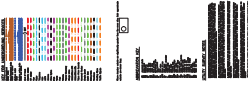


                             	                             	                             	                             	                            
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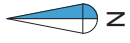


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Comments

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Langstone Technology Park	
Langstone Road, Havant, PO9 1SA	
Reference: D04207-USP	
Drawing Title: Utilities Survey of Langstone Techn	
Sheet (4 of 8 A0)	
Client: AWW	

Drawn by: 00 - AS	Checked by: 00 - JS	Project Code DO-407
Grid Orientation: North GPS		Site Level OS GPS



Building 4000

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Building 7000

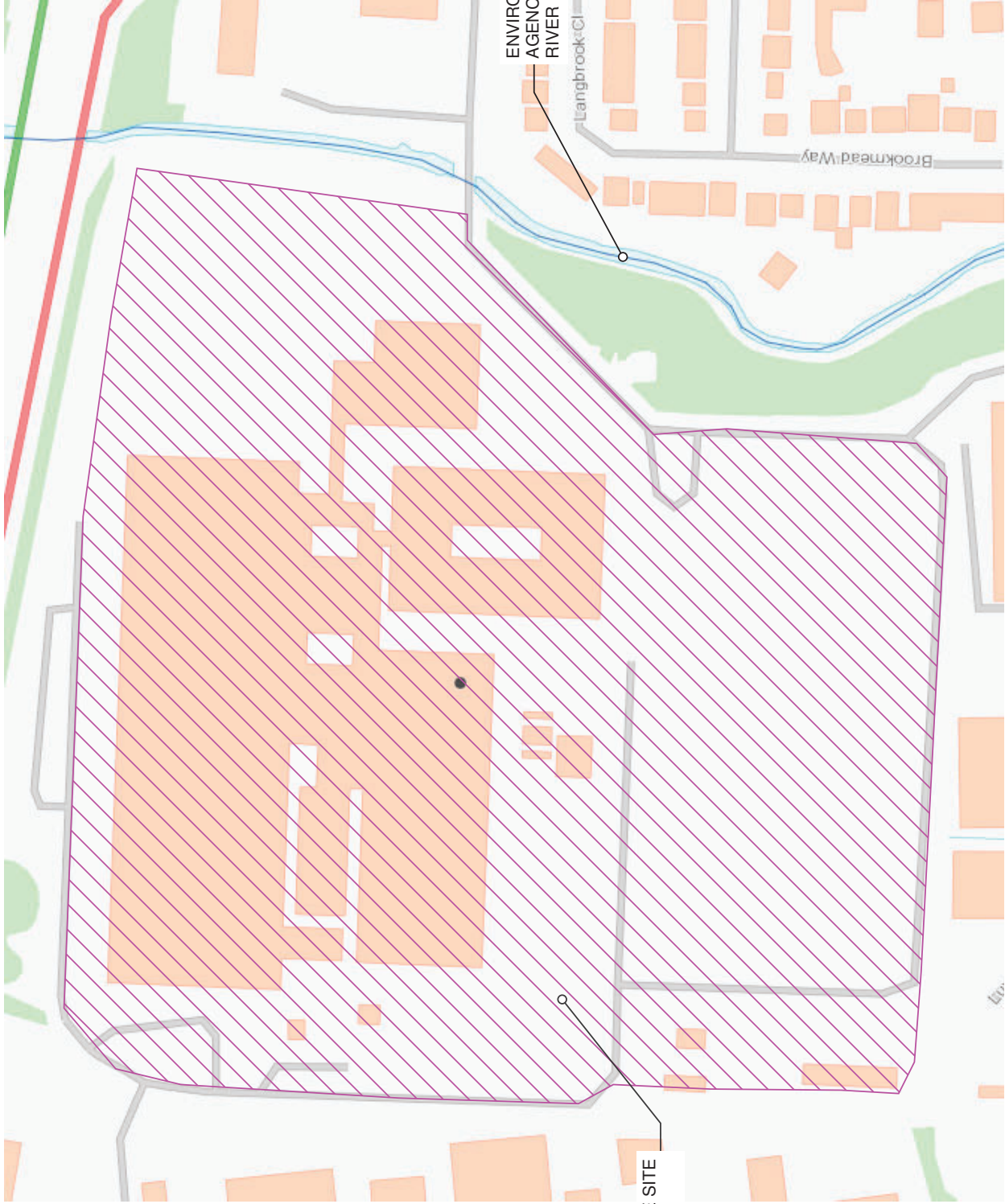
Building 6000

KEY FOR UNDERGROUND SERVICES

100mm	150mm	225mm	300mm	375mm	450mm	525mm	600mm	750mm	900mm	1050mm	1200mm	1350mm	1500mm	1650mm	1800mm	2000mm	2250mm	2400mm	2700mm	3000mm	3300mm	3600mm	3900mm	4200mm	4500mm	4800mm	5100mm	5400mm	5700mm	6000mm	6300mm	6600mm	6900mm	7200mm	7500mm	7800mm	8100mm	8400mm	8700mm	9000mm	9300mm	9600mm	9900mm	10200mm	10500mm	10800mm	11100mm	11400mm	11700mm	12000mm	12300mm	12600mm	12900mm	13200mm	13500mm	13800mm	14100mm	14400mm	14700mm	15000mm	15300mm	15600mm	15900mm	16200mm	16500mm	16800mm	17100mm	17400mm	17700mm	18000mm	18300mm	18600mm	18900mm	19200mm	19500mm	19800mm	20100mm	20400mm	20700mm	21000mm	21300mm	21600mm	21900mm	22200mm	22500mm	22800mm	23100mm	23400mm	23700mm	24000mm	24300mm	24600mm	24900mm	25200mm	25500mm	25800mm	26100mm	26400mm	26700mm	27000mm	27300mm	27600mm	27900mm	28200mm	28500mm	28800mm	29100mm	29400mm	29700mm	30000mm	30300mm	30600mm	30900mm	31200mm	31500mm	31800mm	32100mm	32400mm	32700mm	33000mm	33300mm	33600mm	33900mm	34200mm	34500mm	34800mm	35100mm	35400mm	35700mm	36000mm	36300mm	36600mm	36900mm	37200mm	37500mm	37800mm	38100mm	38400mm	38700mm	39000mm	39300mm	39600mm	39900mm	40200mm	40500mm	40800mm	41100mm	41400mm	41700mm	42000mm	42300mm	42600mm	42900mm	43200mm	43500mm	43800mm	44100mm	44400mm	44700mm	45000mm	45300mm	45600mm	45900mm	46200mm	46500mm	46800mm	47100mm	47400mm	47700mm	48000mm	48300mm	48600mm	48900mm	49200mm	49500mm	49800mm	50100mm	50400mm	50700mm	51000mm	51300mm	51600mm	51900mm	52200mm	52500mm	52800mm	53100mm	53400mm	53700mm	54000mm	54300mm	54600mm	54900mm	55200mm	55500mm	55800mm	56100mm	56400mm	56700mm	57000mm	57300mm	57600mm	57900mm	58200mm	58500mm	58800mm	59100mm	59400mm	59700mm	60000mm	60300mm	60600mm	60900mm	61200mm	61500mm	61800mm	62100mm	62400mm	62700mm	63000mm	63300mm	63600mm	63900mm	64200mm	64500mm	64800mm	65100mm	65400mm	65700mm	66000mm	66300mm	66600mm	66900mm	67200mm	67500mm	67800mm	68100mm	68400mm	68700mm	69000mm	69300mm	69600mm	69900mm	70200mm	70500mm	70800mm	71100mm	71400mm	71700mm	72000mm	72300mm	72600mm	72900mm	73200mm	73500mm	73800mm	74100mm	74400mm	74700mm	75000mm	75300mm	75600mm	75900mm	76200mm	76500mm	76800mm	77100mm	77400mm	77700mm	