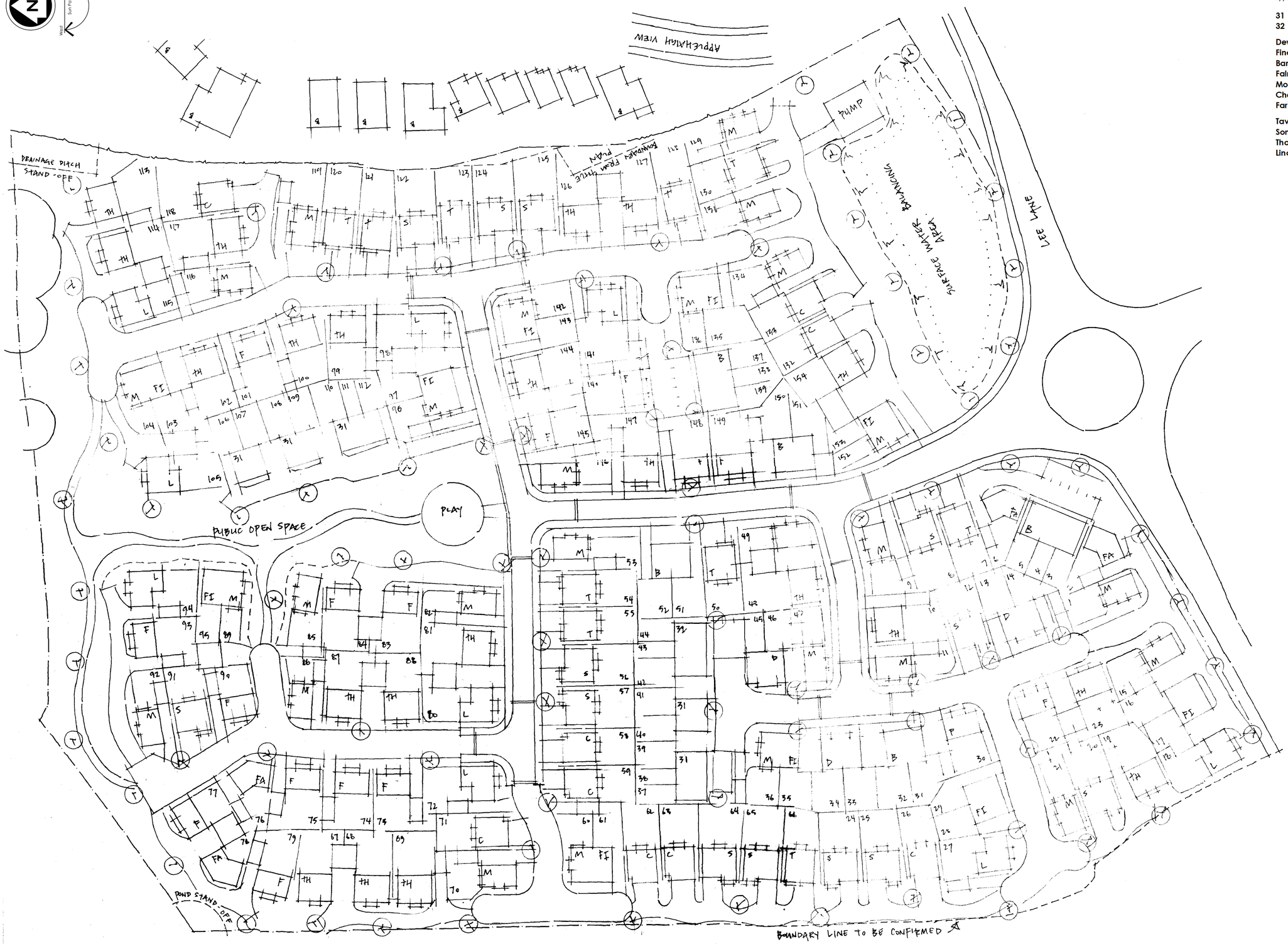

house type schedule

type		Sq. Ft	No.	
31	2 Bed semi/terrace	608	12	**7296**
32	3 Bed semi/terrace	701	3	**2103**
Dewsbury	3 bed semi/terrace	795	6	**4770**
Finchley	3 bed semi/terrace	831	12	**9972**
Barwick	3 bed semi/terrace	831	12	**9972**
Falmouth	3 bed semi / detached	914	16	**14624**
Morpeth	3 bed semi / detached	956	27	**25812**
Cheadle	3 bed detached	946	9	**8514**
Faringdon	3 Bed detached	1098	4	**4392**
Tavistock	4 Bed detached	1126	10	**11260**
Somerton	4 Bed detached	1170	13	**15210**
Thornbury	4 Bed detached	1203	21	**25263**
Lincoln	4 Bed detached	1243	9	**11187**
	TOTAL		**154**	**150375**

BARRATT HOMES

scale bar 20m
1-500 a1 paper

Lee Lane
Royston
Sketch Layout

scale 1-500 @ a1 Nov 2015 dwg. no. KSL -01

A P P E N D I X G

INDICATIVE SURFACE WATER DRAINAGE CALCULATIONS

ARP ASSOCIATES
AND GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

5/6 Northwest Business Park
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Client: BDW YORKSHIRE WEST	Project No. 1048/88	Sheet 1 of 7
Project: LEE LANE, ROYSTON	Calc By. ARP.	Date. 29/11/16
Element: SURFACE WATER DRAINAGE	Chkd By.	Date.

