
- 1.1.2 This FRA has been undertaken in accordance with Planning Practice Guidance: Flood Risk and Coastal Change (FRCC) and National Planning Policy Framework Section 10.
- 1.1.3 The proposed development will involve the construction of nine new detached and semi-detached properties in total; five four-bedroom properties and four three-bedroom properties at the above stated location.
- 1.1.4 In preparing this report, RGP has made reference to the following documents and 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
 - Local Authorities Strategic Flood Risk Assessment
 - Arun District Council Drainage Records
 - Topographical Survey
 - British Geological Survey & Report
- 1.1.5 This FRA has been prepared to assess if the proposed development is suitable for the site and confirms if mitigation is required to ensure that flood risk is not increased and that the proposed development remains safe during its design life.
- 1.1.6 This report has been prepared for the benefit of the named Client only.

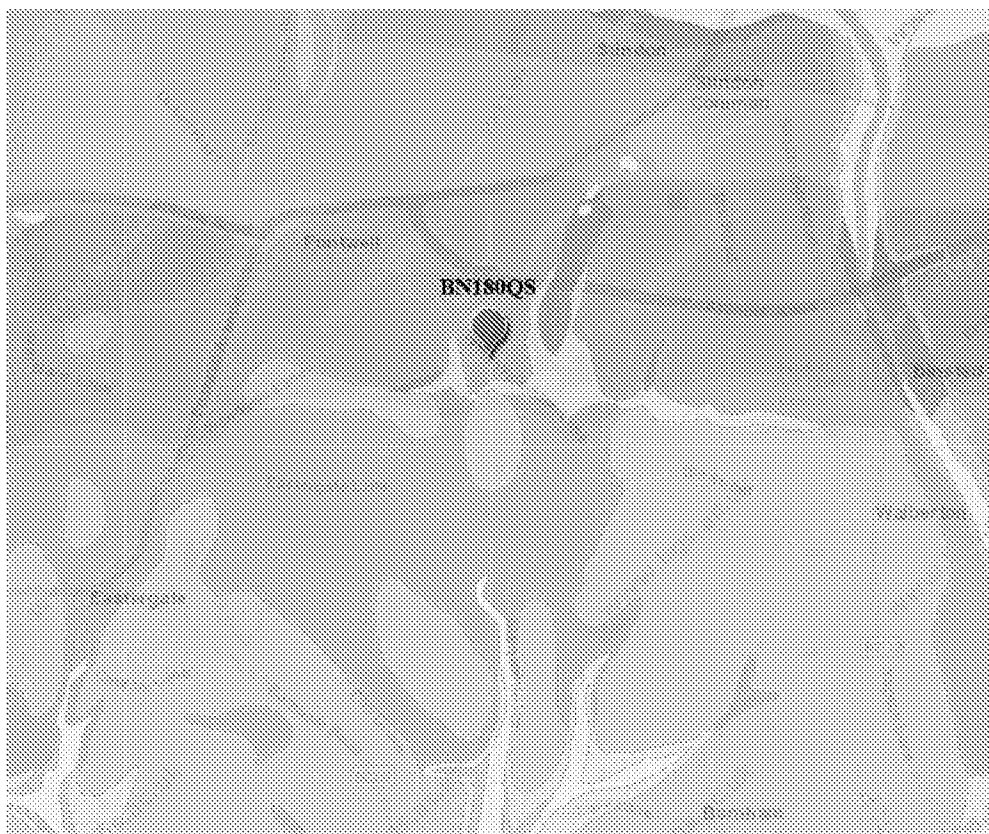
1.2 Site Location and Description

- 1.2.1 The site is located to the south-west of the existing property known as Sunny Corner (West Walberton Lane, Walberton, West Sussex BN18 0QS).
- 1.2.2 The site is located approximately 5km west of Arundel and 8km east of Chichester. It is a semi-rural/residential area and lies at approximately 16m to 26m AOD with a steep fall towards the south west corner where it meets West Walberton Lane.

- 1.2.3 A watercourse is present at the western boundary of the proposed development site which connects to ponds to the north of the site. This tributary, known as the Barnham Rife, is designated as main river just south of West Walberton Lane.
- 1.2.4 The site is currently an un-developed greenfield location with no existing hardstanding and/or impermeable areas.
- 1.2.5 The proposed development will involve the construction of 9 no. residential dwellings with associated hard standing for access and off-street parking.
- 1.2.6 The overall site area is 0.93a as shown on drawing **SK200**.
- 1.2.7 The existing impermeable area is 0.00m².

1.3 Ground Conditions

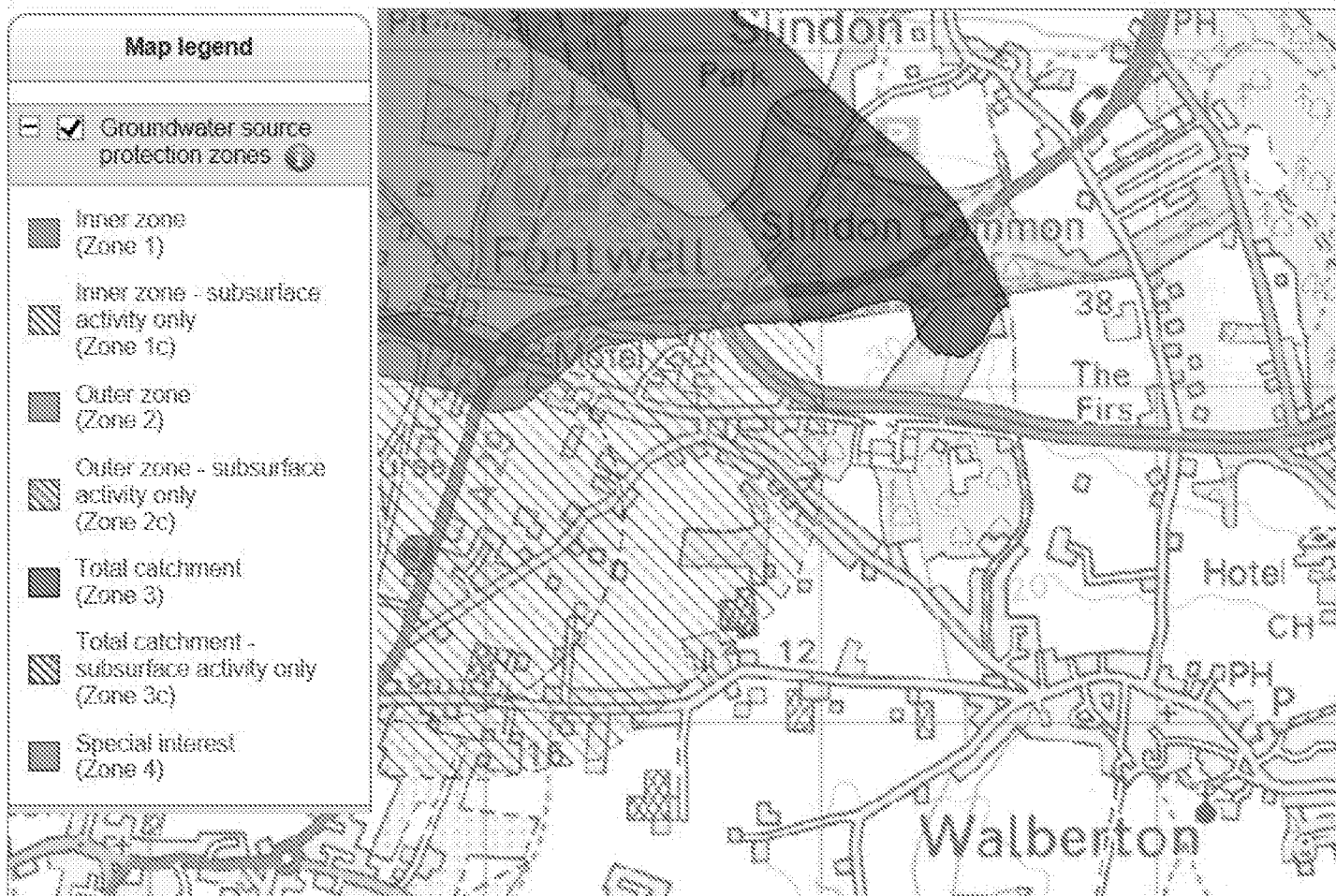
- 1.3.1 An intrusive geotechnical study has not been undertaken for the site, meaning precise infiltration testing results are not available. Furthermore, as a direct result it has not been possible to ascertain or determine the level of Groundwater, as Groundwater monitoring has not been conducted.
- 1.3.2 In view of 1.3.1, reference has been made to the British Geological Survey (BGS) website.
- 1.3.3 Bedrock geology is reported by the BGS as being 'London Clay Formation – Clay, Silt and Sand. Sedimentary Bedrock formed approximately 34 to 56 million years ago in the Palaeogene Period. Local environment previous dominated by shallow seas'
- 1.3.4 Superficial deposits are reported by the BGS as being '*None recorded*'.



- 1.3.5 An historical borehole exists to the south-west of the site (SU90NE82) as confirmed by BGS (Appendix C), with a recorded depth of 5.18m. This identifies a topsoil recorded as being 300mm deep. A light brown sandy clay was encountered beneath the topsoil, to a depth of 3.36m after which grey chalky clay was discovered.
- 1.3.6 With reference to the borehole mentioned in 1.3.5, groundwater was encountered 1.82m below ground level.
- 1.3.7 It was noted during a site walkover that there were areas of standing water, suggesting, along with the information obtained from BGS, that the infiltration potential of soil underlying the site is low.
- 1.3.8 The site is not located in a Groundwater Source Protection Zone, as confirmed by information available on the Environment Agency's website. The site is, however, located in a Groundwater Vulnerability Zone – classified as 'Minor Aquifer High'.

Map of BN18 0QR at scale 1:20,000

Other maps  Data search  Text only version 



1.4 Existing Drainage

- 1.4.1 The existing drainage systems have been identified by reviewing the OS mapping along with statutory records obtained from the local Water Authority, Southern Water.
- 1.4.2 Surface Water:

- The Southern Water public sewer records (Appendix B) demonstrate that there are no public surface water sewers located within the vicinity of the site.
- It is believed that the site is drained partially by infiltration, whilst surface water is also discharged to the existing watercourse located to the west, via naturally occurring overland flow routes.
- Greenfield runoff rate (Qbar) has been calculated to be 1.9l/s (Q1=1.6l/s, Q30=4.4l/s and Q100 = 6.2l/s).
- The Greenfield run-off volume is calculated to be 200.203m³ (Based on FEH, SPR of 30.00%).

1.4.3 Foul Water:

- The Southern Water public sewer records (Appendix B) show there are two existing public foul water sewers located within close proximity of the site. Firstly, there is a 150mm dia. public foul water sewer located in the centre of West Walberton Lane, flowing from north-west to south-east. In addition to this, there is a further 150mm dia. public foul water sewer located in Copse Lane, to the east of the site, located in the centre of the road flowing from north to south.
- It is understood that the site does not have any existing connections to either of the two public foul water sewers mentioned above.

