BWB
A CAF GROUP COMPANY

ENVIRONMENT

Miller Homes Ltd
Royal Hill Road
Spondon
Sustainable Drainage Statement

ENVIRONMENT

Miller Homes Ltd
Royal Hill Road
Spondon
Sustainable Drainage Statement

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Notice

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APPENDICES

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 Miller Homes Ltd in respect of a site located at Royal Hill Road, Spondon.

1.3 A Flood Risk Assessment (FRA) has been prepared for the site (reference: RHR-BWB-ZZ-XX-RP-YE-0002_FRA) and this SDS accompanies this overarching document.

1.4 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.

1.5 A proposed site development plan is included as **Appendix 1**.

1.6 The location of the site is illustrated within **Figure 1.1**, with contextual information provided within **Table 1.1**.

Table 1.1: Site Details

Site Name	Royal Hill Road
Location	Spondon
NGR (approx.)	SK 39611 36717
Application Site Area (ha)	4.51 (Approx.)
Development Area (ha)	2.23 (Approx.)
Development Type	Residential
Lead Local Flood Authority	Derby City Council
Local Planning Authority	Derby City Council
Sewerage Undertaker	Severn Trent Water

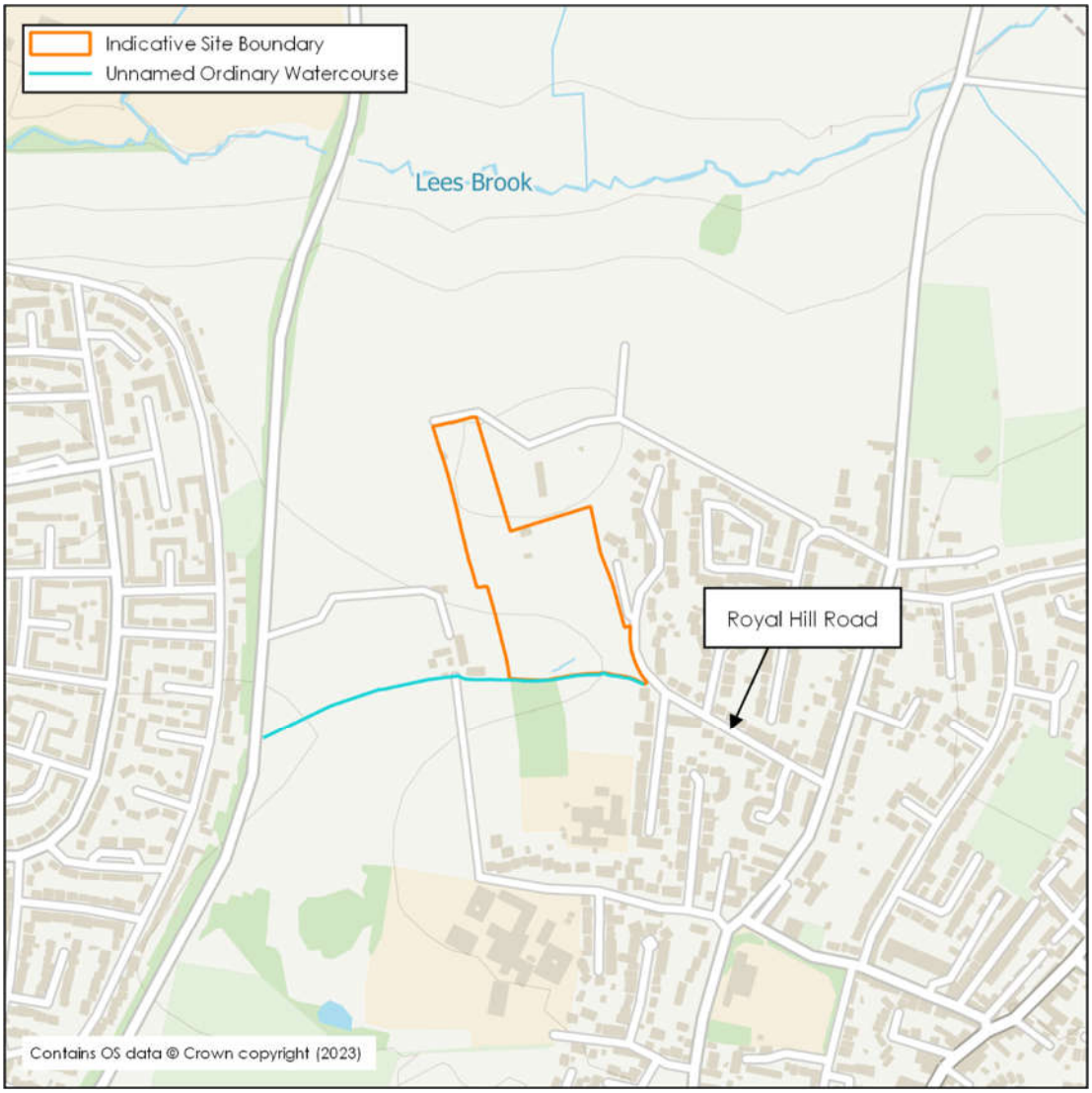

Figure 1.1: Site Location

Sustainable Drainage Guidance

1.7 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 quantity, water quality, amenity provision and biodiversity.

1.8 Derby City Council, in their role as Lead Local Flood Authority (LLFA), are in the process of producing a "SuDS design and adoption guidance" document. However, in the absence of this information at the time of writing this SDS, the Non-Statutory Technical Standards for SuDS[1] as published by DEFRA, the Sewerage Sector Guidance 'Design and Construction Guidance[2] (DCG) and the SuDS Manual[3] published by CIRIA have been utilised to inform the strategy.

1.9 Predicted future changes in peak rainfall intensity caused by climate change are provided by the Environment Agency (EA). Table 2 from the EA's 'Flood risk assessments: climate change allowances'[4], included as **Table 1.2** shows the anticipated changes in peak rainfall intensity for the site.

Table 1.2: Peak Rainfall Climate Change Allowances for the Derwent Derbyshire Management Catchment

Derwent Derbyshire 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 (3.3% Annual Exceedance) Rainfall Event		
Upper End	35%	35%
Central	20%	25%
1 in 100-Year (1% Annual Exceedance) Rainfall Event		
Upper End	40%	40%
Central	20%	30%

1.10 Given the development proposals, and the percentages set out by the EA, a climate change allowance of 40% has been made for the 1 in 100-year return period. As the scheme progresses towards a full / reserved matters planning application the 1 in 30-year return period should be considered to assess the hydraulic performance of the proposed drainage system, using a climate change allowance of 35%, as per EA and local guidance.

1.11 In accordance with the CIRIA SuDS Manual, a 10% allowance for urban creep has been included within the attenuation calculations undertaken within this SDS.

1.12 The CIRIA SuDS Manual[5] and the Sewerage Sector Guidance 'Design and Construction Guidance[6] (DCG) have also been used to inform the production of this SDS.

[1] 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems
[2] Design and Construction Guidance for foul and surface water sewers (May 2021) available at: https://www.water.org.uk/wp-content/uploads/2021/07/SSG-App-C-Des-Con-Guide.pdf
[3] The SuDS Manual (C753). (CIRIA, 2015)
[4] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
[5] The SuDS Manual (C753). CIRIA 2015.
[6] Design and Construction Guidance for foul and surface water sewers (May 2021) available at: https://www.water.org.uk/wp-content/uploads/2021/07/SSG-App-C-Des-Con-Guide.pdf

2. EXISTING CONDITIONS

2.1 The topographical survey data, which is included as **Appendix 2**, demonstrates that levels across the site generally fall in a south-westerly direction. The levels range from 91m Above Ordnance Datum (AOD) within the north to a low point of 76m AOD along the southern boundary.

2.2 Along the southern boundary, there is an Unnamed Ordinary Watercourse (UOW). In line with national guidance, a 5m easement from the top of bank will be required for maintenance access purposes.

2.3 Due to the small catchment of the UOW (<3km^2) the watercourse is not included on the EA's Flood Map for Planning. Therefore, a hydraulic modelling exercise has been undertaken to assess the flood zones associated with it. More infromation relating to the hydraulic modelling exercise and the flood risk posed to the site can be founded within the accopanying FRA.

2.4 Severn Trent Water sewer records are included as **Appendix 3.** They show that there are both foul and surface water sewers located within Royal Hill Road. The surface water sewer leaves Royal Hill Road and crosses the south-east corner of the site to outfall into the UOW. A 10m easement is required by Severn Trent Water, as confirmed with Severn Trent Water via a pre-development enquiry, which is presented within **Appendix 3**.

