

ENVIRONMENT

Richborough
Land North of A47 Normandy Way and
West of A447 Ashby Road
Hinckley
Sustainable Drainage Statement

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1. INTRODUCTION

- 1.1 A Sustainable Drainage Statement (SDS) sets out the principles of drainage design for a development and summarises the reasoning behind the chosen design. This includes consideration of national and local guidance, justification of specific flow rates, volumes of attenuated storage, as well as the appropriate level of treatment to be provided to surface water runoff.
- 1.2 This SDS has been produced by BWB Consulting on behalf of Richborough in respect of a planning application for a proposed residential development on Land North of A47 Normandy Way and West of A447 Ashby Road, Hinckley. The report is intended to support an outline planning application with all matters reserved except for access, for the erection of up to 415 dwellings, associated open space, drainage, landscaping and infrastructure. The level of detail included is commensurate and subject to the nature of the proposals. Proposed plans are included as **Appendix 1**.
- 1.3 A Flood Risk Assessment (FRA) has been developed for the site (reference: HN2-BWB-ZZ-XX-RP-YE-0002) and this SDS accompanies that overarching document.
- 1.4 The site is greenfield, comprising agricultural land and farm buildings. The site is located approximately 1.9km north of Hinckley town centre and is bound to the north by agricultural land, to the north east by Hinckley and Bosworth Community Hospital and to the east by residential development and agricultural land. Normandy Way (A47) is located adjacent to the southern boundary and an Unnamed Ordinary Watercourse (UOW) forms the western boundary of the site.
- 1.5 Key site details are provided within **Table 1.1**, with the location of the site illustrated within **Figure 1.1**.

Table 1.1: Site Details

Site Name	Land North of A47 Normandy Way and West of A447 Ashby Road
Location	Hinckley
NGR (approx.)	SP426958
Application Site Area (ha)	16.9 (approx.)
Development Area (ha)	11.4 (approx.)
Development Type	Residential
Lead Local Flood Authority	Leicestershire County Council
Local Planning Authority	Hinckley & Bosworth Borough Council
Sewerage Undertaker	Severn Trent Water