1.4.4 Highway Drainage:

- West Walberton Lane does not appear to be served by any positive surface water drainage infrastructure. It is believed that it is drained by 'over the edge' methods, the outfall of which is believed to fall to the ordinary watercourse along the north-eastern edge of the carriageway.

2 PROBABILITY

2.1 Sources of Information

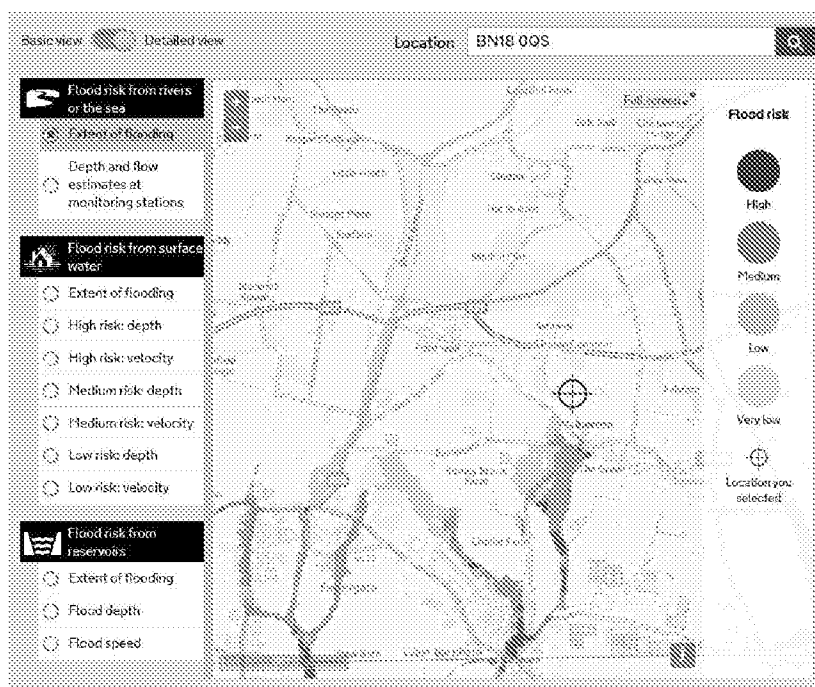
2.1.1 The NPPF requires that all sources of flooding are considered being Tidal, Fluvial, Pluvial, Groundwater, Sewers and Man-made reservoirs/canals.

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

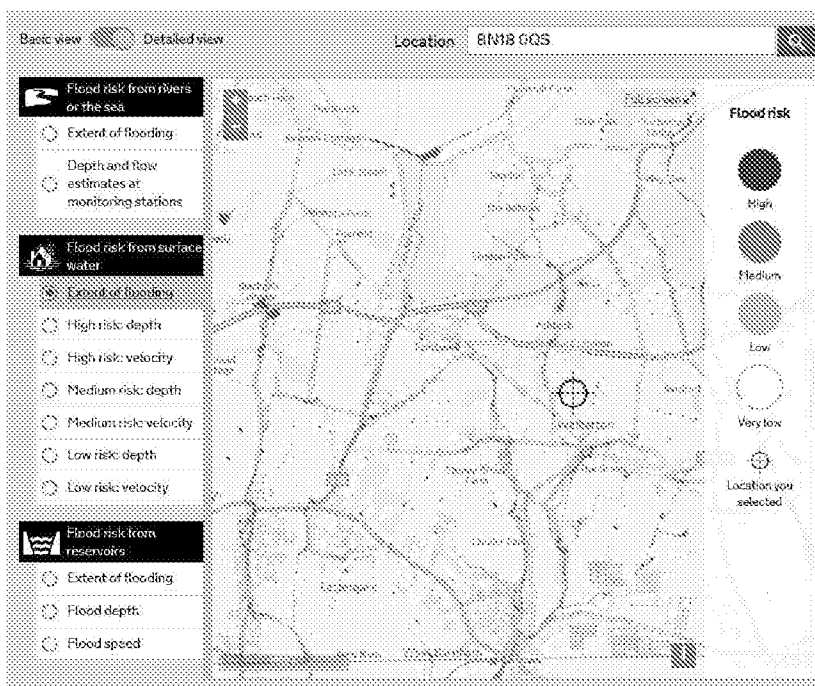
- Environment Agency Flood Maps for Planning
- Long Term Flood Risk Assessment Surface Water Flood Risk Maps
- Long Term Flood Risk Assessment Reservoir Flood Risk Maps
- Local Authorities Strategic Flood Risk Assessment
- Consultation with Local Authority/Lead Local Flood Authority
- Topographic Survey

2.2 Flood Maps and Modelling

2.2.1 The Environment Agency's on-line Flood Maps for Planning (rivers and sea) show that the site is partially within Flood Zones 2 & 3 (fluvial). This is also confirmed by information and mapping obtained from The Environment Agency. The western boundary of the site appears to fall within Flood Zone 2, whilst the south-west corner of the site falls within Flood Zone 3 near to the neighbouring property, Hanthorpe. This is demonstrated by the mapping contained within Appendix C.

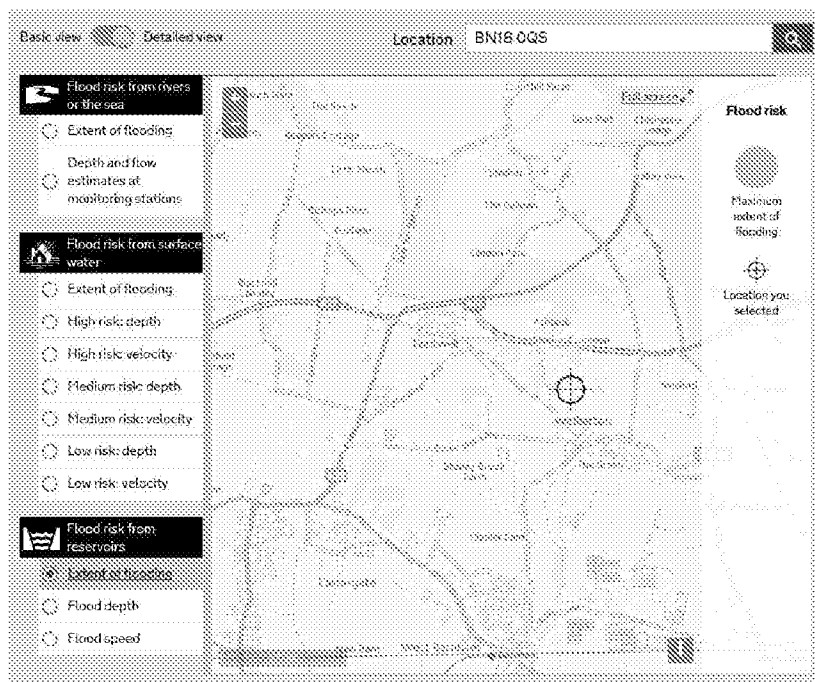


2.2.2 The Long-Term Flood Risk Map for Surface Water show that the site is at varying levels of susceptibility to surface water flooding. The areas adjacent to the existing watercourse located at the western boundary of the site are susceptible to low level risk of surface water flooding, whilst the south-western extent is stated as being at high risk of surface water flooding at the boundary with the neighbouring property, Hanthorpe. This information is consistent with the Flood Risk Mapping obtained from the Environment Agency.



2.2.3 Whilst the SFRA indicates the permeability of soils in this area to be highly variable, the BGS website borehole data does not indicate high groundwater and therefore the site is at a low risk of ground water flooding.

2.2.4 The Flood Maps for Reservoirs (gov.uk) show that the site is not at risk from this source.



2.2.5 There is no evidence to suggest a Sewer flood risk within the vicinity of the site.

2.2.6 There are no known artificial sources in the area.

2.3 Strategic Flood Risk Assessment

2.3.1 The site falls within the boundaries of West Sussex County Council (WSCC) and Arun District Council (ADC).

2.3.2 WSCC has published a Local Flood Risk Management Strategy covering 2013-2018. Flood mapping and information obtained therein is consistent with other flood maps reviewed and detailed within this report. This site and/or area is not specifically identified for development and is not identified to be high risk.

2.4 Historic Flooding

2.4.1 The SFRA & The Environment Agency has confirmed that they are not aware of any historical flooding within the confines of the site.

2.5 Summary of Flood Risk

2.5.1 The potential sources of flooding are:

- Overtopping or breach of the watercourse
- Blockages in drains or culverts
- Surface water flooding (low-high)

- 2.5.2 Overtopping/Surface water flooding - An assessment of the Flood Maps for Planning and a topographic survey has been made to determine a level for the extent of Zone 3 and the 16.00m contour appears to coincide fairly well with the coarsely shown extent. The proposed site layout has been designed so that all of the buildings are located in Zone 1 (lowest risk of flooding), avoiding those areas which pose a greater risk of flooding (Zones 2 and 3, whilst overland flow is also directed away from the buildings.
- 2.5.3 Blockages in drains or culverts - The watercourse is maintained by The Riparian Owners and regular annual maintenance will be undertaken. The new oversized culvert will mitigate long-term blockages and/or siltation. The scenario if a blockage occurred in the culverted drainage system, flood water is unlikely to reach the building ground floor levels as the watercourse and culvert 'overland route' is nominally lower than and bypasses the site.
- 2.5.4 The aforementioned data confirms the following sources and level of risk:

Source of Flooding	Level of Risk
Rivers and Watercourses	West: Medium East: Low
The Sea	Very low
Surface water	Low (Adjacent to the eastern bank of the existing watercourse) Medium (Adjacent to the western bank of the existing watercourse) High (At the south-west corner of the site at the neighbouring boundary with Hanthorpe)
Groundwater	Low
Sewers (*)	Low
Artificial Sources	None

3 PROPOSED DEVELOPMENT

3.1 Description of Development

- 3.1.1 The proposed development will involve the construction of nine new detached and semi-detached properties in total; five four-bedroom properties and four three-bedroom properties at the above stated location.
- 3.1.2 The type of development falls within the More Vulnerable classification (Flood Risk and Costal Change Table 2) and is compatible with Flood Zones 1 and 2 (Flood Risk and Costal Change Table 3).

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	x	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	x	x	x	✓*

- 3.1.3 The proposed development encompasses land which is currently an un-developed greenfield site which has no existing impermeable areas. The proposed development involves the creation of new impermeable areas and will therefore increase the rate or volume of run-off generated by the site. Post development, the total impermeable area will amount to 0.93Ha. The increase in impermeable area will result in an increase in surface water run-off, which will be mitigated through the use of SuDS methods and techniques (where conditions allows) within the bounds of the site. Further to this, additional surface water which is to be discharged to the existing watercourse will be done so at a restricted rate as so not to exacerbate existing flow rates, to ensure that the development does not to ensure that the development does not increase the risk of flooding both on and off of the site.
- 3.1.4 The proposed site layout is shown on drawing SCR-MHA-00-XX-DR-A-004 P2 (**Appendix A**) prepared by MH Architects.

