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job Hillside, Moor Lane, Hutton BB7 9DG

made by: date: 28.02.2024 job no: 7804 sheet no: 1/1

Design for foul and SW drainage systems.

Ex. Impermeable Area ~ N/A

Proposed " " ~ 564.7m²

Permeable Area ~ 973.9m²

Grc = from Table 5 (A0-H) flowrate = 2.5l/sec. (Grc) suitable.
Recommended flowrate 3.5l/sec.

Use: Package Plant. — due to direct access to a watercourse.
Klargester BA (8-person) or BA-X (9-person) (450 or 750mm to Invert)

SW (SuDS) 100-year return.
SW Attenuation — 35m³. (If direct discharge to watercourse not permitted)
or via
Allowable Discharge Method — 22.5m³

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Project				Job no.
Hillside, Moor Lane, Wiswell BB7 9DG				3804
Calcs for				Start page no./Revision
SW Attenuation				1
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
PH	28/02/2024				

ATTENUATION DESIGN

Attenuation design in accordance with CIRIA publication C753 - The SUDS Manual

Tedds calculation version 1.0.04

EA_Defra method

Site characteristics

Location	Preston
Hydrological region	10
Soil type (Wallingford Procedure W.R.A.P map)	4
Standard percentage runoff	SPR = **0.47**
Average annual rainfall	SAAR = **950** mm
5 year return period rainfall of 60 minute duration	M5_60min = **18.5** mm
Ratio 60-minute to 2 day rainfalls of 5 year return	r = **0.34**
Rainfall intensity increase due to global warming	$p_{climate}$ = **10%**
Impervious area req. attenuation storage	α = **100.0** %

Catchment details

Subcatchment	Name	Area (ha)	PIMP (%)	Impermeable. area (ha)
1;	Hillside;	0.15;	37.0	0.06;
	Total	0.15;	37.0	0.06;

Greenfield runoff rates

Catchment area	AREA = **50.00** hectare
Greenfield runoff rate (50 hectare site)	$\bar{Q}_{rural} = 0.00108 m^3/s \times (AREA/1km^2)^{0.89} \times (SAAR/1mm)^{1.17} \times SPR^{2.17}$ = **345.1** l / s
Greenfield runoff rate	$\bar{Q} = \bar{Q}_{rural} / AREA \times A$ = **1.0** l / s
Greenfield runoff rate per unit area	$\bar{Q}_A = \bar{Q} / A$ = **6.9** l / s / hectare

Estimated site discharges

FSR growth rate (1 year)	FSR_{1yr} = **0.87**
Discharge (1 year)	$Q_{1yr} = \bar{Q} \times FSR_{1yr}$ = **0.9** l/s
FSR growth rate (10 year)	FSR_{10yr} = **1.38**
Discharge (10 year)	$Q_{10yr} = \bar{Q} \times FSR_{10yr}$ = **1.4** l/s
FSR growth rate (100 year)	FSR_{100yr} = **2.08**
Discharge (100 year)	$Q_{100yr} = \bar{Q} \times FSR_{100yr}$ = **2.2** l/s

Estimated attenuation volume - 1 year

Attenuation storage vol (fig A7.1 - A7.8)	$Uvol_{1yr}$ = **46.0** m^3 / hectare
Basic storage volume	$BSV_{1yr} = Uvol_{1yr} \times \alpha \times A$ = **6.90** m^3
FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4)	FF_{1yr} = **0.95**
Storage volume ratio (fig A8.1 - A8.8)	SVR_{1yr} = **1.23**
Adjusted storage volume	$ASV_{1yr} = SVR_{1yr} \times BSV_{1yr}$ = **8.52** m^3
Hydrological regional volume ratio (fig A9.1)	HR_{1yr} = **1.00**
Final estimated attenuation storage	$Vol_{1yr} = HR_{1yr} \times ASV_{1yr}$ = **8.53** m^3

Library item: Estimated attenuation output

Estimated attenuation volume - 10 year

Attenuation storage vol (fig A7.1 - A7.8)	$Uvol_{10yr}$ = **66.0** m^3 / hectare
Basic storage volume	$BSV_{10yr} = Uvol_{10yr} \times \alpha \times A$ = **9.90** m^3
FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4)	FF_{10yr} = **0.95**

Storage volume ratio (fig A8.1 - A8.8)	SVR_{10yr} = **1.23**
Adjusted storage volume	$ASV_{10yr} = SVR_{10yr} \times BSV_{10yr}$ = **12.23** m^3
Hydrological regional volume ratio (fig A9.1)	HR_{10yr} = **1.06**
Final estimated attenuation storage	$Vol_{10yr} = HR_{10yr} \times ASV_{10yr}$ = **12.94** m^3

