

Baynham Meikle

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Contract

Langstone Technology Park
Surface water runoff calcs

Job No.

12055

Date.

26/03/21

Part of Structure

Rainfall intensity

Page No.

1/4

Member
Ref.

Calculations

Output

IN ACCORDANCE WITH CLANCY FLOOD RISK
ASSESSMENT + SUDS STRATEGY AND THE
WALLINGFORD PROCEDURE:

DESIGN RAINFALL INTENSITY

$$1\text{yr} : I_{\text{max}} = 28.7 \text{ mm/hr}$$

$$30\text{yr} : I_{\text{max}} = 70.4 \text{ mm/hr}$$

$$100\text{yr} : I_{\text{max}} = 90.8 \text{ mm/hr.}$$

Baynham Meikle Consulting Structural & Civil Engineers 8 Meadow Road Edgbaston Birmingham B17 8BU tel: 0121 434 4100 fax: 0121 434 4073 email: admin@bm-p.co.uk	Contract Langstone Technology Park. Sugarcane Water runoff calcs. Part of Structure Area 1	Job No. 13055 Date. 26/03/21 Page No. 2/3
Member Ref.	Calculations	Output
	<u>AREA 1</u> <u>Maximum surface water runoff:</u> <u>1 year: ($I_{max} = 28.7 \text{ mm/hr}$)</u> Existing Impermeable area = 0.170ha. $\therefore$ Maximum surface water runoff (Q_{max}) = C.i.A. $\therefore Q_{max} = 2.78 \times 28.7 \times 0.170$ <u>$= 13.6 \text{ l/s}$</u> <u>30 year ($I_{max} = 70.4 \text{ mm/hr}$)</u> Existing Impermeable area = 0.170ha. $\therefore Q_{max} = 2.78 \times 70.4 \times 0.170$ <u>$= 33.27 \text{ l/s}$</u> <u>100yr ($I_{max} = 90.8 \text{ mm/hr}$)</u> Existing Impermeable area = 0.170ha. $\therefore Q_{max} = 2.78 \times 90.8 \times 0.170$ <u>$= 42.91 \text{ l/s}$</u>	

Baynham Meikle Consulting Structural & Civil Engineers 8 Meadow Road Edgbaston Birmingham B17 8BU tel: 0121 434 4100 fax: 0121 434 4073 email: admin@bm-p.co.uk	Contract <i>Langstone Technology Park</i> <i>Surface water runoff calc</i>	Job No. <i>13055</i>
	Part of Structure <i>Area 2.</i>	Date. <i>26/03/21</i>
		Page No. <i>3/4.</i>
Member Ref.	Calculations	Output
	① <u>Area 2: Development West of ex. car park:</u> Max. Surface water runoff. <u>1 year ($i_{max} = 28.7 \text{ mm/hr}$)</u> Existing Impermeable area : 2.115 Ha Maximum surface water runoff (Q_{max}) = CiA. $\therefore Q_{max} = 2.78 \times 28.7 \times 2.115 \text{ Ha}$ <u>$= 168.7 \text{ l/s.}$</u> 30 year ($i_{max} = 70.4 \text{ mm/hr}$) <u>Ex. Impermeable area : 2.115 Ha.</u> $\therefore Q_{max} = 2.78 \times 70.4 \times 2.115$ <u>$= 413.9 \text{ l/s.}$</u> <u>100 year ($i_{max} = 90.8 \text{ mm/hr}$)</u> Ex. Impermeable area : 2.115 Ha. $\therefore Q_{max} = 2.78 \times 90.8 \times 2.115$ <u>$= 533.9 \text{ l/s.}$</u>	
	② <u>Area 2: Ex. Car park.</u> Max. Surface water runoff. <u>1 year ($i_{max} = 28.7 \text{ mm/hr}$)</u> Ex. Impermeable area draining to existing network : 0.239 Ha. $\therefore Q_{max} = 2.78 \times 28.7 \times 0.239$ <u>$= 19.1 \text{ l/s.}$</u>	

Baynham Meikle Consulting Structural & Civil Engineers 8 Meadow Road Edgbaston Birmingham B17 8BU tel: 0121 434 4100 fax: 0121 434 4073 email: admin@bm-p.co.uk	Contract Langstone Technology Park. Surface Water runoff calcs.	Job No. 13055
	Part of Structure Area 2.	Date. 26/03/21
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Member Ref.	Calculations	Output
	<u>30year (Imax = 70.4mm/hr)</u> Ex Impermeable area draining to existing network : 0.239Ha. $\therefore Q_{max} = 2.78 \times 70.4 \times 0.239$ <u>= 46.8 l/s</u> <u>100year (Imax = 90.8mm/hr)</u> Ex Impermeable area draining to existing network : 0.239Ha. $\therefore Q_{max} = 2.78 \times 90.8 \times 0.239$ <u>= 60.3 l/s.</u> In accordance with Clancy FRA + SUDS Strategy (02/07/2019, Ref 8/1982), maximum flow through 375mm discharge pipe = <u>132 l/s.</u> $\therefore$ Existing car park to remain and discharge at existing rate of 19.1 l/s and development area west of existing car park to discharge at 112.9 l/s (132.0 - 19.1). $\therefore$ Entire development area 2 is limited to 132.0 l/s as per Clancy FRA + SUDS Strategy (Appendix D).	



IH 124

IH 124 Input

Return Period (Years)

Area (ha)

SAAR (mm)

Soil

Growth Curve

Partly Urbanised Catchment (QBAR)

Urban

Region

Results

QBAR rural (l/s)

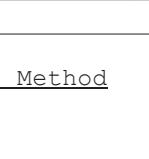
QBAR urban (l/s)

Warning: It is unusual to use the IH124 method with an area < 50ha. The Interim Code of Practice recommends that the IH124 method is applied with 50ha and the resulting discharge is linearly interpolated for the required

	Region	QBAR (l/s)	Q (100yrs) (l/s)	Q (1 yrs) (l/s)	Q (2 yrs) (l/s)	Q (5 yrs) (l/s)	Q (10 yrs) (l/s)	Q (20 yrs) (l/s)	Q (25 yrs) (l/s)	Q (30 yrs) (l/s)
IH 124	Region 1	0.9	2.2	0.8	0.8	1.1	1.3	1.5	1.6	1.7
ICP SUDS	Region 2	0.9	2.4	0.8	0.8	1.1	1.3	1.5	1.6	1.7
ADAS 345	Region 3	0.9	1.9	0.8	0.9	1.1	1.3	1.5	1.5	1.6
FEH	Region 4	0.9	2.3	0.8	0.8	1.1	1.4	1.6	1.7	1.8
ReFH2	Region 5	0.9	3.2	0.8	0.8	1.2	1.5	1.9	2.1	2.2
Greenfield Volume	Region 6/Region 7	0.9	2.9	0.8	0.8	1.2	1.5	1.8	1.9	2.1
Greenfield Volume (ReFH2)	Region 8	0.9	2.2	0.7	0.8	1.1	1.4	1.6	1.7	1.7

Enter Return Period between 1 and 1000

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Date 31/03/2021 File 2021.03.31 NETWORK -		Designed by Chloe Ross Checked by -	
Micro Drainage		Network 2020.1	



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	40
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

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
1.000	9.667	0.040	241.7	0.034	6.00	0.0	0.600	o	300	Pipe/Conduit		
1.001	31.556	0.130	242.7	0.034	0.00	0.0	0.600	o	300	Pipe/Conduit		
2.000	13.052	0.055	237.3	0.034	6.00	0.0	0.600	o	300	Pipe/Conduit		
1.002	9.545	0.040	238.6	0.034	0.00	0.0	0.600	o	300	Pipe/Conduit		
1.003	13.865	0.020	693.3	0.034	0.00	0.0	0.600	o	300	Pipe/Conduit		
1.004	6.303	0.010	630.3	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit		
1.005	10.322	0.035	294.9	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit		

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL Σ (m)	I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	6.16	3.760	0.034	0.0	0.0	1.8	1.01	71.2	6.4
1.001	50.00	6.68	3.720	0.068	0.0	0.0	3.7	1.00	71.0	12.9
2.000	50.00	6.21	3.645	0.034	0.0	0.0	1.8	1.02	71.8	6.4
1.002	50.00	6.84	3.590	0.136	0.0	0.0	7.4	1.01	71.6	25.8
1.003	50.00	7.23	3.550	0.170	0.0	0.0	9.2	0.59	41.7	32.2
1.004	50.00	7.38	3.530	0.170	0.0	0.0	9.2	0.71	78.9	32.2
1.005	50.00	7.54	3.520	0.170	0.0	0.0	9.2	1.05	116.0	32.2

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Micro Drainage	Network 2020.1
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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S1	5.055	1.295	Open Manhole	1200	1.000	3.760	300				
S2	4.920	1.200	Open Manhole	1200	1.001	3.720	300	1.000	3.720	300	
S3	5.050	1.405	Open Manhole	1200	2.000	3.645	300				
S4	5.275	1.685	Open Manhole	1200	1.002	3.590	300	1.001	3.590	300	
								2.000	3.590	300	
S5	5.385	1.835	Open Manhole	1200	1.003	3.550	300	1.002	3.550	300	
TANK	5.155	1.625	Open Manhole	100	1.004	3.530	375	1.003	3.530	300	
S6	5.095	1.575	Open Manhole	1350	1.005	3.520	375	1.004	3.520	375	
	5.245	1.760	Open Manhole	0		OUTFALL		1.005	3.485	375	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	471117.706	105681.357	471117.706	105681.357	Required	
S2	471127.367	105681.029	471127.367	105681.029	Required	
S3	471139.182	105649.014	471139.182	105649.014	Required	
S4	471126.140	105649.497	471126.140	105649.497	Required	
S5	471116.600	105649.834	471116.600	105649.834	Required	
TANK	471117.104	105663.690	471117.104	105663.690	Required	
S6	471110.805	105663.919	471110.805	105663.919	Required	
	471100.492	105664.354			No Entry	

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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)
1.000	o	300	S1	5.055	3.760	0.995	Open Manhole	1200
1.001	o	300	S2	4.920	3.720	0.900	Open Manhole	1200
2.000	o	300	S3	5.050	3.645	1.105	Open Manhole	1200
1.002	o	300	S4	5.275	3.590	1.385	Open Manhole	1200
1.003	o	300	S5	5.385	3.550	1.535	Open Manhole	1200
1.004	o	375	TANK	5.155	3.530	1.250	Open Manhole	100
1.005	o	375	S6	5.095	3.520	1.200	Open Manhole	1350

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)
1.000	9.667	241.7	S2	4.920	3.720	0.900	Open Manhole	1200
1.001	31.556	242.7	S4	5.275	3.590	1.385	Open Manhole	1200
2.000	13.052	237.3	S4	5.275	3.590	1.385	Open Manhole	1200
1.002	9.545	238.6	S5	5.385	3.550	1.535	Open Manhole	1200
1.003	13.865	693.3	TANK	5.155	3.530	1.325	Open Manhole	100
1.004	6.303	630.3	S6	5.095	3.520	1.200	Open Manhole	1350
1.005	10.322	294.9		5.245	3.485	1.385	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,I (mm)	W (mm)
1.005		5.245	3.485	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

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8 Meadow Road Edgbaston, Birmingham B 17 8BU	Langstone Technology Park Network - Area 1																																																																																											
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Micro Drainage Network 2020.1																																																																																												
Online Controls for Storm Hydro-Brake® Optimum Manhole: S6, DS/PN: 1.005, Volume (m³): 2.9 Unit Reference MD-SHE-0167-1320-0900-1320 Design Head (m)0.900 Design Flow (l/s)13.2 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)167 Invert Level (m)3.520 Minimum Outlet Pipe Diameter (mm)225 Suggested Manhole Diameter (mm)1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>0.900</td><td>13.2</td><td>Kick-Flo®</td><td>0.638</td><td>11.2</td></tr><tr><td>Flush-Flo™</td><td>0.295</td><td>13.1</td><td>Mean Flow over Head Range</td><td>-</td><td>11.1</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>5.9</td><td>1.200</td><td>15.1</td><td>3.000</td><td>23.4</td><td>7.000</td><td>35.2</td></tr><tr><td>0.200</td><td>12.8</td><td>1.400</td><td>16.3</td><td>3.500</td><td>25.2</td><td>7.500</td><td>36.4</td></tr><tr><td>0.300</td><td>13.1</td><td>1.600</td><td>17.3</td><td>4.000</td><td>26.9</td><td>8.000</td><td>37.5</td></tr><tr><td>0.400</td><td>13.0</td><td>1.800</td><td>18.3</td><td>4.500</td><td>28.4</td><td>8.500</td><td>38.7</td></tr><tr><td>0.500</td><td>12.6</td><td>2.000</td><td>19.3</td><td>5.000</td><td>29.9</td><td>9.000</td><td>39.7</td></tr><tr><td>0.600</td><td>11.8</td><td>2.200</td><td>20.2</td><td>5.500</td><td>31.3</td><td>9.500</td><td>40.7</td></tr><tr><td>0.800</td><td>12.5</td><td>2.400</td><td>21.0</td><td>6.000</td><td>32.7</td><td></td><td></td></tr><tr><td>1.000</td><td>13.9</td><td>2.600</td><td>21.8</td><td>6.500</td><td>33.9</td><td></td><td></td></tr></table> ©1982-2020 Innovyze			Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	0.900	13.2	Kick-Flo®	0.638	11.2	Flush-Flo™	0.295	13.1	Mean Flow over Head Range	-	11.1	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	5.9	1.200	15.1	3.000	23.4	7.000	35.2	0.200	12.8	1.400	16.3	3.500	25.2	7.500	36.4	0.300	13.1	1.600	17.3	4.000	26.9	8.000	37.5	0.400	13.0	1.800	18.3	4.500	28.4	8.500	38.7	0.500	12.6	2.000	19.3	5.000	29.9	9.000	39.7	0.600	11.8	2.200	20.2	5.500	31.3	9.500	40.7	0.800	12.5	2.400	21.0	6.000	32.7			1.000	13.9	2.600	21.8	6.500	33.9		
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Date 31/03/2021 File 2021.03.31 NETWORK -		Designed by Chloe Ross Checked by -
Micro Drainage		Network 2020.1

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales			
Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	40
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

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
1.000	17.129	0.030	571.0	0.265	6.00	0.0	0.600	o	600	Pipe/Conduit	🔴
1.001	13.800	0.030	460.0	0.083	0.00	0.0	0.600	o	600	Pipe/Conduit	🔴
1.002	9.144	0.015	609.6	0.080	0.00	0.0	0.600	o	600	Pipe/Conduit	🔴
1.003	13.795	0.030	459.8	0.020	0.00	0.0	0.600	o	600	Pipe/Conduit	🔴
1.004	8.894	0.015	592.9	0.044	0.00	0.0	0.600	o	600	Pipe/Conduit	🔴
1.005	26.562	0.010	2656.2	0.456	0.00	0.0	0.600	o	600	Pipe/Conduit	🔴
2.000	18.632	0.070	266.2	0.023	6.00	0.0	0.600	o	225	Pipe/Conduit	🔴
2.001	9.324	0.040	233.1	0.030	0.00	0.0	0.600	o	225	Pipe/Conduit	🔴
2.002	33.657	0.095	354.3	0.013	0.00	0.0	0.600	o	225	Pipe/Conduit	🔴

