

Land at Larchwood Avenue, Havant

Drainage Strategy Statement

BIM Ref: 068960-CUR-01-XX-RP-CE-Drainage Strategy

Curtins Ref: 068960

Revision: V05

Issue Date: 05 September 2018

Client Name: Tiger Developments Ltd.

Client Address: Carrington House, 126-130 Regent St, Soho, London W1B 5SE

Site Address: Land at Larchwood Avenue, Havant, PO9 3QL

Curtins
56 The Ropewalk,
Nottingham, NG1 5DW
Tel: 0115 941 5551
www.curtins.com

STRUCTURES • TRANSPORT PLANNING • ENVIRONMENTAL • CIVILS & INFRASTRUCTURE • SUSTAINABILITY • STAKEHOLDER ENGAGEMENT
Birmingham • Bristol • Cardiff • Douglas • Edinburgh • Kendal • Leeds • Liverpool • London • Manchester • Nottingham



Rev	Description	Issued by	Checked	Date
V01	First Issue	ID	RJ	24/08/18
V02	Report Revised.	ID	AW	28/08/18
V03	Report Revised.	RV	AW	05/09/18
V04	Report Revised	AS	ID	25/09/18
V05	Report Revised	MK	ID	11/10/18

This report has been prepared for the sole benefit, use, and information for the client. The liability of Curtins Consulting Limited with respect to the information contained in the report will not extend to any third party.

Author	Signature	Date
Ivayla Dimitrov MSc Project Engineer		24/08/18

Reviewed	Signature	Date
Ania Wojnowska BEng (Hons) Principal Engineer		24/08/18

Table of contents

1.0	Surface Water.....	3
1.1	National Guidelines	3
1.2	Proposed Surface Water Design	4
	Figure 1: Environment Agency Map for planning (Flooding Zone 1)	6
2.0	Foul Water	7
3.0	Appendices	8
Appendix A	Site Location Plan	9
Appendix B	Proposed Site Layout.....	10
Appendix C	Site Investigation Report	11
Appendix D	Utility Survey	12
Appendix E	Public Sewer Records	13
Appendix F	Greenfield Run-Off Rate Calculations.....	14
Appendix G	Response to Pre-Development Enquiry	15
Appendix H	MicroDrainage Network Calculations.....	16
Appendix I	Surface Water and Foul Water Drainage Layouts	17

1.0 Surface Water

1.1 National Guidelines

The aim of the surface water drainage proposals is to focus on the capture and management of all surface water within the site boundary, to prevent any likelihood of flooding to the proposed development, adjacent sites and infrastructure.

General national guidance for the design of the surface water drainage systems include the following:

- National Planning Policy Framework (NPPF)
- Non-Statutory Technical Standards for Sustainable Drainage Systems, DEFRA, March 2015
- Written Ministerial Statement regarding Sustainable Drainage (HCWS161)
- The SUDS Manual – C753, CIRIA Industry Best Practice Guidance
- Flood Risk Planning Practice Guidance
- Building Regulations Part H

The NPPF recognises that flood risk and other environmental damage can be managed by minimising changes to the volume and rate of surface runoff from development sites, and recommends that priority is given to the use of Sustainable Drainage Systems (SUDS) in new developments.

Building Regulations 2010 Requirement H3 stipulates that rainwater from roofs and paved areas is carried away from the surface to discharge to one of the following, listed in order of hierarchy:

- I. Discharge into the ground;
- II. Discharge to a surface water body;
- III. Discharge to a surface water sewer;
- IV. Discharge to a combined sewer where there are absolutely no other options and only where agreed in advance with the relevant sewage undertaker.

The site details are as follows:

Land at Larchwood Avenue
Havant
PO9 3QL

OS Grid Reference:

469515, 107601

The site is located in Havant and is bounded by a hypermarket to the south, with a green area bordering the western boundary, Larchwood Avenue to the east and an aerospace development north of the site (Appendix A).

The site is currently derelict, comprising previously developed hardstanding areas, which are overgrown with colonising grassland and scrub vegetation. The proposal for the development includes the construction of a 4-storey hotel with associated infrastructure - a car park, footpaths, a lay-by and new soft landscaping (Appendix B).

Discharge into the ground

A Geo-Environmental Site Investigation was undertaken by DeltaSimons in June 2018 (18-0609.01). Cable percussion boreholes and Trial pits were undertaken. Information on the ground conditions are detailed below.

Variable thicknesses of Made Ground, underlain by Clay Head Deposits and London Clay were recorded. Additional monitoring of the standpipes indicated that groundwater is within the shallow Head Deposits.

Based on the above ground conditions and the shallow groundwater encountered in most of the exploratory holes, soakaways are deemed unfeasible for the scheme (Appendix C).

Furthermore, the site is located within a Source Protection Zone 1c for the Havant and Bedhampton Springs. As discussed in the paragraph above it is not intended to use soakaways on site for surface water discharge, therefore no impact to the aquifer is anticipated. Additionally, even though there is a possibility that a shallow piled foundation for one of the retaining structures on site may need to be utilised, our Geotechnical Ground Investigation works show that there is a deep layer of London Clay on site that is significantly deeper than the depth of piles that would be proposed, as such the risk of impact on the aquifer is very low.

Discharge into a surface water body

The nearest watercourse sits approximately 400m to the north of the site. The distance to the brook means that a new direct connection to the brook is unviable because Purbrook Way and 3 major commercial developments lie between the site and the brook.

Discharge into a surface water public sewer

A utility survey undertaken by Spatial Dimensions in May 2018 confirmed the presence of an existing 600mm diameter surface water and 150mm diameter foul water sewers in the north-eastern corner of the site, adjacent to the site boundary (Appendix D). The development is proposed to discharge surface water and foul water flows from site to these existing sewers, respectively. The existing sewers are assumed to connect to the existing public sewers manholes 6502 and 6550 to the opposite side of McDonald's (Appendix E). This will be confirmed via additional survey.

Discharge into a combined sewer

This option is deemed unfeasible for this site.

1.2 Proposed Surface Water Design

The proposed land at Larchwood Avenue development covers total area of 0.451ha of which 0.343ha comprise impermeable hardstanding areas.

The greenfield run-off rate generated by the 0.451ha site area was calculated using the Source Control module in Micro Drainage, resulting in 1.9 l/s (Appendix F). A discharge rate of 5l/s from site has been proposed, as this figure is the practical minimum rate used to minimise the risk of blockages.

A pre-development enquiry was submitted to Southern Water to confirm existing capacity within their public sewers. The response to the enquiry stated that Southern Water has no objections to discharging surface water from site to their existing public water sewer at the rate of 5l/s (Appendix G).

The Microdrainage Network Module has been used to establish the overall attenuation volume required for the 100 years plus 30% climate change event. This has been calculated to be approximately 183m³, which is to be accommodated in an underground attenuation tank and permeable pavement within car park spaces.

Additionally, a sensitivity test of the proposed system was undertaken for the 100 years plus 40% climate change event to ensure that no flooding to any proposed or existing properties will occur. This shows a minor increase in the discharge rate from site but no flooding events.

A calculation summary is included in Appendix H.

Considering the site constraints, a sealed drainage system, with an underground tank, has been proposed, connecting to the existing surface water manhole to the north of the site. All proposed parking within the site will utilise a permeable surface with a wrapped stone subbase. The subbase will provide water quality improvement and surface water storage.

The strategy proposes to control the runoff to the above discharge rate via a Hydro-brake Flow Control Chamber downstream of the underground tank.

The surface water drainage layout is included in Appendix I.

Water Quality

The new SUDS Manual (CIRIA C753, November 2015) introduced a slightly different approach compared to the previous version for the water quality management of surface water. The manual describes risks posed by the surface water runoff to the receiving environment as a function of:

- The pollution hazard at a particular site (i.e. the pollution source);
- The effectiveness of the SUDS treatment components in reducing levels of pollutants to environmentally acceptable levels (i.e. the pollutant pathway); and,
- The sensitivity of the receiving environment (the environmental receptor).

In accordance with the SUDS Manual, the site is classified as presenting a low pollutant hazard level in vehicular areas. In order to ensure water quality improvement into the surface water sewer system, a combination of permeable paving/sub-base and filter drains are proposed. These measures will treat runoff from car parking and hardstanding areas.

Flood Risk

It is apparent from the Environment Agency (EA) and Government flood mapping tool, that the site and surrounding areas are categorised to be in Flood Zone 1, therefore having a low probability of flooding as indicated in Figure 1. Other forms of flooding have been assessed, such as that from rivers & seas, groundwater reservoirs, canals and other artificial forms of flooding, for which the risks are considered negligible.

The risk of surface water flooding is also very low with the exception of two small strips to the west of the site which are considered to be at a low risk. However, surface water flooding is highly dependent on the ground levels which are to be redesigned as part of the development which as result will reduce the slightly increased risk.

