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Drainage Statement

Proposed Residential Development at

Waterford Gardens, Climping, West Sussex

On behalf of

Waterford Properties Limited

February 2022

Document History and Status

Project Number 23078

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1 Non Technical Summary

- 1.1 This Drainage Statement has been undertaken on behalf of Waterford Properties Limited in support of a Planning Application for the construction of two semi detached houses with parking and access.
- 1.2 This Statement is to be read in conjunction with all planning, architectural and other reports that accompany the Planning Application for the proposed development.
- 1.3 The proposed development will incorporate a sustainable drainage system which will discharge surface water at a restricted discharge to the adjacent ditch.
- 1.4 Storage will be provided for all storm return periods up to and including the 1:100 year rainfall event with an allowance for climate change.
- 1.5 Foul water will be discharged to the existing public foul sewer located beneath Horsemere Green Lane.
- 1.6 This Statement concludes that a suitable surface water and foul water drainage system can be designed to accommodate the anticipated flows from the proposed development.

2 Design Criteria

- 2.1 The surface water drainage system has been designed in accordance with the National Planning Policy Framework (NPPF), its accompanying Guidance and Technical Standards for SuDS. It also complies with the requirements under Building Regulations Part H.
- 2.2 The surface water drainage system and storage have been designed to accept the discharge from a 100 year return period pluvial event with a further 40% allowance for future climate change.
- 2.3 In accordance with CIRIA SuDS Manual 2015 (Report C753), NPPF and Building Regulations Part H surface water drainage design follows a discharge destination hierarchy ranging from infiltration to ground as first priority before consideration for discharging to a watercourse and as a last resort discharging to a public sewer.
- 2.4 The foul drainage system has been designed to the Design and Construction Guidance in the Sewage Sector Guidance.

3 Existing Site

3.1 Site Location

3.1.1 The development site is located on land to the south of Horsemere Green Lane and north of Waterford Gardens, Climping, Littlehampton, West Sussex BN17 5PQ.



Image 1: Site Location

3.1.2 A copy of the site location plan is located in Appendix 1 at the rear of this report.

3.2 Site Description

3.2.1 The site is approximately 600m² in area and currently an undeveloped open space area.

3.2.2 Existing ground levels are highest at the southern boundary of the site at approximately 6.25m AOD. The site falls towards its northern boundary to a level of approximately 5m AOD.

3.2.3 A copy of the existing site layout plan is located in Appendix 2 at the rear of this report.

3.3 Existing Drainage

- 3.3.1 The site currently has no positive surface water or foul water drainage infrastructure.
- 3.3.2 Rainfall currently discharges in part to ground and in part overland as a greenfield runoff to the north of the site.
- 3.3.3 Pre-developed greenfield runoff rates have been established using the HR Wallingford tool for Greenfield runoff estimation.



HR Wallingford
Building with Nature

Greenfield runoff rate
estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:

Site name:

Site location:

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SO902 19 (2013), the SuDS Manual C763 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach:

Site characteristics

Total site area (ha):

Methodology

Q_{BAR} estimation method:

SPR estimation method:

Soil characteristics

	Default	Edited
SOIL type:	3	3
HOST class:	N/A	N/A
SPR/SPRH/OST	0.37	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm):	722	722
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):	2.98	2.98
1 in 1 year (l/s):	2.53	2.53
1 in 30 years (l/s):	6.85	6.85
1 in 100 years (l/s):	9.5	9.5
1 in 200 years (l/s):	11.14	11.14

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

Site Details

Latitude:

Longitude:

Reference:

Date:

Notes

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

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

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

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

(3) Is $SPR/SPRH/OST \leq 0.37$?

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

Image 2: Greenfield Runoff Calculation

3.3.1 The pre-developed greenfield runoff rates are as follows:

- Q_{bar} 2.98 l/s/ha
- 1:100 year 9.5 l/s/ha

3.4 Geology and Groundwater

3.4.1 An initial site investigation was carried out as part of the original design work in 2001 when development in this location was first proposed but not constructed. From that site investigation an infiltration rate of 2.03×10^{-6} m/s was recorded.

3.4.2 An additional site investigation was carried out by Ground and Water in January 2021 and comprised the machine excavation of 3 Trial Pits, referenced TP1 – TP3, to depths of between 0.70m – 2.10m bgl. Soakage tests in accordance with the principles of BRE365 were undertaken within TP1 – TP3.