4 PROPOSED DRAINAGE STRATEGY

4.1 Surface Water

- 4.1.1 The SUDS manual and Building Regulations set out a hierarchy of drainage methods to ensure that developments maximise the use of sustainable drainage techniques. The Hierarchy favours infiltration methods of disposal over other methods such as watercourse and sewers.

SUDS Technique	Suitable	Comments
Living Roof	Yes	No initial constraints but may not be suitable due to structural load and maintainability
Basins and Ponds		
- Constructed Wetlands	No	Constraints on existing site limits the use of these techniques in view of the current arrangement, i.e. 'land take'.
- Balancing Ponds	No	
- Detention Basins	No	
- Retention Ponds	No	
Filter strips and swales	No	Constraints on existing site limits the use of these techniques
Infiltration Devices		
- Soakaways	Yes	Infiltration potential of underlying soil unknown without further testing. This is therefore limited as single option.
- Infiltration trenches and basins	Yes	
Permeable surfaces and filter drains		
- Gravelled areas	Yes	Infiltration potential of underlying soil unknown without further testing, however can still be utilised with an outfall to the existing watercourse if infiltration rates are determined to be poor.
- Solid paving blocks	Yes	
Porous paviers	Yes	
Tanked systems		
Oversized pipes	Yes	These techniques could be utilised with an outfall to the existing watercourse.
Cellular tanks	Yes	

- 4.1.2 Infiltration rates are currently unconfirmed, however it is believed – owing to information obtained from BGS, that underlying soil conditions will not be suited to offering infiltration as a means of dealing with surface water.
- 4.1.3 As has already been established, there are no public surface water sewers located within the vicinity of the site to which a connection could be made in order to discharge surface water run-off from the site.
- 4.1.4 In view of 4.1.2 and 4.1.3, it is proposed to employ porous paving across the site to cater for an increase in potential surface water run-off in view of the increase of impermeable areas. This will ensure that all surface water is drained via sustainable drainage methods outlined within the SuDS manual as well as Building Regulations, which both seek to maximise the use of sustainable drainage techniques.
- 4.1.5 Additional surface water run-off which is not dealt with via infiltration methods will discharge to the existing water course at a controlled rate of 5l/s as so not to increase the risk of flooding either on, or off of the site.
- 4.1.6 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.

4.2 Treatment

- 4.2.1 The use of porous paving will ensure that the run-off from the road receives a level of treatment that meets the requirement of the SuDS Manual due to naturally occurring microbes digesting Hydrocarbons entering the system and the filtration effects of the aggregates and geotextiles.
- 4.2.2 Impermeable hard stand areas will be drained by trapped road gullies and/or channel with a sump providing a basic level of treatment by collecting silts and oil pollutants. Catchpits will also be provided to collect silts and oil pollutants.
- 4.2.3 The CIRIA SuDS Manual C753 outlines three categories of pollution hazard identification for the various types of land use as follows:
- Total Suspended Solids (TSS).
 - Metals (M).
 - Hydrocarbons (H).
- 4.2.4 In accordance with C753 table 26.2 the proposed land uses at the site are categorised as follows:
- Residential Roofs - very low/TSS-0.2/M-0.2/H-0.05.
 - For other impermeable surfaces - low/TSS-0.5/M-0.4/H-0.4.

- 4.2.5 In accordance with C753 table 26.3 to establish whether a proposed surface water management technique can provide sufficient treatment for runoff, the values are compared. If the treatment score for each pollutant category is higher than the pollution score then the chosen technique is sufficient. If a single technique is not judged to provide enough treatment then other techniques can be added to the system.
- 4.2.6 The treatment afforded by the proposed outline surface water management strategy has been assessed based on the following components:

- Permeable pavement – TSS-0.7/M-0.6/H-0.7

- 4.2.7 In conclusion, the proposed porous pavement can be considered to provide sufficient treatment.

4.3 Foul Water Drainage

- 4.3.1 It is proposed to connect the development to the existing foul water sewer located in West Walberton Lane, subject to confirmation of its levels. A Section 106 application will need to be submitted with Southern Water before a connection can be made.
- 4.3.2 Based on the residual design guidance provided in Sewers for Adoption, the proposed foul flow will be in the region of 0.42l/s (based on 4,000 l/day Sewers for Adoption 7th Edition).

4.4 Climate Change

- 4.4.1 NPPF sets out percentage increases to be applied to the peak rainfall intensity values used in the design of a surface water drainage system to allow for the effects of climate change.
- 4.4.2 In accordance with NPPF 'climate change allowances' update 12th April 2016, an increase of 20% should be applied for this development and a review should be undertaken to determine the impact of an increase of 40%.
- 4.4.3 The proposed development involves the creation of additional impermeable areas, therefore rainfall increases need to be incorporated into the existing surface water drainage regime.
- 4.4.4 The available long-term flood maps suggest that the effects of climate change will not increase the 'predicted' fluvial flood zone expanse in the future. Whilst the extent of the site at risk of flooding is predicted to increase for 100 years lifetime, this is not as a result of the minor development proposals, i.e. this will occur to all properties in this location unless further mitigation works are implemented.
- 4.4.5 The site arrangement has been set out sequentially so that new builds are constructed in areas of the site which represent lower risk(s) of flooding (Zone 1). Furthermore, overland flow is directed away from the proposed buildings, whilst floor levels have been set to ensure that the buildings are elevated beyond the level of supposed risk (determined to be at the 16.00m contour line). These actions provide a level of protection against the effects of climate change for the lifetime of the development.

4.5 Flood Plain Compensation

- 4.5.1 As established already, the proposed development has been set out to ensure all new builds are located in areas of the site which are at lowest risk of flooding (Flood Zone 1).

- 4.5.2 Improvements will be made to the existing watercourse along the western boundary of the site, along with re-grading works to the end of the rear gardens which are adjacent to this, to ensure that the properties are not affected by potential flooding.

5 RESIDUAL RISK AND MITIGATION

5.1 Residual Risk

- 5.1.1 As discussed in Section 2, there is a residual risk of increased flood depths if the watercourse is overtopped (fluvial).

5.2 Mitigation

- 5.2.1 As discussed in Section 2, there is a risk of flooding and so mitigation is proposed.
- 5.2.2 The proposed arrangement of the site has been set out sequentially to ensure that all dwellings are located within Flood Zone 1, presenting the lowest risk of flooding.
- 5.2.3 Finished floor levels have been set to ensure that the properties are elevated beyond the level deemed to represent the highest level of potential flood risk.
- 5.2.4 The existing watercourse will be improved as part of the overall development of the site, whilst the end of the rear gardens which are adjacent to the watercourse will be locally regraded within the buffer zone.

6 SEQUENTIAL AND EXCEPTION TESTS

6.1 Sequential Test

- 6.1.1 The site has been laid out sequentially to ensure that all of the proposed properties are located within Flood Zone 1, which presents the lowest risk of flooding. The development itself is classified as "More Vulnerable".
- 6.1.2 The floor levels of the proposed buildings have been set to ensure that the properties are elevated beyond the level believed to represent the highest level of potential flood risk.
- 6.1.3 The existing watercourse will be re-profiled as part of the overall development, whilst garden adjacent to this will be locally re-graded within the buffer zone to ensure that overland flow falls away from the buildings.
- 6.1.4 In view of the above, the application of the sequential test is not required.

6.2 Exception Test

- 6.2.1 Table 3 within Paragraph 067 of Flood Risk and Coastal Change confirms that developments classified as 'More Vulnerable' are suitable for Zones 1 and 2. The proposed development is in Zone 1 and therefore an exception test is not required.

7 FLOOD RISK MANAGEMENT

7.1 Safe Access and Egress

- 7.1.1 The site has been set out sequentially and all habitable dwellings are located within Flood Zone 1 and is expected to remain in that zone throughout its design life.
- 7.1.2 Access and egress via West Walberton Lane will require traversing an area located within in Zones 2 and 3. The proposed access road will bridge over the existing watercourse, providing a final ground level of 16.00m AOD – above the measured flood zone datum discussed previously, and is therefore deemed to be a dry access route.

7.2 Maintenance

- 7.2.1 Maintenance plays an important part in the long-term performance of a surface water drainage system and will be required to ensure that it remains fully operational.
- 7.2.2 The traditional parts (inspection chambers, pipes, gullies etc.) of the proposed surface water drainage system will need a minimal amount of maintenance similar to other traditional systems.
- 7.2.3 The SuDS devices will require slightly more maintenance focusing on reducing the amount of silt that is allowed to enter the system. Upstream catchpits and gully sumps will need to be regularly emptied of silt.
- 7.2.4 It is important to ensure that the porous paved areas are properly maintained in accordance with the manufacturers recommendations which may include:
- Periodic surface sweeping to reduce silt and debris accumulation.
 - Periodic silt removal from porous paved construction.
 - Redressing the joints on the block paved surface as required.
- 7.2.5 It is recommended that a simple maintenance strategy is prepared by monitoring the proposed drainage system over a specific duration to establish the rate at which silt builds up, which can then inform a programme of regular works.
- 7.2.6 It is anticipated that individual property owners/tennants will be responsible for the ongoing maintenance of the proposed surface water drainage system on the site.
- 7.2.7 The site will also rely on the existing watercourse network to convey surface water run-off. The riparian owner of a watercourse is responsible for its maintenance. This is likely to include ensuring all branches of the watercourse are free flowing and de-silted at periodic intervals. Failure to do so could result in an increased risk of flooding upstream and/or downstream of the site.