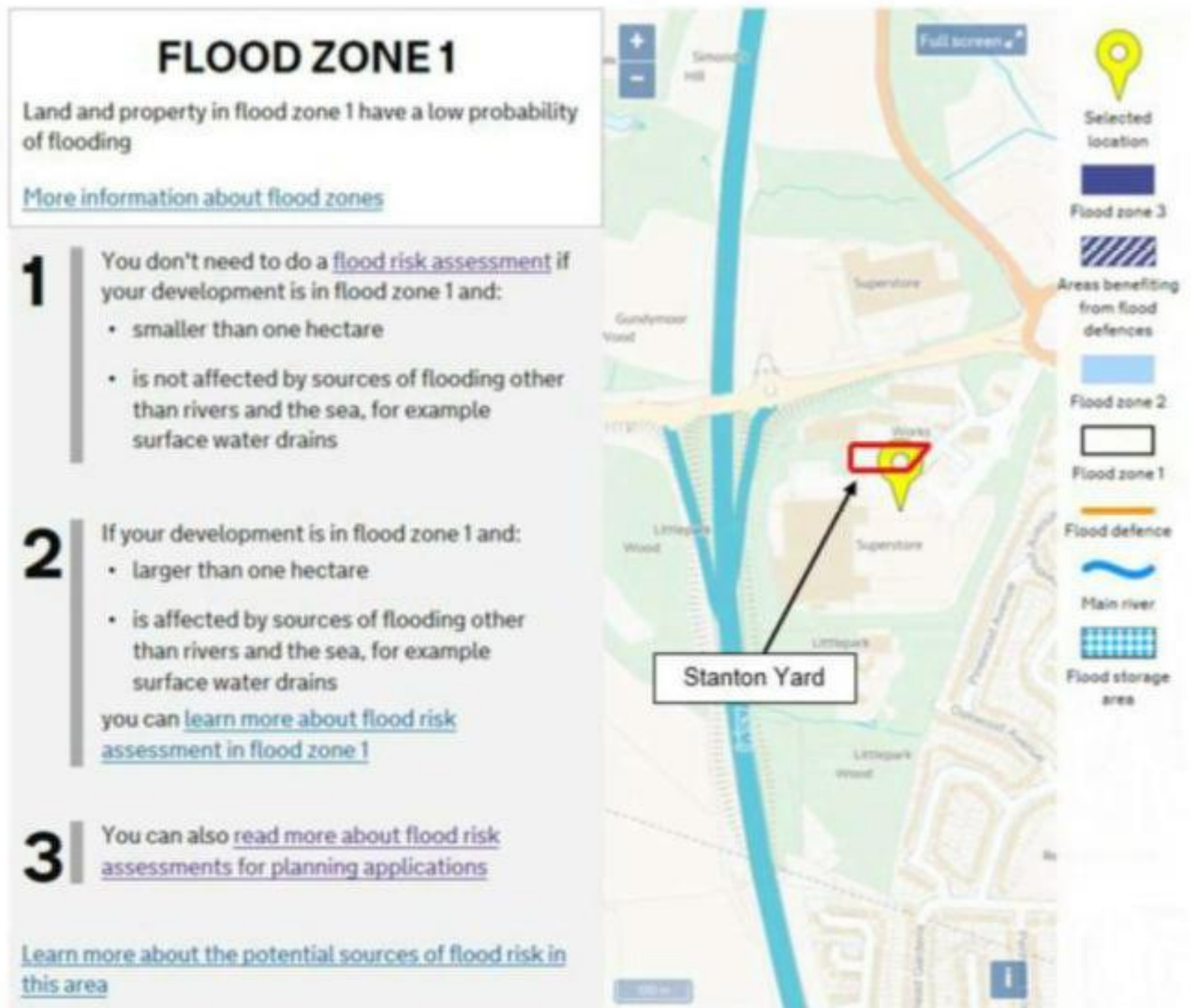


Figure 1: Environment Agency Map for planning (Flooding Zone 1)

2.0 Foul Water

The proposed foul water network is gravity fed, and it is proposed to connect to the existing foul sewer to the north east of the site. The response to the Developer Enquiry confirms that Southern Water's system has sufficient capacity to accommodate the foul water discharge from site. The construction of the new connection to the sewer will be subject to Section 106 approval.

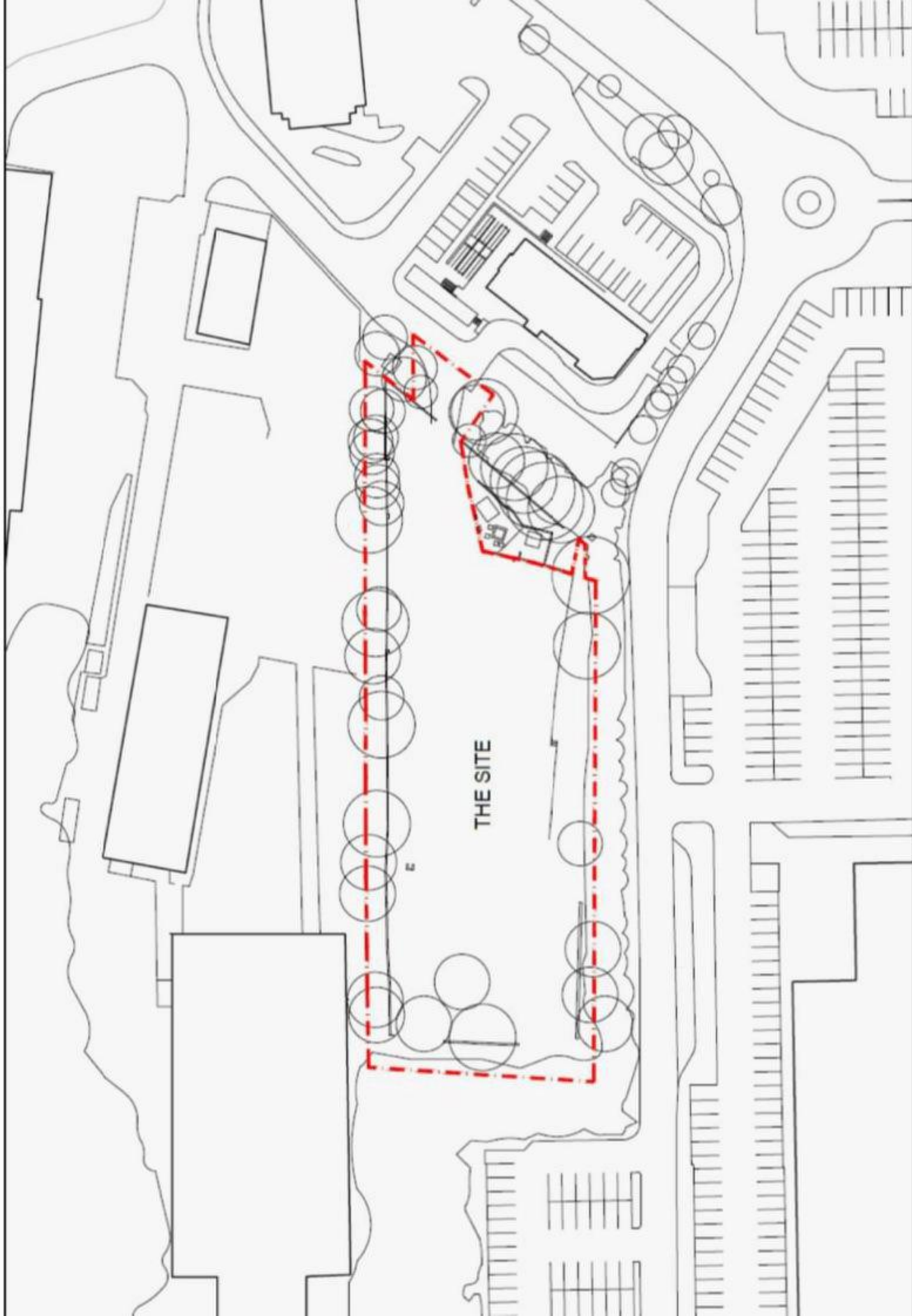
The foul water drainage layout is included in Appendix I.

Completion of the foul water drainage networks is reliant upon receipt of finalised and frozen Public Health (above ground foul drainage) design information.

3.0 Appendices

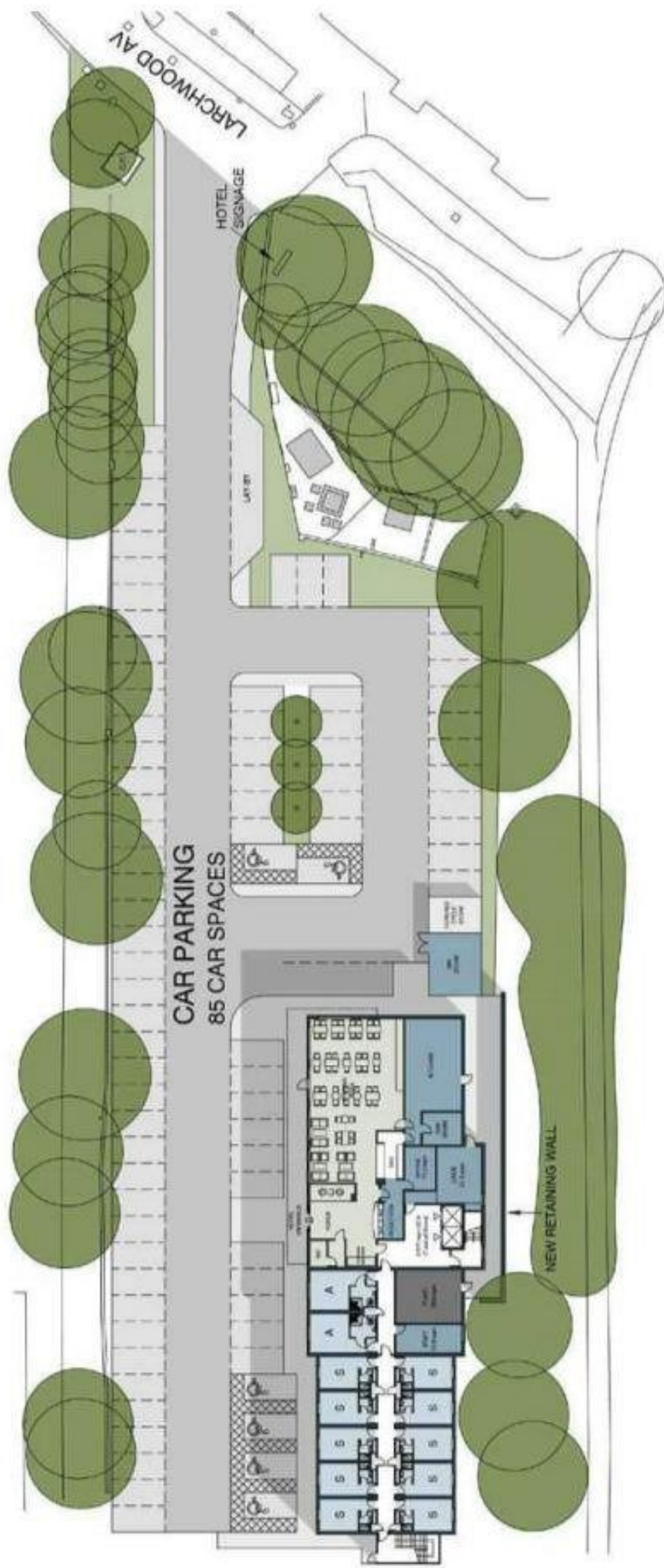
Appendix A	Site Location Plan
Appendix B	Proposed Site Layout
Appendix C	Site Investigation Report
Appendix D	Utility Survey
Appendix E	Public Sewer Records
Appendix F	Greenfield Run-Off Rate Calculations
Appendix G	Response to Pre-Development Enquiry
Appendix H	MicroDrainage Network Calculations
Appendix I	Surface Water and Foul Drainage Layouts

Appendix A Site Location Plan



THE SITE

Appendix B Proposed Site Layout



Appendix C Site Investigation Report



Geo-Environmental Site Investigation

Stanton's Yard, Larchwood Avenue, Havant PO9 3QL

Presented to Tiger Developments

Issued: June 2018

Delta-Simons Project No. 18-0609.01



Delta-Simons Environmental Consultants Limited
Head Office: 3 Henley Office Park, Doddington Road, Lincoln, LN6 3QR
Tel: 01522 882555 | www.deltasimons.com



Report Details

Client	Tiger Developments
Report Title	Geo-Environmental Site Investigation
Site Address	Stanton's Yard, Larchwood Avenue, Havant PO9 3QL
Project No.	18-0609.01
Report Date	June 2018
Delta-Simons Contact	Tom Horner (tom.horner@deltasimons.com)

Quality Assurance

Issue No.	Status	Issue Date	Comments	Author	Technical Review	Authorised
1	Final	21 st June 2018	-			
				Aidan Nelson Graduate	Tom Horner Principal	Paul Bennett Unit Director

About us

Delta-Simons is a trusted, multidisciplinary environmental consultancy, focused on delivering the best possible project outcomes for customers.