2.5 There is no private sewerage infrastructure indicated to be present within the site on the topographical survey.

2.6 British Geological Survey (BGS) mapping indicates the site to be wholly underlain by Tarporley Siltstone Formation - Mudstone and siltstone. The EA defines this as a Secondary B Aquifer, which means that it is classed as a lower permeability layers which store limited amounts of water if fissures or eroded layers.

2.7 Within the north of the site there are superficial deposits of Thrussington Member – Diamicton. The EA defines this as an unproductive strata.

2.8 Therefore, the existing drainage regime for the site is limited infiltration into ground, followed by rapid surface runoff toward the UOW when infiltration potential is exceeded.

Existing Runoff Rates

2.9 An assessment of the existing surface water runoff rates on a per hectare basis has been undertaken and prorated based on the proposed development area, plus the total open SuDS footprint associated with the proposed surface water drainage strategy (i.e., 2.42ha). This is summarised within **Table 2.1** and the supporting calculations are included within **Appendix 4**.

2.10 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 Drainage[7]. This was undertaken within Micro Drainage, which makes the necessary adjustments for small sites automatically.

Table 2.1: Existing Runoff Rate

Return Period (Yrs.)	Runoff Rate (l/s/ha)	Runoff Rate based on 2.42ha (l/s)
1	2.7	6.5
Mean Annual Flow Rate (QBAR)	3.3	8.0
30	6.5	15.7
100	8.5	20.6

Existing Runoff Volume

2.11 An assessment of the existing surface water runoff rates from the area proposed for development has been made for a 1 in 100-year, 6-hour storm.

2.12 As the existing site is permeable, the runoff volume has been calculated using the Source Control module within Micro Drainage to be **302m³**, results are included within **Appendix 5**.

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

3. SURFACE WATER DRAINAGE STRATEGY

Drainage Hierarchy

3.1 The Planning Policy Guidance[8] and the SuDS Manual[9] identify that surface water runoff from a development should be disposed of as high up the following hierarchy as reasonably practicable:

i. into the ground (infiltration);
ii. to a surface water body;
iii. to a surface water sewer, highway drain, or another drainage system;
iv. to a combined sewer.

3.2 The aim of this is approach is to manage surface water runoff close to where it falls and mimic natural drainage as closely as possible.

Infiltration

3.3 The Site is entirely underlain by mudstone and siltstone bedrock which is largely impermeable strata with very poor infiltration potential. For this reason, infiltration is considered unsuitable for the proposed development.

3.4 BRE365 soakaway testing should be undertaken to confirm the viability of the use of soakaways. If BRE365 soakaway testing confirms infiltration to be a viable solution, the drainage strategy should be revised to be in accordance with the above drainage hierarchy.

Discharge to Surface Water Body

3.5 As mentioned within **Section 2m** there is a UOW present along the south boundary which is considered to be the primary point of discharge for surface water runoff in it greenfield condition. Therefore, it is proposed to discharge into the UOW at a rate equivalent to QBAR for all events up to and including the 1 in 100-year plus climate change critical storm.

Peak Flow Control

3.6 In order to comply with the Non-Statutory Technical Standards for Sustainable Drainage Systems S2-S6[10], it is proposed to restrict the rate of surface water leaving the site to the equivalent greenfield QBAR rate for all events up to and including the 1 in 100-year plus climate change critical storm. This is summarised within **Table 3.1**.

[8] Planning Practice Guidance. http://planningguidance.planningportal.gov.uk/.
[9] The SuDS Manual (C753). CIRIA 2015.
[10] 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

Table 3.1: Existing & Proposed Runoff Rates

Return Period (Yr.)	Existing Runoff Rate (l/s)	Proposed Discharge Rate (l/s)
1	6.5	8.0
QBAR	8.0	
30	15.7	
100	20.6	
100 + 40%	-	

Attenuated Storage

3.7 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.

3.8 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.

3.9 Sufficient storage for events up to the 1 in 100-year storm with an allowance for climate change should be provided. The post-development impermeable area has been calculated to be 1.78ha, assuming 65% of the measured development area will be impermeable, with an additional 10% allowance for urban creep. 100% of the footprint of the proposed above ground SuDS features has been included in the impermeable area measurement.

3.10 After considering the site constraints and development aspirations it is suggested that the necessary surface water storage volume is found within a detention basin located in the south-west site corner, between the proposed development and the outfall location.

3.11 For the purpose of this outline assessment, it has been assumed that the basin 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, manholes, and any additional source control SuDS that may be included at detailed design)).

3.12 A simulation has been run using Micro Drainage 'Source Control' to identify the necessary storage provision. Using a restriction of 8.0l/s and the estimated proposed impermeable area of 1.78ha, 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

3.13 **Table** 3.2 and calculations are included as **Appendix 6**.

Table 3.2: Outline Attenuated Storage Requirements

Rainfall Method	Critical Storm	Maximum Volume (m^3)
Flood Studies Report (FSR)	960 min Winter	1,225
Flood Estimation Handbook (FEH)	600 min Winter	1,415

3.14 At this outline design stage, it is expected that a minimum of 1,415m^3 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 10% allowance for future urban creep.

3.15 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

3.16 The Non-Statutory Technical Standards for Sustainable Drainage Systems S4-S6[11] 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. 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.:

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.

3.17 The existing and post-development runoff volumes during the 1 in 100-year 6-hour storm are compared within **Table 3.3**.

3.18 The post-development runoff volume from the impermeable portion of the proposed development (1.78ha) has been calculated using the formula outlined within **Figure 3.1**. The average rainfall intensity was calculated using FEH rainfall data within Micro Drainage. The 1 in 100-year 6-hour rainfall profile is provided as **Appendix 7**.

Av. Rainfall (m/hr) x 6 (hours) x Impermeable Area (m^2) = Runoff Volume (m^3)

0.010006 x 6 x 17800 = 1,069m^3

Figure 3.1: 1 in 100-Year, 6 Hour Runoff Volume

[11] 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

3.19 The post-development run off volume for the permeable area (0.64ha) was calculated in the same method as in **Section 2** and is included in **Appendix 8**.

Table 3.3: Runoff Volume Comparison

Existing Volume (m^3)	Proposed Volume (m^3)		Difference (m^3)
	Permeable	Impermeable	
302	57	1069	+824

3.20 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.

Sustainable Drainage Systems

3.21 An Outline Drainage Strategy (reference: RHR-BWB-DDG-XX-DR-CD-0500) has been produced and is included as **Appendix 9**.

3.22 It is proposed that surface water runoff is captured via gullies and down pipes before being conveyed via a piped network to a detention basin located in the south-west of the site. Surface water runoff will then be discharged via a gravity pipe to the UOW at a rate limited to the greenfield QBAR rate via a vortex flow control. A new headwall at the outlet will be required and considerations should be made to ensure the outfall pipe has the required cover at the detailed design stage.

3.23 The detention basin is proposed to have 1:3 side slopes, a maximum design water depth of 1.0m and a minimum 400mm freeboard above the 100 year plus 40% climate change critical storm. The detention basin should be appropriately planted with native flora to enhance treatment and biodiversity.

3.24 At the detailed design stage, other features could be considered within the basin such as: a forebay and/or a permanent water depth. These would add both amenity and biodiversity value to the scheme.

3.25 Additionally, further SuDS features could be considered within the development at detailed design, such as: water butts, rain gardens, tree pits and permeable paving. The use of additional source control SuDS within the development would provide further water quality, biodiversity and amenity benefits to the site post-development.

Water Quality

3.26 The SuDS Manual Mitigation Index has been used to assess the treatment levels proposed in relation to the pollution hazard posed from the proposed land uses.

3.27 **Table 3.4** shows the pollution hazard indices for the land use classifications that are relevant to the proposed development.

Table 3.4: 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
Low traffic roads and individual property driveways	Low	0.5	0.4	0.4

3.28 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 3.5.**

Table 3.5: SuDS Mitigation Indices

Type of SuDS Component	Mitigation Indices		
	TSS	Metals	Hydrocarbons
Detention Basin	0.5	0.5	0.6

3.29 The pollution hazard rating and proposed SuDS Mitigation Index for the Site is compared within **Table 3.6**.

Table 3.6: Comparison of Pollution Hazard Rating against Proposed Mitigation Index

Pollution Type	Pollution Hazard Rating*	Proposed Mitigation Index	Sufficient Treatment Provided?
TSS	0.5	0.5	✓
Metals	0.4	0.5	✓
Hydrocarbons	0.4	0.6	✓

* Worst case pollution hazard for catchment used

3.30 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.

3.31 The inclusion of additional SuDS features during the detailed design stage would provide additional water quality treatment to surface water prior to discharge from the site.

Residual Risk and Designing for Exceedance

3.32 The proposed detention basin has been designed with a minimum 400mm of freeboard above the maximum design water level, providing a robust level of resilience to the proposed drainage system.