8 OFFSITE IMPACTS

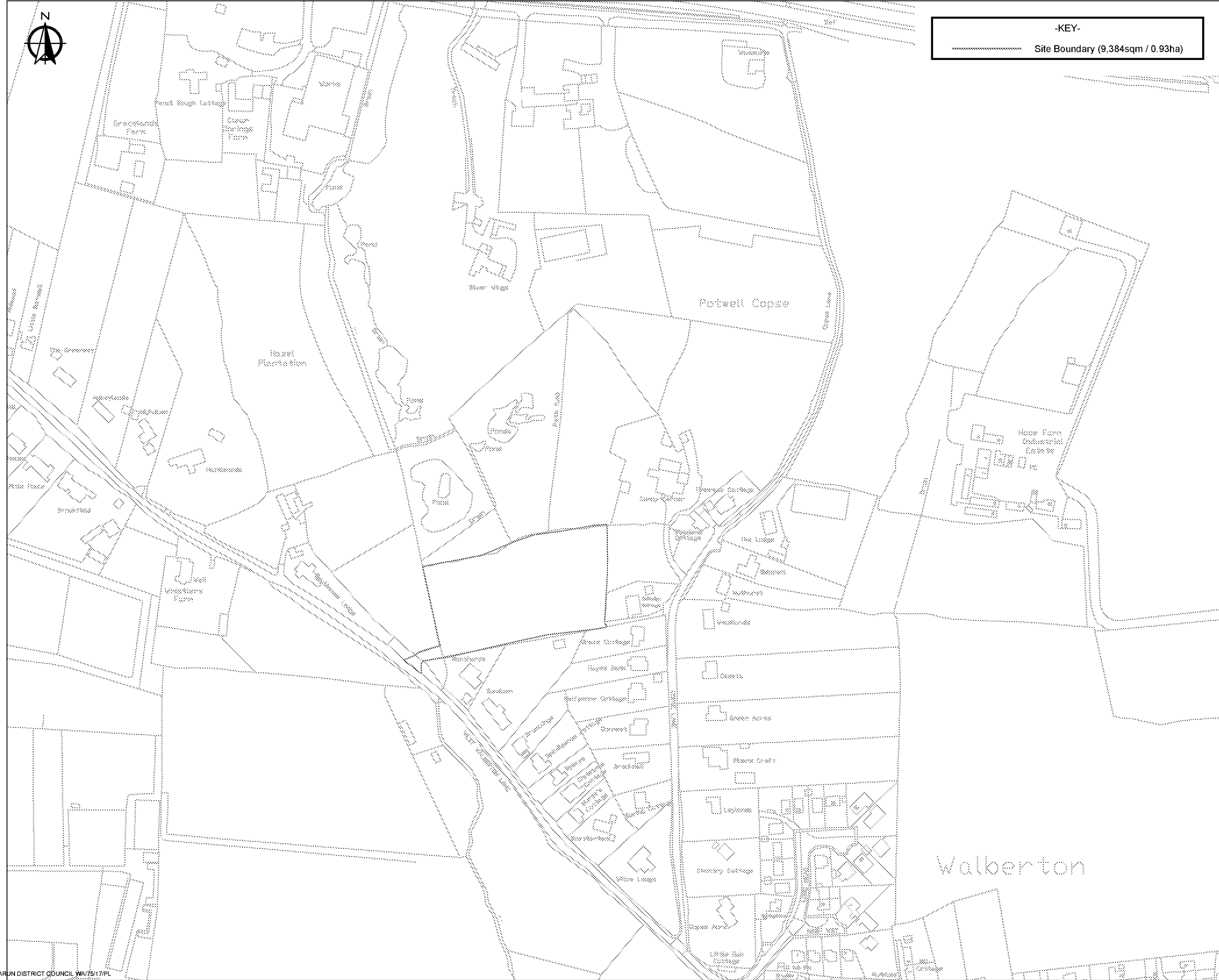
- 8.1.1 The proposed development will not have an impact on flooding issues off-site.
- 8.1.2 There will be no increase in the rate of run-off leaving the site and no significant impact to the existing surface water system and/or receiving watercourse body.
- 8.1.3 There will be no adverse impact on overland flood flow routes because the proposals will follow the existing general topography (falls from north-east to south-west).
- 8.1.4 The effects of climate change should be considered in the design of the proposed surface water drainage system, to ensure there is no off-site impact.

9 SUMMARY

- 9.1.1 This site-specific flood risk assessment is based on Flood Maps, the Local Authority's Strategic Flood Risk Assessment, Topographical Survey data and Public Sewer Records.
- 9.1.2 The site is currently an undeveloped greenfield site.
- 9.1.3 The site lies at approximately 16m AOD to 26m AOD and falls from north-east to south-west.
- 9.1.4 There are no existing impermeable surfaces on the site.
- 9.1.5 The development lies within Flood Zone 1 and it is expected to remain unchanged for the duration of the development's life expectancy.
- 9.1.6 The run-off from the site is believed to follow existing overland flow routes discharging to the existing watercourse located within the bounds of the site, as well as by partial infiltration.
- 9.1.7 The wastewater from the proposed development will outfall to the existing public foul water sewer located within West Walberton Lane, to the west of the proposed development.
- 9.1.8 As a result of an increase in impermeable areas across the site, an increase in surface water run-off will occur. This will be managed by sustainable drainage methods and techniques (with porous paving) within the bounds of the site, meaning there will be no increase in the rate of surface water run-off leaving the site. Additional overland flow will be discharged to the existing watercourse at a restricted rate of 5l/s as so not to increase potential flooding both on and off of the site.
- 9.1.9 Following completion of the development the flood risk both on and off the site will remain unchanged.
- 9.1.10 The nature of the development does not permit the sequential test to be applied but this FRA shows that the elements of the Exception test can be passed.
- 9.1.11 It is recommended that occupiers subscribe to the Environment Agency's flood warning service and prepare a flood plan.
- 9.1.12 In conclusion, from a flood risk point of view the proposed development is suitable.

DRAWINGS

SK100 Site Location Plan
SK101 Topographical Survey with Contours
SK102 LiDAR Banding
SK200 Impermeable Area Comparison
SK300 Drainage Strategy
SK1000 Flood Risk Constraints Map



1. This drawing is to be read in conjunction with all other RGP 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. RGP 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.

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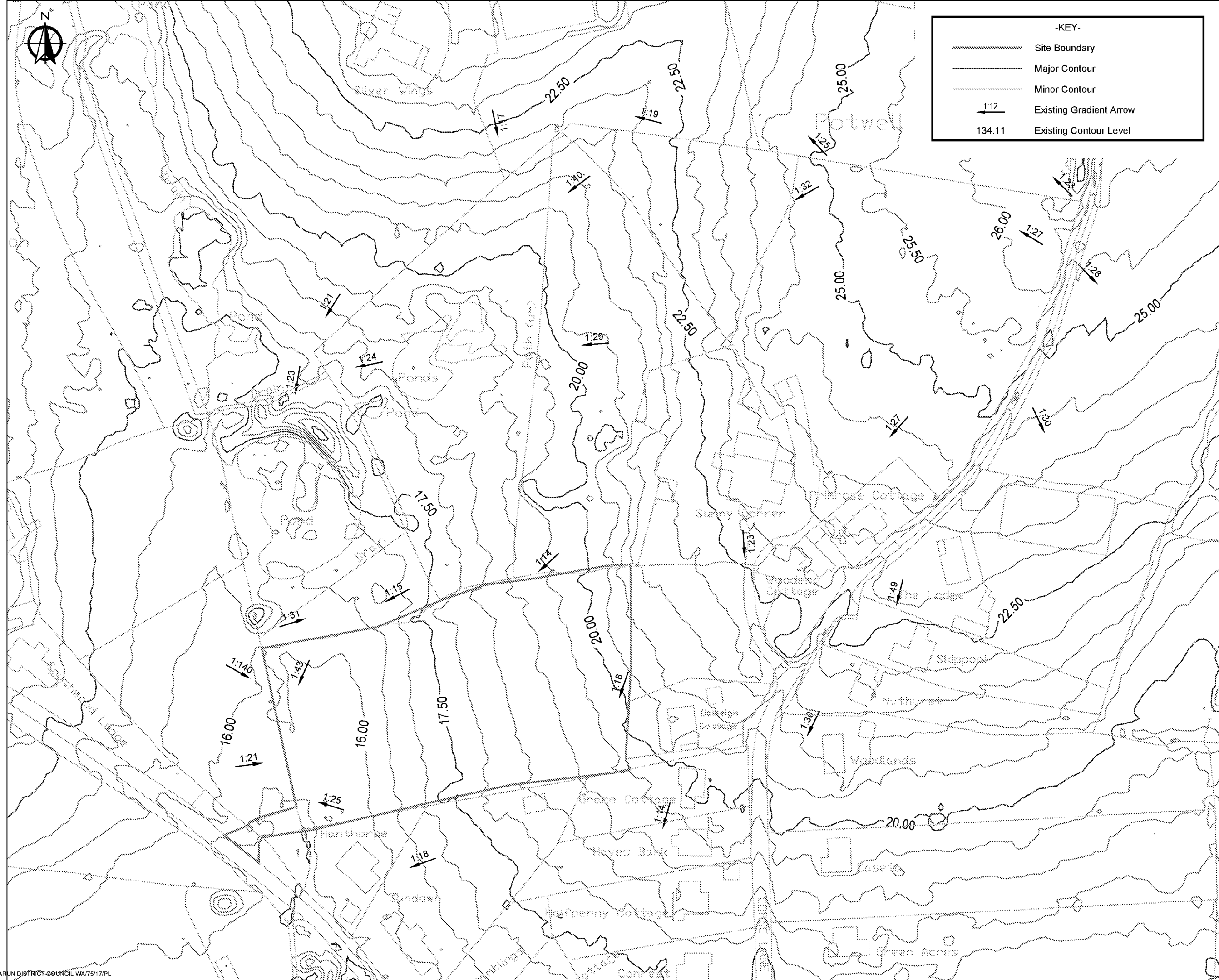
Project

Sunny Corner, Walberton
BN18 0QS

Drawing Title

Site Location Plan

Scale	1:2500	Drawn By	SPB	Checked By	MJA	Approved By	MJA
Date	August 2017	Drawing No.	2017-D1271-SK100	Rev.	-		



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Project
Sunny Corner, Walberton
BN18 0QS

Drawing Title
Topographical Survey with Contours

Scale	1:1250	Drawn By	SPB	Checked By	MJA	Approved By	MJA
Date	August 2017	Drawing No.	2017-D1271-SK101	Rev.	-		



-KEY-

Site Boundary



MINIMUM LEVEL	MAXIMUM LEVEL	COLOUR
10.00	12.00	
12.00	14.00	
14.00	16.00	
16.00	18.00	
18.00	20.00	
20.00	22.00	
22.00	24.00	
24.00	26.00	
26.00	28.00	
28.00	30.00	
30.00	32.00	
32.00	34.00	
34.00	36.00	
36.00	38.00	

NOTES

A3

1. This drawing is to be read in conjunction with all other RGP 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. RGP 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.