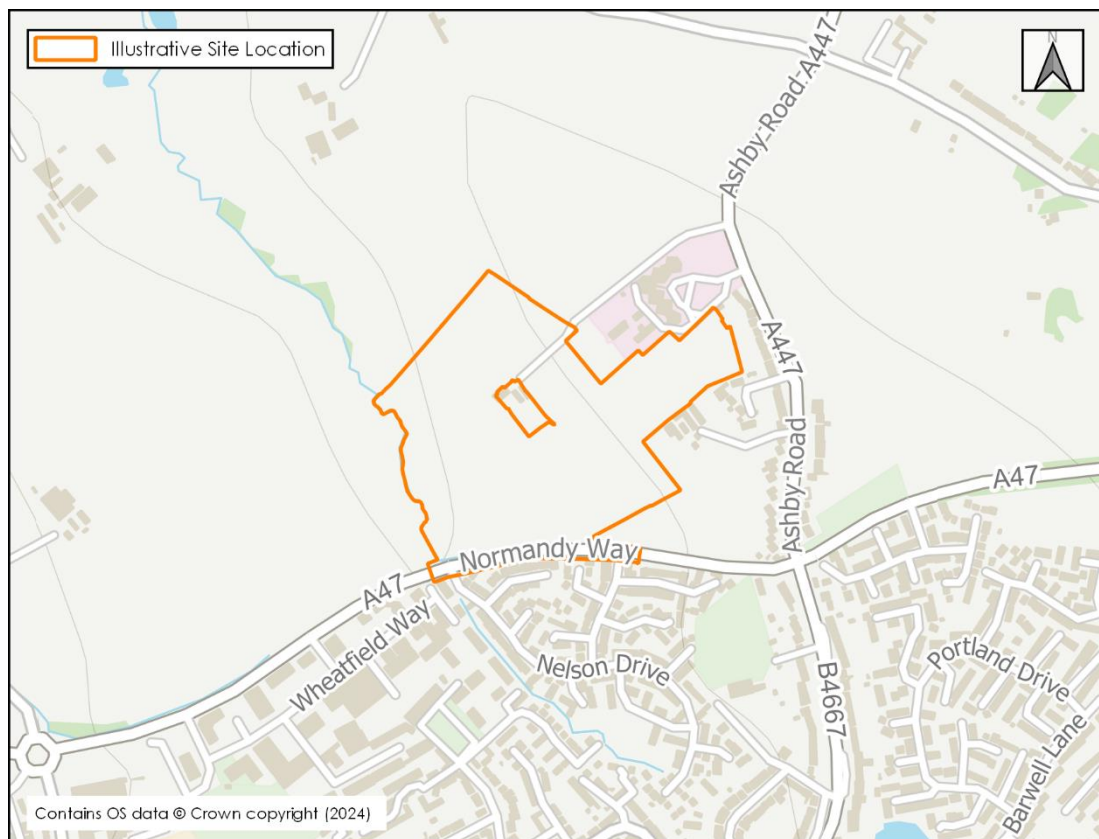


Figure 1.1: Site Location

Sustainable Drainage Guidance

- 1.6 Sustainable Drainage Systems (SuDS) aim to reduce the impact of development by replicating the natural runoff regime in a sustainable, cost effective manner whilst protecting water quality and reducing pollution. The four key objectives of SuDS design are to achieve improvements in water quality, water quantity, amenity provision and biodiversity.
- 1.7 Leicestershire County Council, in their role as the Lead Local Flood Authority (LLFA), have published an 'Interim LLFA Guidance Note: Planning and Development in Leicestershire'¹ which serves as interim LLFA surface water and flood risk guidance prior to completion of more comprehensive guidance.
- 1.8 The guidance notes that calculations for attenuation requirements should allow for up to the 1 in 100-year return period plus the appropriate allowance for climate change.
- 1.9 Table 2 from the Environment Agency's (EA) 'Flood risk assessments: climate change allowances'², included as **Table 1.2**, shows anticipated changes in peak rainfall intensity.

¹ Interim LLFA Guidance Note: Planning and Development in Leicestershire (Leicestershire County Council, October 2018)

² <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Table 1.2: Tame Anker and Mease Management Catchment Peak Rainfall Allowances

Tame Anker and Mease Management Catchment Allowance	Total Potential Change Anticipated for the '2050s' (Lifetime up to 2060)	Total Potential Change Anticipated for the '2070s' (2061 to 2125)
1 in 30-Year Rainfall Event		
Upper End	35%	35%
Central	20%	25%
1 in 100-Year Rainfall Event		
Upper End	40%	40%
Central	20%	25%

- 1.10 The EA's guidance on peak rainfall intensity climate change allowances states that residential development should be considered to have a minimum lifetime of 100 years. Therefore, the proposed development falls into the 2070s epoch.
- 1.11 The local guidance also notes that where applicable, the impacts of urban creep should be included. Unless it can be demonstrated otherwise, a 10% increase in the impermeable area should be included within the storage calculations.
- 1.12 Based on the guidance detailed above, a 40% climate change allowance and a 10% allowance (to the assumed impermeable area) for urban creep will be applied to the calculations. It should be noted that the 1 in 30-year event plus 35% climate change event will need to be considered at the detailed design stage.
- 1.13 In addition to the LLFA guidance, the Non-Statutory Technical Standards for Sustainable Drainage Systems³ as published by DEFRA and the SuDS Manual⁴ have been utilised to inform the strategy.