3.4.3 A summary of the ground conditions encountered within the site investigation in January 2021 is as follows:

Strata	Depth Encountered (m bgl)	Final Depth (m bgl)	Thickness (m)
MADE GROUND (All Trial Holes): Brown slightly sandy silty CLAY. The sand was fine to coarse.	0.00	0.30 – 0.40	0.30 – 0.40
UNDIFFERENTIATED RIVER TERRACE DEPOSITS (TP1): Greyish brown to orangish brown sandy silty CLAY. Sand was fine to medium.	0.40	1.50	1.10
RAISED BEACH DEPOSITS (All Trial Holes): Greyish brown to orangish brown and grey gravelly clayey fine to medium SAND. The gravel was angular to sub-rounded fine to coarse flint.	0.30 – 1.50	>0.70 - >2.10	>0.40 – >1.80

Table 1: Ground Conditions

3.4.4 No groundwater or perched water was encountered within the trial holes during the investigation.

3.4.5 Soakage testing, in accordance with the principles of BRE365, was undertaken within TP1 – TP3 between 0.70m and 2.10m bgl.

3.4.6 The infiltration rates recorded are as follows:

Trial Hole / Depth / Stratum	Test 1	Test 2	Test 3
TP1 @ 2.10m bgl, within the 1st Raised Beach Deposits	7.59×10^{-7} m/s **	1.45×10^{-6} m/s	3.22×10^{-6} m/s *
TP2 @ 0.70m bgl, within the 1st Raised Beach Deposits (Silted to 0.63m bgl in Test 3)	5.77×10^{-6} m/s	2.30×10^{-6} m/s	1.48×10^{-6} m/s
TP3 @ 2.10m bgl, within the 1st Raised Beach Deposits (Silted to 2.03m bgl in Test 3)	4.50×10^{-7} m/s	2.56×10^{-6} m/s	2.04×10^{-6} m/s

Table 2: Recorded Infiltration Rates

** Given the close proximity to the pond on site, it was likely the soils were already saturated, as well as from the previous day's rainfall. This could account for the slow infiltration rate.

3.4.7 After discussions with Arun District Council Drainage Team infiltration has been discounted at this location.

4 Development Proposals

4.1 Description

- 4.1.1 The proposed development will consist of the construction of two semi-detached houses with parking and access on land to the south of Horsemere Green Lane, Climping, Littlehampton, West Sussex BN17 5PQ.

4.2 Impermeable areas

- 4.2.1 The impermeable areas of the various elements of the development are summarised as follows:

- Roof areas 130m²
- Access road and parking areas 85m²

4.3 Surface Water Drainage

- 4.3.1 CIRIA report C753 The SuDS Manual-v6 provides guidance on the redevelopment of brownfield sites. The aim for surface water runoff is to match greenfield runoff rates and volumes where reasonably achievable.

- 4.3.2 For surface water discharge, the drainage hierarchy notes the following list of drainage options in order of preference:

1. Infiltration to ground
2. Discharge to a watercourse
3. Discharge to a surface water sewer
4. Discharge to a foul water sewer

- 4.3.3 The proposed surface water drainage strategy will be based on a discharge to the adjacent watercourse / ditch with sufficient storage provided to accommodate a 1:100 year storm event including an additional 40% to account for the predicted effects of future climate change.

- 4.3.4 The total impermeable area of the site will be approximately 215m² and the equivalent Q_{bar} greenfield runoff at 2.98l/s/ha is 0.064l/s.

- 4.3.5 Such low levels of restriction are impractical and HR Wallingford guidance recommends a maximum restriction of 5l/s. Rates of 1l/s are however now achievable.

