

CAREHOME
MIDDLETON-ON-SEA,
WEST SUSSEX

Flood Risk Assessment & Drainage Strategy

Proposed Care Home Development

PREPARED FOR: FRONTIER ESTATES LIMITED

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EXECUTIVE SUMMARY

SLR Consulting Ltd has prepared this FRA on behalf of Frontier Estates Limited to support the Planning Application for a 66 bedroom care home with associated car parking, landscaping and amenity space in land off Silver Birch Way, Middleton-on-Sea PO22 6SE (Application Site). A summary of the FRA's key findings are provided below.

Subject	Element	Findings
Site Flood Risk	Tidal	The site is remote from any tidal extent and at low risk of tidal flooding.
	Fluvial	The site is located within Flood Zone 1 which is described as having a low risk of flooding. Climate change is unlikely to increase the risk of fluvial flooding at this site over the 75 year lifetime of the proposed development.
	Ground Water	There is a medium risk of groundwater flooding. Site testing and BGS borehole scans indicate the possibility of shallow groundwater in the region. However, the SFRA indicates that there is less than 25% chance of groundwater flooding at the site and there are no features at or in the vicinity of the site associated with groundwater emergence.
	Surface Water	Whilst there are two ditches in poor condition inside the southern site boundary, overall there is a very low risk of surface water flooding.
	Sewers and Artificial Sources	The rising main/gravity main adjacent to the Site boundary flows between waste water treatment works in a general north westerly direction away from the Site. With ground levels reducing away from the Site and towards the Yapton Road sewer flooding is not anticipated to be a risk to the Site.
Planning Requirements	Sequential Test and Exception Test	The Sequential Test and Exception Test are not be required as the site is within Flood Zone 1. The Proposed Development has been classified as 'More Vulnerable'.
Mitigation measures	Design Flood Event	The design flood event (DFE) is the defended 1 % AEP event. A climate change allowance has been considered for peak flows (30%) and peak rainfall intensity (40%) at the development site with no anticipated adverse impact.
	Finished Floor Levels	The site is at low risk of tidal and fluvial flooding. However, the buildings are proposed to be raised to 4.9m aOD, nominally 150mm higher than the surrounding ground level at the lowest point of the site.
	Safe access and egress	Not required.
	Floodplain compensation	Not required.
	Surface water drainage strategy	The concept Surface Water Drainage Strategy has been developed including permeable paving to improve water quality, proprietary 'crate' storage for attenuation, filter drains to improve water quality and provide infiltration with an outfall to the existing ditch restricted to greenfield runoff rates. The discharge of surface water runoff resulting from the proposed development into the existing ditch will be restricted to 1.53l/s. The existing ditches within the southern boundary will be cleared and restored.
	Residual Risk	The drainage strategy has been designed to accommodate flows in excess of the DFE with the effects of climate change. Exceedance flood events in excess of the design standard have also been considered with storage provided within the Site car parking area. Events greater than this will revert to the pre-existing runoff regime with flow to the existing ditch.
Conclusion		This FRA demonstrates that, with the measures implemented to mitigate and minimise risk, for the DFE of 1 % AEP the overall flood risk to the site over the design life of the proposals is low.

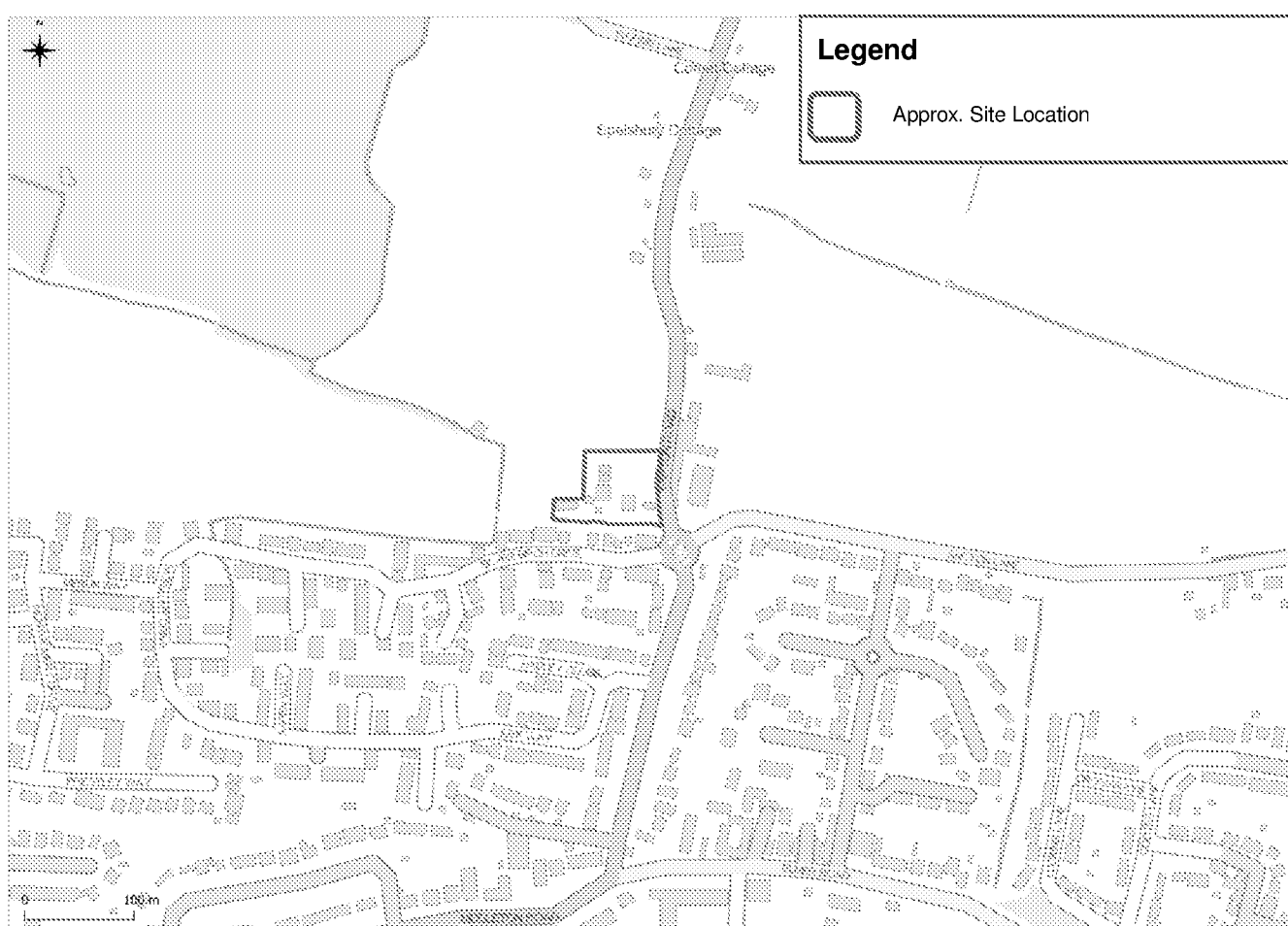
1.0 INTRODUCTION

1.1 Terms of Reference

SLR Consulting Limited (SLR) was appointed by Frontier Estates Limited (FEL) to prepare a Flood Risk Assessment (FRA) and Surface Water Drainage Strategy (SWDS) to support a planning application for a 66 bedroom care home on land off Silver Birch Way, Middleton-on-Sea, West Sussex, PO22 6SE (referred to as 'the Site').

The Site is centred at National Grid Reference (NGR) SU 973 007, on the northern outskirts of Middleton-on-Sea. A site location plan is provided as Figure 1-1.

Figure 1-1
Site Location Plan

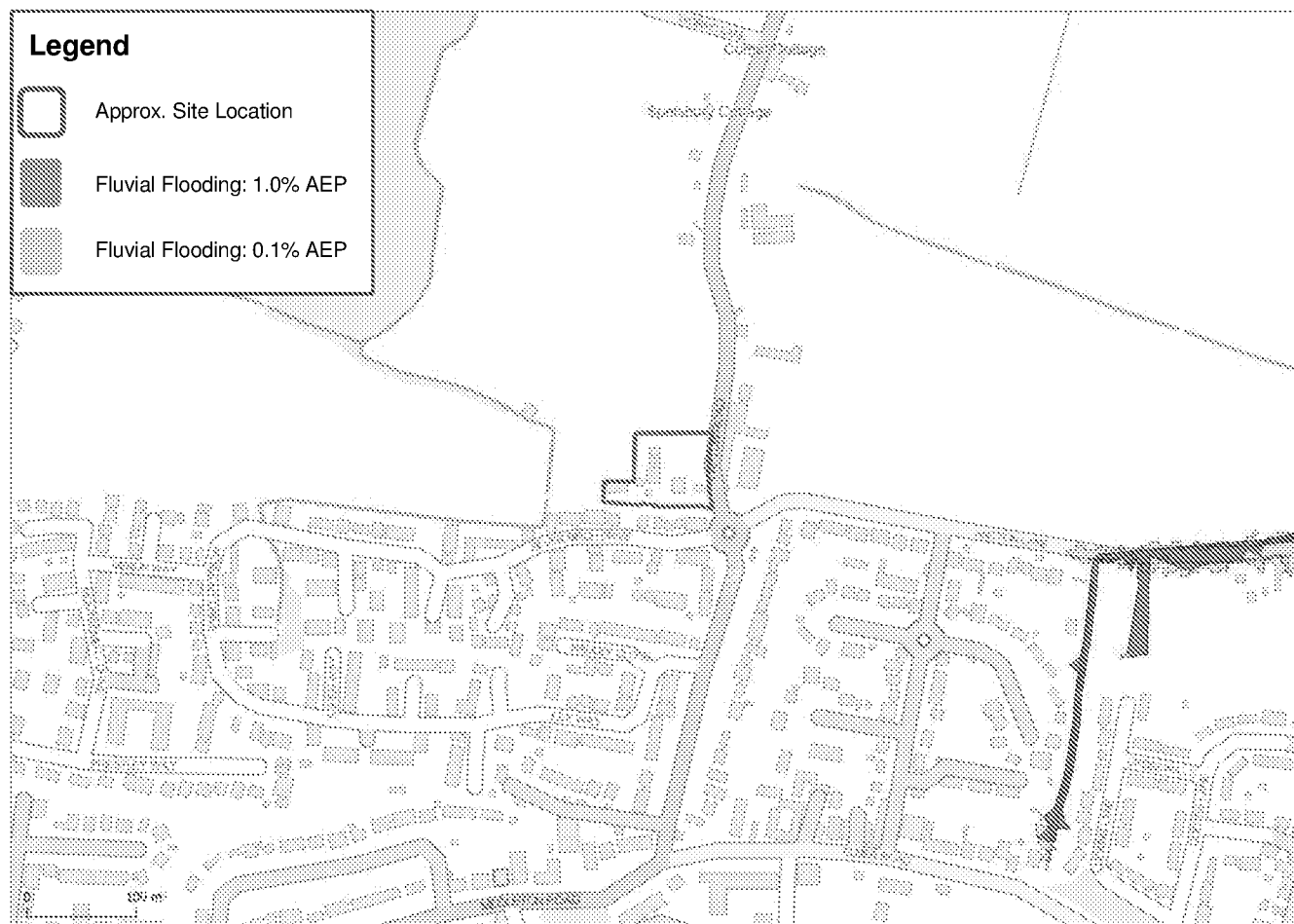


1.2 Background and Aims

With reference to the *Flood Map for Planning (Rivers and Sea)*¹ the Site does not lie within an area considered to be at risk of fluvial or tidal flooding. An extract of the Flood Map for Planning is provided by Figure 1-2.

¹ Government Digital Service (Accessed on 02 July 2019) <https://flood-map-for-planning.service.gov.uk/>

Figure 1-2
 Extract of the Flood Map for Planning



As the Site covers an area less than 1 hectare (ha) and lies outside an area at risk of fluvial or tidal flooding, with reference to footnote 50 of the National Planning Policy Framework² (NPPF), any planning application for development on the Site would not normally have to be accompanied by a site-specific FRA.

However, as the flood map for planning does not make any allowance for the impact of climate change, this FRA has been prepared to assess the impact of climate change on the fluvial and/or tidal flood risk and the flood risk from other potential sources.

1.3 Best Practice

This report has been prepared in accordance with the advice and requirements prescribed in current best practice documents relating to the management of flood risk in development published by the Construction Industry Research and Information Association (CIRIA)³, the British Standards Institution (BSI) BS8533⁴ and the Environment Agency's National Standing Advice on Development and Flood Risk⁵.

² National Planning Policy Framework, Department for Communities and Local Government (Updated February 2019)

³ CIRIA Report C624, Development and flood risk – guidance for the construction industry (October 2004)

⁴ BS8533:2017, Assessing and managing flood risk in development – Code of Practice (December 2017)

⁵ Department for Environment, Food & Rural Affairs and Environment Agency (2015). Flood risk assessment: local planning authorities (Accessed 15 July 2019 at <https://www.gov.uk/guidance/flood-riskassessmentlocal-planning-authorities>)

2.0 SITE DETAILS

2.1 Existing Site Description

The Site, which is the former Yapton Poultry Farm extends to approximately 0.61ha and is located wholly within West Sussex County Council administrative area.

The Site is accessed off Silver Birch Drive which, together with a public footpath forms the southern boundary to the site. The Yapton Road provides the eastern boundary, with the north and western boundaries are arable fields.

2.2 Topography

A topographic survey of the Site was completed by Offington Land Surveys in August 2015 to Ordnance Datum and is enclosed at Appendix 01. The survey indicates the ground levels across the Site fall in a general easterly direction from an elevation of approximately 4.80m Above Ordnance Datum (AOD) in the western corner of the Site, to approximately 3.98m AOD at the footpath alongside Yapton Road.

2.3 Geological and Hydrogeological Context

2.3.1 Geology

Published British Geological Survey (BGS) online geology maps⁶ indicate that the bedrock geology at the Site consists of *Lewes Nodular Chalk Formation - Chalk*, which is overlain by superficial deposits of *River Terrace Deposits – Sand, Silt and Clay*.

The bedrock is formed from sedimentary rocks that are shallow-marine in origin. They are biogenic and detrital, generally comprising carbonate material (coccoliths), forming distinctive beds of chalk.

Intrusive ground investigation works were undertaken by SLR in May 2019 and recorded the presence of topsoil to be depth of 0.15-0.25m below ground level (bgl) across the Site. The topsoil is underlain by gravelly silts with sand and further silts recorded within the trial pits to depths of approx. 3.20m. Sandy gravels recorded to 5.20m in Trial Pits WS-01, WS-02, WS-03 & WS-04.

Groundwater monitoring was carried out on 07/05/2019 that recorded water depths in three window sampler boreholes as shown in Table 2-1:

Table 2-1
Groundwater Monitoring

Borehole	Depth to water (mbgl)	Water level (m AOD)
WS01	1.545	3.25
WS02	1.853	3.16
WS03	1.530	3.28

⁶ BGS Website (Accessed on 23 July 2019) <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

A copy of the trial pit and window sampler logs is enclosed at Appendix 02 along with a plan showing the location of each pit.

Defra MAGIC mapping⁷ describes the soil type as '*loamy soils with naturally high groundwater*'. In this regard groundwater was encountered from 1.55 to 1.83m bgl generally in the chalk formation, confined by the overlying cohesive River Terrace Deposits.

2.3.2 Hydrogeology

The superficial geology (River Terrace Deposits) is designated as a 'Secondary (A) aquifer'.

The underlying chalk aquifer is designated as a 'Principal aquifer'. However, there are no Groundwater Source Protection Zones (SPZ) in the vicinity or within 500m of the Site. Groundwater SPZs have been developed by the Environment Agency to map the catchment areas of abstractions that are used for public drinking water supply and Zone 1 'is defined by a travel time of 50-days or less from any point within the zone at, or below, the water table. Additionally, the zone has as a minimum a 50-metre radius. It is based principally on biological decay criteria and is designed to protect against the transmission of toxic chemicals and water-borne disease.'

A number of groundwater and surface water abstraction licences (at minimum 949m and 595m from the site respectively) are known to exist.

2.4 Hydrological Context

2.4.1 Local Hydrology

Whilst there is a ditch shown on the topographic survey traversing the inside the southern site boundary, the feature is minor and not shown on the Ordnance Survey 1:25,000 scale mapping. There are no further surface waterbodies, or springs located within the site boundary.

The nearest watercourse was identified to be the Pigeonhouse Stream that passes within 50m to the west of the site that drains land north of Middleton-on-Sea including Worms Wood managed by the Woodland Trust to the area north of Worms Lane. These ditches eventually discharge into the Ryebank Rife located c.800m north of the site that discharges to the English Channel when conditions allow.

2.4.2 Existing Drainage Infrastructure

In response to a utility search a Southern Water asset plan was obtained, showing both surface and foul water assets; a copy of which is enclosed at Appendix 03.

The Southern Water surface water drainage network passes along Silver Birch Way and at the closest manhole to the Site access flows from a 300mm to a 450mm diameter pre-cast concrete pipe.

With reference to the Southern Water sewer plan, a rising foul water sewer lies adjacent to the southern boundary of the Site. From Manhole 3071 the main appears to run as a gravity sewer.

⁷ Defra online interactive maps (Accessed on 16 January 2019) <http://magic.defra.gov.uk/MagicMap.aspx>

3.0 DEVELOPMENT PROPOSAL

3.1 Proposed Development Description

It is proposed to redevelop the Site with a care home (use Class C2), which will provide 66 bedrooms over two floors. The remaining part of the site area will be reconfigured to include internal communal and operating areas, vehicle parking, cycle storage and associated soft landscaping.