³ 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

⁴ The SuDS Manual (CIRIA, 2015)

2. EXISTING CONDITIONS

- 2.1 A topographical survey of the site is included as **Appendix 2**. The site falls steeply in a westerly direction, towards the UOW, with levels shown to range from 124.5m Above Ordnance Datum (AOD) in the east to 106.8m AOD in the west.
- 2.2 Severn Trent Water (STW) sewer records, included as **Appendix 3**, show that there are no sewerage assets located within the majority of the site. A 200mm foul water rising main is shown to be located within the south of the site, adjacent to Normandy Way and two public surface water sewers (700mm and 900mm diameter) are shown to outfall to the UOW within the south west of the site.
- 2.3 The accompanying FRA shows that the site is at a low risk of flooding from all sources. The site is located entirely within Flood Zone 1, however the UOW, located adjacent to the western site boundary, has not been represented on the EA's Flood Map for Planning and therefore a hydraulic modelling study has been completed by BWB Consulting to provide a detailed understanding of fluvial flooding at the site. The modelling shows that adjacent to the site, flows remain in channel and therefore the proposed development is located outside of all modelled flood extents.
- 2.4 British Geological Survey (BGS) mapping shows the site to be underlain by Mercia Mudstone Group. Superficial deposits of Alluvium (Clay, Silt, Sand and Gravel), Bosworth Clay Member (Clay and Silt), Wolston Sand and Gravel, Oadby Member (Diamicton) and Dunsmore Gravel (Sand and Gravel).
- 2.5 Given the greenfield nature of the site, topographical features and underlying geology, it is likely that the existing drainage regime consists of limited infiltration followed by surface water runoff which will follow existing topography and flow towards the UOW to the west of the site.

Existing Runoff Rates

- 2.6 An assessment of the existing surface water runoff rates per hectare has been undertaken and is summarised within **Table 2.1**. Calculations are included within **Appendix 4**.
- 2.7 The runoff rates have been estimated using the IH124 method, with appropriate prorated adjustments for a site of less than 50ha, as recommended in Interim Code of Practice for Sustainable Drainage⁵. This was undertaken within Micro Drainage, which makes the necessary adjustments for small sites automatically.

⁵ The National SUDS Working Group (2004), Interim Code of Practice for Sustainable Drainage

Table 2.1: Existing Runoff Rate from the Site per Hectare

Return Period (Yrs.)	Runoff Rate (l/s/ha)
1	3.6
Mean Annual Flow Rate (QBAR)	4.4
30	8.6
100	11.3

Existing Runoff Volume

- 2.8 An assessment of the existing surface water runoff rates from the development area (11.4ha) has been made for a 1 in 100-year, 6 hour storm.
- 2.9 As the existing site is permeable, the runoff volume has been calculated using the Source Control module within Micro Drainage to be 3,434m³, results are included within **Appendix 4**.

3. SURFACE WATER DRAINAGE STRATEGY

- 3.1 The site has an approximate total area of 16.9ha and an approximate development area of 11.4ha. It is assumed that 65% of the development area is impermeable (7.4ha). A 10% increase to the proposed impermeable area will be applied to account for urban creep as outlined within the local guidance, giving a total impermeable area of 8.1ha to be used in the attenuation calculations.
- 3.2 The site has been split into four catchments based upon topography and development aspirations. Details of the catchments are presented in **Table 3.1**.

Table 3.1: Catchment Details

Catchment	Development Area (ha)	Impermeable Area (ha)	Impermeable Area + 10% Urban Creep
1	1.3	0.8	0.9
2	2.1	1.4	1.5
3	1.6	1.0	1.1
4	6.4	4.2	4.6
Total	11.4	7.4	8.1

Drainage Hierarchy

- 3.3 The Planning Policy Guidance⁶ and the SuDS Manual identify that surface water runoff from a development should be disposed of as high up the following hierarchy as reasonably practicable:
- into the ground (infiltration);
 - to a surface water body;
 - to a surface water sewer, highway drain, or another drainage system;
 - to a combined sewer.
- 3.4 The aim of this approach is to manage surface water runoff close to where it falls and mimic natural drainage as closely as possible.
- 3.5 It is assumed, based on the underlying mudstone bedrock, that infiltration is unlikely to be feasible at the site. As the scheme progresses, it is recommended that infiltration testing is undertaken in accordance with BRE365. If infiltration is found to be a suitable method of discharging surface water from the development, this strategy should be revised in accordance with the above hierarchy.