3.33 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 the basin for events in excess of the capacity of the drainage system.

3.34 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.

3.35 In the event that the capacity of the attenuated storage is exceeded, overland flows will overtop the detention basin and drain directly into the UOW at the south site boundary. Indicative exceedance routing is shown on the Outline Drainage Strategy within **Appendix 9**.

4. MAINTENANCE

4.1 The drainage should be designed in accordance with the DCG and proposed for adoption by Severn Trent Water. Any features which remain unadopted, or until the point that they are, should be maintained by a private management company. The maintenance of the private plot drainage systems located within the curtilage will be responsibility of the respective homeowners.

4.2 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.

4.3 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. 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.
v. Regular inspections of the detention 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.
vi. Vegetation/grass with the detention basin should be maintained appropriately to allow establishment and promote habitat formation, without impeding the operation of the inlet and outlet structure.
vii. Flow controls should be inspected every 6 months, litter/debris and silt build up should be removed as necessary.

5. FOUL WATER DRAINAGE

5.1 It is proposed to drain used water from the development separately to surface water.

5.2 Severn Trent Water sewer records demonstrate the presence of an existing 225mm foul sewer located within Royal Hill Road to the east of the site, with a preferred connection point at manhole 7607.

5.3 Severn Trent Water have confirmed that further modelling is required to determine whether the existing network has capacity to accept foul flows from the development, with a connection point in the southeast site corner being appropriate (**Appendix 3**).

5.4 Due to levels, a pumping station will be required. The pumping station should be located near the low point within the developable area and will require a 15m easement from the pumping station wet well to any dwellings or third-party land. The pumping station will require vehicular access, appropriate for a tanker and should be designed in accordance with the DCG. An indicative pumping station location is shown on the drawing in **Appendix 9**.

5.5 It may be possible to undertake localised levels raising at the site entrance in order to drain a portion of the development via gravity, but it is expected that a foul pumping station will be required for at least part of the development.

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)		4.51	
Impermeable Area (Ha)		-	1.78
Outfall Location		Watercourse	Watercourse
Peak Runoff Rate (l/s/ha)	**QBAR**	8.0	8.0
	1 in 30-Year	15.7	
	1 in 100-Year	20.6	
	1 in 100-Year + CC	-	
Runoff Volume (100yr RP 6 hour Storm)		302m^3	1126m^3
Volume Control		-	Discharge rate limited to QBAR
Proposed Storage Volume		-	1420m^3
Flow Control Type		-	Vortex
SuDS Features		-	Detention Basin
Maintenance Responsibility		-	Home Owners and Sewerage Company / Management 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 Masterplan

Key

Development

- Site Boundary — 4.51Ha
- Residential Development Area — 2.19Ha = Circa 90 dwellings. Dependent on housing mix
- Illustrative Built Form
- Equipped Play Space — LEAP

Movement

- Site Access — Vehicle and Pedestrian
- Streets
- Lanes
- Shared Private Drives
- Public Rights of Way
- Footpaths &/or Cycleways — Infrastructure to connect to the wider existing network of routes and PRoWs to adjacent schools
- Pedestrian Connections at Site Boundary

Landscape

- Retained Trees & Hedgerows — With associated RPAs
- Structural Landscaping — Planting buffer along eastern boundary
- Illustrative Landscape Strategy — Includes opportunities for a kickabout area, orchard and grasslands (to be agreed as part of detailed applications)
- Drainage Basin
- Illustrative Location of Pumping Station
- Flood Zones

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Land off Royal Hill Road, Spondon, Derby - **Illustrative Masterplan**

| Drawn by: JF/KC | Approved by: JF/PS | Date: 20/06/23 | Scale: 1:1250 @ A1 | DRG: P19-2639_DE_001 Sheet No: 01 Rev: E | Client: Miller Homes |

Pegasus Group

Appendix 2: Topographical Survey

Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in metres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. No scale factor has been applied to this survey, therefore the os coordinates are to be treated as arbitrary. Please refer to survey station information below for on site control establishment.
6. All coordinates and height data relate to OSGB36(15). Control stations are coordinated by means of GPS receiving real time corrections via OS smart net.
7. All manhole data is collected from ground level therefore discrepancies may occur. More accurate data is only achievable via confined space entry.
8. OS license number: 100022432

Key Plan

Legend

OS Buildings		Contour Lines	
Surveyed Buildings		Inspection Chamber	
Building		Flow direction and pipe diameter	0.25
Wall		Station and Name	1
Kerb Channel Line		Monitoring Borehole	BH 1
Top of Kerb		Tree / Bush / Sapling	
Edge of Surface		Area of Vegetation/ Extent of Tree Canopy	
Top of Bank		Hedge	
Bottom of Bank		Body of Water	
Canopy / Overhang		Body of Water from OS	
Line Marking		Spot Level	50.00
Centre Line		Assumed Surface Water Drainage Line	
Watercourse		Surface Water Drainage Line	
Centre Line Barrier			
Fence			
Gate			
Overhead Powerline			
Overhead Utilities			

AP	Anchor Point	FBW	Fence Barbed Wire	LB	Litter Bin
BG	Back Gully	FCB	Fence Closed Board	LP	Lamp Post
BO	Bollard	FCL	Fence Chain Link	MH	Manhole
BS	Bus Stop	FEL	Fence Electric	Mkr	Service Marker
BT	British Telecom	FMP	Fence Metal Panel	PB	Post Box
C	Crest	FMR	Fence Metal Railing	PT	Post
CL	Cover Level	FOB	Fence Open Board	RE	Rodding Eye
CMP	Cable Marker Post	FPW	Fence Post & Wire	SP	Sign Post
		FSP	Fence Steel Palisade	ST	Stop Tap
CCTV	Security Camera	FWM	Fence Wire Mesh	SV	Stop Valve
CTV	Cable TV	FFL	Finished Floor Level	TCB	Telephone Cell Box
DC	Drainage Channel	FP	Flagpole	THL	Threshold Level
DK	Drop Kerb	Gas	Gas	TL	Traffic Light
DP	Down Pipe	GV	Gas Valve	TP	Telegraph Post
Elec	Electric	GY	Gully	TS	Traffic Signal
EP	Electricity Post	Ht	Height	UTS	Unable to Survey
ER	Earth Rod	IC	Inspection Chamber	WL	Water Level
FH	Fire Hydrant	IFL	Internal Floor Level	WM	Water Meter
FL	Floodlight	IL	Invert Level (as a reduced level)	WO	Wash Out

Rev	Date	Details of issue / revision	Drw	Rev
P2	08.04.22	Middle Field Added	IR	DS
P1	26.11.20	First Issue	IR	DS