Details of the proposed development are enclosed at Appendix 04.

3.2 Anticipated Lifetime of Development

In line with Planning Policy Guidance (PPG) and best practice guidance (BS8533), a 75 years lifetime of development should be applied to this commercial development.

3.3 Flood Risk Vulnerability

With reference to PPG Table 2: *Flood Risk Vulnerability Classification* 'residential care homes' are classified as a *More Vulnerable* use.

3.4 Planning Context

3.4.1 National Planning Policy

This FRA report has been completed in accordance with the guidance presented in NPPF² and with reference to the PPG for flood risk and coastal change⁸.

3.4.2 Regional Planning Policy

In addition to national planning policy and associated guidance, the West Sussex County Council (WSCC) have expanded on the documents at National level, by giving further detail to the Non-statutory technical standards for SuDS. These practice guidance notes⁹ have been produced by the Local Authority SuDS Officer Organisation (LASOO) in 2016.

Both the WSCC '*Policy for the Management of Surface Water*' and '*A Guide for master planning sustainable drainage into developments*' have been produced to supplement the planning guidance.

3.4.3 Local Planning Policy

The site is located within West Sussex County Council, where development is guided by their Core Strategy¹⁰ for development and planning policies. In relation to flood risk the Development Requirements SPD sets out key requirements which are reproduced below:

Policy W SP1 Water

... Development will be encouraged to make active use of surface water as a design feature and permitted where it identifies measures to improve and enhance water-bodies, coastal habitats or provides additional flood relief.

The Council will also support development that:

- a. Is appropriately located, taking into account flood risk and promotes the incorporation of appropriate mitigation measures into new development, particularly SuDS that reduces the creation and flow of surface water and improves water quality.*

⁸ Planning Practice Guidance to the National Planning Policy Framework : Department for Communities and Local Government (March 2014)

⁹ Non-statutory technical standards for Sustainable Drainage, LASOO, 2016

¹⁰ Arun District Council Core Strategy, Adopted 11th July 2016

- b. Reduces the risk to homes and places of work from flooding whilst increasing biodiversity;*
- c. Delivers a range of community benefits including enhancing the quality of life and providing greater resistance to the impact of climate change.*

Policy W DM1 Water Supply and Quality

... Where surface water and foul water drainage systems are approved as part of the consideration of a planning application, conditions may be imposed upon the permission relating to dates for implementation or other detailed technical requirements. In order to discharge conditions, the developer will be required to submit a statement from a suitably qualified and experienced engineer that the measures have been adequately and satisfactorily implemented.

Policy W DM2 Flood Risk

... Development in areas at risk from flooding, identified on the latest Environment Agency flood risk maps and the Councils' Strategic Flood Risk Assessment (SFRA), will only be permitted where all of the following criteria have been satisfied... [As the site is in Flood Zone 1 Policy W DM2 Flood Risk does not apply]

Policy W DM3 Sustainable Urban Drainage Systems

... To increase the levels of water capture and storage and improve water quality, all development must identify opportunities to integrate a range of SuDS, appropriate to the size of development, at an early stage of the design process.

Proposals for major development must also integrate SuDS within public open spaces and roads integrated into the overall development..... In order to ensure SuDS discharge water from the development at the same or lesser rate, as prior construction, developers must:

- f. Follow the hierarchy of preference for different SuDS as set out in the SuDS Manual.*
- g. Undertake up to six months groundwater monitoring within the winter period.*
- h. Undertake winter percolation testing in accordance with RE365.*
- i. Designed to ensure there is no flooding in 1 in 30 year storm event.*
- j. Design must take account of the 1 in 100 year storm event plus 30% allowance for climate change, on stored volumes... Any excess flows must be stored within the site boundary, and within designated storage areas.*

Policy SD SP1 Sustainable Development

...When considering development proposals the Council will take a positive approach that reflects the presumption in favour of sustainable development contained within NPPF....

3.4.4 Arun Strategic Flood Risk Assessment

The Combined Level 1 and Level 2 Arun District Council Strategic Flood Risk Assessment¹¹ (SFRA) provides the background on strategic flood risk within Arun District Council region.

Refer to Appendix 05 for figures displaying local historic flood incidents and groundwater flood risk.

In particular, it provides the following advice for future development:

Future development must seek opportunities to reduce overall levels of flood risk at the site, for example by:

- ❖ Reducing volume and rate of surface water runoff based on Local Plan policy and LLFA Guidance*
- ❖ Locating development to areas with lower flood risk*
- ❖ Creating space for flooding.*
- ❖ Integrating green infrastructure into mitigation measures for surface water runoff from potential development and consider using Flood Zones 2 and 3 as public open space.*

¹¹ Combined Level 1 and Level 2 Strategic Flood Risk Assessment, JBA, November 2016

4.0 ASSESSMENT OF FLOOD RISK

4.1 Potential sources of flooding

There are a number of potential sources of flooding and these include:

- ✧ Flooding from rivers or fluvial flooding;
- ✧ Flooding from the sea or tidal flooding;
- ✧ Flooding from surface water or pluvial flooding;
- ✧ Flooding from groundwater;
- ✧ Flooding from sewers; and
- ✧ Flooding from reservoirs, canals, and other artificial sources.

The flood risk from each of these potential sources is discussed below.

4.1.1 Flooding from Rivers or Fluvial Flooding and Sea or Tidal Flooding

With reference to the *Flood Map for Planning (Rivers and Sea)*¹, the Site to lie within an area having less than 0.1% Annual Exceedance Probability (AEP) of flooding from these sources.

The flood risk from these sources is not significant and has not therefore been considered further.

4.1.2 Flooding from Surface Water or Pluvial Flooding

An extract from the *Long Term Flood Risk Information*¹² mapping showing areas potentially at risk of flooding from surface water has been provided as Figure 4–1.

The surface water flood risk categories are defined as:

- ✧ **Very Low:** less than 1 in 1,000 (0.1% AEP) chance of flooding in any given year;
- ✧ **Low:** less than 1 in 100 (1% AEP) but greater than or equal to 1 in 1,000 (0.1% AEP) chance of flooding in any given year;
- ✧ **Medium:** between 1 in 100 (1% AEP) and 1 in 30 (3.3% AEP) chance of flooding in any given year; and
- ✧ **High:** greater than 1 in 30 (3.3% AEP) chance of flooding in any given year.

The site is generally at a low risk of flooding in flood events up to an including the 0.1% AEP (Annual Exceedance Probability) event. However, there is a small area (<30m²) that is shown to flood the ditch from Yapton Road, estimated to be between 150-300mm deep, shown in the 0.1% AEP event (the rare 1 in 1,000 year event).

Additionally, there is a topographical low point in the agricultural field 50m to the north of the site where surface water is shown to collect. This surface water ponds and is shown by the EA mapping to flow north eastwards towards Yapton Road and does not affect the Site.

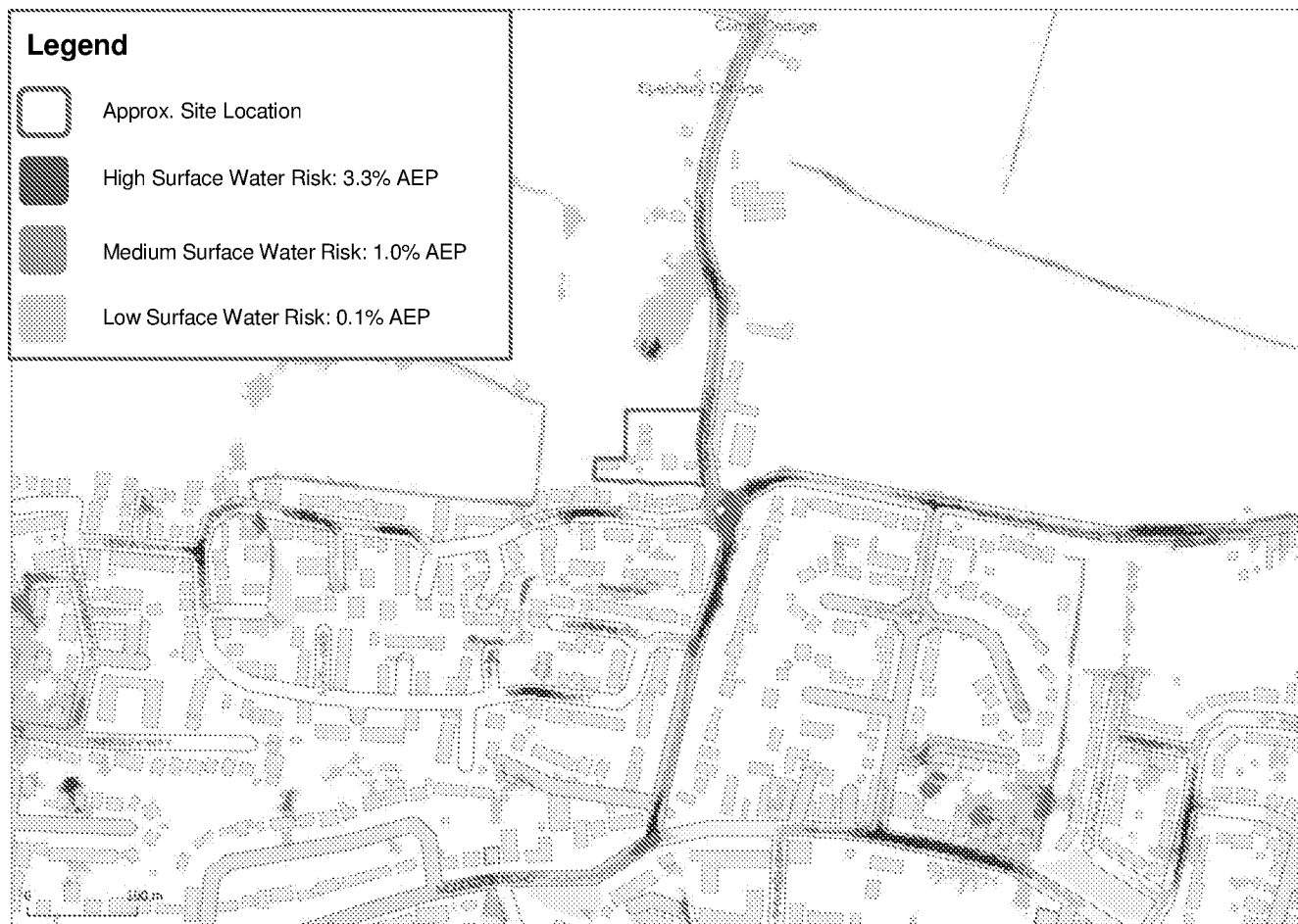
The SFRA shows an incident of surface water flooding approx. 200m west of the Site, although no further detail was available; refer to Appendix 05.

Surface water drainage across the Site will be formalised as discussed at Section 7.0 which will manage surface water runoff and provide significant betterment, in particular to the existing ditches within the southern boundary.

Flooding from this source is not considered significant and has therefore not been considered further.

¹² Government Digital Service (Accessed 23 July 2019) <https://flood-warning-information.service.gov.uk/longterm-flood-risk/>

Figure 4-1
 Extract of the Environment Agency Surface Water Flood Map



4.1.3 Flooding from Groundwater

Appendix F of the SFRA¹¹ provided in Appendix 05 of this FRA states:

'Significant groundwater flood events have been recorded across the district. This risk is supported by the Areas Susceptible to Groundwater Flooding (AStGWF) mapping suggests that susceptibility to groundwater flooding is generally high across the district.'

The AStGWF is a strategic scale map showing groundwater flood areas on a 1km square grid. The application Site is shown as having a less than 25% rating (the lowest risk). 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).'

The SFRA advises that the data 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.'

From a visual inspection at the Site there are no features at or in the vicinity of the site associated with groundwater emergence.

Flooding from this source is not considered to be significant and has therefore not been considered further.

4.1.4 Flooding from Sewers

As discussed at Section 2.4.2, there is a foul sewer adjacent to the southern boundary of the Site as shown on the SW Drawing '327966 – Yapton Poultry Farm', refer to Appendix 03. The rising main becomes a gravity main adjacent to the Site boundary and flows from the waste water treatment works (WWTW) at Ford Aerodrome to Tangmere WWTW in a general north westerly direction away from the Site.

With topographic ground levels reducing towards the Yapton Road it is not unreasonable to consider that any resultant sewer flooding would migrate to the east and away from the Site. It is recommended that proposed ground levels mimic this effect.

Flooding from this source is not considered to be significant and has therefore not been considered further.

4.1.5 Flooding from Reservoirs, Canals and other Artificial Sources

Based upon *Long Term Flood Risk Information*¹² mapping, the Site lies outside an area denoted as being at risk of flooding from a breach (failure) of a raised reservoir embankment.

4.1.6 Flooding from Infrastructure Failure

With reference to the 1:25,000 scale Ordnance Survey mapping, the two closest WWTW's are located over 3.2km from the Site and are not likely to cause a flood risk at the Site.

4.2 Flood Risk Summary

A summary of the potential sources of flooding and the flood risk arising from them is presented in Table 4-1.

Table 4-1
 Potential Sources of Flooding

Potential Source of flooding	Significant Flood Risk at the Site (Y/N)
Rivers or Fluvial Flooding	N
Sea or Tidal Flooding	N
Surface Water or Pluvial Flooding	N
Groundwater	N
Sewers	N
Reservoirs, Canals and other Artificial Sources	N
Infrastructure Failure	N

The flood screening assessment indicates that the Site is not a significant risk of flooding.

4.3 Flood Zone

The definition of flood zones is provided by *Table 1: Flood zones* at PPG Paragraph 065 and is summarised below:

- ✦ *Zone 1 - low probability* (Flood Zone 1). Land having a less than 1 in 1,000 annual probability of river or sea flooding.
- ✦ *Zone 2 - medium probability* (Flood Zone 2) 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.
- ✦ *Zone 3a - high probability* (Flood Zone 3a) 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.
- ✦ *Zone 3b - the functional floodplain* (Flood Zone 3b) 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.

Based on the screening study, the entire Site lies within *Flood Zone 1*.

5.0 POLICY STATUS FOR PROPOSED DEVELOPMENT

5.1 Flood Risk Compatibility

As discussed at Section 3.2, the proposed development is classified as a *More Vulnerable* use and, with reference to Section 0, the Site has been assessed as being within Flood Zone 1.

Therefore, with reference to *Table 3: Flood risk vulnerability and flood zone 'compatibility'* at PPG Paragraph 067 (reproduced as Table 5-1), the proposed development would be considered an 'appropriate' form of development.

Table 5-1
 Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability Classification (PPG Table 2)		Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone (PPG Table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	Exception Test Required	✓	✓	✓
	Zone 3a	Exception Test Required	x	Exception Test Required	✓	✓
	Zone 3b (functional floodplain)	Exception Test Required	x	x	x	✓

Key: ✓ Development is appropriate x Development should not be permitted

5.2 Sequential Test

As the Site lies within Flood Zone 1 the Sequential Test does not have to be applied.

5.3 Exception Test

As the Site lies within Flood Zone 1 the Exception Test does not have to be applied.

6.0 CLIMATE CHANGE

6.1 Peak River Flow Allowance

The assessment of the impact of climate change on the flood risk at the Site has been based on the most recent advice on climate change is provided by the Environment Agency¹³. An extract of Table 1 peak river flow allowances by river basin district (use 1961 to 1990 baseline) is reproduced as Table 6-1 for the Southern area of England.

Table 6-1
 Peak River Flow Allowances by River Basin District

River Basin District	Allowance Category	Total Potential Change Anticipated for '2020s' (2015 to 39)	Total Potential Change Anticipated for '2050s' (2040 to 59)	Total Potential Change Anticipated for '2080s' (2070 to 2115)
South East	Upper End	25%	50%	105%
	Higher Central	15%	30%	45%
	Central	10%	20%	35%

With reference to Section 3.2, the proposed development is considered a *More Vulnerable* use. The Environment Agency advises that for *More Vulnerable* uses in Flood Zone 1 within the South East River Basin District, the Central allowance category should be used to assess the impact of climate change on the flood risk at the Site.

Based on Table 6-1 and uplift of 35% to the 1% AEP peak fluvial flow should be considered when assessing fluvial flood risks over the lifetime of the proposed development (refer to Section 3.2), i.e. to 2094.

With reference to Section 4.3, the 1% AEP flood extent defines Flood Zone 3. Comparison of the Flood Zone 3 shown by the *Flood Map for Planning (Rivers and Sea)*¹ to the 1m resolution aerial photogrammetry (LiDAR) data indicates a 1% AEP flood level of approximately 14.10m AOD nearest to the Site.

The EA advised that the Site is at *very low* risk as it is 340m away from Flood Zone 2 envelop (1% AEP to 0.1% AEP flood event) of the Ryebank Rife. The maximum recorded historical flood level in the Rife at Bognor was 1.14m AOD on 15 February 2014 some 3.66m below that of the lowest level on the site of approximately 4.80m AOD.

The indicative *Flood Map for Planning (Rivers and Sea)*¹ also shows little increase between the 1% AEP (Flood Zone 3) and the 0.1% (Flood Zone 2) flood levels. A 35% uplift to the 1% AEP peak fluvial flow is not therefore expected to result in an increase in the 1% AEP flood level greater than 4.80m and it is therefore expected that the Site would remain dry when accounting for the impact of climate change on the 1% AEP fluvial flood level.

¹³ Environment Agency, February 2016. Flood risk assessments: climate change allowances (Accessed 23 July 2019 at <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>)

6.2 Peak Rainfall Intensity Allowance

The most recent advice on climate change is provided by the Environment Agency¹⁴. An extract of *Table 2 peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)* is reproduced as Table 6-2.