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL E (m)	I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	6.28	3.520	0.265	0.0	0.0	14.4	1.01	286.1	50.2
1.001	50.00	6.49	3.490	0.348	0.0	0.0	18.8	1.13	319.2	66.0
1.002	50.00	6.64	3.460	0.428	0.0	0.0	23.2	0.98	276.8	81.1
1.003	50.00	6.85	3.445	0.448	0.0	0.0	24.3	1.13	319.2	84.9
1.004	50.00	6.99	3.415	0.492	0.0	0.0	26.6	0.99	280.7	93.3
1.005	50.00	7.95	3.400	0.948	0.0	0.0	51.3	0.46	130.9«	179.7
2.000	50.00	6.39	3.595	0.023	0.0	0.0	1.2	0.80	31.7	4.4
2.001	50.00	6.57	3.525	0.053	0.0	0.0	2.9	0.85	33.9	10.0
2.002	50.00	7.39	3.485	0.066	0.0	0.0	3.6	0.69	27.4	12.5

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Micro Drainage						Network 2020.1					
<u>Network Design Table for Storm</u>											
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
3.000	19.490	0.050	389.8	0.333	6.00	0.0	0.600	o	450	Pipe/Conduit	
3.001	30.736	0.035	878.2	0.304	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.000	30.498	0.095	321.0	0.181	6.00	0.0	0.600	o	300	Pipe/Conduit	
5.000	26.182	0.015	1745.5	0.147	6.00	0.0	0.600	o	300	Pipe/Conduit	
1.006	29.145	0.060	485.8	0.136	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.007	5.851	0.015	390.1	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.008	61.470	0.185	332.3	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.009	34.390	0.100	343.9	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
<u>Network Results Table</u>											
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)	
3.000	50.00	6.32	3.475	0.333	0.0	0.0	18.0	1.02	162.8	63.1	
3.001	50.00	7.07	3.425	0.637	0.0	0.0	34.5	0.68	107.8«	120.8	
4.000	50.00	6.58	3.485	0.181	0.0	0.0	9.8	0.87	61.6	34.3	
5.000	50.00	7.19	3.400	0.147	0.0	0.0	8.0	0.37	26.0«	27.9	
1.006	50.00	8.43	3.390	2.115	0.0	0.0	114.6	1.01	218.5«	401.0	
1.007	50.00	8.52	3.330	2.115	0.0	0.0	114.6	1.13	244.2«	401.0	
1.008	50.00	9.36	3.315	2.115	0.0	0.0	114.6	1.22	264.8«	401.0	
1.009	50.00	9.83	3.130	2.115	0.0	0.0	114.6	1.20	260.2«	401.0	
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Micro Drainage	Network 2020.1	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S1	5.320	1.800	Open Manhole	1500	1.000	3.520	600				
S2	5.290	1.800	Open Manhole	1500	1.001	3.490	600	1.000	3.490	600	
S3	5.270	1.810	Open Manhole	1500	1.002	3.460	600	1.001	3.460	600	
S4	5.270	1.825	Open Manhole	1500	1.003	3.445	600	1.002	3.445	600	
S5	5.270	1.855	Open Manhole	1500	1.004	3.415	600	1.003	3.415	600	
S6	5.270	1.870	Open Manhole	1500	1.005	3.400	600	1.004	3.400	600	
S7	5.275	1.680	Open Manhole	1200	2.000	3.595	225				
S8	5.280	1.755	Open Manhole	1200	2.001	3.525	225	2.000	3.525	225	
S9	5.285	1.800	Open Manhole	1200	2.002	3.485	225	2.001	3.485	225	
S10	5.125	1.650	Open Manhole	1350	3.000	3.475	450				
S11	5.125	1.700	Open Manhole	1350	3.001	3.425	450	3.000	3.425	450	
S12	5.250	1.765	Open Manhole	1200	4.000	3.485	300				
S13	5.150	1.750	Open Manhole	1200	5.000	3.400	300				
TANK	4.990	1.605	Open Manhole	1500	1.006	3.390	525	1.005	3.390	600	
								2.002	3.390	225	
								3.001	3.390	450	
								4.000	3.390	300	
								5.000	3.385	300	
S14	4.870	1.540	Open Manhole	1500	1.007	3.330	525	1.006	3.330	525	
S15	4.980	1.665	Open Manhole	1500	1.008	3.315	525	1.007	3.315	525	
S16	4.950	1.820	Open Manhole	1500	1.009	3.130	525	1.008	3.130	525	
	4.320	1.290	Open Manhole	3000		OUTFALL		1.009	3.030	525	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	471156.325	105618.046	471156.325	105618.046	Required	
S2	471155.669	105600.929	471155.669	105600.929	Required	
S3	471155.144	105587.140	471155.144	105587.140	Required	
S4	471154.796	105578.002	471154.796	105578.002	Required	

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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)
1.000	o	600	S1	5.320	3.520	1.200	Open Manhole	1500
1.001	o	600	S2	5.290	3.490	1.200	Open Manhole	1500
1.002	o	600	S3	5.270	3.460	1.210	Open Manhole	1500
1.003	o	600	S4	5.270	3.445	1.225	Open Manhole	1500
1.004	o	600	S5	5.270	3.415	1.255	Open Manhole	1500
1.005	o	600	S6	5.270	3.400	1.270	Open Manhole	1500
2.000	o	225	S7	5.275	3.595	1.455	Open Manhole	1200
2.001	o	225	S8	5.280	3.525	1.530	Open Manhole	1200
2.002	o	225	S9	5.285	3.485	1.575	Open Manhole	1200
3.000	o	450	S10	5.125	3.475	1.200	Open Manhole	1350
3.001	o	450	S11	5.125	3.425	1.250	Open Manhole	1350
4.000	o	300	S12	5.250	3.485	1.465	Open Manhole	1200
5.000	o	300	S13	5.150	3.400	1.450	Open Manhole	1200
1.006	o	525	TANK	4.990	3.390	1.075	Open Manhole	1500
1.007	o	525	S14	4.870	3.330	1.015	Open Manhole	1500
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)
1.000	17.129	571.0	S2	5.290	3.490	1.200	Open Manhole	1500
1.001	13.800	460.0	S3	5.270	3.460	1.210	Open Manhole	1500
1.002	9.144	609.6	S4	5.270	3.445	1.225	Open Manhole	1500
1.003	13.795	459.8	S5	5.270	3.415	1.255	Open Manhole	1500
1.004	8.894	592.9	S6	5.270	3.400	1.270	Open Manhole	1500
1.005	26.562	2656.2	TANK	4.990	3.390	1.000	Open Manhole	1500
2.000	18.632	266.2	S8	5.280	3.525	1.530	Open Manhole	1200
2.001	9.324	233.1	S9	5.285	3.485	1.575	Open Manhole	1200
2.002	33.657	354.3	TANK	4.990	3.390	1.375	Open Manhole	1500
3.000	19.490	389.8	S11	5.125	3.425	1.250	Open Manhole	1350
3.001	30.736	878.2	TANK	4.990	3.390	1.150	Open Manhole	1500
4.000	30.498	321.0	TANK	4.990	3.390	1.300	Open Manhole	1500
5.000	26.182	1745.5	TANK	4.990	3.385	1.305	Open Manhole	1500
1.006	29.145	485.8	S14	4.870	3.330	1.015	Open Manhole	1500
1.007	5.851	390.1	S15	4.980	3.315	1.140	Open Manhole	1500
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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)
1.008	o	525	S15	4.980	3.315	1.140	Open Manhole	1500
1.009	o	525	S16	4.950	3.130	1.295	Open Manhole	1500

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)
1.008	61.470	332.3	S16	4.950	3.130	1.295	Open Manhole	1500
1.009	34.390	343.9		4.320	3.030	0.765	Open Manhole	3000

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.009		4.320	3.030	0.000	3000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.350		

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S16, DS/PN: 1.009, Volume (m³): 16.2

Unit Reference	MD-SHE-0397-1015-1000-1015
Design Head (m)	1.000
Design Flow (l/s)	101.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	397
Invert Level (m)	3.130
Minimum Outlet Pipe Diameter (mm)	450
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	101.4	Kick-Flo®	0.848	93.6
Flush-Flo™	0.554	101.2	Mean Flow over Head Range	-	76.9

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)
0.100	11.0	1.200	110.8	3.000	173.2	7.000	262.3
0.200	39.1	1.400	119.4	3.500	186.7	7.500	271.4
0.300	75.4	1.600	127.4	4.000	199.4	8.000	280.1
0.400	98.6	1.800	135.0	4.500	211.2	8.500	288.6
0.500	100.9	2.000	142.1	5.000	222.4	9.000	296.8
0.600	101.0	2.200	148.8	5.500	233.0	9.500	304.8
0.800	96.0	2.400	155.3	6.000	243.2		
1.000	101.4	2.600	161.5	6.500	253.0		

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<u>Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>																																																																																																																																																																																													
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Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000																																																																																																																																																																																													
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M5-60 (mm) 19.000 Cv (Winter) 0.840																																																																																																																																																																																													
Margin for Flood Risk Warning (mm) 300.0																																																																																																																																																																																													
Analysis Timestep 2.5 Second Increment (Extended)																																																																																																																																																																																													
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Return Period(s) (years) 1, 30, 100																																																																																																																																																																																													
Climate Change (%) 0, 0, 40																																																																																																																																																																																													
<table><tr><th>PN</th><th>US/MH Name</th><th>Storm</th><th>Return Period</th><th>Climate Change</th><th>First (X) Surge</th><th>First (Y) Flood</th><th>First (Z) Overflow</th><th>Overflow Act.</th><th>Water Level (m)</th></tr><tr><td>1.000</td><td>S1</td><td>15 Winter</td><td>100</td><td>+40%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>4.391</td></tr><tr><td>1.001</td><td>S2</td><td>15 Winter</td><td>100</td><td>+40%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>4.366</td></tr><tr><td>1.002</td><td>S3</td><td>15 Winter</td><td>100</td><td>+40%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>4.335</td></tr><tr><td>1.003</td><td>S4</td><td>15 Winter</td><td>100</td><td>+40%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>4.306</td></tr><tr><td>1.004</td><td>S5</td><td>15 Winter</td><td>100</td><td>+40%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>4.266</td></tr><tr><td>1.005</td><td>S6</td><td>15 Winter</td><td>100</td><td>+40%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>4.230</td></tr><tr><td>2.000</td><td>S7</td><td>120 Winter</td><td>100</td><td>+40%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>4.011</td></tr><tr><td>2.001</td><td>S8</td><td>120 Winter</td><td>100</td><td>+40%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>4.009</td></tr><tr><td>2.002</td><td>S9</td><td>120 Winter</td><td>100</td><td>+40%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>4.005</td></tr><tr><td>3.000</td><td>S10</td><td>15 Winter</td><td>100</td><td>+40%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>4.381</td></tr><tr><td>3.001</td><td>S11</td><td>15 Winter</td><td>100</td><td>+40%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>4.297</td></tr><tr><td>4.000</td><td>S12</td><td>120 Winter</td><td>100</td><td>+40%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>4.009</td></tr><tr><td>5.000</td><td>S13</td><td>120 Winter</td><td>100</td><td>+40%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>4.006</td></tr><tr><td>1.006</td><td>TANK</td><td>120 Winter</td><td>100</td><td>+40%</td><td>100/60 Winter</td><td></td><td></td><td></td><td>3.997</td></tr><tr><td>1.007</td><td>S14</td><td>120 Winter</td><td>100</td><td>+40%</td><td>100/30 Winter</td><td></td><td></td><td></td><td>4.431</td></tr><tr><td>1.008</td><td>S15</td><td>120 Winter</td><td>100</td><td>+40%</td><td>100/30 Winter</td><td></td><td></td><td></td><td>4.659</td></tr><tr><td>1.009</td><td>S16</td><td>120 Winter</td><td>100</td><td>+40%</td><td>100/15 Winter</td><td></td><td></td><td></td><td>4.704</td></tr></table>										PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	1.000	S1	15 Winter	100	+40%	30/15 Summer				4.391	1.001	S2	15 Winter	100	+40%	30/15 Summer				4.366	1.002	S3	15 Winter	100	+40%	30/15 Summer				4.335	1.003	S4	15 Winter	100	+40%	30/15 Summer				4.306	1.004	S5	15 Winter	100	+40%	30/15 Summer				4.266	1.005	S6	15 Winter	100	+40%	30/15 Summer				4.230	2.000	S7	120 Winter	100	+40%	100/15 Summer				4.011	2.001	S8	120 Winter	100	+40%	100/15 Summer				4.009	2.002	S9	120 Winter	100	+40%	100/15 Summer				4.005	3.000	S10	15 Winter	100	+40%	30/15 Summer				4.381	3.001	S11	15 Winter	100	+40%	30/15 Summer				4.297	4.000	S12	120 Winter	100	+40%	100/15 Summer				4.009	5.000	S13	120 Winter	100	+40%	30/15 Summer				4.006	1.006	TANK	120 Winter	100	+40%	100/60 Winter				3.997	1.007	S14	120 Winter	100	+40%	100/30 Winter				4.431	1.008	S15	120 Winter	100	+40%	100/30 Winter				4.659	1.009	S16	120 Winter	100	+40%	100/15 Winter				4.704
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)																																																																																																																																																																																				
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1.003	S4	15 Winter	100	+40%	30/15 Summer				4.306																																																																																																																																																																																				
1.004	S5	15 Winter	100	+40%	30/15 Summer				4.266																																																																																																																																																																																				
1.005	S6	15 Winter	100	+40%	30/15 Summer				4.230																																																																																																																																																																																				
2.000	S7	120 Winter	100	+40%	100/15 Summer				4.011																																																																																																																																																																																				
2.001	S8	120 Winter	100	+40%	100/15 Summer				4.009																																																																																																																																																																																				
2.002	S9	120 Winter	100	+40%	100/15 Summer				4.005																																																																																																																																																																																				
3.000	S10	15 Winter	100	+40%	30/15 Summer				4.381																																																																																																																																																																																				
3.001	S11	15 Winter	100	+40%	30/15 Summer				4.297																																																																																																																																																																																				
4.000	S12	120 Winter	100	+40%	100/15 Summer				4.009																																																																																																																																																																																				
5.000	S13	120 Winter	100	+40%	30/15 Summer				4.006																																																																																																																																																																																				
1.006	TANK	120 Winter	100	+40%	100/60 Winter				3.997																																																																																																																																																																																				
1.007	S14	120 Winter	100	+40%	100/30 Winter				4.431																																																																																																																																																																																				
1.008	S15	120 Winter	100	+40%	100/30 Winter				4.659																																																																																																																																																																																				
1.009	S16	120 Winter	100	+40%	100/15 Winter				4.704																																																																																																																																																																																				
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Date 31/03/2021 File 2021.03.31 NETWORK -				Designed by Chloe Ross Checked by -						
Micro Drainage				Network 2020.1						
<u>Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>										
PN	US/MH Name	Surcharged		Flooded	Flow / Cap.	Overflow (l/s)	Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Time (mins)			Flow (l/s)			
1.000	S1	0.271	0.000	0.86				138.4	SURCHARGED	
1.001	S2	0.276	0.000	1.02				182.0	SURCHARGED	
1.002	S3	0.275	0.000	1.42				224.7	SURCHARGED	
1.003	S4	0.261	0.000	1.32				234.6	SURCHARGED	
1.004	S5	0.251	0.000	1.59				257.5	SURCHARGED	
1.005	S6	0.230	0.000	3.97				498.1	SURCHARGED	
2.000	S7	0.191	0.000	0.14				4.1	SURCHARGED	
2.001	S8	0.259	0.000	0.33				9.3	SURCHARGED	
2.002	S9	0.295	0.000	0.44				11.4	SURCHARGED	
3.000	S10	0.456	0.000	1.33				174.2	SURCHARGED	
3.001	S11	0.422	0.000	4.24				330.5	SURCHARGED	
4.000	S12	0.224	0.000	0.61				34.3	SURCHARGED	
5.000	S13	0.306	0.000	1.24				27.8	SURCHARGED	
1.006	TANK	0.082	0.000	1.18			145	214.1	SURCHARGED	
1.007	S14	0.576	0.000	1.34				210.9	SURCHARGED	
1.008	S15	0.819	0.000	0.72				173.4	SURCHARGED	
1.009	S16	1.049	0.000	0.51				112.3	FLOOD RISK	
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Micro Drainage		Network 2020.1