Issues & Revisions

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Client

Miller Homes Ltd

Project Title

Land At
Royal Hill Road
Spondon

Drawing Title

Existing Site Plan

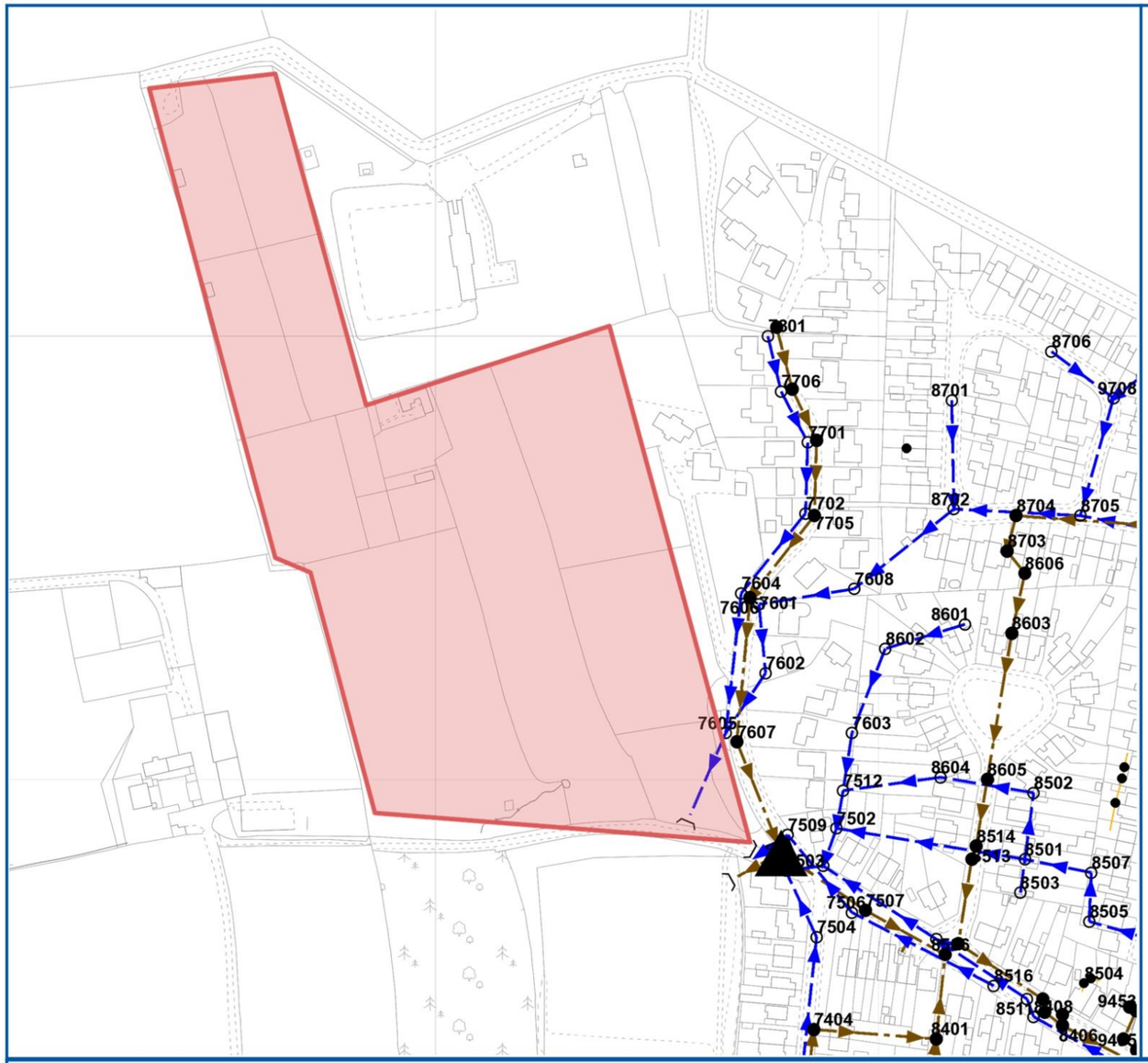
Drawn:	I.Riley		Reviewed:	D.Smith	
BWB Ref:	BMW 3087	Date:	26.11.20	Scale@A0:	1:500

Drawing Status

Information

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
RHR-BWB-00-ZZ-DR-G-0001	**S2**	**P2**

Appendix 3: Severn Trent Water Sewer Records and Pre-Development Enquiry Response



Reference	Cover Level	Invert Level Upstream	Invert Level Downstream	Purpose	Material	Pipe Shape	Max Size	Min Size	Gradient	Year Laid
SK39367802	86.6699	84.69	84.1	F	VC	C	225	<UNK>	48.92	31/12/1899 00:00:00
SK39367512	<UNK>	<UNK>	<UNK>	S	<UNK>	<UNK>	<UNK>	<UNK>	0	31/12/1899 00:00:00
SK39367608	84.0699	81.19	80.98	S	CO	C	375	<UNK>	207.48	31/12/1899 00:00:00
SK39368513	83.66	82.05	81.65	F	VC	C	300	<UNK>	96.18	31/12/1899 00:00:00
SK39368604	83.61	82.01	<UNK>	S	VC	C	225	<UNK>	0	31/12/1899 00:00:00
SK39368406	<UNK>	<UNK>	81.23	F	<UNK>	<UNK>	<UNK>	<UNK>	0	31/12/1899 00:00:00
SK39367404	84.5599	83.24	<UNK>	F	VC	C	150	<UNK>	0	31/12/1899 00:00:00
SK39367606	83.26	81.39	79.52	F	VC	C	225	<UNK>	34.91	31/12/1899 00:00:00
SK39368512	84.15	81.6	81.47	F	CO	C	450	<UNK>	349.92	31/12/1899 00:00:00
SK39368514	83.76	82.35	82.07	F	VC	C	300	<UNK>	22.57	31/12/1899 00:00:00
SK39369456	0	0	0	F	VC	C	100	0	0	31/12/1899 00:00:00
SK39367502	<UNK>	<UNK>	81.1	S	VC	C	300	<UNK>	0	31/12/1899 00:00:00
SK39367704	85.44	83.42	82.88	F	VC	C	225	<UNK>	62.98	31/12/1899 00:00:00
SK39368511	84.73	82.69	82.02	S	CO	C	450	<UNK>	73.27	31/12/1899 00:00:00
SK39368505	<UNK>	<UNK>	<UNK>	S	<UNK>	<UNK>	<UNK>	<UNK>	0	31/12/1899 00:00:00
SK39368703	85.0599	83.13	<UNK>	F	VC	C	150	<UNK>	0	31/12/1899 00:00:00
SK39368702	85.0999	82.27	81.24	S	CO	C	300	<UNK>	55.95	31/12/1899 00:00:00
SK39367701	85.4599	83.86	83.19	S	VC	C	225	<UNK>	47.79	31/12/1899 00:00:00
SK39367801	86.6299	84.94	84.49	S	VC	C	225	<UNK>	57.13	31/12/1899 00:00:00
SK39367508	82.6999	80.94	80.78	S	CO	C	450	<UNK>	107	31/12/1899 00:00:00
SK39367503	82.23	80.75	80.55	S	CO	C	450	<UNK>	69.45	31/12/1899 00:00:00
SK39368516	84.5699	83.31	81.74	S	VC	C	150	<UNK>	45.87	31/12/1899 00:00:00
SK39367602	82.4899	80.4	79.99	S	CO	C	375	<UNK>	79.15	31/12/1899 00:00:00
SK39368704	84.98	83.26	83.16	F	VC	C	150	<UNK>	164.9	31/12/1899 00:00:00
SK39368407	84.87	81.43	<UNK>	F	CO	C	450	<UNK>	0	31/12/1899 00:00:00
SK39367703	86.0599	84.06	83.51	F	VC	C	225	<UNK>	46.36	31/12/1899 00:00:00
SK39369455	0	0	0	F	VC	C	100	0	0	31/12/1899 00:00:00
SK39368601	84.2099	83.44	<UNK>	S	VC	C	225	<UNK>	0	31/12/1899 00:00:00
SK39368705	<UNK>	<UNK>	82.29	S	<UNK>	<UNK>	<UNK>	<UNK>	0	31/12/1899 00:00:00

LEGEND

Operational Site
Waste Water Pump
Transferred Asset
S24
S104
S102
Null Private
Null
None
Highway Drain
Adopted Sewer
Storage
Disposal Site
Off-Line Waste Water Storage
On-Line Waste Water Storage
Wet Well
Waste Water Process Structure
Sewage Treatment Point
Sewage Treatment Structure
Sludge Treatment Point
Sludge Treatment Structure
Manhole
Foul Bifurcation Manhole
Combined Bifurcation Manhole
Surface Water Bifurcation Manhole
Dual Manhole
Foul Single Manhole
Combined Single Manhole
Surface Water Single Manhole
Twin Manhole
Foul Adopted Manhole
Combined Adopted Manhole
Surface Adopted Manhole
Transferred Manhole
Unsurveyed Manhole
Gravity Sewer Pipe
Foul Gravity Sewer
Combined Gravity Sewer
Surface Water Gravity Sewer
S104 Surface Water Gravity Sewer
S104 Combined Gravity Sewer
S104 Foul Gravity Sewer
Private Surface Water Gravity Sewer
Private Combined Gravity Sewer
Private Foul Gravity Sewer
Surface Water Unsurveyed Pipe
Combined Unsurveyed Sewer
Foul Unsurveyed Pipe
Transferred Surface Water Sewer
Transferred Combined Sewer
Transferred Foul Sewer
Disposal Pipe
Overflow Pipe
Culverted Water Course
Waste Internal Site Pipe
Sewer Service Connection
Gravity Sewer Others
Pressure Sewer Pipe
Surface Water Pressure Sewer
Combined Pressure Sewer
Foul Pressure Sewer
S104 Surface Water Pressure Sewer
S104 Combined Pressure Sewer
S104 Foul Pressure Sewer
Private Surface Water Pressure Sewer
Private Combined Pressure Sewer
Private Foul Pressure Sewer
Surface Water Vacuum Sewer
Foul Vacuum Sewer
Combined Vacuum Sewer
S104 Surface Water Vacuum Sewer
S104 Combined Vacuum Sewer
S104 Foul Vacuum Sewer
Private Surface Water Vaccum Sewer
Private Combined Vacuum Sewer
Private Foul Vacuum Sewer
Surface Water Siphon
Combined Siphon
Foul Siphon
Private Surface Water Siphon
Private Combined Siphon
Private Foul Siphon
S104 Surface Water Siphon
S104 Combined Siphon
S104 Foul Siphon
Surface Water Unsurveyed Pipe
Combined Unsurveyed Pipe
Foul Unsurveyed Pipe
Disposal Pipe
Service Pipe
Surface Water Lateral Drain
Combined Lateral Drain
Foul Lateral Drain
S104 Surface Water Lateral Drain
S104 Combined Lateral Drain
S104 Foul Lateral Drain
Private Surface Water Lateral Drain
Private Combined Lateral Drain
Private Foul Lateral Drain
Transferred Surface Water Lateral Dra
Transferred Combined Lateral Drain
Transferred Foul Lateral Drain
Ancillary
Balancing Lagoon
Grease Trap
Interceptor
Screen
Chamber
Flushing Chamber
Scalaway
Overflow
Fitting
Blind Shaft
Facility Connector
Head Node
Lamphole
Sewerage Air Valve
Sewerage Chemical Injection Point
Sewerage Hatch Box
Sewerage Pressure Washout
Vent Column
Waste Water Outfall
Control Valve
Hydrobrake
Penstock
Sewerage Isolation Valve
Sewerage Non Return Valve
Print200mLine