Table 6-2
 Table 2 peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)

Allowance Category	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper End	10%	20%	40%
Central	5%	10%	20%

In line with Table 4–1, the Surface Water Management Strategy will be developed to take into account increases in rainfall intensity of 40% over the lifetime of the entire development.

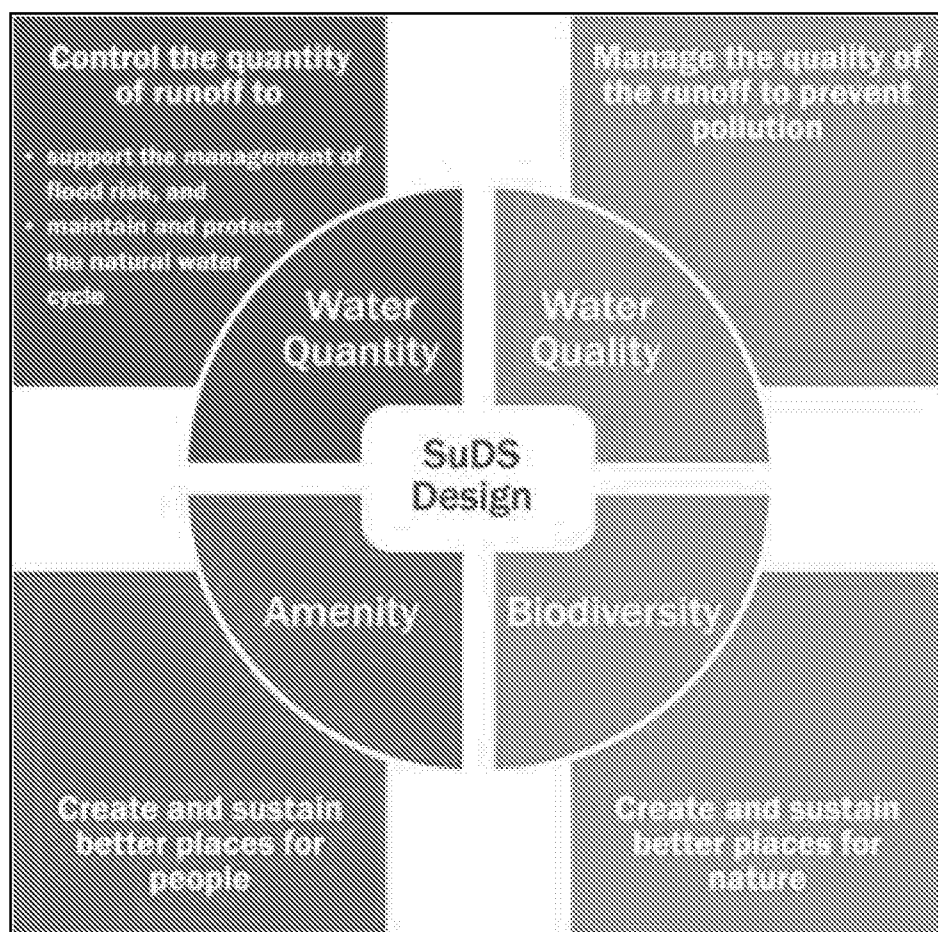
¹⁴ Environment Agency, February 2016. Flood risk assessments: climate change allowances (Accessed 23 July 2019 at <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>)

7.0 SURFACE WATER DRAINAGE STRATEGY

7.1 Sustainable Drainage Systems

Current best practice guidance document, The SuDS Manual (CIRIA Report C753)¹⁵, promotes sustainable water management through the use of SuDS. There are four main categories of SuDS which are referred to as the ‘four pillars of SuDS’ as shown in Figure 7-1.

Figure 7-1
 Four Pillars of SuDS (after CIRIA Report C753)

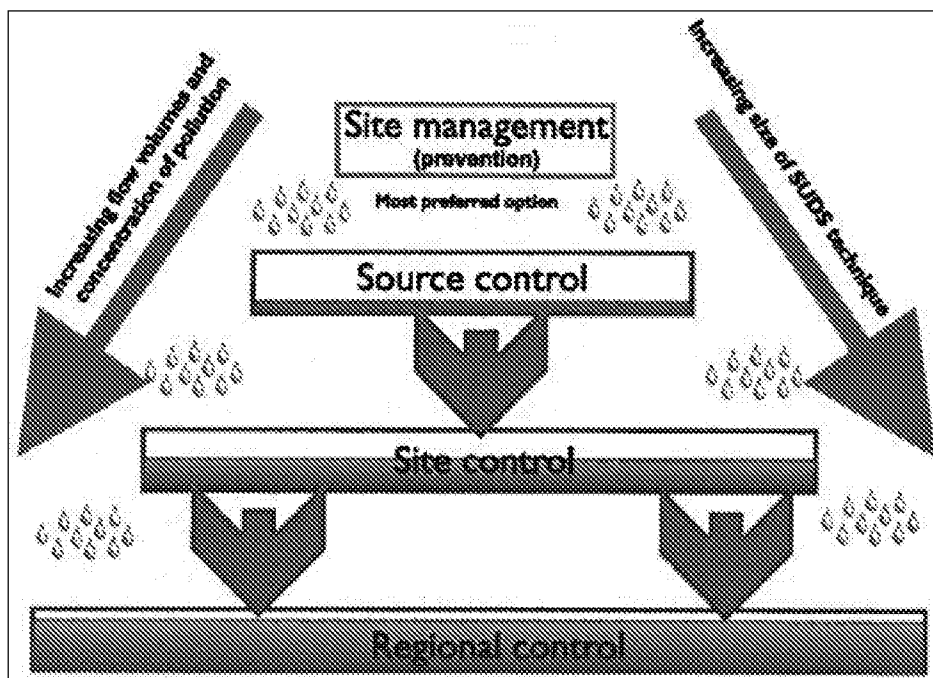


The SuDS Manual identifies a hierarchy of SuDS for managing runoff, which is commonly referred to as a ‘management train’ and is depicted in Figure 7-2:

- ✧ **Prevention** – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hard standing).
- ✧ **Source Control** – control of runoff at or very near its source (such as the use of rainwater harvesting).
- ✧ **Site Control** – management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole site).
- ✧ **Regional Control** – management of runoff from several sites, typically in a retention pond or wetland.

¹⁵ CIRIA (2015). Report C753, The SuDS Manual

Figure 7-2
 SuDS Management Train



It is generally accepted that the implementation of SuDS, as opposed to conventional drainage systems, provides several benefits by:

- ✦ Reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
- ✦ Reducing the volumes and frequency of water flowing directly to watercourses or sewers from developed sites;
- ✦ Improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources;
- ✦ Reducing potable water demand through rainwater harvesting;
- ✦ Improving amenity through the provision of public open spaces and wildlife habitat; and replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

In addition to the above, Arun District Council and West Sussex County Council, as the lead Local Flood Authority (LLFA), both promote the use of Sustainable Drainage Systems (SuDS); refer to Section 3.4.3.

7.2 Proposed Discharge Arrangement

With reference to The SuDS Manual, the hierarchy of preferred disposal options for surface water runoff from development sites in decreasing order of sustainability is as follows:

1. Infiltration to Ground;
2. Discharge to Surface Waters; or
3. Discharge to Sewer.

Table 7-1 summarises the suitability of disposal methods suitability in the context of the Site and the proposed development.

Table 7-1
Suitability of Surface Water Disposal Methods

Surface Water Disposal Method (in Order of Preference)	Suitability Description	Assessed Suitable? (Y / N)
Infiltration to Ground	It was not possible to undertake the infiltration tests over the winter period as is best practise. As such, 'typical infiltration coefficients' provided within Table 25.1 of The SuDS Manual has been used in the sizing of the attenuation feature discussed at Section 7.3. With reference to Section 2.3.1, the superficial deposits underlying the Site comprises gravelly silts with sand and sandy gravels. As a precautionary approach, the infiltration coefficient for the underlying superficial deposits is expected to range between 1×10^{-4} to $1 \times 10^{-7} \text{ms}^{-1}$. For the purpose of sizing of the attenuation feature discussed at Section 7.3 an average value of $5 \times 10^{-5} \text{ms}^{-1}$ (equivalent to 0.18mhr^{-1}). It is noted that the depth to groundwater may be shallow and subject to fluctuate during the winter months as such infiltration testing should be carried out during the winter months in order to inform detailed design.	Y
Discharge to Surface Waters	As discussed at Section 2.4.1, there is a surface water ditch located just inside the southern boundary of the Site. A suitably restricted connection into this watercourse may be viable.	Y
Discharge to Sewer	As discussed at Section 2.4.2, with reference to Southern Water Drawing 327966 – Yapton Poultry Farm and enclosed at Appendix 03, there is a 450mm diameter surface water sewer serving the residential development to the south of the Site. However, as infiltration to ground and a connection into Pigeonhouse Stream can be provided, in line with the SuDS hierarchy, a connection to the public surface water sewer has been discounted.	N

7.3 Proposed Outline SuDS Strategy

It is proposed to manage surface water runoff from the development via the following 'Source Control', 'Conveyance' and 'Site Control' options as summarised in Table 7-2.

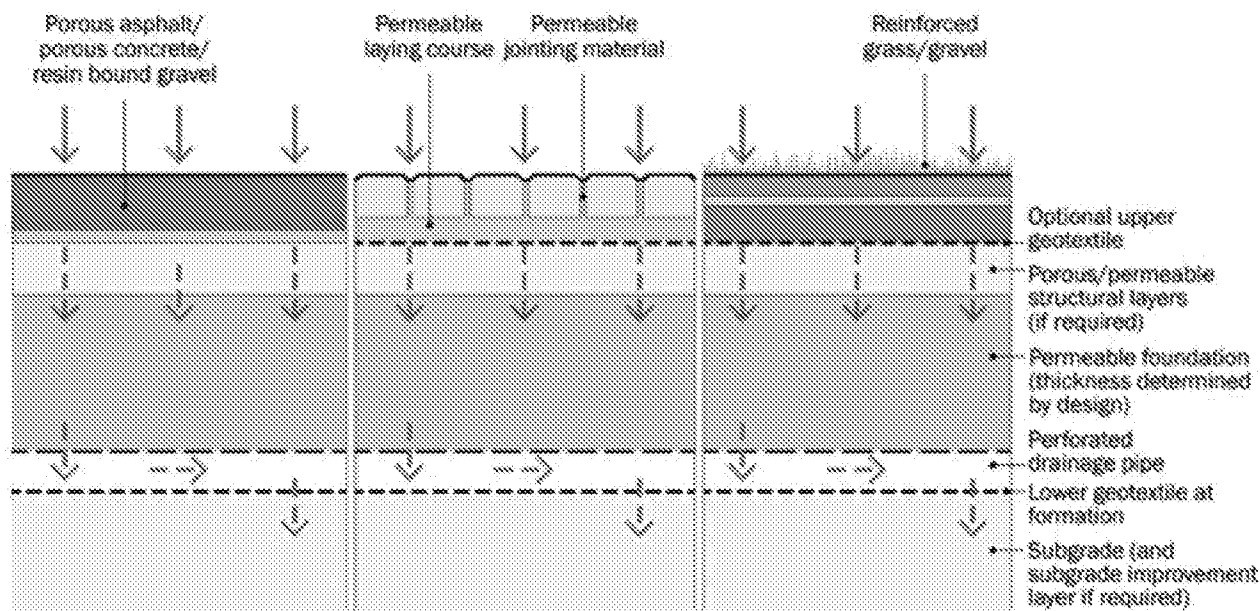
Table 7-2
Summary of Surface Water Management Strategy SuDS Options

SuDS Management Train Mechanism	Application	Potential Suitable SuDS Features
Source Control	For the interception of surface water runoff at the source such as property buildings, car parking and internal access roads / pavements.	- Filter drains - Pervious pavement/tarmac (Type B)
Conveyance	To convey surface water runoff from 'Source Control' mechanisms to 'Site Control'.	- Filter drains - Swales / ditches
Site Control	Provides the required surface water attenuation / storage prior to controlled discharge to the water environment.	Pervious pavement/tarmac (Type B)

'Source Control', 'Conveyance' and 'Site Control' in the form of filter drains and pervious pavement are considered to be viable and beneficial (in terms of water quality enhancements) option and has been integrated into this Surface Water Drainage Strategy (SWDS).

As discussed within Table 7-1, as a precautionary approach, the SWDS has been developed based on infiltration but with an overflow to a restricted discharge to a surface water ditch. The system of 'pervious pavement' proposed for this SWDS is therefore Type B – 'Partial Infiltration'. Design concepts for the different porous surfaces and sub-layers are illustrated in Figure 7-3¹⁶ below.

Figure 7-3
 Type B: Pervious Pavement System: Design Concept



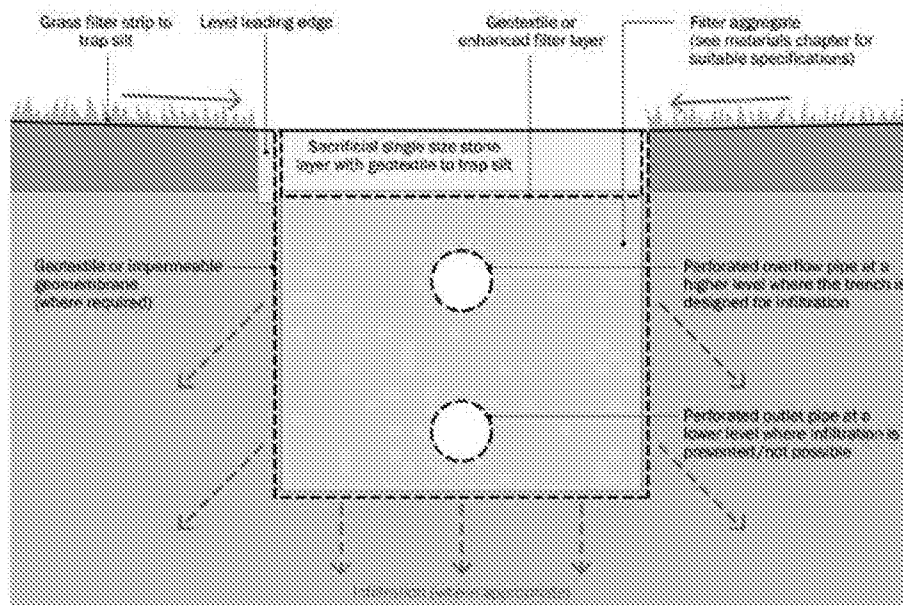
It is proposed that the car parking area and access road, identified on Drawing No. SWDS 01, be surfaced with pervious pavement and tarmac respectively to collect incident rainfall and infiltrate to ground as far as possible. A perforated drainage pipe beneath the permeable paving that makes up the access road, as shown on Drawing No. SWDS 01, will connect with a proprietary 'crate' system to provide the required attenuation storage.

Runoff from the roof of the proposed care home will be intercepted by filter drains and conveyed to the permeable paving / proprietary 'crate' system via a network of filter drains and a below ground piped drainage system as shown on Drawing No. SWDS 01. A typical filter drain detail is provided by Figure 7-4.

As a precautionary measure the permeable paving will drain via a perforated pipe to the existing surface water ditch adjacent to the southern boundary of the Site albeit at the maximum allowable discharge discussed at Section 7.5.

¹⁶ Illustration extracted from The SuDS Manual

Figure 7-4
 Filter Drain: Conceptual Design Details



Indicative locations of the proposed permeable paving, filter drains and drainage network serving the proposed development are shown by Drawing No. SWDS 01.

7.4 Contributing Area

7.4.1 Proposed Impermeable Area

The proposed development will render 0.41ha of the Site impermeable which will contribute to surface water runoff including roof areas, patios, footpaths and permeable paving.

7.4.2 Proposed Grassed Area

As discussed at Section 2.2, ground levels across the Site fall in a general south easterly direction. As such, surface water runoff from the grassed/planted areas will be intercepted by the filter drains shown on Drawing No. SWDS 01 and will also need to be accounted for within the design of the SWDS.

However, a fraction of the incident rainfall across the grassed/planted areas will infiltrate through the top soil and be stored within this stratum before evaporating. A Standard Percentage Runoff (SPR) based on the Hydrology of Soil Types (HOST) dataset is used to estimate the fraction of the grassed / planted area contributing to surface water runoff and is based primarily on the soil type.

With reference to the Section 3.2 of the Institute of Hydrology (IoH) Report 126¹⁷, the HOST response model for the Site is Model E. Based on soil descriptions provided within Table 3.3 of the IoH126, the 'sand' with 'unconsolidated, microporous [with] by-pass flow very uncommon' best describes the geology underlying the Site and the hydrogeological site settings discussed at Section 2.3.

With reference to Figure 3-3 of the IoH126, this soil type has a HOST classification of 7. Table 4.16 of the IoH126 recommends an SPR of 44.3% for these HOST classifications.

Based on the above, an additional 0.09ha will contribute to surface water runoff.

¹⁷ Institute of Hydrology, November 1995. Report 126 Hydrology for soil types: a hydrologically-based classification of the soil of the United Kingdom

7.5 Water Quantity Design Standard

As discussed within Table 7-1, infiltration methods have been deemed viable at the Site and an average infiltration rate of $5 \times 10^{-5} \text{ms}^{-1}$ (equivalent to 0.18mhr^{-1}) has been used in the development of the SWDS with a secondary discharge to the existing ditch along the southern boundary of the Site.

The management of peak runoff volume and estimation of the peak runoff rate into this ditch are discussed below.