78000mm	78300mm	78600mm	78900mm	79200mm	79500mm	79800mm	80100mm	80400mm	80700mm	81000mm	81300mm	81600mm	81900mm	82200mm	82500mm	82800mm	83100mm	83400mm	83700mm	84000mm	84300mm	84600mm	84900mm	85200mm	85500mm	85800mm	86100mm	86400mm	86700mm	87000mm	87300mm	87600mm	87900mm	88200mm	88500mm	88800mm	89100mm	89400mm	89700mm	90000mm	90300mm	90600mm	90900mm	91200mm	91500mm	91800mm	92100mm	92400mm	92700mm	93000mm	93300mm	93600mm	93900mm	94200mm	94500mm	94800mm	95100mm	95400mm	95700mm	96000mm	96300mm	96600mm	96900mm	97200mm	97500mm	97800mm	98100mm	98400mm	98700mm	99000mm	99300mm	99600mm	99900mm	100200mm	100500mm	100800mm	101100mm	101400mm	101700mm	102000mm	102300mm	102600mm	102900mm	103200mm	103500mm	103800mm	104100mm	104400mm	104700mm	105000mm	105300mm	105600mm	105900mm	106200mm	106500mm	106800mm	107100mm	107400mm	107700mm	108000mm	108300mm	108600mm	108900mm	109200mm	109500mm	109800mm	110100mm	110400mm	110700mm	111000mm	111300mm	111600mm	111900mm	112200mm	112500mm	112800mm	113100mm	113400mm	113700mm	114000mm	114300mm	114600mm	114900mm	115200mm	115500mm	115800mm	116100mm	116400mm	116700mm	117000mm	117300mm	117600mm	117900mm	118200mm	118500mm	118800mm	119100mm	119400mm	119700mm	120000mm	120300mm	120600mm	120900mm	121200mm	121500mm	121800mm	122100mm	122400mm	122700mm	123000mm	123300mm	123600mm	123900mm	124200mm	124500mm	124800mm	125100mm	125400mm	125700mm	126000mm	126300mm	126600mm	126900mm	127200mm	127500mm	127800mm	128100mm	128400mm	128700mm	129000mm	129300mm	129600mm	129900mm	130200mm	130500mm	130800mm	131100mm	131400mm	131700mm	132000mm	132300mm	132600mm	132900mm	133200mm	133500mm	133800mm	134100mm	134400mm	134700mm	135000mm	135300mm	135600mm	135900mm	136200mm	136500mm	136800mm	137100mm	137400mm	137700mm	138000mm	138300mm	138600mm	138900mm	139200mm	139500mm	139800mm	140100mm	140400mm	140700mm	141000mm	141300mm	141600mm	141900mm	142200mm	142500mm	142800mm	143100mm	143400mm	143700mm	144000mm	144300mm	144600mm	144900mm	145200mm	145500mm	145800mm	146100mm	146400mm	146700mm	147000mm	147300mm	147600mm	147900mm	148200mm	148500mm	148800mm	149100mm	149400mm	149700mm	150000mm	150300mm	150600mm	150900mm	151200mm	151500mm	151800mm	152100mm	152400mm	152700mm	153000mm	153300mm	153600mm	153900mm	154200mm	154500mm	154800mm	155100mm	155400mm	155700mm	156000mm	156300mm	156600mm	156900mm	157200mm	157500mm	157800mm	158100mm	158400mm	158700mm	159000mm	159300mm	159600mm	159900mm	160200mm	160500mm	160800mm	161100mm	161400mm	161700mm	162000mm	162300mm	162600mm	162900mm	163200mm	163500mm	163800mm	164100mm	164400mm	164700mm	165000mm	165300mm	165600mm	165900mm	166200mm	166500mm	166800mm	167100mm	167400mm	167700mm	168000mm	168300mm	168600mm	168900mm	169200mm	169500mm	169800mm	170100mm	170400mm	170700mm	171000mm	171300mm	171600mm	171900mm	172200mm	172500mm	172800mm	173100mm	173400mm	173700mm	174000mm	174300mm	174600mm	174900mm	175200mm	175500mm	175800mm	176100mm	176400mm	176700m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APPENDIX C