- 4.3.6 Storage calculations have been prepared in order to demonstrate that surface water drainage can be adequately accommodated within the site without any increased flood risk elsewhere.
- 4.3.7 The discharge has been restricted to 1l/s, the lowest achievable discharge at present for this type of system. A 24m² crate system is proposed with 95% void ratio, providing 9.12m³ of storage.
- 4.3.8 The system has a half drain time from the 100 year plus 40% critical storm of 78 minutes.
- 4.3.9 Surface water from the driveway will discharge via a permeable surface and the unlined crate storage system to the east side of the site before discharging into the watercourse / ditch at the northern boundary of the site.
- 4.3.10 Surface water from the building roofs will be collected in the unlined crate storage system to the east of the site before discharging into the watercourse / ditch at the northern boundary of the site.
- 4.3.11 A drainage channel located across the site entrance will ensure no surface water from the site enters the public highway.
- 4.3.12 The proposed storage crates will be unlined and set 28mm below the outfall level to allow some infiltration to ground and for the first flush of any rainfall event to drain to ground. No allowance for infiltration has been allowed for in the storage calculations.
- 4.3.13 Causeway Flow storage calculations are attached in Appendix 4 at the rear of this report

4.4 Foul Water Drainage

- 4.4.1 It is proposed to discharge foul water by gravity into the public foul sewer adjacent to the site. The connection will be made across Horsemere Green Lane via a new manhole constructed over the sewer.
- 4.4.2 Copies of the proposed drainage strategy plan and calculations are located in Appendix 3 at the rear of this report.

4.5 Water Quality

- 4.5.1 The proposed development is for residential use. In accordance with CIRIA SuDS Manual 2015 (Report C753), the pollution hazard level for this type of development is between very low and low depending on the use / area of the site.

4.5.2 The surface water scheme will include mitigation to ensure that surface water is suitably treated and any pollution risk adequately managed prior to discharge.

4.5.3 Table 26.2 in Chapter 26 of CIRIA report C753 The SuDS Manual provides Pollution Hazard Indices for varying land types. Those of relevance to the development proposals are as follows:

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very Low	0.2	0.2	0.05
Individual property driveways, residential car park, low-traffic roads	Low	0.5	0.4	0.4

Table 3: Pollution Hazard Indices

4.5.4 Where multiple drainage components are used in series the individual mitigation index of secondary and tertiary components is lowered by 50% due to reduced performance associated with primary treatment.

SuDS Type	Total suspended solids (TSS)	Metals	Hydrocarbons
Permeable pavement	0.7	0.6	0.7
Storage with 300mm minimum depth underlying soil drainage media	0.4	0.4	0.4

Table 4: Pollution Mitigation Indices

4.5.5 The proposed use of permeable paving and allowance for some infiltration will meet the target treatment level required for runoff with very low to low risk of pollution hazard thus demonstrating that the surface water drainage system for the site can be designed to adequately mitigate against the risk of pollution.

4.5.6 An outline drainage maintenance schedule is located in Appendix 4 at the rear of this report.

4.6 Flood Routing for Exceedance Flows and Risk to Others

4.6.1 The proposed surface water drainage system has been designed to current standards incorporating SuDS elements providing treatment, attenuation and storage which will minimise runoff leaving the site during times of heavy rain.

- 4.6.2 Allowance has been made for 40% increase in rainfall intensities which accords with the latest figures published by the Environment Agency and in accordance with the requirements under the National Planning Policy Framework.
- 4.6.3 The likelihood of a storm event exceeding the 100 year +40% event is extremely low and the risk of surface water flooding to others due to the development proposals is negligible.
- 4.6.4 In the extremely unlikely event that the future 1:100 year design storm is exceeded the additional surface water would flow overland to the north of the site where it would be intercepted by the existing watercourse (ditch) along the northern site boundary following the route of any exceedance flow from the existing site.

5 Conclusions

- 5.1 The proposed development will incorporate a sustainable drainage system which will discharge surface water via a restricted discharge to the adjacent watercourse / ditch.
- 5.2 A suitable SuDS drainage system is proposed which accords with the requirements of national and local policy.
- 5.3 Preliminary calculations confirm that surface water runoff generated by the proposed development can be attenuated on site for all rainfall events up to the 1:100 year event including an allowance for climate change.
- 5.4 Water quality improvement will be provided to mitigate against any risk to any receiving waterbody.
- 5.5 Foul drainage will be discharged to the existing public foul sewer located beneath Horsemere Green Lane.
- 5.6 A suitable surface water and foul water drainage system has been designed to accommodate the anticipated flows from the proposed development and in terms of drainage the development proposals are suitable at this location.

