

# LAND WEST OF YAPTON ROAD MIDDLETON-ON-SEA, WEST SUSSEX

**Drainage Strategy**

**Proposed Residential Scheme**

PREPARED FOR: FRONTIER ESTATES LIMITED

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## EXECUTIVE SUMMARY

SLR Consulting Ltd has prepared this Surface Water Drainage Strategy (SWDS) on behalf of Frontier Estates Limited to support the Planning Application for the erection of 13 dwellings with associated car parking and landscaping in land off Silver Birch Way, Middleton-on-Sea PO22 6SE (Application Site). A summary of the SWDS key findings are provided below.

| Subject               | Element                           | Findings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Planning Requirements | Discharge of Planning Conditions  | The Arun District Council planning application reference for the development is M/45/16/PL. An initial Drainage Strategy was submitted by 'The Civil Engineering Practice' in January 2016. Arun District Council approved the planning application subject to conditions addressed within this report.                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Surface Water         | Water Quantity Design Standard    | The design storm event is the 1% AEP event. A climate change allowance has been considered for peak rainfall intensity (40%) at the development site with no anticipated adverse impact.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                       | Proposed discharge arrangement    | Groundwater monitoring conducted over the winter of 2019/2020 shows that ground water levels will not allow for a 1m layer of unsaturated soil between maximum ground water levels and the base of any possible infiltration features. Infiltration to ground will therefore not be a suitable form of surface water discharge and consequently outfall to the existing ditch is deemed the most appropriate form of surface water disposal.                                                                                                                                                                                                                                                                                                       |
|                       | Peak allowable discharge to ditch | The peak discharge rate will be restricted to the greenfield runoff rate of the Site, which is estimated to be 1.06l/s.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                       | Surface water drainage strategy   | The concept Surface Water Drainage Strategy has been developed including: <ul style="list-style-type: none"> <li>Filter drains – Improve water quality from roofs and convey water to the central proprietary crate storage</li> <li>Swales - Improve water quality from access roads and convey water to the central proprietary crate storage</li> <li>Proprietary Crate Storage – Attenuate the runoff. The existing trees will be retained with appropriate tree root protection zones. A hydrobrake will be utilised at the point of discharge to restrict outflow to the ditch to greenfield runoff rates.</li> </ul> The existing ditch within the southern boundary will be cleared and restored to enable it to convey water effectively. |
|                       | Residual Risk                     | The drainage strategy has been designed to accommodate flows in excess of the Design Storm Event with the effects of climate change.<br>Exceedance flood events in excess of the design standard have also been considered with events greater than this will revert to the pre-existing runoff regime with flow to the existing ditch.<br>Due to the topography of the northern part of the site excess runoff could flow eastwards to Yapton road. The construction of a low bund is suggested along the perimeter with Yapton Road to capture flows and divert them south towards the ditch within the southern boundary of the Site.                                                                                                           |
| Foul Water            |                                   | Foul flows of up to 0.16l/s will be allowed to discharge to a 300mmØ Southern Water foul sewer adjacent to the site boundary.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Conclusion            |                                   | This SWDS presented in this report has addressed the surface and foul water conditions outlined by Arun District Council regarding planning application M/45/16/PL.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## 1.0 INTRODUCTION

### 1.1 Terms of Reference

SLR Consulting Limited (SLR) was appointed by Frontier Estates Limited (FEL) to prepare a Surface Water Drainage Strategy (SWDS) to discharge four of the 26 conditions related to the management of surface water runoff arising from the proposed development. The planning application (ref. M/45/16/PL) is for the erection of 13 dwellings with associated car parking and landscaping in land off Silver Birch Way, Middleton-on-Sea 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



## 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 Arun District Council and West Sussex County Council administrative area.

The Site is bound to the east by Yapton Road from which the Site can be accessed. Access to the Site is also available off a track along the southern boundary of the Site, beyond which are residential properties. Arable fields form the northern and western boundaries of the Site.

The Site is occupied by a series of sheds and a dwelling, some of which have been partially demolished or in varying state of disrepair. Several chicken coops are also present, mostly within the eastern part of the Site. The remaining Site is scrub land.

There is a ditch along the southern boundary of the site, which flows in a westerly direction through the Site.

### 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 south 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 maps<sup>1</sup> 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*.

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.

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 mapping<sup>2</sup> 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

Review of the online MAGIC mapping<sup>2</sup> indicates that the superficial geology is designated as a Secondary A aquifer which is defined as:

*'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'.*

<sup>1</sup> BGS Website (Accessed on 28<sup>th</sup> March 2020) <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

<sup>2</sup> Defra online interactive maps (Accessed on 28<sup>th</sup> March 2020) <http://magic.defra.gov.uk/MagicMap.aspx>

The underlying chalk aquifer is designated as a Principal aquifer comprising 'layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major 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.

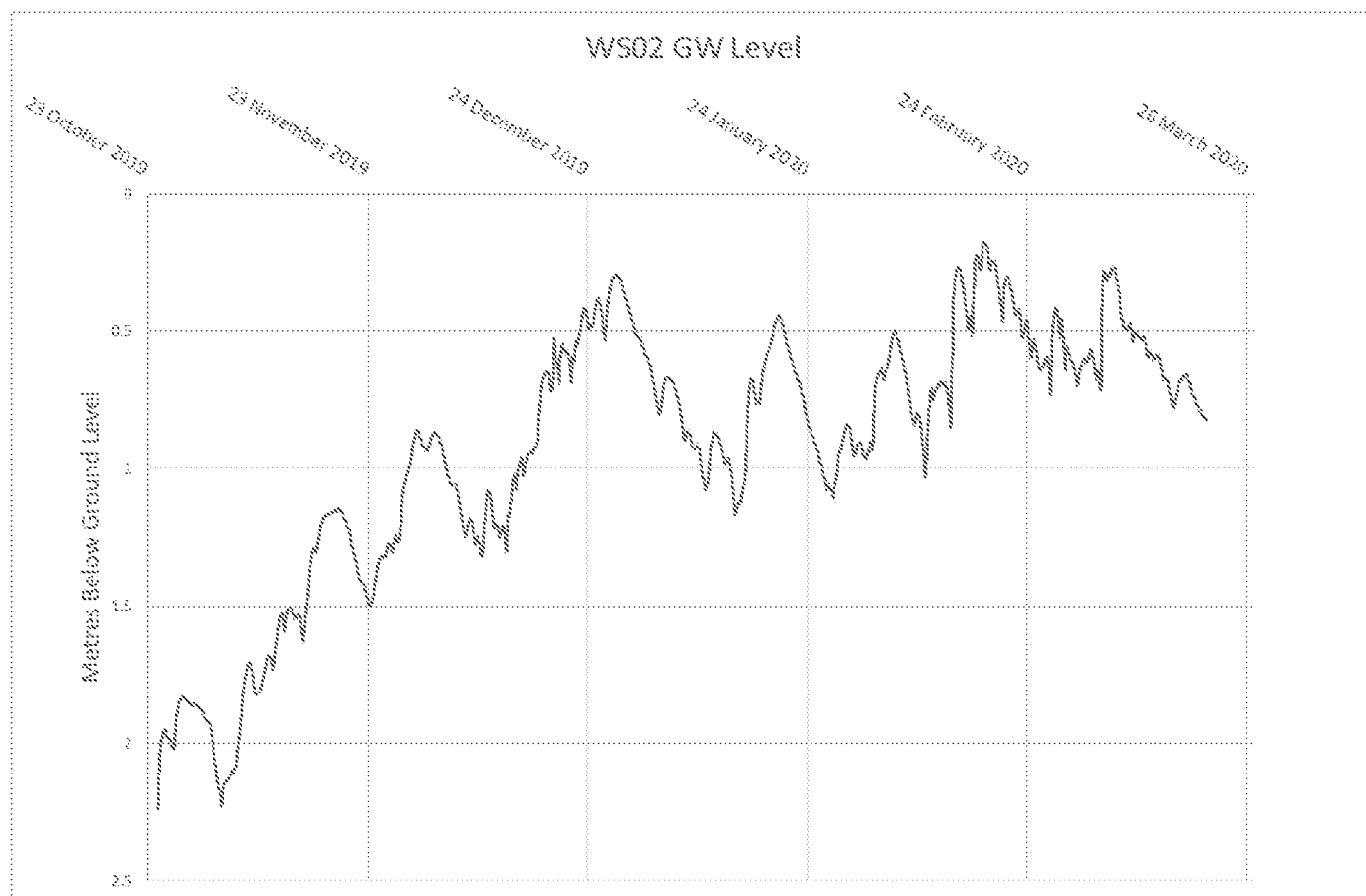
Groundwater monitoring was carried out on 7<sup>th</sup> March 2019 and recorded water in three window sampler boreholes as summarised within Table 2-1.

Table 2-1  
Groundwater Monitoring

| Borehole | Depth to water<br>(m bgl) | Water level<br>(m AOD) |
|----------|---------------------------|------------------------|
| WS01     | 1.545                     | 3.25                   |
| WS02     | 1.853                     | 3.16                   |
| WS03     | 1.530                     | 3.28                   |

Continuous monitoring was also completed throughout the winter of 2019/2020 to determine the peak ground water level at the Site. The results, shown below in Figure 2-1, indicate that the peak water level over this winter period was 0.18m bgl.

Figure 2-1  
Groundwater Monitoring Results



## 2.4 Hydrological Context

### 2.4.1 Local Hydrology

As discussed at Section 2.1, there is a ditch along the southern boundary of the Site, adjacent to the access track. This unnamed ditch flows west to connect to the nearest watercourse marked on OS mapping, Pigeonhouse Stream (minor watercourse), 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 (major watercourse) located c.800m north of the site that discharges to the River Arun.

### 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 present in the vicinity of the Site. A copy of the Southern Water asset plan is enclosed at Appendix 03.

With reference to the above plan, there is a surface water sewer within Silver Birch Drive which is presumed to serve the residential properties to the south of the Site.

There is also a foul water sewer within Yapton Road. A rising foul water extends beneath the eastern part of the access track and discharges into a foul water gravity sewer beneath the rest of the access track.

All building on site currently shed water to ground.

## 3.0 DEVELOPMENT PROPOSAL

### 3.1 Proposed Development Description

It is proposed to demolish the redundant poultry farm buildings and dwellings and erect 13 residential houses with associated access, car parking and 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)<sup>3</sup> and best practice guidance (BS8533), a 100 years lifetime of development should be applied to this residential development.

### 3.3 Planning Context

The Arun District Council planning application reference for the development is **M/45/16/PL**. An initial Drainage Strategy was submitted by 'The Civil Engineering Practice' in January 2016. Arun District Council approved the planning application subject to conditions. The full Decision notice is included in Appendix 05 while the conditions pertinent to this report are included below:

10. *The construction of the development shall not commence until full details of the proposed foul water drainage scheme have been submitted to and approved in writing by the Local Planning Authority (in consultation with Southern Water).*

*No Building shall be occupied until the foul water drainage scheme has been implemented in accordance with the approved details and the details so approved shall be retained in good working order in perpetuity.*

*Reason: To ensure that the proposed development is satisfactorily drained in accordance with policies GEN7 and GEN9 of the Arun District Council Local Plan. It is considered necessary for this to be a pre-commencement condition because it would not be possible to implement a surface drainage scheme once development had commenced.*

11. *No construction works shall commence until full details of the proposed surface water drainage scheme have been submitted to and approved in writing by the Local Planning Authority.*

*The design should follow the hierarchy of preference for different types of surface water drainage disposal systems as set out in the Approved Document H of the Building Regulation, the recommendations of the SuDS Manual produced by CIRIA.*

*Winter groundwater monitoring to establish highest annual ground water levels and Percolation testing to BRE 365m, or similar approved, will be required to support the design of any infiltration drainage.*

*Reason: To ensure that the proposed development is satisfactorily drained in accordance with the policies GEN7 and GEN9 of the Arun District Council Local Plan. It is considered necessary for this to be a pre-commencement condition because it would not be possible to implement a surface drainage scheme once development had commenced.*

13. *Construction work shall not proceed until formal consent has been approved in writing from the lead local flood authority (WSCC) or its agent (ADC) for the discharge of any flows to watercourses, or the culverting, diversion, infilling or obstruction of any water course on the site.*  
*Any discharge to a water course must be at a rate no greater than pre-development run off values.*

*Reason: To ensure that the proposed development is satisfactorily drained in accordance with policies GEN7 and GEN9 of the Arun District Council local plan. It is considered necessary for this to be a pre-commencement condition because it would not be possible to implement a surface drainage scheme once development had commenced.*

14. *Construction works shall not commence until full details of the maintenance and management of the SuDS system is set out in a site-specific maintenance manual and submitted to, and approved in writing by the Local Planning Authority. The manual is to*

<sup>3</sup> Planning Practice Guidance to the National Planning Policy Framework : Department for Communities and Local Government (February 2019)

include (a) details of financial management of the site including arrangements made in the event that the management company (or any subsequent management company) is no longer able to fulfil its duties; and (b) arrangements for the replacement of major components at the end of the manufacturers recommended design life.

*Reason: To ensure the efficient maintenance and on-going operation of the SuDS system and to ensure the best practice in the line with guidance set out in 'The SuDS Manual' CIRIA publication ref: C753 Chapter 32. It is considered necessary for this to be a pre-commencement condition because it would not be possible to implement a surface drainage scheme once development had commenced.*

### 3.3.1 National Planning Policy

This SWDS report has been completed in accordance with the guidance presented in the National Planning Policy Framework (NPPF) and with reference to the PPG for the incorporation of sustainable drainage systems<sup>4</sup>.

### 3.3.2 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 notes<sup>5</sup> 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.

### 3.3.3 Local Planning Policy

The Site is located within West Sussex County Council, where development is guided by their Core Strategy<sup>6</sup> for development and planning policies. In relation to management of surface water resulting from the proposed development, 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.*
- 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*

<sup>4</sup> Planning Practice Guidance to the National Planning Policy Framework : Department for Communities and Local Government (February 2019)

<sup>5</sup> Non-statutory technical standards for Sustainable Drainage, LASOO, 2016

<sup>6</sup> Arun District Council Core Strategy, Adopted 11<sup>th</sup> July 2016

*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 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.'*

### **3.3.4 Adopted Arun Local Plan 2018**

The Arun Local Plan<sup>7</sup> aims to provide guidelines for future development in the local area. Section 18 which covers Sustainable Drainage systems is included for reference below:

**'18.4.1** - The primary purpose of Sustainable Drainage Systems (SUDS) is to minimise the impact of urban development on the water environment, reduce flood risk and provide habitats for wildlife. A resultant effect can be an increase in flows into groundwater and pollution of aquifers. There are many different SUDS features available to suit the constraints of a site. These features include green roofs, more nature features such as ponds, wetlands and shallow ditches called swales. Hard engineered elements are often used in high density, commercial and industrial developments. These include permeable paving, canals, treatment channels, attenuation storage and soakaways. Opportunities for incorporating a range of SUDS must be taken wherever possible. The discharge of surface water to soakaways or other infiltration devices must be considered first, before alternative methods are investigated.

**18.4.2** - SUDS should be designed into the landscape of all new development and should be included as part of a District wide approach to improve water quality and provide flood mitigation. SUDS should also be identified as part of a Green Infrastructure network to improve the landscape quality, recreation and biodiversity offered in Arun.'

### **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 incorporate a range of Sustainable Urban Drainage Systems (SUDS), appropriate to the size of development, at an early stage of the design process.*

*Proposals for both major and minor development proposals must incorporate SUDS within the private areas of the development in order to provide source control features to the overall SUDS design. These features include:*

- ✧ Green roofs
- ✧ Permeable driveways and parking

<sup>7</sup> Adoption Arun Local Plan 2011-2031, Arun District Council, July 2018  
(Accessed 28<sup>th</sup> March 2019 <https://www.arun.gov.uk/download.cfm?doc=docm93jjim4n12844.pdf&ver=12984>)

- » *Soakaways Water harvesting and storage features including water butts.*

*Proposals for major development must also integrate SUDS within public open spaces and roads, reflecting discussion with the appropriate bodies. SUDS must therefore be integrated into the overall design of a development and must:*

- a) Contribute positively to the appearance of the area, integrating access to allow maintenance of existing watercourses and the system.*
- b) Effectively manage water (including its quality)*
- c) Accommodate and enhance biodiversity by making connections to existing Green Infrastructure assets and*
- d) Provide amenity for local residents (ensuring a safe environment)*
- e) Retain the existing drainage network of the site and the wider area,*
- f) Be maintained in perpetuity, supported through a Maintenance and Management Plan/Regime, including its financing, agreed with the Local Planning Authority.*

*In order to ensure that SUDS discharge water from the development at the same or lesser rate, as prior to construction, developers must:*

- f) Follow the hierarchy of preference for different types of surface water drainage disposal systems as set out in Approved Document H of the Building Regulations and the SUDS manual produced by CIRIA.*
- g) Undertake up to six months groundwater monitoring within the winter period.*
- h) Undertake winter percolation testing in accordance with BRE365.*
- i) The proposed drainage system must be designed to ensure that there is no flooding on a 1 in 30 year storm event [3.3% Annual Exceedance Probability (AEP) event].*
- j) The design must also take account of the 1 in 100 year storm event [1% AEP event] plus 30% allowance for climate change, on stored volumes, to ensure that there is no flooding of properties or the public highway or inundation of the foul sewerage system. Any excess flows must be contained within the site boundary, and within designated storage areas.'*

## 4.0 CLIMATE CHANGE

### 4.1 Peak Rainfall Intensity Allowance

The most recent advice on climate change is provided by the Environment Agency<sup>8</sup>. An extract of *Table 2 peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)* is reproduced as Table 4-1.

Table 4-1  
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. Despite the Arun Local Plan mention of 30% allowance for climate change, the more conservative approach of 40% allowance will be included in this report.