Existing Drainage

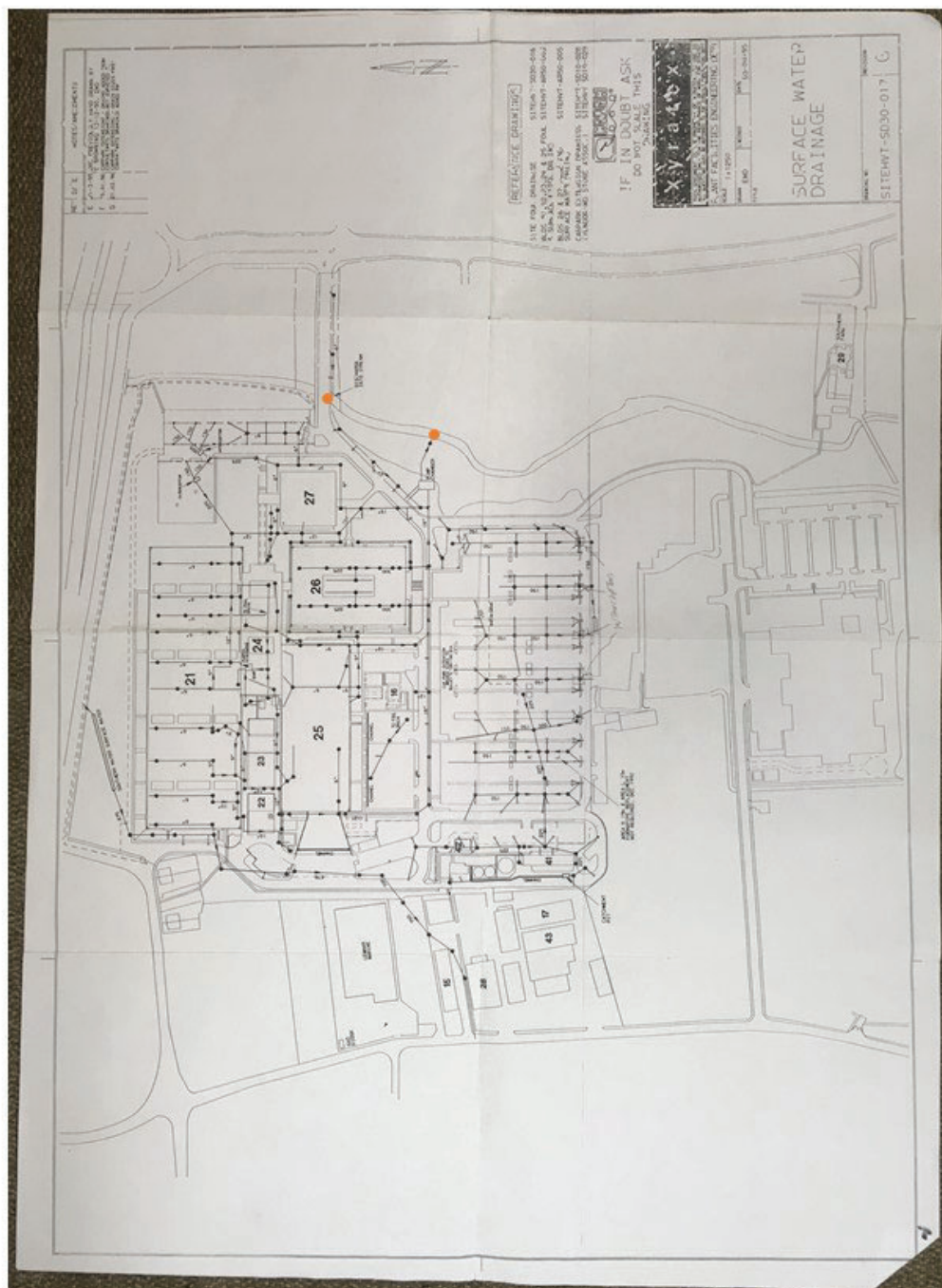


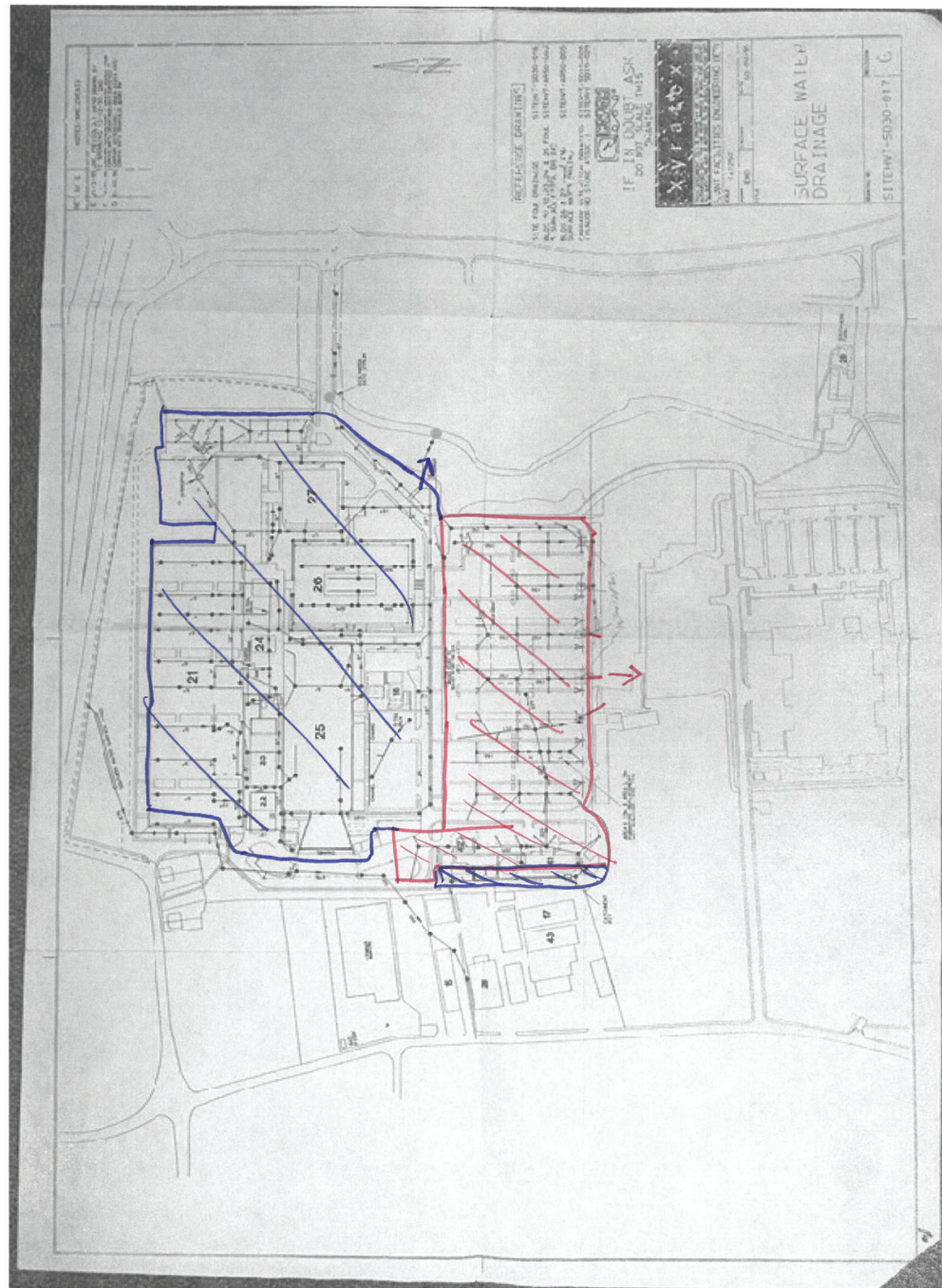
Flow control currently on site in north car park.

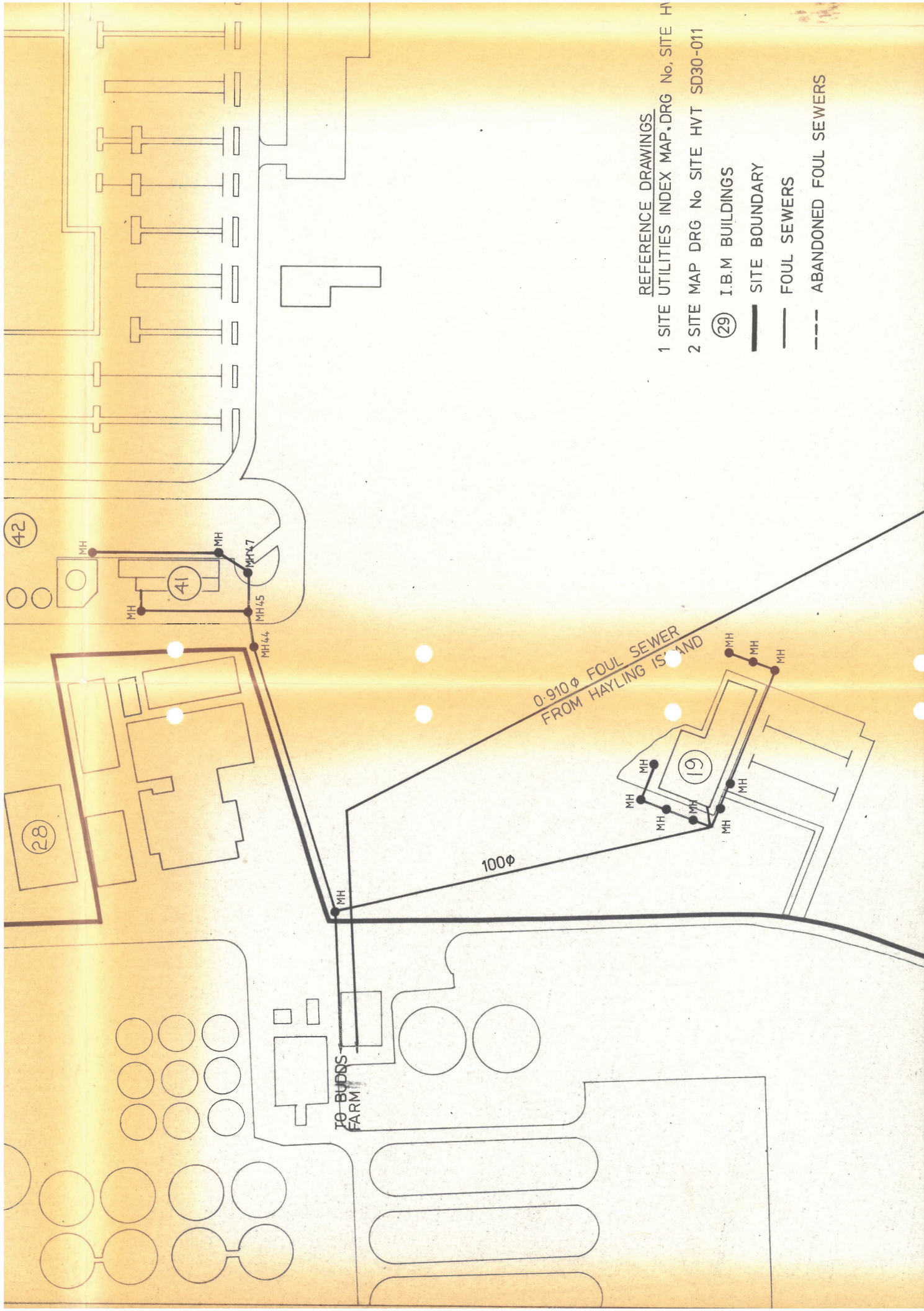
The following photos were taken after the CCTV survey was undertaken to identify the previously unknown flow control devices. The restriction on the flow is currently unknown and will be required to be established in detailed design for full hydraulic modelling.