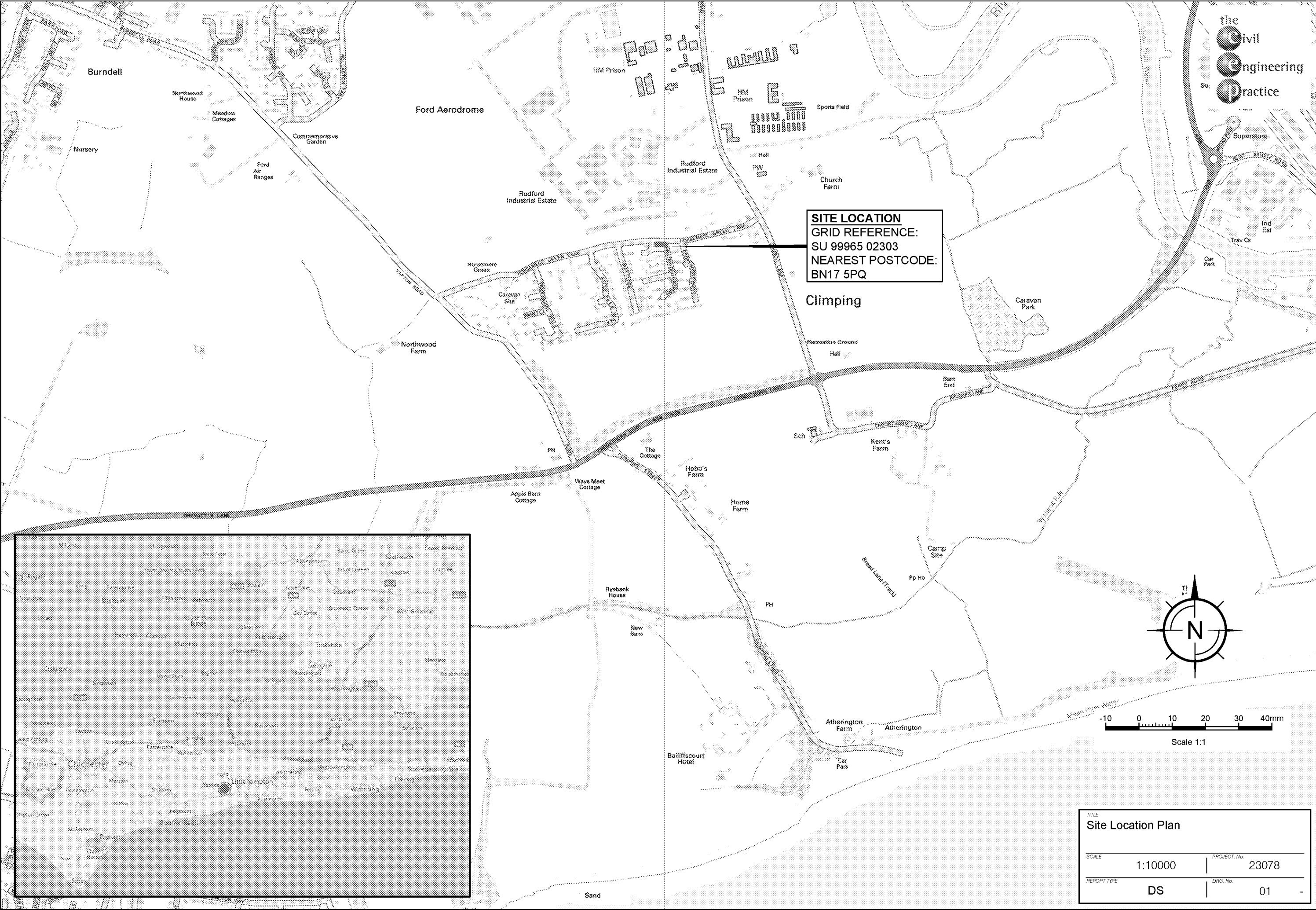
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Appendix 2	Existing Site Layout Plan
Appendix 3	Proposed Drainage Strategy Plan and Calculations
Appendix 4	Outline Drainage Maintenance Schedule

Table 1	Ground Conditions
Table 2	Recorded Infiltration Rates
Table 3	Pollution Hazard Indices
Table 4	Pollution Mitigation Indices