STORM SEWER DESIGN by the Modified Rational Method

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
1.000	7.924	0.045	176.1	0.054	6.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	13.414	0.080	167.7	0.054	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	11.132	0.045	247.4	0.054	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	4.999	0.005	999.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.004	13.692	0.040	342.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	6.13	3.650	0.054	0.0	0.0	2.9	0.98	39.1	10.2
1.001	50.00	6.36	3.605	0.108	0.0	0.0	5.8	1.01	40.0	20.5
1.002	50.00	6.58	3.525	0.162	0.0	0.0	8.8	0.83	32.9	30.7
1.003	50.00	6.71	3.480	0.162	0.0	0.0	8.8	0.63	100.9	30.7
1.004	50.00	6.92	3.475	0.162	0.0	0.0	8.8	1.09	173.9	30.7

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Micro Drainage Network 2020.1

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S1	4.895	1.245	Open Manhole	1200	1.000	3.650	225				
S2	5.040	1.435	Open Manhole	1200	1.001	3.605	225	1.000	3.605	225	
S3	4.975	1.450	Open Manhole	1200	1.002	3.525	225	1.001	3.525	225	
TANK	4.760	1.280	Open Manhole	100	1.003	3.480	450	1.002	3.480	225	
S4	5.080	1.605	Open Manhole	1350	1.004	3.475	450	1.003	3.475	450	
	5.090	1.655	Open Manhole	0		OUTFALL		1.004	3.435	450	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	471349.019	105577.328	471349.019	105577.328	Required	
S2	471342.228	105581.413	471342.228	105581.413	Required	
S3	471342.740	105594.817	471342.740	105594.817	Required	
TANK	471342.492	105605.946	471342.492	105605.946	Required	
S4	471342.684	105610.941	471342.684	105610.941	Required	
	471353.388	105619.479			No Entry	

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Micro Drainage		Network 2020.1



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)
1.000	o	225	S1	4.895	3.650	1.020	Open Manhole	1200
1.001	o	225	S2	5.040	3.605	1.210	Open Manhole	1200
1.002	o	225	S3	4.975	3.525	1.225	Open Manhole	1200
1.003	o	450	TANK	4.760	3.480	0.830	Open Manhole	100
1.004	o	450	S4	5.080	3.475	1.155	Open Manhole	1350

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)
1.000	7.924	176.1	S2	5.040	3.605	1.210	Open Manhole	1200
1.001	13.414	167.7	S3	4.975	3.525	1.225	Open Manhole	1200
1.002	11.132	247.4	TANK	4.760	3.480	1.055	Open Manhole	100
1.003	4.999	999.8	S4	5.080	3.475	1.155	Open Manhole	1350
1.004	13.692	342.3		5.090	3.435	1.205	Open Manhole	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Storage Structures 1
 Number of Online Controls 1 Number of Time/Area Diagrams 0
 Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.350		

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S4, DS/PN: 1.004, Volume (m³): 3.0

Unit Reference	MD-SHE-0098-3800-0600-3800
Design Head (m)	0.600
Design Flow (l/s)	3.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	98
Invert Level (m)	3.475
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)	0.600	3.8	Kick-Flo®	0.419	3.2
Flush-Flo™	0.185	3.8	Mean Flow over Head Range	-	3.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.2	1.200	5.2	3.000	8.0	7.000	12.0
0.200	3.8	1.400	5.6	3.500	8.7	7.500	12.5
0.300	3.7	1.600	6.0	4.000	9.2	8.000	12.9
0.400	3.4	1.800	6.3	4.500	9.8	8.500	13.3
0.500	3.5	2.000	6.6	5.000	10.3	9.000	13.7
0.600	3.8	2.200	7.0	5.500	10.7	9.500	14.0
0.800	4.3	2.400	7.2	6.000	11.2		
1.000	4.8	2.600	7.5	6.500	11.6		

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Storage Structures for Storm

Cellular Storage Manhole: TANK, DS/PN: 1.003

Invert Level (m) 3.440

Safety Factor 2.0

Infiltration Coefficient Base (m/hr) 0.00000

Porosity 0.95

Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	155.4	155.4	0.500	0.0	178.1
0.400	155.4	178.1			

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Micro Drainage Network 2020.1		

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
 Number of Online Controls 1 Number of Time/Area Diagrams 0
 Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status ON
 Inertia Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1	240 Winter	100	+40%	30/15 Summer				4.592
1.001	S2	240 Winter	100	+40%	30/15 Summer				4.590
1.002	S3	240 Winter	100	+40%	30/15 Summer				4.585
1.003	TANK	240 Winter	100	+40%	100/120 Winter				4.578
1.004	S4	240 Winter	100	+40%	100/120 Winter				4.577

PN	US/MH Name	Depth (m)	Surcharged Volume (m³)	Flooded Volume (m³)	Flow / Cap. (l/s)	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	0.717	0.000	0.21				6.3	SURCHARGED	
1.001	S2	0.760	0.000	0.36				12.6	SURCHARGED	
1.002	S3	0.835	0.000	0.68				18.9	SURCHARGED	
1.003	TANK	0.648	0.000	0.05		223	6.3	FLOOD RISK		
1.004	S4	0.652	0.000	0.04				5.0	SURCHARGED	

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Net Internal Areas of Existing Buildings Have Been Taken From Plowman Craven Area Measurement Report

BUILDING	FLOOR	TYPE	AREA
B1000	FIRST	ACCOMODATION	54.3
B1000	GROUND	ACCOMODATION	122.6
B1000	FIRST	ANCILLARY	13.4
B1000	FIRST	LABORATORY	1029.5
B1000	FIRST	OFFICE	12777.2
B1000	FIRST	STORAGE	733.1
B1000	GROUND	STORAGE	623.1
B4000	GROUND	ACCOMODATION	168.2
B4000	FIRST	ANCILLARY	1318.7
B4000	GROUND	ANCILLARY	297.5
B4000	FIRST	LABORATORY	431.4
B4000	FIRST	OFFICE	674.6
B4000	GROUND	OFFICE	425.8
B4000	FIRST	STORAGE	5.7
B4000	GROUND	STORAGE	243.8
B5000	FIRST	ANCILLARY	14.5
B5000	MEZZANINE	OFFICE	1469.6
B5000	FIRST	OFFICE	5854.2
B5000	GROUND	OFFICE	100.8
B5000	FIRST	STORAGE	1285.3
B5000	GROUND	STORAGE	392.6
B6000	SECOND	ANCILLARY	39.2
B6000	GROUND	ANCILLARY	20.7
B6000	SECOND	OFFICE	4165.5
B6000	FIRST	OFFICE	4117.8
B6000	GROUND	OFFICE	3367.2
B6000	SECOND	STORAGE	54.1
B6000	FIRST	STORAGE	54.6
B6000	GROUND	STORAGE	67.7
B7000	SECOND	ANCILLARY	5.1
B7000	FIRST	LABORATORY	364.3
B7000	SECOND	OFFICE	1859
B7000	FIRST	OFFICE	1766.1
B7000	GROUND	STORAGE	955.8
GYM	GROUND	STORAGE	334.4
NURSERY	GROUND		263.6

Existing Buildings				EXISTING FOUL FLOWS			
INTERNAL AREAS (NIA)							
		m ²	ha	I/m2/day	I/day (DWF)	Peak flow 6 x DWF + 10%	Peak Flow I/s
B1000	ACCOMADATION	176.9	0.018	11.25	1990.1	13135	0.152
	ANCILLARY	13.4	0.001	3	40.2	265	0.003
	LABORATORY	1029.5	0.103	7.5	7721.3	50960	0.590
	OFFICE	12777.2	1.278	7.5	95829.0	632471	7.320
	STORAGE	1356.2	0.136	1.5	2034.3	13426	0.155
		15353.4	1.535				
B4000	ACCOMADATION	168.2	0.017	11.25	1892.3	12489	0.145
	ANCILLARY	1616.2	0.162	3	4848.6	32001	0.370
	LABORATORY	431.4	0.043	7.5	3235.5	21354	0.247
	OFFICE	1100.4	0.110	7.5	8253.0	54470	0.630
	STORAGE	249.5	0.025	1.5	374.3	2470	0.029
		3565.7	0.357				
B5000	ANCILLARY	14.5	0.001	3	43.5	287	0.003
	OFFICE	7424.6	0.742	7.5	55684.5	367518	4.254
	STORAGE	1677.9	0.168	1.5	2516.9	16611	0.192
		9117.0	0.912				
B6000	ANCILLARY	59.9	0.006	3	179.7	1186	0.014
	OFFICE	11650.5	1.165	7.5	87378.8	576700	6.675
	STORAGE	176.4	0.018	1.5	264.6	1746	0.020
		11886.8	1.189				
B7000	ANCILLARY	5.1	0.001	3	15.3	101	0.001
	LABORATORY	364.3	0.036	7.5	2732.3	18033	0.209
	OFFICE	3625.1	0.363	7.5	27188.3	179442	2.077
	STORAGE	955.8	0.096	1.5	1433.7	9462	0.110
		4950.3	0.495				
GYM (GIA)		334.4	0.033	1.5	501.6	3311	0.038
NURSERY (GIA)		263.6	0.026	1.5	395.4	2610	0.030
		598.0	0.059				
TOTAL AREA		45471.0	4.547			TOTAL FLOW	23.3

I/m2/day has been based on the below

	Suggested dry weather flow rates - Litres
HOTEL	550 per room
COMMERCIAL PREMISES	300 per 100m ²
OFFICES	750 per 100m ²
WAREHOUSE	150 per 100m ²

Phase 1

EXPECTED REDUCTION IN FOUL FLOW DUE TO DEMOLITION (B1000 & GYM DEMOLITION WORKS)			
B1000	Total Area	15353	
	Flow I/s	8.221	
	Area Demolished	5904.4 (38%)	
	Adjusted Flow I/s (38% reduction)	3.161	
GYM	Flow I/s	0.038	
TOTAL FLOW REDUCTION (I/s)		3.200	

NIA: Net Internal Area

B1000 Demolished area is an approximate figure only and has been taken from Plowman Craven Area Measurement Report (Sum of NIA of loading bay 1 and 1

EXPECTED ADDITION IN FOUL FLOW DUE TO PLOT 1 DEVELOPMENT					
INTERNAL AREAS (GIA)			FOUL FLOWS		
Building	m ²	I/m ² /day (Office/Commercial)	DWF I/day	Peak Flow 6 x DWF + 10%	Peak Flow I/s
1 (Office)	337.350	1.5	506.025	3339.8	0.039
1 (Commercial)	1911.650	3	5734.950	37850.7	0.438
2 (Office)	278.850	1.5	418.275	2760.6	0.032
2 (Commercial)	1580.150	3	4740.450	31287.0	0.362
3 (Office)	542.700	1.5	814.050	5372.7	0.062
3 (Commercial)	3075.300	3	9225.900	60890.9	0.705
4 (Office)	475.500	1.5	713.250	4707.5	0.054
4 (Commercial)	2694.500	3	8083.500	53351.1	0.617
TOTAL AREA		10896.000		TOTAL FLOW	2.310

EXPECTED OVERALL REDUCTION IN FOUL FLOW		
BUILDING	TOTAL AREA (m ²)	PEAK FLOW (I/s)
B1000 & Gym	6238.8	3.200
Plot 1	10896.0	2.310
TOTAL REDUCTION IN FOUL FLOW		0.890



Appendix D – Other Supporting Information

- E.1 Clancy Flood Risk Assessment (FRA) and SUDS Strategy, 02/07/2019 (Report Reference 8/1982)
- E.2 Delta Simons Phase 1 Environmental Assessment, Nov 2020 (Report Reference 15-0754.07)
- E.3 Clancy Consulting Geo-Environmental Appraisal Report, Oct 2029 (Report Reference 10/1425/001).



Flood Risk Assessment and SUDS Strategy

Langstone Technology
Park,
Langstone Road,
Havant,
PO9 1SA

2nd July 2019

Ref: 8/1982

Prepared on Behalf of:
AG Langstone B.V and
Trinity Investment
Management

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FLOOD RISK ASSESSMENT
Langstone Technology Park, Langstone Road, Havant, PO9 1SA

Report Reference: 8/1982

Prepared for: AG Langstone B.V and Trinity Investment Management

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Revision List

REVISION	REASON FOR ISSUE	DATE OF ISSUE
A	Issue for Planning	28 th June 2019
B	Updated to Comment	1 st July 2019
C	Updated to Comment	2 nd July 2019

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APPENDICES

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Appendix B	Topographic and CCTV Survey
Appendix C	Existing Drainage
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Appendix E	Proposed Drainage Strategy
Appendix F	Borehole Logs
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1.0 INTRODUCTION

1.1 General

- 1.1.1 This report has been prepared on instructions received from AG Langstone BV and Trinity Investment Management.
- 1.1.2 This report relates to the proposed works at Langstone Technology Park, Havant to reconfigure the existing building '1000', add new areas of car parking along with construction of 12 No. units on the South West of the site.
- 1.1.3 This report sets out the results of a flood risk assessment required in support of a planning application for this development. The assessment has been carried out in accordance with the general principals set out in National Planning Policy Framework, Technical Guidance to the National Planning Policy Framework published in March 2012 and Planning Practice Guidance May 2019, Flood risk last updated in March 2014.
- 1.1.4 This report is prepared solely for the benefit of the Client. This report may not be assigned without prior written permission from Clancy Consulting.