Specialising in Environment, Health & Safety and Sustainability, Delta-Simons provide support and advice within the property development, asset management, corporate and industrial markets. Operating from nine locations - Lincoln, Birmingham, Dublin, Durham, Leeds, London, Manchester, Norwich and Nottingham - we employ over 70 environmental professionals, bringing experience from across the private consultancy and public sector markets.

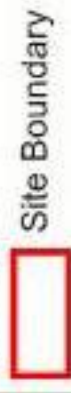
Delta-Simons is proud to be a founder member of the Inogen® Environmental Alliance, enabling us to efficiently deliver customer projects worldwide by calling upon over 4,330 resources in our global network of consultants, each committed to providing superior EH&S and sustainability consulting expertise to our customers. Inogen Environmental Alliance offers its clients more consultants, with more services in more countries than the traditional multinational consultancy.

Executive Summary

Brief	Delta-Simons Environmental Consultants Limited ('Delta-Simons') was instructed by Legge Consulting on the behalf of Tiger Developments (the 'Client') to undertake a Geo-Environmental Site Investigation for land at Stanton's Yard, Larchwood Avenue, Havant PO9 3QL (hereafter referred to as the 'Site'). The proposed development is understood to comprise a hotel development with associated car parking. The purpose of this assessment is to identify the potential for land contamination issues to be present at the Site in the context of the proposed development, to support the planning application and to provide a geotechnical assessment.
Site Setting	The Site was previously an unspecified works and, with the exception of the radio mast in the south-eastern corner of the Site, all previous buildings have now been demolished. Currently the Site is predominantly covered with hardstanding, with a stockpile present at the centre. The western side of the Site has become overgrown, with trees and other vegetation. There is a raised slab, which runs along the south of the Site, with a slope leading up towards the adjacent supermarket car park.
Ground Conditions	The current ground investigation recorded a variable thickness of Made Ground, which is in turn underlain by Head Deposits and London Clay. Monitoring of standpipes indicates that groundwater is within the Head Deposits.
Land Contamination Assessment	<u>Human Health</u> Asbestos was identified in the shallow Made Ground in the south west of the Site. The main exposure pathway is direct contact, ingestion and inhalation of dust/fibres. Prior to any redevelopment works, appropriate method statements and risk assessments should be created to ensure safety to ground workers, end users and adjacent Site users. A topsoil capping system in landscaped areas will be sufficient to mitigate potential risk to Site end users. <u>Controlled Waters</u> Potential risks to controlled waters has been identified. Given the presence of cohesive superficial deposits at the Site, it is considered that the contamination sources have a limited mobility to controlled water receptors, and given only marginal exceedances have been recorded, remedial measures are not considered necessary. <u>Built Environment</u> The detailed investigation of each utility route was not within the scope of this investigation, however, given the presence of petroleum hydrocarbon contaminants at the Site, it is considered likely /prudent to consider the use of barrier pipe materials. In accordance with the recommendations of BRE Special Digest 1, 'Concrete in Aggressive Ground' 2005, the conditions of the soils at the Site would be classified as Design Sulphate Class DS-3 and ACEC Class AC-2s in order to resist chemical attack from elevated sulphate present in the soils (assuming static groundwater in potentially pyritic soils). <u>Ground Gas</u> Preliminary ground gas monitoring indicates the Site can be provisionally classified as CS2. As such, ground gas protection measures will need to be incorporated into the proposed development.



LEGEND



Site Boundary



Dynamic Sampler with SPTs



Borehole with SPTs



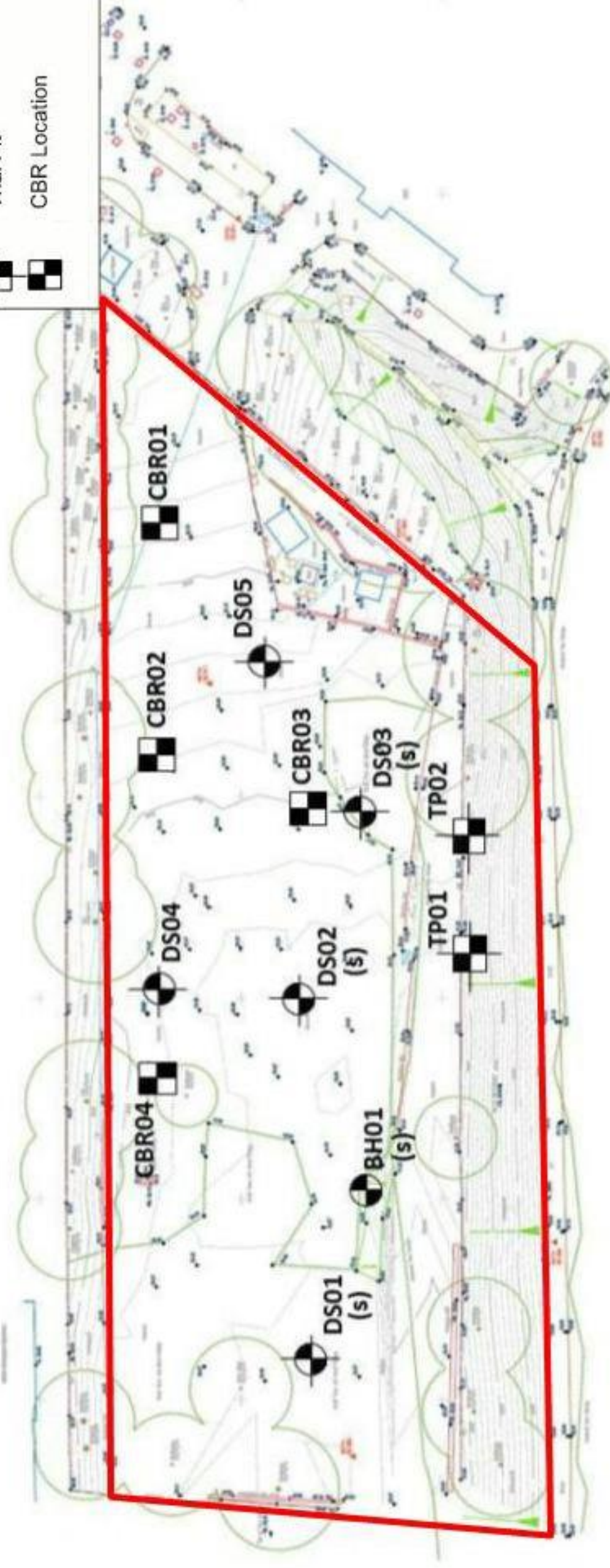
Standpipe



Trial Pit



CBR Location



Contains Data from, © 2015 Landmark Information Group Ltd

Contains OS data © , Crown Copyright and Database Right (2016)

Cable Percussive Borehole Log

 Date: **24/05/2018**

 Client: **Tiger Developments**

Description of Strata	Legend	Strata Depth (m bgl)	Strata Thickness (m)	Reduced Level (mAOD)	Casing Diameter (mm)	Water	Sample Details			Test Details		Backfill
							Depth (m)	Type	Ref	Depth (m)	Results	
MADE GROUND: Concrete.		0.20	(0.20)				0.00 - 1.00	B	1			
Firm white brown mottled slightly gravelly CLAY. Gravel is angular to subangular fine to medium flint and chalk. Occasional plant remains. (HEAD DEPOSITS)		0.50	(0.30)				0.30 0.40	ES D	1 2			
Firm light brown orange and grey mottled closely fissured slightly silty slightly sandy CLAY. Sand is fine. Rare plant remains. (HEAD DEPOSITS)			(2.40)				0.70	D	3			
							1.20 1.20 1.20 - 1.65	D G B	1 4 5	1.20	SPT(S)N=7 (1.2/1.2,2.2)	
							2.00 - 2.45 2.00 - 2.45	B D	6 7	2.00	SPT(S)N=9 (1.2/2.2,2.2)	
		2.90					2.90 3.00 3.00 - 3.45 3.00 - 3.45	D G B D	8 10 2 9	3.00	SPT(S)N=8 (1.2/2.2,2.2)	
Firm dark brown grey mottled closely fissured slightly silty sandy CLAY. Sand is fine. Rare plant remains. (HEAD DEPOSITS)			(1.70)				4.00 4.00 - 4.45	D B	11 12	4.00	SPT(S)N=11 (1.2/2.3,3.3)	
		4.60					4.60	D	13			
Stiff greyish brown closely fissured slightly silty slightly sandy, becoming very sandy from 12 m bgl, CLAY. Sand is fine to medium. Frequent shell fragments from 5 m bgl. (LONDON CLAY)						5.00	5.00 5.00 - 5.45 5.00 - 5.45	G B D	14 15 3	5.00	SPT(S)N=18 (2.3/4.4,5.5)	