-

22/08/2017

Original Issue

SPB

Rev

Date

Amendments

Drawn



Southport Planning and Infrastructure Design Consultants

Metro House, Northgate, Chichester, West Sussex, PO19 1BE

Tel: 01243 410418 Fax: 01483 861682 www.rgp.co.uk

Client

Mr and Mrs Holden

Project

Sunny Corner, Walberton
BN18 0QS

Drawing Title

LIDAR Banding

Scale

1:1000

Drawn By

SPB

Checked By

MJA

Approved By

MJA

Date

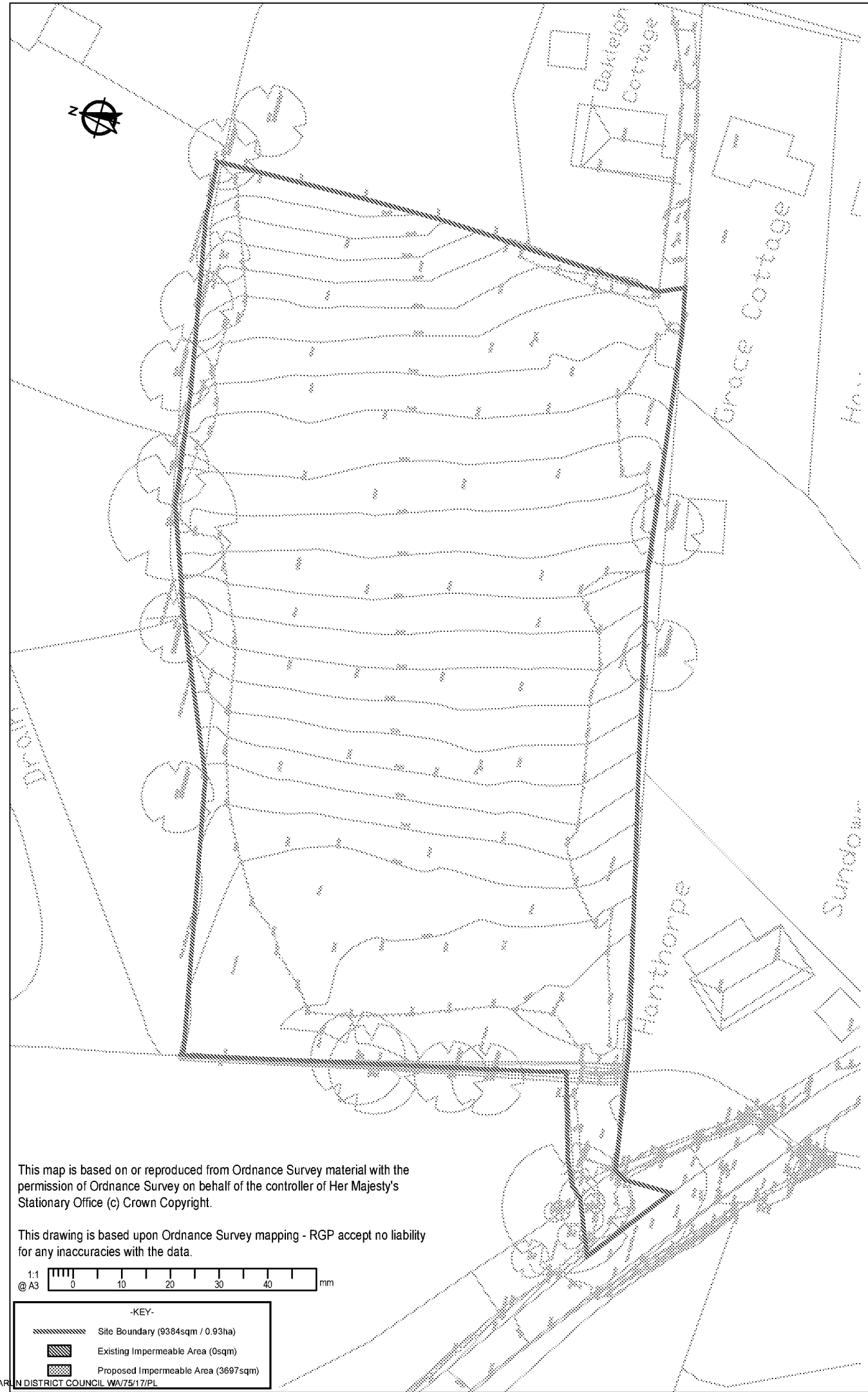
August 2017

Drawing No.

2016-D1271-SK102

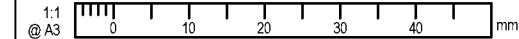
Rev.

-



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-KEY-	
	Site Boundary (9384sqm / 0.93ha)
	Existing Impermeable Area (0sqm)
	Proposed Impermeable Area (3697sqm)

ARLINDISTRICT COUNCIL WA/75/17/PL



NOTES

A3

1.

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4.

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	17/08/2017	Original Issue	SPB
Rev.	Date	Amendments	Drawn

Transport Planning and Infrastructure Design Consultants

Metro House, Northgate, Chichester, West Sussex, PO19 1BE

Tel: 01243 410418 Fax: 01483 861682 www.rgp.co.uk

Client

Mr & Mrs Holden

Project

Sunny Corner, Walberton

BN18 0QS

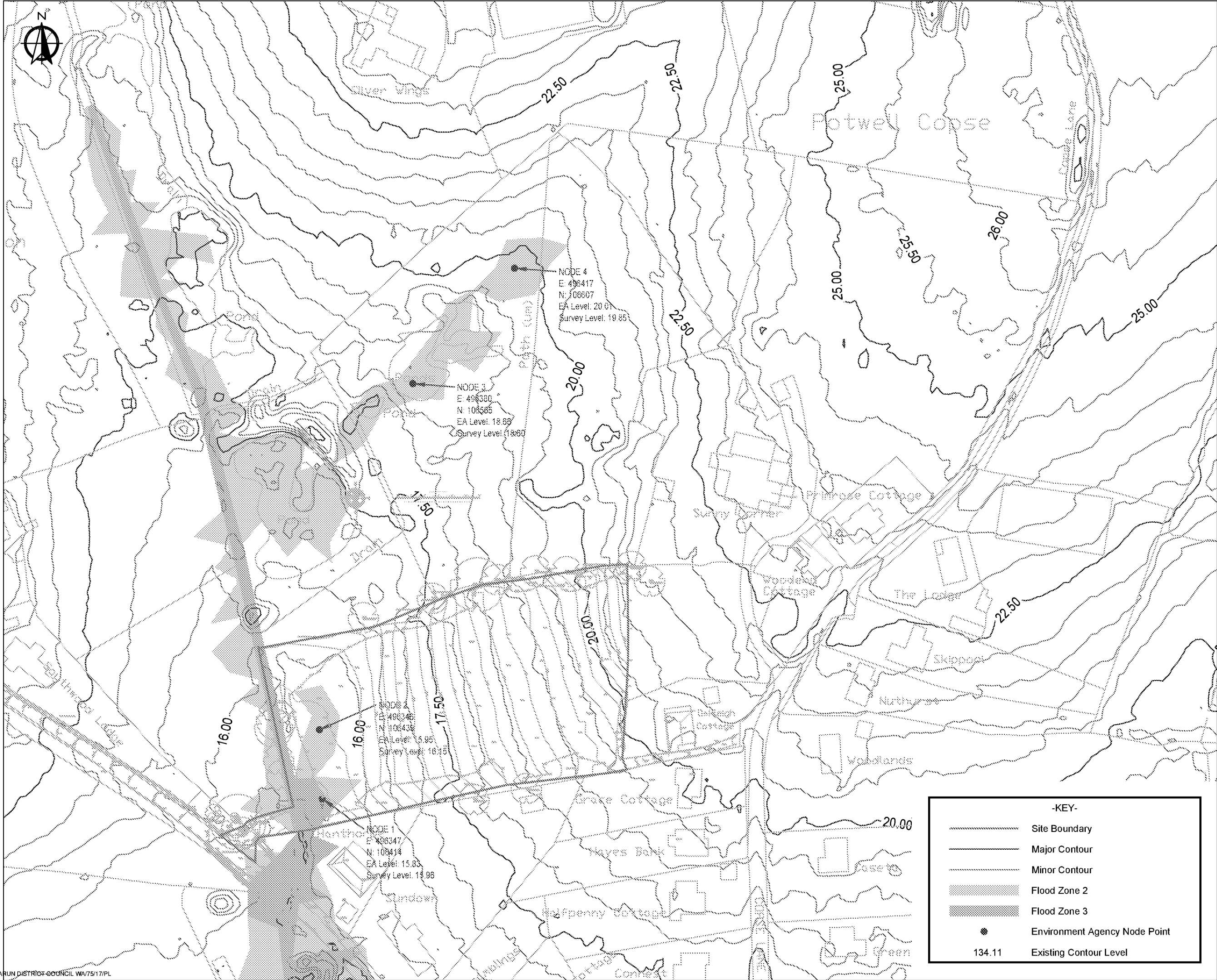
Drawing Title

Impermeable Areas Comparison

Scale	1:750	Drawn By	SPB	Checked By	MJA	Approved By	MJA
Date	August 2017	Drawing No.	2017-D1271-SK200	Rev.	-		



-	21/08/2017	Original Issue	SPB
Rev.	Date	Amendments	Drawn
			
Environment Planning and Infrastructure Design Consultants Metro House, Northgate, Chichester, West Sussex. PO19 1BE Tel: 01243 210418 Fax: 01483 861682 www.rgp.co.uk			
Client			
Mr & Mrs Holden			
Project			
Sunny Corner, Walberton BN18 0QS			
Drawing Title			
Foul and Surface Water Drainage Proposal			
Scale	Drawn By	Checked By	Approved By
1:500	SPB	MJA	MJA
Date	Drawing No.		Rev.
August 2017	2017-D1271-SK300		-



NOTES

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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.

A	21/08/2017	Node survey levels corrected	SPB
-	10/03/2017	Original Issue	RAA

Rev	Date	Amendments	Drawn

rgp

Design

Transport Planning and Infrastructure Design Consultants

Metro House, Northgate, Chichester, West Sussex, PO19 1BE

Tel: 01243 410418 Fax: 01483 861682 www.rgp.co.uk

Client

Mr and Mrs Holden

Project

Sunny Corner, Walberton
BN18 0QS

Drawing Title

Flood Risk Constraint Map

Scale	1:1250	Drawn By	SPB	Checked By	MJA	Approved By	MJA
Date	August 2017	Drawing No.	2017-D1271-SK1000		Rev.	A	