REFERENCE DRAWINGS

1 SITE UTILITIES INDEX MAP, DRG No. SITE H

2 SITE MAP DRG No SITE HVT SD30-011

(29) I.B.M BUILDINGS

— SITE BOUNDARY

— FOUL SEWERS

--- ABANDONED FOUL SEWERS

SEWER RECORDS PAGE 1 OF 2



105338

O.S. REF.
SU7105NW

470855

Drawn by: ghoshri

Scale: 1:2500

Date: 12/10/2015

Title: Langstone Technology Park 2B

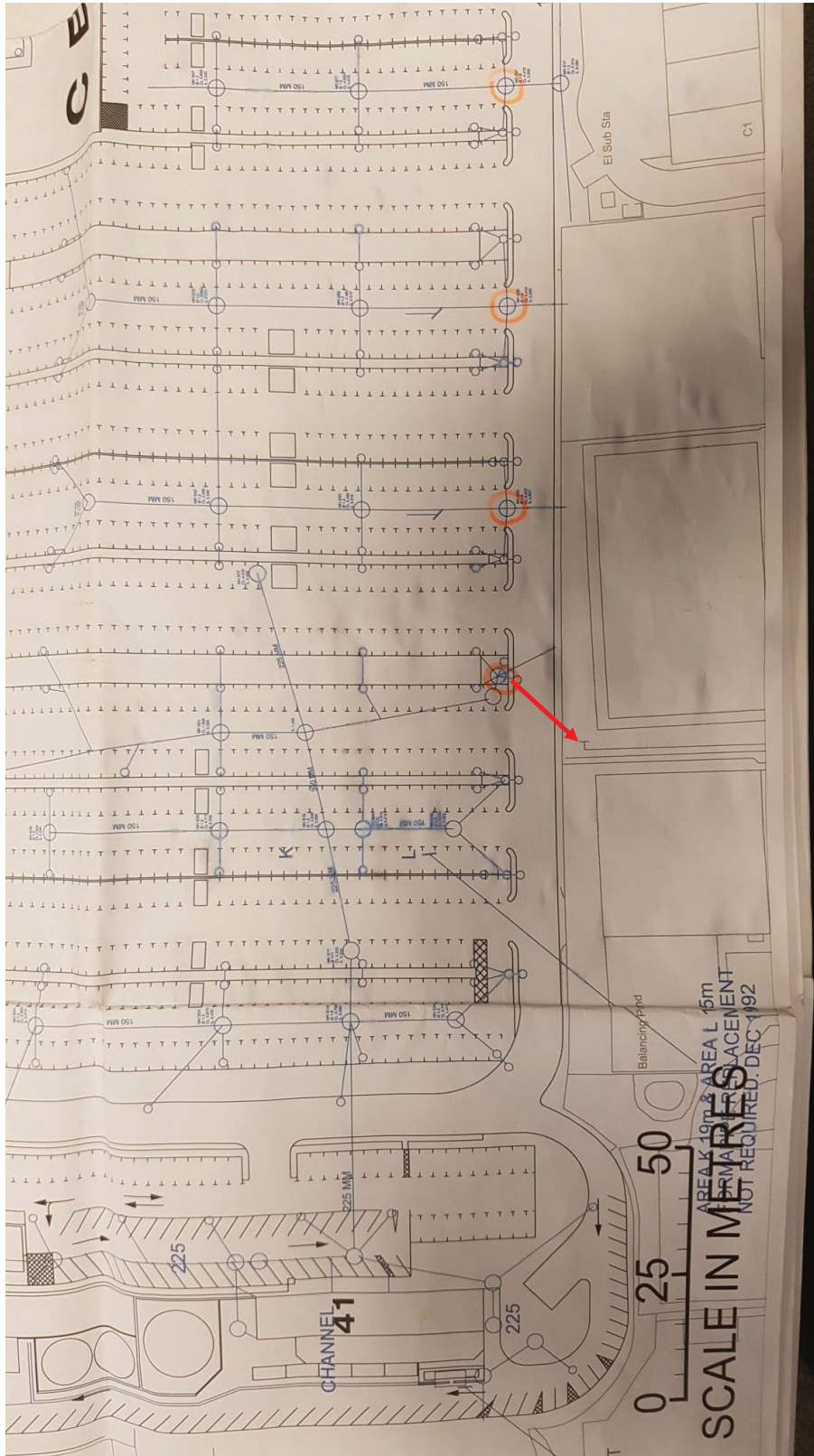

Southern Water


N

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy.
The actual positions should be determined on site.
WARNING: BAC pipes are constructed of Bonded Asbestos Cement
WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement

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APPENDIX D

Drainage Calculations

 Clancy Consulting Ltd 19 Upper King Street, Norwich, NR3 1RB.	Project LANGSTONE TECHNOLOGY PARK				Job no. 8-1982	
	Calcs for AREA 1 - 1 IN 1 YEAR				Start page no./Revision 1	
	Calcs by CH	Calcs date 27/06/2019	Checked by	Checked date	Approved by	Approved date

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 1 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.61
Rainfall for 15min storm with 1 year return period	M1_15min = Z2 × M5_15min _i = 7.2 mm
Design rainfall intensity	I _{max} = M1_15min / D = 28.7 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 2044 m ²
Percentage of area that is impermeable	p = 46 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 7.5 l/s

 Clancy Consulting Ltd 19 Upper King Street, Norwich, NR3 1RB.	Project LANGSTONE TECHNOLOGY PARK				Job no. 8-1982	
	Calcs for AREA 1 - 1 IN 30 YEAR				Start page no./Revision 1	
	Calcs by CH	Calcs date 27/06/2019	Checked by	Checked date	Approved by	Approved date

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 30 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.50
Rainfall for 15min storm with 30 year return period	M30_15min = Z2 × M5_15min _i = 17.6 mm
Design rainfall intensity	I _{max} = M30_15min / D = 70.4 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 2044 m ²
Percentage of area that is impermeable	p = 46 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 18.4 l/s

 Clancy Consulting Ltd 19 Upper King Street, Norwich, NR3 1RB.	Project LANGSTONE TECHNOLOGY PARK				Job no. 8-1982	
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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area Bournemouth
 Storm duration D = **15** min
 Return period Period = **100** yr
 Ratio 60 min to 2 day rainfall of 5 yr return period r = **0.350**
 5-year return period rainfall of 60 minutes duration M5_60min = **19.0** mm
 Increase of rainfall intensity due to global warming p_{climate} = **0** %
 Factor Z1 (Wallingford procedure) Z1 = **0.62**
 Rainfall for 15min storm with 5 year return period M5_15min_i = Z1 × M5_60min = **11.7** mm
 Factor Z2 (Wallingford procedure) Z2 = **1.94**
 Rainfall for 15min storm with 100 year return period M100_15min = Z2 × M5_15min_i = **22.7** mm
 Design rainfall intensity I_{max} = M100_15min / D = **90.8** mm/hr

Maximum surface water runoff

Catchment area A_{catch} = **2044** m²
 Percentage of area that is impermeable p = **46** %
 Maximum surface water runoff Q_{max} = A_{catch} × p × I_{max} = **23.7** l/s

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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 1 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.61
Rainfall for 15min storm with 1 year return period	M1_15min = Z2 × M5_15min _i = 7.2 mm
Design rainfall intensity	I _{max} = M1_15min / D = 28.7 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 25439 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 203.2 l/s

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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 30 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.50
Rainfall for 15min storm with 30 year return period	M30_15min = Z2 × M5_15min _i = 17.6 mm
Design rainfall intensity	I _{max} = M30_15min / D = 70.4 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 25439 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 497.6 l/s

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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area Bournemouth
 Storm duration D = **15** min
 Return period Period = **100** yr
 Ratio 60 min to 2 day rainfall of 5 yr return period r = **0.350**
 5-year return period rainfall of 60 minutes duration M5_60min = **19.0** mm
 Increase of rainfall intensity due to global warming p_{climate} = **0** %
 Factor Z1 (Wallingford procedure) Z1 = **0.62**
 Rainfall for 15min storm with 5 year return period M5_15min_i = Z1 × M5_60min = **11.7** mm
 Factor Z2 (Wallingford procedure) Z2 = **1.94**
 Rainfall for 15min storm with 100 year return period M100_15min = Z2 × M5_15min_i = **22.7** mm
 Design rainfall intensity I_{max} = M100_15min / D = **90.8** mm/hr

Maximum surface water runoff

Catchment area A_{catch} = **25439** m²
 Percentage of area that is impermeable p = **100** %
 Maximum surface water runoff Q_{max} = A_{catch} × p × I_{max} = **641.6** l/s

Calculated by:

Site name:

Site location:

Site coordinates

Latitude:

Longitude:

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Reference:

Date:

Methodology	IH124
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Site characteristics

Total site area (ha)	0.1822
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Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	3	3
HOST class	---	---
SPR/SPRHOST	0.37	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm)	719	719
Hydrological region	7	7
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.3	2.3
Growth curve factor: 100 year	3.19	3.19

Notes:

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

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

Where flow rates are less than 5.0 l/s consents are usually set at 5.0l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set in which case blockage work must be addressed by using appropriate drainage elements

(3) Is $SPR/SPRHOST \leq 0.3$?

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	0.54	0.54
1 in 1 year (l/s)	0.46	0.46
1 in 30 years (l/s)	1.24	1.24
1 in 100 years (l/s)	1.72	1.72

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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 1 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.61
Rainfall for 15min storm with 1 year return period	M1_15min = Z2 × M5_15min _i = 7.2 mm
Design rainfall intensity	I _{max} = M1_15min / D = 28.7 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 531 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 4.2 l/s

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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 1 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.61
Rainfall for 15min storm with 1 year return period	M1_15min = Z2 × M5_15min _i = 7.2 mm
Design rainfall intensity	I _{max} = M1_15min / D = 28.7 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 1694 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 13.5 l/s

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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 1 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.61
Rainfall for 15min storm with 1 year return period	M1_15min = Z2 × M5_15min _i = 7.2 mm
Design rainfall intensity	I _{max} = M1_15min / D = 28.7 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 2656 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 21.2 l/s