MATERIALS

- - NONE
AC - ASBESTOS CEME
BR - BRICK
CC - CONCRETE BOX CULVERT
CI - CAST IRON
CO - CONCRETE
CSB CONCRETE SEGMENTS (BOLTED)
CSU - CONCRETE SEGMENTS (UNBOLTED)
DI - DUCTILE IRON
GRP - GLASS REINFORCED PLASTIC
MAC - MASONRY IN REGULAR COURSES
MAR - MASONRY RANDOMLY COURSED
PE - POLYETHLENE
PF - PITCH
PP - POLYPROPYLENE
PSC - PLASTIC STEEL COMPOSITE
PVC - POLYVINYL CHLORIDE
RPM - REINFORCED PLASTIC MATRIX
SI - SPUN (GREY) IRON
ST - STEEL
U - UNKNOWN
VC - VITRIFIED CLAY
XXX - OTHER

CATEGORIES

W - WEIR
C - CASCADE
DB - DAMBOARD
SE - SIDE ENTRY
FV - FLAP VALVE
BD - BACK DROP
S - SIPHON
D - HIGHWAY DRAIN
S104 - SECTION 104

SHAPE

C - CIRCULAR
E - EGG SHAPED
O - OTHER
R - RECTANGLE
S - SQUARE
T - TRAPEZOIDAL
U - UNKNOWN

PURPOSE

C - COMBINED
E - FINAL EFFLUENT
F - FOUL
L - SLUDGE
S - SURFACE WATER

SEVERN TRENT

Severn Trent Water Limited
Asset Data Management
PO Box 5344
Coventry
CV3 9FT
Telephone: 0345 601 6616

SEWER RECORD (Tabular)

O/S Map Scale: 1:2,500

Date of Issue: 23-05-23

This map is centred upon:

X: 439661.97 **Y:** 336711.45

Disclaimer Statement:

1 Do not scale off this Map.

2 This plan and any information supplied with it is furnished as a general guide, is only valid at the date of issue and no warranty as to its correctness is given or implied. In particular this plan and any information shown on it must not be relied upon in the event of any development or works (including but not limited to excavations) in the vicinity of SEVERN TRENT WATER assets or for the purposes of determining the suitability of a point of connection to the sewerage or distribution systems.

3 On 1 October 2011 most private sewers and private lateral drains in Severn Trent Water's sewerage area, which were connected to a public sewer as at 1 July 2011, transferred to the ownership of Severn Trent Water and became public sewers and public lateral drains. A further transfer takes place on 1 October 2012. Private pumping stations, which form part of these sewers or lateral drains, will transfer to ownership of Severn Trent Water on or before 1 October 2016. Severn Trent Water does not possess complete records of these assets. These assets may not be displayed on the map.

5 Ordnance Survey licence number: **100031673**

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WONDERFUL ON TAP

SEVERN TRENT

23rd May 2023

Matthew Bailey
11 Portland Street
Manchester
M1 3HU

Severn Trent Water Ltd
Oxley Moor Road
Wolverhampton
WV9 5HN

www.stwater.co.uk

Email:
Network.Solutions@SevernTrent.co.uk

Our ref: 1083233

Dear Matthew

Proposed Development: Royal Hill Rd Derby

I refer to your 'Development Enquiry Request' of 80 houses, commercial and school sites in respect of the above-named site. Please find enclosed the sewer records that are included in the fee together with the Supplementary Guidance Notes (SGN) which refer to surface water disposal from development sites.

Protective Strip

Having viewed our statutory sewer records, they demonstrate there is a public sewer within the site. The following easements apply to our public sewers.

100mm to 225mm 6m – 3m either side
300mm to 999mm 10m – 5m either side
1000mm and above 15m – 7.5m either side .

The site should be designed that the sewers should run through public open space or highway, If this is not possible then you may wish to apply for a S185 sewer diversion,

Due to a change in legislation on 1 October 2011, there may be former private sewers on the site which have transferred to the responsibility of Severn Trent Water Ltd, which are not shown on the statutory sewer records, but are located in your client's land. These sewers would also have protective strips that we will not allow to be built over. If such sewers are identified to be present on the site, please contact us for further guidance.

.

Foul Water Drainage

A foul connection into the local 225mm foul sewers in the south east corner would be appropriate, All the sewers seem to run towards the existing Severn Trent pump station , the flows for the overall housing site@ 1.25l/s 2xdwf but due to surcharge levels and the expected additional flows into the network downstream including the receiving pump station then additional investigation/modelling will be required., modelling will be required to better understand the impact of the additional properties on the public network.

In a change to our previous process, we no longer charge developers for the hydraulic modelling service. We will liaise with you over time with regards to the outcome of our investigations and any impact that may have on the planning status, occupation, or phasing of the site. However, while we can provide a brief summary of our findings if you need us to, we will no longer provide the full external capacity assessment report.

From the application you have submitted, I am assuming that the development has not been granted planning approval. In the meantime, the site will be added to our modelling tracker and reviewed regularly until the site can be progressed for sewer modelling. I would therefore be grateful if you would forward as soon as possible the following details:

- Confirmation whether a pumped solution is required (please provide pump rate and frequency, if available)
- Anticipated flow rate from the site
- Proposed planned start and completion date
- Any phasing details of the proposed development
- Confirm how many properties will discharge into each of the connections to the public sewer.
- Planned occupation date

Surface Water Drainage

Under the terms of Section H of the Building Regulations 2000, the disposal of surface water by means of soakaways should be considered as the primary method. If these are found to be unsuitable, satisfactory evidence will need to be submitted. The evidence should be either percolation test results or by the submission of a statement from the SI consultant (extract or a supplementary letter).

Subject to above Severn Trent Water expects all surface water from the development to be drained in a sustainable way to the nearest

watercourse or land drainage channel, including highway drainage etc. subject to the developer discussing all aspects of the developments surface water drainage, with the Local Lead Flood Authority (LLFA). Any discharge rate to a watercourse or drainage ditch will be determined by the LLFA / EA. Any discharges into the existing surface water sewers will be assessed at a later date, when a more detailed plan is available, due to the numerous options available. Due to watercourses and surface water sewers readily available, we would not permit and surface water discharge into any foul or combined sewers.

.

New Connections

For any new connections (including the re-use of existing connections) to the public sewerage system, the developer will need to submit a Section 106 application form. Our Developer Services department are responsible for handling all new connections enquiries and applications. To contact them for an application form and associated guidance notes please call 0800 707 6600 or download from www.stwater.co.uk.

Please quote the reference 1083233 in any future correspondence (including e-mails) with STW Limited. Please note that Developer Enquiry responses are only valid for 6 months from the date of this letter.