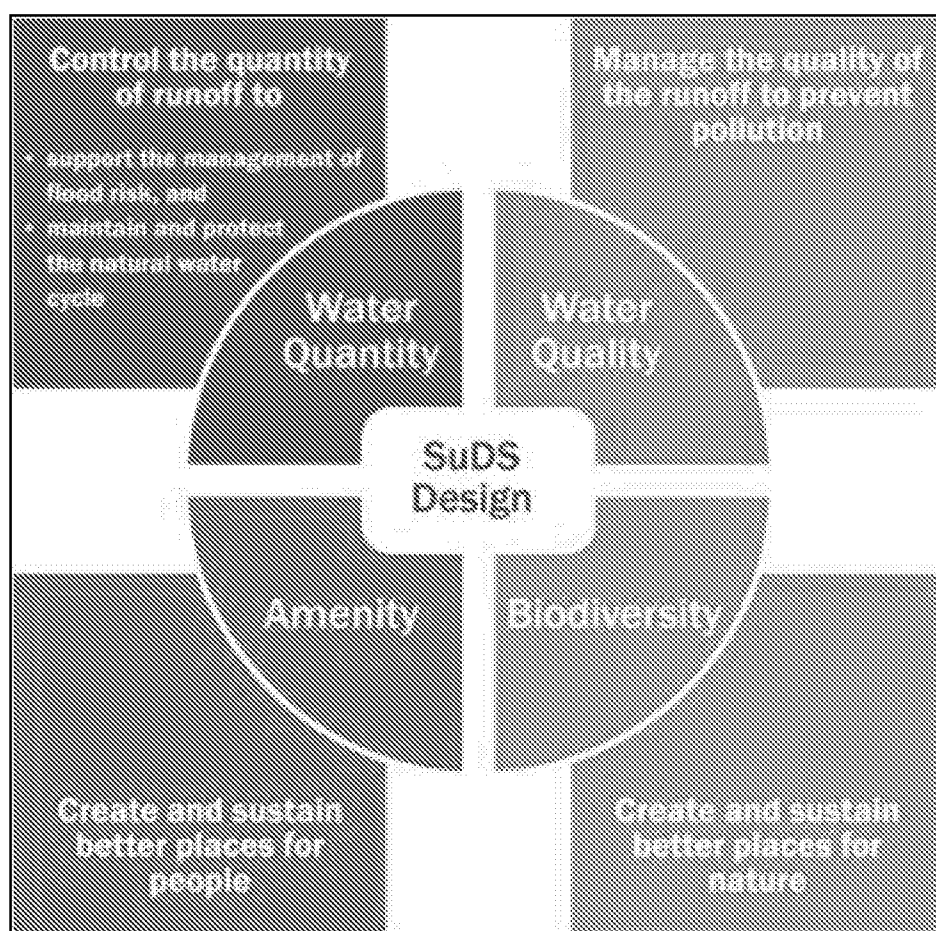
<sup>8</sup> Environment Agency, February 2016. Flood risk assessments: climate change allowances (Accessed 28<sup>th</sup> March 2019 at <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>)

## 5.0 SURFACE WATER DRAINAGE STRATEGY

### 5.1 Sustainable Drainage Systems

Current best practice guidance document, The SuDS Manual (CIRIA Report C753)<sup>9</sup>, 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 5-1.

Figure 5-1  
Four Pillars of SuDS (after CIRIA Report C753)

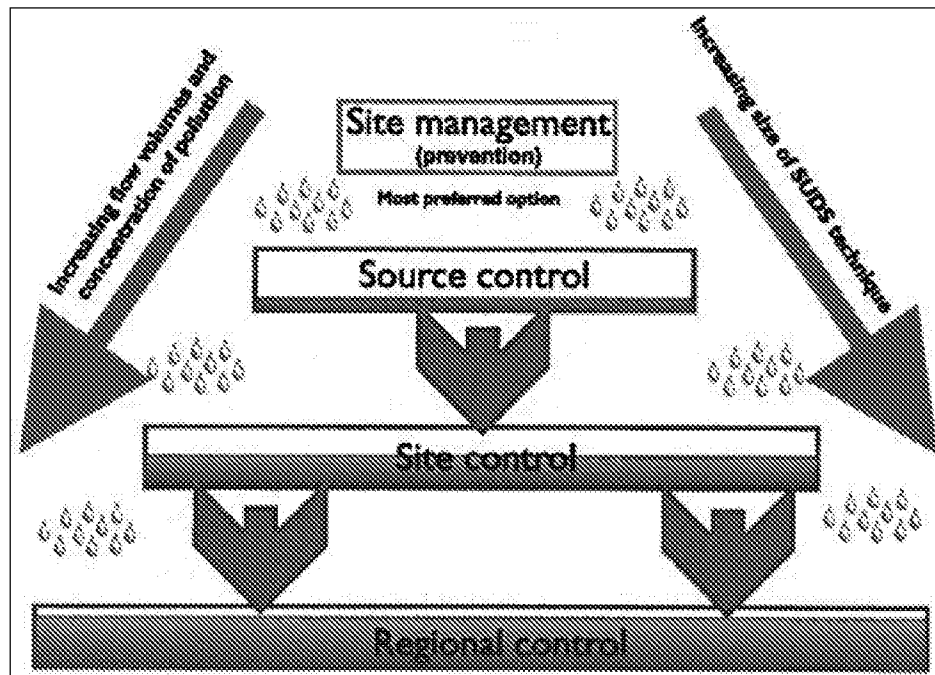


The SuDS Manual identifies a hierarchy of SuDS for managing runoff, which is commonly referred to as a ‘management train’ and is depicted in Figure 5-2:

- ✦ **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.

<sup>9</sup> CIRIA (2015). Report C753, The SuDS Manual

Figure 5-2  
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) through policies and guidance as set out at Section 3.3.3.

## 5.2 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 5-1 summarises the suitability of disposal methods suitability in the context of the Site and the proposed development.

**Table 5-1**  
**Suitability of Surface Water Disposal Methods**

| Surface Water Disposal Method (in Order of Preference) | Suitability Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Method Suitable? (Y / N) |
|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Infiltration to Ground                                 | With reference to Section 2.3.2, the 2019/2020 winter monitoring found that ground water levels in borehole WS02 peaked at 0.18m bgl. Section 4.3.2 of The SuDS Manual states:<br><i>'There should be a minimum depth of 1m of unsaturated aquifer material between the base of any infiltration system and the maximum likely groundwater level (taking account of potential shifts in groundwater level resulting from extended periods of wet weather).'</i><br>As the highest groundwater level was recorded at 0.18m bgl and the protect the underlying Lewes Nodular Chalk Formation from pollution, it is proposed that infiltration to ground be discounted. | N                        |
| Discharge to Surface Waters                            | As discussed at Section 2.4.1, there is a surface water ditch within the southern part of the Site, adjacent to the access track. A suitably restricted connection into this watercourse is deemed viable.                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Y                        |
| Discharge to Sewer                                     | As discussed at Section 2.4.2, there is a surface water sewer serving the residential properties to the south of the Site. However, as a connection into an existing ditch can be provided, in line with the SuDS hierarchy, a connection to the public surface water sewer has been discounted.                                                                                                                                                                                                                                                                                                                                                                     | N                        |

### 5.3 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 5-2.

**Table 5-2**  
**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. | <ul style="list-style-type: none"> <li>Filter drains</li> </ul>                 |
| Conveyance                      | To convey surface water runoff from 'Source Control' mechanisms to 'Site Control'.                                                        | <ul style="list-style-type: none"> <li>Filter drains</li> <li>Swales</li> </ul> |
| Site Control                    | Provides the required surface water attenuation / storage prior to controlled discharge to the water environment.                         | <ul style="list-style-type: none"> <li>Proprietary Crate Storage</li> </ul>     |

'Source Control', 'Conveyance' and 'Site Control', in the form of filter drains, swales and proprietary crate storage, are considered to be viable and beneficial options (in terms of water quality enhancements) and have been integrated into this SWDS.

As discussed within Table 5-1, the SWDS has been developed based on no infiltration to ground.

Runoff from the roof of the proposed residential dwellings will be conveyed to a network of filter drains via a downpipes with shallow underground pipe networks taking flow to the proprietary crate storage. Runoff from

the driveways, footpaths and access roads will pass to the swale that will flow to the downstream end and enter the proprietary crate storage as shown on Drawing No. SWDS 01. The proprietary crate storage will provide the required attenuation of surface water runoff on the site. Note that the root protection zones to the retained trees will be respected. Typical proprietary crate storage, swale and filter drain details are provided by Figure 5-3 and Figure 5-4 respectively.

It should be noted that the filter drains and proprietary crate storage will be lined to prevent infiltration to ground, thereby protecting the underlying soils from potential contamination when groundwater levels rise to less than 1m bgl.

Figure 5-3  
Proprietary crate storage: Conceptual Design Details

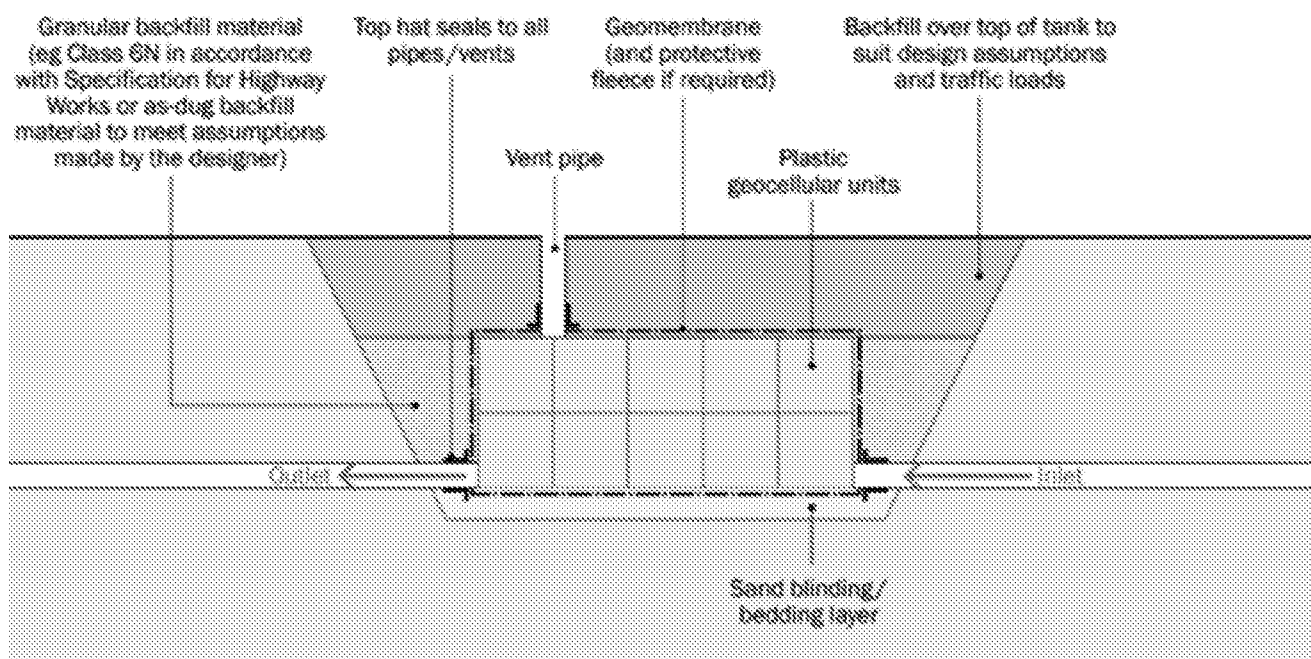


Figure 5-4  
Filter Drain: Conceptual Design Details

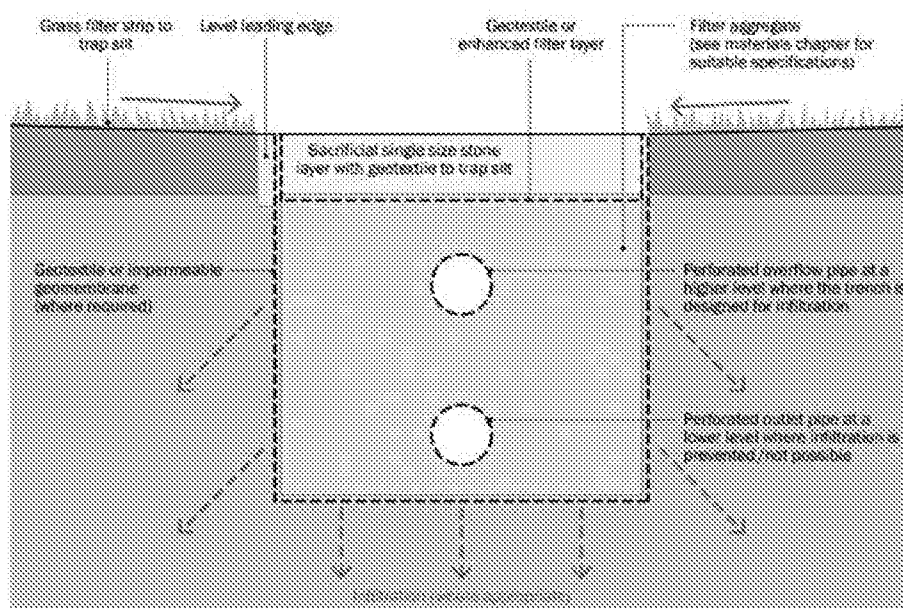
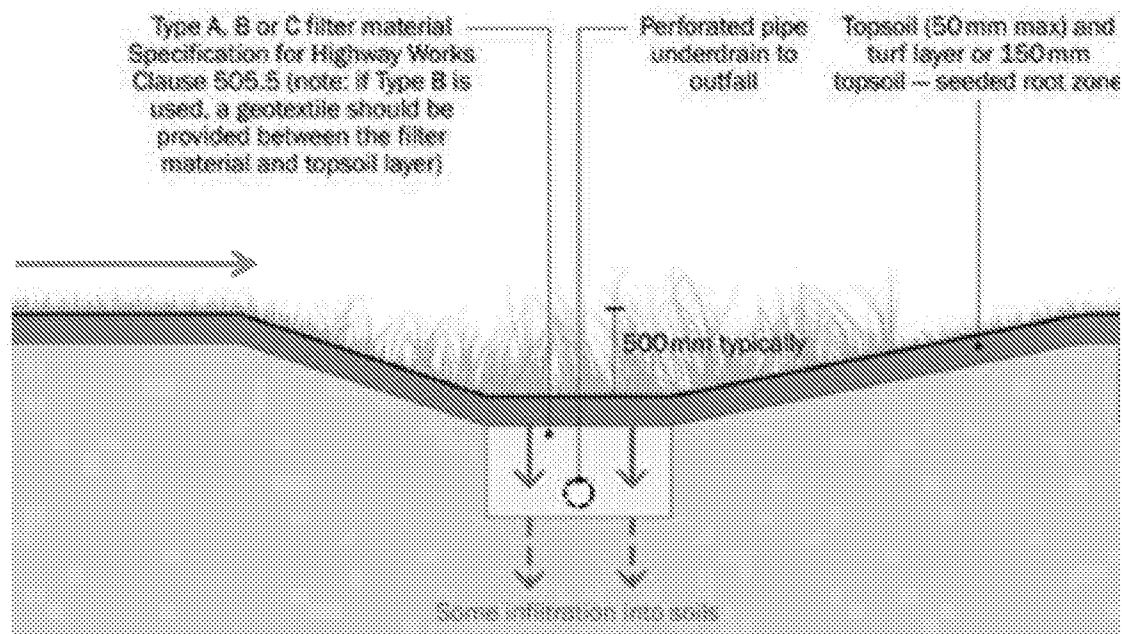


Figure 5-5  
Swale: Conceptual Design



Indicative locations of the filter drains, swales and proprietary crate storage serving the proposed development are shown by Drawing No. SWDS 01.

## 5.4 Contributing Area

### 5.4.1 Proposed Impermeable Area

The proposed development will render 0.24ha of the Site impermeable which will contribute to surface water runoff including roof areas, driveways, footpaths and access road as shown on Drawing No SWDS 01.

### 5.4.2 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 gardens will not drain to the central proprietary crate storage.

However, a fraction of the incident rainfall across the grassed/planted areas will infiltrate through the topsoil 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 126<sup>10</sup>, 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 0.05ha will contribute to surface water runoff.

<sup>10</sup> Institute of Hydrology, November 1995. Report 126 Hydrology for soil types: a hydrologically-based classification of the soil of the United Kingdom

## 5.5 Water Quantity Design Standard

As discussed within Table 5-1, infiltration methods have been deemed unreliable due to the high ground water levels discovered during winter monitoring. Therefore, discharge will be 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.

### 5.5.1 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 5.4, the total area of the proposed development contributing to surface water runoff is 0.30ha. A 5mm depth of rainfall over this area will result in 14.79m<sup>3</sup> of surface water runoff.

It is proposed that this Interception volume is provided within the bottom 35mm of the proprietary crate storage. To prevent the Interception volume from discharging to the existing ditch, the outflow control will be set a minimum of 35mm above the invert level of the proprietary crate storage.

#### 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'*.

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. 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 Handbook<sup>11</sup> (FEH) Web Service were used in the ReFH2 analysis.

Table 5-3  
Greenfield Runoff Rate Estimate

| AEP (%) | Estimated Greenfield Runoff Rate |                         |
|---------|----------------------------------|-------------------------|
|         | l/s/ha                           | l/s/0.36ha <sup>1</sup> |
| 50      | 2.94                             | 1.06                    |

Note: <sup>1</sup> As discussed at above, the entire Site (impermeable and permeable areas) drain to the network. As such, the total Site area of 0.36ha has been used to estimate the greenfield runoff rate.

As the QBAR peak runoff rate of 1.06l/s for Site is greater than 2.00l/s/ha (or 0.72l/s for the entire Site), this has been adopted in the design of the SWDS.

### 5.5.2 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 5-1.

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 0.36ha, 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 5-4  
Existing Maximum Discharge to the Ditch

| AEP (%) | Minimum Existing Discharge Rate |                         |
|---------|---------------------------------|-------------------------|
|         | l/s/ha                          | l/s/0.36ha <sup>1</sup> |
| 50      | 1.06                            | 2.93                    |
| 3.33    | 6.98                            | 2.51                    |
| 1       | 9.04                            | 3.26                    |

Note: <sup>1</sup> For an area of 0.36ha.