7.5.1 Control of Runoff Volume

Section 3.3.1 of The SuDS Manual sets out volume control criteria for:

- ✦ Frequent rainfall events.
- ✦ Extreme rainfall events.

Frequent rainfall events

The SuDS Manual requires 'the prevention of runoff from the [Site] for the majority of small (frequent) rainfall events (or for the initial depth of rainfall for larger events)'. This is known as *Interception* and 'Inception of about 5mm is normally achievable.'

With reference to Section 24.8 of The SuDS Manual:

'Inception can be delivered using one or a combination of process:

- ✦ *Rainwater harvesting*
- ✦ ***Infiltration***
- ✦ *Evapotranspiration using temporary shallow ponding or storage within the soil or upper aggregate layers.'*

With reference to Section 7.4, the total area of the proposed development contributing to surface water runoff is 0.50ha. A 5mm depth of rainfall over this area will result in 25.00m^3 of surface water runoff.

It is proposed that this Interception volume is provided within the permeable paving system, covering an area of approximately 804m^2 with a porosity of 0.3, beneath the car parking/access road. However, to prevent the Interception volume from discharging to the surface water sewer, an outflow control will be set a minimum of 0.03m above the invert level of the system.

As discussed within Table 7-1, it was not possible to undertake winter infiltration tests to allow a meaningful infiltration value to be achieved and, as such, the SWDS has been developed based on the worst case values quoted in The SuDS Manual for the soil descriptions noted during the site investigation. However, the recorded drawdown indicates that some discharge of surface water to ground will take place and it is therefore proposed that the Interception volume be drained via infiltration into the underlying strata. It should be noted that, in practice, the Interception volume will partly infiltrate through the base of the filter drain and pervious pavement/tarmac as it flows through these features.

Extreme rainfall events

For extreme rainfall events, the SWDS should be designed such that '*the volume of runoff from the Site (or development) area [does] not exceed the volume of runoff from the equivalent area in its natural undeveloped or "greenfield" state*'.

Based on '*a simple method of using the 1:100 year [1% AEP] 6 hour rainfall event*' and applying Equation 24.10 of The SuDS Manual, the difference in the volume of runoff between the developed and greenfield scenarios (the Long Term Storage) is estimated as follows:

EQ. 24.11 Estimating the extra runoff volume from a proposed development site compared to the previously developed site

$$Vol_{xs} = RD \times A \times 10 \left[(0.8 - SPR) \frac{PIMP_2}{100} + (SPR - 0.8) \frac{PIMP_1}{100} \right]$$

where:

Vol_{xs} = extra runoff volume of the proposed development runoff over the runoff volume from the previously developed site (m³)

RD = rainfall depth for the 1:100 year, 6 hour event (mm)

A = area of the site (ha)

SPR = SPR index for the SOIL or HOST class (specified as a decimal proportion); this specifies the proportion of runoff from pervious surfaces (if SPRHOST values are used, the minimum value should be set to 0.1)

$PIMP_2$ = percentage impermeability of the proposed site

$PIMP_1$ = percentage impermeability of the previously developed site

where:

RD = 65.22mm

A = 0.61ha

SPR = 44.3% or 0.44

$PIMP_2 = \frac{0.50^{(a)}}{0.61} \times 100 = 81.97\%$

$PIMP_1 = \frac{0.11^{(b)}}{0.61} \times 100 = 18.03\%$

which results in Vol_{xs} of 91.48m³.

Notes: (a) See Section 7.4.

(b) This is the area of the existing outbuildings and footpath/access road.

The proposed development will therefore result in an increase in volume of runoff.

With reference to Section 3.3.1 of The SuDS Manual, one approach to controlling an increase in Long Term Storage is for 'all the runoff from the site for the 1:100 year [1% AEP] event [to] be discharged at either a rate of 2l/s/ha or the average annual peak flow rate (i.e. the mean annual flood, QBAR), whichever is greater.'

Table 24.1 Summary of runoff estimation methods of The SuDS Manual recommends the application of the Revitalised Rainfall-Runoff Method (ReFH2) to estimate greenfield runoff rates. ReFH2 has therefore been used to estimate greenfield runoff rate for the 50% AEP (1 in 2 year) rainfall event as summarised at Table 9-3. It should be noted that QBAR has a return period of approximately 1 in 2.3 years, however, only integers can be inputted into ReFH2. A conservative QBAR peak runoff rate has been estimated assuming a 1 in 2 year return period.

The descriptors for the Site extracted from the Flood Estimation Handbook¹⁸ (FEH) Web Service were used in the ReFH2 analysis with the AREA set to 1.00ha.

¹⁸ Centre for Ecology and Hydrology (CEH), 2017. Flood Estimation Handbook Web Service (Accessed on 31 July 2019) <https://fehweb.ceh.ac.uk/GB/map>

Table 7-3
 Greenfield Runoff Rate Estimate

AEP (%)	Estimated Greenfield Runoff Rate	
	l/s/ha	l/s/0.61ha ¹
50	2.50	1.53

Note: ¹ As discussed at above, the entire Site (impermeable and permeable areas) drain to the network.
 As such, the total Site area of 0.61ha has been used to estimate the greenfield runoff rate.

As the QBAR peak runoff rate of 1.53l/s is greater than 2.00l/s/ha (or 1.22l/s for the entire Site), this has been adopted in the design of the SWDS.

7.5.2 Control of Peak Rate of Runoff

Section 3.3.2 of The SuDS Manual sets out peak rate of runoff criteria for:

- Events likely to impact on morphology, ecology or capacity of the receiving surface waters, or the capacity of receiving sewers.
- Extreme events.

Events likely to impact on morphology, ecology or capacity of the receiving surface waters, or the capacity of receiving sewers

With reference to Section 2.4.2, formal drainage is limited to the existing house with the outbuildings shedding directly to ground. As a conservative approach, it is assumed that the existing house drains to ground and/or the foul water sewer identified within Table 7-1.

During the site visit completed on 5 July 2019, it was observed that the existing outbuildings shed to ground. Surface water runoff from the roof of these outbuildings and remaining grassed / vegetated areas, a total area of 0.60ha, currently discharges via a combination of infiltration into the underlying strata, evaporation and overland flow to the existing ditch within the site boundary.

On the basis of the above, the existing runoff rate into the ditch is as follows:

Table 7-4
 Existing Maximum Discharge to the Ditch

AEP (%)	Maximum Existing Discharge Rate	
	l/s/ha	l/s/0.60ha ¹
50	2.50	1.50
3.33	6.12	3.67
1	7.95	4.77

Note: ¹ For an area of 0.60ha.

As discussed at Section 7.5.1, to meet the criteria for control of runoff volume, the SWDS has been designed to allow a maximum discharge into the surface water sewer of 1.53l/s for a range of AEP rainfall events up to an including the 1% AEP rainfall event +40%.

While during a 50% AEP rainfall event, there will be an increase in the proposed maximum discharge rate into the ditch compared to the existing, this increase is small and deemed unlikely to impact the morphology, ecology or capacity of the drain.

Moreover, for all other AEPs assessed, the maximum discharge rate into the ditch from the proposed development will be reduced.

The proposed SWDS is not considered likely to *'impact on morphology, ecology or capacity of the receiving surface waters, or the capacity of receiving sewers.'*

Extreme events

Therefore, in line with Section 3.3.2 of The SuDS Manual, the SWDS *'should be designed so that peak runoff rates for extreme rainfall events (...) are constrained to the greenfield rates of runoff for the same event.'*

However, as discussed at Section 7.5.1, to meet the criteria for control of runoff volume, the SWDS has been designed to allow a maximum discharge into the surface water sewer of 1.53l/s.

7.6 Water Quality Design Standard

With reference to The SuDS Manual, post development surface water runoff generated from commercial roofs, non-residential car parks and general access roads considered to have a *'Low' Pollution Hazard Level* as set out within Table 7-5. Footpaths are not identified within The SuDS Manual as having a *Pollution Hazard Level* however, the filter drains are provided as a sustainable means of capturing surface water runoff from the footpaths and grassed/planted areas.

Table 7-5
 Pollution Hazard Potential for Proposed Development

Land Use	Pollution Hazard Level	Pollution Hazard Indices		
		Total Suspended Solids (TSS)	Metals	Hydro-Carbons
Commercial Roofs	Low	0.3	0.2	0.05
Non-residential Car Parks		0.5	0.4	0.4
General Access Roads				

The proposed SWDS is required to demonstrate sufficient treatment capability to manage the specified *Pollution Hazard Indices*.

As discussed at Section 7.3, it is proposed to discharge surface water runoff resulting from the proposed development to ground with a secondary discharge to the existing ditch. The *SuDS Mitigation Indices*, provided by the proposed *'Source Control'*, *'Conveyance'* and *'Site Control'* measures for discharge to both groundwater and surface waters, against the *Pollution Hazard Indices*.

Table 7-6
 SuDS Performance: Water Quality Indices Assessment (Discharge to Groundwater)

Land Use	Pollution Hazard Level	Pollution Hazard and SuDS Mitigation Indices Comparison					
		Total Suspended Solids (TSS)		Metals		Hydro-Carbons	
		Pollution Index	SuDS Mitigation Index ²	Pollution Index	SuDS Mitigation Index ²	Pollution Index	SuDS Mitigation Index ¹
Commercial Roofs ²	Low	0.3	0.4	0.2	0.3	0.05	0.3
Non-residential Car Parks ³		0.5	0.7	0.4	0.6	0.4	0.7
General Access Roads ³							

Notes: ¹ Indicative SuDS mitigation indices for discharges into groundwater.

² Filter drains SuDS Mitigation Indices used for 'a soil with good contaminant attenuation potential of at least 300mm in depth' beneath the filter drains conveying commercial roof runoff. (Table 26.4 of The SuDS Manual)

³ Pervious pavement/tarmac SuDS Mitigation Indices used for the collection of incident rainfall 'where a suitable filtration layer is included that provides treatment, and including a geotextile at the base separating the foundation from the subgrade' and 'underlain by a soil with good contaminant attenuation potential of at least 300mm in depth'. (Table 26.4 of The SuDS Manual)

Table 7-7
 SuDS Performance: Water Quality Indices Assessment (Discharge to Surface Water)

Land Use	Pollution Hazard Level	Pollution Hazard and SuDS Mitigation Indices Comparison					
		Total Suspended Solids (TSS)		Metals		Hydro-Carbons	
		Pollution Index	SuDS Mitigation Index ¹	Pollution Index	SuDS Mitigation Index ¹	Pollution Index	SuDS Mitigation Index ¹
Commercial Roofs ²	Low	0.3	0.4	0.2	0.4	0.05	0.4
Non-residential Car Parks ³		0.5	0.7	0.4	0.6	0.4	0.7
General Access Roads ³							

- Notes: ¹ Indicative SuDS mitigation indices for discharges into surface waters.
² Filter drains SuDS Mitigation Indices used for the collection of commercial roof runoff.
³ Pervious pavement/tarmac SuDS Mitigation Indices used for the collection of incident rainfall.

As the *SuDS Mitigation Index* provided by the proposed SuDS measures are greater than or equal to the *Pollution Hazard Index* for discharge to both surface water and groundwater, the water quality assessment criteria are satisfied.

7.7 Attenuation Volume Estimate

Based on a total contributing area of 0.50ha, using the MicroDrainage 'Source Control' module, the attenuation volumes required for the proposed development in response to a range of AEP rainfall events up to and including the 1% AEP storm event inclusive of an allowance for climate change (+40%) have been estimated as follows:

Table 7-8
 Drainage Performance and Sizing

AEP (%)	Maximum Allowable Discharge to the Existing Ditch (l/s)	Maximum Proposed Discharge to the Existing Ditch (l/s)	Minimum Attenuation Storage Required (m ³)
50	1.53	0.1	35.6
3.3		1.5	91.7
1 +40%		1.5 ²	192.8

Notes: ¹ Refer to Section 7.5.

The proposed below ground proprietary 'crate' system, located as shown on Drawing No. SWDS 01, will provide a maximum storage of approximately **252m³** over an area of approximately 804m² and a depth of 0.33m. It should be noted that the below ground proprietary 'crate' system will have a porosity of 0.95.

With reference to the National Standards for sustainable drainage system¹⁹ published by Defra:

'Drainage systems must be designed so that (...) flooding from the drainage system does not occur:

- a) *On any part of the site for a 1 in 30 year [3.33% AEP] rainfall event; and*
- b) *During a 1 in 100 year [1% AEP] rainfall event in any part of:*
 - ✧ *a building (including a basement); or*
 - ✧ *utility plant susceptible to water (e.g. pumping station or electricity substation); or*
- c) *On neighbouring sites during a 1 in 100 year [1% AEP] rainfall event.'*

The proposed SWDS meets the above criteria with no flooding during the range of AEP rainfall events assessed up to and including the 1% AEP storm event +40%.

Details of analysis are enclosed at Appendix 06.

¹⁹ Defra, December 2011. National Standards for sustainable drainage systems - Designing, constructing, operating and maintaining drainage for surface runoff

7.8 Design Exceedance Arrangement

The proposed SWDS has also considered residual events i.e. those that are in excess of the design event.

Therefore, should the design 1% AEP +40% event be exceeded, excess surface water runoff would be stored across the surface of the carpark areas. Should this volume be exceeded, runoff from the Site will follow pre-existing exceedance route and flow to the ditch within the southern boundary of the Site.

8.0 PRINCIPAL OPERATION AND MAINTENANCE REQUIREMENTS

All surface water drainage and pollution control features associated with the Site will remain private and will be maintained. The following sections outline recommended maintenance requirements for the various aspects of the drainage system for the development. If necessary, these outline operation and maintenance plan will be refined when the Site is operational to suit specific conditions.

8.1.1 Filter Drains

A recommended operation and maintenance plan for filter drains is summarised in Table 8-1.

Table 8-1
 Typical Pipe System Operation and Maintenance Requirements

Operation Schedule	Required Action	Minimum Frequency
Regular maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockage, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

8.1.2 Pervious Pavement/Tarmac

A recommended operation and maintenance plan for areas of pervious pavement is summarised in Table 8-2.

Table 8-2
 Typical Pervious Pavement Operation and Maintenance Requirements

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

8.1.3 Below Ground Drainage Crates

A recommended operation and maintenance plan for the drainage crates is summarised in Table 8-3.

Table 8-3
 Typical Drainage Crate Operation and Maintenance Requirements

Maintenance Schedule	Required Action	Minimum Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance).	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays.	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlets, overflows and vents.	As required
Monitoring	Repair/check all inlets, outlets, vents and overflows to ensure they are in good condition and operating as designed.	Annually
	Survey inside of tank for sediment build-up and remove if necessary.	Every 5 years or as required

8.1.4 Underground Piped Systems

A recommended operation and maintenance plan for the piped drainage network is summarised in Table 8-4.

Table 8-4
Typical Pipe System Operation and Maintenance Requirements

Maintenance Schedule	Required Action	Minimum Frequency
Regular maintenance	Ensuring drainage intakes are clear of debris/silt.	Monthly (or as required)
Occasional maintenance	Clear gully pots.	6 monthly
	Jet clean sewer lines, gully tails and kerb channels to remove grease, grit, sediment and other debris to ensure conveyance capacity is not compromised.	Every 2 years
Intermittent maintenance	CCTV survey of sewer lines to identify any defects/signs of performance degradation such as: - Cracked / deteriorating pipes; - Leaking joints/seals at manholes; - High water lines showing regular high stage in pipes (sign of lack of capacity or downstream constraint); and - Suspected infiltration or exfiltration.	Every 2 – 5 years
Remedial actions	Repair defects using suitable methods. Effective temporary repairs may be sufficient in short term until scheduled/capital improvements can be made.	As required
Monitoring	Record areas of surface ponding / intake bypassing / surcharging (photos, inundated areas, depths) during extreme storm events and investigate the reasoning for this post-storm.	As required

9.0 Foul Water Drainage Strategy

9.1 Foul Water Quantity

Foul flows generated by the proposed care home have been estimated using industry guidance²⁰. Using a figure of 375 litres per bed per day attributed to a 'nursing home' or 'care home' for the proposed 66 bedroom care home, the estimated average 'dry weather' foul flow from the development is 0.9 l/s. Based upon a multiplier of 3, the estimated peak foul flow generated by the proposed development is expected to be in the order of 2.6 l/s.

9.2 Foul Discharge Arrangement

A 300mmØ foul sewer drains foul flows westwards adjacent to the Site boundary for treatment by Southern Water. It is proposed that foul water from the Site discharges to this foul water main using the Southern Water sewerage network along a new pipe network from the Site connecting in to manhole 3071 at an invert level of 3.94m AOD.

²⁰ Foul Sewer Design Flows : Surveyor Datafile : January 1992 : Peter M Jones

10.0 CONCLUSIONS

SLR Consulting Limited has been appointed to develop a Flood Risk Assessment and an outline Surface Water Drainage Strategy to manage surface water runoff resulting from the proposed care home on land off Silver Birch Way, Middleton-on-Sea, West Sussex, PO22 6SJ.

Whilst the Site is located in Flood Zone 1, the potential sources of flood risk at the Site have been further evaluated. This assessment concluded that the flood risk to the Site was predominantly very low and warrant no further consideration or specific mitigation measures to be applied.

Technical information provided in this report on behalf of the Applicant seeks to demonstrate that a robust and sustainable drainage strategy has been prepared for the Site, including residual events. It is proposed that the surface water runoff arising from the development discharges to ground with a secondary outfall to the existing ditch along the southern boundary of the Site, albeit at an attenuated rate to current best practice sustainable water management guidelines through the use of SuDS.