⁶ Planning Practice Guidance. <http://planningguidance.planningportal.gov.uk/>.

- 3.6 Due to the close proximity of the UOW, it is proposed to discharge surface water from the site to this watercourse. Given the existing topography, a gravity connection to the watercourse is considered to be viable, mimicking the pre-development conditions.

Peak Flow Control

- 3.7 In order to comply with the Non-Statutory Technical Standards for Sustainable Drainage Systems S2-S3⁷, runoff from greenfield developments should not exceed the equivalent greenfield rates.
- 3.8 To comply with the peak flow control criterion, it is proposed to restrict the discharge rate from the development to the receiving watercourse at the equivalent greenfield QBAR rate up to the 1 in 100-year plus climate change event. This is summarised within **Table 3.2**.

Table 3.2: Existing & Proposed Runoff Rates

Return Period (Yr.)	Existing Runoff Rate (l/s/ha)	Total Existing Runoff Rate (11.4ha) (l/s)	Proposed Discharge Rate (l/s)
1	3.6	41.0	50.2
QBAR	4.4	50.2	
30	8.6	98.0	
100	11.3	128.8	
100 + 40%	-	-	

- 3.9 The proposed discharge rate has been pro-rated between the catchments and is detailed within **Table 3.3**.

Table 3.3: Proposed Runoff Rates per Catchment

Catchment	QBAR Greenfield Discharge Rate (l/s)
1	5.7
2	9.2
3	7.0
4	28.2
Total	50.1

- 3.10 This approach fulfils the necessary peak runoff control criteria.

⁷ 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

Attenuated Storage

- 3.11 As the development proposals require a restricted runoff rate, it will be necessary to provide attenuated storage to balance the excess volume in a safe manner within the site.
- 3.12 The surface water storage should be located within the site in a position where it can receive runoff from the development and discharge from the site by gravity, and also in a position where it is hydraulically isolated from any fluvial floodplain or external surface water floodplain/overland flow route that may be present in the site. The FRA does not identify any constraints in terms of locating the drainage basins.
- 3.13 Sufficient storage for events up to the 1 in 100-year storm with an allowance for climate change should be provided, and a 10% allowance should be applied to the current proposed development area to allow for urban creep over the lifetime of the development.
- 3.14 After considering the site constraints and development aspirations it is suggested that the necessary surface water storage volume is found within a series of detention basins located at the lowest elevation of the site, between the proposed development and the outfall location.
- 3.15 For the purpose of this outline assessment, it has been assumed that the basins will accommodate all of the necessary storage, but it may be possible to redistribute a portion of the storage within other drainage components during the detailed design of the development (e.g.: in the pipe network, swales, filter drains, etc).
- 3.16 A simulation has been run using Micro Drainage 'Source Control' to identify the necessary storage provision. Using a restriction, as detailed within **Table 3.3**, the volume of attenuated storage required for the development has been calculated for storm events up to the 100 year + 40% storm. The results are summarised in **Table 3.4** and calculations are included as **Appendix 5**.

Table 3.4: Outline Attenuated Storage Requirements

Rainfall Method	Critical Storm	Maximum Volume (m ³)
<i>Catchment 1</i>		
FSR	600 min Winter	574.9
FEH	600 min Winter	606.0
<i>Catchment 2</i>		
FSR	600 min Winter	970.9
FEH	600 min Winter	1022.6
<i>Catchment 3</i>		
FSR	600 min Winter	711.4
FEH	600 min Winter	749.1
<i>Catchment 4</i>		
FSR	600 min Winter	3051.6
FEH	600 min Winter	3208.9
Total (FEH)		5586.6

- 3.17 At this outline design stage it is expected that a minimum of 5587m³ of attenuated storage will be provided to cater for the maximum anticipated runoff volume for all storm durations up to the 1 in 100-year return period storm, including a 40% climate change allowance and future urban creep.
- 3.18 It is envisaged that the final required attenuated storage volume will be determined during the detailed design stage, once the development layout and drainage areas are fixed.