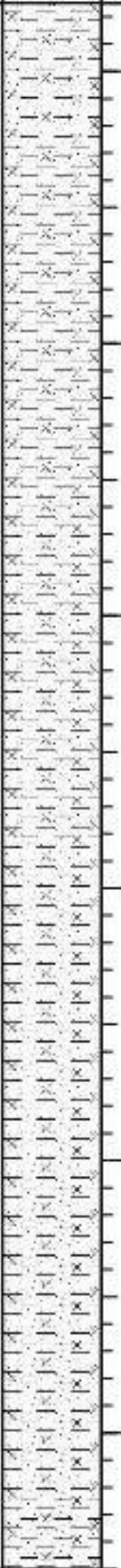
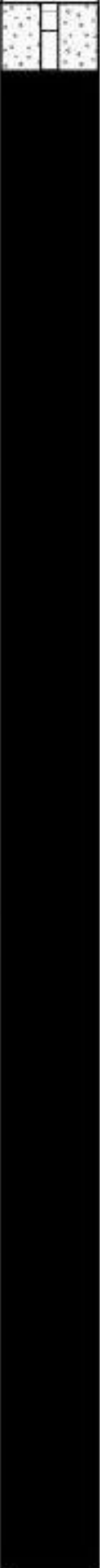
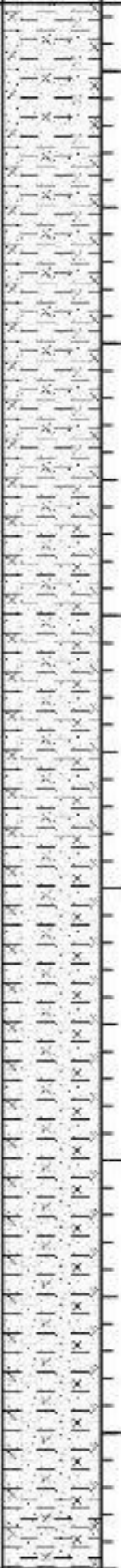
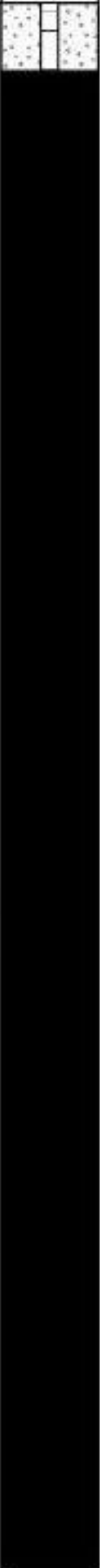
 Remarks:
 1. Engineer logged in general accordance to BS 5930:2015. 2. Area cleared for services prior to drilling. 3. Driller noted seepage between 5.00 and 5.50 m bgl. 4. Groundwater was encountered at 12 m bgl. 5. Borehole installed with 50mm diameter standpipe, gas bung and lockable tophat/ traffic strength flush cover.

Water Strike			Water Level		Chiselling	
Date	Time	Strike	Duration	Standing	Depth (m)	Time (h:m)
24/05/2018		5.00 m				
24/05/2018		12.00 m				

Cable Percussive Borehole Log

 Date: **24/05/2018**

 Client: **Tiger Developments**

Description of Strata	Legend	Strata Depth (m bgl)	Strata Thickness (m)	Reduced Level (mAOD)	Casing Diameter (mm)	Water	Sample Details			Test Details		Backfill
							Depth (m)	Type	Ref	Depth (m)	Results	
Stiff greyish brown closely fissured slightly silty slightly sandy, becoming very sandy from 12 m bgl, CLAY. Sand is fine to medium. Frequent shell fragments from 5 m bgl. (LONDON CLAY)							6.00 - 6.45	B	17	6.00	SPT(S)N=18 (2,3/4,4,5,5)	
							6.00 - 6.45	D	19			
							7.50 - 7.95	B	18	7.50	SPT(S)N=24 (3,4/6,5,6,7)	
							7.50 - 7.95	D	19			
			(10.40)				9.00 - 9.45	B	20	9.00	SPT(S)N=42 (5,7/8,10,12,12)	
							9.00 - 9.45	D	21			
							10.50 - 10.95	B	22	10.50	SPT(S)N=33 (5,6/7,8,9,9)	
							10.50 - 10.95	D	23			

 Remarks:
 1. Engineer logged in general accordance to BS 5930:2015. 2. Area cleared for services prior to drilling. 3. Driller noted seepage between 5.00 and 5.50 m bgl. 4. Groundwater was encountered at 12 m bgl. 5. Borehole installed with 50mm diameter standpipe, gas bung and lockable tophat/ traffic strength flush cover.

Water Stike			Water Level		Chiselling	
Date	Time	Strike	Duration	Standing	Depth (m)	Time (h:m)
24/05/2018		5.00 m				
24/05/2018		12.00 m				

Coordinates:	Elevation (mAOD):	Drilled By: Paul Blackledge Drilling	Plant Used: Dando 3000	Logged: AN	Checked: TH	Approved: TH	Scale (m): 1:30
--------------	-------------------	--	----------------------------------	----------------------	-----------------------	------------------------	---------------------------

 Head Office 3 Henley Way, Doddington Road Lincoln, LN5 3QR Tel: +44 (0) 1522 882555 Email: info@deltasimons.com					Project No: 18-0609.01		Hole ID: BH01		Page: 3 of 3				
Cable Percussive Borehole Log					Date: 24/05/2018		Client: Tiger Developments						
Description of Strata		Legend	Strata Depth (m bgl)	Strata Thickness (m)	Reduced Level (mAOD)	Casing Diameter (mm)	Water	Sample Details			Test Details		Backfill
Stiff greyish brown closely fissured slightly silty slightly sandy, becoming very sandy from 12 m bgl, CLAY. Sand is fine to medium. Frequent shell fragments from 5 m bgl. (LONDON CLAY)			15.00				12.00	12.00 - 12.45 12.00 - 12.45	B 24 D 25	12.00	SPT(S)N=30 (6,6/7,7,8,8)		
								13.50 - 13.95 13.50 - 13.95	B 26 D 27	13.50	SPT(S)N=36 (7,8/8,9,9,10)		
Borehole complete at 15.00 m bgl.							15.00 - 15.45		D 28	15.00	SPT(S)N=39 (6,8/8,9,10,12)		
Remarks: 1. Engineer logged in general accordance to BS 5930:2015. 2. Area cleared for services prior to drilling. 3. Driller noted seepage between 5.00 and 5.50 m bgl. 4. Groundwater was encountered at 12 m bgl. 5. Borehole installed with 50mm diameter standpipe, gas bung and lockable tophat/ traffic strength flush cover.						Water Stike			Water Level		Chiselling		
						Date	Time	Strike	Duration	Standing	Depth (m)	Time (h:m)	
						24/05/2018 24/05/2018		5.00 m 12.00 m					
Coordinates:		Elevation (mAOD):		Drilled By: Paul Blackledge Drilling		Plant Used: Dando 3000		Logged: AN	Checked: TH	Approved: TH	Scale (m): 1:30		

Appendix D Utility Survey

Utility Key	
TV	CCTV / CABLE TELEVISION
450	COMBINED DRAINAGE
COM	COMMUNICATIONS CABLE
A	COMPRESSED AIR
	DUCTING
	EARTH CABLE
	ELECTRIC CABLE
EOT	END OF TRACE
150	FOUL DRAINAGE
F	FUEL PIPE
	GAS PIPE
G	GAUGE LINE
H	HEATING
O	OFFSET FILL PIPE
	PUMPING MAIN
R	RADAR AREA ANOMALY
R	RADAR UTILITY TRACE
300	SURFACE DRAINAGE
	TELECOM CABLE
TL	TRAFFIC LIGHTS
U	UNIDENTIFIED
VR	VAPOUR RECOVERY
V	VENT PIPE
	WATER PIPE

Utility Abbreviations

AR	ASSUMED ROUTE	KO	KERB OUTLET	SL	SIGNAL POST
AV	AIR VALVE	LW	LIFEBOLT	SP	SIGN POST
BB	BIFURCATION BEACON	LK	LOCK GATE	SPH	SHEET PILING
BD	BACKDROP	LH	LADDER	SPR	SPIRING
Bd	BED LEVEL	LH	LAMP HOLE	SPH	SAMPLING POINT
BH	BORERHOLE	LP	LAMP POST	ST	STOP TAP
BH01	BASINENT MATCH COVER	LV	LOW VOLTAGE	STL	STILE
Bn	LITTER / GRIT SALT BIN	MgP	MOORING POST	STR	STRUCTURE TOP LEVEL
BL	BASINENT LIGHT	MH	METERS HIGH	STP	STUMP (TREE)
Bd	BOLLARD	Mch	MACHINERY	SP	STAND PIPE
BP	BOUNDARY POST	Mh	MANHOLE	SPH	STAY POST
BS	BUS STOP	Mh	MARKER POST	SPW	STAY WIRE
BTIC	BRITISH TELECOM CHAMBER	Mh	MARKER POST (ELECTRIC)	SV	STOP VALVE
CdL	CABLE TO COVER	Mh	MARKER POST (GAS)	SVP	SOIL VENT PIPE
CdL	CABLE TO COVER	Mh	MARKER POST (RAILWAY)	TBR	TEMPERATURE BEACON MARK

Appendix E Public Sewer Records



Appendix F Greenfield Run-Off Rate Calculations

Curtins Consulting Ltd		
7 College Street Nottingham NG15 5AQ		
Date 25/09/2018 11:38 File 068960 - STANTON YARD GREENFIELD RUNOFF RATE.SRCX		Designed by slawinska_a Checked by
Micro Drainage	Source Control 2017.1.2	

ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 Area (ha) 0.450 SAAR (mm) 681 Soil 0.450 Urban 0.000 Region Number Region

Results 1/s

QBAR Rural 1.9
QBAR Urban 1.9

Q100 years 6.8

Q1 year 1.7
Q30 years 4.6
Q100 years 6.8

Appendix G Response to Pre-Development Enquiry

Mr Ricardo Vendone
Curtins Consulting Ltd
56 The Ropewalk
Nottingham
NG1 5DW

Developer Services
Southern Water
Sparrowgrove House
Sparrowgrove
Otterbourne
Hampshire
SO21 2SW

Tel: **0330 303 0119**

Email: developerservices@southernwater.co.uk

Your Ref:

Our Ref:

DS_CC_PDE-102547

Date:

10 September 2018

Site: Stanton yard, Larchwood Avenue, Havant, Hampshire, PO9 3QW.

