



Paul Grinyer Associates Ltd

Structural Engineers
& Party Wall Surveyors

Structural Design Calculations

LINDEN PARK, LITTLEHAMPTON – Soakaway design only.

Project No.: 19119

Prepared by: Eur Ing P S Grinyer CEng., MStructE CBuildE FCABE

Date: October 2019



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JOB TITLE Linden Park, Littlehampton		
JOB NO. 19119		SHEET NO. 1
PREPARED BY P. Grinyer	CHECKED BY	DATE October 2019
ITEM Design Data		

Client	Future FMC Limited				
Architect	ADCS Limited				
QS	-				
Others	-				
Design Codes, British & European Standards and References (Current editions & Parts will be used as appropriate at the time of this design).	EUROCODE 1 : Actions on Structures EUROCODE 2 : Design of Concrete Structures EUROCODE 3 : Design of Steel Structures EUROCODE 5 : Design of Timber Structures EUROCODE 6 : Design of Masonry Structures EUROCODE 7 : Geotechnical Design BS 8500 : Concrete The Building Regulations Others : BS5950, BS5268, BS5628				
Building Structure Description	A development of new apartments. Design is for a SUDS soakaway only, to be used as an alternative to the previously designed permeable paving system.				
Design Working Life Category	4				
Fire Resistance	N/A				
Subsoil/Foundation data	Soil infiltration rate provided by others = 8.9×10^{-6} m/s				
Material Data		Min. Strength Class	Aggregate Size	Cement Content Min. Kg/m³	Max. Free Water/Cement Ratio
1. Concrete Padstones	Blinding Concrete	GEN1	20	180	-
	R. C. Foundations	RC30	20	260	0.65
	M. C. Foundations	GEN1	20	220	-
	Superstructure	RC30	20	260	0.65
2. Reinforcement	High yield (H) fy = 500N/mm ²				
3. Timber	Grade: N/A				
4. Steelwork	Grade: N/A				
Other Information					



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JOB TITLE Linden Park, Littlehampton		
JOB NO. 19119		SHEET NO. 2
PREPARED BY P. Grinyer	CHECKED BY	DATE October 2019
ITEM Design and Construction Notes		

Design Philosophy

A SUDS drainage system has already been designed by BTA Civils and our client has instructed us to provide design for a soakaway type SUDS system, replacing the permeable paving and sub-base system designed.

A soil infiltration rate has been confirmed and will be used in the soakaway design, this being 8.9×10^{-6} m/s.

All details produced and designed by GTA Civils are to be retained, substituting the sub-base infiltration system and distribution units for the soakaway system as shown. Final details of the surface water connections and all levels etc to be agreed between the contractor and Building Control Officer.

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	Calcs for Soakaway design				Start page no./Revision 3	
	Calcs by PSG	Calcs date Sept 19	Checked by	Checked date	Approved by	Approved date

DESIGN RAINFALL

Design rainfall in accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Brighton
Storm duration	D = 5 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 = 20.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 30 %
Factor Z1 (Wallingford procedure)	Z1 = 0.36
Rainfall for 5min storm with 5 year return period	M5_5min _i = Z1 × M5_60min × (1 + p _{climate}) = 9.3 mm
Factor Z2 (Wallingford procedure)	Z2 = 1.89
Rainfall for 5min storm with 100 year return period	M100_5min = Z2 × M5_5min _i = 17.6 mm
Design rainfall intensity	I _{max} = M100_5min / D = 210.6 mm/hr

Maximum surface water runoff

Catchment area	A _{catch} = 552 m ²
Percentage of area that is impermeable	p = 100 %
Maximum surface water runoff	Q _{max} = A _{catch} × p × I _{max} = 32.3 l/s

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	Calcs for Surface Water drainage Soakaway				Start page no./Revision 4	
	Calcs by PSG	Calcs date October 19	Checked by	Checked date	Approved by	Approved date

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.04

Design rainfall intensity

Location of catchment area Brighton
Impermeable area drained to the system $A = 551.5 \text{ m}^2$
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 $M5_{60\text{min}} = 20.0 \text{ mm}$
Increase of rainfall intensity due to global warming $p_{\text{climate}} = 30 \%$

Soakaway / infiltration trench details

Soakaway type Rectangular
Minimum depth of pit (below incoming invert) $d = 14776 \text{ mm}$
Width of pit $w = 1000 \text{ mm}$
Length of pit $l = 2500 \text{ mm}$
Percentage free volume $V_{\text{free}} = 95 \%$
Soil infiltration rate $f = 8.90 \times 10^{-6} \text{ m/s}$
Wetted area of pit 50% full $a_{s50} = l \times d + w \times d = 51717716 \text{ mm}^2$

Table equations

Inflow (cl.3.3.1) $I = M100 \times A$
Outflow (cl.3.3.2) $O = a_{s50} \times f \times D$
Storage (cl.3.3.3) $S = I - O$

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m³)	Outflow (m³)	Storage required (m³)
5	0.36;	9.3;	1.89;	17.6;	9.68;	0.14;	9.54
10	0.51;	13.2;	1.96;	25.8;	14.25;	0.28;	13.97
15	0.62;	16.0;	2.00;	32.0;	17.67;	0.41;	17.26
30	0.79;	20.5;	2.03;	41.5;	22.88;	0.83;	22.05
60	1.00;	26.0;	2.00;	52.1;	28.71;	1.66;	27.05
120	1.22;	31.8;	1.96;	62.2;	34.30;	3.31;	30.99
240	1.50;	38.9;	1.90;	73.9;	40.75;	6.63;	34.12
360	1.69;	43.9;	1.86;	81.7;	45.04;	9.94;	35.09
600	1.95;	50.6;	1.81;	91.4;	50.41;	16.57;	33.84
1440	2.48;	64.5;	1.71;	110.4;	60.86;	39.77;	21.09

Required storage volume $S_{\text{req}} = 35.09 \text{ m}^3$

Soakaway storage volume $S_{\text{act}} = l \times d \times w \times V_{\text{free}} = 35.09 \text{ m}^3$

PASS - Soakaway storage volume

Time for emptying soakaway to half volume $t_{s50} = S_{\text{req}} \times 0.5 / (a_{s50} \times f) = 10\text{hr } 35\text{min } 18\text{s}$

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