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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 1 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 0.61
Rainfall for 15min storm with 1 year return period	M1_15min = Z2 × M5_15min _i = 7.2 mm
Design rainfall intensity	I _{max} = M1_15min / D = 28.7 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 5213 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 41.6 l/s

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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 30 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.50
Rainfall for 15min storm with 30 year return period	M30_15min = Z2 × M5_15min _i = 17.6 mm
Design rainfall intensity	I _{max} = M30_15min / D = 70.4 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 531 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 10.4 l/s

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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 30 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.50
Rainfall for 15min storm with 30 year return period	M30_15min = Z2 × M5_15min _i = 17.6 mm
Design rainfall intensity	I _{max} = M30_15min / D = 70.4 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 1694 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 33.1 l/s

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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 30 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.50
Rainfall for 15min storm with 30 year return period	M30_15min = Z2 × M5_15min _i = 17.6 mm
Design rainfall intensity	I _{max} = M30_15min / D = 70.4 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 2656 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 51.9 l/s

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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 30 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.50
Rainfall for 15min storm with 30 year return period	M30_15min = Z2 × M5_15min _i = 17.6 mm
Design rainfall intensity	I _{max} = M30_15min / D = 70.4 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 5213 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 102.0 l/s

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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 100 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.94
Rainfall for 15min storm with 100 year return period	M100_15min = Z2 × M5_15min _i = 22.7 mm
Design rainfall intensity	I _{max} = M100_15min / D = 90.8 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 531 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 13.4 l/s

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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area Bournemouth
 Storm duration D = **15** min
 Return period Period = **100** yr
 Ratio 60 min to 2 day rainfall of 5 yr return period r = **0.350**
 5-year return period rainfall of 60 minutes duration M5_60min = **19.0** mm
 Increase of rainfall intensity due to global warming p_{climate} = **0** %
 Factor Z1 (Wallingford procedure) Z1 = **0.62**
 Rainfall for 15min storm with 5 year return period M5_15min_i = Z1 × M5_60min = **11.7** mm
 Factor Z2 (Wallingford procedure) Z2 = **1.94**
 Rainfall for 15min storm with 100 year return period M100_15min = Z2 × M5_15min_i = **22.7** mm
 Design rainfall intensity I_{max} = M100_15min / D = **90.8** mm/hr

Maximum surface water runoff

Catchment area A_{catch} = **1694** m²
 Percentage of area that is impermeable p = **100** %
 Maximum surface water runoff Q_{max} = A_{catch} × p × I_{max} = **42.7** l/s

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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area Bournemouth
 Storm duration D = **15** min
 Return period Period = **100** yr
 Ratio 60 min to 2 day rainfall of 5 yr return period r = **0.350**
 5-year return period rainfall of 60 minutes duration M5_60min = **19.0** mm
 Increase of rainfall intensity due to global warming p_{climate} = **0** %
 Factor Z1 (Wallingford procedure) Z1 = **0.62**
 Rainfall for 15min storm with 5 year return period M5_15min_i = Z1 × M5_60min = **11.7** mm
 Factor Z2 (Wallingford procedure) Z2 = **1.94**
 Rainfall for 15min storm with 100 year return period M100_15min = Z2 × M5_15min_i = **22.7** mm
 Design rainfall intensity I_{max} = M100_15min / D = **90.8** mm/hr

Maximum surface water runoff

Catchment area A_{catch} = **2656** m²
 Percentage of area that is impermeable p = **100** %
 Maximum surface water runoff Q_{max} = A_{catch} × p × I_{max} = **67.0** l/s

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DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = 15 min
Return period	Period = 100 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.350
5-year return period rainfall of 60 minutes duration	M5_60min = 19.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 0 %
Factor Z1 (Wallingford procedure)	Z1 = 0.62
Rainfall for 15min storm with 5 year return period	M5_15min _i = Z1 × M5_60min = 11.7 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.94
Rainfall for 15min storm with 100 year return period	M100_15min = Z2 × M5_15min _i = 22.7 mm
Design rainfall intensity	I _{max} = M100_15min / D = 90.8 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 5213 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 131.5 l/s



19 Upper King Street,
Norwich, Norfolk, NR3 1RB
TEL: 01603 305190

Contract Title

Langstone Technology Park

Contract No.

Part of Structure

Attenuation tank sizing

Calculation Sheet No:

Rev

Drawing ref:

Check By:

Date

Calcs By:

CH

Date

27/06/2019

South West Car park and industrial area

As there will be heavy vehicle access to this area, permeable paving has been considered unsuitable for use in the car park. Therefore the surface water will be captured and attenuated before draining off site at the current discharge location.

Total impermeable area 25439 m²

Unit 01 489 m²

Unit 02 349 m²

Unit 03 420 m²

Unit 04 349 m²

Unit 05 700 m²

Unit 06 1115 m²

Unit 07 766 m²

Unit 08 929 m²

Unit 09 1301 m²

Unit 10 838 m²

Unit 11 1557.0 m²

Unit 12 2300 m²

Total unit area 11113 m²

Parking area 14326 m²

Assuming a mixture of oversized pipes and attenuation storage for the site,
Designing for a 1 in 100 + 40% CC storm event