1.2 Background Information

- 1.2.1 In 2001 the Department for Transport Local Government Regions (DTLR) published Planning Policy Guidance Note 25 (PPG25), which explains how flood risk should be taken into consideration during the planning and development process.

PPG25 was replaced by Planning Policy Statement 25: Development and Flood Risk published in March 2010. This latest Policy Statement has been introduced to place more emphasis on the increased flood risk from climate change.

PPS25 specifies a sequential test which local planning authorities should apply to all future proposed development sites. An exception test may also be applied to provide a method of managing flood risk while still allowing necessary development to occur.

In Feb 2019, the Government released a revised National Planning Policy Framework (NPPF) aiming to make the planning system less complex and more accessible, to protect the environment and promote sustainable growth.

NPPF accompanied with the Technical Guidance published also in March 2012 supersedes PPS25 although the principles set out in the new publication remain similar in terms of the flood risk aspect. The flood risk Practice Guide was published on-line in March 2014.

- 1.2.2 The following zones define the levels of flood risk:

Zone 1: Low Probability.

This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any one year. (<0.1%)

Zone 2: Medium Probability

This zone comprises land assessed as having between 1 in 100 and 1 in 1000 annual probability of river flooding (1%-0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.

Zone 3a: High Probability

This zone comprises land assessed as having between 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Zone 3b: Functional Flood Plain

This zone comprises land where water has to flow or be stored in times of flood. Strategic Flood Risk Assessments should identify this zone.

- 1.2.3 As part of its general obligations under the Water Resources Act 1991, The Environment Agency has carried out surveys of its existing defences against flooding and has published a series of nationwide 'Indicative Floodplain Maps' based upon information from historic flood events and basic hydraulic modelling. In general terms, these maps give a good indication of the areas likely to be affected by flooding. More recently, the Environment Agency have published the 'Flood Map' on their website which is based on improved hydraulic modelling and detailed local data. The map highlights Zones 2 and 3 on the map with all other areas being Flood Zone 1.
- 1.2.4 The EA Flood Map for the area of the proposed development indicates that there is a small strip of land within flood zone 3 on the site. However, the majority of the development lies in an area of flood risk **zone 1 – low probability of flooding**.

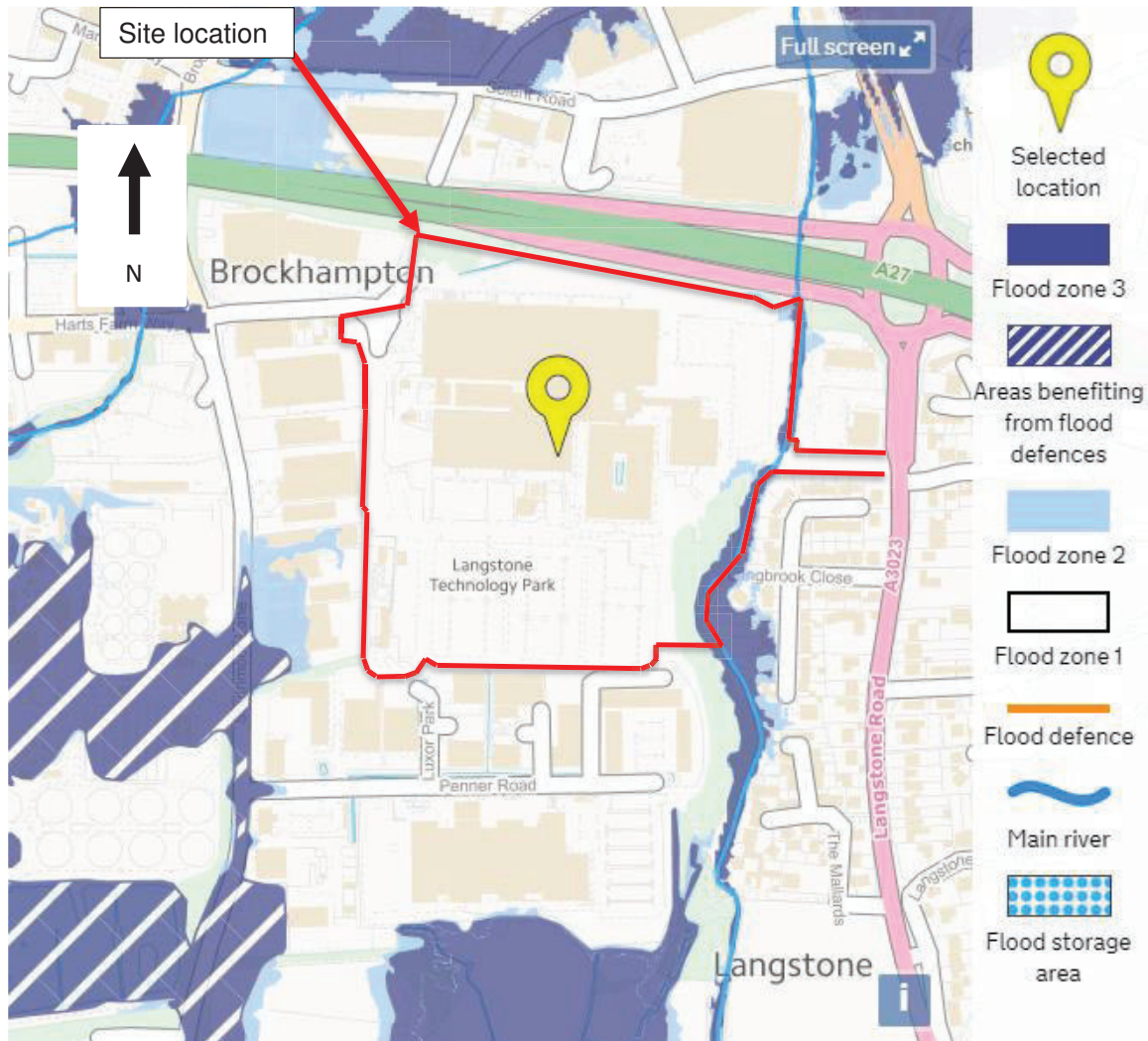


Figure 1 - Risk of Flooding from Rivers and Seas (EA)

2.0 STRUCTURE OF THE REPORT

2.1 The report has been structured to follow the general principals set out in the Technical Guidance published in March 2012.

2.2 The methodology for this FRA has comprised a desktop study and liaison with the Environment Agency (EA) and reference has also been made to relevant plans including plans showing the location of local sewers.

2.3 Sources of information

- Flood maps from the Environment Agency published online (EA)
- Havant Borough Council Strategic Flood Risk Assessment 2018
- British Geological Survey (BGS)
- Southern Water Asset Plan (SW)
- Preliminary Geo-environmental Risk Assessment (deltasimons May 2019)

3.0 SITE DESCRIPTION

3.1 Location

3.1.1 The site is located as detailed as below.

OS X (Eastings)	471279
OS Y (Northings)	105702
Nearest Post Code	PO9 1SA
Lat (WGS84)	N50:50:47 (50.846458)
Long (WGS84)	W0:59:20 (-0.988916)
LR	50.846458,-0.988916
National Grid	SU712057 / SU7127905702
mX	-110085
mY	6561024

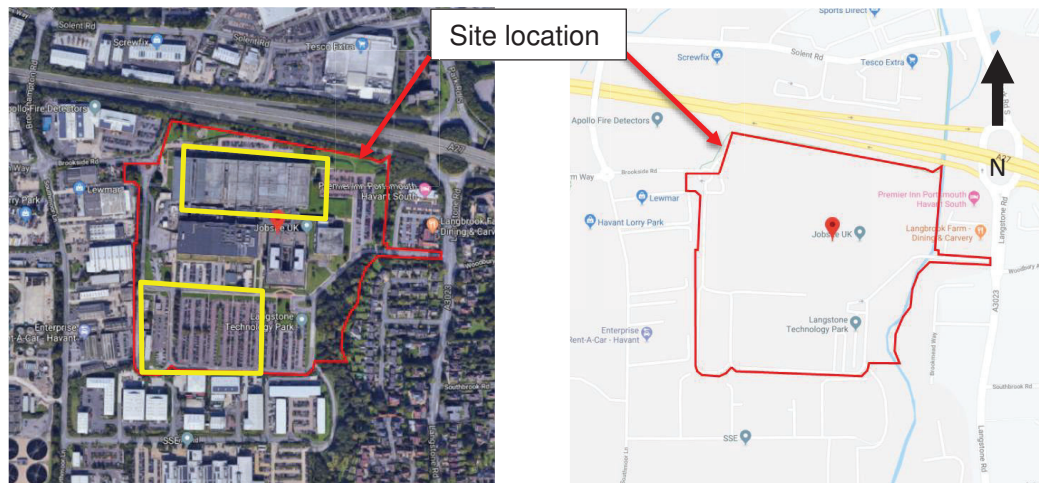


Figure 2 - Site Location Plan (Google Maps)

3.1.2 The overall site is approximately 425m long by 400m wide (17ha) and comprises of multiple large office and laboratory spaces hosting multiple businesses.

3.2 Development Proposals

3.2.1 The applicant seeks full planning permission for the part-demolition of Building 1000, installation of a new flank elevation to the East, a new elevation to the North of Building 4000 as a result of the aforementioned part-demolition of Building 1000, the erection of new buildings in flexible B1c, B2 and B8 use in the South-West corner of the site with associated parking; and the creation of new car parking areas and the rationalisation of existing parking areas.

4.0 FLOOD POTENTIAL

4.1 Development Proposal

4.1.1 The NPPF classification of this development is 'less vulnerable'.

4.2 Potential for Flooding

4.2.1 The site is located within a zone 1 area in terms of flooding from rivers and the sea.

4.2.2 There are, therefore, four potential sources of flooding at the site which will be addressed in more detail in this report, i.e.

- (i) From surface water overland flow off site.
- (ii) From high groundwater levels.
- (iii) From artificial sources such as reservoirs.
- (iv) From the surcharging of drains or sewers on the site.

4.3 Existing Historical Flooding Information

4.3.1 No record of historical flooding history of the site has been found in the Havant Borough Council Strategic Flood Risk Assessment.

4.4 Flood Risk Probabilities

- (i) *Flooding from Surface Water – Overland flow*

4.4.1 During extreme rainfall events or due to poor drainage gully maintenance there will be times when gully capacity is exceeded which will lead to surface flow within the surrounding roads. Mapping for this form of flooding is shown on the Environment Agency web site.

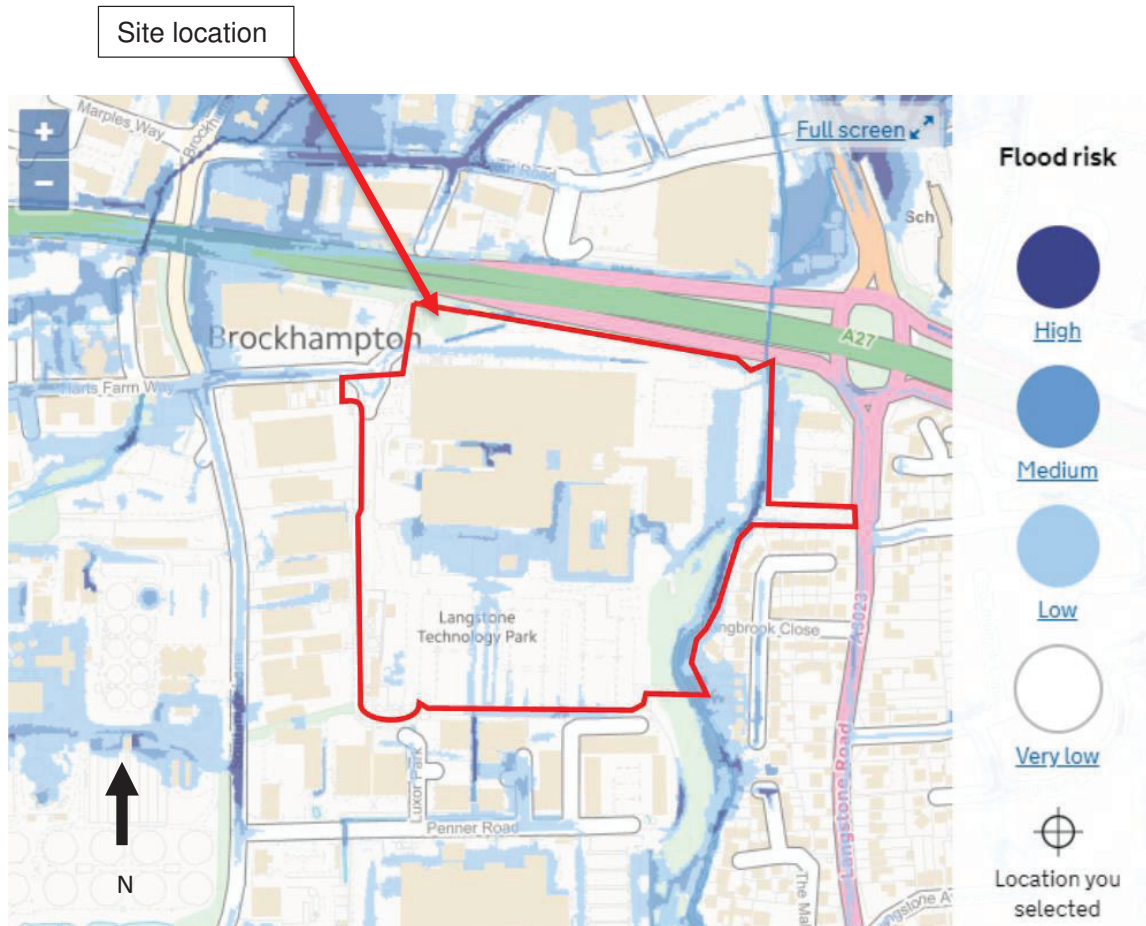


Figure 3 - Risk of Flooding from Surface Water (EA)

4.4.2 There is predicted to be various areas of low to medium risk of surface water flooding during extreme rainfall events on site, however the rest of the site is of very low risk up to the 0.1% probability event. **The Environment Agency classifies this site as low flood risk from surface water.**

4.4.3 As shown in Figure 3, the EA flood modelling anticipates that there is low potential for overland run off from the south of the development running north towards the existing buildings in the technology park. To mitigate this it is recommended that the new industrial units to be constructed on the car park have a minimal elevation raise. This elevation raise can be seen as provided on the architectural proposals.

(ii) *Flooding from Groundwater*

4.4.4 Geological records for this area indicate that the superficial geology consists of Alluvium (clay, sand, silt and gravel). The bedrock geology consists of Lewes Nodular Chalk, Seaford Chalk, Newhaven Chalk, Culver Chalk and Portsdown Chalk.

4.4.5 There are a number of historic borehole logs for the technology park. The boreholes indicate superficial deposits of clays and gravels overlaying firm chalk deposits. This is in line with expectations from British geological society maps. Ground water was encountered in the boreholes between approximately 1.35-2.25m. A summary of the boreholes can be found in Appendix F.