134.11

Existing Contour Level

Site Boundary

Major Contour

Minor Contour

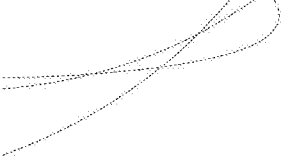
Flood Zone 2

Flood Zone 3

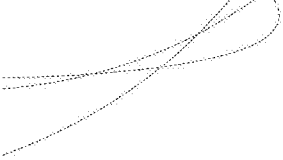
Environment Agency Node Point

Environment Agency Node Point

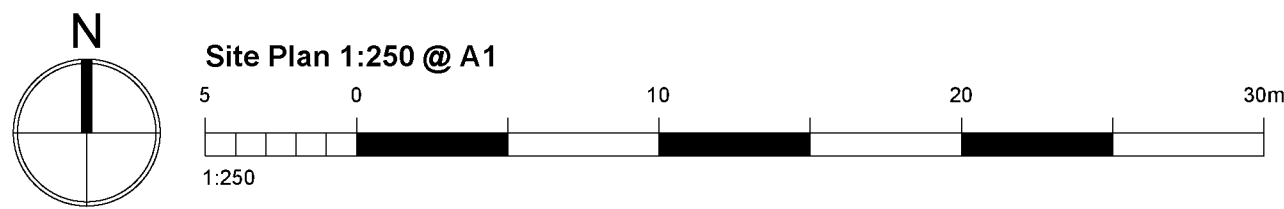
Existing Contour Level



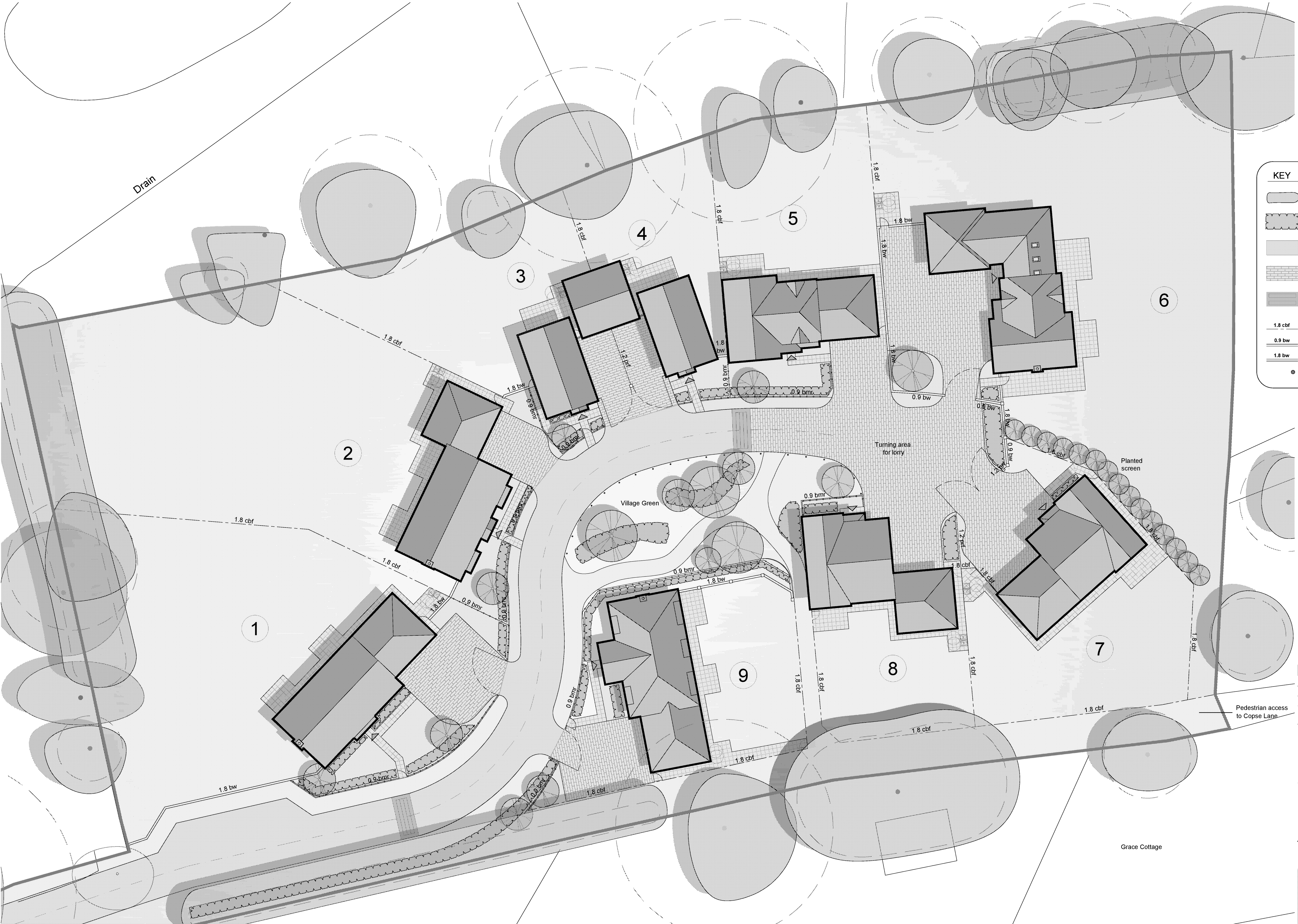
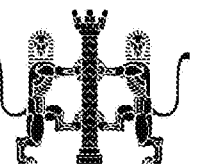
APPENDICIES



Appendix A Architects Layout GA



- Notes
1. This drawing is the copyright of MH Architects Ltd
 2. Do not scale this drawing except for Local Authority planning purposes
 3. All dimensions must be checked on site by the contractor prior to commencement of the works.



KEY

	EXISTING SHRUB PLANTING		EXISTING TREES (refer to tree survey and report)
	PROPOSED SHRUB PLANTING		PROPOSED TREES (to be removed)
	TARMAC ROAD SURFACE		GRASS
	TEGULAR BLOCK PAVING		MARSHALL SAXON PAVING OR SIMILAR, REAR PATIOS AND PRIVATE PATHS
	GRANITE SETTS RUMBLE STRIPS AND ROAD DESIGNATION CHANGE DEMARCATION		BOUND GRAVEL COMMUNAL PATH
	1.8m CLOSE BOARDED FENCE		1.2m POST AND RAIL TIMBER FENCE
	0.9m BRICK WALL		0.9m BLACK PAINTED METAL ESTATE RAILING
	1.8m BRICK WALL		APPLICATION BOUNDARY
	TIMBER BOLLARDS		

Rev.	Revision Note/Purpose of Issue	Drawn By	Date	CHK By	Date
X	A - Approved				
X	B - Approved with comments				
X	C - Do not use				

Client: Mr & Mrs Holden

Job title: Development at Sunny Corner, Copse Lane, Walberton, West Sussex, BN18 0QH

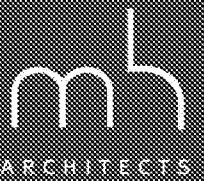
Drawing title: Proposed Site Layout

Drawn	Date	Checked	Date	Scale at A1
CJP	06.07.17			1:250
Job No.	Drawing No.			Rev.
17-025	SCR-MHA-00-XX-DR-A	0004		P2
Purpose of issue: PRELIMINARY				

Ground Floor | Bicentennial Building
Southern Gate | Chichester
West Sussex | PO19 8EZ

T: 01243 774748
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www.mharchitects.co.uk

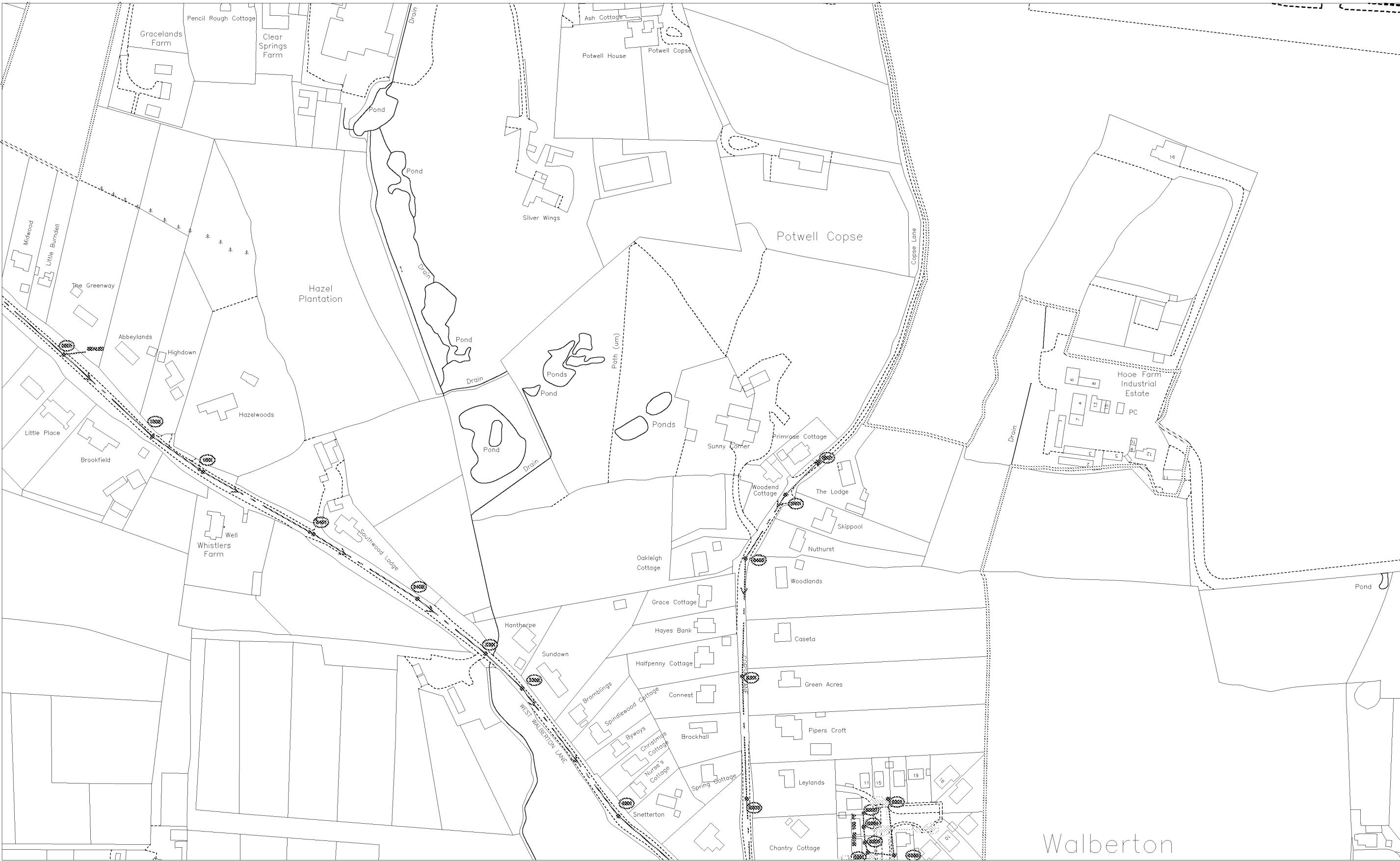
Limited Company
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Appendix B Public Sewer Maps

SEWER RECORDS PAGE 1 OF 2

106817



106240

496007

O.S. REF.