Dear Mr Vendone,

The enquiry has been re-assessed to determine the capacity for the SW flow rate of 5 l/s at manhole reference SU69076550.

The assessment indicates that there is sufficient capacity in the local SW network to accommodate a SW flow rate of 5 l/s at manhole reference SU69076550.

Should you require any further information, please contact us at the above mentioned phone number or address.

Yours sincerely,


Geoffrey Hall
Developer services

Please note: -

The information provided above does not grant approval for any designs/drawings submitted for the capacity analysis. The results quoted above are only valid for 12 months from the date of issue of this letter.

Appendix H MicroDrainage Network Calculations

Curtins Consulting Limited	
56 The Ropewalk Nottingham NG1 5DW	
Date 25/09/2018 10:44	Designed by dimitrov_i
File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX	Checked by
XP Solutions	Network 2017.1.2

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

Return Period (years)		1		Maximum Time of Concentration (mins)		30		Add Flow / Climate Change (%)		0		Min Vel for	
M5-60 (mm)		19.000		Foul Sewage (l/s/ha)		0.000		Minimum Backdrop Height (m)		0.200		Min Slope	
Ratio R		0.350		Volumetric Runoff Coeff.		0.750		Maximum Backdrop Height (m)		1.500			
Maximum Rainfall (mm/hr)		50		PIMP (%)		100		Min Design Depth for Optimisation (m)		1.200			

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.094	4-8	0.243	8-12	0.005

Total Area Contributing (ha) = 0.343

Total Pipe Volume (m³) = 11.253

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	14.809	0.099	150.0	0.014	5.00	0.0	0.600	o	150	Pipe/Conduit	🟡
S1.001	3.041	0.020	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S1.002	15.818	0.105	150.0	0.015	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S1.003	16.776	0.112	150.0	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢

Curtins Consulting Limited	
56 The Ropewalk Nottingham NG1 5DW	
Date 25/09/2018 10:44	Designed by dimitrov_i
File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX	Checked by
XP Solutions	Network 2017.1.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.000	35.068	0.341	102.8	0.000	5.00	0.0	0.600	0	150	Pipe/Conduit	🟡
S2.002	1.237	0.302	4.1	0.013	0.00	0.0	0.600	0	150	Pipe/Conduit	🟢
S1.004	11.655	0.379	30.7	0.009	0.00	0.0	0.600	0	150	Pipe/Conduit	🟢
S4.000	7.808	0.052	150.0	0.013	5.00	0.0	0.600	0	150	Pipe/Conduit	🟡
S4.001	28.939	0.193	150.0	0.000	0.00	0.0	0.600	0	150	Pipe/Conduit	🟢
S4.002	21.422	0.143	150.0	0.008	0.00	0.0	0.600	0	150	Pipe/Conduit	🔴
S5.000	43.971	0.293	150.1	0.000	5.00	0.0	0.600	0	150	Pipe/Conduit	🟡
S5.001	4.981	0.033	150.0	0.053	0.00	0.0	0.600	0	150	Pipe/Conduit	🟢
S4.003	12.419	0.083	150.0	0.000	0.00	0.0	0.600	0	150	Pipe/Conduit	🟢
S1.005	26.360	0.695	37.9	0.029	0.00	0.0	0.600	0	150	Pipe/Conduit	🟢
S6.000	25.437	0.700	36.3	0.000	5.00	0.0	0.600	0	150	Pipe/Conduit	🟡
S6.001	7.864	0.079	99.5	0.022	0.00	0.0	0.600	0	150	Pipe/Conduit	🟢
S7.000	17.158	0.500	34.3	0.000	5.00	0.0	0.600	0	150	Pipe/Conduit	🟡

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul Flow (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	46.39	5.59	30.057	0.000	0.0	0.0	0.0	0.99	17.5	0.0
S2.002	44.56	6.12	29.716	0.013	0.0	0.0	0.0	5.02	88.7	1.6
S1.004	44.21	6.23	29.414	0.064	0.0	0.0	0.0	1.82	32.2	7.6

Curtins Consulting Limited	
56 The Ropewalk Nottingham NG1 5DW	
Date 25/09/2018 10:44	Designed by dimitrov_i
File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX	Checked by
XP Solutions	Network 2017.1.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S7.001	8.720	0.573	15.2	0.021	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S8.000	13.667	0.234	58.4	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	🟡
S8.001	6.863	0.069	99.5	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S9.000	6.496	0.043	150.0	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	🟡
S9.001	5.834	0.039	149.6	0.012	0.00	0.0	0.600	o	150	Pipe/Conduit	🔴
S7.002	4.087	0.041	99.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S1.006	16.816	0.774	21.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S10.000	49.356	0.844	58.5	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	🟡
S10.001	50.595	1.100	46.0	0.039	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S10.002	4.108	0.070	58.5	0.037	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S10.003	3.635	0.062	58.5	0.012	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S10.004	5.093	0.152	33.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔴
S11.000	18.188	0.227	80.1	0.019	5.00	0.0	0.600	o	150	Pipe/Conduit	🔴
S1.007	15.206	0.000	0.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	🔴
S1.008	16.502	0.529	31.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	🟢

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S7.001	47.77	5.22	28.342	0.021	0.0	0.0	0.0	2.59	45.9	2.7
S8.000	47.96	5.17	28.357	0.000	0.0	0.0	0.0	1.32	23.3	0.0
S8.001	47.52	5.29	28.123	0.013	0.0	0.0	0.0	1.01	17.8	1.7
S9.000	48.12	5.13	27.852	0.000	0.0	0.0	0.0	0.82	14.5	0.0
S9.001	47.66	5.25	27.809	0.012	0.0	0.0	0.0	0.82	14.5	1.5

Curtins Consulting Limited

56 The Ropewalk

Nottingham

NG1 5DW

Date 25/09/2018 10:44

File 068960-CUR-00-00-DC-C-0001 P01-SURFACE DRAINAGE MODEL.MDX

XP Solutions

Designed by dimitrov_i
Checked by

Checked by

Network 2017.1.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SL009	10.912	0.187	58.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	I Area (ha)	I Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.009	36.69	9.12	25.951	0.343	0.0	0.0	0.0	1.71	68.1	34.5

Curtins Consulting Limited	
56 The Ropewalk Nottingham NG1 5DW	
Date 25/09/2018 10:44	Designed by dimitrov_i
File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX	Checked by
XP Solutions	Network 2017.1.2

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	0	150	S1	30.693	29.750	0.793	Open Manhole	1200
S1.001	0	150	S2	30.647	29.651	0.846	Open Manhole	1200
S1.002	0	150	S3	30.620	29.631	0.839	Open Manhole	1200
S1.003	0	150	S4	30.578	29.526	0.903	Open Manhole	1200
S2.000	0	150	S5	32.254	30.040	2.064	Open Manhole	1200
S2.001	0	150	S6	32.213	29.878	2.185	Open Manhole	1200
S3.000	0	150	S7	31.452	30.057	1.245	Open Manhole	1200
S2.002	0	150	S7	32.114	29.716	2.248	Open Manhole	1200
S1.004	0	150	S5	30.534	29.414	0.971	Open Manhole	1200
S4.000	0	150	S10	30.765	29.105	1.510	Open Manhole	1200
S4.001	0	150	S11	30.414	29.053	1.211	Open Manhole	1200
S4.002	0	150	S14	30.616	28.852	1.614	Open Manhole	1200
S5.000	0	150	S16	30.545	29.400	0.995	Open Manhole	1200
S5.001	0	150	S17	30.483	29.107	1.226	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	14.809	150.0	S2	30.647	29.651	0.846	Open Manhole	1200
S1.001	3.041	150.0	S3	30.620	29.631	0.839	Open Manhole	1200
S1.002	15.818	150.0	S4	30.578	29.526	0.903	Open Manhole	1200
S1.003	16.776	150.0	S5	30.534	29.414	0.971	Open Manhole	1200
S2.000	26.153	159.8	S6	32.213	29.876	2.186	Open Manhole	1200

Curtins Consulting Limited	
56 The Ropewalk Nottingham NG1 5DW	
Date 25/09/2018 10:44	Designed by dimitrov_i
File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX	Checked by
XP Solutions	Network 2017.1.2

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S4.003	o	150	S16	30.480	28.709	1.621	Open Manhole	1200
S1.005	o	150	S6	30.439	28.424	1.866	Open Manhole	1200
S6.000	o	150	S18	30.556	29.206	1.200	Open Manhole	1200
S6.001	o	150	S19	29.875	28.506	1.219	Open Manhole	1200
S7.000	o	150	S20	30.204	28.854	1.200	Open Manhole	1200
S7.001	o	150	S21	29.659	28.342	1.167	Open Manhole	1200
S8.000	o	150	S22	30.157	28.357	1.650	Open Manhole	1200
S8.001	o	150	S23	29.703	28.123	1.430	Open Manhole	1200
S9.000	o	150	S24	29.202	27.852	1.200	Open Manhole	1200
S9.001	o	150	S25	29.456	27.809	1.437	Open Manhole	1200
S7.002	o	150	S22	29.520	27.770	1.600	Open Manhole	1200
S1.006	o	150	S7	29.624	27.729	1.745	Open Manhole	1200
S10.000	o	150	S28	30.618	29.268	1.200	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S4.003	12.419	150.0	S6	30.439	28.626	1.663	Open Manhole	1200
S1.005	26.360	37.9	S7	29.624	27.729	1.745	Open Manhole	1200
S6.000	25.437	36.3	S19	29.875	28.506	1.219	Open Manhole	1200
S6.001	7.864	99.5	S7	29.624	28.427	1.047	Open Manhole	1200

Curtins Consulting Limited	
56 The Ropewalk Nottingham NG1 5DW	
Date 25/09/2018 10:44	Designed by dimitrov_i
File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX	Checked by
XP Solutions	Network 2017.1.2