To meet the criteria for the control of runoff volume and peak rate of runoff as set out within The SuDS Manual, discharge of surface water runoff resulting from the proposed development into the existing ditch will be restricted to 1.53l/s.

The required attenuation storage will be provided within a proprietary 'crate' system. Filter drains will provide treatment of surface water runoff from the proposed roof, patios and footpaths prior to discharge into the proposed proprietary 'crate' system. Treatment of surface water runoff from the external hardstanding areas (car parking areas and access road) will be provided by pervious pavement/tarmac across these areas.

To provide the required treatment for discharge to groundwater, an appropriate soil layer will be provided to a minimum of 300mm deep. Additionally, the pervious pavement/tarmac will be constructed with *'a suitable filtration layer is included that provides treatment, and including a geotextile at the base separating the foundation from the subgrade'* and *'underlain by a soil with good contaminant attenuation potential of at least 300mm in depth'*.

Residual flood events in excess of the design standard have also been considered with storage provided within the Site car parking area. Events greater than this will revert to the pre-existing runoff regime with flow to the existing ditch.

The surface water drainage strategy presented in this report demonstrates that adequate SuDS space provision is afforded within the development and that the proposed scheme is feasible and compliant to appropriate best practice and regulatory requirements and can be maintained in accordance with best practise.

A recommended maintenance plan has been outlined.

A foul water drainage strategy has been presented that passes foul flows of up to 2.6l/s to a 300mmØ Southern Water foul sewer westwards adjacent to the site boundary.

The proposed FRA demonstrates that the proposed development will not increase the flood risk elsewhere in accordance with current policy and guidance.

11.0 CLOSURE

The information reported herein is based on the interpretation of data collected during the environmental assessment.

SLR has relied upon data obtained by third parties in the preparation of this report. SLR has not had the opportunity to verify if this data is correct. SLR therefore cannot guarantee conclusions reached based upon this data.

It should be noted that where budget costs are provided within this report, these are based upon the information available at the time of reporting and are provided for guidance only; a detailed survey would be required to accurately confirm the cost. It should also be noted that the cost associated with the introduction and application of new legislation, not in existence at the time of this report, could escalate substantially.

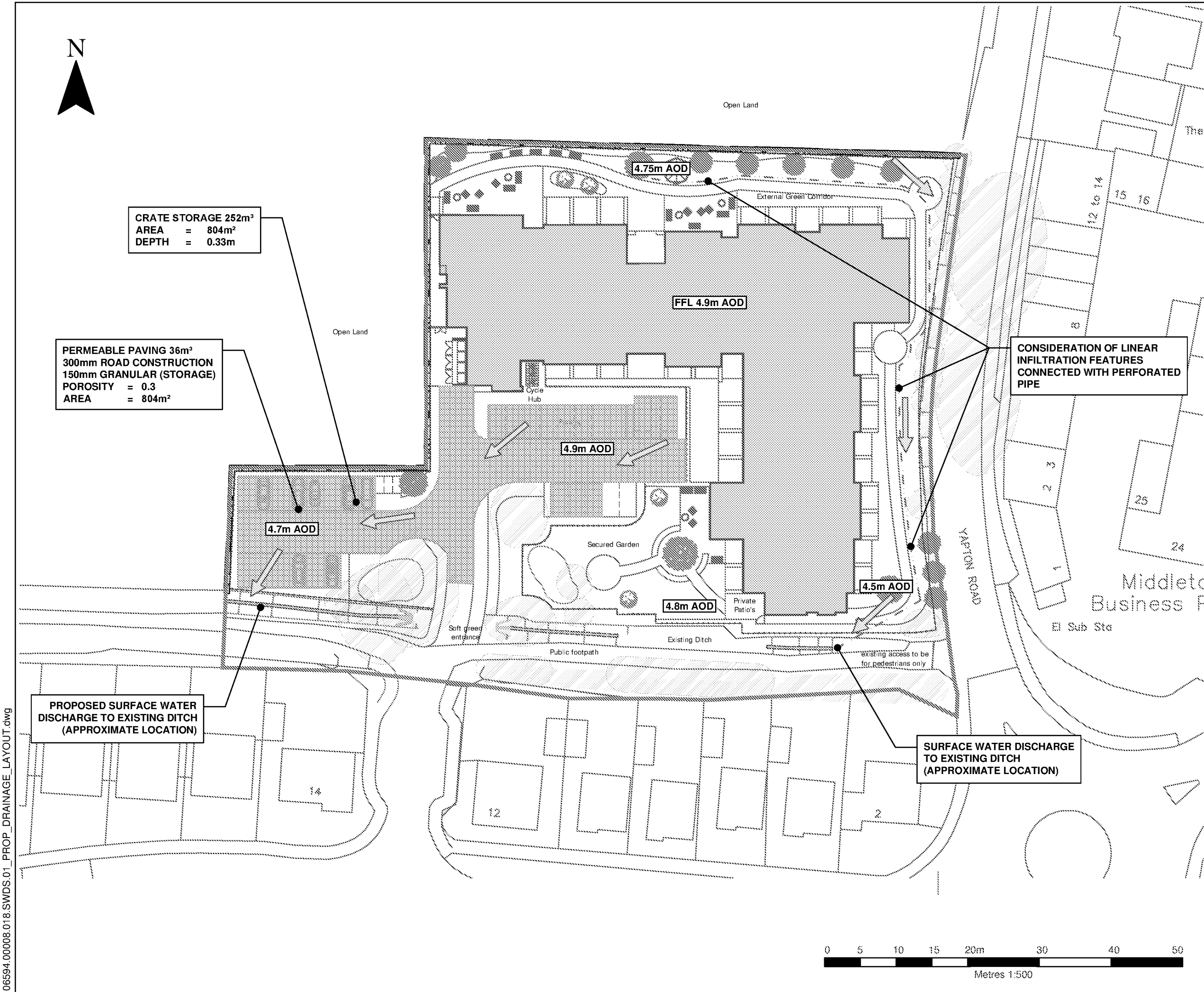
This report is for the exclusive use of those parties listed in Section 1.0 of this report and their exclusive agents; no warranties or guarantees are expressed or should be inferred by any third parties. Any such party relies upon the report at their risk.

SLR disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

DRAWING NO. SWDS 01

Proposed Drainage Layout

06594.00008.018.SWDS.01_PROP_DRAINAGE_LAYOUT.dwg



CRATE STORAGE 252m³
AREA = 804m²
DEPTH = 0.33m

PERMEABLE PAVING 36m³
300mm ROAD CONSTRUCTION
150mm GRANULAR (STORAGE)
POROSITY = 0.3
AREA = 804m²

PROPOSED SURFACE WATER
DISCHARGE TO EXISTING DITCH
(APPROXIMATE LOCATION)

SURFACE WATER DISCHARGE
TO EXISTING DITCH
(APPROXIMATE LOCATION)

CONSIDERATION OF LINEAR
INFILTRATION FEATURES
CONNECTED WITH PERFORATED
PIPE

- NOTES
1. DRAWING PREPARED FOR THE SURFACE WATER DRAINAGE STRATEGY, NOT FOR CONSTRUCTION.
 2. ALL LEVELS INDICATED ARE TO OS DATUM (METRES) FROM PROPOSED LEVELS RECEIVED.

- LEGEND
- SITE BOUNDARY
 - PERMEABLE PAVING
 - EXISTING DITCH
 - PROPOSED STORMBLOC ATTENUATION STORAGE
 - EXCEEDANCE FLOW ROUTE ABOVE DESIGN FLOOD EVENT
 - PERFORATED INFILTRATION DRAIN

SLR
Global environmental solutions

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F: 01225 309401
www.slrconsulting.com

YAPTON ROAD POULTRY FARM
MIDDLETON-ON-SEA

SURFACE WATER DRAINAGE
STRATEGY

PROPOSED DRAINAGE LAYOUT

SWDS 01

Scale 1:500 @ A3

Date SEPTEMBER 2019

APPENDIX 01

Topographic Survey



Charles Surveys
Copyright ©2010
Offington Land Surveys Ltd
29 Offington Drive
Worthing
West Sussex BN14 9PW
Tel/fax 01903 267814
www.offington.com

Drawn by: 13090815 Site Plan
Date: 08/02
Project: W900
Client: NAPTON ROAD POULTRY FARM
MIDDLETON ON SEA
WEST SUSSEX
Survey Date: 10/06/2010 - 17/06/2010
Surveyed by: ST
Checked by: ST

Notes:
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APPENDIX 02

Details of Intrusive Ground Works

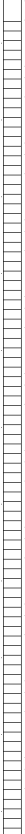
BOREHOLE LOG				BOREHOLE No. WS-01	
Client: FRONTIER					
Project No: Yapton Road Farm		Date: 01/05/19	Ground Level: 4.80maOD	Co-ordinates: E497364 N100776	
Project: GROUND INVESTIGATION					
					Sheet: 1 of 1

SAMPLES & TESTS						Water	STRATA			Instrument/ Backfill		
Depth	Type No	HS(ppm)	HV(kPa)	PP(kPa)	SPT-N		Reduced Level	Legend (Thick-ness)	Depth		DESCRIPTION	
0.00	BAG	1				↓	4.60		0.20	Grey brown slightly sandy clay SILT with occasional rootlets. (TOPSOIL)	Instrument/Backfill	
0.20	J									Soft to firm orangey brown, sandy, slightly clayey SILT. Gravels are fine angular of chalk and flint.		
1	1.00	BAG	1						(1.60)			
	1.30	J										
2	2.00	BAG	0				↓	3.00		1.80		Firm, mottled orange and white, silty gravelly SAND. Gravel consists of angular fine to medium chalk and flint, moist to wet.
	2.50	J						2.20		2.60		Firm, grey SILT with rare sand, moist to wet.
3	2.80	J							(0.50)			
	3.00	BAG	0				↓	1.70		3.10		Firm, mottled orange and white, slightly gravelly sandy SILT. Gravel consists of rounded to angular fine to medium chalk and flint, moist to wet.
4	4.00	BAG	1						(1.00)			
								0.70		4.10		Soft, grey slightly gravelly slightly sandy SILT. Gravel is fine to coarse, angular to sub angular of flint. moist to wet.
							0.30		4.50	Grey to white sandy, silty, GRAVEL. Gravel consists of angular fine chalk and flint, wet.		
5	5.00	BAG	0					(0.70)				
							-0.40		5.20	Borehole complete at 5.20m		

Boring Progress and Water Observations				Casing		Chiselling			Water Added		General Remarks
Date	Time	Depth	Water Dpt	Depth	Dia. mm	From	To	Hours	From	To	
01-05-19	10.00		3.20								Hand pit to 1.2mbg
01-05-19	10.30		1.95								
07-05-19	15.00		1.545								

All dimensions in metres Scale 1:34.375		Contractor: ESL Plant:		Method: Windowless Sampler Hole Size: 200mm		Logged By: JG	Approved By: BAJ
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BOREHOLE LOG				BOREHOLE No. WS-02	
Client: FRONTIER					
Project No: Yapton Road Farm		Date: 01/05/19	Ground Level: 5.01maOD	Co-ordinates: E497413 N100782	
Project: GROUND INVESTIGATION					
					Sheet: 1 of 1

SAMPLES & TESTS						Water	STRATA				Instrument/ Backfill
Depth	Type No	HS(ppm)	HV(kPa)	PP(kPa)	SPT-N		Reduced Level	Legend (Thick-ness)	Depth	DESCRIPTION	
0.00	BAG	1				 			Grey brown slightly sandy clay SILT with occasional rootlets. (TOPSOIL)		
0.20	J						4.76		0.25		Firm, orangey brown, sandy slightly clayey SILT.
									(0.75)		
1.00	BAG	1					4.01		1.00		Firm, orangey brown, slightly gravelly, sandy slightly clayey SILT. Gravel consists of angular to rounded, fine to medium chalk and flint, moist.
1.30	J								(0.60)		
							3.41		1.60		Firm, orangey brown, sandy gravelly SILT. Gravel consists of angular fine to medium chalk and flint, moist to wet.
									(0.60)		
2.00	BAG	0					2.81		2.20		Firm, mottled orange and white, slightly gravelly sandy SILT. Gravel consists of rounded fine to medium chalk and flint, moist to wet.
2.30	J								(1.30)		
											
3.00	BAG	0						3.50	Soft to firm, brown changing to grey slightly gravelly sandy SILT. Occasional sand lenses. Wet.		
3.10	J							(1.10)			
											
								4.60	Grey to white sandy, silty, GRAVEL. Gravel consists of angular fine chalk and flint, wet.		
								(0.60)			
5.00	BAG	0						5.20	Borehole complete at 5.20m		
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											

Boring Progress and Water Observations				Casing		Chiselling			Water Added		General Remarks
Date	Time	Depth	Water Dpt	Depth	Dia. mm	From	To	Hours	From	To	
01-05-19	13.00		2.511								Hand pit to 1.2mbg
01-05-19	13.30		1.992								
07-05-19	15.05		1.853								

All dimensions in metres Scale 1:34.375	Contractor: ESL Plant:	Method: Windowless Sampler Hole Size: 200mm	Logged By: JG	Approved By: BAJ
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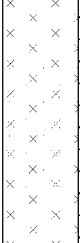
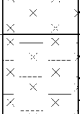
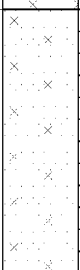
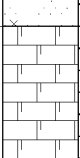
BOREHOLE LOG				BOREHOLE No. WS-03					
Client: FRONTIER									
Project No: Yapton Road Farm		Date: 01/05/19				Ground Level: 4.81maOD		Co-ordinates: E497348 N100731	
Project: GROUND INVESTIGATION						Sheet: 1 of 1			

SAMPLES & TESTS							STRATA				Instrument/ Backfill
Depth	Type No	HS (ppm)	HV (kPa)	PP (kPa)	SPT-N	Water	Reduced Level	Legend (Thickness)	Depth	DESCRIPTION	
1							4.56		0.25	Grey brown slightly sandy clay SILT with occasional rootlets. (TOPSOIL)	
									(1.25)	Soft to firm, orangey brown slightly sandy slightly clayey SILT.	
							3.31		1.50		
2							3.01		1.80	Firm, mottled orange white, slightly sandy slightly gravelly SILT. Gravel is fine to coarse, angular to sub angular of flint.	
									(0.40)	Mottled orange white slightly gravelly slightly silty fine to medium SAND. Gravel is rounded to angular chalk and flint. Moist to wet.	
							2.61		2.20		
3							2.01		2.80	Firm, mottled brown and white slightly gravelly sandy SILT. Becoming increasingly white and sandy with depth. Wet.	
									(1.90)	Loose, white, slightly silty, fine to medium SAND and GRAVEL. Gravel is fine chalk and flint, wet.	
							0.11		4.70		
5							-0.19		5.00	Firm, grey white, slightly sandy gravelly SILT. Gravel is medium to coarse, angular to sub angular of flint and chalk.	
										Borehole complete at 5.20m	

Boring Progress and Water Observations				Casing		Chiselling			Water Added		General Remarks
Date	Time	Depth	Water Dpt	Depth	Dia. mm	From	To	Hours	From	To	
01-05-19	08.30		3.11								
01-05-19	09.15		2.31								Hand pit to 1.2mbg
07-05-19	15.10		1.53								

All dimensions in metres Scale 1:34.375		Contractor: ESL Plant:		Method: Windowless Sampler Hole Size: 200mm		Logged By: JG	Approved By: BAJ
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BOREHOLE LOG				BOREHOLE No. WS-04		
Client: FRONTIER						
Project No: Yapton Road Farm		Date: 01/05/19	Ground Level:			Co-ordinates: E497406 N100741
Project: GROUND INVESTIGATION						Sheet: 1 of 1

SAMPLES & TESTS						STRATA				Instrument/ Backfill	
Depth	Type No	HS(ppm)	HV(kPa)	PP(kPa)	SPT-N	Water	Reduced Level	Legend (Thick- ness)	Depth		DESCRIPTION
1						1			0.10	Brown to grey sandy SILT with bricks and occasional metal debris. Dry. (MADE GROUND) Loose, grey brown slightly sandy clay SILT with occasional rootlets. (TOPSOIL) Soft to firm, orangey brown, slightly gravelly sandy SILT. Gravel is fine to coarse, angular of flint. Infrequent sandy lenses, moist.	
									0.20		
									(2.40)		
									2.60		
									(0.40) 3.00		
3						1			(1.30)	Loose, mottled orange and brown, slightly gravelly silty fine to medium SAND. Gravel comprises rounded to subrounded flint and chalk. Wet.	
									4.30 (0.70)		
									5.00		
5										Borehole complete at 5.20m	

Boring Progress and Water Observations				Casing		Chiselling			Water Added		General Remarks
Date	Time	Depth	Water Dpt	Depth	Dia. mm	From	To	Hours	From	To	
											Hand pit to 1.2mbg

All dimensions in metres Scale 1:34.375		Contractor: ESL Plant:		Method: Windowless Sampler Hole Size: 200mm		Logged By: JG	Approved By: BAJ
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TRIAL PIT LOG				TRIAL PIT No TP-01	
Client: FRONTIER					
Project: GROUND INVESTIGATION					
Project No: Yapton Road Farm		Date: 29/04/19	Ground Level: 4.90mAOD	Co-ordinates: E 497379 N 100775	Sheet: 1 of 1

SAMPLES & TESTS				Water	STRATA			Instrument/ Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thick-ness)		DESCRIPTION
0.00	BAG	HS	0ppm					Grey brown slightly sandy clay SILT with occasional rootlets. (TOPSOIL).	
0.25	J				4.65		0.25	Firm, light brown, slightly gravelly, sandy SILT with rare clay. Gravel consists of fine angular chalk and flint, moist.	
							(1.05)		
									