Yours sincerely,

Michael Taylor
Network Solutions
Developer Services

Appendix 4: Greenfield Runoff Rate

ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 SAAR (mm) 684 Urban 0.000
Area (ha) 1.000 Soil 0.400 Region Number Region 4

Results l/s

QBAR Rural 3.3
QBAR Urban 3.3

Q100 years 8.5

Q1 year 2.7
Q30 years 6.5
Q100 years 8.5

Appendix 5: Greenfield Runoff Volume

Greenfield Runoff Volume

FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	18.900
Ratio R	0.388
Areal Reduction Factor	1.00
Area (ha)	2.230
SAAR (mm)	684
CWI	45.000
Urban	0.000
SPR	37.000

Results

Percentage Runoff (%)	20.70
Greenfield Runoff Volume (m^3)	278.068

Appendix 6: Source Control Calculations

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.030	0.330	8.0	420.4	O K
30 min Summer	99.129	0.429	8.0	553.7	O K
60 min Summer	99.228	0.528	8.0	691.9	O K
120 min Summer	99.324	0.624	8.0	829.2	O K
180 min Summer	99.376	0.676	8.0	904.7	O K
240 min Summer	99.408	0.708	8.0	952.2	O K
360 min Summer	99.444	0.744	8.0	1006.8	O K
480 min Summer	99.466	0.766	8.0	1038.9	O K
600 min Summer	99.477	0.777	8.0	1056.7	O K
720 min Summer	99.483	0.783	8.0	1065.2	O K
960 min Summer	99.482	0.782	8.0	1064.5	O K
1440 min Summer	99.463	0.763	8.0	1034.8	O K
2160 min Summer	99.429	0.729	8.0	983.5	O K
2880 min Summer	99.392	0.692	8.0	929.1	O K
4320 min Summer	99.309	0.609	8.0	808.3	O K
5760 min Summer	99.233	0.533	8.0	698.7	O K
7200 min Summer	99.164	0.464	8.0	601.8	O K
8640 min Summer	99.101	0.401	8.0	515.7	O K
10080 min Summer	99.046	0.346	8.0	441.8	O K
15 min Winter	99.069	0.369	8.0	471.7	O K
30 min Winter	99.178	0.478	8.0	621.5	O K
60 min Winter	99.288	0.588	8.0	777.4	O K
120 min Winter	99.395	0.695	8.0	934.0	O K
180 min Winter	99.453	0.753	8.0	1019.6	O K
240 min Winter	99.489	0.789	8.0	1074.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	128.350	0.0	389.0	26
30 min Summer	84.832	0.0	510.9	41
60 min Summer	53.483	0.0	692.5	70
120 min Summer	32.610	0.0	843.5	130
180 min Summer	24.098	0.0	932.3	190
240 min Summer	19.330	0.0	993.7	248
360 min Summer	14.073	0.0	1076.5	368
480 min Summer	11.242	0.0	1134.2	486
600 min Summer	9.438	0.0	1172.2	604
720 min Summer	8.177	0.0	1192.5	724
960 min Summer	6.516	0.0	1185.6	960
1440 min Summer	4.724	0.0	1125.3	1234
2160 min Summer	3.418	0.0	1624.0	1608
2880 min Summer	2.715	0.0	1715.7	2020
4320 min Summer	1.959	0.0	1843.0	2808
5760 min Summer	1.552	0.0	1983.2	3576
7200 min Summer	1.295	0.0	2067.3	4328
8640 min Summer	1.117	0.0	2136.0	5024
10080 min Summer	0.985	0.0	2190.8	5752
15 min Winter	128.350	0.0	435.7	26
30 min Winter	84.832	0.0	565.9	41
60 min Winter	53.483	0.0	775.6	70
120 min Winter	32.610	0.0	942.1	128
180 min Winter	24.098	0.0	1038.3	186
240 min Winter	19.330	0.0	1103.0	244

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	99.531	0.831	8.0	1138.1	O K
480 min Winter	99.556	0.856	8.0	1177.5	O K
600 min Winter	99.571	0.871	8.0	1201.0	O K
720 min Winter	99.580	0.880	8.0	1214.1	O K
960 min Winter	99.584	0.884	8.0	1221.0	O K
1440 min Winter	99.566	0.866	8.0	1193.5	O K
2160 min Winter	99.522	0.822	8.0	1125.3	O K
2880 min Winter	99.476	0.776	8.0	1054.6	O K
4320 min Winter	99.368	0.668	8.0	894.0	O K
5760 min Winter	99.245	0.545	8.0	715.5	O K
7200 min Winter	99.139	0.439	8.0	567.0	O K
8640 min Winter	99.047	0.347	8.0	442.9	O K
10080 min Winter	98.974	0.274	8.0	345.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	14.073	0.0	1183.3	360
480 min Winter	11.242	0.0	1224.2	476
600 min Winter	9.438	0.0	1230.0	592
720 min Winter	8.177	0.0	1219.5	706
960 min Winter	6.516	0.0	1193.4	932
1440 min Winter	4.724	0.0	1139.8	1358
2160 min Winter	3.418	0.0	1817.0	1696
2880 min Winter	2.715	0.0	1917.4	2164
4320 min Winter	1.959	0.0	2041.2	3080
5760 min Winter	1.552	0.0	2221.6	3864
7200 min Winter	1.295	0.0	2316.3	4608
8640 min Winter	1.117	0.0	2393.9	5280
10080 min Winter	0.985	0.0	2456.9	5952

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.900	Shortest Storm (mins)	15
Ratio R	0.387	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.780

Time From: (mins)	To:	Area (ha)	Time From: (mins)	To:	Area (ha)	Time From: (mins)	To:	Area (ha)
0	4	0.594	4	8	0.593	8	12	0.593

Model Details

Storage is Online Cover Level (m) 100.100

Tank or Pond Structure

Invert Level (m) 98.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1210.0	1.000	1608.2	1.400	1783.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0132-8000-1000-8000
Design Head (m)	1.000
Design Flow (l/s)	8.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	132
Invert Level (m)	98.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	8.0	Kick-Flo®	0.664	6.6
Flush-Flo™	0.302	8.0	Mean Flow over Head Range	-	6.9

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)	Depth (m)	Flow (l/s)
0.100	4.7	0.800	7.2	2.000	11.1	4.000	15.4	7.000	20.1
0.200	7.8	1.000	8.0	2.200	11.6	4.500	16.3	7.500	20.8
0.300	8.0	1.200	8.7	2.400	12.1	5.000	17.1	8.000	21.5
0.400	7.9	1.400	9.4	2.600	12.6	5.500	17.9	8.500	22.1
0.500	7.7	1.600	10.0	3.000	13.4	6.000	18.7	9.000	22.7
0.600	7.2	1.800	10.5	3.500	14.5	6.500	19.4	9.500	23.3

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.086	0.386	8.0	494.5	O K
30 min Summer	99.197	0.497	8.0	648.5	O K
60 min Summer	99.306	0.606	8.0	803.7	O K
120 min Summer	99.429	0.729	8.0	984.3	O K
180 min Summer	99.497	0.797	8.0	1086.5	O K
240 min Summer	99.538	0.838	8.0	1150.1	O K
360 min Summer	99.581	0.881	8.0	1215.9	O K
480 min Summer	99.597	0.897	8.0	1241.5	O K
600 min Summer	99.601	0.901	8.0	1247.0	O K
720 min Summer	99.597	0.897	8.0	1241.4	O K
960 min Summer	99.577	0.877	8.0	1210.4	O K
1440 min Summer	99.523	0.823	8.0	1127.1	O K
2160 min Summer	99.454	0.754	8.0	1022.0	O K
2880 min Summer	99.396	0.696	8.0	935.2	O K
4320 min Summer	99.292	0.592	8.0	782.9	O K
5760 min Summer	99.212	0.512	8.0	668.8	O K
7200 min Summer	99.151	0.451	8.0	583.9	O K
8640 min Summer	99.101	0.401	8.0	516.2	O K
10080 min Summer	99.062	0.362	8.0	462.6	O K
15 min Winter	99.130	0.430	8.0	554.8	O K
30 min Winter	99.253	0.553	8.0	727.8	O K
60 min Winter	99.374	0.674	8.0	903.2	O K
120 min Winter	99.510	0.810	8.0	1106.2	O K
180 min Winter	99.585	0.885	8.0	1222.5	O K
240 min Winter	99.632	0.932	8.0	1295.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	150.640	0.0	456.2	26
30 min Summer	99.067	0.0	586.0	41
60 min Summer	61.880	0.0	801.1	70
120 min Summer	38.419	0.0	988.8	130
180 min Summer	28.697	0.0	1098.1	190
240 min Summer	23.124	0.0	1166.4	248
360 min Summer	16.787	0.0	1231.3	368
480 min Summer	13.240	0.0	1242.0	486
600 min Summer	10.960	0.0	1232.1	604
720 min Summer	9.366	0.0	1219.5	724
960 min Summer	7.273	0.0	1191.2	962
1440 min Summer	5.068	0.0	1130.2	1254
2160 min Summer	3.522	0.0	1672.7	1620
2880 min Summer	2.727	0.0	1723.5	2020
4320 min Summer	1.922	0.0	1810.5	2772
5760 min Summer	1.515	0.0	1935.3	3536
7200 min Summer	1.275	0.0	2035.2	4320
8640 min Summer	1.117	0.0	2137.1	5024
10080 min Summer	1.006	0.0	2238.9	5760
15 min Winter	150.640	0.0	508.6	26
30 min Winter	99.067	0.0	635.6	41
60 min Winter	61.880	0.0	895.5	70
120 min Winter	38.419	0.0	1098.7	128
180 min Winter	28.697	0.0	1206.2	186
240 min Winter	23.124	0.0	1255.4	244