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S10.001	0	150	S29	30.298	28.424	1.724	Open Manhole	1200
S10.002	0	150	S30	28.661	27.324	1.187	Open Manhole	1200
S10.003	0	150	S31	28.752	27.254	1.349	Open Manhole	1200
S10.004	0	150	S32	28.877	27.208	1.519	Open Manhole	1200
S11.000	0	150	S33	28.310	27.397	0.763	Open Manhole	1200
S1.007	0	225	S8	29.025	26.480	2.320	Open Manhole	1200
S1.008	0	225	S9	28.472	26.480	1.767	Open Manhole	1200
S1.009	0	225	S10	27.185	25.951	1.009	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S10.001	50.595	46.0	S30	28.661	27.324	1.187	Open Manhole	1200
S10.002	4.108	58.5	S31	28.752	27.254	1.349	Open Manhole	1200
S10.003	3.635	58.5	S32	28.877	27.192	1.535	Open Manhole	1200
S10.004	5.093	33.5	S8	29.025	27.056	1.819	Open Manhole	1200
S11.000	18.188	80.1	S8	29.025	27.170	1.705	Open Manhole	1200
S1.007	15.206	0.0	S9	28.472	26.480	1.767	Open Manhole	1200
S1.008	16.502	31.2	S10	27.185	25.951	1.009	Open Manhole	1200
S1.009	10.912	58.5	S	26.850	25.764	0.861	Open Manhole	0

Curtins Consulting Limited	
56 The Ropewalk Nottingham NG1 5DW	
Date 25/09/2018 10:44 File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX XP Solutions	Designed by dimitrov_i Checked by Network 2017.1.2

Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Manhole Volume (m³)	Total Volume (m³)
S1.000	S1	1.067	1.067
S1.001	S2	1.126	1.126
S1.002	S3	1.118	1.118
S1.003	S4	1.191	1.191
S2.000	S5	2.504	2.504
S2.001	S6	2.641	2.641
S3.000	S7	1.578	1.578
S2.002	S7	2.712	2.712
S1.004	S5	1.267	1.267
S4.000	S10	1.877	1.877
S4.001	S11	1.540	1.540
S4.002	S14	1.995	1.995
S5.000	S16	1.295	1.295
S5.001	S17	1.556	1.556
S4.003	S16	2.003	2.003
S1.005	S6	2.280	2.280
S6.000	S18	1.527	1.527
S6.001	S19	1.549	1.549
S7.000	S20	1.526	1.526
S7.001	S21	1.489	1.489
S8.000	S22	2.036	2.036
S8.001	S23	1.787	1.787
S9.000	S24	1.527	1.527
S9.001	S25	1.863	1.863
S7.002	S22	1.979	1.979
S1.006	S7	2.144	2.144
S10.000	S28	1.526	1.526
S10.001	S29	2.120	2.120
S10.002	S30	1.512	1.512
S10.003	S31	1.695	1.695
S10.004	S32	1.887	1.887
S11.000	S33	1.033	1.033
S1.007	S8	2.879	2.879
S1.008	S9	2.253	2.253

Curtins Consulting Limited	
56 The Ropewalk Nottingham NG1 5DW	
Date 25/09/2018 10:44 File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX XP Solutions	Designed by dimitrov_i Checked by Network 2017.1.2

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Manhole Volume (m³)	Total Volume (m³)
S1.000	S1	1.067	1.067
S1.001	S2	1.126	1.126
S1.002	S3	1.118	1.118
S1.003	S4	1.191	1.191
S2.000	S5	2.504	2.504
S2.001	S6	2.641	2.641
S3.000	S7	1.578	1.578
S2.002	S7	2.712	2.712
S1.004	S5	1.267	1.267
S4.000	S10	1.877	1.877
S4.001	S11	1.540	1.540
S4.002	S14	1.995	1.995
S5.000	S16	1.295	1.295
S5.001	S17	1.556	1.556
S4.003	S16	2.003	2.003
S1.005	S6	2.280	2.280
S6.000	S18	1.527	1.527
S6.001	S19	1.549	1.549
S7.000	S20	1.526	1.526
S7.001	S21	1.489	1.489
S8.000	S22	2.036	2.036
S8.001	S23	1.787	1.787
S9.000	S24	1.527	1.527
S9.001	S25	1.863	1.863
S7.002	S22	1.979	1.979
S1.006	S7	2.144	2.144
S10.000	S28	1.526	1.526
S10.001	S29	2.120	2.120
S10.002	S30	1.512	1.512
S10.003	S31	1.695	1.695
S10.004	S32	1.887	1.887
S11.000	S33	1.033	1.033
S1.007	S8	2.879	2.879
S1.008	S9	2.253	2.253

Curtins Consulting Limited		
56 The Ropewalk Nottingham NG1 5DW		
Date 25/09/2018 10:44		
File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX		
XP Solutions		
Designed by dimitrov_i Checked by Network 2017.1.2		
1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm		
Simulation Criteria		
Areal Reduction Factor 1.000 Hot Start Level (mm) 0 Foul Sewage per hectare (l/s) 0.000 MADD Factor * 10m³/ha Storage 2.000 Hot Start (mins) 0 Manhole Headloss Coeff (Global) 0.500 Additional Flow - % of Total Flow 0.000 Inlet Coefficient 0.800		
Number of Input Hydrographs 0 Number of Online Controls 7 Number of Offline Controls 0 Number of Storage Structures 8 Number of Time/Area D		
Synthetic Rainfall Details		
Rainfall Model FSR Region England and Wales M5-60 (mm) 19.000 Ratio R 0.350 Cv (Summer) 0.750 Cv (Winter)		
Margin for Flood Risk Warning (mm) 300.0 Analysis Timestep Fine DTS Status ON DVD Status OFF Inertia Stat		
Profile(s)		
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 7200, 7200,		
Return Period(s) (years)		
Climate Change (%)		
Summe		
Water Surcharged Flooded		
PN	US/MH Name	Storm
S1.000	S1	15 Winter
S1.001	S2	15 Winter
S1.002	S3	15 Winter
S1.003	S4	15 Winter
S2.000	S5	360 Winter
S2.001	S6	360 Winter
S3.000	S7	360 Winter
S2.002	S7	15 Winter
S1.004	S5	15 Winter
S4.000	S10	15 Winter
S4.001	S11	15 Winter
S4.002	S14	15 Winter
S5.000	S16	60 Winter
S5.001	S17	60 Winter
S4.003	S16	15 Winter
S1.005	S6	15 Winter

Curtins Consulting Limited												
56 The Ropewalk Nottingham NG1 5DW												
Date 25/09/2018 10:44												
File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX												
XP Solutions												
Designed by dimitrov_i Checked by Network 2017.1.2												
30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm												
Simulation Criteria												
Areal Reduction Factor 1.000 Hot Start Level (mm) 0 Foul Sewage per hectare (l/s) 0.000 MADD Factor * 10m³/ha Storage 2.000 Hot Start (mins) 0 Manhole Headloss Coeff (Global) 0.500 Additional Flow - % of Total Flow 0.000 Inlet Coefficient 0.800												
Number of Input Hydrographs 0 Number of Online Controls 7 Number of Offline Controls 0 Number of Storage Structures 8 Number of Time/Area D												
Synthetic Rainfall Details												
Rainfall Model FSR Region England and Wales M5-60 (mm) 19.000 Ratio R 0.350 Cv (Summer) 0.750 Cv (Winter)												
Margin for Flood Risk Warning (mm) 300.0 Analysis Timestep Fine DTS Status ON DVD Status OFF Inertia Stat												
Profile(s)												
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, Summe												
Return Period(s) (years)												
Climate Change (%)												
Water Surcharged Flooded												
PN	US/MH Name	Storm	Return Climate Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Depth (m)	Volume (m³)	Flow / Overflow Cap. (l/s)
S1.000	S1	15 Winter	30	+0%	100/15 Winter				29.809	-0.091	0.000	0.32
S1.001	S2	15 Winter	30	+0%	100/15 Summer				29.729	-0.072	0.000	0.41
S1.002	S3	15 Winter	30	+0%	100/15 Summer				29.723	-0.058	0.000	0.67
S1.003	S4	15 Winter	30	+0%	100/15 Summer				29.643	-0.033	0.000	0.95
S2.000	S5	360 Winter	30	+0%					30.040	-0.150	0.000	0.00
S2.001	S6	360 Winter	30	+0%					29.876	-0.151	0.000	0.00
S3.000	S7	360 Winter	30	+0%					30.057	-0.150	0.000	0.00
S2.002	S7	15 Summer	30	+0%					29.752	-0.114	0.000	0.13
S1.004	S5	15 Winter	30	+0%	100/15 Summer				29.505	-0.058	0.000	0.67
S4.000	S10	15 Winter	30	+0%	100/15 Summer				29.165	-0.090	0.000	0.33
S4.001	S11	15 Winter	30	+0%	100/15 Summer				29.109	-0.094	0.000	0.29
S4.002	S14	15 Winter	30	+0%	100/15 Summer				28.926	-0.076	0.000	0.47
S5.000	S16	60 Winter	30	+0%	30/15 Summer				30.274	0.724	0.000	0.08
S5.001	S17	60 Winter	30	+0%	1/15 Summer				30.274	1.017	0.000	0.31
S4.003	S16	15 Winter	30	+0%	30/15 Summer				28.896	0.037	0.000	0.85
S1.005	S6	15 Winter	30	+0%	30/15 Summer				28.867	0.000	0.000	1.19

Curtins Consulting Limited		
56 The Ropewalk Nottingham NG1 5DW		
Date 25/09/2018 10:44	Designed by dimitrov_i	
File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX	Checked by	
XP Solutions	Network 2017.1.2	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Stor

Simulation Criteria		
Areal Reduction Factor 1.000	Hot Start Level (mm) 0	Foul Sewage per hectare (l/s) 0.000 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0	Manhole Headloss Coeff (Global) 0.500	Additional Flow - % of Total Flow 0.000 Inlet Coefficient 0.800
Number of Input Hydrographs 0 Number of Online Controls 7 Number of Offline Controls 0 Number of Storage Structures 8 Number of Time/Area D		
Rainfall Model FSR Region England and Wales M5-60 (mm) 19.000 Ratio R 0.350 Cv (Summer) 0.750 Cv (Winter)		
Margin for Flood Risk Warning (mm) 300.0 Analysis Timestep Fine DTS Status ON DVD Status OFF Inertia Stat		
Profile(s)		
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200,		
Return Period(s) (years)		
Climate Change (%)		