4.4.6 Based upon the desk study evidence above, **the risk of flooding due to ground water can be considered low for this proposed development.**

(iii) *Flooding from Artificial Sources - Reservoirs*

4.4.7 Artificial sources of flooding are potentially from man-made structures and infrastructure. The Environment Agency have modelled the potential effect of flooding from failures in retaining structures containing reservoirs.

4.4.8 It should be noted that reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs are inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in England, the Environment Agency ensure that reservoirs are inspected regularly, and essential safety work is carried out. **The risk of flooding from reservoirs at this site is extremely low.**

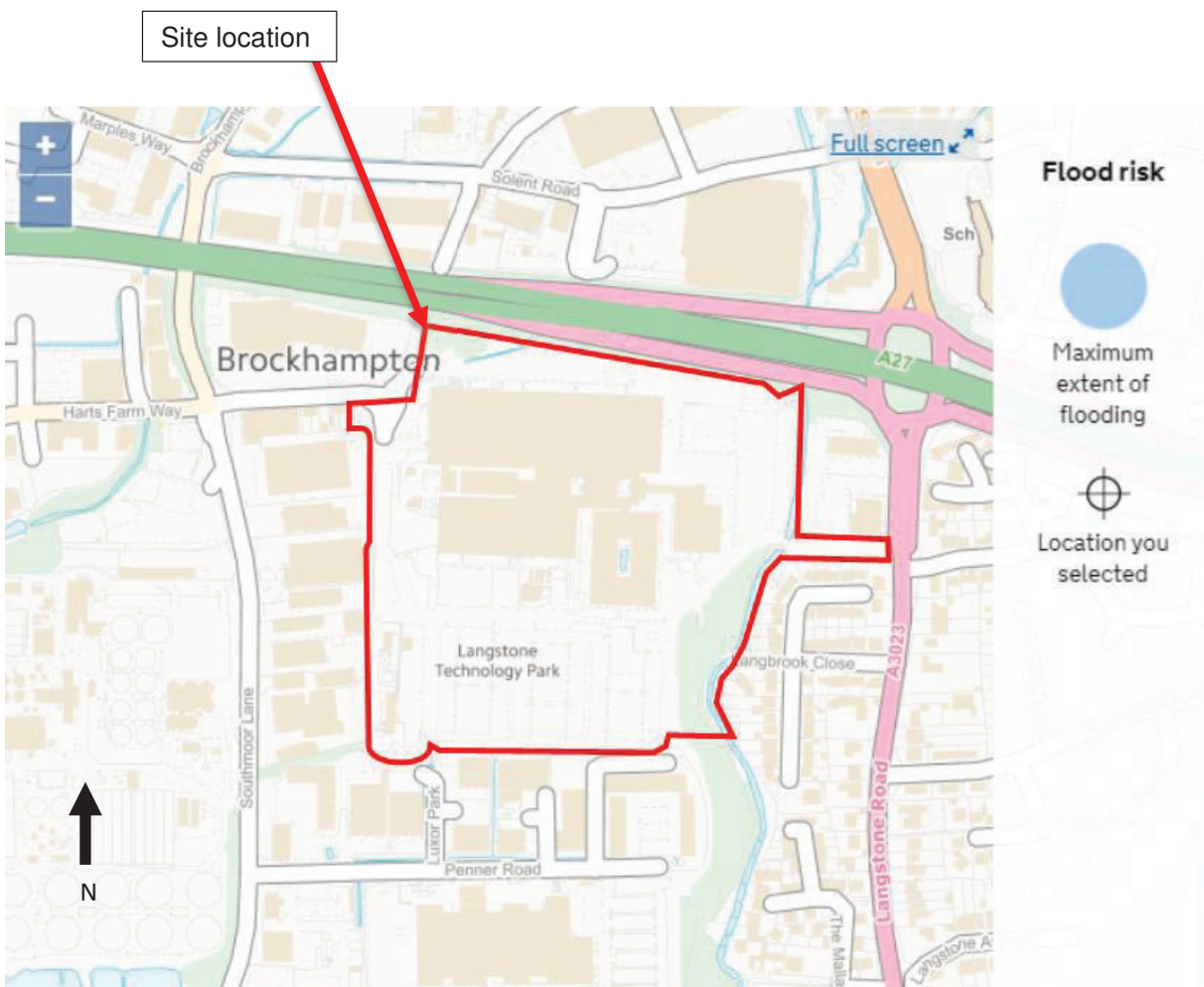


Figure 4 - Risk of Flooding from Reservoirs (EA)

(iv) *Flooding from Drainage on site*

4.4.9 Flooding could occur if the on-site drainage system becomes blocked or the rainfall event exceeds the design capacity. Details of the drainage system are discussed in Chapter 5.

5.0 DRAINAGE

5.1 EXISTING DRAINAGE

5.1.1 The Southern Water drainage mapping shows that there are adopted public drainage systems in the site. A large 600mm diameter foul sewer running from East to West through the centre of the site, 750mm diameter foul sewer running from East to West just north of the site and a 675mm diameter surface water sewer running from North to South along the western site boundary. Additional private drainage has been recorded in a CCTV survey.

5.1.2 The CCTV and Topographic survey undertaken at the site can be found in Appendix B.

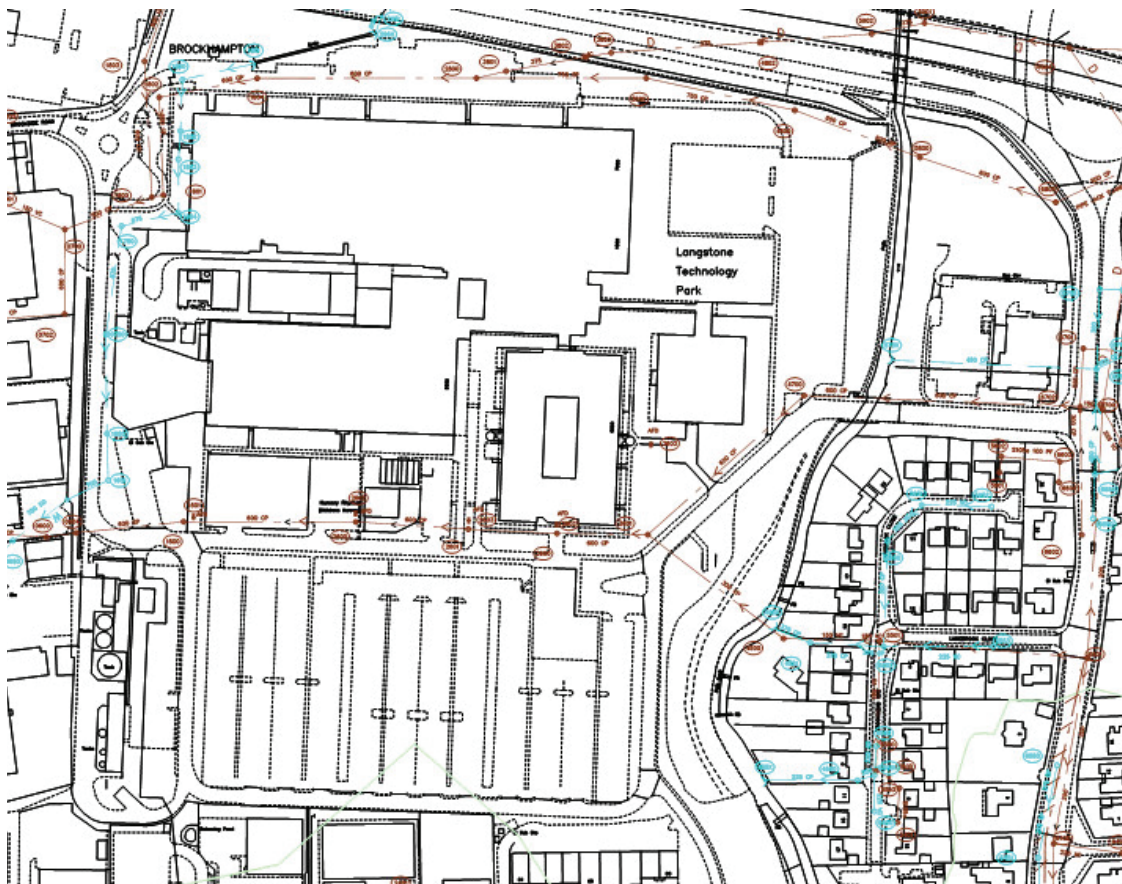


Figure 5 - Existing Public Sewer Plan (Southern Water)

- 5.1.3 The CCTV survey located a number of private drainage systems within the site. These can be found in Appendix B and are summarised on the proposed drainage strategy drawing found in Appendix E.
- 5.1.4 Surface water on the site north of the road bisecting the site drains via a 450mm surface water pipe discharging to the Environment Agency (EA) main river to the east of the site. Surface water drainage for the existing car park on the south of the site exits the site via 375mm diameter pipes heading south. A sketch summary of the CCTV survey overlaid on the proposed scheme can be found in Appendix C.

- 5.1.5 Foul water from the site connects to the existing adopted Southern Water mains foul sewers running through the site.
- 5.1.6 Information from the EA main river map indicates the river running along the east side of the site is a main river.



Figure 6 – EA River map

5.2 PROPOSED DRAINAGE

5.2.1 Surface Water Disposal Hierarchy

The disposal of surface water should be considered in the following order of priority;

1. Infiltration into the subsoil via soakaways or permeable paving.
2. Discharge to a water course or the sea.
3. Discharge to a surface water sewer.
4. Discharge to a combined sewer.

If it is not possible to discharge to a soakaway, surface water should be controlled with the use of Sustainable Drainage Systems (SuDS) and considered using the SuDS Hierarchy.

5.2.2 SuDS Hierarchy

Most Sustainable	SUDS technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit
	Living roofs	✓	✓	✓
	Basins and ponds - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✓	✓	✓
	Filter strips and swales	✓	✓	✓
	Infiltration devices - soakaways - infiltration trenches and basins	✓	✓	✓
	Permeable surfaces and filter drains - gravelled areas - solid paving blocks - porous paviers	✓	✓	
Least Sustainable	Tanked systems - over-sized pipes/tanks - storms cells	✓		

5.2.3 Disposal of Surface Water

Infiltration

At the time of writing infiltration test results are not available for the area. Infiltration via soakaways would be the primary discharge option for surface water if proven viable.

The current drainage does not discharge via infiltration, instead the northern area of the site discharges to a river east of the site while the south discharges via carrier pipe to an unknown location off site. Therefore it has been assumed, until proven otherwise, that infiltration is not viable.

Looking at historic borehole records available via the British Geological Society for the technology park, it is found that there is the potential for high groundwater. High groundwater levels are not preferable for soakaways as ground water fluctuates throughout the year and greatly reduce their efficiency if the soakaways are not at least 1m above the highest ground water level.

At detailed design stage a full ground investigation should be carried out including infiltration testing to establish if infiltration is viable.

Watercourse

As identified in Section 5.1, there is a main river located East of the developed site. If soakaways are found to not be viable then discharge into the watercourse is the next preferred option. Discussions have been undertaken with the Environment Agency (EA) via a phone conversation on 14/6/2019. The EA have stated that so long as the discharged surface water is 'clean' then there will not be a permit required for discharge to the main river.

Existing Sewer Connections

If permission for additional discharge into the main river is not granted then a connection to the existing adopted surface water sewers will be required.

5.2.4 SuDS Strategy - Control at Source.

One of the most effective means of reducing surface water flows and run-off is to control the rainfall at source with the use of increased soft landscaping, green roofs, and permeable paving.

Permeable paving has been proposed as an option in areas of low trafficked hardstanding. Permeable paving can be used to filter and improve water quality as well as provide a storage reservoir for storm water during extreme rainfall events. The main areas that permeable paving would be utilised in this development is the car parks. As a precautionary measure it would be advisable to only utilise permeable paving in the parking bays to avoid excessive wear on the surface. Permeable paving will not be viable in the heavy trafficked areas of the south-west of the site due to the proposed vehicle loading in the area.

It would not be advisable to utilise green roofs on this type of development due to the style and function of the proposed buildings.

Generally, the smaller, more isolated footpaths may drain directly into adjacent soft landscaping if permeable paving is not utilised.

5.2.5 Proposed Drainage

Any new drainage should be designed in accordance with the building regulations to allow for easy access for maintenance and blockage clearance.

Runoff Rates (See Appendix D for calculations)

The drainage areas have been split into four distinct areas as shown in Figure 7. The Havant Local Plan stipulates in section 3.5.b that run off rates should be below the pre-development rate, or, if not possible show no increase compared to predevelopment rates.

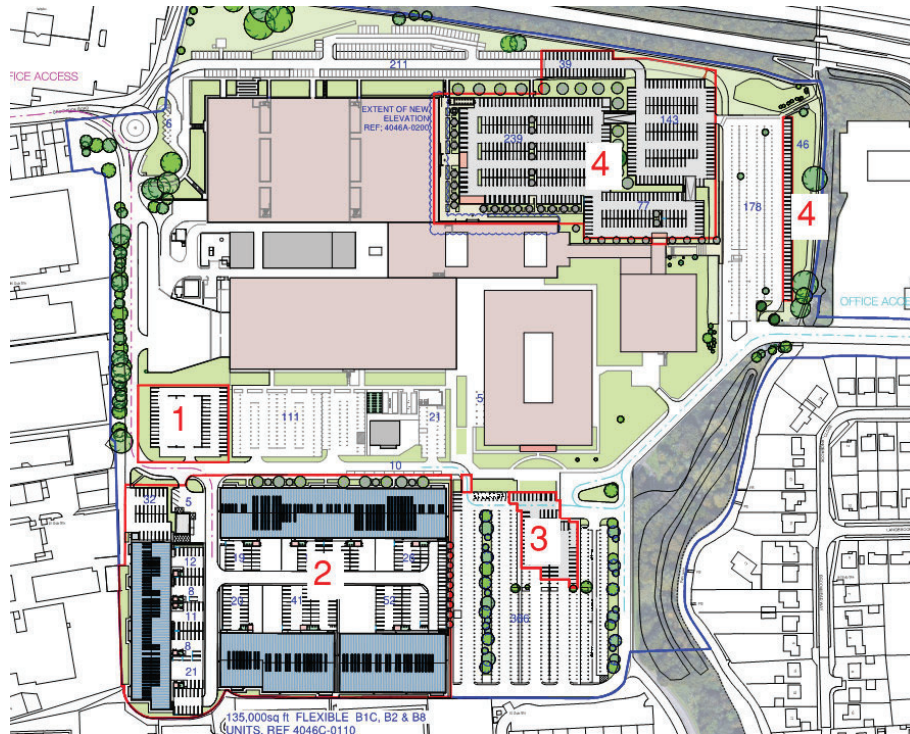


Figure 7 – Development areas, 1 to 4

Area 1 – Impermeable area = 2,044m²

Current run-off rates

1 in 1 year (l/s) = 7.5

1 in 30 year (l/s) = 18.4

1 in 100 year (l/s) = 23.7

Area 2 – Impermeable area = 25,439 m²

Current run-off rates

1 in 1 year (l/s) = 203.2

1 in 30 year (l/s) = 497.6

1 in 100 year (l/s) = 641.6

Area 3 – Impermeable area = 1,822 m²

Current run-off rates

Current area is soft landscaping, see greenfield rates

1 in 1 year (l/s) = 0.46

1 in 30 year (l/s) = 1.24

1 in 100 year (l/s) = 1.72

Obar (l/s) = 0.54

Area 4

Car park in footprint of Building 1000 area = 5212.5m²

1 in 1 year (l/s) = 41.6

1 in 30 year (l/s) = 102.6

1 in 100 year (l/s) = 131.5

New car parking in north of area 4 = 1693.5m²

1 in 1 year (l/s) = 13.5

1 in 30 year (l/s) = 33.1

1 in 100 year (l/s) = 42.7

Additional car parking area = 2655.6m²

1 in 1 year (l/s) = 21.2

1 in 30 year (l/s) = 51.9

1 in 100 year (l/s) = 67.0

Eastern proposed parking area = 530.71m²

1 in 1 year (l/s) = 4.2

1 in 30 year (l/s) = 10.4

1 in 100 year (l/s) = 13.4

Proposed Runoff Rate

The proposed runoff rate for the site have been chosen to match the current discharge and are therefore as follows:

Area 1 – 7.5 l/s

Area 2 – 132.0 l/s

Area 3 – 5.0 l/s

Area 4 – See Drainage Strategy Drawing

5 l/s has been chosen for area 3 as a flow control device will be used to limit the flow for higher storm events. The impermeable area in area 1 is also increasing. 5 l/s is the minimum recommended flow rate to reduce the likelihood of debris build up in the network.