Library item: Estimated attenuation output

Estimated attenuation volume - 100 year

Attenuation storage vol (fig A7.1 - A7.8)	$Uvol_{100yr}$ = **150.0** m^3 / hectare
Basic storage volume	$BSV_{100yr} = Uvol_{100yr} \times \alpha \times A$ = **22.50** m^3
FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4)	FF_{100yr} = **0.90**
Storage volume ratio (fig A8.1 - A8.8)	SVR_{100yr} = **1.33**
Adjusted storage volume	$ASV_{100yr} = SVR_{100yr} \times BSV_{100yr}$ = **30.04** m^3
Hydrological regional volume ratio (fig A9.1)	HR_{100yr} = **1.17**
Final estimated attenuation storage	$Vol_{100yr} = HR_{100yr} \times ASV_{100yr}$ = **35.08** m^3

Library item: Estimated attenuation output

Attenuation storage required

Vol. increase due to head-discharge relationship	p_{hydro} = **1.25**
Maximum attenuation storage required	$V_{req\_max} = Vol_{10yr} \times p_{hydro}$ = **16.2** m^3

Interception storage

Interception rainfall depth	d_{int} = **5** mm
Volume of interception storage required	$V_{int\_req} = 0.8 \times A_{imp} \times d_{int}$ = **2.22** m^3

Long term storage

Proportion of paved area draining in to network	α = **1.0**
Proportion of pervious area draining in to network	β = **0.5**
Rainfall depth for 100years, 6 hour event	RD = M100_360 = **67.2** mm
Extra runoff vol of dev.runoff over greenfield runoff	$Vol_{xs} = \max(RD \times A \times (PIMP \times \alpha \times 0.8 + ((1 - PIMP) \times \beta \times SPR) - SPR), 0m^3)$ = **0.00** m^3

Treatment volume

Treatment volume (assume 80% runoff)	$T_{vol} = 0.8 \times A \times 15mm \times PIMP$ = **6.66** m^3

ATTENUATION DESIGN

In accordance with CIRIA publication C753 - The SUDS Manual

Tedds calculation version 1.0.04

Allowable discharge method

Site characteristics

Location	Preston
Hydrological region	10
Soil type (Wallingford Procedure W.R.A.P map)	4
Standard percentage runoff	SPR = **0.47**
Average annual rainfall	SAAR = **950** mm
5 year return period rainfall of 60 minute duration	M5_60min = **18.5** mm
Ratio 60-minute to 2 day rainfalls of 5 year return	r = **0.34**
Rainfall intensity increase due to global warming	$p_{climate}$ = **30%**

Catchment details

Subcatchment	Name	Area (ha)	PIMP (%)	Impermeable. area (ha)
1;	Hillside;	0.15;	37.0	0.06;
	Total	0.15;	37.0	0.06;

Greenfield runoff rates

Catchment area	AREA = **50.00** hectare
Greenfield runoff rate (50 hectare site)	$\bar{Q}_{rural} = 0.00108 m^3/s \times (AREA/1km^2)^{0.89} \times (SAAR/1mm)^{1.17} \times SPR^{2.17}$ = **345.1** l / s
Greenfield runoff rate	$\bar{Q} = \bar{Q}_{rural} / AREA \times A$ = **1.0** l / s
Greenfield runoff rate per unit area	$\bar{Q}_A = \bar{Q} / A$ = **6.9** l / s / hectare

Estimated site discharges

FSR growth rate (2 year)	FSR_{2yr} = **0.91**
Discharge (2 year)	$Q_{2yr} = \bar{Q} \times FSR_{2yr}$ = **0.9** l/s
FSR growth rate (30 year)	FSR_{30yr} = **1.70**
Discharge (30 year)	$Q_{30yr} = \bar{Q} \times FSR_{30yr}$ = **1.8** l/s
FSR growth rate (100 year)	FSR_{100yr} = **2.08**
Discharge (100 year)	$Q_{100yr} = \bar{Q} \times FSR_{100yr}$ = **2.2** l/s

Table equations

Total surface water	$V_w = A_{imp} \times M$
Permitted dischrage	$Q_{allow} = Q_{2yr} \times D$
Storage volume required	$V_{req} = V_w - Q_{allow}$

Attenuation storage

Duration (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	30 year rainfall (mm)	Total surf water (m^3)	Permit dischrge (2 years) (m^3)	Storage vol. reqd (m^3)
5	0.35;	8.5;	1.47;	12.5;	6.94;	0.28;	6.65
10	0.50;	12.1;	1.51;	18.2;	10.11;	0.57;	9.55
15	0.61;	14.8;	1.52;	22.5;	12.48;	0.85;	11.64
30	0.78;	18.8;	1.54;	29.0;	16.10;	1.70;	14.40