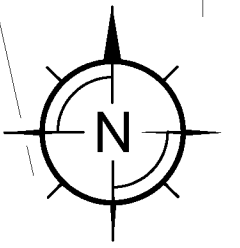
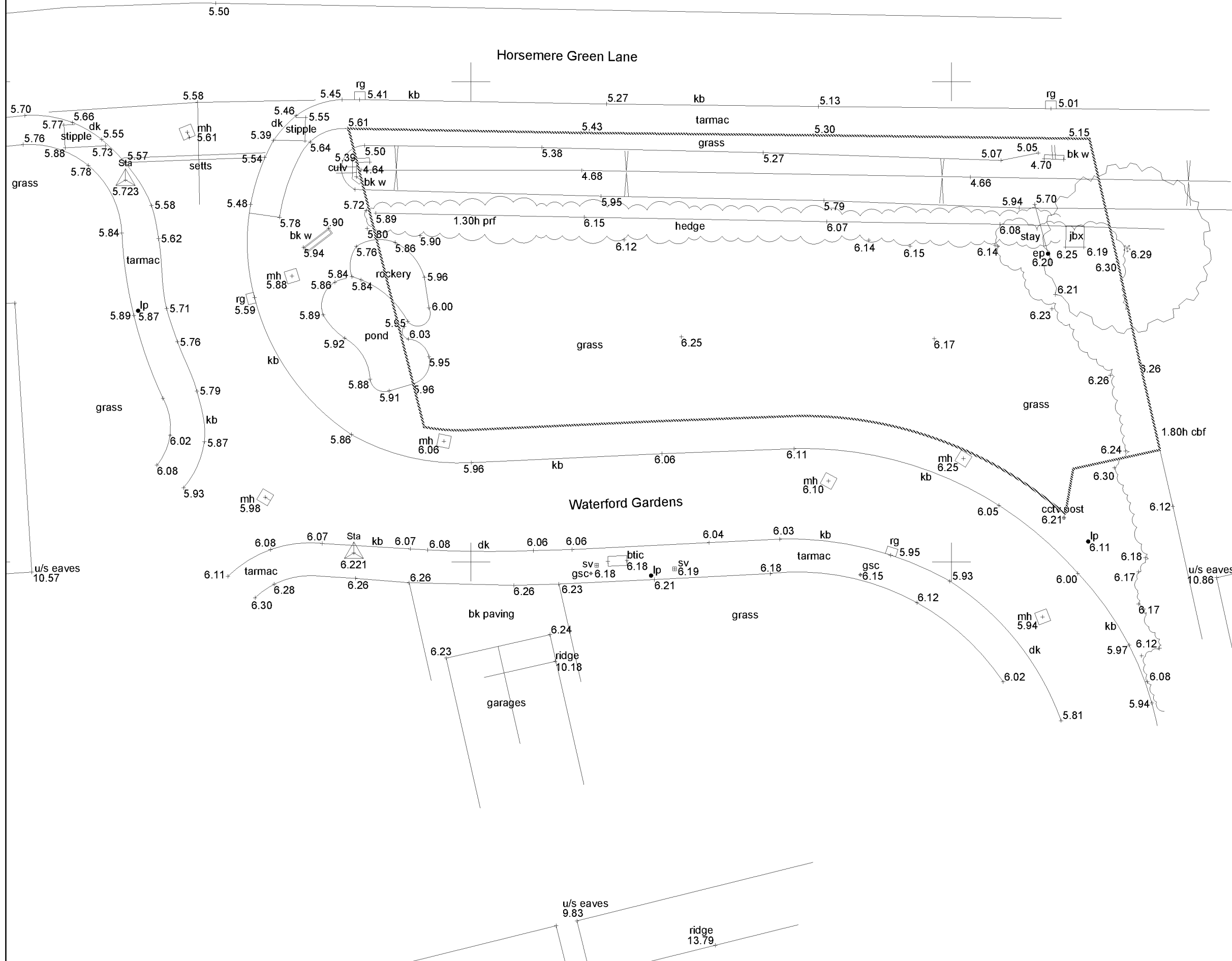
Appendix 1

Site Location Plan



Appendix 2

Existing Site Layout Plan



TITLE Existing Site Layout			
SCALE 1:200		PROJECT No. 23078	
REPORT TYPE DS		DRG. No. 02	

Appendix 3

Proposed Drainage Strategy Plan and Calculations

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.850	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
Storage	0.021	5.00	6.000	1200	1.000

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0
Summer CV	0.850	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.900	Drain Down Time (mins)	2000	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
10	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0