For Area 2 see the calculations provided in Appendix 4. The discharge rate from this area has been lowered from the current run off rate as the hydraulic capacity of the discharge pipe is not expected to be able to meet the proposed flow. This is a betterment of the existing drainage.

Drainage Strategy

The proposal for this site is to attenuate all flows from impermeable areas to current run off rates with the use of below ground geocellular tanks, oversized pipes, permeable paving and flow control devices.

See Appendix D for drainage calculations including current and greenfield run off rates alongside storage tank size calculations.

See Appendix E for the proposed drainage drawings and typical details.

Water Quality

TABLE 26.2 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
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

Figure 8 – SuDS Manual extract

In accordance with the SuDS Manual, we will need to mitigate the above pollution hazard indices via the use of SuDS devices and features.

Car Parks;

The SuDS Manual identifies car parks of this use as a low pollution hazard level. It is therefore proposed that permeable pavement will be used to help mitigate this risk.

The hazard indices for car parks are;

Total Suspended Solids – 0.5

Metals – 0.4

Hydrocarbons – 0.4

Permeable Paving provides the following mitigation indices;

Total Suspended Solids – 0.7

Metals – 0.6

Hydrocarbons – 0.7

Permeable Paving is therefore suitable for SuDS mitigation in car park areas.

Area 2 (Industrial area)

The hazard indices for Industrial areas are;

Total Suspended Solids – 0.7

Metals – 0.6

Hydrocarbons – 0.7

It will not be suitable to use permeable paving for the area due to the potential for heavy vehicle loading.

Hydro International Downstream Defenders provide the following mitigation indices;

Total Suspended Solids – 0.5
Metals – 0.4
Hydrocarbons – 0.8

Therefore two downstream defenders will provide cleaning of:
Total Suspended Solids – 0.75
Metals – 0.6
Hydrocarbons – 1.2

As per SuDS manual mitigation the second item in a treatment chain will have an effectiveness of 50% This is adequate to meet the required mitigation measures as suggested by the CIRIA SuDS manual.

Roof areas of new units on the South west of the site:

As roof areas are a very low risk, the mitigation provided by the Downstream Defenders will be more than adequate.

5.2.6 Drainage and SuDS Maintenance Strategy

All of the measures described in this document will form part of the building O&M manual. All of the measures and designs will need to be adhered to in order to maintain the design life and design capacity of the surface and foul water drainage systems. Health and Safety risks have been communicated on design drawings. All responsibility for the on-site surface, foul water drainage and maintenance will lie with the site owner, this is to include all aspects of the surface water drainage system, including piped drains.

The below ground drainage network is designed in accordance with Building Regulations Part H 2015, BSEN 752-2008, LASOO Non-Statutory Technical Standards for Sustainable Drainage 2015 and CIRIA C753 – The SUDS Manual.

General Maintenance

Inspection chambers and access points are provided at regular intervals which can be jetted / cleaned. General checking of the below ground drainage systems should be every three (3) months. General maintenance / cleaning of the below ground systems should be after each major storm event and on an annual basis. This applies to all pipes, inspection chambers, manholes, rodding eyes, gullies, channels and headwalls etc.

Drainage Channels & Slot Drains

To be maintained in accordance with the manufacturer's recommendations and the "General" Section above.

Foul Systems

To be maintained in accordance with the "General" Section above.

Attenuation tank

The attenuation tank is to be inspected after every major storm event as will the catch pit prior to the tank. Catch pits should be emptied regularly to prevent them becoming full and causing inefficiency within the surface water drainage system.

Permeable paving

All permeable paving should be inspected monthly for the first three months after use. After this period the paving should be inspected three-monthly for operation and 48h after large storm events in the first six months.

Downstream Defender and Up-flow Filter

To be maintained in accordance with the manufacturer recommendations.

Flow Controls

Flow control device recommended to be inspected monthly for first three months and thereafter at six monthly intervals with hose dose down if required. Flow control device to be maintained in accordance with manufacturers recommendations.

Please refer to Appendix E and G for operation and maintenance requirement information.

6.0 NPPF AND LOCAL POLICY

6.1 Planning Policy Requirements

The proposal site has been classified as being within Flood Zone 1.

NPPF considers the development use as “less vulnerable” development in respect of flood risk.

The NPPF (Technical Guide) Table 3, Flood Risk Vulnerability and Flood Zone Compatibility matrix indicates that “less vulnerable” development proposals in Flood Zone 1 are appropriate.

6.2 Exception test and Policy check.

The site is in an area of flood zone 1, therefore no exception test is required.

6.3 Residual Risks, Flood Mitigation, Resistance and Resilience of Proposed Building

6.3.1 The site has been shown to be at low to very low risk from all forms of flooding.

6.3.2 The residual risk will be from failure of drainage systems on site. A detailed maintenance strategy and regime should be developed during the detailed design stage.

6.3.3 The proposed drainage system will improve upon the existing drainage. The existing drainage for the areas of development have unattenuated flows and therefore have the potential to increase flood risk in lower lying areas, or areas downstream of the adjacent river. The proposed drainage will control flow rates with the use of attenuation devices such as permeable paving, storage tanks and vortex flow devices to mitigate this potential.

7.0 CONCLUSIONS AND RECOMMENDATIONS

- 7.1** This report gives details of the flood risk assessment, which has been carried out in relation to the proposed redevelopment at Langstone Technology Park, Havant for commercial use.
- 7.2** The site is in flood zone 1. The development is at low risk from all sources of flooding.
- 7.3** It has been shown that improvements can be made to the existing drainage to better manage surface water flow rates and reduce the risk of flooding off site.

APPENDIX A

Proposed Development Plans



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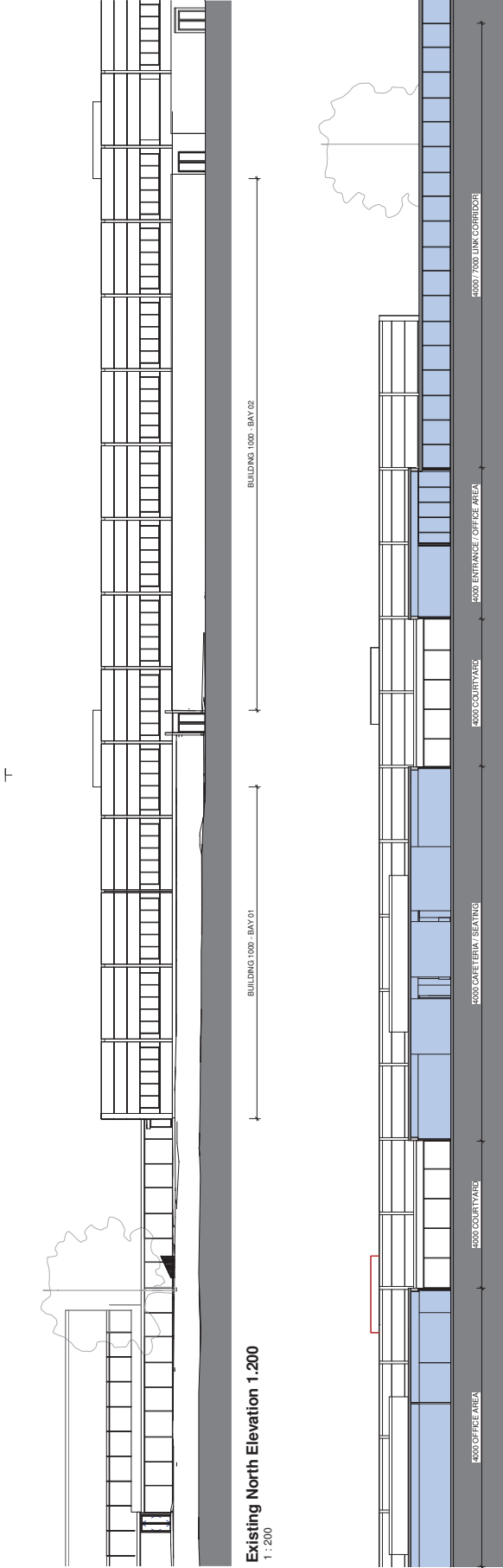
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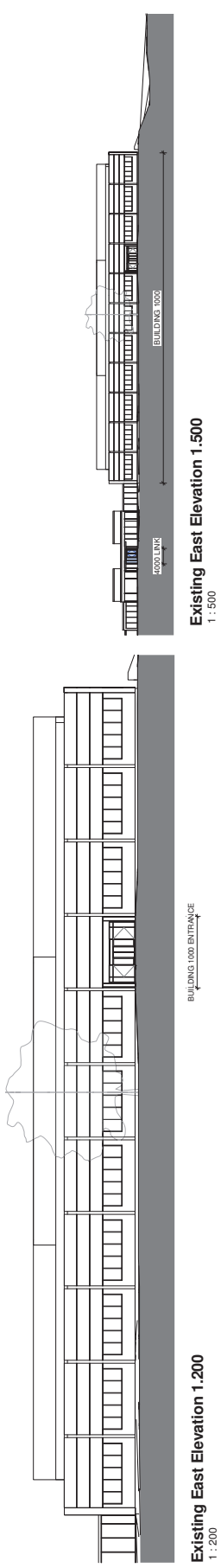


Drawing Title
Existing Ground Floor Plan

Scale	Sheet	Drawn	Checked	Date
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Status		Project No.		
PLANNING		4046A		
Drawing Reference		Drawing No.		Revision
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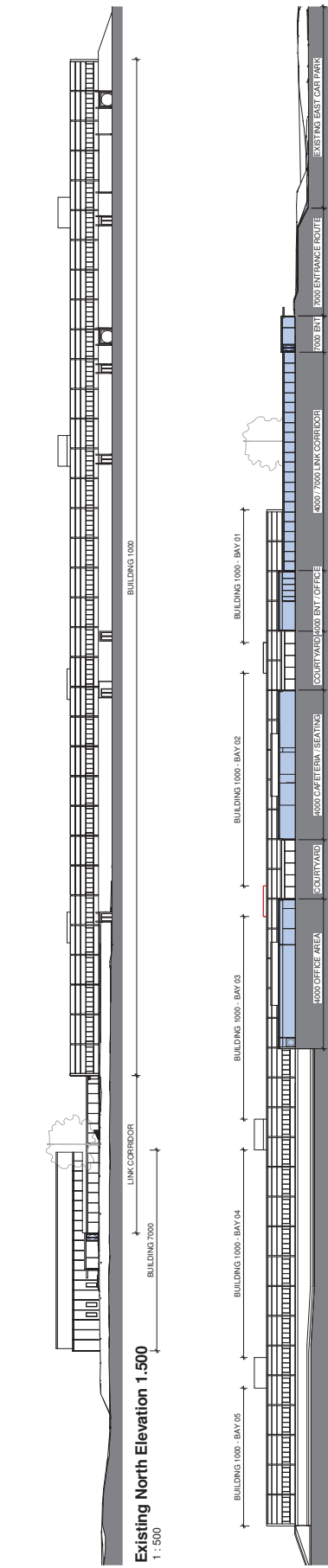


Existing Site Section - Building 1000 South Elevation 1.200
1 : 200



Existing East Elevation 1.200
1 : 200

Existing East Elevation 1.500
1 : 500



Existing North Elevation 1.500
1 : 500

Existing Site Section - Building 1000 South Elevation 1.500
1 : 500

NOTES

1. The drawings are for the proposed development of the Langstone Technology Park, and are not to be used for any other purpose without the written consent of the Architect.

2. The drawings are for the proposed development of the Langstone Technology Park, and are not to be used for any other purpose without the written consent of the Architect.