Runoff Volume Control

- 3.19 The Non-Statutory Technical Standards for Sustainable Drainage Systems S4-S6⁸ states that where reasonably practical the runoff volume from a development for the 1 in 100-year 6 hour rainfall event should not exceed the runoff volume prior to development or redevelopment. Additionally, if practicable on previously developed sites, the runoff volume should not exceed the equivalent greenfield runoff volume. Where it is not reasonably practicable to constrain the volume of runoff from a development at or below the existing volume, then the runoff must be discharged in a manner that does not adversely affect flood risk, i.e.:

⁸ 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

- i. The additional runoff volume resulting from the development (the 'long term storage volume') should be discharged separately from the site at a rate of 2l/s/ha or less. Or,
 - ii. All the runoff volume from the development should be discharged at a rate equivalent to the mean annual flow rate (QBAR) rate under greenfield conditions or less. Or,
 - iii. All the runoff volume from the development should be discharged at a rate of 2l/s/ha or less.
- 3.20 An estimate of the post-development runoff volume from the 1 in 100-year 6 hour storm can be derived from the Micro Drainage calculations. The existing and post-development runoff volumes are compared within **Table 3.5**.

Table 3.5: Runoff Volume Comparison

Existing Volume (m³)	Proposed Volume (m³)	Difference (m³)
3434	5378	+1944

- 3.21 The 1 in 100-year 6 hour storm runoff volume from the site has been shown to increase as a result of the proposed development. However, as the runoff volume from the development will be discharged at a rate equivalent to the mean annual flow rate (QBAR) rate under greenfield conditions, the volume control criteria will be met.

Long Term Storage

- 3.22 It is proposed to discharge the runoff from the development at a rate equivalent to the mean annual flow rate (QBAR) rate under greenfield conditions or less. Therefore, provision for long term storage is not required.

Sustainable Drainage Systems

- 3.23 An Illustrative Drainage Strategy is included as **Appendix 6** (drawing reference: HN2-BWB-ZZ-XX-DR-CD-0001) and demonstrates how the required storage volume can be achieved within the site.
- 3.24 Surface water runoff will be stored within a series of above ground detention basins located within the west of the site. The detention basins within Catchments 1, 2 and 4 have been modelled with a total depth of 1.4m inclusive of a 400mm freeboard in the 1 in 100-year + 40% climate change event. The detention basin within Catchment 3 has been modelled with a total depth of 1.2m inclusive of a 400mm freeboard in the 1 in 100-year + 40% climate change event.
- 3.25 The detention basins should be appropriately planted to provide a primary level of treatment through filtration. It is recommended that the detention basins have a variable depth, permanent water level and low flow channel, the details of which should be agreed and advised during the detailed design.

- 3.26 Further levels of treatment will be provided via swales and rain gardens located throughout the proposed development. These features will provide water quality, amenity and biodiversity benefits.
- 3.27 Where possible, the swales and detention basins should be unlined to allow for any residual infiltration. The viability of having unlined swales and detention basins should be confirmed following seasonal groundwater monitoring within the proposed development site.

Water Quality

- 3.28 In accordance with the SuDS Manual a simple index approach to water quality risk management should be undertaken for the proposed development. This will be compiled to provide a comprehensive account of the water quality treatment provided by the proposed surface water drainage system.
- 3.29 The SuDS Manual Mitigation Index will be used to assess the treatment levels proposed in relation to the pollution hazard posed from the proposed land use(s). This methodology is adopted to ensure that surface water flows receive adequate treatment through all areas of the site prior to final outfall.
- 3.30 **Table 3.6** shows the pollution hazard indices for the land use classification(s) that are relevant to the proposed development, as described within table 26.2 in the SuDS Manual.

Table 3.6: Pollution Hazard Indices for Different Land Use Classifications

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Driveways, residential car parks and low traffic roads	Low	0.5	0.4	0.4

- 3.31 The SuDS Mitigation Indices that are relevant to the proposed development, as described within table 26.3 of the SuDS Manual, are outlined in **Table 3.7**.