SU9606NW

Title: 237786_Sunny Corner, Walberton

Drawn by: kumaria

Scale: 1:2500

Date: 21/03/2017

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.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement

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

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496949

SEWER RECORDS PAGE 2 OF 2

Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape
0501X	23.72	21.07	150	OTHER	CIRC																		
1501X	21.26	18.9	150	VC	CIRC																		
1502X	22.23	20.53	150	VC	CIRC																		
2401X	18.72	16.89	150	VC	CIRC																		
2402X	16.06	14.58	150	VC	CIRC																		
3301X	15.23	13.81	150	VC	CIRC																		
3302X	15.05	13.41	150	VC	CIRC																		
4201X	14.12	12.78	150	VC	CIRC																		
5201X	15.01	13.39	150	VC	CIRC																		
5203X	13.94		150	VC	CIRC																		
5204X			100	PF	CIRC																		
5205X			100	PF	CIRC																		
520DX			100	PF	CIRC																		
5250X	15.02	13.73	150	VC	CIRC																		
5301X	17.62		150	VC	CIRC																		
5401X	22.24	20.73	150	VC	CIRC																		
5402X	20.53	19.13	150	VC	CIRC																		
5501X	23.08	21.5	150	VC	CIRC																		
6201X	15.76	13.67	150	VC	CIRC																		
6202X	15.04	13.13	150	VC	CIRC																		
6250X	15.61	14.06	150	VC	CIRC																		
6251X	15.49	14.06	150	VC	CIRC																		
6252X	15.16	13.81	150	VC	CIRC																		

LINE STYLES / COLOURS		MATERIALS		LEGEND - SEWERS	
Brown	----- Foul	AK	Alkaline	Washout (SW)	Other (s)
	----- Foul Syphon Sewer	BAC	Bonded Asbestos Cement	Washout (F&C)	Other
	----- Foul Vacuum Main	BRD	Brick (Common)	Rodding Eye (SW)	Change In sewer (s)
	----- Foul Rising Main	BRE	Brick (Engineering)	Rodding Eye (F&C)	Change In sewer
Red	----- Combined	CI	Cast Iron	Gauging point (SW)	Rafflux valve
	----- Combined Syphon Sewer	CO	Concrete (In-Situ)	Gauging point (F&C)	Flap valve
	----- Combined Rising Main	CP	Concrete (Pre-Cast)	Intercept chamber (SW)	Cascade
	----- Lateral Drain	CSU	Concrete Segments (unbolted)	Intercept chamber (F&C)	Anode
Orange	----- Building Over Agreement Area	DI	Ductile Iron	Storm Tank (SW)	Valve
Dark Blue	----- Treated Effluent	GRD	Glass Reinforced Concrete	Storm Tank (F&C)	Closed Valve
Purple	----- Sludge	GRP	Glass Reinforced Plastic	Vortex chamber (SW)	Air Valve
	----- Sewer Catchment	MAC	Masonry In regular Courses	Vortex chamber (F&C)	Hatch box (SW)
	----- Section 104 Area	MAR	Masonry In random Courses	Label ellipse	Hatch box (F&C)
Light Blue	----- Surface Water	PE	Polyethylene	Dummy/S24 manhole	Direction arrow
	----- Surface Water Rising Main	PP	Polypropylene	Outfall	Emptying valve
Yellow	----- Private	PVC	Polyvinyl Chloride	Penstock chamber	Catchpit
	----- Access Shaft	RPM	Reinforced Plastic Matrix	Demiboards	Soskaway
	----- Decommissioned	SI	Spun Iron	Storm Overflow	Inlet
		ST	Steel	Backdrop manhole	Balancing Pond
		VC	Vertifed Clay		
		XXX	Other		
		ZZZ	Unknown		

Drawn by: kumaria

Title: 237786_Sunny Corner, Walberton

Date: 21/03/2017



Appendix C Historical Borehole Records

COMMERCIAL
IN CONFIDENCE



BORE HOLE NO. 6

**COMMERCIAL
IN CONFIDENCE**

Ordnance Plot No. 68

Water Struck at 6 ft. 0 ins. Rest Water Level _____ ft. _____ ins. after _____ hours

Ordnance Datum Level ca. 23m

[illegible]

REMARKS

Samples taken at

(1) _____ ft. _____ ins. (2) _____ ft. _____ ins. (3) _____ ft. _____ ins. (4) _____ ft. _____ ins.

Appendix D LLFA/LPA Flood Risk

Our ref: SSD38077

Date: 02/03/2017

Dear Mark Akmenkalns

Provision of Product 4 for address: Sunny Corner, Copse Lane, Walberton, West Sussex, BN18 0QH

Thank you for your request of 16/02/2017 to use Environment Agency data, Product 4. The information is attached.

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

The property is in an area partially located within Flood Zone 2 and 3 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.

Please find attached a copy of the Flood Map for Planning (Rivers and Sea) for the area relating to your address.

Further details about the Environment Agency information supplied can be found on the GOV.UK website:

<https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather>

If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency Information for Flood Risk Assessments

<https://www.gov.uk/planning-applications-assessing-flood-risk>

<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Guildbourne House, Chatsworth Road, Worthing, West Sussex, BN11 1LD
Customer services line: 03708 506 506
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk
98_07_SD01

Supporting Information

Modelling Information

All flood levels, depths and outlines are taken from the Aldingbourne Flood Risk Mapping Study, completed in 2015 by JBA Consulting.

Flood History

We do not have any records of previous flood events affecting this site. I would suggest contacting Arun District Council for a more comprehensive flood history check.

Flood Defences

There are no formal raised flood defences to protect this area from river flooding.

Please note our records are not comprehensive and may not include all events, you can contact your Local Authority to check if they hold any relevant information regarding your application.

You are encouraged to use and re-use this information freely and flexibly, with only a few conditions. Details of which can be found here:

<http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

We respond to requests for recorded information that we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

If you are not satisfied with our response to your request for information you can contact us within 2 calendar months to ask for our decision to be reviewed.

If you have any queries or would like to discuss the content of this letter further please call us on [REDACTED]

Yours faithfully

Eleonora Pilla
West Sussex PSO Officer

Enc. Flood Map for Planning (Rivers and Sea) / Node point locations / Flood levels/depths / Modelled flood outlines

Flood Map for Planning (Rivers and Sea) cetred BN18 0QH. Created 28/02/2017



Scale 1: 10,000



Flood Map for Planning (Rivers & Sea)

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

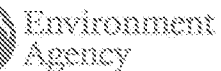
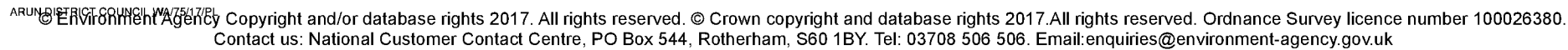
Flood Map Areas (assuming no defences)

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

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

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

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 Main River
 1% AEP (Defended Fluvial)
 1% AEP Plus Climate Change (Defended Fluvial)
 0.1% AEP (Defended Fluvial)
 Site_Boundary

Climate Change (CC) extent
based on an increase of 20%
in river flows.

Risk of flooding from Surface Water centred on BN18 0QH. Created 28/02/2017

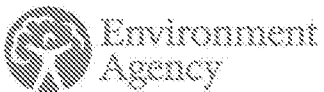
Legend

- Sealed Main Rivers
Flood Extent 1 in 30
Flood Extent 1 in 100
Flood Extent 1 in 1000



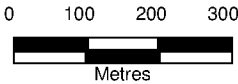
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Surface Water Flood Depth 1in30 centred on BN18 0QH. Created 28/02/2017



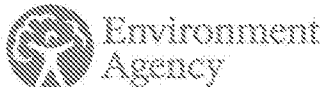
Legend

- Sealed Main Rivers
- Flood Depth 1 in 30
- Below 150mm
 - 150-300mm
 - 300-600mm
 - 600-900mm
 - 900-1200mm
 - Over 1200mm



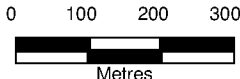
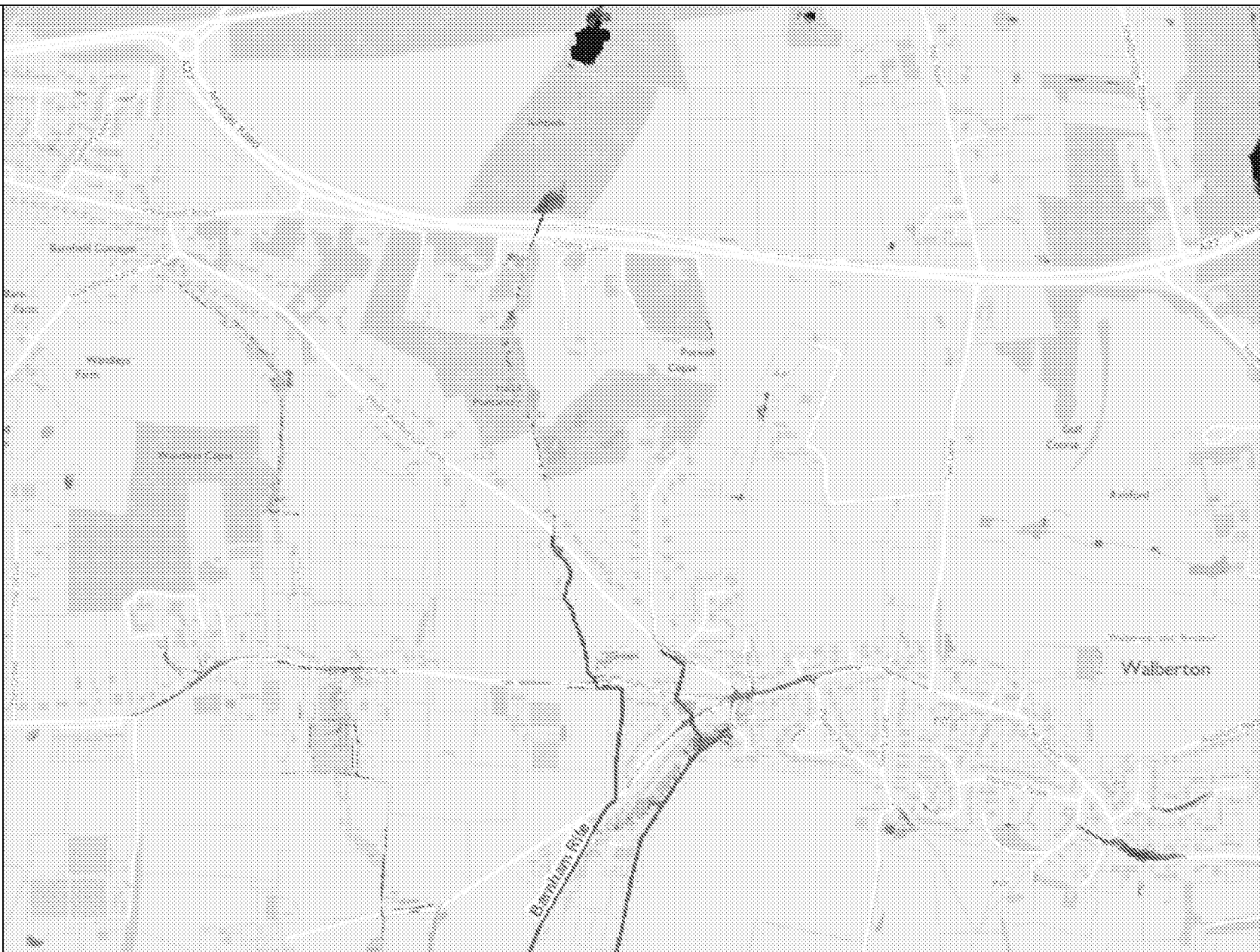
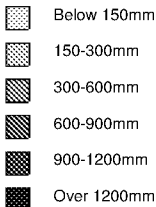
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Surface Water Flood Depth 1in100 centred on BN18 0QH. Created 28/02/2017