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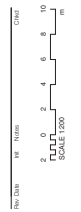
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Client

AWW inspired environments

Langstone Technology Park, Building 1000

Project Title

Langstone Technology Park, Building 1000

Client

Project Title

Langstone Technology Park, Building 1000

Client

Existing Elevations

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Project Title

Langstone Technology Park, Building 1000

Client

Existing Elevations

Scale

As Indicated

At

CJ

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14.06.19

Project Title

Langstone Technology Park, Building 1000

Client

Existing Elevations

Scale

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Project Title

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Project Title

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Existing Elevations

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As Indicated

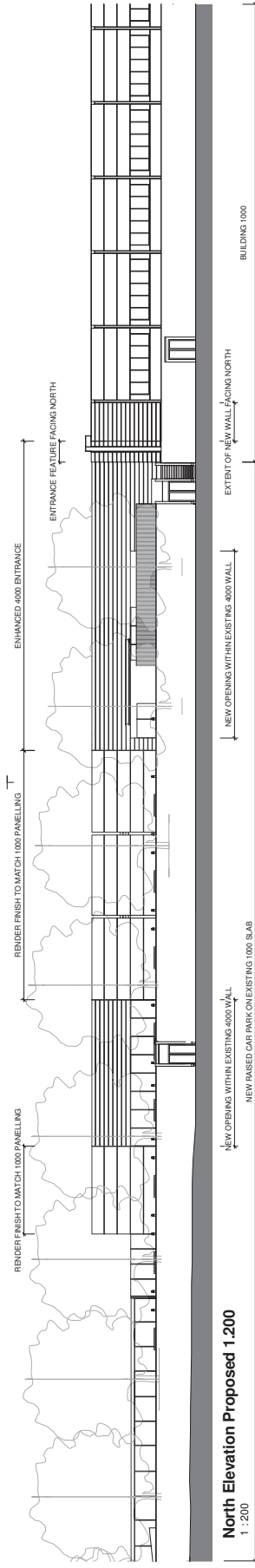
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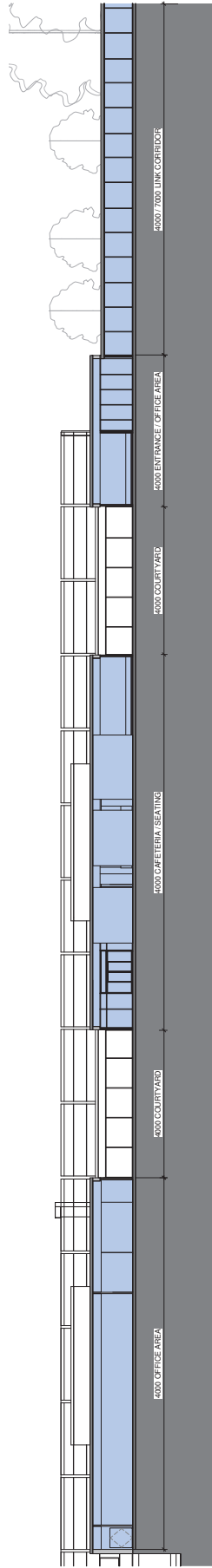
1000 - Proposed Ground Floor (8330 Survey) 1.500

- APPLICATION AREA
APPLICANT OWNERSHIP BOUNDARY
EDGE OF EXISTING SLAB / PARKING AREA
1500x1500mm OFFICE GRID
ELEMENTS REMOVED
EXISTING GIA
RECEPTION / ENTRANCE
OPEN PLAN WORK STATION
BREAKOUT / INFORMAL
CONFERENCE / MEETING / FORMAL
KITCHEN / WC / SERVICES
EXISTING CORE (PLANT / WC / ST)

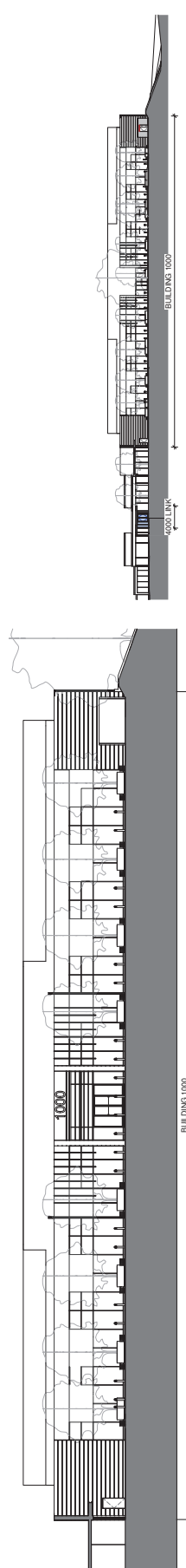
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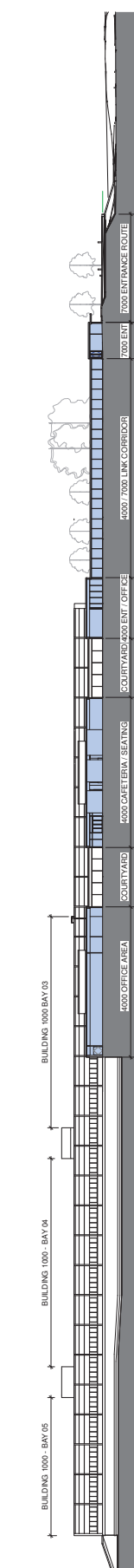
North Elevation Proposed 1.200



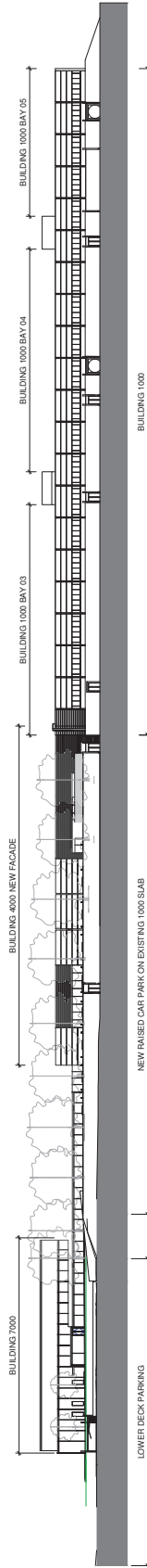
Proposed Site Section - Building 1000 South Elevation 1.200



Proposed East Elevation 1.200



Proposed Site Section - Building 1000 South Elevation 1.500



North Elevation Proposed 1.500



419

Drawing Conclusions

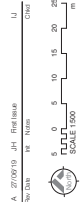
AWW inspired environments
020 7 960 0000
01753 803 210
01753 205 282
www.aww-uk.com

Project Title
Langstone Technology Park,
Building 1000

Proposed Elevations

Scale	Sheet	Drawn	Checked	Date
As indicated	A1	CJ	U	14.06.19

Status	Project No.
PLANNING	4046A
Drawing Reference	Drawing No.
	300
	Revision



Client

AWW inspired environments
Drawing Designer
Langstone Technology Park
Havant

Project Title
Proposed Industrial Units
Langstone Technology Park,
Havant
Drawing Title
Site Plan

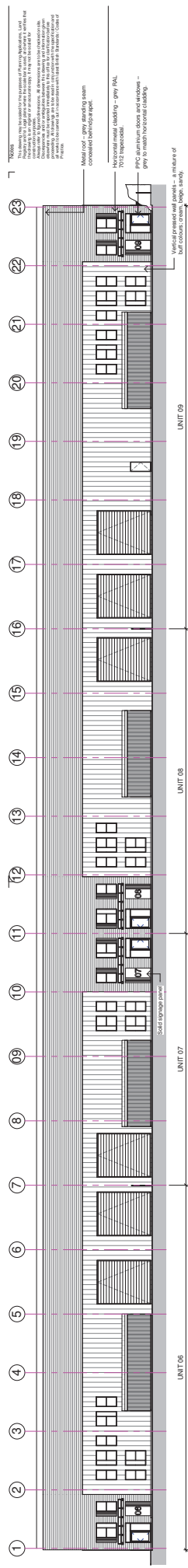
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Revision				
PLANNING				
Drawing No.				
4046C				
Drawing Title				
Site Plan				
Drawing No.				
0110				
Revision				
A				

Notes:
1. The site plan shows the proposed development and the existing site conditions.
2. The site plan shows the proposed development and the existing site conditions.
3. The site plan shows the proposed development and the existing site conditions.
4. The site plan shows the proposed development and the existing site conditions.
5. The site plan shows the proposed development and the existing site conditions.
6. The site plan shows the proposed development and the existing site conditions.
7. The site plan shows the proposed development and the existing site conditions.
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9. The site plan shows the proposed development and the existing site conditions.
10. The site plan shows the proposed development and the existing site conditions.





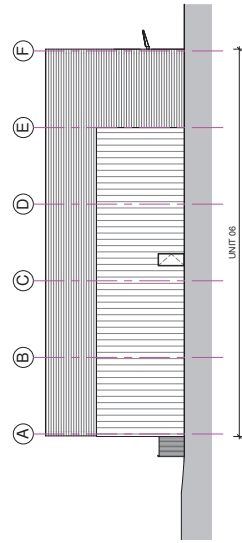
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PLANING Drawing Reference Drawing No. 0211 Revision A				



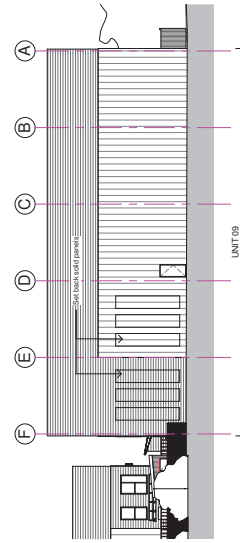
Units 6-9 South Elevation



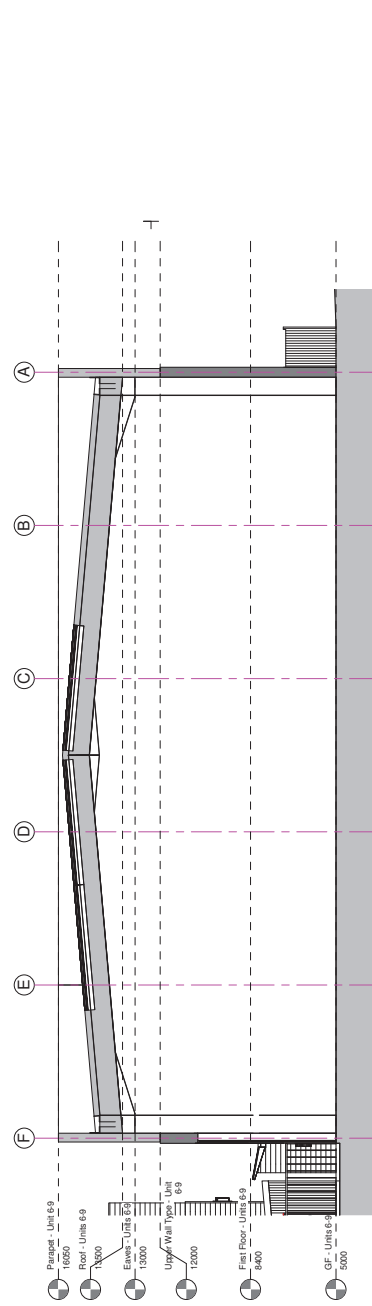
Units 6-9 North Elevation



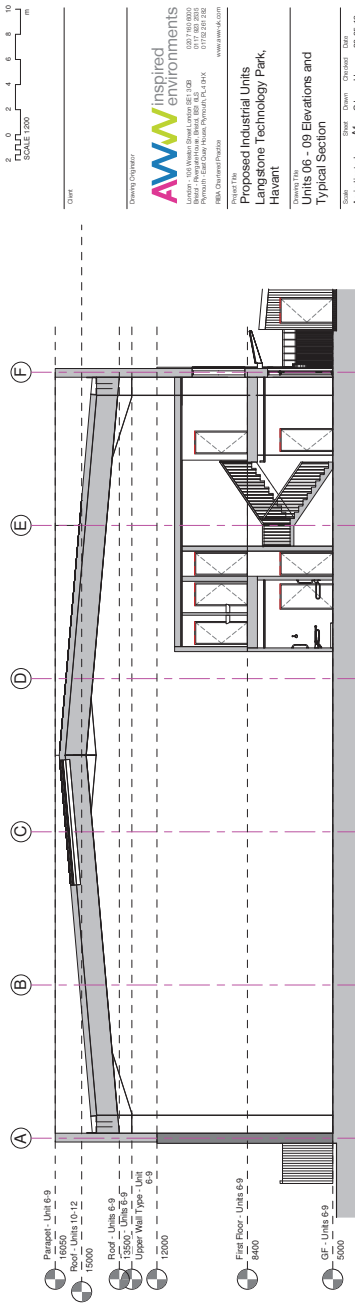
Units 6-9 West Elevation



Units 6-9 East Elevation



Units 6-9 Warehouse Section



Unit 06 Section - Staircore

Base Date	Ver	Notes	Client
C	01.07.19	CJ	Unit 6 revision and annotations updated.
B	28/06/19	JH	Minor updates
A	27/06/19	JH	Final issue



1011

Drawing Conclusions

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London - 1100 Weydon Street, London SE1 3QB
Amsterdam - Pleyerlaan 10, 1053 S
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FROM CHAIRMAN FREDERICK

IN ROOM AT THIS OFFICE

Proposed Industrial Units
Langstone Technology Park,
Havant

Drawing Title
Units 06 - 09 Elevations and
Typical Section

Scale	Sheet	Drawn	Checked	Date									
As indicated	A1	CJ	U	30.05.19									
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Status	Project No. 4046C												
	Drawing No. Revision 0215 C												
Drawing Reference													



Year	Issue	Notes	Class
2019	1	Minor updates	1
2019	2	Minor updates	2
2019	3	Minor updates	3
2019	4	Minor updates	4
2019	5	Minor updates	5
2019	6	Minor updates	6
2019	7	Minor updates	7
2019	8	Minor updates	8
2019	9	Minor updates	9
2019	10	Minor updates	10
2019	11	Minor updates	11
2019	12	Minor updates	12

Client

Drawing Critique

AWW inspired environments

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Bristol • 0117 923 2015
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09 17 923 2015
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1000 JOURNAL OF MANAGEMENT INQUIRY / December 2005

Proposed Industrial Units
Langstone Technology Park,
Havant

Division Title

Units 10 - 12 Floor Plans

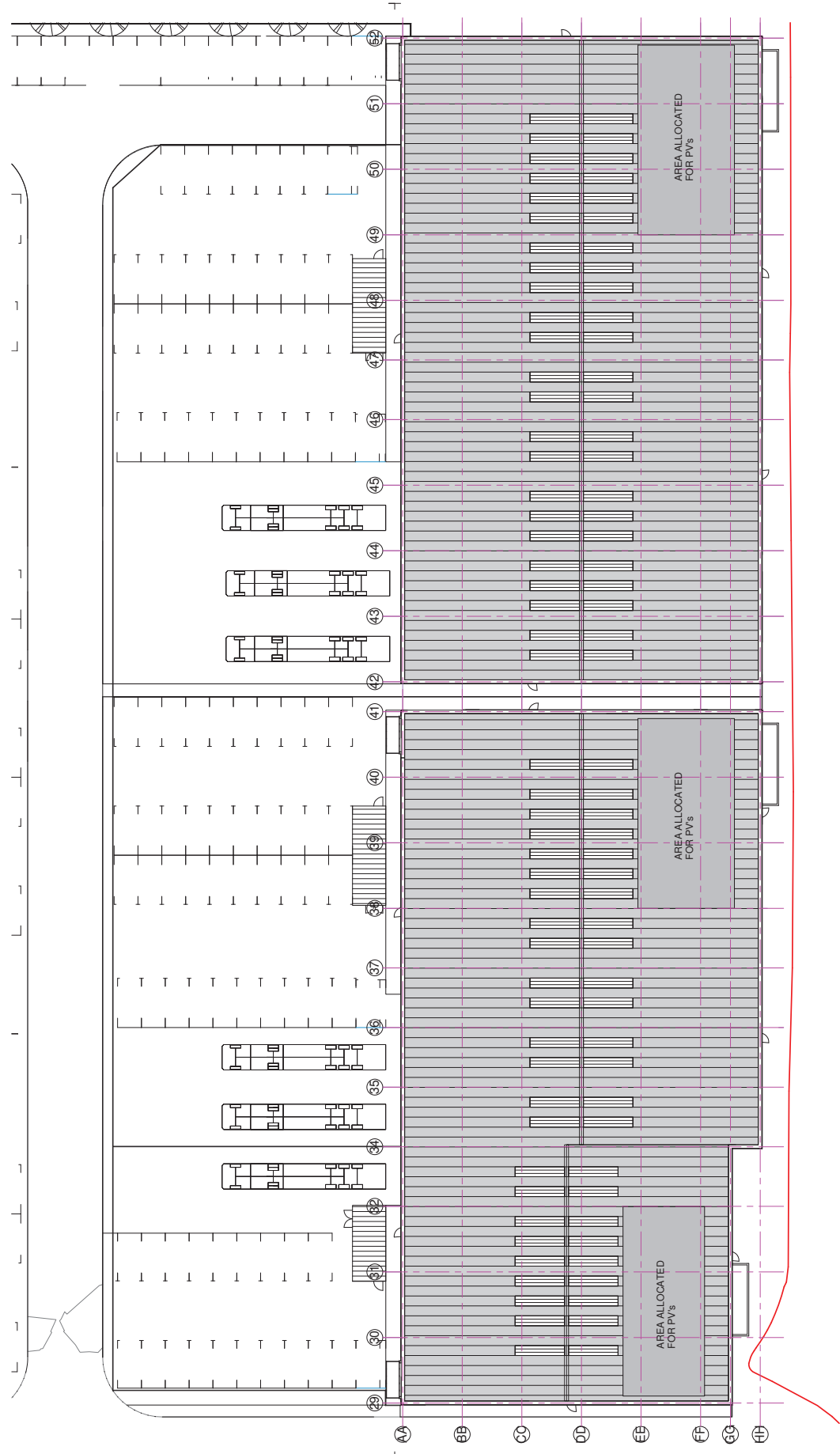
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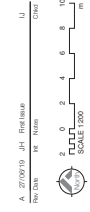
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PLANNING	4046C
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The information contained in this drawing is for the use of the client and is not to be used for any other purpose without the written consent of the architect. The architect is not responsible for any errors or omissions in this drawing. The client is responsible for the accuracy of the information provided to the architect. The architect is not responsible for any errors or omissions in this drawing. The client is responsible for the accuracy of the information provided to the architect.