<sup>11</sup> Centre for Ecology and Hydrology (CEH), 2017. Flood Estimation Handbook Web Service (Accessed on 28<sup>th</sup> March 2020) <https://fehweb.ceh.ac.uk/GB/map>

As discussed at Section 5.5.1, 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 1.06l/s for a range of AEP rainfall events up to and 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 not considered significant 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 5.5.1, 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 1.06l/s.

## 5.6 Water Quality Design Standard

With reference to The SuDS Manual, post development surface water runoff generated from residential roofs, individual property driveways and residential low traffic roads are considered to have a *'Low' Pollution Hazard Level* as set out within Table 5-5. 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 5-5  
Pollution Hazard Potential for Proposed Development

| Land Use                      | Pollution Hazard Level | Pollution Hazard Indices     |        |               |
|-------------------------------|------------------------|------------------------------|--------|---------------|
|                               |                        | Total Suspended Solids (TSS) | Metals | Hydro-Carbons |
| Residential roofs             | Low                    | 0.2                          | 0.2    | 0.05          |
| Individual property driveways |                        | 0.5                          | 0.4    | 0.4           |
| Low traffic roads             |                        |                              |        |               |

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

As discussed at Table 5-1, it is proposed to discharge surface water runoff resulting from the proposed development to the existing ditch. The *SuDS Mitigation Indices*, provided by the proposed *'Source Control'*, *'Conveyance'* and *'Site Control'* measures for discharge to surface waters, against the *Pollution Hazard Indices*.

Table 5-6  
SuDS Performance: Water Quality Indices Assessment

| Land Use                                   | Pollution Hazard Level | Pollution Hazard and SuDS Mitigation Indices Comparison |                                    |                 |                                    |                 |                                    |
|--------------------------------------------|------------------------|---------------------------------------------------------|------------------------------------|-----------------|------------------------------------|-----------------|------------------------------------|
|                                            |                        | Total Suspended Solids (TSS)                            |                                    | Metals          |                                    | Hydro-Carbons   |                                    |
|                                            |                        | Pollution Index                                         | SuDS Mitigation Index <sup>1</sup> | Pollution Index | SuDS Mitigation Index <sup>1</sup> | Pollution Index | SuDS Mitigation Index <sup>2</sup> |
| Residential roofs <sup>2</sup>             | Low                    | 0.2                                                     | 0.4                                | 0.2             | 0.4                                | 0.05            | 0.4                                |
| Individual property driveways <sup>3</sup> |                        | 0.5                                                     | 0.5                                | 0.4             | 0.6                                | 0.4             | 0.6                                |
| Low traffic roads <sup>3</sup>             |                        |                                                         |                                    |                 |                                    |                 |                                    |

Notes: <sup>1</sup> Indicative SuDS mitigation indices for discharges into surface waters.

<sup>2</sup> Filter drains SuDS Mitigation Indices used for the collection of residential roof runoff.

<sup>3</sup> Swale SuDS Mitigation Indices used for the collection of low traffic roads and property driveways.

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

## 5.7 Attenuation Volume Estimate

Based on a total contributing area of 0.42ha, 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 5-7  
Drainage Performance and Sizing

| AEP (%)   | Maximum Allowable Discharge to the Existing Ditch (l/s) <sup>1</sup> | Maximum Proposed Discharge to the Existing Ditch (l/s) | Maximum Volume (m <sup>3</sup> ) | Max Water Depth (m) | Freshboard (m) |
|-----------|----------------------------------------------------------------------|--------------------------------------------------------|----------------------------------|---------------------|----------------|
| 50        | 1.06                                                                 | 1.1                                                    | 60.7                             | 0.124               | 0.376          |
| 3.3       |                                                                      | 1.1                                                    | 116.7                            | 0.226               | 0.274          |
| 1<br>+40% |                                                                      | 1.1                                                    | 211.5                            | 0.392               | 0.108          |

The proposed proprietary crate storage, located as shown on Drawing No. SWDS 01, will provide a maximum storage of approximately **300m<sup>3</sup>** over an area of approximately 450m<sup>2</sup> and a depth of 0.66m. The proprietary crate storage will have an outlet into the existing ditch that will be controlled by a hydro brake.

With reference to the National Standards for sustainable drainage system<sup>12</sup> 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. It should be noted that a conservative approach has been taken by not including the filter drains and pervious pavement in the design storm duration volume calculations. The inclusion of these the attenuation features would lead to a substantial decrease in the maximum level and volume in the proprietary crate storage for each of the design storm events.

## 5.8 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 will follow the pre-existing exceedance routes as shown on Drawing SWDS 01. The topography of the Site means that all flows excess flows will head south towards the southern boundary drainage ditch apart from the gardens in the north of the Site, where the fall is predominantly to the east. To prevent excess flow onto Yapton road, the construction of a low bund is suggested along the perimeter with Yapton Road to capture flows and divert them south towards the ditch within the southern boundary of the Site.

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<sup>12</sup> Defra, December 2011. National Standards for sustainable drainage systems - Designing, constructing, operating and maintaining drainage for surface runoff

## 6.0 OPERATION AND MAINTENANCE PLAN

### 6.1 SuDS Maintenance Responsibilities

Client-employed maintenance teams will manage and maintain the long-term integrity and function of the proposed surface water drainage SuDS facilities that will fall under private ownership.

### 6.2 Maintenance Access

The proposed development layout provides adequate maintenance access to all surface water drainage and SuDS features (for details refer to Drawing SWDS1).

The swales and proprietary crate system are all located within or adjacent to the on-site road network and parking bays, with the filter drains requiring residential house notification. Maintenance access to these features will be readily available from the road network and parking bays for maintenance vehicles and maintenance operatives.

The main swale is located along the main on-site road network and maintenance access to the swale will be readily available from the road network with parking bays for maintenance vehicles and maintenance operatives. The proprietary crate system and discharge channel are accessible from the main access route for maintenance access.

Maintenance access to the underground piped systems linking the various SuDS features will be readily available from the access road and parking areas for maintenance operatives. Access for maintenance vehicles, jetting units, etc. will be available.

### 6.3 Maintenance Schedules

The following sub-sections provide recommended maintenance schedules and management plans for the various components of the surface water drainage system.

The anticipated lifetime of the SuDS facilities, their frequency of replacement, and methods for their replacement are largely dictated by the choice of installation, manufacturer, and the quality of the workmanship during construction. Where necessary, these maintenance and management schedules will be refined by the Applicant once the site is operational to suit the specific site conditions.

#### 6.3.1 Filter Drains

A recommended operation and maintenance plan for filter drains is summarised in Table 6-1.

Table 6-1  
Typical Filter Drain Operation and Maintenance Requirements

| Maintenance 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              |

| Maintenance Schedule   | Required Action                                                                                                                                  | Minimum Frequency           |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
|                        | 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                 |

### 6.3.2 Proprietary Crate Storage

A recommended operation and maintenance plan for the proprietary crate storage is summarised in Table 6-2.

Table 6-2  
 Typical Proprietary Crate Storage 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        |

### 6.3.3 Swales

The proposed drainage scheme will utilise a swale as a mechanism for treatment and attenuation of surface water runoff. The anticipated maintenance and management for swales associated with the surface water drainage system is outlined in Table 6-3.

Table 6-3  
Typical Swale Maintenance Requirements

| Maintenance Schedule   | Required Action                                                                                                                         | Minimum Frequency                                                                    |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Regular Inspections    | Remove Litter and Debris.                                                                                                               | Monthly, or as required.                                                             |
|                        | Cut grass – to retain grass height within specified design range.                                                                       | Monthly (during growing season) or as required.                                      |
|                        | Manage other vegetation and remove nuisance plants.                                                                                     | Monthly at start, then as required.                                                  |
|                        | Inspect inlets and outlets and overflows for blockages, and clear if required.                                                          | Monthly.                                                                             |
|                        | Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours.           | Monthly, or when required.                                                           |
|                        | Inspect vegetation coverage.                                                                                                            | Monthly for 6 months, quarterly for 2 years, the half yearly.                        |
|                        | Inspect inlet and facility surface for silt accumulation, establish appropriate silt removal frequencies.                               | Half yearly.                                                                         |
| Occasional Maintenance | Reseed areas of poor vegetation growth, after plant types to better suit conditions, if required.                                       | As required or if bare soil is exposed over 10% or more of the swale treatment area. |
| Remedial Actions       | Repair erosion or other damage by re-turfing or reseeded.                                                                               | As required.                                                                         |
|                        | Relevel uneven surfaces and reinstate design levels.                                                                                    | As required.                                                                         |
|                        | Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface. | As required.                                                                         |
|                        | Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip.                                         | As required.                                                                         |
|                        | Remove and dispose of oils or petrol residues using safe standard practices.                                                            | As required.                                                                         |

### 6.3.4 Underground Piped Systems

A recommended operation and maintenance plan for the piped drainage network is summarised in Table 6-4.

Table 6-4  
 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: <ul style="list-style-type: none"> <li>Cracked / deteriorating pipes;</li> <li>Leaking joints/seals at manholes;</li> <li>High water lines showing regular high stage in pipes (sign of lack of capacity or downstream constraint); and</li> <li>Suspected infiltration or exfiltration.</li> </ul> | 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              |

## 7.0 FOUL WATER DRAINAGE STRATEGY

### 7.1 Foul Water Quantity

Foul flows generated by the residential development have been estimated using Best Practice industry guidance<sup>13</sup>.

Using a wastewater figure of 350 litres per household per day, attributed to a residential household, for the proposed development of 13no dwellings, the estimated average 'dry weather' foul flow from the development is 0.8 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 2.4 l/s.

### 7.2 Foul Discharge Arrangement

It is proposed that foul water from the residential properties discharges to the foul network in Silver Birch Drive using the Southern Water sewerage network along a new pipe run from the Site connecting into Manhole 471L at an invert level of 2.26m AOD (cover level is 3.92m AOD). The pipe diameter is 175mm Cast Iron.

The residential network is shown on Drawing SWDS 01.

A 300mmØ foul sewer pumping main flows westwards from the roundabout linking Silver Birch with Yapton Road adjacent to the Site boundary for treatment by Southern Water.

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<sup>13</sup> Foul Sewer Design Flows : Surveyor Datafile : January 1992 : Peter M Jones

## 8.0 CONCLUSIONS

SLR Consulting Limited has been appointed to develop a Surface Water Drainage Strategy to manage surface water runoff resulting from the proposed residential development on land off Silver Birch Way, Middleton-on-Sea, West Sussex, PO22 6SJ.

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 via an 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 1.06l/s.

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

Residual flood events in excess of the design standard have also been considered with storage provided within the filter drains and the proprietary crate storage. The construction of a low bund along the perimeter with Yapton Road will guide excess flows to the existing southerly 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 a peak of 2.4l/s to a 175mmØ Southern Water foul sewer network adjacent to the site boundary at MH 471L in Yapton Road.

## 9.0 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.

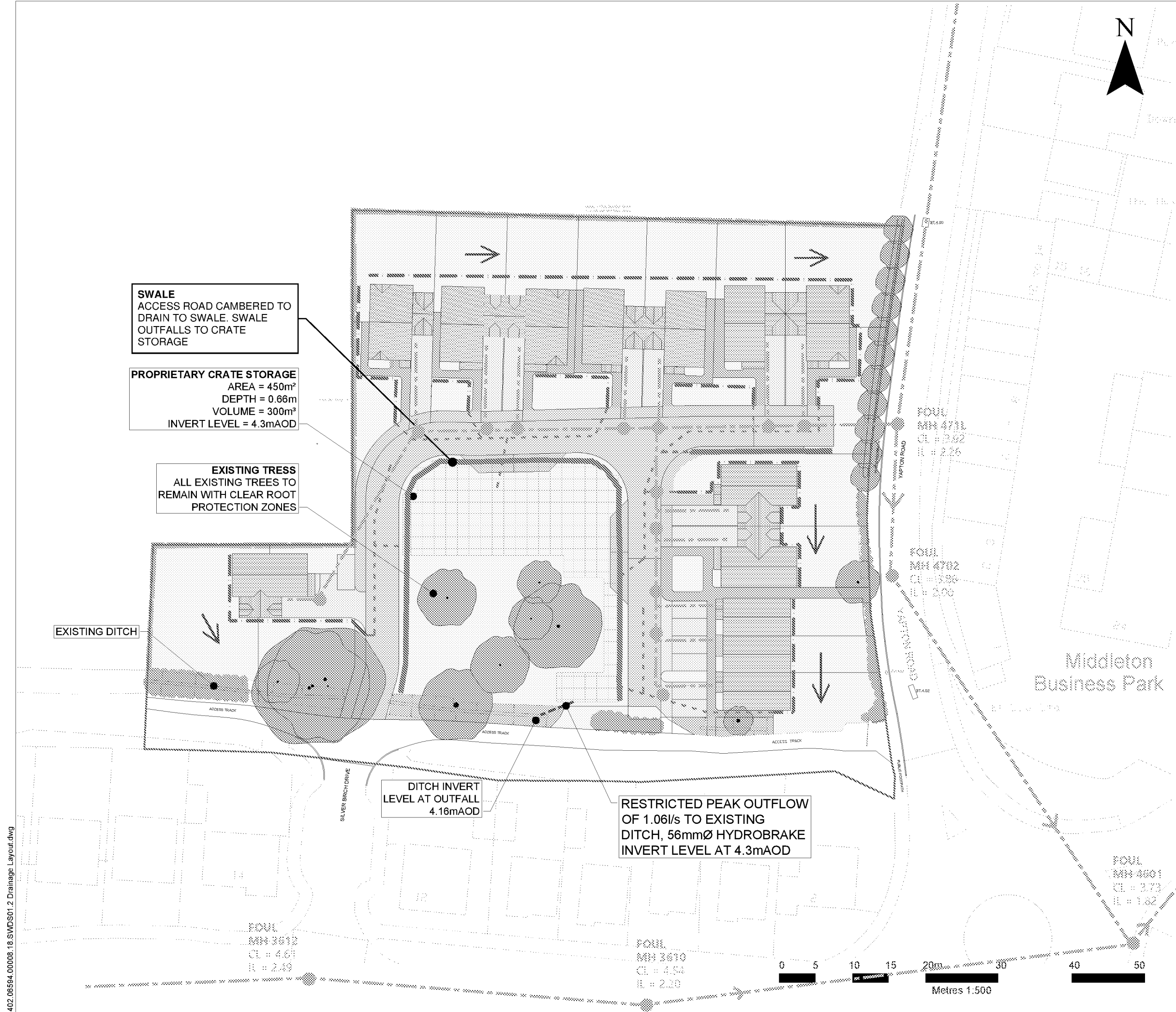
This report is for the exclusive use of those parties listed in Section 1.0 of this report and their exclusive agents; no warranties or guarantees are expressed or should be inferred by any third parties. Any such party relies upon the report at their risk.

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



**NOTES**

PROPOSED PLAN TAKEN FROM THE SEAMAN PARTNERSHIP LTD 13950815 SITE PLAN, DATED 17/08/2015

**LEGEND**

- SITE BOUNDARY
- OUTFALL PIPE
- UNDERGROUND PIPED DRAINAGE
- FILTER DRAIN
- EXCEEDANCE FLOW ROUTE ABOVE DESIGN FLOOD EVENT
- CRATE STORAGE
- SWALE
- FOUL NETWORK

| Revision | By | Chk'd By | Date  | Comments                                    |
|----------|----|----------|-------|---------------------------------------------|
| 2        | AB | AD       | 04/20 | Detention basin replaced with crate storage |
| 1        | AB | GF       | 04/20 | pipes and filter drains added               |
| 0        | AB | GF       | 03/20 |                                             |

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**Site**

LAND WEST OF YAPTON ROAD

**Project**

SURFACE WATER DRAINAGE STRATEGY

**Drawing Title**

**PROPOSED DRAINAGE LAYOUT**

|                                  |                      |
|----------------------------------|----------------------|
| Scale<br>1:500 @A3               | Date<br>07/04/20     |
| Drawing Number<br><b>SWDS 01</b> | Revision<br><b>2</b> |

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## APPENDIX 01

### Topographic Survey



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

Drawn No. 1309GB15 Site Plan  
 Date: 08/02  
 Project: NAPTON ROAD POULTRY FARM  
 YAPTON ROAD  
 MIDDLETON ON SEA  
 WEST SUSSEX

**REVISIONS**  
 Revision No. 1  
 Description: Revised site plan to include new building footprint and parking area.  
 Date: 08/02  
 Drawn by: [Signature]  
 Checked by: [Signature]

**SCALE**  
 1:200  
 1" = 20'

**VERSION HISTORY**  
 Version No. 1  
 Description: Initial site plan.  
 Date: 08/02  
 Drawn by: [Signature]  
 Checked by: [Signature]

**STAKE SCHEDULE**  
 Stake No. 1  
 Description: Stake 1 at the corner of the site.  
 Date: 08/02  
 Drawn by: [Signature]  
 Checked by: [Signature]

**TREE SCHEDULE**  
 Tree No. 1  
 Description: Tree 1 at the corner of the site.  
 Date: 08/02  
 Drawn by: [Signature]  
 Checked by: [Signature]