PN	US/MH Name	Storm	Return Climate Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Surcharged Flooded		
									Level (m)	Depth (m)	Volume (m³) Cap. (l/s)
S1.000	S1	15 Winter	100	+30%	100/15 Winter				29.917	0.017	0.000 0.47
S1.001	S2	15 Winter	100	+30%	100/15 Summer				29.893	0.092	0.000 0.68
S1.002	S3	15 Winter	100	+30%	100/15 Summer				29.885	0.104	0.000 0.87
S1.003	S4	15 Winter	100	+30%	100/15 Summer				29.813	0.137	0.000 1.26
S2.000	S5	360 Winter	100	+30%					30.040	-0.150	0.000 0.00
S2.001	S6	360 Winter	100	+30%					29.876	-0.151	0.000 0.00
S3.000	S7	360 Winter	100	+30%					30.057	-0.150	0.000 0.00
S2.002	S7	15 Summer	100	+30%					29.763	-0.103	0.000 0.22
S1.004	S5	15 Winter	100	+30%	100/15 Summer				29.666	0.102	0.000 0.92
S4.000	S10	15 Winter	100	+30%	100/15 Summer				29.518	0.263	0.000 0.50
S4.001	S11	15 Winter	100	+30%	100/15 Summer				29.506	0.303	0.000 0.48
S4.002	S14	15 Winter	100	+30%	100/15 Summer				29.485	0.483	0.000 0.85
S5.000	S16	60 Winter	100	+30%	30/15 Summer				30.447	0.897	0.000 0.08
S5.001	S17	60 Winter	100	+30%	1/15 Summer				30.447	1.190	0.000 0.34
S4.003	S16	15 Winter	100	+30%	30/15 Summer				29.462	0.603	0.000 1.38
S1.005	S6	15 Winter	100	+30%	30/15 Summer				29.438	0.864	0.000 1.38

Curtins Consulting Limited	
56 The Ropewalk Nottingham NG1 5DW	
Date 25/09/2018 10:40	Designed by dimitrov_i
File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX	Checked by
XP Solutions	Network 2017.1.2

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

Return Period (years)		1		Maximum Time of Concentration (mins)		30		Add Flow / Climate Change (%)		0		Min Vel for	
M5-60 (mm)		19.000		Foul Sewage (l/s/ha)		0.000		Minimum Backdrop Height (m)		0.200		Min Slope	
Ratio R		0.350		Volumetric Runoff Coeff.		0.750		Maximum Backdrop Height (m)		1.500			
Maximum Rainfall (mm/hr)		50		PIMP (%)		100		Min Design Depth for Optimisation (m)		1.200			

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.094	4-8	0.243	8-12	0.005

Total Area Contributing (ha) = 0.343

Total Pipe Volume (m³) = 11.253

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	14.809	0.099	150.0	0.014	5.00	0.0	0.600	o	150	Pipe/Conduit	🟡
S1.001	3.041	0.020	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S1.002	15.818	0.105	150.0	0.015	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S1.003	16.776	0.112	150.0	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢

Curtins Consulting Limited	
56 The Ropewalk Nottingham NG1 5DW	
Date 25/09/2018 10:40	Designed by dimitrov_i
File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX	Checked by
XP Solutions	Network 2017.1.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.000	35.068	0.341	102.8	0.000	5.00	0.0	0.600	0	150	Pipe/Conduit	🟡
S2.002	1.237	0.302	4.1	0.013	0.00	0.0	0.600	0	150	Pipe/Conduit	🟢
S1.004	11.655	0.379	30.7	0.009	0.00	0.0	0.600	0	150	Pipe/Conduit	🟢
S4.000	7.808	0.052	150.0	0.013	5.00	0.0	0.600	0	150	Pipe/Conduit	🟡
S4.001	28.939	0.193	150.0	0.000	0.00	0.0	0.600	0	150	Pipe/Conduit	🟢
S4.002	21.422	0.143	150.0	0.008	0.00	0.0	0.600	0	150	Pipe/Conduit	🔴
S5.000	43.971	0.293	150.1	0.000	5.00	0.0	0.600	0	150	Pipe/Conduit	🟡
S5.001	4.981	0.033	150.0	0.053	0.00	0.0	0.600	0	150	Pipe/Conduit	🟢
S4.003	12.419	0.083	150.0	0.000	0.00	0.0	0.600	0	150	Pipe/Conduit	🟢
S1.005	26.360	0.695	37.9	0.029	0.00	0.0	0.600	0	150	Pipe/Conduit	🟢
S6.000	25.437	0.700	36.3	0.000	5.00	0.0	0.600	0	150	Pipe/Conduit	🟡
S6.001	7.864	0.079	99.5	0.022	0.00	0.0	0.600	0	150	Pipe/Conduit	🟢
S7.000	17.158	0.500	34.3	0.000	5.00	0.0	0.600	0	150	Pipe/Conduit	🟡

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul Flow (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	46.39	5.59	30.057	0.000	0.0	0.0	0.0	0.99	17.5	0.0
S2.002	44.56	6.12	29.716	0.013	0.0	0.0	0.0	5.02	88.7	1.6
S1.004	44.21	6.23	29.414	0.064	0.0	0.0	0.0	1.82	32.2	7.6

Curtins Consulting Limited	
56 The Ropewalk Nottingham NG1 5DW	
Date 25/09/2018 10:40 File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX XP Solutions	Designed by dimitrov_i Checked by Network 2017.1.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S7.001	8.720	0.573	15.2	0.021	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S8.000	13.667	0.234	58.4	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	🟡
S8.001	6.863	0.069	99.5	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S9.000	6.496	0.043	150.0	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	🟡
S9.001	5.834	0.039	149.6	0.012	0.00	0.0	0.600	o	150	Pipe/Conduit	🔴
S7.002	4.087	0.041	99.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S1.006	16.816	0.774	21.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S10.000	49.356	0.844	58.5	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	🟡
S10.001	50.595	1.100	46.0	0.039	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S10.002	4.108	0.070	58.5	0.037	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S10.003	3.635	0.062	58.5	0.012	0.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S10.004	5.093	0.152	33.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔴
S11.000	18.188	0.227	80.1	0.019	5.00	0.0	0.600	o	150	Pipe/Conduit	🔴
S1.007	15.206	0.000	0.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	🔴
S1.008	16.502	0.529	31.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	🟢

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add (l/s)	Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S7.001	47.77	5.22	28.342	0.021	0.0	0.0	0.0	0.0	2.59	45.9	2.7
S8.000	47.96	5.17	28.357	0.000	0.0	0.0	0.0	0.0	1.32	23.3	0.0
S8.001	47.52	5.29	28.123	0.013	0.0	0.0	0.0	0.0	1.01	17.8	1.7
S9.000	48.12	5.13	27.852	0.000	0.0	0.0	0.0	0.0	0.82	14.5	0.0
S9.001	47.66	5.25	27.809	0.012	0.0	0.0	0.0	0.0	0.82	14.5	1.5

Curtins Consulting Limited	
56 The Ropewalk Nottingham NG1 5DW	
Date 25/09/2018 10:40	Designed by dimitrov_i
File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX	Checked by
XP Solutions	Network 2017.1.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.009	10.912	0.187	58.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.009	36.69	9.12	25.951	0.343	0.0	0.0	0.0	1.71	68.1	34.5

Curtins Consulting Limited		
56 The Ropewalk Nottingham NG1 5DW		
Date 25/09/2018 10:40	Designed by dimitrov_i	
File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX	Checked by	
XP Solutions	Network 2017.1.2	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	0	150	S1	30.693	29.750	0.793	Open Manhole	1200
S1.001	0	150	S2	30.647	29.651	0.846	Open Manhole	1200
S1.002	0	150	S3	30.620	29.631	0.839	Open Manhole	1200
S1.003	0	150	S4	30.578	29.526	0.903	Open Manhole	1200
S2.000	0	150	S5	32.254	30.040	2.064	Open Manhole	1200
S2.001	0	150	S6	32.213	29.878	2.185	Open Manhole	1200
S3.000	0	150	S7	31.452	30.057	1.245	Open Manhole	1200
S2.002	0	150	S7	32.114	29.716	2.248	Open Manhole	1200
S1.004	0	150	S5	30.534	29.414	0.971	Open Manhole	1200
S4.000	0	150	S10	30.765	29.109	1.510	Open Manhole	1200
S4.001	0	150	S11	30.414	29.053	1.211	Open Manhole	1200
S4.002	0	150	S14	30.616	28.852	1.614	Open Manhole	1200
S5.000	0	150	S16	30.545	29.400	0.995	Open Manhole	1200
S5.001	0	150	S17	30.483	29.107	1.226	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	14.809	150.0	S2	30.647	29.651	0.846	Open Manhole	1200
S1.001	3.041	150.0	S3	30.620	29.631	0.839	Open Manhole	1200
S1.002	15.818	150.0	S4	30.578	29.526	0.903	Open Manhole	1200
S1.003	16.776	150.0	S5	30.534	29.414	0.971	Open Manhole	1200
S2.000	26.153	159.8	S6	32.213	29.876	2.186	Open Manhole	1200

Curtins Consulting Limited	
56 The Ropewalk Nottingham NG1 5DW	
Date 25/09/2018 10:40	Designed by dimitrov_i
File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX	Checked by
XP Solutions	Network 2017.1.2

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S4.003	o	150	S16	30.480	28.709	1.621	Open Manhole	1200
S1.005	o	150	S6	30.439	28.424	1.866	Open Manhole	1200
S6.000	o	150	S18	30.556	29.206	1.200	Open Manhole	1200
S6.001	o	150	S19	29.875	28.506	1.219	Open Manhole	1200
S7.000	o	150	S20	30.204	28.854	1.200	Open Manhole	1200
S7.001	o	150	S21	29.659	28.342	1.167	Open Manhole	1200
S8.000	o	150	S22	30.157	28.357	1.650	Open Manhole	1200
S8.001	o	150	S23	29.703	28.123	1.430	Open Manhole	1200
S9.000	o	150	S24	29.202	27.852	1.200	Open Manhole	1200
S9.001	o	150	S25	29.456	27.809	1.437	Open Manhole	1200
S7.002	o	150	S22	29.520	27.770	1.600	Open Manhole	1200
S1.006	o	150	S7	29.624	27.729	1.745	Open Manhole	1200
S10.000	o	150	S28	30.618	29.268	1.200	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S4.003	12.419	150.0	S6	30.439	28.626	1.663	Open Manhole	1200
S1.005	26.360	37.9	S7	29.624	27.729	1.745	Open Manhole	1200
S6.000	25.437	36.3	S19	29.875	28.506	1.219	Open Manhole	1200
S6.001	7.864	99.5	S7	29.624	28.427	1.047	Open Manhole	1200