Legend

Sealed Main Rivers
Flood Depth 1 in 100

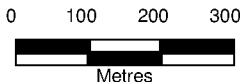
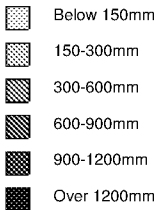


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Surface Water Flood Depth 1in1000 centred on BN18 0QH. Created 28/02/2017

Legend

Sealed Main Rivers
Flood Depth 1 in 1000



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Appendix E Microdrainage/Run-off Calculations

RGP Design Limited		Page 1
Metro House Northgate Chichester PO19 1BE		
Date 18/08/2017 13:12 File	Designed by sburnett Checked by	
XP Solutions Source Control 2016.1		

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	0.930	Urban	0.000
SAAR (mm)	782	Region Number	Region 7

Results 1/s

QBAR Rural	1.9
QBAR Urban	1.9
Q100 years	6.2
Q1 year	1.6
Q30 years	4.4
Q100 years	6.2

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RGP Design Limited		Page 1																										
Metro House Northgate Chichester PO19 1BE																												
Date 18/08/2017 13:14	Designed by sburnett																											
File	Checked by																											
XP Solutions		Source Control 2016.1																										
<u>Greenfield Runoff Volume</u> FSR Data <table> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>Storm Duration (mins)</td> <td>360</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.600</td> </tr> <tr> <td>Ratio R</td> <td>0.323</td> </tr> <tr> <td>Areal Reduction Factor</td> <td>1.00</td> </tr> <tr> <td>Area (ha)</td> <td>0.930</td> </tr> <tr> <td>SAAR (mm)</td> <td>785</td> </tr> <tr> <td>CWI</td> <td>115.968</td> </tr> <tr> <td>Urban</td> <td>0.000</td> </tr> <tr> <td>SPR</td> <td>30.000</td> </tr> </table> Results <table> <tr> <td>Percentage Runoff (%)</td> <td>32.24</td> </tr> <tr> <td>Greenfield Runoff Volume (m³)</td> <td>200.203</td> </tr> </table>			Return Period (years)	100	Storm Duration (mins)	360	Region	England and Wales	M5-60 (mm)	19.600	Ratio R	0.323	Areal Reduction Factor	1.00	Area (ha)	0.930	SAAR (mm)	785	CWI	115.968	Urban	0.000	SPR	30.000	Percentage Runoff (%)	32.24	Greenfield Runoff Volume (m³)	200.203
Return Period (years)	100																											
Storm Duration (mins)	360																											
Region	England and Wales																											
M5-60 (mm)	19.600																											
Ratio R	0.323																											
Areal Reduction Factor	1.00																											
Area (ha)	0.930																											
SAAR (mm)	785																											
CWI	115.968																											
Urban	0.000																											
SPR	30.000																											
Percentage Runoff (%)	32.24																											
Greenfield Runoff Volume (m³)	200.203																											
©1982-2016 XP Solutions																												

RGP Design Limited							Page 1
Metro House Northgate Chichester PO19 1BE			D1271 Sunny Corner, Walberton BN18 0QS				
Date 21/08/2017 File D1271 HYDRO-BRAKE, PORO...			Designed by SPB Checked by MJA				
XP Solutions			Source Control 2016.1				
<u>Summary of Results for 100 year Return Period (+40%)</u> Half Drain Time : 143 minutes.							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	16.716	0.166	7.3	0.0	7.3	72.5	Flood Risk
30 min Summer	16.778	0.228	7.3	0.4	7.7	99.7	Flood Risk
60 min Summer	16.832	0.282	7.3	2.9	10.2	123.2	Flood Risk
120 min Summer	16.861	0.311	7.3	4.2	11.5	136.0	Flood Risk
180 min Summer	16.867	0.317	7.3	4.4	11.7	138.8	Flood Risk
240 min Summer	16.866	0.316	7.3	4.4	11.7	138.3	Flood Risk
360 min Summer	16.859	0.309	7.3	4.1	11.4	134.9	Flood Risk
480 min Summer	16.847	0.297	7.3	3.6	10.9	129.9	Flood Risk
600 min Summer	16.836	0.286	7.3	3.1	10.4	124.8	Flood Risk
720 min Summer	16.824	0.274	7.3	2.5	9.8	119.7	Flood Risk
960 min Summer	16.801	0.251	7.3	1.3	8.6	109.9	Flood Risk
1440 min Summer	16.753	0.203	7.3	0.0	7.3	88.8	Flood Risk
2160 min Summer	16.683	0.133	7.3	0.0	7.3	58.0	O K
2880 min Summer	16.634	0.084	7.3	0.0	7.3	36.7	O K
4320 min Summer	16.597	0.047	6.8	0.0	6.8	20.5	O K
5760 min Summer	16.588	0.038	5.5	0.0	5.5	16.6	O K
7200 min Summer	16.582	0.032	4.7	0.0	4.7	14.0	O K
8640 min Summer	16.578	0.028	4.0	0.0	4.0	12.2	O K
10080 min Summer	16.575	0.025	3.6	0.0	3.6	10.8	O K
15 min Winter	16.739	0.189	7.3	0.0	7.3	82.8	Flood Risk
Storm Event			Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer			125.386	0.0	79.4	24	
30 min Summer			85.416	0.0	110.9	38	
60 min Summer			55.544	0.0	146.4	64	
120 min Summer			34.799	0.0	185.2	106	
180 min Summer			26.019	0.0	208.5	136	
240 min Summer			21.022	0.0	225.1	170	
360 min Summer			15.582	0.0	250.8	240	
480 min Summer			12.576	0.0	270.2	310	
600 min Summer			10.639	0.0	285.9	378	
720 min Summer			9.275	0.0	299.1	448	
960 min Summer			7.461	0.0	320.8	588	
1440 min Summer			5.478	0.0	353.0	858	
2160 min Summer			4.012	0.0	386.8	1216	
2880 min Summer			3.212	0.0	411.6	1556	
4320 min Summer			2.342	0.0	447.4	2208	
5760 min Summer			1.873	0.0	474.0	2936	
7200 min Summer			1.576	0.0	495.4	3672	
8640 min Summer			1.369	0.0	513.2	4408	
10080 min Summer			1.215	0.0	528.3	5136	
15 min Winter			125.386	0.0	89.8	25	
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Metro House Northgate Chichester PO19 1BE			D1271 Sunny Corner, Walberton BN18 0QS				
Date 21/08/2017 File D1271 HYDRO-BRAKE, PORO...			Designed by SPB Checked by MJA				
XP Solutions			Source Control 2016.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	16.808	0.258	7.3	1.7	9.0	113.0	Flood Risk
60 min Winter	16.869	0.319	7.3	4.5	11.8	139.2	Flood Risk
120 min Winter	16.906	0.356	7.3	4.9	12.2	155.5	Flood Risk
180 min Winter	16.912	0.362	7.3	4.9	12.2	158.1	Flood Risk
240 min Winter	16.908	0.358	7.3	4.9	12.2	156.6	Flood Risk
360 min Winter	16.892	0.342	7.3	4.8	12.1	149.7	Flood Risk
480 min Winter	16.873	0.323	7.3	4.6	11.9	141.1	Flood Risk
600 min Winter	16.855	0.305	7.3	4.0	11.2	133.1	Flood Risk
720 min Winter	16.838	0.288	7.3	3.2	10.5	125.7	Flood Risk
960 min Winter	16.807	0.257	7.3	1.6	8.9	112.1	Flood Risk
1440 min Winter	16.733	0.183	7.3	0.0	7.3	79.9	Flood Risk
2160 min Winter	16.633	0.083	7.3	0.0	7.3	36.4	O K
2880 min Winter	16.597	0.047	6.9	0.0	6.9	20.6	O K
4320 min Winter	16.585	0.035	5.1	0.0	5.1	15.1	O K
5760 min Winter	16.578	0.028	4.0	0.0	4.0	12.0	O K
7200 min Winter	16.573	0.023	3.4	0.0	3.4	10.1	O K
8640 min Winter	16.570	0.020	3.0	0.0	3.0	8.8	O K
10080 min Winter	16.568	0.018	2.6	0.0	2.6	7.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
30 min Winter	85.416	0.0	125.1	38			
60 min Winter	55.544	0.0	164.9	64			
120 min Winter	34.799	0.0	208.4	116			
180 min Winter	26.019	0.0	234.5	146			
240 min Winter	21.022	0.0	253.1	184			
360 min Winter	15.582	0.0	282.0	258			
480 min Winter	12.576	0.0	303.7	330			
600 min Winter	10.639	0.0	321.3	404			
720 min Winter	9.275	0.0	336.2	476			
960 min Winter	7.461	0.0	360.6	624			
1440 min Winter	5.478	0.0	396.7	910			
2160 min Winter	4.012	0.0	434.9	1236			
2880 min Winter	3.212	0.0	462.9	1480			
4320 min Winter	2.342	0.0	503.6	2200			
5760 min Winter	1.873	0.0	534.0	2880			
7200 min Winter	1.576	0.0	558.5	3672			
8640 min Winter	1.369	0.0	578.9	4400			
10080 min Winter	1.215	0.0	596.4	5144			
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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.600	Shortest Storm (mins)	15
Ratio R	0.323	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.370

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)
0 4	0.130	4 8	0.120	8 12	0.120

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Model Details

Storage is Online Cover Level (m) 17.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.03600	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	145.7
Max Percolation (l/s)	404.7	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	16.550	Membrane Depth (m)	0

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0109-5000-0750-5000		
Design Head (m)	0.750		
Design Flow (l/s)	5.0		
Flush-Flo™	Calculated		
Objective	Minimise upstream storage		
Application	Surface		
Sump Available	Yes		
Diameter (mm)	109		
Invert Level (m)	16.750		
Minimum Outlet Pipe Diameter (mm)	150		
Suggested Manhole Diameter (mm)	1200		

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	5.0
Flush-Flo™	0.226	5.0
Kick-Flo®	0.509	4.2
Mean Flow over Head Range	-	4.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.8	1.200	6.2	3.000	9.6	7.000	14.3
0.200	5.0	1.400	6.7	3.500	10.3	7.500	14.8
0.300	4.9	1.600	7.1	4.000	11.0	8.000	15.2
0.400	4.8	1.800	7.5	4.500	11.6	8.500	15.7
0.500	4.3	2.000	7.9	5.000	12.2	9.000	16.2
0.600	4.5	2.200	8.3	5.500	12.8	9.500	16.6
0.800	5.1	2.400	8.6	6.000	13.3		
1.000	5.7	2.600	8.9	6.500	13.8		