**SCALE BAR**  
 0 10 20 30 40 50 60 70 80 90 100  
 Feet

**North Arrow**  
 True North  
 Magnetic North

---

## APPENDIX 02

### Details of Intrusive Ground Works

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

| SAMPLES & TESTS |         |         |         |         |       | Water        | STRATA        |                     |       |                                                                         | Instrument/<br>Backfill                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       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| Depth           | Type No | HS(ppm) | HV(kPa) | PP(kPa) | SPT-N |              | Reduced Level | Legend (Thick-ness) | Depth | DESCRIPTION                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               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| 0.00            | BAG     | 1       |         |         |       | <div>↓</div> | 4.60          |                     | 0.20  | Grey brown slightly sandy clay SILT with occasional rootlets. (TOPSOIL) | <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><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|

| 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<br>Scale 1:34.375 |  | Contractor: ESL<br>Plant: |  | Method: Windowless Sampler<br>Hole Size: 200mm |  | Logged By:<br>JG | Approved By:<br>BAJ |
|--------------------------------------------|--|---------------------------|--|------------------------------------------------|--|------------------|---------------------|

|                                         |  |                   |                           |                                  |                         |
|-----------------------------------------|--|-------------------|---------------------------|----------------------------------|-------------------------|
| <b>BOREHOLE LOG</b>                     |  |                   |                           | BOREHOLE No.<br><b>WS-02</b>     |                         |
| Client:<br><b>FRONTIER</b>              |  |                   |                           |                                  |                         |
| Project No:<br>Yapton Road Farm         |  | Date:<br>01/05/19 | Ground Level:<br>5.01maOD | Co-ordinates:<br>E497413 N100782 |                         |
| Project:<br><b>GROUND INVESTIGATION</b> |  |                   |                           |                                  |                         |
|                                         |  |                   |                           |                                  | Sheet:<br><b>1 of 1</b> |

| SAMPLES & TESTS |         |         |         |         |       | Water           | STRATA                                                                                         |                                                                                                |        |                                                                                                                                                   | Instrument/<br>Backfill |
|-----------------|---------|---------|---------|---------|-------|-----------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| Depth           | Type No | HS(ppm) | HV(kPa) | PP(kPa) | SPT-N |                 | Reduced Level                                                                                  | Legend (Thick-ness)                                                                            | Depth  | DESCRIPTION                                                                                                                                       |                         |
| 0.00            | BAG     | 1       |         |         |       | <div>1</div>    | <div>4.76</div>                                                                                | <div></div>   | 0.25   | Grey brown slightly sandy clay SILT with occasional rootlets. (TOPSOIL)                                                                           | <div></div>             |
| 0.20            | J       |         |         |         |       |                 |                                                                                                | <div></div>   | (0.75) | Firm, orangey brown, sandy slightly clayey SILT.                                                                                                  |                         |
| 1.00            | BAG     | 1       |         |         |       |                 | <div>4.01</div>                                                                                | <div></div>   | 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       |         |         |         |       |                 |                                                                                                | <div></div>   | (0.60) |                                                                                                                                                   |                         |
|                 |         |         |         |         |       |                 | <div>3.41</div>                                                                                | <div></div>   | 1.60   | Firm, orangey brown, sandy gravelly SILT. Gravel consists of angular fine to medium chalk and flint, moist to wet.                                |                         |
|                 |         |         |         |         |       |                 |                                                                                                | <div></div>   | (0.60) |                                                                                                                                                   |                         |
| 2.00            | BAG     | 0       |         |         |       |                 | <div>2.81</div>                                                                                | <div></div>   | 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       |         |         |         |       |                 |                                                                                                | <div></div>   | (1.30) |                                                                                                                                                   |                         |
| 3.00            | BAG     | 0       |         |         |       |                 |                                                                                                | <div></div>  |        |                                                                                                                                                   |                         |
| 3.10            | J       |         |         |         |       |                 |                                                                                                | <div></div> | 3.50   | Soft to firm, brown changing to grey slightly gravelly sandy SILT. Occasional sand lenses. Wet.                                                   |                         |
|                 |         |         |         |         |       | <div>1.51</div> | <div></div> |                                                                                                |        |                                                                                                                                                   |                         |
|                 |         |         |         |         |       |                 | <div></div> | (1.10)                                                                                         |        |                                                                                                                                                   |                         |
| 3.90            | J       |         |         |         |       |                 | <div></div> |                                                                                                |        |                                                                                                                                                   |                         |
| 4.00            | BAG     | 0       |         |         |       |                 | <div>0.41</div>                                                                                | <div></div> | 4.60   | Grey to white sandy, silty, GRAVEL. Gravel consists of angular fine chalk and flint, wet.                                                         |                         |
|                 |         |         |         |         |       |                 |                                                                                                | (0.60)                                                                                         |        |                                                                                                                                                   |                         |
| 5.00            | BAG     | 0       |         |         |       |                 | <div>-0.19</div>                                                                               | <div></div> | 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<br>Scale 1:34.375 |  | Contractor: ESL<br>Plant: |  | Method: Windowless Sampler<br>Hole Size: 200mm |  | Logged By:<br>JG |  | Approved By:<br>BAJ |  |
|--------------------------------------------|--|---------------------------|--|------------------------------------------------|--|------------------|--|---------------------|--|

|                                         |  |                   |                           |                                  |                         |
|-----------------------------------------|--|-------------------|---------------------------|----------------------------------|-------------------------|
| BOREHOLE LOG                            |  |                   |                           | BOREHOLE No.<br><b>WS-03</b>     |                         |
| Client:<br><b>FRONTIER</b>              |  |                   |                           |                                  |                         |
| Project No:<br>Yapton Road Farm         |  | Date:<br>01/05/19 | Ground Level:<br>4.81maOD | Co-ordinates:<br>E497348 N100731 |                         |
| Project:<br><b>GROUND INVESTIGATION</b> |  |                   |                           |                                  |                         |
|                                         |  |                   |                           |                                  | Sheet:<br><b>1 of 1</b> |

| SAMPLES & TESTS |         |         |         |         |       | Water                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | STRATA        |                     |       |             | Instrument/<br>Backfill |
|-----------------|---------|---------|---------|---------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------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| Depth           | Type No | HS(ppm) | HV(kPa) | PP(kPa) | SPT-N |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Reduced Level | Legend (Thick-ness) | Depth | DESCRIPTION |                         |
| 1               |         |         |         |         |       | <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><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|               |                     |       |             |                         |

| 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      |        |         |            |    |       |             |    | Hand pit to 1.2mbg |
| 01-05-19                               | 09.15 |       | 2.31      |        |         |            |    |       |             |    |                    |
| 07-05-19                               | 15.10 |       | 1.53      |        |         |            |    |       |             |    |                    |

|                                            |  |                           |  |                                                |  |                  |                     |
|--------------------------------------------|--|---------------------------|--|------------------------------------------------|--|------------------|---------------------|
| All dimensions in metres<br>Scale 1:34.375 |  | Contractor: ESL<br>Plant: |  | Method: Windowless Sampler<br>Hole Size: 200mm |  | Logged By:<br>JG | Approved By:<br>BAJ |
|--------------------------------------------|--|---------------------------|--|------------------------------------------------|--|------------------|---------------------|

|                                         |  |                   |               |                                                                                     |  |                                  |
|-----------------------------------------|--|-------------------|---------------|-------------------------------------------------------------------------------------|--|----------------------------------|
| <b>BOREHOLE LOG</b>                     |  |                   |               | <b>BOREHOLE No.</b><br><b>WS-04</b>                                                 |  |                                  |
| Client:<br><b>FRONTIER</b>              |  |                   |               |  |  |                                  |
| Project No:<br>Yapton Road Farm         |  | Date:<br>01/05/19 | Ground Level: |                                                                                     |  | Co-ordinates:<br>E497406 N100741 |
| Project:<br><b>GROUND INVESTIGATION</b> |  |                   |               |                                                                                     |  | Sheet:<br>1 of 1                 |

| SAMPLES & TESTS |         |         |         |         |       | STRATA |               |                                                                                   |       | Instrument/<br>Backfill                                                                                                                    |
|-----------------|---------|---------|---------|---------|-------|--------|---------------|-----------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Depth           | Type No | HS(ppm) | HV(kPa) | PP(kPa) | SPT-N | Water  | Reduced Level | Legend (Thick-ness)                                                               | Depth |                                                                                                                                            |
|                 |         |         |         |         |       |        |               |  | 0.10  | Brown to grey sandy SILT with bricks and occasional metal debris. Dry. (MADE GROUND)                                                       |
|                 |         |         |         |         |       |        |               |  | 0.20  |                                                                                                                                            |
| 1               |         |         |         |         |       |        |               |  |       | Loose, grey brown slightly sandy clay SILT with occasional rootlets. (TOPSOIL)                                                             |
|                 |         |         |         |         |       |        |               |  |       |                                                                                                                                            |
| 2               |         |         |         |         |       |        |               |  |       | Soft to firm, orangey brown, slightly gravelly sandy SILT. Gravel is fine to coarse, angular of flint. Infrequent sandy lenses, moist.     |
|                 |         |         |         |         |       |        |               |  |       |                                                                                                                                            |
| 3               |         |         |         |         |       |        |               |  |       | Soft to firm, mottled grey white, slightly gravelly sandy slightly clayey SILT. Gravel is fine to medium sub rounded to rounded of flint.  |
|                 |         |         |         |         |       |        |               |  |       |                                                                                                                                            |
| 4               |         |         |         |         |       |        |               |  |       | Loose, mottled orange and brown, slightly gravelly silty fine to medium SAND. Gravel comprises rounded to subrounded flint and chalk. Wet. |
|                 |         |         |         |         |       |        |               |  |       |                                                                                                                                            |
| 5               |         |         |         |         |       |        |               |  |       | Firm, grey to white, slightly gravelly sandy SILT. Gravel is fine to coarse, angular of chalk. Moist to wet.                               |
|                 |         |         |         |         |       |        |               |  |       |                                                                                                                                            |
|                 |         |         |         |         |       |        |               |                                                                                   |       | 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<br>Scale 1:34.375 |  | Contractor: ESL<br>Plant: |  | Method: Windowless Sampler<br>Hole Size: 200mm |  | Logged By:<br>JG | Approved By:<br>BAJ |
|--------------------------------------------|--|---------------------------|--|------------------------------------------------|--|------------------|---------------------|

|                                         |  |                   |                           |                                    |                         |
|-----------------------------------------|--|-------------------|---------------------------|------------------------------------|-------------------------|
| TRIAL PIT LOG                           |  |                   |                           | TRIAL PIT No<br><b>TP-01</b>       |                         |
| Client:<br><b>FRONTIER</b>              |  |                   |                           |                                    |                         |
| Project:<br><b>GROUND INVESTIGATION</b> |  |                   |                           |                                    |                         |
| Project No:<br>Yapton Road Farm         |  | Date:<br>29/04/19 | Ground Level:<br>4.90mAOD | Co-ordinates:<br>E 497379 N 100775 | Sheet:<br><b>1 of 1</b> |

| SAMPLES & TESTS |         |           |             | Water | STRATA        |                                                                                   |                             | Instrument/<br>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)                      |                                                                                                                          |                                                                                      |
| 1.00            | BAG     | HS        | 0ppm        |       |               |  |                             |                                                                                                                          |                                                                                      |
| 1.00            | J       |           |             |       | 3.60          |  | 1.30                        | Firm, mottled brown and white, sandy, gravelly SILT. Gravel consists of fine angular chalk and flint, moist.             |                                                                                      |
|                 |         |           |             |       |               |  | (1.20)                      |                                                                                                                          |                                                                                      |
| 2.00            | BAG     | HS        | 1ppm        |       |               |  |                             |                                                                                                                          |                                                                                      |
|                 |         |           |             |       | 2.40          |  | 2.50                        | Soft, white to brown, gravelly SILT. Gravel consists of medium to coarse flint and chalk. Moist to wet.                  |                                                                                      |
|                 |         |           |             |       |               |  | (0.70)                      |                                                                                                                          |                                                                                      |
| 3.00            | BAG     | HS        | 0ppm        |       | 1.70          |  | 3.20                        |                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                   | Trial Pit complete at 3.20m |                                                                                                                          |                                                                                      |
| 4               |         |           |             |       |               |                                                                                   |                             |                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                   |                             |                                                                                                                          |                                                                                      |
| 5               |         |           |             |       |               |                                                                                   |                             |                                                                                                                          |                                                                                      |
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| <b>GENERAL REMARKS:</b><br>Trial pit dry.                                                                                                                                                      |  | <b>Trial Pit Dimensions:</b><br><br>Shoring/Support: None<br>Stability: Pit Stable |
| <b>KEY:</b><br>V = Hand Vane Shear Strength<br>PP = Pocket Penetrometer Shear Strength<br>J = Jar Sample<br>D = Small Disturbed Sample<br>B = Large Bulk Sample<br>HS = Head Space Measurement |  |                                                                                    |

|                                            |                                    |                          |                  |                     |
|--------------------------------------------|------------------------------------|--------------------------|------------------|---------------------|
| All dimensions in metres<br>Scale 1:34.375 | Contractor : ESL<br>Plant: JCB 3CX | Method: Trial Pit/trench | Logged By:<br>JG | Approved By:<br>BAJ |
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ARUN DISTRICT COUNCIL M/28/20/DOC

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

| SAMPLES & TESTS |                                                                                   |           |             | Water | STRATA        |                                                                                     |                                                                                                        | Instrument/<br>Backfill                                                                                                               |
|-----------------|-----------------------------------------------------------------------------------|-----------|-------------|-------|---------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Depth           | Type No                                                                           | Test Type | Test Result |       | Reduced Level | Legend                                                                              | Depth (Thick-ness)                                                                                     |                                                                                                                                       |
| 1               | 0.00                                                                              | BAG J     | HS          | 0ppm  |               |    | 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                                                                              | B B       | HS          | 1ppm  |               |    | (0.60)                                                                                                 | Light brown, silty fine to medium SAND.                                                                                               |
|                 | 1.00                                                                              |           |             |       |               |    | 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  |               |  | (1.10)                                                                                                 |                                                                                                                                       |
|                 |                                                                                   |           |             |       |               | 1.68                                                                                | 3.20                                                                                                   |                                                                                                                                       |
| 4               |                                                                                   |           |             |       |               |                                                                                     |                                                                                                        | Trial Pit complete at 3.20m                                                                                                           |
| 5               |                                                                                   |           |             |       |               |                                                                                     |                                                                                                        |                                                                                                                                       |

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

|                                            |                                    |                          |                  |                     |
|--------------------------------------------|------------------------------------|--------------------------|------------------|---------------------|
| All dimensions in metres<br>Scale 1:34.375 | Contractor : ESL<br>Plant: JCB 3CX | Method: Trial Pit/trench | Logged By:<br>JG | Approved By:<br>BAJ |
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ARUN DISTRICT COUNCIL M/28/20/DOC

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

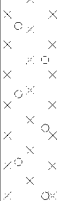
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| TRIAL PIT LOG                           |  |                   |                           | TRIAL PIT No<br><b>TP-06</b>       |                         |
| Client:<br><b>FRONTIER</b>              |  |                   |                           |                                    |                         |
| Project:<br><b>GROUND INVESTIGATION</b> |  |                   |                           |                                    |                         |
| Project No:<br>Yapton Road Farm         |  | Date:<br>30/04/19 | Ground Level:<br>5.10mAOD | Co-ordinates:<br>E 497378 N 100730 | Sheet:<br><b>1 of 1</b> |

| SAMPLES & TESTS |         |           |             | Water | STRATA        |                                                                                     |                    | Instrument/<br>Backfill                                                                                                   |                                                                                      |
|-----------------|---------|-----------|-------------|-------|---------------|-------------------------------------------------------------------------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Depth           | Type No | Test Type | Test Result |       | Reduced Level | Legend                                                                              | Depth (Thick-ness) |                                                                                                                           | DESCRIPTION                                                                          |
| 0.00            | BAG     | HS        | 0ppm        |       | 4.95          |    | 0.15               | Grey brown slightly sandy SILT with occasional rootlets (TOPSOIL)                                                         |  |
| 0.20            | J       |           |             |       | 4.65          |    | (0.30)<br>0.45     | Light brown, silty SAND with rare gravel. Gravel consists of brick and rare charcoal. Moist (MADE GROUND).                |                                                                                      |
| 0.70            | DIST    |           |             |       |               |    | (1.05)             | Firm, orangey brown, slightly gravelly sandy SILT with rare clay. Gravel consists of angular fine chalk and flint. Moist. |                                                                                      |
| 0.90            | B       |           |             |       | 3.60          |    | 1.50               | Orange brown, gravelly silty SAND. Gravel is angular to rounded fine chalk, moist.                                        |                                                                                      |
|                 |         |           |             |       |               |   | (1.70)             | 2.20 - 3.20 becoming increasingly gravelly with depth.                                                                    |                                                                                      |
|                 |         |           |             |       |               |  |                    |                                                                                                                           |                                                                                      |
|                 |         |           |             |       |               |  |                    |                                                                                                                           |                                                                                      |
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| <b>GENERAL REMARKS:</b><br>Trial pit dry.                                                                                                                                                      |  | <b>Trial Pit Dimensions:</b><br><br><br>Shoring/Support: None<br>Stability: Pit Stable |
| <b>KEY:</b><br>V = Hand Vane Shear Strength<br>PP = Pocket Penetrometer Shear Strength<br>J = Jar Sample<br>D = Small Disturbed Sample<br>B = Large Bulk Sample<br>HS = Head Space Measurement |  |                                                                                        |

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

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

| SAMPLES & TESTS |         |           |             | Water | STRATA        |                                                                                              |                    | Instrument/<br>Backfill                                                                                                                                                                                                                                                                                                  |                                                                                      |
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| 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.<br>(MADE GROUND)<br>Orangey brown, silty SAND. Moist.<br>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    |           |             |       |               | <br>(1.40)  |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
| 0.80            | J       |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
| 0.90            | B       |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       | 3.41          |             | 1.70               |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               | <br>(1.50) |                    | Firm, mottled orange white, gravelly, slightly sandy SILT. Gravel consists of fine to medium chalk and flint.                                                                                                                                                                                                            |                                                                                      |
| 2.00            | BAG     | HS        | 0ppm        |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
| 2.30            | DIST    |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
| 2.40            | B       | HS        | 0ppm        |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
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| 3.00            | BAG     | HS        | 0ppm        |       | 1.91          |                                                                                              | 3.20               |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                              |                    | Trial Pit complete at 3.20m                                                                                                                                                                                                                                                                                              |                                                                                      |
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|                 |         |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |
|                 |         |           |             |       |               |                                                                                              |                    |                                                                                                                                                                                                                                                                                                                          |                                                                                      |

|                                                                                                                                                                                                |                                    |                                                                                                                                                                                                                                                                                                                                                                      |                  |                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|
| <b>GENERAL REMARKS:</b><br>Trial pit dry.                                                                                                                                                      |                                    | <b>Trial Pit Dimensions:</b><br><div style="display: flex; align-items: center; justify-content: center;"> <div style="text-align: center; margin-right: 10px;">             0.5<br/>↑<br/>↓           </div> <div style="border: 1px solid black; width: 150px; height: 40px; margin: 0 auto;"></div> </div> <p>Shoring/Support: None<br/>Stability: Pit Stable</p> |                  |                     |
| <b>KEY:</b><br>V = Hand Vane Shear Strength<br>PP = Pocket Penetrometer Shear Strength<br>J = Jar Sample<br>D = Small Disturbed Sample<br>B = Large Bulk Sample<br>HS = Head Space Measurement |                                    |                                                                                                                                                                                                                                                                                                                                                                      |                  |                     |
| All dimensions in metres<br>Scale 1:34.375                                                                                                                                                     | Contractor : ESL<br>Plant: JCB 3CX | Method: Trial Pit/trench                                                                                                                                                                                                                                                                                                                                             | Logged By:<br>JG | Approved By:<br>BAJ |