									
									
									
									
									
									
1	BAG	HS	0ppm				Firm, mottled brown and white, sandy, gravelly SILT. Gravel consists of fine angular chalk and flint, moist.		
1.00	J			3.60		1.30			
1.00						(1.20)			
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
							</		

GENERAL REMARKS: Trial pit dry.		Trial Pit Dimensions:
KEY: V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Small Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement		

All dimensions in metres Scale 1:34.375	Contractor : ESL Plant: JCB 3CX	Method: Trial Pit/trench	Logged By: JG	Approved By: BAJ
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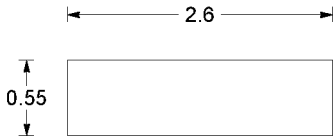
ARUN DISTRICT COUNCIL M/80/19/PL

TRIAL PIT LOG				TRIAL PIT No TP-03	
Client: FRONTIER					
Project: GROUND INVESTIGATION					
Project No: Yapton Road Farm		Date: 29/04/19	Ground Level: 4.88mAOD	Co-ordinates: E 497365 N 497365	Sheet: 1 of 1

SAMPLES & TESTS				Water	STRATA			Instrument/ Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thick-ness)		DESCRIPTION
1	0.00 0.15	BAG J	HS	0ppm		4.73		0.15	Grey brown slightly sandy clay SILT with occasional rootlets. (TOPSOIL).
								(0.65)	Firm, light brown, slightly gravelly sandy SILT. Gravel consists of angular fine chalk and flint. Dry.
	0.90 1.00	B B	HS	1ppm		4.08		0.80	Light brown, silty fine to medium SAND.
						3.48		1.40	1.20 - 1.30 fine to medium lense of sand.
2	2.00	BAG	HS	0ppm				(0.70)	Firm, mottled orange white sandy SILT. moist.
						2.78		2.10	Firm, mottled orange white, slightly gravelly SILT with rare clay and sand. Gravel consists of fine to medium chalk and flint. Moist.
3	3.00	BAG	HS	0ppm		1.68		3.20	
									Trial Pit complete at 3.20m
4									
5									

GENERAL REMARKS: Trial pit dry.		Trial Pit Dimensions: Shoring/Support: None Stability: Pit Stable
KEY: V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Small Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement		

All dimensions in metres Scale 1:34.375	Contractor : ESL Plant: JCB 3CX	Method: Trial Pit/trench	Logged By: JG	Approved By: BAJ
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TRIAL PIT LOG										TRIAL PIT No TP-04	
Client: FRONTIER											
Project: GROUND INVESTIGATION											
Project No: Yapton Road Farm			Date: 29/04/19		Ground Level: 4.86m AOD		Co-ordinates: E 497386 N 100755			Sheet: 1 of 1	
SAMPLES & TESTS				Water	STRATA					Instrument/ Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION			
0.00	BAG	HS	0ppm		4.76		0.10	Grey brown slightly sandy clay SILT with occasional brick and charcoal. (TOPSOIL). Firm, light brown, slightly gravelly sandy SILT. Gravel consists of angular to rounded fine chalk and flint. Dry.			
0.20	J						(1.10)				
0.80	DIST B B	HS	0ppm		3.66		1.20	Light brown, silty fine to medium SAND. 1.20 - 1.30 fine to medium sand lense. Firm, mottled orange white, SILT with rare clay and sand, moist.			
0.90										3.46	1.40
1.00									(0.70)		
2.00	BAG	HS	0ppm		2.76		2.10	Firm, mottled orange white, slightly gravelly SILT with rare clay and sand. Gravel consists of rounded to angular fine to medium chalk and flint. Moist.			
2.10	DIST						(1.10)				
2.50	J										
3.00	BAG	HS	0ppm		1.66		3.20	Trial Pit complete at 3.20m			
4											
5											
GENERAL REMARKS: Trial pit dry.								Trial Pit Dimensions:  Shoring/Support: None Stability: Pit Stable			
KEY: V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Small Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement											
All dimensions in metres Scale 1:34.375		Contractor : ESL Plant: JCB 3CX			Method: Trial Pit/trench			Logged By: JG	Approved By: BAJ		

TRIAL PIT LOG				TRIAL PIT No TP-05	
Client: FRONTIER					
Project: GROUND INVESTIGATION					
Project No: Yapton Road Farm		Date: 30/04/19	Ground Level: 4.91mAOD	Co-ordinates: E 497365 N 100746	Sheet: 1 of 1

SAMPLES & TESTS				Water	STRATA			Instrument/ Backfill		
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thick-ness)		DESCRIPTION	
1	0.00	BAG	HS	0ppm	4.71		0.20	Grey brown slightly sandy clay SILT with occasional rootlets. (TOPSOIL)		
	0.20	J					(0.45)	Firm, light brown, slightly gravelly sandy SILT. Gravel consists of fine chalk and flint. Dry.		
							4.26	0.65		Light brown, silty SAND. Moist.
	0.90	B					(0.50)			
1.00	B	HS	1ppm	3.76	1.15		Firm, mottled orange white, slightly gravelly, slightly clayey SILT with rare sand. Gravel consists of angular fine to medium chalk and flint. 1.20 - 1.30 Fine to medium sand lense.			
2	2.00	BAG	HS	0ppm	1.71		(2.05)			
	2.50	B								
3	3.00	BAG	HS	0ppm						
4										
5										

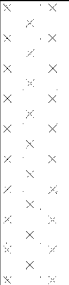
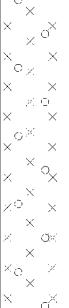
GENERAL REMARKS: Trial pit dry.		Trial Pit Dimensions: Shoring/Support: None Stability: Pit Stable
KEY: V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Small Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement		

All dimensions in metres Scale 1:34.375	Contractor : ESL Plant: JCB 3CX	Method: Trial Pit/trench	Logged By: JG	Approved By: BAJ
--	------------------------------------	--------------------------	------------------	---------------------

Form SLR AGS3 UK TP File MIDDLETON_FINAL GPJ 29-05-19

From SLR AGS3 UK TP File MIDDLETON FINAL.GPJ 29-05-19

TRIAL PIT LOG				TRIAL PIT No TP-07	
Client: FRONTIER					
Project: GROUND INVESTIGATION					
Project No: Yapton Road Farm		Date: 30/04/19	Ground Level: 5.11mAOD	Co-ordinates: E 497411 N 100753	Sheet: 1 of 1

SAMPLES & TESTS				Water	STRATA			Instrument/ Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thick-ness)		DESCRIPTION
0.00	BAG	HS	0ppm		4.96		0.15	Grey brown slightly gravelly sandy clay SILT with occasional rootlets. Gravel concists of chalk and rare charcoal and brick. Dry. (MADE GROUND) Orangey brown, silty SAND. Moist. Firm, orangey brown, slightly clayey, gravelly sandy SILT. Gravel consists of angular to rounded fine chalk and flint. Moist.	
0.30	J				4.81		0.30		
0.80	DIST						(1.40)		
0.80	J								
0.90	B								
					3.41		1.70	Firm, mottled orange white, gravelly, slightly sandy SILT. Gravel consists of fine to medium chalk and flint.	
							(1.50)		

GENERAL REMARKS: Trial pit dry.		Trial Pit Dimensions: 0.5 ↑ ↓ 2.6 ← →
KEY: V = Hand Vane Shear Strength PP = Pocket Penetrometer Shear Strength J = Jar Sample D = Small Disturbed Sample B = Large Bulk Sample HS = Head Space Measurement		

All dimensions in metres Scale 1:34.375	Contractor : ESL Plant: JCB 3CX	Method: Trial Pit/trench	Logged By: JG	Approved By: BAJ
--	------------------------------------	--------------------------	------------------	---------------------

ARUN DISTRICT COUNCIL M/80/19/PL

TRIAL PIT LOG										TRIAL PIT No TP-09	
Client: FRONTIER											
Project: GROUND INVESTIGATION											
Project No: Yapton Road Farm			Date: 30/04/19		Ground Level: 5.10m AOD		Co-ordinates: E 497389 N 100745			Sheet: 1 of 1	
SAMPLES & TESTS				Water	STRATA					Instrument/ Backfill	
Depth	Type No	Test Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION			
0.00	BAG	HS	0ppm		5.00		0.10	Grey brown slightly sandy SILT with occasional rootlets (TOPSOIL).			
0.30	J				4.70		(0.30) 0.40	Light brown gravelly silty SAND. Gravel is fine to coarse, angular to sub angular of charcoal and brick. Frequent fragments of fibre cement sheet (may contain asbestos). (MADE GROUND)			
0.80	B							Firm, orangey brown, slightly sandy slightly gravelly clayey SILT. Gravel consists of angular fine chalk and flint. Moist.			
0.80	DIST						(1.20)				
											
											
											
							1.60				
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
											
	</										

APPENDIX 03

Southern Water Asset Plan

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
0401X			UNK	VC	CIRC	3505X	5.52	3.07	175	VC	CIRC	9652X	4.56	2.97	225	CP	CIRC						
0501X			UNK	UNK	RECT	3506X	5.56	3.17	175	VC	CIRC	9653X	4.59	3	375	CP	CIRC						
0511X	7.81	6.44	175	VC	CIRC	3507X			UNK	UNK	CIRC	9901X	3	0.96	300	BAC	RECT						
0512X	6.98	5.24	175	VC	CIRC	3508X			UNK	UNK	CIRC	9951X	3.76	1.07	900	CP	CIRC						
0550X			UNK	UNK	CIRC	3510X			UNK	UNK	CIRC												
0560X	7.03	4.5	375	CP	CIRC	3600X			150	VC	CIRC												
0561X	6.69	5.39	225	VC	CIRC	3610X	4.54	2.2	150	VC	CIRC												
0562X	7.23	5.06	225	VC	CIRC	3611X	4.54	2.74	150	VC	CIRC												
0611X	4.94	3.14	150	VC	CIRC	3612X	4.61	2.49	150	VC	CIRC												
0612X	5.1	3.82	150	VC	CIRC	3613X	4.55	2.84	150	VC	CIRC												
0613X	4.99	3.03	150	VC	CIRC	3614X			150	VC	CIRC												
0614X	4.65	2.94	150	VC	CIRC	3660X	4.59	2.88	300	CP	CIRC												
0616X			UNK	UNK	CIRC	3661X	4.57	3.14	225	CP	CIRC												
0617X			UNK	UNK	CIRC	3662X	4.63	2.72	450	CP	CIRC												
0661X	4.95	1.68	675	CP	CIRC	3701X	4.69	3.94	300	BAC	CIRC												
0662X	4.93	1.92	600	CP	CIRC	4501X	4.42	2.82	175	VC	CIRC												
0663X	5.08	3.12	225	CP	CIRC	4502X	3.99	2.54	175	VC	CIRC												
0664X	4.72	2.34	225	CP	CIRC	450DX			UNK	UNK	CIRC												
0760X	5.21		900	CP	CIRC	451DX			175	VC	CIRC												
0761X	4.94	1.4	675	CP	CIRC	451LX	4.09	2.67	175	VC	CIRC												
0801X	3.81	1.92	300	BAC	CIRC	4601X	3.73	1.82	175	CI	CIRC												
0851X	4.29	1.3	900	CP	CIRC	4602X	3.83	2.28	175	VC	CIRC												
0852X	4.15	1.23	900	CP	CIRC	4701X	3.72	1.59	175	CI	CIRC												
1411X	7.04	5.72	175	VC	CIRC	4702X	3.88	2	175	CI	CIRC												
1452X	7.27	5.62	150	VC	CIRC	471LX	3.92	2.26	175	CI	CIRC												
1511X	7.41	5.02	175	VC	CIRC	4801X	3.82	2.92	175	VC	CIRC												
1512X	6.96	4.77	175	VC	CIRC	5501X	5.45	3.76	175	VC	CIRC												
1513X	7.08	5.21	175	VC	CIRC	5601X	5.07	3.36	175	VC	CIRC												
1514X	6.47	4.51	150	VC	CIRC	5602X			UNK	UNK	CIRC												
1515X	6.52		150	VC	CIRC	5603X			UNK	UNK	CIRC												
1560X	7.04	4.99	300	VC	CIRC	5604X			UNK	UNK	CIRC												
1561X	6.67	5.32	150	VC	CIRC	5606X			100	VC	CIRC												
1562X	6.68	5.21	225	VC	CIRC	5607X			100	VC	CIRC												
1611X	5.23	3.94	150	VC	CIRC	5608X			100	VC	CIRC												
1612X	5.48	4.17	150	VC	CIRC	5701X	3.83	1.19	175	CI	CIRC												
1613X	4.97	3.71	150	VC	CIRC	5702X	4.02	1.37	175	CI	CIRC												
1650X	5.25	2.23	450	CP	CIRC	570DX			175	CI	CIRC												
1651X	5.42	3.54	450	CP	CIRC	640DX			175	VC	CIRC												
1652X	4.98	2.08	600	CP	CIRC	6501X	5.11	1.21	175	VC	CIRC												
2401X	6.63	4.61	175	VC	CIRC	6502X	5.29	0.78	175	VC	CIRC												
2405X	6.4	4.93	150	VC	RECT	6503X	4.96	3.04	150	VC	CIRC												
240DX			100	VC	CIRC	6504X	4.94	3.26	150	PF	CIRC												
2501X	5.82		175	VC	CIRC	6505X			UNK	UNK	CIRC												
2502X	5.25		175	VC	CIRC	650DX			175	VC	CIRC												
2503X	5.4	4.05	175	VC	CIRC	651DX			175	VC	CIRC												
2504X	5.32		175	VC	CIRC	652DX			UNK	UNK	CIRC												
2505X			175	VC	CIRC	653DX			175	VC	CIRC												
2506X	5.94	4.14	175	VC	CIRC	6601X	3.37	0.19	175	CI	CIRC												
2507X			UNK	UNK	CIRC	6602X			UNK	UNK	CIRC												
250DX			UNK	UNK	CIRC	662DX			175	VC	CIRC												
2610X	4.86	3.08	150	VC	CIRC	7501X	4.9	3.61	150	PF	CIRC												
2611X	5.3	3.37	150	VC	CIRC	7502X			UNK	UNK	CIRC												
2612X	5.4	3.58	150	VC	CIRC	750DX			UNK	UNK	CIRC												
2613X	5.52	3.97	150	VC	CIRC	7601X	3.15	-0.04	175	CI	CIRC												
2660X	4.83	2.4	450	CP	CIRC	7602X	2.68	-0.27	175	CI	CIRC												
2661X	5.3	2.32	450	CP	CIRC	7603X			UNK	UNK	CIRC												
2662X	5.38	3.02	225	CP	CIRC	8601X	2.5	-0.54	175	CI	CIRC												
2663X	5.54	3.44	150	VC	CIRC	9451X			375	CP	CIRC												
2664X	4.57	2.55	450	CP	CIRC	9552X	4.85	3.32	300	CP	CIRC												
2701X	4.77	3.21	300	BAC	CIRC	9555X	4.78	3.36	225	CP	CIRC												
3401X	4.88	3.35	175	VC	CIRC	9602Y	4.57	2.53	150	VC	CIRC												
3501X	4.93	2.76	175	VC	CIRC	9602X	4.57	2.51	300	VC	RECT												
3502X	4.95	3.19	175	VC	CIRC	9603X	4.85	2.81	300	VC	RECT												
3503X	5.25	2.84	175	VC	CIRC	9611X	4.647	2.702	150	VC	CIRC												
3504X	5.44	3.34	175	VC	CIRC	9612X	3.46		300	VC	RECT												

LINE STYLES / COLOURS

Brown	----- Foul
	----- Foul Siphon Sewer
	----- Foul Vacuum Main
	----- Foul Rising Main
Red	----- Combined
	----- Combined Siphon Sewer
	----- Combined Rising Main
Orange	----- Lateral Drain
	----- Building Over Agreement Area
Dark Blue	----- Treated Effluent
Purple	----- Sludge
	----- Sewer Catchment
	----- Section 104 Area
Light Blue	----- Surface Water
	----- Surface Water Rising Main
Yellow	----- Private
Green	----- Access Shaft
	----- Decommissioned

MATERIALS

AK	Alkaline
BAC	Bonded Asbestos Cement
BRD	Brick (Common)
BRE	Brick (Engineering)
CC	Concrete Box Culvert
CI	Cast Iron
CO	Concrete (In-Situ)
CP	Concrete (Pre-Cast)
CSB	Concrete Segments (bolted)
CSU	Concrete Segments (unbolted)
DI	Ductile Iron
GRG	Glass Reinforced Concrete
GRP	Glass Reinforced Plastic
MAC	Masonry in regular Courses
MAR	Masonry in random Courses
PE	Polyethylene
PF	Pitch Fibre
PP	Polypropylene
PVC	Polyvinyl Chloride
RFW	Reinforced Plastic Matrix
SI	Spun Iron
ST	Steel
VC	Vertifluid Clay
XXX	Other
ZZZ	Unknown

Manhole (SW)
Manhole (F&C)
Lamp hole (SW)
Lamp hole (F&C)
Pumping Station (SW)
Pumping Station (F&C)
Side entry manhole (SW)
Side entry manhole (F&C)
Blind shaft (SW)
Blind shaft (F&C)
Ejector station (SW)
Ejector station (F&C)
Watertight door (SW)
Watertight door (F&C)
Flushing ch. Min-e (SW)
Flushing ch. Min-e (F&C)
Flushing ch. No-e (SW)
Flushing ch. No-e (F&C)
Demonstration Chamber