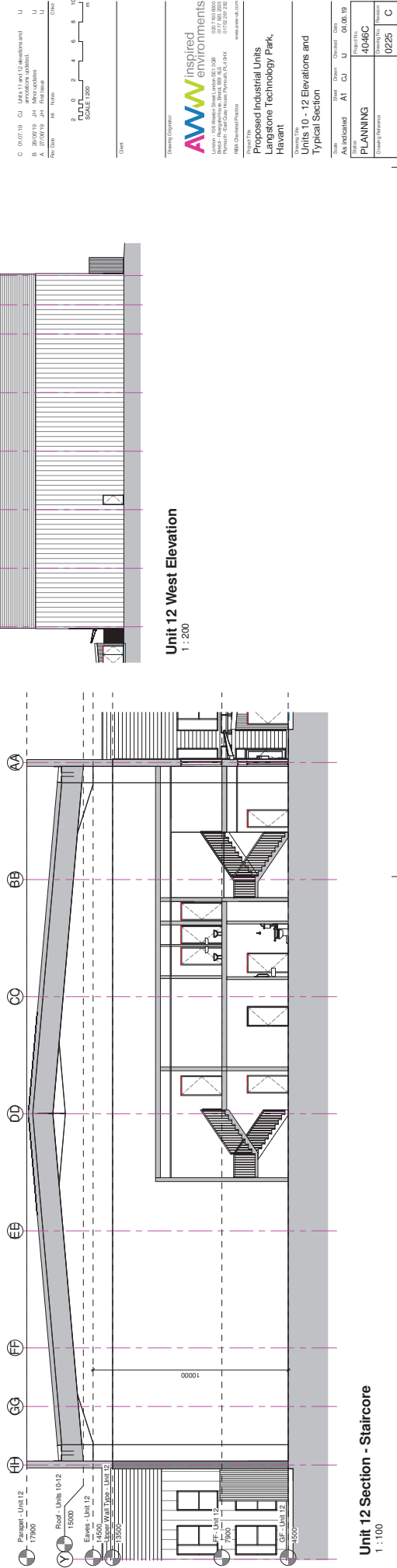
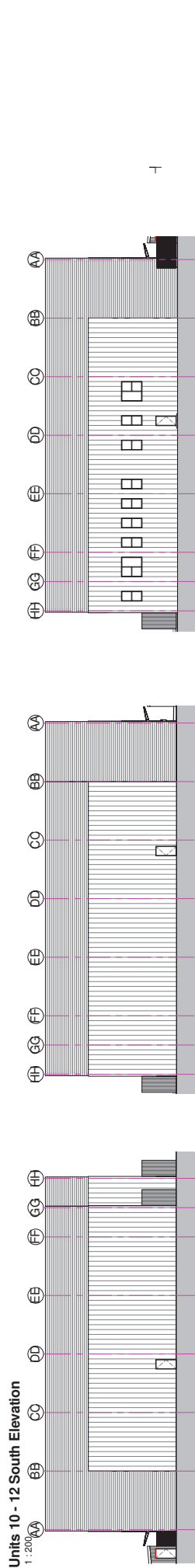


Units 10 - 12 Roof Plan
 1:200



Drawing Designer
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Drawn	CJ
Checked	U
Date	04.08.19
Project No.	4046C
Revision No.	0021
Revision	A



Units 10 - 12 Elevations and Typical Section

Proposed Industrial Units
Langstone Technology Park,
Havant

Client: Havant Borough Council
Project No: 4046C
Drawn By: 0225
Checked By: C

Scale: As indicated
Sheet: A1
Drawn: CJ
Date: 04.08.19

Project Info:
Units 10 - 12 Elevations and Typical Section
Langstone Technology Park, Havant

Client: Havant Borough Council
Project No: 4046C
Drawn By: 0225
Checked By: C

Scale: As indicated
Sheet: A1
Drawn: CJ
Date: 04.08.19

Project Info:
Units 10 - 12 Elevations and Typical Section
Langstone Technology Park, Havant

Client: Havant Borough Council
Project No: 4046C
Drawn By: 0225
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Scale: As indicated
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Date: 04.08.19

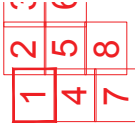
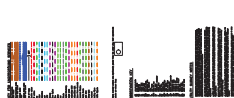
APPENDIX B

Topographic and CCTV Survey



Students A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z are marked with a
Students G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z are marked with a 100%

$\alpha = 0.05$ 时, $\chi^2_{0.05}(1) = 3.84$, $\chi^2_{0.05}(2) = 5.99$, $\chi^2_{0.05}(3) = 7.88$, $\chi^2_{0.05}(4) = 9.49$, $\chi^2_{0.05}(5) = 11.07$, $\chi^2_{0.05}(6) = 12.59$, $\chi^2_{0.05}(7) = 14.07$, $\chi^2_{0.05}(8) = 15.51$, $\chi^2_{0.05}(9) = 16.92$, $\chi^2_{0.05}(10) = 18.31$, $\chi^2_{0.05}(11) = 19.68$, $\chi^2_{0.05}(12) = 21.03$, $\chi^2_{0.05}(13) = 22.36$, $\chi^2_{0.05}(14) = 23.68$, $\chi^2_{0.05}(15) = 25.00$, $\chi^2_{0.05}(16) = 26.36$, $\chi^2_{0.05}(17) = 27.59$, $\chi^2_{0.05}(18) = 28.79$, $\chi^2_{0.05}(19) = 30.19$, $\chi^2_{0.05}(20) = 31.53$, $\chi^2_{0.05}(21) = 32.81$, $\chi^2_{0.05}(22) = 34.17$, $\chi^2_{0.05}(23) = 35.43$, $\chi^2_{0.05}(24) = 36.78$, $\chi^2_{0.05}(25) = 38.08$, $\chi^2_{0.05}(26) = 39.36$, $\chi^2_{0.05}(27) = 40.65$, $\chi^2_{0.05}(28) = 41.90$, $\chi^2_{0.05}(29) = 43.19$, $\chi^2_{0.05}(30) = 44.43$, $\chi^2_{0.05}(31) = 45.66$, $\chi^2_{0.05}(32) = 46.88$, $\chi^2_{0.05}(33) = 48.09$, $\chi^2_{0.05}(34) = 49.29$, $\chi^2_{0.05}(35) = 50.49$, $\chi^2_{0.05}(36) = 51.68$, $\chi^2_{0.05}(37) = 52.86$, $\chi^2_{0.05}(38) = 54.03$, $\chi^2_{0.05}(39) = 55.19$, $\chi^2_{0.05}(40) = 56.34$, $\chi^2_{0.05}(41) = 57.49$, $\chi^2_{0.05}(42) = 58.63$, $\chi^2_{0.05}(43) = 59.77$, $\chi^2_{0.05}(44) = 60.90$, $\chi^2_{0.05}(45) = 62.03$, $\chi^2_{0.05}(46) = 63.16$, $\chi^2_{0.05}(47) = 64.28$, $\chi^2_{0.05}(48) = 65.41$, $\chi^2_{0.05}(49) = 66.53$, $\chi^2_{0.05}(50) = 67.66$, $\chi^2_{0.05}(51) = 68.78$, $\chi^2_{0.05}(52) = 69.89$, $\chi^2_{0.05}(53) = 71.01$, $\chi^2_{0.05}(54) = 72.12$, $\chi^2_{0.05}(55) = 73.23$, $\chi^2_{0.05}(56) = 74.34$, $\chi^2_{0.05}(57) = 75.45$, $\chi^2_{0.05}(58) = 76.55$, $\chi^2_{0.05}(59) = 77.65$, $\chi^2_{0.05}(60) = 78.75$, $\chi^2_{0.05}(61) = 79.85$, $\chi^2_{0.05}(62) = 80.95$, $\chi^2_{0.05}(63) = 82.05$, $\chi^2_{0.05}(64) = 83.15$, $\chi^2_{0.05}(65) = 84.25$, $\chi^2_{0.05}(66) = 85.35$, $\chi^2_{0.05}(67) = 86.45$, $\chi^2_{0.05}(68) = 87.55$, $\chi^2_{0.05}(69) = 88.65$, $\chi^2_{0.05}(70) = 89.75$, $\chi^2_{0.05}(71) = 90.85$, $\chi^2_{0.05}(72) = 91.95$, $\chi^2_{0.05}(73) = 93.05$, $\chi^2_{0.05}(74) = 94.15$, $\chi^2_{0.05}(75) = 95.25$, $\chi^2_{0.05}(76) = 96.35$, $\chi^2_{0.05}(77) = 97.45$, $\chi^2_{0.05}(78) = 98.55$, $\chi^2_{0.05}(79) = 99.65$, $\chi^2_{0.05}(80) = 100.75$, $\chi^2_{0.05}(81) = 101.85$, $\chi^2_{0.05}(82) = 102.95$, $\chi^2_{0.05}(83) = 104.05$, $\chi^2_{0.05}(84) = 105.15$, $\chi^2_{0.05}(85) = 106.25$, $\chi^2_{0.05}(86) = 107.35$, $\chi^2_{0.05}(87) = 108.45$, $\chi^2_{0.05}(88) = 109.55$, $\chi^2_{0.05}(89) = 110.65$, $\chi^2_{0.05}(90) = 111.75$, $\chi^2_{0.05}(91) = 112.85$, $\chi^2_{0.05}(92) = 113.95$, $\chi^2_{0.05}(93) = 115.05$, $\chi^2_{0.05}(94) = 116.15$, $\chi^2_{0.05}(95) = 117.25$, $\chi^2_{0.05}(96) = 118.35$, $\chi^2_{0.05}(97) = 119.45$, $\chi^2_{0.05}(98) = 120.55$, $\chi^2_{0.05}(99) = 121.65$, $\chi^2_{0.05}(100) = 122.75$, $\chi^2_{0.05}(101) = 123.85$, $\chi^2_{0.05}(102) = 124.95$, $\chi^2_{0.05}(103) = 126.05$, $\chi^2_{0.05}(104) = 127.15$, $\chi^2_{0.05}(105) = 128.25$, $\chi^2_{0.05}(106) = 129.35$, $\chi^2_{0.05}(107) = 130.45$, $\chi^2_{0.05}(108) = 131.55$, $\chi^2_{0.05}(109) = 132.65$, $\chi^2_{0.05}(110) = 133.75$, $\chi^2_{0.05}(111) = 134.85$, $\chi^2_{0.05}(112) = 135.95$, $\chi^2_{0.05}(113) = 137.05$, $\chi^2_{0.05}(114) = 138.15$, $\chi^2_{0.05}(115) = 139.25$, $\chi^2_{0.05}(116) = 140.35$, $\chi^2_{0.05}(117) = 141.45$, $\chi^2_{0.05}(118) = 142.55$, $\chi^2_{0.05}(119) = 143.65$, $\chi^2_{0.05}(120) = 144.75$, $\chi^2_{0.05}(121) = 145.85$, $\chi^2_{0.05}(122) = 146.95$, $\chi^2_{0.05}(123) = 148.05$, $\chi^2_{0.05}(124) = 149.15$, $\chi^2_{0.05}(125) = 150.25$, $\chi^2_{0.05}(126) = 151.35$, $\chi^2_{0.05}(127) = 152.45$, $\chi^2_{0.05}(128) = 153.55$, $\chi^2_{0.05}(129) = 154.65$, $\chi^2_{0.05}(130) = 155.75$, $\chi^2_{0.05}(131) = 156.85$, $\chi^2_{0.05}(132) = 157.95$, $\chi^2_{0.05}(133) = 159.05$, $\chi^2_{0.05}(134) = 160.15$, $\chi^2_{0.05}(135) = 161.25$, $\chi^2_{0.05}(136) = 162.35$, $\chi^2_{0.05}(137) = 163.45$, $\chi^2_{0.05}(138) = 164.55$, $\chi^2_{0.05}(139) = 165.65$, $\chi^2_{0.05}(140) = 166.75$, $\chi^2_{0.05}(141) = 167.85$, $\chi^2_{0.05}(142) = 168.95$, $\chi^2_{0.05}(143) = 170.05$, $\chi^2_{0.05}(144) = 171.15$, $\chi^2_{0.05}(145) = 172.25$, $\chi^2_{0.05}(146) = 173.35$, $\chi^2_{0.05}(147) = 174.45$, $\chi^2_{0.05}(148) = 175.55$, $\chi^2_{0.05}(149) = 176.65$, $\chi^2_{0.05}(150) = 177.75$, $\chi^2_{0.05}(151) = 178.85$, $\chi^2_{0.05}(152) = 179.95$, $\chi^2_{0.05}(153) = 181.05$, $\chi^2_{0.05}(154) = 182.15$, $\chi^2_{0.05}(155) = 183.25$, $\chi^2_{0.05}(156) = 184.35$, $\chi^2_{0.05}(157) = 185.45$, $\chi^2_{0.05}(158) = 186.55$,

[illegible]

Day: Comments:



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Langstone Technology

Date	2010
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Score	Q1
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Project Code:	0101 2017 / 150
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Site Level Data	Q1-Q4
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on site also is appropriate. This drawing must be
 signed by the architect and the engineer. The
 drawing should be submitted.

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