Table 3.7: SuDS Mitigation Indices

Type of SuDS Component	Mitigation Indices		
	TSS	Metals	Hydrocarbons
Swale	0.5	0.6	0.6
Bioretention System/Rain Garden	0.8	0.8	0.8
Detention Basin	0.5	0.5	0.6

- 3.32 The pollution hazard rating and proposed SuDS Mitigation Index for the site is compared within **Table 3.8**. Where more than one SuDS component is proposed, a factor of 0.5 has been applied to the downstream (i.e., secondary and/or tertiary) treatment stages to account for the reduced performance due to reduced inflow concentrations.

Table 3.8: Comparison of Pollution Hazard Rating against Proposed Mitigation Index

Pollution Type	Pollution Hazard Rating	Proposed Mitigation Index	Sufficient Treatment Provided?
<i>Catchment 1 – Swale, Rain Gardens and Detention Basin</i>			
TSS	0.7	1.15	✓
Metals	0.6	1.25	✓
Hydrocarbons	0.45	1.3	✓
<i>Catchment 2 – Swale and Detention Basin</i>			
TSS	0.7	0.75	✓
Metals	0.6	0.85	✓
Hydrocarbons	0.45	0.9	✓
<i>Catchment 3 – Swale and Detention Basin</i>			
TSS	0.7	0.75	✓
Metals	0.6	0.85	✓
Hydrocarbons	0.45	0.9	✓
<i>Catchment 4 – Swale, Rain Gardens and Detention Basin</i>			
TSS	0.7	1.15	✓
Metals	0.6	1.25	✓
Hydrocarbons	0.45	1.3	✓

- 3.33 Based on the above assessment, the proposed drainage strategy is considered to provide an appropriate level of treatment to surface water prior to discharge from the site.

Residual Risk and Designing for Exceedance

- 3.34 It is recommended that the final layout uses the proposed road infrastructure to provide drainage exceedance (overland flood flow) routes through the development and towards positively drained areas.

- 3.35 In the event that the capacity of the attenuated storage is exceeded, ground levels should be profiled to direct overland flows west, towards the UOW.
- 3.36 In addition to the volume of storage provided within the main attenuation, there will be capacity within upstream pipes and manholes which has not been accounted for at this stage and a further level of redundancy to the network will therefore be provided.
- 3.37 A 400mm freeboard has been provided in the 1 in 100-year plus 40% climate change scenario.

4. FOUL WATER DRAINAGE

- 4.1 It is proposed to drain foul water from the proposed development separately to surface water. As the site is currently undeveloped, a new connection will be required. It is therefore proposed that foul water from the proposed development will outfall to the existing STW public sewer network at the closest connection point available.
- 4.2 The nearest adopted gravity sewer is the STW foul water within Nelson Drive. A Pre-Development Enquiry was submitted to STW and is included within **Appendix 3**. STW have confirmed that additional investigation/modelling will be required to better understand the impact of additional properties on the public network.
- 4.3 A review of existing ground levels suggests that a gravity connection to this sewer for the whole site is not possible. Therefore, to connect into this sewer, a foul pumping station will be required to serve a portion of Catchment 1, 2 and 3. The foul pumping station should be located in the lowest developable area of the site to achieve a gravity connection from the site to the pumping station.
- 4.4 Based on the size of the development, it is anticipated that the pumping station will be a 'Type 3' pumping station as outlined within the DCG. Type 3 pumping stations have typical compound dimensions of 8m x 12m and required access via an adoptable highway, consultation will be required with STW to determine the final dimensions and requirements for emergency storage. Type 3 pumping stations require a 15m easement between the compound's wet well and the nearest habitable building.
- 4.5 The suggested pumping station locations and connection point is shown on the Illustrative Drainage Strategy included as **Appendix 6**.
- 4.6 A S106 (Water Industry Act 1991) application should be made to STW for approval prior to a connection being made.