LEGEND - SEWERS

Washout (SW)
Washout (F&C)
Rodding Eye (SW)
Rodding Eye (F&C)
Gauging point (SW)
Gauging point (F&C)
Intercept chamber (SW)
Intercept chamber (F&C)
Storm Tank (SW)
Storm Tank (F&C)
Vortex chamber (SW)
Vortex chamber (F&C)
Label ellipse
Dummy/S24 manhole
Penstock chamber
Demiboards
Storm Overflow
Backdrop manhole

Other (s)
Other
Change In sewer (s)
Change In sewer
Rafflux valve
Flap valve
Cascade
Anode
Valve
Closed Valve
Air Valve
Hatch box (SW)
Hatch box (F&C)
Direction arrow
Emptying valve
Catchpit
Soakaway
Inlet
Balancing Pond

Wastewater treatment works
Marine treatment works
Outfall headworks
Vent
Vent column
Tidal storage tank
Blank end
Head of Public Sewer
Micro Pumping Station

SHAPES (S)

A	Arched	R	Rectangular
B	Barrel	S	Square
C	Circular	T	Trapezoidal
E	Egg	U	U Shape
H	Horseshoe	X	Other

NODE REFERENCING SYSTEM

1st digit:	hundred metre easting identifier
2nd digit:	hundred metre northing identifier
3rd digit:	sewer type identifier
4th digit:	next sequential node

Drawn by: rogersc

Title: 327966 - Yapton Poultry Farm

Date: 01/03/2019





407040

APPENDIX 04

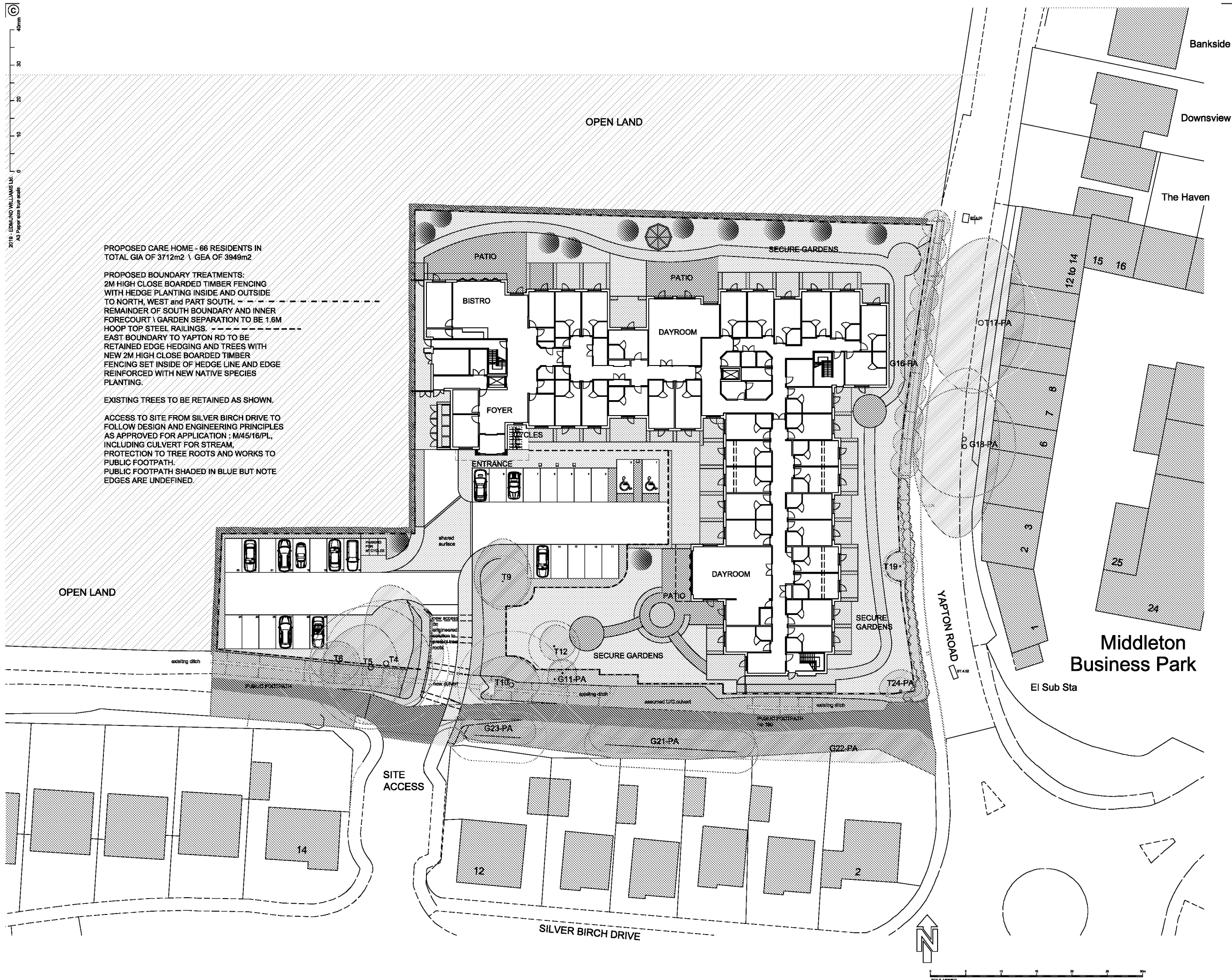
Details of the Proposed Development

PROPOSED CARE HOME - 66 RESIDENTS IN
TOTAL GIA OF 3712m2 \ GEA OF 3949m2

PROPOSED BOUNDARY TREATMENTS:
2M HIGH CLOSE BOARDED TIMBER FENCING
WITH HEDGE PLANTING INSIDE AND OUTSIDE
TO NORTH, WEST AND PART SOUTH. -----
REMAINDER OF SOUTH BOUNDARY AND INNER
FORECOURT \ GARDEN SEPARATION TO BE 1.6M
HOOP TOP STEEL RAILINGS. -----
EAST BOUNDARY TO YAPTON RD TO BE
RETAINED EDGE HEDGING AND TREES WITH
NEW 2M HIGH CLOSE BOARDED TIMBER
FENCING SET INSIDE OF HEDGE LINE AND EDGE
REINFORCED WITH NEW NATIVE SPECIES
PLANTING.

EXISTING TREES TO BE RETAINED AS SHOWN.

ACCESS TO SITE FROM SILVER BIRCH DRIVE TO FOLLOW DESIGN AND ENGINEERING PRINCIPLES AS APPROVED FOR APPLICATION : M45/16/PL, INCLUDING CULVERT FOR STREAM, PROTECTION TO TREE ROOTS AND WORKS TO PUBLIC FOOTPATH.
PUBLIC FOOTPATH SHADED IN BLUE BUT NOTE EDGES ARE UNDEFINED.



DRAWING STATUS

PLANNING APPLICATION

REV:	DATE:	DESCRIPTION:



PROJECT:

YAPTON RD, MIDDLETON-on-SEA
PROPOSED 66 BED CARE HOME

TITLE:

SITE PLAN PROPOSED

SCALE: 5000A3

DATE: AUG 19

AUTHOR:

DRG NO:

1904\PA\005

FILE:

Strategic Flood Risk Assessment Appendices F & H



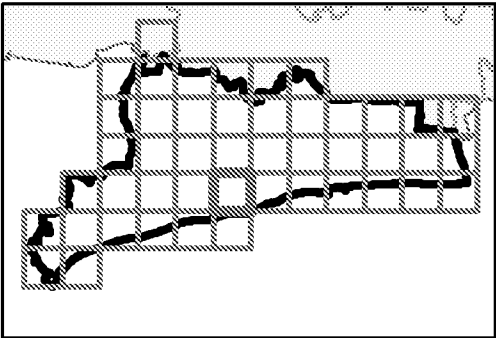
Notes

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
- < 25%
- >= 25% <50%
- >= 50% <75%
- >= 75%



REF	Date	Comments
A	June 2016	-
B		
C		

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ARUN DISTRICT COUNCIL

LEVEL 1 SFRA: APPENDIX F AREAS SUSCEPTIBLE TO GROUNDWATER

Sheet No. 13 of 48 Index Number: ADC_13

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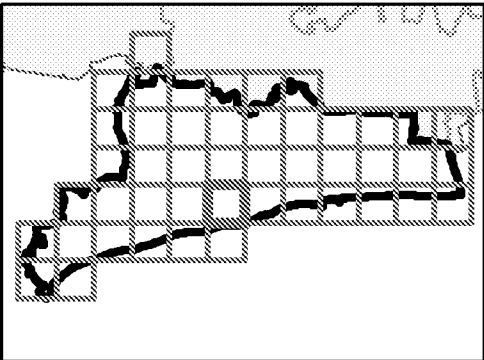
Notes

The Historic Flooding Map shows the recorded incidents and flood outlines provided by Arun District Council, West Sussex County Council, Southern Water and Environment Agency. Historical flood extent was obtained from the Environment Agency

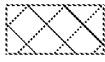
Flooding incidents provided have been categorised based upon the details provided in the records. Unknown flood points could not be determined from the information provided, and therefore could be from a number of sources.

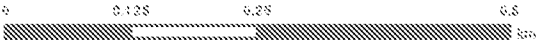
Please note that not all historical records may be shown on this map, and that it is therefore advised you contact Arun District Council for updated information post 2015.

Key Plan



Legend

-  Arun District SFRA boundary
-  Historic flood outline
- Source of flooding**
-  Fluvial
-  Coastal
-  Tidal
-  Surface Water
-  Feature
-  Unknown



REF	Date	Comments
A	June 2015	-
B		
C		

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ARUN DISTRICT COUNCIL LEVEL 1 SFRA: APPENDIX H HISTORIC FLOODING RECORDS

Sheet No. 13 of 48 Index Number: AGC_13

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APPENDIX 06

Preliminary Drainage Design

SLR Consulting Limited							Page 1
4 The Roundal Roddinglaw Road Edinburgh EH12 9DB			402.06594.00008 Middleoton-on-Sea SWDS_1%AEP +40%				
Date 01/07/2019 File 190731_402_06594_00008_...			Designed by SLR Consulting L... Checked by SLR Consulting Li...				
Micro Drainage			Source Control 2017.1.2				
Summary of Results for 100 year Return Period (+40%)							
Half Drain Time : 81 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	8.819	0.149	20.1	1.5	21.6	113.9	O K
30 min Summer	8.860	0.190	20.1	1.5	21.6	145.1	O K
60 min Summer	8.889	0.219	20.1	1.5	21.6	167.1	O K
120 min Summer	8.887	0.217	20.1	1.5	21.6	166.0	O K
180 min Summer	8.876	0.206	20.1	1.5	21.6	157.5	O K
240 min Summer	8.862	0.192	20.1	1.5	21.6	146.7	O K
360 min Summer	8.832	0.162	20.1	1.5	21.6	123.7	O K
480 min Summer	8.804	0.134	20.1	1.5	21.6	102.7	O K
600 min Summer	8.781	0.111	20.1	1.4	21.5	85.1	O K
720 min Summer	8.762	0.092	20.1	1.1	21.2	70.6	O K
960 min Summer	8.735	0.065	20.1	0.5	20.6	49.9	O K
1440 min Summer	8.714	0.044	17.8	0.1	17.9	33.7	O K
2160 min Summer	8.703	0.033	13.4	0.0	13.4	25.3	O K
2880 min Summer	8.697	0.027	10.8	0.0	10.8	20.5	O K
4320 min Summer	8.690	0.020	8.1	0.0	8.1	15.3	O K
5760 min Summer	8.686	0.016	6.5	0.0	6.5	12.4	O K
7200 min Summer	8.684	0.014	5.7	0.0	5.7	10.7	O K
8640 min Summer	8.683	0.013	5.1	0.0	5.1	9.6	O K
10080 min Summer	8.682	0.012	4.7	0.0	4.7	8.8	O K
15 min Winter	8.839	0.169	20.1	1.5	21.6	129.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
15 min Summer	140.493	0.0	131.3	20			
30 min Summer	93.886	0.0	175.6	33			
60 min Summer	60.155	0.0	225.2	60			
120 min Summer	36.094	0.0	270.3	92			
180 min Summer	26.478	0.0	297.5	126			
240 min Summer	21.127	0.0	316.5	160			
360 min Summer	15.217	0.0	342.0	226			
480 min Summer	11.991	0.0	359.4	288			
600 min Summer	9.949	0.0	372.7	350			
720 min Summer	8.533	0.0	383.6	408			
960 min Summer	6.692	0.0	401.1	520			
1440 min Summer	4.760	0.0	428.0	742			
2160 min Summer	3.406	0.0	459.4	1104			
2880 min Summer	2.704	0.0	486.4	1472			
4320 min Summer	1.984	0.0	535.3	2204			
5760 min Summer	1.612	0.0	580.1	2936			
7200 min Summer	1.387	0.0	623.9	3656			
8640 min Summer	1.235	0.0	666.5	4392			
10080 min Summer	1.125	0.0	708.3	5064			
15 min Winter	140.493	0.0	147.1	20			
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4 The Roundal Roddinglaw Road Edinburgh EH12 9DB			402.06594.00008 Middleleaton-on-Sea SWDS_1%AEP +40%				
Date 01/07/2019 File 190731_402_06594_00008_...			Designed by SLR Consulting L... Checked by SLR Consulting Li...				
Micro Drainage			Source Control 2017.1.2				
Summary of Results for 100 year Return Period (+40%)							
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
30 min Winter	8.887	0.217	20.1	1.5	21.6	165.4	O K
60 min Winter	8.922	0.252	20.1	1.5	21.6	192.8	O K
120 min Winter	8.920	0.250	20.1	1.5	21.6	190.6	O K
180 min Winter	8.903	0.233	20.1	1.5	21.6	178.2	O K
240 min Winter	8.882	0.212	20.1	1.5	21.6	162.0	O K
360 min Winter	8.837	0.167	20.1	1.5	21.6	127.4	O K
480 min Winter	8.796	0.126	20.1	1.5	21.6	96.5	O K
600 min Winter	8.764	0.094	20.1	1.1	21.2	72.0	O K
720 min Winter	8.740	0.070	20.1	0.6	20.7	53.5	O K
960 min Winter	8.717	0.047	19.0	0.1	19.1	35.9	O K
1440 min Winter	8.704	0.034	13.8	0.1	13.8	26.1	O K
2160 min Winter	8.695	0.025	9.9	0.1	9.9	18.9	O K
2880 min Winter	8.690	0.020	7.9	0.1	7.9	15.0	O K
4320 min Winter	8.685	0.015	5.9	0.1	5.9	11.1	O K
5760 min Winter	8.682	0.012	4.7	0.1	4.7	9.1	O K
7200 min Winter	8.680	0.010	4.1	0.1	4.1	7.7	O K
8640 min Winter	8.679	0.009	3.7	0.2	3.7	6.9	O K
10080 min Winter	8.678	0.008	3.3	0.2	3.3	6.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
30 min Winter	93.886	0.0	196.8	34			
60 min Winter	60.155	0.0	252.3	60			
120 min Winter	36.094	0.0	302.8	98			
180 min Winter	26.478	0.0	333.2	136			
240 min Winter	21.127	0.0	354.6	174			
360 min Winter	15.217	0.0	383.1	242			
480 min Winter	11.991	0.0	402.5	306			
600 min Winter	9.949	0.0	417.5	364			
720 min Winter	8.533	0.0	429.7	418			
960 min Winter	6.692	0.0	449.3	510			
1440 min Winter	4.760	0.0	479.4	752			
2160 min Winter	3.406	0.0	514.7	1108			
2880 min Winter	2.704	0.0	544.8	1472			
4320 min Winter	1.984	0.0	599.5	2160			
5760 min Winter	1.612	0.0	649.7	2944			
7200 min Winter	1.387	0.0	698.8	3648			
8640 min Winter	1.235	0.0	746.5	4360			
10080 min Winter	1.125	0.0	793.3	4888			
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4 The Roundal Roddinglaw Road Edinburgh EH12 9DB	402.06594.00008 Middleton-on-Sea SWDS_1%AEF +40%	
Date 01/07/2019 File 190731_402_06594_00008_...	Designed by SLR Consulting L... Checked by SLR Consulting Li...	
Micro Drainage Source Control 2017.1.2		

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 497381 100755	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.500

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	0.250	4 8	0.250

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4 The Roundal Roddinglaw Road Edinburgh EH12 9DB	402.06594.00008 Middleleaton-on-Sea SWDS_1% AEP +40%	
Date 01/07/2019 File 190731_402_06594_00008_...	Designed by SLR Consulting L... Checked by SLR Consulting Li...	
Micro Drainage	Source Control 2017.1.2	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 8.670 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.18000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	804.0	804.0	0.331	0.0	804.0
0.330	804.0	804.0	1.330	0.0	804.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCL-0062-1500-0330-1500
Design Head (m) 0.330
Design Flow (l/s) 1.5
Flush-Flo™ Calculated
Objective Minimise blockage risk
Application Surface
Sump Available Yes
Diameter (mm) 62
Invert Level (m) 8.700
Minimum Outlet Pipe Diameter (mm) 75
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.330	1.5
Flush-Flo™	0.088	1.5
Kick-Flo®	0.217	1.2
Mean Flow over Head Range	-	1.2

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	1.5	1.200	2.7	3.000	4.1	7.000	6.2
0.200	1.3	1.400	2.9	3.500	4.4	7.500	6.4
0.300	1.4	1.600	3.1	4.000	4.7	8.000	6.6
0.400	1.6	1.800	3.2	4.500	5.0	8.500	6.9
0.500	1.8	2.000	3.4	5.000	5.2	9.000	7.1
0.600	2.0	2.200	3.5	5.500	5.5	9.500	7.2
0.800	2.2	2.400	3.7	6.000	5.8		
1.000	2.5	2.600	3.8	6.500	6.0		