EXISTING DEVELOPMENT AREA (IP_{ex})

Using the proposed development layout (Appendix F)

IP_{ex} = Total Site area - green areas

$= 56000 - (95 \times 40) - (100 \times 20) - (170 \times 15)$

$= 47500 \cdot m^2 = \underline{4.75 ha}$

GREENFIELD DISCHARGE RATE (Q_{ex})

Consultations with Barnsley MDC

Rate = 5 l/s/ha

PROPOSED DISCHARGE RATE (Q_{PROP})

Development Area = 4.75 ha

Discharge Rate = 5 l/s/ha

$\therefore Q_{PROP} = 4.75 \times 5$

$= \underline{23.8 l/s}$

PROPOSED IMPERMEABLE AREA (IP_{PROP})

Make assumption that 50% of development area becomes impermeable

$Q_{PROP} = 4.75 \times 0.5$

$Q_{PROP} = \underline{2.38 ha}$

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Client: BDW YORKSHIRE WEST	Project No. 1048/88	Sheet 2 of 7
Project: LEE LANE, ROYSTON	Calc By. ARP	Date. 29/11/16
Element: SURFACE WATER DRAINAGE	Chkd By.	Date.

ATTENUATION

Using the WinDES Source Control Computer Program with the following parameters

Q_{PROP} = 23.8 l/s.

I_{PROP} = 2.38 ha.

Storm Intensity = 1 in 100 year.

Climate Change = + 40%

∴ Attenuation = 1247.2 m^3

This can be accommodated by a detention pond with a net area of 1248 m^2 at 1m deep.

If side slopes are 1 in 6, then the top surface area will be 1914 m^2 (43.75m x 43.75m) or equivalent.

Computer output sheets are presented on pages 3 -

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	100.431	0.431	23.8	0.0	23.8	537.4	O K
30 min Summer	100.565	0.565	23.8	0.0	23.8	705.4	O K
60 min Summer	100.696	0.696	23.8	0.0	23.8	869.0	O K
120 min Summer	100.808	0.808	23.8	0.0	23.8	1007.8	O K
180 min Summer	100.848	0.848	23.8	0.0	23.8	1057.7	O K
240 min Summer	100.855	0.855	23.8	0.0	23.8	1067.6	O K
360 min Summer	100.831	0.831	23.8	0.0	23.8	1037.4	O K
480 min Summer	100.801	0.801	23.8	0.0	23.8	1000.2	O K
600 min Summer	100.777	0.777	23.8	0.0	23.8	969.7	O K
720 min Summer	100.755	0.755	23.8	0.0	23.8	942.0	O K
960 min Summer	100.713	0.713	23.8	0.0	23.8	890.2	O K
1440 min Summer	100.631	0.631	23.8	0.0	23.8	787.0	O K
2160 min Summer	100.510	0.510	23.8	0.0	23.8	637.0	O K
2880 min Summer	100.400	0.400	23.8	0.0	23.8	499.0	O K
4320 min Summer	100.219	0.219	23.8	0.0	23.8	272.7	O K
5760 min Summer	100.096	0.096	23.8	0.0	23.8	119.2	O K
7200 min Summer	100.025	0.025	23.8	0.0	23.8	30.9	O K
8640 min Summer	100.000	0.000	23.1	0.0	23.1	0.0	O K
10080 min Summer	100.000	0.000	20.4	0.0	20.4	0.0	O K
15 min Winter	100.485	0.485	23.8	0.0	23.8	604.7	O K
30 min Winter	100.639	0.639	23.8	0.0	23.8	797.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	126.356	0.0	539.5	0.0	23
30 min Summer	84.383	0.0	725.6	0.0	37
60 min Summer	53.779	0.0	946.1	0.0	66
120 min Summer	33.118	0.0	1168.5	0.0	126
180 min Summer	24.591	0.0	1302.6	0.0	186
240 min Summer	19.777	0.0	1396.8	0.0	246
360 min Summer	14.482	0.0	1535.6	0.0	358
480 min Summer	11.611	0.0	1641.8	0.0	410
600 min Summer	9.774	0.0	1727.7	0.0	470
720 min Summer	8.487	0.0	1800.1	0.0	534
960 min Summer	6.785	0.0	1918.7	0.0	668
1440 min Summer	4.942	0.0	2094.1	0.0	942
2160 min Summer	3.592	0.0	2300.0	0.0	1344
2880 min Summer	2.861	0.0	2441.2	0.0	1732
4320 min Summer	2.072	0.0	2645.9	0.0	2428
5760 min Summer	1.646	0.0	2816.4	0.0	3120
7200 min Summer	1.377	0.0	2942.7	0.0	5904
8640 min Summer	1.189	0.0	3055.5	0.0	0
10080 min Summer	1.051	0.0	3151.0	0.0	0
15 min Winter	126.356	0.0	605.7	0.0	22
30 min Winter	84.383	0.0	814.6	0.0	37

