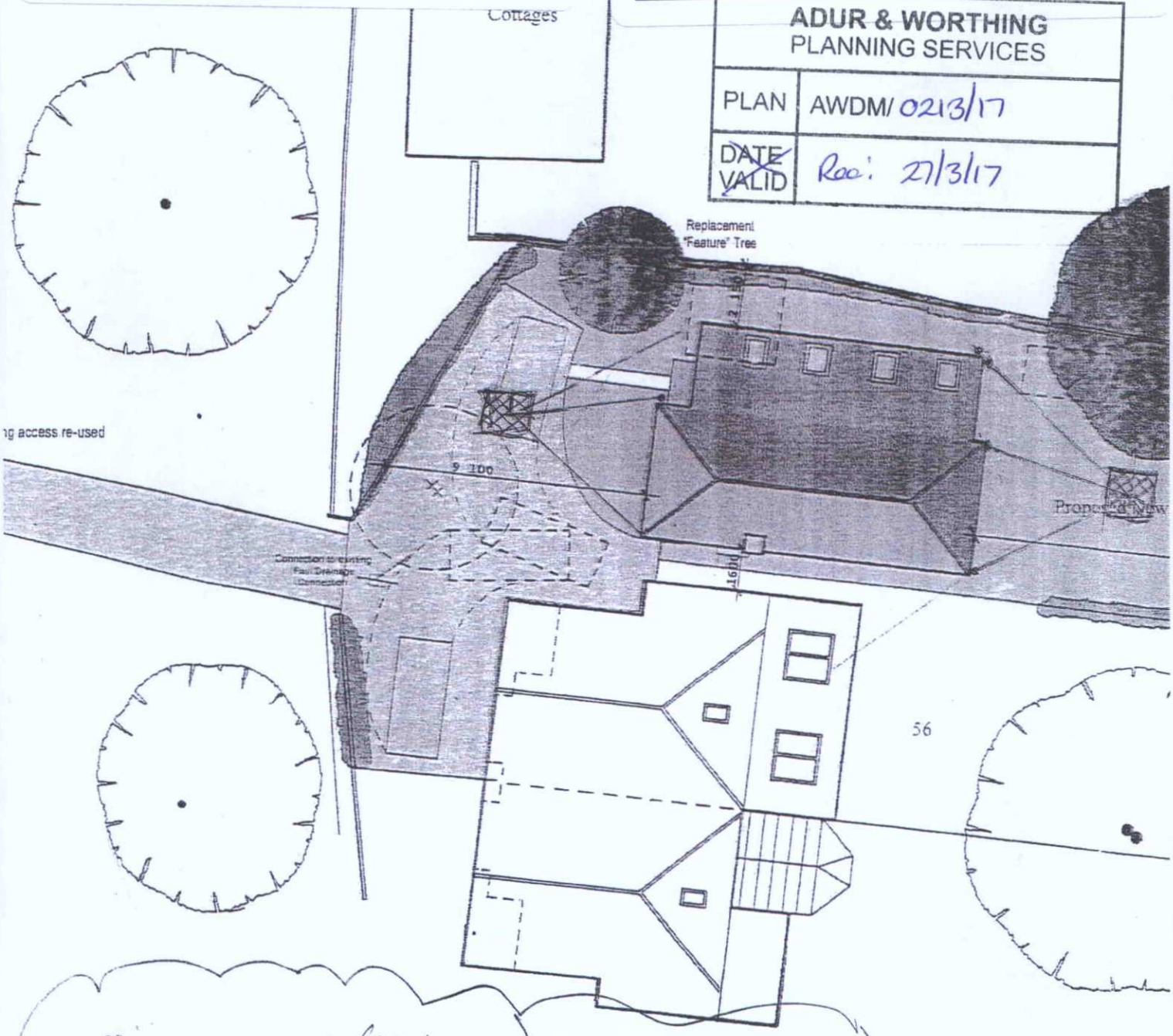
CONSTRUCTION DESIGN PARTNERSHIP
51 Station Approach, West Byfleet
Surrey KT14 6NE