5. MAINTENANCE

- 5.1 The proposed drainage system should be designed in accordance with the Design and Construction Guidance (DCG) and be offered up for adoption to STW. If any parts of the drainage network remain unadopted, or until the point that they are, an appropriate maintenance company should be appointed. Any drainage features within private curtilage will be the responsibility of the homeowner.
- 5.2 Requirements for ongoing maintenance of the drainage network should form part of the Operation and Maintenance manual for the site and should be undertaken by the site management. Any specialist or proprietary products that are specified at detailed design should have a manufacturer specific maintenance regime which should be included within the document.
- 5.3 It is envisaged that the Operation and Maintenance manual will be developed at the detailed design stage, but some examples are included below.
- i. All drainage features should be located in open areas which are readily accessible.
 - ii. Gullies should be inspected and de-silted at least once a year, where necessary.
 - iii. Pipes, manholes and silt traps should be inspected and de-silted at least once a year, where necessary.
 - iv. If permeable paving is incorporated within the layout, it should be swept a minimum of every 6 months to maintain flow capacity of the joints between blocks.
 - v. The surface water attenuation areas will be predominantly dry and the base will be seeded with a wildflower grass seed mix that can tolerate wet ground conditions.
 - vi. Regular inspections of the attenuation basin should be undertaken to remove litter/debris, invasive/colonising vegetation and silt build up as necessary. Inlet and outlet structures to be regularly inspected, with remedial work as required to maintain water flows and prevent silt/vegetation build up.
 - vii. Vegetation/grass with the attenuation basin should be maintained appropriately to allow establishment and promote habitat formation, without impeding the operation of the inlet and outlet structure.
 - viii. Flow controls should be inspected every 6 months, litter/debris and silt build up should be removed as necessary.

6. SUMMARY

- 6.1 This statement and supporting appendices demonstrate that the drainage design for the development will comply with the relevant local and national standards, specifically the hierarchy of discharge, runoff rate and volume criterion.
- 6.2 This SDS is intended to support an outline planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.

Table 6.1: Sustainable Drainage Statement Summary

		Existing Site	Proposed Development
Site Area (ha)		16.9	
Impermeable Area (ha)		-	7.4
Outfall Location		Watercourse	Watercourse
Peak Runoff Rate (l/s)	QBAR	50.2	50.2
	1 in 30-Year	98.0	
	1 in 100-Year	128.8	
	1 in 100-Year + CC	-	
Runoff Volume (100yr RP 6 hour Storm)		3434m ³	5378m ³
Volume Control		-	Discharge rate limited to QBAR
Proposed Storage Volume		-	5587m ³
Interception Volume		-	37m ³
Flow Control Type		-	Vortex
SuDS Features		-	Detention Basins Swales Rainwater Gardens
Maintenance Responsibility		-	Management Company/Sewerage Company

- 6.3 It is envisaged that the final drainage strategy will be determined during the detailed design stage, as the development layout is finalised.

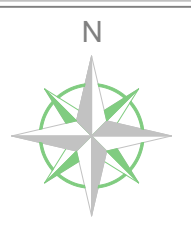
APPENDICES

Appendix 1: Illustrative Layout



- Key
- Application site boundary
 - Other land under control of applicant
 - Existing (retained) trees & hedgerow
 - Indicative proposed planting
 - Proposed community orchard
 - Open space
 - Indicative surface water attenuation basin
 - Existing Public Right of Way
 - Proposed pedestrian/cycle link
 - Potential for equipped play/LEAP
 - Potential for children's play (LAP)
 - Indicative buildings

Appendix 2: Topographical Survey



Station	Easting (m)	Northing (m)	Level (m)
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OS Note:

Legend:

Rev	Date	Description	Drawn	Q. Rev
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CLIENT
Richborough Estates Ltd

**Topographical
Survey**

Level datum	See note
Grid orientation	See note

Comments

This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.

All dimensions should be checked on site prior to design and construction.

Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.