Duration (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	30 year rainfall (mm)	Total surf water (m^3)	Permit dischrge (2 years) (m^3)	Storage vol. reqd (m^3)
60	1.00;	24.1;	1.54;	36.9;	20.49;	3.39;	17.10
120	1.23;	29.5;	1.52;	44.7;	24.81;	6.78;	18.03
240	1.51;	36.4;	1.48;	54.0;	29.97;	13.57;	16.40
360	1.71;	41.1;	1.46;	60.1;	33.36;	20.35;	13.01
600	1.99;	47.9;	1.43;	68.5;	38.04;	33.91;	4.12
1440	2.54;	61.1;	1.39;	84.7;	46.99;	81.39;	-34.40

Attenuation storage required

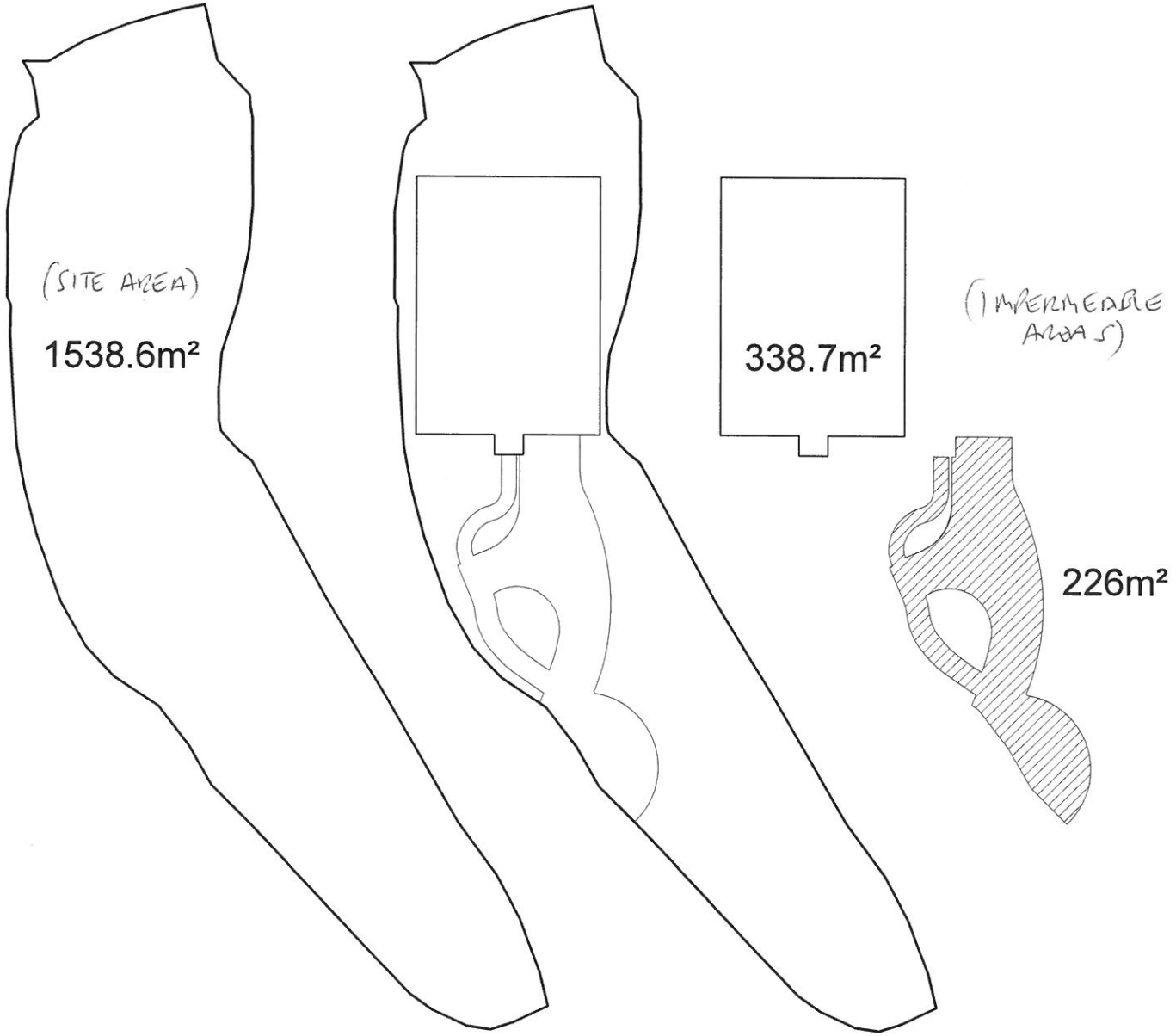
Vol. increase due to head-discharge relationship p_{hydro} = **1.25**

Maximum attenuation storage required $V_{req\_max} = V_{max} \times p_{hydro}$ = **22.5** m^3

Interception storage

Interception rainfall depth d_{int} = **3** mm

Volume of interception storage required $V_{int\_req} = 0.8 \times A_{imp} \times d_{int}$ = **1.33** m^3



HILLSIDE, WISWELL
BB7 9DG

3804/SW/AREAS