ARUN DISTRICT COUNCIL M/28/20/DOC

|                                                                  |                                                   |                                                           |                                                                    |                                                                                                                 |
|------------------------------------------------------------------|---------------------------------------------------|-----------------------------------------------------------|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| <div> <div>TRIAL PIT LOG</div> </div>                            |                                                   |                                                           |                                                                    | <div> <div>TRIAL PIT No</div> <div>TP-09</div> </div>                                                           |
| <div> <div>Client:</div> <div>FRONTIER</div> </div>              |                                                   |                                                           |                                                                    | <div> <div>SLR</div>  </div> |
| <div> <div>Project:</div> <div>GROUND INVESTIGATION</div> </div> |                                                   |                                                           |                                                                    |                                                                                                                 |
| <div> <div>Project No:</div> <div>Yapton Road Farm</div> </div>  | <div> <div>Date:</div> <div>30/04/19</div> </div> | <div> <div>Ground Level:</div> <div>5.10mAOD</div> </div> | <div> <div>Co-ordinates:</div> <div>E 497389 N 100745</div> </div> | <div> <div>Sheet:</div> <div>1 of 1</div> </div>                                                                |

| SAMPLES & TESTS |              |           |             | Water        | STRATA        |        |                    |                                                                                                                                                                                        | Instrument/<br>Backfill |
|-----------------|--------------|-----------|-------------|--------------|---------------|--------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| Depth           | Type No      | Test Type | Test Result |              | Reduced Level | Legend | Depth (Thick-ness) | DESCRIPTION                                                                                                                                                                            |                         |
| 1               | 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)<br>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<br>0.80 | B<br>DIST |             |              |               |        | (1.20)             | Firm, orangey brown, slightly sandy slightly gravelly clayey SILT. Gravel consists of angular fine chalk and flint. Moist.                                                             |                         |
|                 |              |           |             |              | 3.50          |        | 1.60               |                                                                                                                                                                                        |                         |
| 2               | 2.00<br>2.10 | BAG<br>B  | HS<br>HS    | 0ppm<br>0ppm |               |        | (1.20)             | Firm, mottled orange white, slightly gravelly, sandy SILT. Gravel consists of fine to medium chalk and flint. Wet from 2.10m.                                                          |                         |
|                 | 2.30<br>2.30 | DIST<br>J |             |              |               |        |                    |                                                                                                                                                                                        |                         |
|                 | 2.60         | B         |             |              | 2.30          |        | 2.80               |                                                                                                                                                                                        |                         |
|                 |              |           |             |              |               |        |                    |                                                                                                                                                                                        |                         |
| 3               | 3.00         | BAG       | HS          | 1ppm         |               |        | (0.40)<br>3.20     | Soft off white sandy gravelly SILT. Gravel is fine to coarse, angular to sub angular of chalk and flint.                                                                               |                         |
|                 |              |           |             |              | 1.90          |        |                    |                                                                                                                                                                                        |                         |
| 4               |              |           |             |              |               |        |                    | Trial Pit complete at 3.20m                                                                                                                                                            |                         |
|                 |              |           |             |              |               |        |                    |                                                                                                                                                                                        |                         |
| 5               |              |           |             |              |               |        |                    |                                                                                                                                                                                        |                         |

|                                                                                                                                                                                                |                                    |                                                                                                                                        |                  |                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|
| <b>GENERAL REMARKS:</b><br>Trial pit dry.                                                                                                                                                      |                                    | <p style="text-align: center;">Trial Pit Dimensions:</p> <p style="text-align: center;">2.6</p> <p style="text-align: center;">0.6</p> |                  |                     |
| <b>KEY:</b><br>V = Hand Vane Shear Strength<br>PP = Pocket Penetrometer Shear Strength<br>J = Jar Sample<br>D = Small Disturbed Sample<br>B = Large Bulk Sample<br>HS = Head Space Measurement |                                    |                                                                                                                                        |                  |                     |
| All dimensions in metres<br>Scale 1:34.375                                                                                                                                                     | Contractor : ESL<br>Plant: JCB 3CX | Method: Trial Pit/trench                                                                                                               | Logged By:<br>JG | Approved By:<br>BAJ |

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## 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         |
|            | ~~~~~ | Lateral Drain                |
| Orange     | ----- | 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  | Vertiflex 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



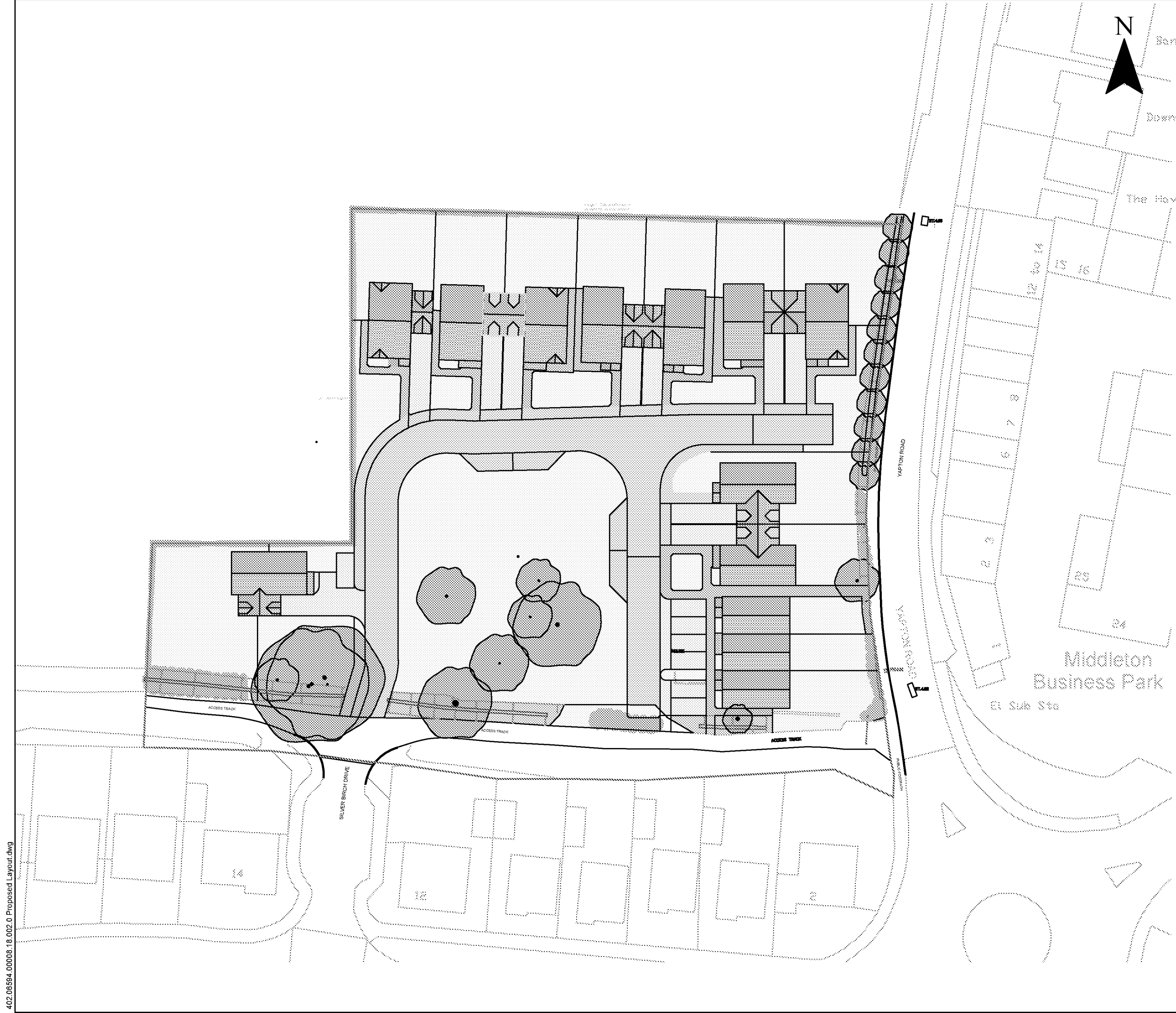


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## APPENDIX 04

### Details of the Proposed Development



NOTES

PROPOSED PLAN TAKEN FROM THE SEAMAN PARTNERSHIP LTD 13950815 SITE PLAN, DATED 17/08/2015

LEGEND

SITE BOUNDARY

|          |    |          |       |          |
|----------|----|----------|-------|----------|
| 0        | AB | GF       | 03/20 |          |
| Revision | By | Chk'd By | Date  | Comments |
|          |    |          |       |          |

SLR

global environmental solutions

TREENWOOD HOUSE

ROWDEN LANE

BRADFORD-ON-AVON

WILTS. BA15 2AU

T: 01225 309400

F: 01225 309401

www.slrconsulting.com

Site

MIDDLETON-ON-SEA

Project

SURFACE WATER DRAINAGE STRATEGY

Drawing Title

PROPOSED SITE PLAN

Scale

1:500 @A3

Date

26/03/20

Drawing Number

002

Revision

0

402.06594.00008.18.002.0 Proposed Layout.dwg

## Arun District Council Application M/45/16/PL Decision Notice



**Town & Country Planning Act 1990 (as amended)**  
**Town and Country Planning (Development Management**  
**Procedure) (England) Order 2015**  
**Application for Planning Permission**  
**DECISION NOTICE**

Application Ref: M/45/16/PL

1

**To Addressee**

Strutt and Parker  
 201 High Street  
 Lewes  
 East Sussex  
 BN7 2NR

2

**Site Address**

Land West of Yapton Road (Poultry Farm)  
 Middleton-on Sea  
 PO22 6DY

3

**Description of Development**

Demolition of redundant poultry farm buildings & dwelling & erection of 13 No. dwellings with associated access, car parking & landscaping. This application is a departure from the development plan

In pursuance of their powers under this Act and related Orders and Regulations the Council **PERMIT** this development to be carried out in accordance with the application and plans and subject to the following conditions

1

The development hereby permitted shall be begun before the expiration of 3 years from the date of this permission.

Reason: To comply with Section 91 of the Town and Country Planning Act 1990 (as amended).

2

The development hereby approved shall be carried out in accordance with the following approved plans Location, Sketch Site Layout FS08, Indicative Floor Plans PL03 reva, Proposed Elevations- sheet 2, PL05 revb, Proposed Elevations Sheet 1 PL04 revC, Proposed Elevations Unit 1 and Block and Location Plans APL02 revf, Proposed Site Layout PL01 rev e, Proposed Access Arrangements ITP-130-1-01 P1, 13950815 site plan, PJC/3822/15/A rev02, Planting Details LV1A7 and Engineered solution to access avoiding Tree Root Protection Areas 17026/001 revA.

Reason: For the avoidance of doubt and in the interests of amenity and the environment in accordance with policy GEN7 of the Arun District Local Plan.

- 3 No development above damp proof course (DPC) level shall take place unless and until a schedule of materials and finishes to be used for external walls and roofs of the proposed buildings have been submitted to and approved by the Local Planning Authority and the materials so approved shall be used in the construction of the buildings.

Reason: To enable the Local Planning Authority to control the development in detail in the interests of amenity by endeavouring to achieve a building of visual quality in accordance with policy GEN7 of the Arun District Local Plan.

- 4 No development above damp proof course (DPC) level shall take place until details of screen walls and/or fences have been submitted to and approved by the Local Planning Authority and no dwellings shall be occupied until such screen walls and/or fences associated with them have been erected.

Reason: In the interests of amenity in accordance with policy GEN7 of the Arun District Local Plan.

- 5 Notwithstanding the provisions of the Town and Country Planning (General Permitted Development)(England) Order 2015, (or any Order revoking or enacting that Order) no windows or other openings (other than those shown on the plans hereby approved) shall be formed in the side walls of the buildings at first floor level and above without the prior permission of the Local Planning Authority on an application in that behalf.

Reason: To protect the amenities of adjoining residential properties in accordance with policy GEN7 of the Arun District Local Plan.

- 6 Notwithstanding the provisions of Part 1 of Schedule 2 of the Town and Country Planning (General Permitted Development Class A (g) no extensions to the dwelling house which project more than 4m in depth for detached dwellings or 3m in any other case shall be constructed unless permission is granted by the Local Planning Authority on an application in that behalf.

Reason: To safeguard the privacy and amenity of adjoining occupiers, maintain adequate amenity space and safeguard the cohesive appearance of the development in accordance with policy GEN7 of the Arun District Local Plan.

- 7 No construction works shall be carried out until all buildings and structures existing on the application site at the date of this permission have been demolished, the debris removed from the site and the site cleared.

Reason: In the interests of the amenities of the locality in accordance with policy GEN7 of the Arun District Local Plan.

- 8 Soft landscaping shall be carried out in accordance with the details shown on plan (LVIA7 Sept 2016). All planting, seeding or turfing comprised in the approved details shall be carried out in the first planting and seeding seasons following the occupation of the buildings or the completion of the development, whichever is the sooner, and any trees or plants which within a period of 5 years from the completion of the development die, are removed or become seriously damaged or diseased shall be replaced in the next planting season with others of similar size and species, unless the Local Planning Authority gives written consent to any variation.

Reason: In the interests of amenity and of the environment of the development in accordance with policy GEN7 of the Arun District Local Plan.

- 9 No development above damp proof course (DPC) level shall take place until there has been submitted to, and approved by, the Local Planning Authority, a hard landscaping scheme and the development shall proceed in accordance with the details so approved.

Reason: In the interests of amenity and of the environment of the development in accordance with policy GEN7 of the Arun District Local Plan.

- 10 The construction of the development shall not commence until full details of the proposed foul water drainage scheme have been submitted to and approved in writing by the Local Planning Authority (in consultation with Southern Water).

No building shall be occupied until the foul water drainage scheme has been implemented in accordance with the approved details and the details so approved shall be retained in good working order in perpetuity.

Reason : To ensure that the proposed development is satisfactorily drained in accordance with policies GEN7 and GEN9 of the Arun District Council Local Plan. It is considered necessary for this to be a pre-commencement condition because it would not be possible to implement a surface drainage scheme once development had commenced.

- 11 No construction works shall commence until full details of the proposed surface water drainage scheme have been submitted to and approved in writing by the Local Planning Authority.

The design should follow the hierarchy of preference for different types of surface water drainage disposal systems as set out in Approved Document H of the Building Regulations, the recommendations of the SuDS Manual produced by CIRIA.

Winter groundwater monitoring to establish highest annual ground water levels and Percolation testing to BRE 365, or similar approved, will be required to support the design of any infiltration drainage.

Reason: To ensure that the proposed development is satisfactorily drained in accordance with policies GEN7 and GEN9 of the Arun District Council Local Plan. It is considered necessary for this to be a pre-commencement condition because it would not be possible to implement a surface drainage scheme once development had commenced.

- 12 Immediately following implementation of the approved SuDS scheme and prior to occupation of any part of the development, the developer/applicant shall provide the local planning authority with as-built drawings of the implemented scheme together with a completion report prepared by an independent engineer that confirms that the scheme was built in accordance with the approved drawing/s and is fit for purpose. There shall be no deviation to the approved scheme other than with the written consent of the Local Planning Authority. The scheme shall thereafter be maintained in perpetuity.

Reason: To ensure that the proposed development is satisfactorily drained in accordance with policies GEN7 and GEN9 of the Arun District Council Local Plan. It is considered necessary for this to be a pre-commencement condition because it would not be possible to implement a surface drainage scheme once development had commenced.

- 13 Construction works shall not proceed until formal consent has been approved in writing from the Lead Local Flood Authority (WSCC) or its agent (ADC) for the discharge of any flows to watercourses, or the culverting, diversion, infilling or obstruction of any watercourse on the site.

Any discharge to a watercourse must be at a rate no greater than the pre-development run off values.

Reason: To ensure that the proposed development is satisfactorily drained in accordance with policies GEN7 and GEN9 of the Arun District Council Local Plan. It is considered necessary for this to be a pre-commencement condition because it would not be possible to implement a surface drainage scheme once development had commenced.

- 14 Construction works shall not commence until full details of the maintenance and management of the SuDS system is set out in a site-specific maintenance manual and submitted to, and approved in writing, by the Local Planning Authority. The manual is to include (a) details of financial management of the site including arrangements made in the event that the management company (or any subsequent management company) is no longer able to fulfil its duties; and (b) arrangements for the replacement of major components at the end of the manufacturers recommended design life.

Reason: To ensure the efficient maintenance and on-going operation of the SuDS system and to ensure the best practice in line with guidance set out in 'The SuDS Manual' CIRIA publication ref: C753 Chapter 32. It is considered necessary for this to be a pre-commencement condition because it would not be possible to implement a surface drainage scheme once development had commenced.

- 15                    Upon completed construction of the SuDS System but prior to occupation of any part of the scheme, the owner or management company shall either provide the local planning authority with an updated copy of the management manual incorporating any changes as a result of construction/implementation or confirm in writing that no changes are required to the manual.