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4 The Roundal Roddinglaw Road Edinburgh EH12 9DB			402.06594.00008 Middleoton-on-Sea SWDS_3.33%AEF				
Date 01/07/2019 File 190731_402_06594_00008_...			Designed by SLR Consulting L... Checked by SLR Consulting Li...				
Micro Drainage			Source Control 2017.1.2				
<u>Summary of Results for 30 year Return Period</u> Half Drain Time : 42 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	8.749	0.079	20.1	0.8	20.9	60.7	O K
30 min Summer	8.767	0.097	20.1	1.2	21.3	74.1	O K
60 min Summer	8.776	0.106	20.1	1.3	21.4	81.0	O K
120 min Summer	8.773	0.103	20.1	1.3	21.4	79.0	O K
180 min Summer	8.764	0.094	20.1	1.1	21.2	72.0	O K
240 min Summer	8.754	0.084	20.1	0.9	21.0	64.3	O K
360 min Summer	8.736	0.066	20.1	0.5	20.6	50.3	O K
480 min Summer	8.723	0.053	20.1	0.2	20.3	40.4	O K
600 min Summer	8.716	0.046	18.6	0.1	18.7	35.2	O K
720 min Summer	8.711	0.041	16.6	0.1	16.6	31.5	O K
960 min Summer	8.704	0.034	13.8	0.0	13.8	26.1	O K
1440 min Summer	8.696	0.026	10.4	0.0	10.4	19.7	O K
2160 min Summer	8.689	0.019	7.7	0.0	7.7	14.8	O K
2880 min Summer	8.686	0.016	6.3	0.0	6.3	12.0	O K
4320 min Summer	8.682	0.012	4.7	0.0	4.7	9.1	O K
5760 min Summer	8.680	0.010	3.9	0.0	3.9	7.4	O K
7200 min Summer	8.679	0.009	3.5	0.0	3.5	6.5	O K
8640 min Summer	8.678	0.008	3.1	0.3	3.1	5.8	O K
10080 min Summer	8.677	0.007	2.9	0.3	2.9	5.4	O K
15 min Winter	8.760	0.090	20.1	1.1	21.2	68.9	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)		
15 min Summer		80.074	0.0	74.7	18		
30 min Summer		53.043	0.0	99.1	30		
60 min Summer		33.627	0.0	125.7	48		
120 min Summer		20.547	0.0	153.7	82		
180 min Summer		15.177	0.0	170.4	116		
240 min Summer		12.151	0.0	181.9	148		
360 min Summer		8.775	0.0	197.1	208		
480 min Summer		6.927	0.0	207.4	264		
600 min Summer		5.754	0.0	215.4	322		
720 min Summer		4.941	0.0	222.0	384		
960 min Summer		3.880	0.0	232.4	504		
1440 min Summer		2.770	0.0	249.0	744		
2160 min Summer		1.995	0.0	269.0	1108		
2880 min Summer		1.593	0.0	286.3	1472		
4320 min Summer		1.181	0.0	318.5	2204		
5760 min Summer		0.969	0.0	348.5	2936		
7200 min Summer		0.840	0.0	377.8	3656		
8640 min Summer		0.753	0.0	406.3	4304		
10080 min Summer		0.690	0.0	434.3	5128		
15 min Winter		80.074	0.0	83.7	19		
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4 The Roundal Roddinglaw Road Edinburgh EH12 9DB			402.06594.00008 Middleleaton-on-Sea SWDS_3.33%AEP				
Date 01/07/2019 File 190731_402_06594_00008_...			Designed by SLR Consulting L... Checked by SLR Consulting Li...				
Micro Drainage			Source Control 2017.1.2				
Summary of Results for 30 year Return Period							
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
30 min Winter	8.781	0.111	20.1	1.4	21.5	84.8	O K
60 min Winter	8.790	0.120	20.1	1.5	21.6	91.7	O K
120 min Winter	8.783	0.113	20.1	1.4	21.5	86.4	O K
180 min Winter	8.768	0.098	20.1	1.2	21.3	75.1	O K
240 min Winter	8.753	0.083	20.1	0.9	21.0	63.2	O K
360 min Winter	8.727	0.057	20.1	0.3	20.4	43.8	O K
480 min Winter	8.715	0.045	18.2	0.1	18.3	34.7	O K
600 min Winter	8.709	0.039	15.8	0.1	15.8	29.8	O K
720 min Winter	8.704	0.034	13.8	0.1	13.8	26.0	O K
960 min Winter	8.697	0.027	11.0	0.1	11.0	20.9	O K
1440 min Winter	8.690	0.020	7.9	0.1	7.9	15.3	O K
2160 min Winter	8.685	0.015	5.9	0.1	5.9	11.1	O K
2880 min Winter	8.682	0.012	4.7	0.1	4.7	8.8	O K
4320 min Winter	8.679	0.009	3.5	0.1	3.5	6.5	O K
5760 min Winter	8.677	0.007	2.9	0.1	2.9	5.4	O K
7200 min Winter	8.676	0.006	2.5	0.2	2.5	4.6	O K
8640 min Winter	8.676	0.006	2.3	0.2	2.3	4.2	O K
10080 min Winter	8.675	0.005	2.1	0.2	2.1	3.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
30 min Winter	53.043	0.0	111.0	31			
60 min Winter	33.627	0.0	140.9	52			
120 min Winter	20.547	0.0	172.2	88			
180 min Winter	15.177	0.0	190.9	124			
240 min Winter	12.151	0.0	203.8	156			
360 min Winter	8.775	0.0	220.8	214			
480 min Winter	6.927	0.0	232.4	270			
600 min Winter	5.754	0.0	241.3	330			
720 min Winter	4.941	0.0	248.6	388			
960 min Winter	3.880	0.0	260.4	512			
1440 min Winter	2.770	0.0	278.9	756			
2160 min Winter	1.995	0.0	301.2	1124			
2880 min Winter	1.593	0.0	320.7	1448			
4320 min Winter	1.181	0.0	356.8	2136			
5760 min Winter	0.969	0.0	390.3	2856			
7200 min Winter	0.840	0.0	423.1	3632			
8640 min Winter	0.753	0.0	455.1	4256			
10080 min Winter	0.690	0.0	486.5	5104			
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4 The Roundal Roddinglaw Road Edinburgh EH12 9DB	402.06594.00008 Middleton-on-Sea SWDS_3.33%AEP	
Date 01/07/2019 File 190731_402_06594_00008_...	Designed by SLR Consulting L... Checked by SLR Consulting Li...	
Micro Drainage Source Control 2017.1.2		

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 497381 100755	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.500

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	0.250	4 8	0.250

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4 The Roundal Roddinglaw Road Edinburgh EH12 9DB	402.06594.00008 Middleleaton-on-Sea SWDS_3.33%AEP	
Date 01/07/2019 File 190731_402_06594_00008_...	Designed by SLR Consulting L... Checked by SLR Consulting Li...	
Micro Drainage	Source Control 2017.1.2	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 8.670 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.18000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	804.0	804.0	0.331	0.0	804.0
0.330	804.0	804.0	1.330	0.0	804.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCL-0062-1500-0330-1500
Design Head (m) 0.330
Design Flow (l/s) 1.5
Flush-Flo™ Calculated
Objective Minimise blockage risk
Application Surface
Sump Available Yes
Diameter (mm) 62
Invert Level (m) 8.700
Minimum Outlet Pipe Diameter (mm) 75
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.330	1.5
Flush-Flo™	0.088	1.5
Kick-Flo®	0.217	1.2
Mean Flow over Head Range	-	1.2

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	1.5	1.200	2.7	3.000	4.1	7.000	6.2
0.200	1.3	1.400	2.9	3.500	4.4	7.500	6.4
0.300	1.4	1.600	3.1	4.000	4.7	8.000	6.6
0.400	1.6	1.800	3.2	4.500	5.0	8.500	6.9
0.500	1.8	2.000	3.4	5.000	5.2	9.000	7.1
0.600	2.0	2.200	3.5	5.500	5.5	9.500	7.2
0.800	2.2	2.400	3.7	6.000	5.8		
1.000	2.5	2.600	3.8	6.500	6.0		

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4 The Roundal Roddinglaw Road Edinburgh EH12 9DB			402.06594.00008 Middleoton-on-Sea SWDS_50%AEP				
Date 01/07/2019 File 190731_402_06594_00008_...			Designed by SLR Consulting L... Checked by SLR Consulting Li...				
Micro Drainage			Source Control 2017.1.2				
<u>Summary of Results for 2 year Return Period</u> Half Drain Time : 21 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	8.706	0.036	14.4	0.0	14.4	27.5	O K
30 min Summer	8.711	0.041	16.6	0.1	16.6	31.5	O K
60 min Summer	8.713	0.043	17.4	0.1	17.5	33.0	O K
120 min Summer	8.715	0.045	18.2	0.1	18.3	34.5	O K
180 min Summer	8.713	0.043	17.2	0.1	17.3	32.8	O K
240 min Summer	8.710	0.040	16.0	0.0	16.0	30.5	O K
360 min Summer	8.704	0.034	13.8	0.0	13.8	26.3	O K
480 min Summer	8.700	0.030	12.2	0.0	12.2	23.0	O K
600 min Summer	8.697	0.027	10.8	0.0	10.8	20.5	O K
720 min Summer	8.694	0.024	9.7	0.0	9.7	18.5	O K
960 min Summer	8.690	0.020	8.1	0.0	8.1	15.5	O K
1440 min Summer	8.686	0.016	6.3	0.0	6.3	11.9	O K
2160 min Summer	8.682	0.012	4.7	0.0	4.7	9.2	O K
2880 min Summer	8.680	0.010	3.9	0.0	3.9	7.6	O K
4320 min Summer	8.678	0.008	3.1	0.3	3.1	5.8	O K
5760 min Summer	8.677	0.007	2.7	0.3	2.7	5.0	O K
7200 min Summer	8.676	0.006	2.3	0.3	2.3	4.2	O K
8640 min Summer	8.675	0.005	2.1	0.3	2.1	3.9	O K
10080 min Summer	8.675	0.005	2.1	0.3	2.1	3.8	O K
15 min Winter	8.710	0.040	16.2	0.1	16.2	30.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
15 min Summer	37.707	0.0	35.0	17			
30 min Summer	24.545	0.0	45.6	26			
60 min Summer	15.479	0.0	57.7	42			
120 min Summer	10.486	0.0	78.3	76			
180 min Summer	8.098	0.0	90.7	108			
240 min Summer	6.653	0.0	99.4	140			
360 min Summer	4.949	0.0	111.0	202			
480 min Summer	3.970	0.0	118.7	262			
600 min Summer	3.335	0.0	124.7	324			
720 min Summer	2.888	0.0	129.6	382			
960 min Summer	2.301	0.0	137.7	504			
1440 min Summer	1.675	0.0	150.4	742			
2160 min Summer	1.234	0.0	166.1	1108			
2880 min Summer	1.003	0.0	180.1	1472			
4320 min Summer	0.766	0.0	206.3	2200			
5760 min Summer	0.643	0.0	231.1	2928			
7200 min Summer	0.568	0.0	255.1	3672			
8640 min Summer	0.517	0.0	278.6	4264			
10080 min Summer	0.480	0.0	302.0	5072			
15 min Winter	37.707	0.0	39.2	18			
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4 The Roundal Roddinglaw Road Edinburgh EH12 9DB			402.06594.00008 Middleleaton-on-Sea SWDS_50%AEP				
Date 01/07/2019 File 190731_402_06594_00008_...			Designed by SLR Consulting L... Checked by SLR Consulting Li...				
Micro Drainage			Source Control 2017.1.2				
Summary of Results for 2 year Return Period							
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
30 min Winter	8.716	0.046	18.4	0.1	18.5	34.9	O K
60 min Winter	8.717	0.047	18.8	0.1	18.9	35.6	O K
120 min Winter	8.716	0.046	18.6	0.1	18.7	35.3	O K
180 min Winter	8.712	0.042	17.0	0.1	17.1	32.1	O K
240 min Winter	8.708	0.038	15.2	0.1	15.2	28.9	O K
360 min Winter	8.701	0.031	12.6	0.0	12.6	23.7	O K
480 min Winter	8.696	0.026	10.6	0.1	10.6	19.9	O K
600 min Winter	8.693	0.023	9.1	0.1	9.1	17.3	O K
720 min Winter	8.690	0.020	7.9	0.1	7.9	15.3	O K
960 min Winter	8.686	0.016	6.5	0.1	6.5	12.4	O K
1440 min Winter	8.682	0.012	4.9	0.1	4.9	9.2	O K
2160 min Winter	8.679	0.009	3.7	0.1	3.7	6.9	O K
2880 min Winter	8.677	0.007	2.9	0.1	2.9	5.5	O K
4320 min Winter	8.676	0.006	2.3	0.2	2.3	4.2	O K
5760 min Winter	8.675	0.005	1.9	0.2	1.9	3.5	O K
7200 min Winter	8.674	0.004	1.7	0.3	1.7	3.1	O K
8640 min Winter	8.674	0.004	1.5	0.3	1.5	2.9	O K
10080 min Winter	8.674	0.004	1.5	0.1	1.5	2.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
30 min Winter	24.545	0.0	51.2	28			
60 min Winter	15.479	0.0	64.6	46			
120 min Winter	10.486	0.0	87.7	80			
180 min Winter	8.098	0.0	101.7	112			
240 min Winter	6.653	0.0	111.4	144			
360 min Winter	4.949	0.0	124.3	206			
480 min Winter	3.970	0.0	133.0	268			
600 min Winter	3.335	0.0	139.7	328			
720 min Winter	2.888	0.0	145.2	392			
960 min Winter	2.301	0.0	154.2	510			
1440 min Winter	1.675	0.0	168.5	736			
2160 min Winter	1.234	0.0	186.2	1120			
2880 min Winter	1.003	0.0	201.8	1496			
4320 min Winter	0.766	0.0	231.1	2184			
5760 min Winter	0.643	0.0	258.8	2840			
7200 min Winter	0.568	0.0	285.7	3536			
8640 min Winter	0.517	0.0	312.1	4416			
10080 min Winter	0.480	0.0	338.6	5024			
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4 The Roundal Roddinglaw Road Edinburgh EH12 9DB	402.06594.00008 Middleton-on-Sea SWDS_50%AEP	
Date 01/07/2019 File 190731_402_06594_00008_...	Designed by SLR Consulting L... Checked by SLR Consulting Li...	
Micro Drainage Source Control 2017.1.2		

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 497381 100755	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.500

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	0.250	4 8	0.250

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4 The Roundal Roddinglaw Road Edinburgh EH12 9DB	402.06594.00008 Middleleaton-on-Sea SWDS_50%AEP	
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Micro Drainage	Source Control 2017.1.2	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 8.670 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.18000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	804.0	804.0	0.331	0.0	804.0
0.330	804.0	804.0	1.330	0.0	804.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCL-0062-1500-0330-1500
Design Head (m) 0.330
Design Flow (l/s) 1.5
Flush-Flo™ Calculated
Objective Minimise blockage risk
Application Surface
Sump Available Yes
Diameter (mm) 62
Invert Level (m) 8.700
Minimum Outlet Pipe Diameter (mm) 75
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.330	1.5
Flush-Flo™	0.088	1.5
Kick-Flo®	0.217	1.2
Mean Flow over Head Range	-	1.2

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	1.5	1.200	2.7	3.000	4.1	7.000	6.2
0.200	1.3	1.400	2.9	3.500	4.4	7.500	6.4
0.300	1.4	1.600	3.1	4.000	4.7	8.000	6.6
0.400	1.6	1.800	3.2	4.500	5.0	8.500	6.9
0.500	1.8	2.000	3.4	5.000	5.2	9.000	7.1
0.600	2.0	2.200	3.5	5.500	5.5	9.500	7.2
0.800	2.2	2.400	3.7	6.000	5.8		
1.000	2.5	2.600	3.8	6.500	6.0		

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UK Design Flood Estimation

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Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details

Checksum: 5A80-0F8B

Site name: FEH_Point_Descriptors_497381_100755

Easting: 497381

Northing: 100755

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.01

Using plot scale calculations: Yes

Site description: None

Model run: 2 year

Summary of results

Rainfall - FEH 2013 (mm):	17.24	Total runoff (ML):	0.02
Total Rainfall (mm):	10.49	Total flow (ML):	0.04
		Peak flow (m ³ /s):	0.00
Peak Rainfall (mm):	1.59	Peak flow (l/s):	2.50

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

* Indicates that the user locked the duration/timestep

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	01:42:00	No
Timestep (hh:mm:ss)	00:06:00	No
SCF (Seasonal correction factor)	0.61	No
ARF (Areal reduction factor)	0.99	No
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	87.46	No
Cmax (mm)	586.09	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	1	No
Up	0.65	No

Uk	0.8	No
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Baseflow model parameters

Name	Value	User-defined?
BF0 (m ³ /s)	0	No
BL (hr)	34.11	No
BR	1.64	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km ²)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km ²)	0.00	Yes
Sewer capacity (m ³ /s)	0.00	Yes

APPENDIX 01

Topographic Survey

APPENDIX 02

Details of Intrusive Ground Works

APPENDIX 03

Southern Water Asset Plan

APPENDIX 04

Details of the Proposed Development

Strategic Flood Risk Assessment Appendices F & H

APPENDIX 06

Preliminary Drainage Design

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United Kingdom



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