Node Storage Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	5.000	Product Number	CTL-SHE-0055-1000-0400-1000
Design Depth (m)	0.400	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.0	Min Node Diameter (mm)	1200

Node Storage Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	78

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	24.0	0.0	0.400	24.0	0.0	0.401	0.0	0.0

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
120 minute summer	Storage	74	5.063	0.063	1.7	1.5304	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
120 minute summer	Storage	Hydro-Brake®	0.8	3.4

Results for 10 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
60 minute winter	Storage	46	5.125	0.125	3.4	3.0458	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
60 minute winter	Storage	Hydro-Brake®	1.0	5.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
60 minute winter	Storage	49	5.177	0.177	4.5	4.3156	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
60 minute winter	Storage	Hydro-Brake®	1.0	6.5

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
60 minute winter	Storage	58	5.243	0.243	5.7	5.9252	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
60 minute winter	Storage	Hydro-Brake®	1.0	8.3

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
60 minute winter	Storage	60	5.372	0.372	8.0	9.0573	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
60 minute winter	Storage	Hydro-Brake®	1.0	11.7

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.850	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
Storage	0.021	5.00	6.000	1200	1.000

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Normal	Additional Storage (m ³ /ha)	20.0
Summer CV	0.850	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.900	Drain Down Time (mins)	2000	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360
----	----	----	-----	-----	-----	-----

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

Node Storage Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	5.000	Product Number	CTL-SHE-0055-1000-0400-1000
Design Depth (m)	0.400	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.0	Min Node Diameter (mm)	1200

Node Storage Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	78

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	24.0	0.0	0.400	24.0	0.0	0.401	0.0	0.0

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
60 minute winter	Storage	60	5.372	0.372	8.0	9.0573	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
60 minute winter	Storage	Hydro-Brake®	1.0	11.7

Appendix 4

Outline Drainage Maintenance Schedule

Drainage Maintenance Schedule



The Civil Engineering Practice
11 Tungsten Building
George Street
Fishergate
Sussex
BN41 1RA

Project	Waterford Gardens, Climping, West Sussex
Project Number	23078

By Stuart Magowan

Date 15 February 2022

1 Schedule of Maintenance

- 1.1 Once appointed the Contractor will prepare a site specific method statement for the control of silt and other pollutants during construction. CIRIA Report C532, Control of water pollution from construction sites, provides further guidance on this.
- 1.2 The Contractor will maintain the proposed drainage system during construction and until the handing over of the site.
- 1.3 Upon completion management of the shared drainage facilities (where not adopted) will be passed on to a Management Company appointed by the Developer on behalf of the Residents.
- 1.4 In the event that the Management Company becomes unable to discharge its duties within two years of first appointment the Developer will endeavour to appoint an alternative on behalf of the Residents.
- 1.5 Maintenance of individual property drainage connections is the responsibility of the individual property owners.
- 1.6 The following maintenance schedule details the typical tasks to be undertaken at different intervals.

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Manage vegetation and remove nuisance plants – aesthetics	As required
	Litter and debris removal – catchpits	Monthly or as required
	Remove sediment and debris from silt trap chambers, channel drains and inlet chambers	6 monthly
	Visual inspection of permeable paving for defects and settlement	Annually
	Sweeping / brushing of permeable paving	Every 2 years
	Surface and foul water pipework – jetting / rodding	Every 2 years or as required



Maintenance Schedule	Required Action	Frequency
Corrective Maintenance	Remove debris / blockages to silt traps / channel drains	As required
	Repairs to access chambers / manhole covers	As required
	Replace any broken permeable blocks / surface, remedial works to any depressions or rutting	As required
	Inspect inlet, outlet from downpipes and gullies for blockages, standing water and clear	As required

Indicative Schedule of Maintenance for the Proposed Drainage System

2 Financing

- 2.1 The regular maintenance of all private drainage, channels, gutters, rainwater pipes and connections will be the responsibility of the individual property owners.
- 2.2 The regular and corrective maintenance of all shared elements of the drainage system will be managed and funded through the Management Company on behalf of the Residents.

Inspection / Action Required	Gullies, Channels and Gutters	Catchpits	Permeable Surface	Surface Water Pipework
6 Months	✓	✓	✓	
1 Year			✓	
After leaf fall in Autumn	✓	✓		
2 Years				✓
When alarm indicates				

Drainage System Maintenance Summary