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
60 min Winter	100.791	0.791	23.8	0.0	23.8	987.2	O K
120 min Winter	100.925	0.925	23.8	0.0	23.8	1153.9	Flood Risk
180 min Winter	100.980	0.980	23.8	0.0	23.8	1222.4	Flood Risk
240 min Winter	100.999	0.999	23.8	0.0	23.8	1247.2	Flood Risk
360 min Winter	100.995	0.995	23.8	0.0	23.8	1241.7	Flood Risk
480 min Winter	100.965	0.965	23.8	0.0	23.8	1204.5	Flood Risk
600 min Winter	100.923	0.923	23.8	0.0	23.8	1151.3	Flood Risk
720 min Winter	100.893	0.893	23.8	0.0	23.8	1114.3	O K
960 min Winter	100.835	0.835	23.8	0.0	23.8	1041.9	O K
1440 min Winter	100.709	0.709	23.8	0.0	23.8	885.2	O K
2160 min Winter	100.523	0.523	23.8	0.0	23.8	652.2	O K
2880 min Winter	100.355	0.355	23.8	0.0	23.8	442.6	O K
4320 min Winter	100.100	0.100	23.8	0.0	23.8	125.3	O K
5760 min Winter	100.000	0.000	23.1	0.0	23.1	0.0	O K
7200 min Winter	100.000	0.000	19.3	0.0	19.3	0.0	O K
8640 min Winter	100.000	0.000	16.7	0.0	16.7	0.0	O K
10080 min Winter	100.000	0.000	14.8	0.0	14.8	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
60 min Winter	53.779	0.0	1062.0	0.0	66
120 min Winter	33.118	0.0	1309.8	0.0	124
180 min Winter	24.591	0.0	1459.6	0.0	182
240 min Winter	19.777	0.0	1565.8	0.0	240
360 min Winter	14.482	0.0	1720.5	0.0	352
480 min Winter	11.611	0.0	1839.5	0.0	460
600 min Winter	9.774	0.0	1935.7	0.0	552
720 min Winter	8.487	0.0	2016.7	0.0	574
960 min Winter	6.785	0.0	2149.3	0.0	726
1440 min Winter	4.942	0.0	2345.6	0.0	1028
2160 min Winter	3.592	0.0	2576.8	0.0	1452
2880 min Winter	2.861	0.0	2735.4	0.0	1824
4320 min Winter	2.072	0.0	2965.9	0.0	2684
5760 min Winter	1.646	0.0	3159.9	0.0	0
7200 min Winter	1.377	0.0	3302.4	0.0	0
8640 min Winter	1.189	0.0	3422.1	0.0	0
10080 min Winter	1.051	0.0	3529.1	0.0	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.364	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.380

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	4	8	2.380

Model Details

Storage is Offline Dividing Weir Level (m) 101.000
Cover Level (m) 101.200

Tank or Pond Structure

Invert Level (m) 100.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1248.0	0.700	1248.0	1.400	0.0	2.100	0.0
0.100	1248.0	0.800	1248.0	1.500	0.0	2.200	0.0
0.200	1248.0	0.900	1248.0	1.600	0.0	2.300	0.0
0.300	1248.0	1.000	1248.0	1.700	0.0	2.400	0.0
0.400	1248.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	1248.0	1.200	0.0	1.900	0.0		
0.600	1248.0	1.300	0.0	2.000	0.0		

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0214-2380-1000-2380
Design Head (m)	1.000
Design Flow (l/s)	23.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	214
Invert Level (m)	100.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	23.8
Flush-Flo™	0.356	23.8
Kick-Flo®	0.732	20.5
Mean Flow over Head Range	-	19.9

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	7.3	1.000	23.8	2.400	36.2	5.500	54.1
0.200	20.9	1.200	26.0	2.600	37.6	6.000	56.4
0.300	23.7	1.400	28.0	3.000	40.3	6.500	58.6
0.400	23.7	1.600	29.8	3.500	43.4	7.000	60.8
0.500	23.4	1.800	31.5	4.000	46.3	7.500	62.8
0.600	22.7	2.000	33.2	4.500	49.0	8.000	64.9
0.800	21.4	2.200	34.7	5.000	51.6	8.500	66.8

Hydro-Brake Optimum® Outflow Control

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
9.000	68.7	9.500	70.5				

Weir Overflow Control

Discharge Coef 0.544 Width (m) 1.500 Invert Level (m) 101.000