No further changes shall be made to the approved SuDS Maintenance & Management Plan/Regime including the management company responsible or the financial arrangements between the owners of the dwellings & the management company other than with the written consent of the Local Planning Authority.

The owner or management company shall thereafter strictly adhere to and implement the recommendations contained within the manual to ensure that the system is maintained in perpetuity.

Reason: To ensure the efficient maintenance and on-going operation of the SuDS system and to ensure the best practice in line with guidance set out in 'The SuDS Manual' CIRIA publication ref: C753 Chapter 32.

- 16                    External lighting in association with this development shall comply with Institution of Lighting Engineers Guidance Notes for the Reduction of Obtrusive Light, Obtrusive Light Limitations for Exterior Lighting Installations for Zone E2.

Reason: To control the residential amenities of the local environment in accordance with Arun District Local Plan policies GEN7 and GEN33.

- 17                    No part of the development shall be first occupied until the road(s), footways, and parking areas serving the development have been constructed, surfaced and drained in accordance with plans and details to be submitted to and approved by the Local Planning Authority.

Reason: To secure satisfactory standards of access for the proposed development.

- 18 No development shall take place, including any works of demolition, until a Construction Management Plan has been submitted to and approved in writing by the Local Planning Authority. Thereafter the approved Plan shall be implemented and adhered to throughout the entire construction period. The Plan shall provide details as appropriate but not necessarily be restricted to the following matters,
- the anticipated number, frequency and types of vehicles used during construction,
  - the method of access and routing of vehicles during construction,
  - the parking of vehicles by site operatives and visitors,
  - the loading and unloading of plant, materials and waste,
  - the storage of plant and materials used in construction of the development,
  - the erection and maintenance of security hoarding,
  - the provision of wheel washing facilities and other works required to mitigate the impact of construction upon the public highway (including the provision of temporary Traffic Regulation Orders),
  - details of public engagement both prior to and during construction works.

Reason: In the interests of highway safety and the amenities of the area. It is considered necessary for this to be a pre-commencement condition because any works on the site could result in congestion or impede access onto a classified road which could compromise highway safety.

- 19 No part of the development shall be first occupied until the car parking spaces have been constructed in accordance with plans and details submitted to and approved by the Local Planning Authority. These spaces shall thereafter be retained at all times for their designated use.

Reason: To provide car parking space for the use in accordance with policy GEN12 of Arun District Local Plan.

- 20 No part of the development shall be first occupied until covered and secure cycle parking spaces have been provided in accordance with plans and details submitted to and approved by the Local Planning Authority and the parking spaces so provided shall be retained in perpetuity for cycle parking.

Reason: To provide alternative travel options to the use of the car in accordance with current sustainable transport policies.

- 21 No part of the development shall be occupied until the footway has been extended from Silver Birch Drive into the development, including where this crosses public right of way no. 160, have been constructed in accordance with plans and details submitted to and approved in writing by the Local Planning Authority.

Reason: In the interests of highway safety and the amenities of the area in accordance with policy GEN7 of Arun District Local Plan.

- 22 The development shall proceed in accordance with the submitted Arboricultural Survey ref 3822/15-01. If any root structures with a diameter over 25mm are exposed during the excavation of the foundations for the dwellings then these should be retained unless otherwise agreed in writing with the Local Planning Authority. Any removal of roots over 25mm in diameter that has been agreed with the Local Planning Authority shall then be carried out under the supervision of the Council's Arboricultural Officer.

Reason: To ensure the retention and maintenance of trees and vegetation; which is an important feature of the area in accordance with sound arboricultural practice.

- 23 No development above damp proof course (DPC) level shall take place until details of 3 bat and 8 bird boxes (including provision for swallows, house martins and swifts) and other enhancements referred to in the Ecology Survey submitted with the application have been submitted to, and approved by, the Local Planning Authority. It is expected that they will become part of the fabric of the house. No occupation of the development shall take place until the agreed provision for bats and birds and enhancements have been secured/provided and they shall thereafter be maintained to the satisfaction of the Local Planning Authority.

Reason: To safeguard the ecology of the area, and in the interests of bats/birds to ensure that a habitat remains for them during and after development in accordance with policy GEN7 of Arun District Local Plan

- 24 The development shall proceed in accordance with the Reptile Strategy dated November 2016 and the Reptile Mitigation Measures and Enhancement Strategy detailed within the report. The Reptile mitigation strategy shall be fully implemented and shall include the following:
- A detailed survey conducted, prior to any works, between March/April to Sep/October;
  - Establishing a reptile exclusion zone on the development footprint, with reptile fencing and under the direction of an ecologist;
  - Tool box talk to all site workers on reptiles and ensure no vegetation is cleared unless under the supervision of the ecologist, no material is dumped in fenced off areas and wildlife protection zone and no fences to be damaged or moved, no entry to fenced off areas, no animals to be handled, no fires/materials stored in areas not previously agreed;
  - Reptile translocation to take place between April and October
  - No strimming of vegetation within the development zone until 5 clear trapping days has been established;
  - No vegetation clearance during the bird nesting season (Feb to Sep) unless vegetation is checked by an ecologist for nests.
  - Enhancements to site margins with planting of native species;
  - Establishing 3 new log piles;
  - Addition of wildflower mix to the grassland habitat.

Reason: To safeguard the ecology of the area, and in the interests of bats/birds to ensure that a habitat remains for them during and after development in accordance with policy GEN7 of Arun District Local Plan.

- 25 The development shall proceed in accordance with the submitted Arboricultural Impact Assessment and revisions dated 03-01-2017, Arboricultural Method Statement and revisions dated 03-01-2017 and Tree Constraints Plan, Tree Retention and Protection Plan drawing no. PJC3822/15/A rev 04 and Tree Retention and Protection Plan Access Detail drawing no. PJC/3822/15/B rev04.

Reason: To ensure retention of the neighbouring preserved tree in accordance with policies GEN7 and GEN28 of Arun District Local Plan.

- 26 The tree works and root protection measures in the area of the access hereby approved shall be undertaken under the supervision of the Local Planning Authority who shall be notified in writing, not less than 7 days before the work commences.

Reason: In order to ensure a satisfactory standard of tree surgery and tree protection in the interests of amenity in accordance with policies GEN7 and GEN28.

INFORMATIVE: This decision has been granted in conjunction with a Section 106 legal agreement relating to a commuted sum in lieu of open space provision, education, libraries, fire and rescue, affordable housing and health services.

INFORMATIVE: The applicant should note that under Part 1 of the Wildlife and Countryside Act 1981, with only a few exceptions, it is an offence for any person to intentionally take, damage or destroy the nest of any wild birds while the nest is in use or being built. Birds nest between March and September and therefore removal of dense bushes, ivy or trees or parts of trees etc. during this period could lead to an offence under the act.

INFORMATIVE: A formal application for connection to the public sewerage system is required in order to service this development. To initiate a sewer capacity check to identify the appropriate connection point for the development, please contact Southern Water, Southern House, Sparrowgrove, Otterbourne, Hampshire, SO21 2SW (Tel 033 0303 0119) or [www.southernwater.co.uk](http://www.southernwater.co.uk).

INFORMATIVE: Statement pursuant to Article 35 of the Town and Country Planning (Development Management Procedure)(England) Order 2015. The Local Planning Authority has acted positively and proactively in determining this application by assessing the proposal against all material considerations, including planning policies and any representations that may have been received and subsequently determining to grant planning permission in accordance with the presumption in favour of sustainable development, as set out within the National Planning Policy Framework.

INFORMATIVE: To ensure that the duties and responsibilities, as required under the Land Drainage Act 1991, and amended by the Flood and Water Management Act 2010, can be fulfilled without additional impediment following the development completion. No construction should take place which will restrict current and future land owners from undertaking their riparian maintenance responsibilities of any watercourse or culvert (piped watercourse) crossing or abutting the site on or adjacent to the site.



Karl Roberts  
Director Planning & Economic Regeneration

Case Officer: Mrs A Gardner

Date of Decision:

**7 February 2017**

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

**IT IS IMPORTANT THAT YOU READ THE NOTES ATTACHED TO THIS DOCUMENT**

## APPEALS TO THE SECRETARY OF STATE

If you are aggrieved by the decision of your local planning authority to refuse permission for the proposed development or to grant it subject to conditions, then you can appeal to the Secretary of State under section 78 of the Town and Country Planning Act 1990.

If this is a decision on a planning application relating to the same or substantially the same land and development as is already the subject of an enforcement notice, and you want to appeal against this planning application decision, then you must do so within 28 days of the date of this notice.

If an enforcement notice is served relating to the same or substantially the same land and development as in your application and you want to appeal against this planning application decision, then you must do so within 28 days of the date of service of the enforcement notice, or within 12 weeks of the date of this notice, whichever period expires earlier.

Otherwise, if you want to appeal against this decision then you must do so within 6 months of the date of this notice.

Appeals must be using a form which you can get from the Secretary of State at Temple Quay House, 2 The Square, Temple Quay, Bristol BS1 6PN (Tel: 0303 444 5000) or online at <http://acp.planninginspectorate.gov.uk>

The Secretary of State can allow a longer period for giving notice of an appeal but will not normally be prepared to use this power unless there are special circumstances which excuse the delay in giving notice of appeal.

The Secretary of State need not consider an appeal if it seems to the Secretary of State that the local planning authority could not have granted planning permission for the proposed development or could not have granted it without the conditions they imposed, having regard to the statutory requirements, to the provisions of any development order and to any directions given under a development order.

## PURCHASE NOTICES

If either the local planning authority or the Secretary of State refused permission to develop land or grants it subject to conditions, the owner may claim that he can neither put the land to a reasonably beneficial use in its existing state nor render the land capable of a reasonably beneficial use by the carrying out of any development which has been or would be permitted.

In these circumstances, the owner may serve a purchase notice on the Council (that is, where the land is situated in a National Park, the National Park authority for the Park, or in any other case the district council in whose area the land is situated). This notice will require the Council to purchase the owner's interest in the land in accordance with the provisions of Chapter 1 of Part VI of the Town & Country Planning Act 1990.

Please note that this decision notice only relates to matters under the Planning Acts and does not give consent under any other legislation that may apply to the development. You will need to carry out your own checks to determine whether any other consents or permissions are required. For example, the Building Regulations are likely to apply to most developments, and a Highways Licence may be required from West Sussex County Council for any development within the public highway (including the placing of skips on highway land).



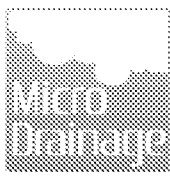
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## APPENDIX 06

### Preliminary Drainage Design

|                                                            |                     |                                   |                             |                       |                                                                                     |
|------------------------------------------------------------|---------------------|-----------------------------------|-----------------------------|-----------------------|-------------------------------------------------------------------------------------|
| SLR Consulting Ltd                                         |                     |                                   |                             |                       | Page 1                                                                              |
| 4/5 Lochside View<br>Edinburgh Park<br>Edinburgh, EH12 9DH |                     |                                   |                             |                       |  |
| Date 02/04/2020 21:37<br>File 200325_Middleton_Dete...     |                     | Designed by gfrisby<br>Checked by |                             |                       |                                                                                     |
| Innovyze                                                   |                     | Source Control 2019.1             |                             |                       |                                                                                     |
| <u>Summary of Results for 2 year Return Period</u>         |                     |                                   |                             |                       |                                                                                     |
| Storm<br>Event                                             | Max<br>Level<br>(m) | Max<br>Depth<br>(m)               | Max<br>Control<br>(l/s)     | Max<br>Volume<br>(m³) | Status                                                                              |
| 15 min Summer                                              | 4.344               | 0.044                             | 0.6                         | 20.6                  | O K                                                                                 |
| 30 min Summer                                              | 4.356               | 0.056                             | 0.8                         | 26.5                  | O K                                                                                 |
| 60 min Summer                                              | 4.369               | 0.069                             | 0.9                         | 32.6                  | O K                                                                                 |
| 120 min Summer                                             | 4.389               | 0.089                             | 1.1                         | 42.5                  | O K                                                                                 |
| 180 min Summer                                             | 4.399               | 0.099                             | 1.1                         | 47.6                  | O K                                                                                 |
| 240 min Summer                                             | 4.404               | 0.104                             | 1.1                         | 50.4                  | O K                                                                                 |
| 360 min Summer                                             | 4.409               | 0.109                             | 1.1                         | 52.7                  | O K                                                                                 |
| 480 min Summer                                             | 4.410               | 0.110                             | 1.1                         | 53.3                  | O K                                                                                 |
| 600 min Summer                                             | 4.410               | 0.110                             | 1.1                         | 53.5                  | O K                                                                                 |
| 720 min Summer                                             | 4.410               | 0.110                             | 1.1                         | 53.4                  | O K                                                                                 |
| 960 min Summer                                             | 4.409               | 0.109                             | 1.1                         | 52.8                  | O K                                                                                 |
| 1440 min Summer                                            | 4.405               | 0.105                             | 1.1                         | 50.9                  | O K                                                                                 |
| 2160 min Summer                                            | 4.399               | 0.099                             | 1.1                         | 47.6                  | O K                                                                                 |
| 2880 min Summer                                            | 4.393               | 0.093                             | 1.1                         | 44.6                  | O K                                                                                 |
| 4320 min Summer                                            | 4.384               | 0.084                             | 1.0                         | 40.0                  | O K                                                                                 |
| 5760 min Summer                                            | 4.377               | 0.077                             | 1.0                         | 36.8                  | O K                                                                                 |
| 7200 min Summer                                            | 4.373               | 0.073                             | 1.0                         | 34.7                  | O K                                                                                 |
| 8640 min Summer                                            | 4.370               | 0.070                             | 0.9                         | 33.1                  | O K                                                                                 |
| 10080 min Summer                                           | 4.367               | 0.067                             | 0.9                         | 31.9                  | O K                                                                                 |
| 15 min Winter                                              | 4.349               | 0.049                             | 0.7                         | 23.1                  | O K                                                                                 |
| Storm<br>Event                                             | Rain<br>(mm/hr)     | Flooded<br>Volume<br>(m³)         | Discharge<br>Volume<br>(m³) | Time-Peak<br>(mins)   |                                                                                     |
| 15 min Summer                                              | 37.707              | 0.0                               | 16.0                        | 26                    |                                                                                     |
| 30 min Summer                                              | 24.545              | 0.0                               | 21.8                        | 40                    |                                                                                     |
| 60 min Summer                                              | 15.479              | 0.0                               | 31.5                        | 68                    |                                                                                     |
| 120 min Summer                                             | 10.486              | 0.0                               | 43.5                        | 126                   |                                                                                     |
| 180 min Summer                                             | 8.098               | 0.0                               | 50.7                        | 184                   |                                                                                     |
| 240 min Summer                                             | 6.653               | 0.0                               | 55.7                        | 242                   |                                                                                     |
| 360 min Summer                                             | 4.949               | 0.0                               | 62.3                        | 342                   |                                                                                     |
| 480 min Summer                                             | 3.970               | 0.0                               | 66.7                        | 396                   |                                                                                     |
| 600 min Summer                                             | 3.335               | 0.0                               | 70.0                        | 458                   |                                                                                     |
| 720 min Summer                                             | 2.888               | 0.0                               | 72.7                        | 522                   |                                                                                     |
| 960 min Summer                                             | 2.301               | 0.0                               | 77.1                        | 656                   |                                                                                     |
| 1440 min Summer                                            | 1.675               | 0.0                               | 83.6                        | 928                   |                                                                                     |
| 2160 min Summer                                            | 1.234               | 0.0                               | 96.7                        | 1328                  |                                                                                     |
| 2880 min Summer                                            | 1.003               | 0.0                               | 104.7                       | 1712                  |                                                                                     |
| 4320 min Summer                                            | 0.766               | 0.0                               | 118.8                       | 2468                  |                                                                                     |
| 5760 min Summer                                            | 0.643               | 0.0                               | 136.2                       | 3176                  |                                                                                     |
| 7200 min Summer                                            | 0.568               | 0.0                               | 150.1                       | 3896                  |                                                                                     |
| 8640 min Summer                                            | 0.517               | 0.0                               | 163.6                       | 4664                  |                                                                                     |
| 10080 min Summer                                           | 0.480               | 0.0                               | 176.3                       | 5352                  |                                                                                     |
| 15 min Winter                                              | 37.707              | 0.0                               | 18.3                        | 26                    |                                                                                     |
| ©1982-2019 Innovyze                                        |                     |                                   |                             |                       |                                                                                     |