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	99.681	0.981	8.0	1373.5	O K
480 min Winter	99.701	1.001	8.0	1406.2	O K
600 min Winter	99.708	1.008	8.0	1416.5	O K
720 min Winter	99.706	1.006	8.0	1414.0	O K
960 min Winter	99.689	0.989	8.0	1387.2	O K
1440 min Winter	99.636	0.936	8.0	1302.0	O K
2160 min Winter	99.551	0.851	8.0	1170.2	O K
2880 min Winter	99.481	0.781	8.0	1061.6	O K
4320 min Winter	99.344	0.644	8.0	858.6	O K
5760 min Winter	99.218	0.518	8.0	678.2	O K
7200 min Winter	99.123	0.423	8.0	545.8	O K
8640 min Winter	99.048	0.348	8.0	443.5	O K
10080 min Winter	98.989	0.289	8.0	365.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	16.787	0.0	1262.2	362
480 min Winter	13.240	0.0	1252.1	478
600 min Winter	10.960	0.0	1240.6	594
720 min Winter	9.366	0.0	1228.6	708
960 min Winter	7.273	0.0	1203.9	934
1440 min Winter	5.068	0.0	1152.1	1364
2160 min Winter	3.522	0.0	1871.1	1708
2880 min Winter	2.727	0.0	1926.0	2164
4320 min Winter	1.922	0.0	2012.4	3072
5760 min Winter	1.515	0.0	2168.1	3816
7200 min Winter	1.275	0.0	2280.4	4552
8640 min Winter	1.117	0.0	2395.1	5280
10080 min Winter	1.006	0.0	2510.7	5960

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 439659 336632 SK 39659 36632	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.780

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.594	4	8	0.593	8	12	0.593

Model Details

Storage is Online Cover Level (m) 100.100

Tank or Pond Structure

Invert Level (m) 98.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1210.0	1.000	1608.2	1.400	1783.3

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0132-8000-1000-8000
Design Head (m)	1.000
Design Flow (l/s)	8.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	132
Invert Level (m)	98.700
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	8.0	Kick-Flo®	0.664	6.6
Flush-Flo™	0.302	8.0	Mean Flow over Head Range	-	6.9

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

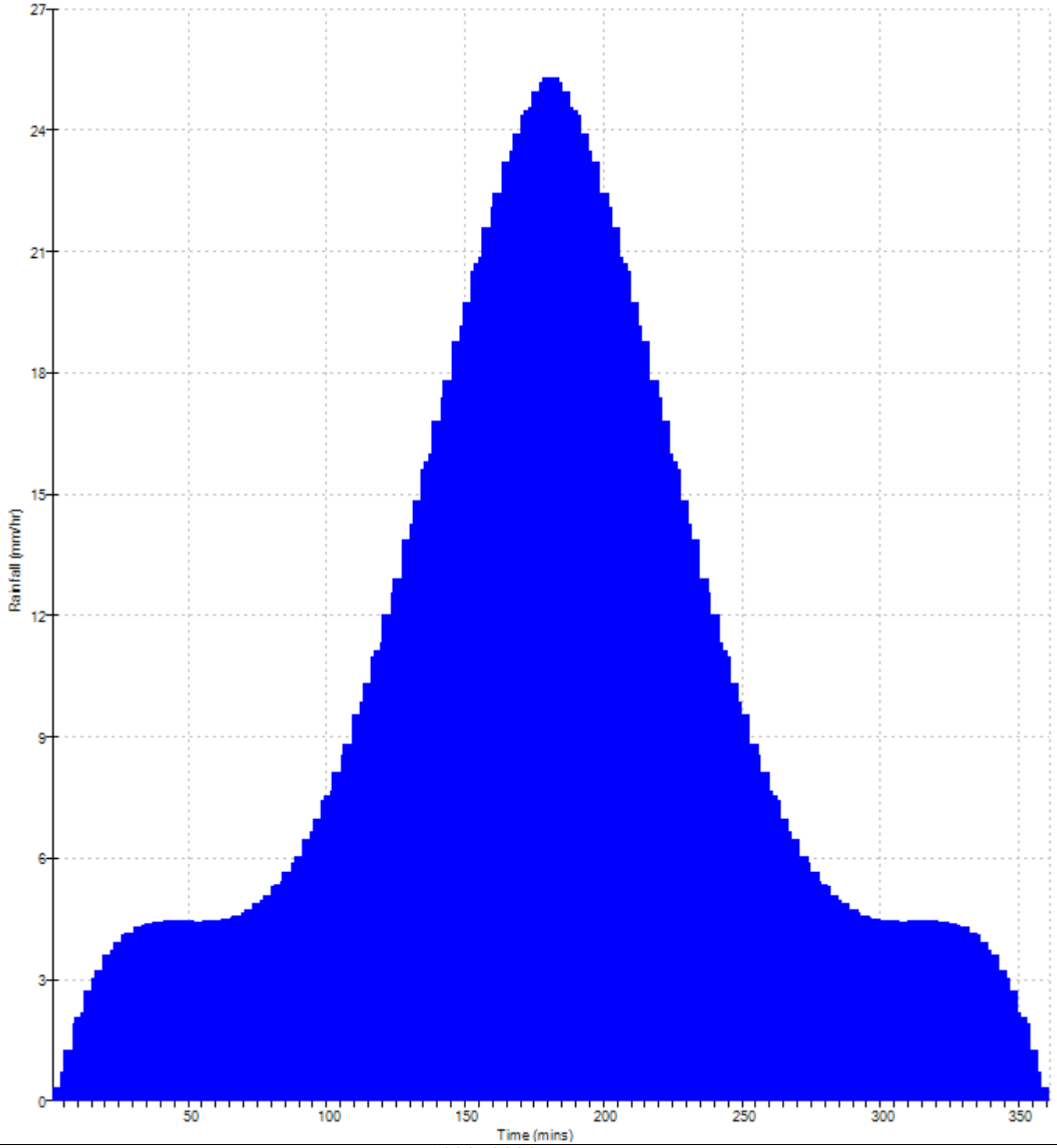
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.7	0.800	7.2	2.000	11.1	4.000	15.4	7.000	20.1
0.200	7.8	1.000	8.0	2.200	11.6	4.500	16.3	7.500	20.8
0.300	8.0	1.200	8.7	2.400	12.1	5.000	17.1	8.000	21.5
0.400	7.9	1.400	9.4	2.600	12.6	5.500	17.9	8.500	22.1
0.500	7.7	1.600	10.0	3.000	13.4	6.000	18.7	9.000	22.7
0.600	7.2	1.800	10.5	3.500	14.5	6.500	19.4	9.500	23.3

Appendix 7: 1 in 100-Year, 6-Hour Storm Rainfall Graph

Rainfall profile

Storm duration (mins) 360

FSR Data	
Region	England and Wales
M5-60 (mm)	18.800
Ratio R	0.387
Peak Intensity (mm/hr)	25.307
Ave. Intensity (mm/hr)	10.006
Return Period (years)	100.0



Appendix 8: Post-Development Greenfield Runoff Volume

Greenfield Runoff Volume

FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	18.900
Ratio R	0.388
Areal Reduction Factor	1.00
Area (ha)	0.450
SAAR (mm)	684
CWI	45.000
Urban	0.000
SPR	37.000

Results

Percentage Runoff (%)	20.70
Greenfield Runoff Volume (m^3)	56.112

Appendix 9: Outline Drainage Strategy

DEVELOPMENT AREA
MEASURED DEVELOPMENT AREA: 2.23ha
ASSUMED IMPERMEABLE AREA (65% + 10% URBAN CREEP): 1.59ha
SUDS FOOTPRINT (100%): 0.19ha

TOTAL CATCHMENT AREA: 2.42ha
TOTAL IMPERMEABLE AREA: 1.78ha

DEVELOPMENT AREA SUBJECT TO CHANGE AS MASTERPLAN DEVELOPS

DETENTION BASIN
DESIGNED TO ACCOMMODATE UP TO THE 1 IN 100-YEAR + 40% CRITICAL STORM
CL: 77.40
IL: 76.00
MAXIMUM WATER DEPTH: 1m
MAXIMUM WATER VOLUME: 1,420m³
FREEBOARD: 400mm
INDICATIVE TOP OF BANK FOOTPRINT: 1,870m²
MINIMUM INTERNAL SIDE SLOPE: 1:3
BASIN INCLUDES 3m MAINTENANCE WALKWAY
BASIN MODELLED IN CIVIL 3D TO PROVIDE ACCURATE POTENTIAL FOOTPRINT

VORTEX FLOW CONTROL
CL: 77.40
IL: 76.00
DESIGN HEAD: 1.0m
DESIGN FLOW: 8.0l/s

PROPOSED OUTFALL TO EXISTING WATERCOURSE @ IL 75.70.
PROPOSED OUTFALL SUBJECT TO CONFIRMATION OF RIPARIAN OWNERSHIP (AND/OR THIRD PARTY LAND PERMISSION) AND AGREEMENT WITH ALL RELEVANT STATUTORY CONSULTEES.