T: 01932 353307

CONTRACT	JOB NO	SHEET NO
56 THE CRESCENT. SOUTHWICK. BRIGHTON	1715	D.01
SECTION SW. DRAINAGE		

ADUR & WORTHING
PLANNING SERVICES

PLAN	AWDM/ 0213/17
~~DATE~~ VALID	Rec'd: 27/3/17



2 No. SOAKAWAYS (AS DRAWN)

2.0 × 2.0 × 0.7 D (BELOW INCOMING PIPES)

OR

1.5 × 1.5 × 1.2 D —"—

ALTERNATIVE. 1 No SOAKAWAY (FRONT OR BACK)

2.4 × 2.4 × 1.0 D

OR

2.0 × 2.0 × 1.4 D

1715/D.02

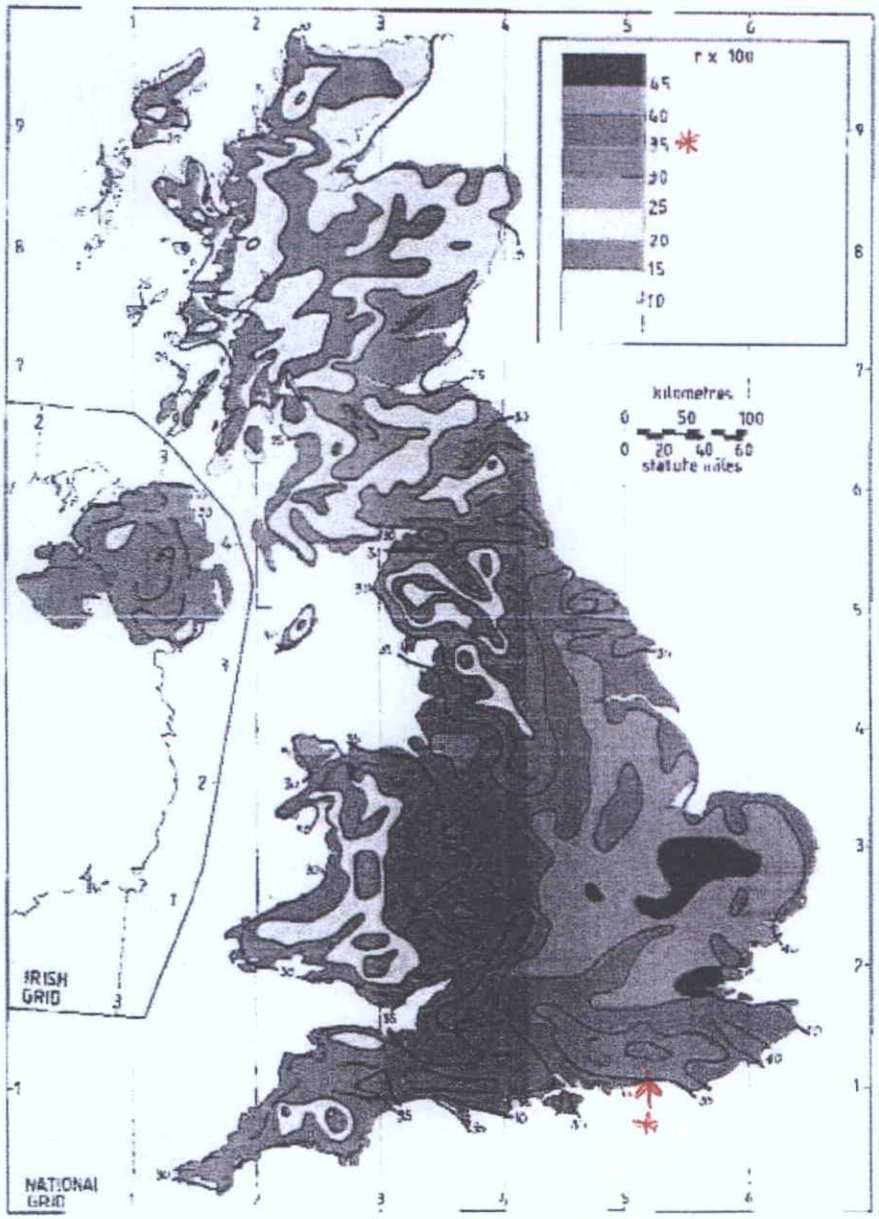
the depth at which the determination is made may be as much as a factor of two. From the results of a soakage trial in Figure 2, the calculated infiltration rate based upon a fall of water level from:

- 75% to 50% effective depth is 5.1 3 10^{-5} m/s;
- 50% to 25% effective depth is 2.9 3 10^{-5} m/s.

The design method adopts the result determined from 75% to 25% effective depth of 3.3 3 10^{-5} m/s.

If it is impossible to carry out a full-depth soakage test, soil infiltration rate calculation should be based on the time for fall of water level from 75% to 25% of the actual maximum water depth achieved in the test. The effective area of loss from the soakage pit is then calculated as the internal surface area of the pit to 50% maximum depth achieved plus the base area of the pit.

Figure 1 Ratio of 60 minute to 2 day rainfalls of 5 year return period - from Design and analysis of urban storm damage



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Consulting Engineers

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INFILTRATION

From SOAKAGE TESTS CARRIED OUT
(300 □ x 300 D cubes AT BOT. of 1000 □ x 1000 D PIT.)

$V(75-25) = 0.3 \times 0.1 = 0.03 m^2$

$A(50) = (0.3 \times 0.3) + (4 \times 0.3 \times 0.15) = 0.27 m^3$

$t(75-25) = 2857$ sec

$f = \frac{0.03}{0.27 \times 2857} = 3.9 \times 10^{-5}$

To the Green.	1715/004

Design Examples

Design a soakaway to receive stormwater from 95 m² impermeable surface for a site near Southampton

Find the rainfall ratio from Figure 1 (r = 0.35) and calculate the storm rainfalls for a range of storm durations.

Storm duration D	M5-D min	Z2	M10-D min
min	= 20 mm x Z1		= R mm
10	10.2	1.22	12.4
15	12.4	1.23	15.3
30	15.8	1.24	19.6
60	20.0	1.24	24.8
120	24.4	1.24	30.3
240	30.0	1.22	36.6
360	33.8	1.21	40.9
600	39.0	1.19	46.6

Assuming the results from a soakage trial pit (Figure 2) were obtained at the site, they can be used to design a soakaway which will be filled with granular material having 30% free volume. The percentage void space of any granular fill material must be pre-determined for use in the design method.

Take the soakaway dimensions as:

2.4 m long x 2.5 m deep x 1.5 m effective storage depth, so that the soakage trial pit can form part of the full-scale soakaway.

Calculate the design width of the soakaway:

Volume equation I – O = S

Inflow to soakaway I:

I = A x R

= impermeable surface area x M10-D min rainfall

eg for 10 min storm duration, M10-10 min = 12.4 mm = 0.0124 m

I = 95 x 0.0124

= 1.178 m³

Outflow from soakaway O:

O = a_{s50} x f x D

= internal surface area of soakaway pit to 50% storage depth (excluding base area) x soil percolation rate x storm duration

For rectangular pit 2.4 m long x 1.5m effective depth x W m wide

a_{s50} = 2 x (2.4 + W) x (1.5 ÷ 2)

= 3.6 + 1.5 W m²

f = 3.3 x 10^{-5} m/s from soakage trial

O = (3.6 + 1.5 W) x (3.3 x 10^{-5}) x (D x 60) m³

Soakaway storage volume S

= effective volume of soakaway with 30% free volume

= 2.4 x 1.5 x W x 0.3

= 1.08 W m³

For satisfactory storage of the M10-10 min run-off.

I – O = S

1.178 – (3.6 + 1.5 W) x (3.3 x 10^{-5}) x (10 x 60) = 1.08 W

Required soakaway width W = 1.00m

Repeat the calculation for a range of M10-D min storms and determine the maximum width. Results are summarised below.