|                                                            |                     |                                   |                             |                       |                                                                                     |
|------------------------------------------------------------|---------------------|-----------------------------------|-----------------------------|-----------------------|-------------------------------------------------------------------------------------|
| SLR Consulting Ltd                                         |                     |                                   |                             |                       | Page 2                                                                              |
| 4/5 Lochside View<br>Edinburgh Park<br>Edinburgh, EH12 9DH |                     |                                   |                             |                       |  |
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| Innovyze                                                   |                     | Source Control 2019.1             |                             |                       |                                                                                     |
| <u>Summary of Results for 2 year Return Period</u>         |                     |                                   |                             |                       |                                                                                     |
| Storm<br>Event                                             | Max<br>Level<br>(m) | Max<br>Depth<br>(m)               | Max<br>Control<br>(l/s)     | Max<br>Volume<br>(m³) | Status                                                                              |
| 30 min Winter                                              | 4.363               | 0.063                             | 0.9                         | 29.7                  | O K                                                                                 |
| 60 min Winter                                              | 4.377               | 0.077                             | 1.0                         | 36.6                  | O K                                                                                 |
| 120 min Winter                                             | 4.400               | 0.100                             | 1.1                         | 48.0                  | O K                                                                                 |
| 180 min Winter                                             | 4.411               | 0.111                             | 1.1                         | 53.9                  | O K                                                                                 |
| 240 min Winter                                             | 4.418               | 0.118                             | 1.1                         | 57.3                  | O K                                                                                 |
| 360 min Winter                                             | 4.423               | 0.123                             | 1.1                         | 60.2                  | O K                                                                                 |
| 480 min Winter                                             | 4.424               | 0.124                             | 1.1                         | 60.7                  | O K                                                                                 |
| 600 min Winter                                             | 4.424               | 0.124                             | 1.1                         | 60.4                  | O K                                                                                 |
| 720 min Winter                                             | 4.423               | 0.123                             | 1.1                         | 60.0                  | O K                                                                                 |
| 960 min Winter                                             | 4.420               | 0.120                             | 1.1                         | 58.7                  | O K                                                                                 |
| 1440 min Winter                                            | 4.413               | 0.113                             | 1.1                         | 55.0                  | O K                                                                                 |
| 2160 min Winter                                            | 4.402               | 0.102                             | 1.1                         | 49.3                  | O K                                                                                 |
| 2880 min Winter                                            | 4.392               | 0.092                             | 1.1                         | 44.3                  | O K                                                                                 |
| 4320 min Winter                                            | 4.378               | 0.078                             | 1.0                         | 37.1                  | O K                                                                                 |
| 5760 min Winter                                            | 4.370               | 0.070                             | 0.9                         | 33.1                  | O K                                                                                 |
| 7200 min Winter                                            | 4.364               | 0.064                             | 0.9                         | 30.3                  | O K                                                                                 |
| 8640 min Winter                                            | 4.360               | 0.060                             | 0.8                         | 28.3                  | O K                                                                                 |
| 10080 min Winter                                           | 4.357               | 0.057                             | 0.8                         | 26.8                  | O K                                                                                 |
| Storm<br>Event                                             | Rain<br>(mm/hr)     | Flooded<br>Volume<br>(m³)         | Discharge<br>Volume<br>(m³) | Time-Peak<br>(mins)   |                                                                                     |
| 30 min Winter                                              | 24.545              | 0.0                               | 24.9                        | 40                    |                                                                                     |
| 60 min Winter                                              | 15.479              | 0.0                               | 35.5                        | 68                    |                                                                                     |
| 120 min Winter                                             | 10.486              | 0.0                               | 49.0                        | 124                   |                                                                                     |
| 180 min Winter                                             | 8.098               | 0.0                               | 57.0                        | 182                   |                                                                                     |
| 240 min Winter                                             | 6.653               | 0.0                               | 62.6                        | 238                   |                                                                                     |
| 360 min Winter                                             | 4.949               | 0.0                               | 70.0                        | 350                   |                                                                                     |
| 480 min Winter                                             | 3.970               | 0.0                               | 74.9                        | 454                   |                                                                                     |
| 600 min Winter                                             | 3.335               | 0.0                               | 78.7                        | 490                   |                                                                                     |
| 720 min Winter                                             | 2.888               | 0.0                               | 81.7                        | 562                   |                                                                                     |
| 960 min Winter                                             | 2.301               | 0.0                               | 86.6                        | 714                   |                                                                                     |
| 1440 min Winter                                            | 1.675               | 0.0                               | 93.9                        | 1012                  |                                                                                     |
| 2160 min Winter                                            | 1.234               | 0.0                               | 108.5                       | 1432                  |                                                                                     |
| 2880 min Winter                                            | 1.003               | 0.0                               | 117.5                       | 1820                  |                                                                                     |
| 4320 min Winter                                            | 0.766               | 0.0                               | 133.5                       | 2552                  |                                                                                     |
| 5760 min Winter                                            | 0.643               | 0.0                               | 152.7                       | 3288                  |                                                                                     |
| 7200 min Winter                                            | 0.568               | 0.0                               | 168.4                       | 4032                  |                                                                                     |
| 8640 min Winter                                            | 0.517               | 0.0                               | 183.5                       | 4752                  |                                                                                     |
| 10080 min Winter                                           | 0.480               | 0.0                               | 197.9                       | 5456                  |                                                                                     |
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|                                                            |                                   |                                                                                     |
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| Innovyze Source Control 2019.1                             |                                   |                                                                                     |

Rainfall Details

|                       |                                 |
|-----------------------|---------------------------------|
| Rainfall Model        | FEH                             |
| Return Period (years) | 2                               |
| FEH Rainfall Version  | 2013                            |
| Site Location         | GB 497381 100755 SU 97381 00755 |
| Data Type             | Point                           |
| Summer Storms         | Yes                             |
| Winter Storms         | Yes                             |
| Cv (Summer)           | 0.750                           |
| Cv (Winter)           | 0.840                           |
| Shortest Storm (mins) | 15                              |
| Longest Storm (mins)  | 10080                           |
| Climate Change %      | +0                              |

Time Area Diagram

Total Area (ha) 0.000

| Time (mins) | Area  |
|-------------|-------|
| From: To:   | (ha)  |
| 0 4         | 0.000 |

Time Area Diagram

Total Area (ha) 0.297

| Time (mins) | Area  | Time (mins) | Area  | Time (mins) | Area  |
|-------------|-------|-------------|-------|-------------|-------|
| From: To:   | (ha)  | From: To:   | (ha)  | From: To:   | (ha)  |
| 0 4         | 0.099 | 4 8         | 0.099 | 8 12        | 0.099 |

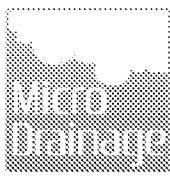
Time Area Diagram

Total Area (ha) 0.000

| Time (mins) | Area  |
|-------------|-------|
| From: To:   | (ha)  |
| 0 4         | 0.000 |

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|                                                            |                     |                                                                                     |
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| Innovyze                                                   |                     | Source Control 2019.1                                                               |

Model Details

Storage is Online Cover Level (m) 4.800

Tank or Pond Structure

Invert Level (m) 4.300

| Depth (m) | Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) |
|-----------|------------------------|-----------|------------------------|
| 0.000     | 455.0                  | 0.500     | 755.0                  |

Hydro-Brake® Optimum Outflow Control

|                                   |                            |
|-----------------------------------|----------------------------|
| Unit Reference                    | MD-SHE-0056-1100-0500-1100 |
| Design Head (m)                   | 0.500                      |
| Design Flow (l/s)                 | 1.1                        |
| Flush-Flo™                        | Calculated                 |
| Objective                         | Minimise upstream storage  |
| Application                       | Surface                    |
| Sump Available                    | Yes                        |
| Diameter (mm)                     | 56                         |
| Invert Level (m)                  | 4.300                      |
| Minimum Outlet Pipe Diameter (mm) | 75                         |
| Suggested Manhole Diameter (mm)   | 1200                       |

| Control Points            | Head (m) | Flow (l/s) |
|---------------------------|----------|------------|
| Design Point (Calculated) | 0.500    | 1.1        |
| Flush-Flo™                | 0.148    | 1.1        |
| Kick-Flo®                 | 0.331    | 0.9        |
| Mean Flow over Head Range | -        | 1.0        |

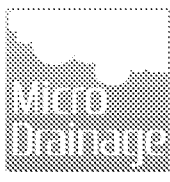
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|-----------|------------|-----------|------------|-----------|------------|-----------|------------|
| 0.100     | 1.1        | 1.200     | 1.6        | 3.000     | 2.5        | 7.000     | 3.7        |
| 0.200     | 1.1        | 1.400     | 1.7        | 3.500     | 2.7        | 7.500     | 3.8        |
| 0.300     | 1.0        | 1.600     | 1.9        | 4.000     | 2.8        | 8.000     | 4.0        |
| 0.400     | 1.0        | 1.800     | 2.0        | 4.500     | 3.0        | 8.500     | 4.1        |
| 0.500     | 1.1        | 2.000     | 2.1        | 5.000     | 3.1        | 9.000     | 4.2        |
| 0.600     | 1.2        | 2.200     | 2.1        | 5.500     | 3.3        | 9.500     | 4.3        |
| 0.800     | 1.4        | 2.400     | 2.2        | 6.000     | 3.4        |           |            |
| 1.000     | 1.5        | 2.600     | 2.3        | 6.500     | 3.6        |           |            |

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|                                                            |                     |                                   |                             |                       |                                                                                     |
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| Innovyze                                                   |                     | Source Control 2019.1             |                             |                       |                                                                                     |
| <u>Summary of Results for 30 year Return Period</u>        |                     |                                   |                             |                       |                                                                                     |
| Storm<br>Event                                             | Max<br>Level<br>(m) | Max<br>Depth<br>(m)               | Max<br>Control<br>(l/s)     | Max<br>Volume<br>(m³) | Status                                                                              |
| 15 min Summer                                              | 4.391               | 0.091                             | 1.1                         | 43.7                  | ○ K                                                                                 |
| 30 min Summer                                              | 4.418               | 0.118                             | 1.1                         | 57.6                  | ○ K                                                                                 |
| 60 min Summer                                              | 4.446               | 0.146                             | 1.1                         | 72.2                  | ○ K                                                                                 |
| 120 min Summer                                             | 4.472               | 0.172                             | 1.1                         | 86.2                  | ○ K                                                                                 |
| 180 min Summer                                             | 4.485               | 0.185                             | 1.1                         | 93.5                  | ○ K                                                                                 |
| 240 min Summer                                             | 4.493               | 0.193                             | 1.1                         | 97.7                  | ○ K                                                                                 |
| 360 min Summer                                             | 4.499               | 0.199                             | 1.1                         | 101.5                 | ○ K                                                                                 |
| 480 min Summer                                             | 4.501               | 0.201                             | 1.1                         | 102.3                 | Flood Risk                                                                          |
| 600 min Summer                                             | 4.500               | 0.200                             | 1.1                         | 101.8                 | ○ K                                                                                 |
| 720 min Summer                                             | 4.497               | 0.197                             | 1.1                         | 100.5                 | ○ K                                                                                 |
| 960 min Summer                                             | 4.493               | 0.193                             | 1.1                         | 97.9                  | ○ K                                                                                 |
| 1440 min Summer                                            | 4.485               | 0.185                             | 1.1                         | 93.4                  | ○ K                                                                                 |
| 2160 min Summer                                            | 4.474               | 0.174                             | 1.1                         | 87.3                  | ○ K                                                                                 |
| 2880 min Summer                                            | 4.464               | 0.164                             | 1.1                         | 81.7                  | ○ K                                                                                 |
| 4320 min Summer                                            | 4.447               | 0.147                             | 1.1                         | 72.5                  | ○ K                                                                                 |
| 5760 min Summer                                            | 4.433               | 0.133                             | 1.1                         | 65.2                  | ○ K                                                                                 |
| 7200 min Summer                                            | 4.422               | 0.122                             | 1.1                         | 59.5                  | ○ K                                                                                 |
| 8640 min Summer                                            | 4.413               | 0.113                             | 1.1                         | 55.0                  | ○ K                                                                                 |
| 10080 min Summer                                           | 4.406               | 0.106                             | 1.1                         | 51.3                  | ○ K                                                                                 |
| 15 min Winter                                              | 4.402               | 0.102                             | 1.1                         | 49.0                  | ○ K                                                                                 |
| Storm<br>Event                                             | Rain<br>(mm/hr)     | Flooded<br>Volume<br>(m³)         | Discharge<br>Volume<br>(m³) | Time-Peak<br>(mins)   |                                                                                     |
| 15 min Summer                                              | 80.074              | 0.0                               | 37.8                        | 26                    |                                                                                     |
| 30 min Summer                                              | 53.043              | 0.0                               | 50.9                        | 41                    |                                                                                     |
| 60 min Summer                                              | 33.627              | 0.0                               | 71.1                        | 70                    |                                                                                     |
| 120 min Summer                                             | 20.547              | 0.0                               | 87.1                        | 128                   |                                                                                     |
| 180 min Summer                                             | 15.177              | 0.0                               | 96.6                        | 188                   |                                                                                     |
| 240 min Summer                                             | 12.151              | 0.0                               | 103.1                       | 246                   |                                                                                     |
| 360 min Summer                                             | 8.775               | 0.0                               | 111.5                       | 364                   |                                                                                     |
| 480 min Summer                                             | 6.927               | 0.0                               | 117.1                       | 482                   |                                                                                     |
| 600 min Summer                                             | 5.754               | 0.0                               | 121.3                       | 600                   |                                                                                     |
| 720 min Summer                                             | 4.941               | 0.0                               | 124.6                       | 676                   |                                                                                     |
| 960 min Summer                                             | 3.880               | 0.0                               | 129.6                       | 776                   |                                                                                     |
| 1440 min Summer                                            | 2.770               | 0.0                               | 136.1                       | 1024                  |                                                                                     |
| 2160 min Summer                                            | 1.995               | 0.0                               | 157.2                       | 1428                  |                                                                                     |
| 2880 min Summer                                            | 1.593               | 0.0                               | 167.1                       | 1828                  |                                                                                     |
| 4320 min Summer                                            | 1.181               | 0.0                               | 184.7                       | 2636                  |                                                                                     |
| 5760 min Summer                                            | 0.969               | 0.0                               | 205.9                       | 3400                  |                                                                                     |
| 7200 min Summer                                            | 0.840               | 0.0                               | 222.9                       | 4120                  |                                                                                     |
| 8640 min Summer                                            | 0.753               | 0.0                               | 239.3                       | 4848                  |                                                                                     |
| 10080 min Summer                                           | 0.690               | 0.0                               | 254.6                       | 5560                  |                                                                                     |
| 15 min Winter                                              | 80.074              | 0.0                               | 42.7                        | 26                    |                                                                                     |
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|                                                            |               |                                   |                       |                  |                                                                                     |
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| Innovyze                                                   |               | Source Control 2019.1             |                       |                  |                                                                                     |
| <u>Summary of Results for 30 year Return Period</u>        |               |                                   |                       |                  |                                                                                     |
| Storm Event                                                | Max Level (m) | Max Depth (m)                     | Max Control (l/s)     | Max Volume (m³)  | Status                                                                              |
| 30 min Winter                                              | 4.432         | 0.132                             | 1.1                   | 64.6             | O K                                                                                 |
| 60 min Winter                                              | 4.462         | 0.162                             | 1.1                   | 81.1             | O K                                                                                 |
| 120 min Winter                                             | 4.491         | 0.191                             | 1.1                   | 97.1             | O K                                                                                 |
| 180 min Winter                                             | 4.506         | 0.206                             | 1.1                   | 105.5            | Flood Risk                                                                          |
| 240 min Winter                                             | 4.515         | 0.215                             | 1.1                   | 110.5            | Flood Risk                                                                          |
| 360 min Winter                                             | 4.523         | 0.223                             | 1.1                   | 115.2            | Flood Risk                                                                          |
| 480 min Winter                                             | 4.526         | 0.226                             | 1.1                   | 116.7            | Flood Risk                                                                          |
| 600 min Winter                                             | 4.526         | 0.226                             | 1.1                   | 116.6            | Flood Risk                                                                          |
| 720 min Winter                                             | 4.524         | 0.224                             | 1.1                   | 115.7            | Flood Risk                                                                          |
| 960 min Winter                                             | 4.518         | 0.218                             | 1.1                   | 112.2            | Flood Risk                                                                          |
| 1440 min Winter                                            | 4.507         | 0.207                             | 1.1                   | 105.6            | Flood Risk                                                                          |
| 2160 min Winter                                            | 4.490         | 0.190                             | 1.1                   | 96.5             | O K                                                                                 |
| 2880 min Winter                                            | 4.475         | 0.175                             | 1.1                   | 87.7             | O K                                                                                 |
| 4320 min Winter                                            | 4.447         | 0.147                             | 1.1                   | 72.8             | O K                                                                                 |
| 5760 min Winter                                            | 4.425         | 0.125                             | 1.1                   | 61.1             | O K                                                                                 |
| 7200 min Winter                                            | 4.408         | 0.108                             | 1.1                   | 52.3             | O K                                                                                 |
| 8640 min Winter                                            | 4.395         | 0.095                             | 1.1                   | 45.6             | O K                                                                                 |
| 10080 min Winter                                           | 4.385         | 0.085                             | 1.0                   | 40.6             | O K                                                                                 |
| Storm Event                                                | Rain (mm/hr)  | Flooded Volume (m³)               | Discharge Volume (m³) | Time-Peak (mins) |                                                                                     |
| 30 min Winter                                              | 53.043        | 0.0                               | 57.1                  | 40               |                                                                                     |
| 60 min Winter                                              | 33.627        | 0.0                               | 79.8                  | 70               |                                                                                     |
| 120 min Winter                                             | 20.547        | 0.0                               | 97.7                  | 126              |                                                                                     |
| 180 min Winter                                             | 15.177        | 0.0                               | 108.2                 | 184              |                                                                                     |
| 240 min Winter                                             | 12.151        | 0.0                               | 115.4                 | 242              |                                                                                     |
| 360 min Winter                                             | 8.775         | 0.0                               | 124.6                 | 358              |                                                                                     |
| 480 min Winter                                             | 6.927         | 0.0                               | 130.7                 | 472              |                                                                                     |
| 600 min Winter                                             | 5.754         | 0.0                               | 135.3                 | 584              |                                                                                     |
| 720 min Winter                                             | 4.941         | 0.0                               | 138.8                 | 694              |                                                                                     |
| 960 min Winter                                             | 3.880         | 0.0                               | 143.9                 | 900              |                                                                                     |
| 1440 min Winter                                            | 2.770         | 0.0                               | 149.5                 | 1110             |                                                                                     |
| 2160 min Winter                                            | 1.995         | 0.0                               | 176.2                 | 1560             |                                                                                     |
| 2880 min Winter                                            | 1.593         | 0.0                               | 187.3                 | 1992             |                                                                                     |
| 4320 min Winter                                            | 1.181         | 0.0                               | 207.1                 | 2812             |                                                                                     |
| 5760 min Winter                                            | 0.969         | 0.0                               | 230.8                 | 3576             |                                                                                     |
| 7200 min Winter                                            | 0.840         | 0.0                               | 249.9                 | 4320             |                                                                                     |
| 8640 min Winter                                            | 0.753         | 0.0                               | 268.3                 | 5016             |                                                                                     |
| 10080 min Winter                                           | 0.690         | 0.0                               | 285.7                 | 5656             |                                                                                     |
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|                                                            |                                   |                                                                                     |
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| Innovyze Source Control 2019.1                             |                                   |                                                                                     |