INDICATIVE 5m BUFFER FROM ORDINARY WATERCOURSE (TO BE CONFIRMED BY DERBY CITY COUNCIL)

SURFACE WATER FLOW ROUTE BASED ON BWB DIRECT RAINFALL MODELLING OUTPUTS

TYPE 3 PUMPING STATION
POSITIONED OUTSIDE OF MEDIUM TO HIGH RISK OF FLOODING.
PUMPING STATION LOCATION TO BE CONFIRMED AS MASTERPLAN DEVELOPS.
PUMPING STATION TO REQUIRE HIGHWAY ACCESS AND A MINIMUM 15m EASEMENT FROM THE PUMPING STATION WET WELL TO THE NEAREST DWELLING.
ALL ELECTRICAL CONTROL EQUIPMENT SHOULD BE EITHER WATER RESISTANT OR SITED ABOVE THE 1 IN 200-YEAR FLOOD LEVEL.

PROPOSED FOUL WATER OUTFALL TO PUBLIC SEWER SUBJECT TO HYDRAULIC MODELLING AND AGREEMENT WITH SEVERN TRENT WATER

10M EASEMENT CORRIDOR FOR PUBLIC SEWER ACCESS BASED ON SEVERN TRENT WATER PRE-DEVELOPMENT ENQUIRY (REF: 1083233), DATED 23/05/23

15m

225mmØ

225mmØ

375mmØ

375mmØ

225mmØ

SPONDON

ROYAL HILL ROAD

Legend

- SITE BOUNDARY
- EXISTING SURFACE WATER PUBLIC SEWER
- EXISTING FOUL WATER PUBLIC SEWER
- EXISTING FOUL WATER PUMPING STATION
- EXISTING FOUL WATER RISING MAIN
- EXISTING HEADWALL
- INDICATIVE PUBLIC SEWER EASEMENTS
- INDICATIVE 5m WATERCOURSE EASEMENT
- ASSUMED DEVELOPMENT AREA
- PROPOSED SURFACE WATER SEWER
- PROPOSED FOUL WATER SEWER
- PROPOSED FOUL WATER RISING MAIN
- PROPOSED HEADWALL
- PROPOSED VORTEX FLOW CONTROL
- PROPOSED DETENTION BASIN
- PROPOSED TYPE 3 PUMPING STATION
- INDICATIVE EXCEEDANCE ROUTING

SURFACE WATER FLOOD EXTENTS

- 1 IN 30-YEAR
- 1 IN 30-YEAR + 35%
- 1 IN 100-YEAR
- 1 IN 100-YEAR + 40%

Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. Enclosed Masterplan based on Pegasus Group drawing 'P19-2639_DE_001' dated 20.06.23, received 23.06.23.
6. Enclosed Topographical Survey based on BWB Consulting drawing 'RHR-BWB-00-ZZ-M2-G-0001' dated 08.04.22.
7. The existing public sewerage assets shown are based on Severn Trent Water sewer asset PDF records overlain onto the enclosed masterplan. The existing sewer alignments and easements shown are subject to confirmation following on site utility survey. The public sewerage asset information shown is given without liability or warranty.
8. Enclosed Surface Water Flood Extents based on BWB Hydraulic Modeling Exercise (RHR-BWB-ZZ-XX-RP-YE-0001_HMR).
9. The proposed maximum discharge rate is based on a calculated greenfield Qbar rate of 3.3l/s/ha prorated by a total catchment area of 2.42ha. The maximum discharge rate is subject to change following alterations to the masterplan and proposed development area as the scheme progresses.
10. This drawing is a proof of concept and should only be used for planning purposes. Do not construct or cost from this drawing.
11. This drawing it to be read in conjunction with BWB report 'RHR-BWB-ZZ-XX-RP-CD-0002_SDS'.

Rev	Date	Details of issue / revision	Drw	Rev
P1	18.07.23	For Planning	WJ	MB

Issues & Revisions

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Client
MILLER HOMES LTD

Project Title
ROYAL HILL ROAD, SPONDON

Drawing Title
OUTLINE DRAINAGE LAYOUT

Drawn:	W. James	Reviewed:	M. Bailey
BWB Ref:	BMW3087	Date:	18.07.23	Scale@A1:	1:500

Drawing Status
For Planning

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
RHR-BWB-DDG-XX-DR-CD-0500	S2	P1

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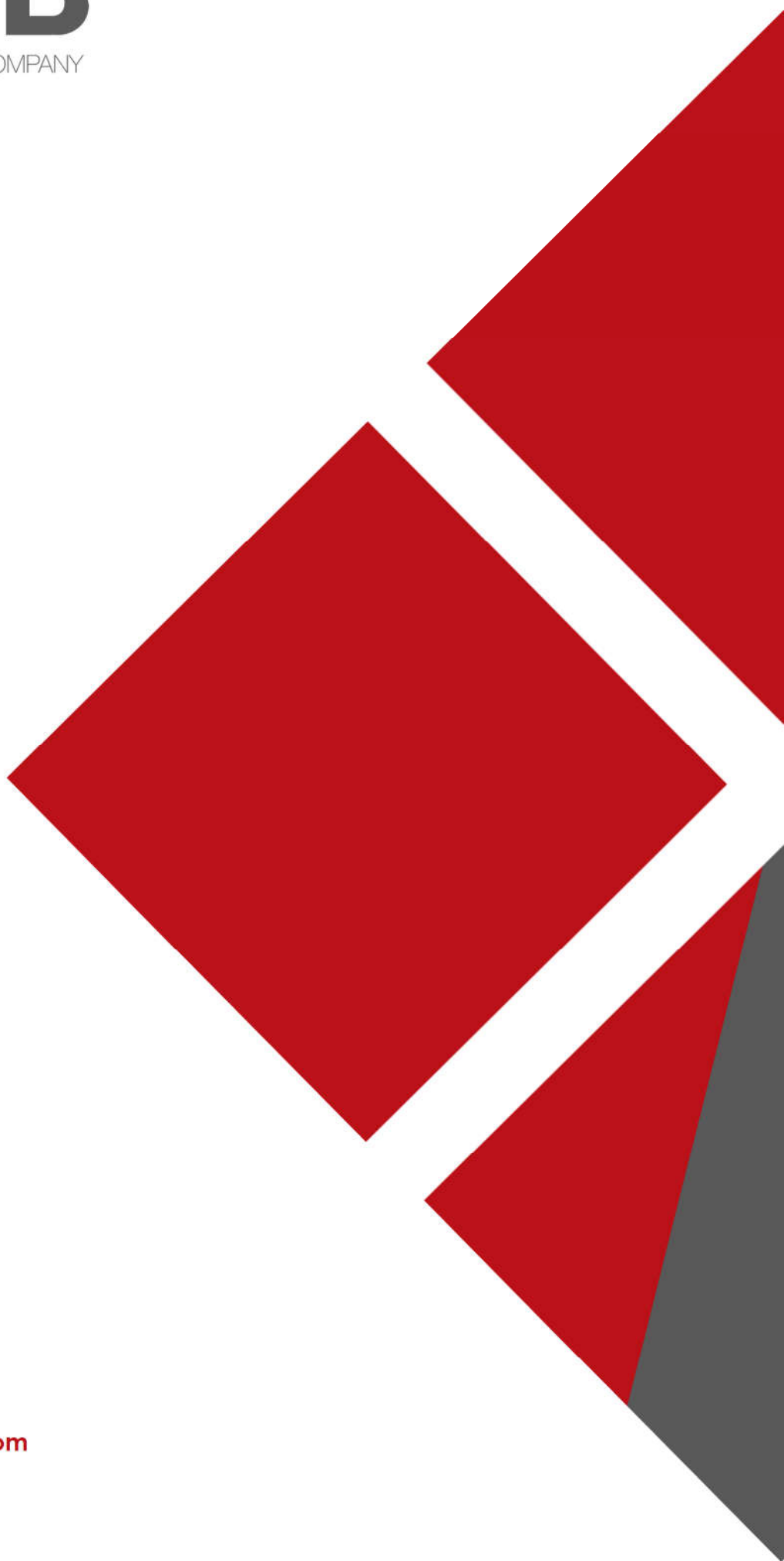

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