Storm duration D - min	Required Soakaway width W - m
10	1.00
15	1.20
30	1.41
60	1.53
120	1.41
240	0.99

A soakaway 2.4 m long x 1.5 m effective depth x 1.53 m wide would be suitable with the criticstorm duration around one hour for 10 year events. The design might be suitable for the site layout but, if not, alternative shapes could be investigated. For example, if a narrow soakaway was necessary similar to the soakage trial pit (0.6 m

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SOAKAWAY

(10) $1.66 - (2.4 + 1.0W)(3.9\times10^{-5})(10\times60) = 2.16W$

$1.66 - 0.06 + 0.02W = 2.16W$

$1.60 = 2.14W$

$0.75 = W$

(30) $2.63 - (2.4 + 1.0W)(3.9\times10^{-5})(30\times60) = 2.16W$

$2.63 - 0.17 + 0.07W = 2.16W$

$2.46 = 2.09W$

$1.18 = W$

(60) $3.32 - (2.4 + 1.0W)(3.9\times10^{-5})(60\times60) = 2.16W$

$3.32 - 0.34 + 0.14W = 2.16W$

$2.98 = 2.02W$

$1.48 = W$

(120) $4.06 - (2.4 + 1.0W)(3.9\times10^{-5})(120\times60) = 2.16W$

$4.06 - 0.67 + 0.28W = 2.16W$

$3.39 = 1.88W$

$1.80 = W$

(240) $4.90 - (2.4 + 1.0W)(3.9\times10^{-5})(240\times60) = 2.16W$

$4.90 - 1.35 + 0.56W = 2.16W$

$3.55 = 1.60W$

$2.2 = W$

∴ SOAKAWAY REQ'D 2.4 × 2.2 × 1.0 ~~EFF DEPTH~~

BUT SEE ALSO COMPUTER ANALYSIS

CONSTRUCTION DESIGN PARTNERSHIP Consulting Engineers 51 Station Approach, West Byfleet Surrey KT14 6NE Tel: 01932 353307	Project: 56. THE GREEN				Job no.: 1715	
	Calcs for: SW DRAINAGE				Start page no./Revision: D.06 4	
	Calcs by: T	Calcs date: 20/02/2017	Checked by	Checked date	Approved by	Approved date

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.02

Design rainfall intensity

Location of catchment area	Brighton
Impermeable area drained to the system	A = **134.0** m^2
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 = **20.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %

Soakaway / infiltration trench details

Soakaway type	Rectangular
Minimum depth of pit (below incoming invert)	d = **1000** mm
Width of pit	w = **2427** mm
Length of pit	l = **2400** mm
Percentage free volume	V_{free} = **90** %
Soil infiltration rate	f = **39.0×10^{-6}** m/s
Wetted area of pit 50% full	a_{s50} = l × d + w × d = **4826633** mm^2

Table equations

Inflow	I = M100 × A
Outflow	O = a_{s50} × f × D
Storage	S = I - O

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
5	0.36	7.1	1.84	13.1	1.76	0.06	1.70
10	0.51	10.1	1.91	19.4	2.60	0.11	2.48
15	0.62	12.3	1.95	24.0	3.22	0.17	3.05
30	0.79	15.7	2.00	31.4	4.21	0.34	3.87
60	1.00	20.0	2.03	40.6	5.44	0.68	4.76
120	1.22	24.5	2.01	49.2	6.60	1.36	5.24
240	1.50	29.9	1.97	59.0	7.90	2.71	5.19
360	1.69	33.8	1.94	65.6	8.78	4.07	4.72
600	1.95	38.9	1.90	73.9	9.90	6.78	3.13
1440	2.48	49.6	1.81	89.9	12.05	16.26	0.00

Required storage volume: S_{req} = **5.24** m^3

Soakaway storage volume: S_{act} = l × d × w × V_{free} = **5.24** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume: t_{s50} = S_{req} × 0.5 / (a_{s50} × f) = 3hr 51min 59s

PASS - Soakaway discharge time less than or equal to 24 hours