Rainfall Details

|                       |                                 |
|-----------------------|---------------------------------|
| Rainfall Model        | FEH                             |
| Return Period (years) | 30                              |
| FEH Rainfall Version  | 2013                            |
| Site Location         | GB 497381 100755 SU 97381 00755 |
| Data Type             | Point                           |
| Summer Storms         | Yes                             |
| Winter Storms         | Yes                             |
| Cv (Summer)           | 0.750                           |
| Cv (Winter)           | 0.840                           |
| Shortest Storm (mins) | 15                              |
| Longest Storm (mins)  | 10080                           |
| Climate Change %      | +0                              |

Time Area Diagram

Total Area (ha) 0.000

| Time (mins) | Area  |
|-------------|-------|
| From: To:   | (ha)  |
| 0 4         | 0.000 |

Time Area Diagram

Total Area (ha) 0.297

| Time (mins) | Area  | Time (mins) | Area  | Time (mins) | Area  |
|-------------|-------|-------------|-------|-------------|-------|
| From: To:   | (ha)  | From: To:   | (ha)  | From: To:   | (ha)  |
| 0 4         | 0.099 | 4 8         | 0.099 | 8 12        | 0.099 |

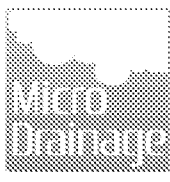
Time Area Diagram

Total Area (ha) 0.000

| Time (mins) | Area  |
|-------------|-------|
| From: To:   | (ha)  |
| 0 4         | 0.000 |

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|                                                            |                                   |                                                                                     |
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| Innovyze<br>Source Control 2019.1                          |                                   |                                                                                     |

Model Details

Storage is Online Cover Level (m) 4.800

Tank or Pond Structure

Invert Level (m) 4.300

| Depth (m) | Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) |
|-----------|------------------------|-----------|------------------------|
| 0.000     | 455.0                  | 0.500     | 755.0                  |

Hydro-Brake® Optimum Outflow Control

|                                   |                            |
|-----------------------------------|----------------------------|
| Unit Reference                    | MD-SHE-0056-1100-0500-1100 |
| Design Head (m)                   | 0.500                      |
| Design Flow (l/s)                 | 1.1                        |
| Flush-Flo™                        | Calculated                 |
| Objective                         | Minimise upstream storage  |
| Application                       | Surface                    |
| Sump Available                    | Yes                        |
| Diameter (mm)                     | 56                         |
| Invert Level (m)                  | 4.300                      |
| Minimum Outlet Pipe Diameter (mm) | 75                         |
| Suggested Manhole Diameter (mm)   | 1200                       |

| Control Points            | Head (m) | Flow (l/s) |
|---------------------------|----------|------------|
| Design Point (Calculated) | 0.500    | 1.1        |
| Flush-Flo™                | 0.148    | 1.1        |
| Kick-Flo®                 | 0.331    | 0.9        |
| Mean Flow over Head Range | -        | 1.0        |

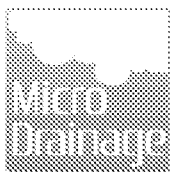
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|-----------|------------|-----------|------------|-----------|------------|-----------|------------|
| 0.100     | 1.1        | 1.200     | 1.6        | 3.000     | 2.5        | 7.000     | 3.7        |
| 0.200     | 1.1        | 1.400     | 1.7        | 3.500     | 2.7        | 7.500     | 3.8        |
| 0.300     | 1.0        | 1.600     | 1.9        | 4.000     | 2.8        | 8.000     | 4.0        |
| 0.400     | 1.0        | 1.800     | 2.0        | 4.500     | 3.0        | 8.500     | 4.1        |
| 0.500     | 1.1        | 2.000     | 2.1        | 5.000     | 3.1        | 9.000     | 4.2        |
| 0.600     | 1.2        | 2.200     | 2.1        | 5.500     | 3.3        | 9.500     | 4.3        |
| 0.800     | 1.4        | 2.400     | 2.2        | 6.000     | 3.4        |           |            |
| 1.000     | 1.5        | 2.600     | 2.3        | 6.500     | 3.6        |           |            |

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|                                                             |               |                                   |                       |                  |                                                                                     |
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| Innovyze                                                    |               | Source Control 2019.1             |                       |                  |                                                                                     |
| <u>Summary of Results for 100 year Return Period (+40%)</u> |               |                                   |                       |                  |                                                                                     |
| Storm Event                                                 | Max Level (m) | Max Depth (m)                     | Max Control (l/s)     | Max Volume (m³)  | Status                                                                              |
| 15 min Summer                                               | 4.455         | 0.155                             | 1.1                   | 77.1             | O K                                                                                 |
| 30 min Summer                                               | 4.502         | 0.202                             | 1.1                   | 102.8            | Flood Risk                                                                          |
| 60 min Summer                                               | 4.550         | 0.250                             | 1.1                   | 130.9            | Flood Risk                                                                          |
| 120 min Summer                                              | 4.590         | 0.290                             | 1.1                   | 155.0            | Flood Risk                                                                          |
| 180 min Summer                                              | 4.611         | 0.311                             | 1.1                   | 168.3            | Flood Risk                                                                          |
| 240 min Summer                                              | 4.624         | 0.324                             | 1.1                   | 176.9            | Flood Risk                                                                          |
| 360 min Summer                                              | 4.639         | 0.339                             | 1.1                   | 186.6            | Flood Risk                                                                          |
| 480 min Summer                                              | 4.647         | 0.347                             | 1.1                   | 191.4            | Flood Risk                                                                          |
| 600 min Summer                                              | 4.650         | 0.350                             | 1.1                   | 193.8            | Flood Risk                                                                          |
| 720 min Summer                                              | 4.652         | 0.352                             | 1.1                   | 194.7            | Flood Risk                                                                          |
| 960 min Summer                                              | 4.651         | 0.351                             | 1.1                   | 194.1            | Flood Risk                                                                          |
| 1440 min Summer                                             | 4.642         | 0.342                             | 1.1                   | 188.2            | Flood Risk                                                                          |
| 2160 min Summer                                             | 4.626         | 0.326                             | 1.1                   | 177.6            | Flood Risk                                                                          |
| 2880 min Summer                                             | 4.612         | 0.312                             | 1.1                   | 169.3            | Flood Risk                                                                          |
| 4320 min Summer                                             | 4.593         | 0.293                             | 1.1                   | 156.9            | Flood Risk                                                                          |
| 5760 min Summer                                             | 4.577         | 0.277                             | 1.1                   | 147.2            | Flood Risk                                                                          |
| 7200 min Summer                                             | 4.564         | 0.264                             | 1.1                   | 139.4            | Flood Risk                                                                          |
| 8640 min Summer                                             | 4.553         | 0.253                             | 1.1                   | 132.9            | Flood Risk                                                                          |
| 10080 min Summer                                            | 4.544         | 0.244                             | 1.1                   | 127.2            | Flood Risk                                                                          |
| 15 min Winter                                               | 4.472         | 0.172                             | 1.1                   | 86.5             | O K                                                                                 |
| Storm Event                                                 | Rain (mm/hr)  | Flooded Volume (m³)               | Discharge Volume (m³) | Time-Peak (mins) |                                                                                     |
| 15 min Summer                                               | 140.493       | 0.0                               | 67.4                  | 27               |                                                                                     |
| 30 min Summer                                               | 93.886        | 0.0                               | 85.5                  | 41               |                                                                                     |
| 60 min Summer                                               | 60.155        | 0.0                               | 127.5                 | 70               |                                                                                     |
| 120 min Summer                                              | 36.094        | 0.0                               | 151.3                 | 130              |                                                                                     |
| 180 min Summer                                              | 26.478        | 0.0                               | 163.7                 | 190              |                                                                                     |
| 240 min Summer                                              | 21.127        | 0.0                               | 170.3                 | 250              |                                                                                     |
| 360 min Summer                                              | 15.217        | 0.0                               | 173.6                 | 368              |                                                                                     |
| 480 min Summer                                              | 11.991        | 0.0                               | 171.9                 | 488              |                                                                                     |
| 600 min Summer                                              | 9.949         | 0.0                               | 169.5                 | 606              |                                                                                     |
| 720 min Summer                                              | 8.533         | 0.0                               | 167.1                 | 726              |                                                                                     |
| 960 min Summer                                              | 6.692         | 0.0                               | 162.5                 | 964              |                                                                                     |
| 1440 min Summer                                             | 4.760         | 0.0                               | 153.9                 | 1440             |                                                                                     |
| 2160 min Summer                                             | 3.406         | 0.0                               | 267.0                 | 1756             |                                                                                     |
| 2880 min Summer                                             | 2.704         | 0.0                               | 280.7                 | 2088             |                                                                                     |
| 4320 min Summer                                             | 1.984         | 0.0                               | 292.9                 | 2896             |                                                                                     |
| 5760 min Summer                                             | 1.612         | 0.0                               | 343.2                 | 3696             |                                                                                     |
| 7200 min Summer                                             | 1.387         | 0.0                               | 368.8                 | 4536             |                                                                                     |
| 8640 min Summer                                             | 1.235         | 0.0                               | 393.5                 | 5288             |                                                                                     |
| 10080 min Summer                                            | 1.125         | 0.0                               | 416.8                 | 6064             |                                                                                     |
| 15 min Winter                                               | 140.493       | 0.0                               | 74.7                  | 26               |                                                                                     |
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|                                                             |                     |                                   |                             |                       |                                                                                     |
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| Innovyze                                                    |                     | Source Control 2019.1             |                             |                       |                                                                                     |
| <u>Summary of Results for 100 year Return Period (+40%)</u> |                     |                                   |                             |                       |                                                                                     |
| Storm<br>Event                                              | Max<br>Level<br>(m) | Max<br>Depth<br>(m)               | Max<br>Control<br>(l/s)     | Max<br>Volume<br>(m³) | Status                                                                              |
| 30 min Winter                                               | 4.524               | 0.224                             | 1.1                         | 115.4                 | Flood Risk                                                                          |
| 60 min Winter                                               | 4.577               | 0.277                             | 1.1                         | 146.9                 | Flood Risk                                                                          |
| 120 min Winter                                              | 4.620               | 0.320                             | 1.1                         | 174.3                 | Flood Risk                                                                          |
| 180 min Winter                                              | 4.644               | 0.344                             | 1.1                         | 189.6                 | Flood Risk                                                                          |
| 240 min Winter                                              | 4.659               | 0.359                             | 1.1                         | 199.5                 | Flood Risk                                                                          |
| 360 min Winter                                              | 4.676               | 0.376                             | 1.1                         | 210.8                 | Flood Risk                                                                          |
| 480 min Winter                                              | 4.684               | 0.384                             | 1.1                         | 216.6                 | Flood Risk                                                                          |
| 600 min Winter                                              | 4.689               | 0.389                             | 1.1                         | 219.7                 | Flood Risk                                                                          |
| 720 min Winter                                              | 4.691               | 0.391                             | 1.1                         | 221.2                 | Flood Risk                                                                          |
| 960 min Winter                                              | 4.692               | 0.392                             | 1.1                         | 221.5                 | Flood Risk                                                                          |
| 1440 min Winter                                             | 4.685               | 0.385                             | 1.1                         | 217.1                 | Flood Risk                                                                          |
| 2160 min Winter                                             | 4.669               | 0.369                             | 1.1                         | 206.0                 | Flood Risk                                                                          |
| 2880 min Winter                                             | 4.653               | 0.353                             | 1.1                         | 195.7                 | Flood Risk                                                                          |
| 4320 min Winter                                             | 4.626               | 0.326                             | 1.1                         | 178.0                 | Flood Risk                                                                          |
| 5760 min Winter                                             | 4.599               | 0.299                             | 1.1                         | 161.0                 | Flood Risk                                                                          |
| 7200 min Winter                                             | 4.576               | 0.276                             | 1.1                         | 146.7                 | Flood Risk                                                                          |
| 8640 min Winter                                             | 4.556               | 0.256                             | 1.1                         | 134.3                 | Flood Risk                                                                          |
| 10080 min Winter                                            | 4.537               | 0.237                             | 1.1                         | 123.2                 | Flood Risk                                                                          |
| Storm<br>Event                                              | Rain<br>(mm/hr)     | Flooded<br>Volume<br>(m³)         | Discharge<br>Volume<br>(m³) | Time-Peak<br>(mins)   |                                                                                     |
| 30 min Winter                                               | 93.886              | 0.0                               | 90.6                        | 41                    |                                                                                     |
| 60 min Winter                                               | 60.155              | 0.0                               | 142.1                       | 70                    |                                                                                     |
| 120 min Winter                                              | 36.094              | 0.0                               | 166.1                       | 128                   |                                                                                     |
| 180 min Winter                                              | 26.478              | 0.0                               | 174.4                       | 186                   |                                                                                     |
| 240 min Winter                                              | 21.127              | 0.0                               | 175.2                       | 246                   |                                                                                     |
| 360 min Winter                                              | 15.217              | 0.0                               | 172.2                       | 362                   |                                                                                     |
| 480 min Winter                                              | 11.991              | 0.0                               | 169.5                       | 480                   |                                                                                     |
| 600 min Winter                                              | 9.949               | 0.0                               | 167.1                       | 596                   |                                                                                     |
| 720 min Winter                                              | 8.533               | 0.0                               | 165.0                       | 712                   |                                                                                     |
| 960 min Winter                                              | 6.692               | 0.0                               | 161.0                       | 942                   |                                                                                     |
| 1440 min Winter                                             | 4.760               | 0.0                               | 153.8                       | 1388                  |                                                                                     |
| 2160 min Winter                                             | 3.406               | 0.0                               | 296.6                       | 2012                  |                                                                                     |
| 2880 min Winter                                             | 2.704               | 0.0                               | 307.4                       | 2280                  |                                                                                     |
| 4320 min Winter                                             | 1.984               | 0.0                               | 297.9                       | 3200                  |                                                                                     |
| 5760 min Winter                                             | 1.612               | 0.0                               | 384.4                       | 4040                  |                                                                                     |
| 7200 min Winter                                             | 1.387               | 0.0                               | 413.1                       | 4904                  |                                                                                     |
| 8640 min Winter                                             | 1.235               | 0.0                               | 440.8                       | 5712                  |                                                                                     |
| 10080 min Winter                                            | 1.125               | 0.0                               | 467.2                       | 6552                  |                                                                                     |
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|                                                            |                                   |                                                                                     |
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Rainfall Details

|                       |                                 |
|-----------------------|---------------------------------|
| Rainfall Model        | FEH                             |
| Return Period (years) | 100                             |
| FEH Rainfall Version  | 2013                            |
| Site Location         | GB 497381 100755 SU 97381 00755 |
| Data Type             | Point                           |
| Summer Storms         | Yes                             |
| Winter Storms         | Yes                             |
| Cv (Summer)           | 0.750                           |
| Cv (Winter)           | 0.840                           |
| Shortest Storm (mins) | 15                              |
| Longest Storm (mins)  | 10080                           |
| Climate Change %      | +40                             |

Time Area Diagram

Total Area (ha) 0.000

| Time (mins) | Area  |
|-------------|-------|
| From: To:   | (ha)  |
| 0 4         | 0.000 |

Time Area Diagram

Total Area (ha) 0.297

| Time (mins) | Area  | Time (mins) | Area  | Time (mins) | Area  |
|-------------|-------|-------------|-------|-------------|-------|
| From: To:   | (ha)  | From: To:   | (ha)  | From: To:   | (ha)  |
| 0 4         | 0.099 | 4 8         | 0.099 | 8 12        | 0.099 |

Time Area Diagram

Total Area (ha) 0.000

| Time (mins) | Area  |
|-------------|-------|
| From: To:   | (ha)  |
| 0 4         | 0.000 |

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|                                                            |                                   |                                                                                     |
|------------------------------------------------------------|-----------------------------------|-------------------------------------------------------------------------------------|
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Model Details

Storage is Online Cover Level (m) 4.800

Tank or Pond Structure

Invert Level (m) 4.300

| Depth (m) | Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) |
|-----------|------------------------|-----------|------------------------|
| 0.000     | 455.0                  | 0.500     | 755.0                  |

Hydro-Brake® Optimum Outflow Control

|                                   |                            |
|-----------------------------------|----------------------------|
| Unit Reference                    | MD-SHE-0056-1100-0500-1100 |
| Design Head (m)                   | 0.500                      |
| Design Flow (l/s)                 | 1.1                        |
| Flush-Flo™                        | Calculated                 |
| Objective                         | Minimise upstream storage  |
| Application                       | Surface                    |
| Sump Available                    | Yes                        |
| Diameter (mm)                     | 56                         |
| Invert Level (m)                  | 4.300                      |
| Minimum Outlet Pipe Diameter (mm) | 75                         |
| Suggested Manhole Diameter (mm)   | 1200                       |

| Control Points            | Head (m) | Flow (l/s) |
|---------------------------|----------|------------|
| Design Point (Calculated) | 0.500    | 1.1        |
| Flush-Flo™                | 0.148    | 1.1        |
| Kick-Flo®                 | 0.331    | 0.9        |
| Mean Flow over Head Range | -        | 1.0        |

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     | 1.1        | 1.200     | 1.6        | 3.000     | 2.5        | 7.000     | 3.7        |
| 0.200     | 1.1        | 1.400     | 1.7        | 3.500     | 2.7        | 7.500     | 3.8        |
| 0.300     | 1.0        | 1.600     | 1.9        | 4.000     | 2.8        | 8.000     | 4.0        |
| 0.400     | 1.0        | 1.800     | 2.0        | 4.500     | 3.0        | 8.500     | 4.1        |
| 0.500     | 1.1        | 2.000     | 2.1        | 5.000     | 3.1        | 9.000     | 4.2        |
| 0.600     | 1.2        | 2.200     | 2.1        | 5.500     | 3.3        | 9.500     | 4.3        |
| 0.800     | 1.4        | 2.400     | 2.2        | 6.000     | 3.4        |           |            |
| 1.000     | 1.5        | 2.600     | 2.3        | 6.500     | 3.6        |           |            |

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