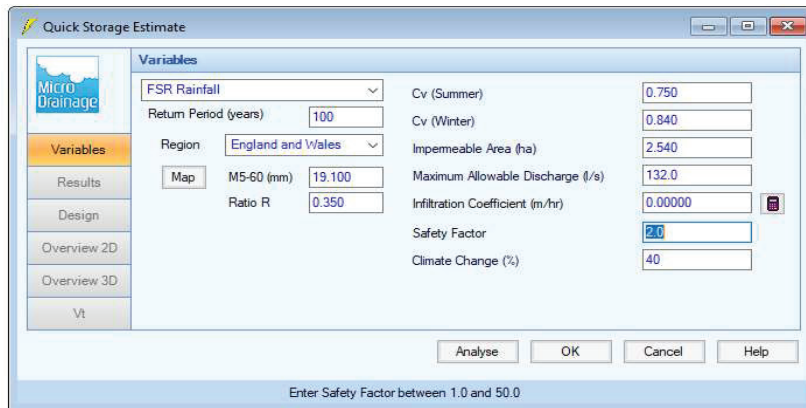
Existing pipe leaving site is 375mm diameter
Pipe has unknown gradient. Assume 1:300

Pipe Data	Geometry
Height = 0.375 m	Area of Flow = 0.110 m ²
Width = 0.375 m	Wetted Perimeter = 1.178 m
Ks = 0.15	Hydraulic Radius = 0.094 m
Gradient = 1 in 300	
Viscosity = 1.143e-06 m ² /s	
Calculation Type	Flow Data
☒ Full bore	Discharge = 0.132 m ³ /s
☐ Proportional Depth (given flow)	Velocity = 1.192 m/s
☐ Proportional Flow (given depth)	

Maximum flow through pipe is 132 l/s

This is lower than the run off rate and will be used as the flow control limit.

Storage estimate based on total impermeable area



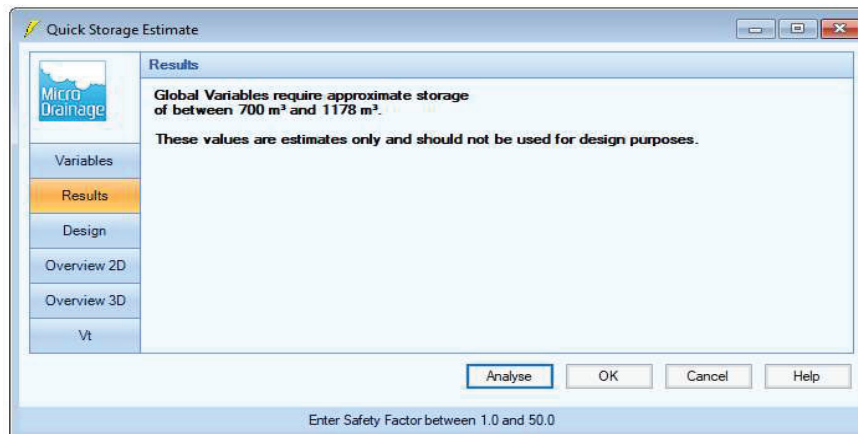
Quick Storage Estimate

Variables

FSR Rainfall: [dropdown]
Return Period (years): 100
Region: England and Wales
Map: M5-60 (mm) 19,100
Ratio R: 0.350
Cv (Summer): 0.750
Cv (Winter): 0.840
Impermeable Area (ha): 2,540
Maximum Allowable Discharge (l/s): 132.0
Infiltration Coefficient (m/hr): 0.00000
Safety Factor: 2.0
Climate Change (%): 40

Analyse OK Cancel Help

Enter Safety Factor between 1.0 and 50.0



Quick Storage Estimate

Results

Global Variables require approximate storage of between 700 m³ and 1178 m³.
These values are estimates only and should not be used for design purposes.

Analyse OK Cancel Help

Enter Safety Factor between 1.0 and 50.0

Minimum volume required 700 m³
Maximum volume required 1178 m³

Using oversized pipes for storage on the site

Pipe diameter 0.6 m
Pipe length 252 m

Total storage volume provided in pipes 71.25 m³

Total storage volume required 1106.75 m³

Assuming tanks will have a depth of 0.8 m

The footprint of storage required is 1383.44 m²

Permeable paving

As infiltration is currently not proven viable, a permeable paving design based on impermeable ground conditions will be designed following guidance from inter pave.

Hydraulic design

Surface type **C**

Using Figure 20 in Edition 6 of inter pave's permeable paving guide.

FSR M60 rainfall **20** mm
r' **0.4**

Using Table 5

1 in 100 year +40% CC sub-base thickness **260** mm

The site is very flat and therefore the run off from sloped ground will not be checked.

Additional depth required due to impermeable area drainaing into permeable paving
It has been assumed that the impermeable area is equal the permeable paving.
Using section 6.2.8 from the inter pave permeable paving guide.

$260 \times (11.52 + 11.52) / 11.52$
Sub-base thickness **520** mm

Structural design

Using table 7

Design loading **Category 4**

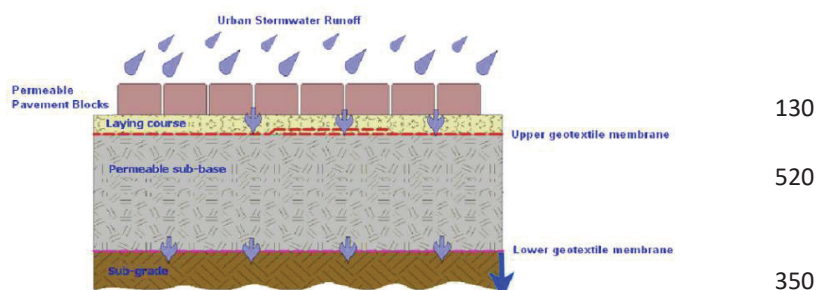
Using figure 24

Block + sufacing **130** mm
Hydraulically bound coarse aggregate **150** mm
Coarse aggregate **150** mm
Capping **150** mm

Adjusting for CBR

Assume CBR **2** %

New capping thickness **350** mm



APPENDIX E

Proposed Drainage Strategy