Curtins Consulting Limited	
56 The Ropewalk Nottingham NG1 5DW	
Date 25/09/2018 10:40	Designed by dimitrov_i
File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX	Checked by
XP Solutions	Network 2017.1.2

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S10.001	0	150	S29	30.298	28.424	1.724	Open Manhole	1200
S10.002	0	150	S30	28.661	27.324	1.187	Open Manhole	1200
S10.003	0	150	S31	28.752	27.254	1.349	Open Manhole	1200
S10.004	0	150	S32	28.877	27.208	1.519	Open Manhole	1200
S11.000	0	150	S33	28.310	27.397	0.763	Open Manhole	1200
S1.007	0	225	S8	29.025	26.480	2.320	Open Manhole	1200
S1.008	0	225	S9	28.472	26.480	1.767	Open Manhole	1200
S1.009	0	225	S10	27.185	25.951	1.009	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S10.001	50.595	46.0	S30	28.661	27.324	1.187	Open Manhole	1200
S10.002	4.108	58.5	S31	28.752	27.254	1.349	Open Manhole	1200
S10.003	3.635	58.5	S32	28.877	27.192	1.535	Open Manhole	1200
S10.004	5.093	33.5	S8	29.025	27.056	1.819	Open Manhole	1200
S11.000	18.188	80.1	S8	29.025	27.170	1.705	Open Manhole	1200
S1.007	15.206	0.0	S9	28.472	26.480	1.767	Open Manhole	1200
S1.008	16.502	31.2	S10	27.185	25.951	1.009	Open Manhole	1200
S1.009	10.912	58.5	S	26.850	25.764	0.861	Open Manhole	0

Curtins Consulting Limited	
56 The Ropewalk Nottingham NG1 5DW	
Date 25/09/2018 10:40 File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX XP Solutions	Designed by dimitrov_i Checked by Network 2017.1.2

Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Manhole Volume (m³)	Total Volume (m³)
S1.000	S1	1.067	1.067
S1.001	S2	1.126	1.126
S1.002	S3	1.118	1.118
S1.003	S4	1.191	1.191
S2.000	S5	2.504	2.504
S2.001	S6	2.641	2.641
S3.000	S7	1.578	1.578
S2.002	S7	2.712	2.712
S1.004	S5	1.267	1.267
S4.000	S10	1.877	1.877
S4.001	S11	1.540	1.540
S4.002	S14	1.995	1.995
S5.000	S16	1.295	1.295
S5.001	S17	1.556	1.556
S4.003	S16	2.003	2.003
S1.005	S6	2.280	2.280
S6.000	S18	1.527	1.527
S6.001	S19	1.549	1.549
S7.000	S20	1.526	1.526
S7.001	S21	1.489	1.489
S8.000	S22	2.036	2.036
S8.001	S23	1.787	1.787
S9.000	S24	1.527	1.527
S9.001	S25	1.863	1.863
S7.002	S22	1.979	1.979
S1.006	S7	2.144	2.144
S10.000	S28	1.526	1.526
S10.001	S29	2.120	2.120
S10.002	S30	1.512	1.512
S10.003	S31	1.695	1.695
S10.004	S32	1.887	1.887
S11.000	S33	1.033	1.033
S1.007	S8	2.879	2.879
S1.008	S9	2.253	2.253

Curtins Consulting Limited	
56 The Ropewalk Nottingham NG1 5DW	
Date 25/09/2018 10:40 File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX XP Solutions	Designed by dimitrov_i Checked by Network 2017.1.2

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Manhole Volume (m³)	Total Volume (m³)
S1.000	S1	1.067	1.067
S1.001	S2	1.126	1.126
S1.002	S3	1.118	1.118
S1.003	S4	1.191	1.191
S2.000	S5	2.504	2.504
S2.001	S6	2.641	2.641
S3.000	S7	1.578	1.578
S2.002	S7	2.712	2.712
S1.004	S5	1.267	1.267
S4.000	S10	1.877	1.877
S4.001	S11	1.540	1.540
S4.002	S14	1.995	1.995
S5.000	S16	1.295	1.295
S5.001	S17	1.556	1.556
S4.003	S16	2.003	2.003
S1.005	S6	2.280	2.280
S6.000	S18	1.527	1.527
S6.001	S19	1.549	1.549
S7.000	S20	1.526	1.526
S7.001	S21	1.489	1.489
S8.000	S22	2.036	2.036
S8.001	S23	1.787	1.787
S9.000	S24	1.527	1.527
S9.001	S25	1.863	1.863
S7.002	S22	1.979	1.979
S1.006	S7	2.144	2.144
S10.000	S28	1.526	1.526
S10.001	S29	2.120	2.120
S10.002	S30	1.512	1.512
S10.003	S31	1.695	1.695
S10.004	S32	1.887	1.887
S11.000	S33	1.033	1.033
S1.007	S8	2.879	2.879
S1.008	S9	2.253	2.253

Curtins Consulting Limited												
56 The Ropewalk Nottingham NG1 5DW												
Date 25/09/2018 10:40												
File 068960-CUR-00-00-DC-C-0001_P01-SURFACE DRAINAGE MODEL.MDX												
XP Solutions												
Designed by dimitrov_i Checked by Network 2017.1.2												
1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm												
Simulation Criteria												
Areal Reduction Factor 1.000 Hot Start Level (mm) 0 Foul Sewage per hectare (l/s) 0.000 MADD Factor * 10m³/ha Storage 2.000 Hot Start (mins) 0 Manhole Headloss Coeff (Global) 0.500 Additional Flow - % of Total Flow 0.000 Inlet Coefficient 0.800												
Number of Input Hydrographs 0 Number of Online Controls 7 Number of Offline Controls 0 Number of Storage Structures 8 Number of Time/Area D												
Synthetic Rainfall Details												
Rainfall Model FSR Region England and Wales M5-60 (mm) 19.000 Ratio R 0.350 Cv (Summer) 0.750 Cv (Winter)												
Margin for Flood Risk Warning (mm) 300.0 Analysis Timestep Fine DTS Status ON DVD Status OFF Inertia Stat												
Profile(s)												
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, Summe												
Return Period(s) (years)												
Climate Change (%)												
Water Surcharged Flooded												
PN	US/MH Name	Storm	Return Climate Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)	Volume (m³)	Flow / Overflow Cap. (l/s)
S1.000	S1	15 Winter	1	+0%	100/15 Summer				29.786	-0.114	0.000	0.13
S1.001	S2	15 Winter	1	+0%	100/15 Summer				29.692	-0.109	0.000	0.16
S1.002	S3	15 Winter	1	+0%	100/15 Summer				29.682	-0.099	0.000	0.25
S1.003	S4	15 Winter	1	+0%	100/15 Summer				29.586	-0.089	0.000	0.34
S2.000	S5	360 Winter	1	+0%					30.040	-0.150	0.000	0.00
S2.001	S6	360 Winter	1	+0%					29.876	-0.151	0.000	0.00
S3.000	S7	360 Winter	1	+0%					30.057	-0.150	0.000	0.00
S2.002	S7	15 Winter	1	+0%					29.736	-0.130	0.000	0.04
S1.004	S5	15 Winter	1	+0%	100/15 Summer				29.463	-0.101	0.000	0.23
S4.000	S10	15 Winter	1	+0%	100/15 Summer				29.142	-0.113	0.000	0.13
S4.001	S11	15 Winter	1	+0%	100/15 Summer				29.088	-0.115	0.000	0.12
S4.002	S14	15 Winter	1	+0%	100/15 Summer				28.895	-0.107	0.000	0.18
S5.000	S16	60 Winter	1	+0%	30/15 Summer				29.495	-0.055	0.000	0.02
S5.001	S17	60 Winter	1	+0%	1/15 Summer				29.495	0.238	0.000	0.18
S4.003	S16	15 Winter	1	+0%	30/15 Summer				28.765	-0.094	0.000	0.30
S1.005	S6	15 Winter	1	+0%	30/15 Summer				28.498	-0.076	0.000	0.49

Appendix I Surface Water and Foul Water Drainage Layouts



Our Locations

Birmingham

2 The Wharf
Bridge Street
Birmingham
B1 2JS
T. 0121 643 4694
birmingham@curtins.com

Bristol

Quayside
40-58 Hotwell Road
Bristol
BS8 4UQ
T. 0117 302 7560
bristol@curtins.com

Cardiff

3 Cwrt-y-Parc
Earlswood Road
Cardiff
CF14 5GH
T. 029 2068 0900
cardiff@curtins.com

Douglas

Varley House
29-31 Duke Street
Douglas
Isle of Man
IM1 2AZ
T. 01624 624 585
douglas@curtins.com

Dublin

39 Fitzwilliam Square
Dublin 2
Ireland
T. 00353 1 507 9447
dublin@curtins.com

Edinburgh

1a Belford Road
Edinburgh
EH4 3BL
T. 0131 225 2175
edinburgh@curtins.com

Glasgow

Queens House
29 St Vincent Place
Glasgow
G1 2DT
T. 0141 319 8777
glasgow@curtins.com

Kendal

28 Lowther Street
Kendal
Cumbria
LA9 4DH
T. 01539 724 823
kendal@curtins.com

Leeds

Rose Wharf
Ground Floor
Leeds
LS9 8EE
T. 0113 274 8509
leeds@curtins.com

Liverpool

Curtin House
Columbus Quay
Riverside Drive
Liverpool
L3 4DB
T. 0151 726 2000
liverpool@curtins.com

London

40 Compton Street
London
EC1V 0BD
T. 020 7324 2240
london@curtins.com

Manchester

Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG
T. 0161 236 2394
manchester@curtins.com

Nottingham

56 The Ropewalk
Nottingham
NG1 5DW
T. 0115 941 5551
nottingham@curtins.com