

Keith Farquharson Associates

Structural Calculations for

Tree Tops,
Fleet Hill,
Finchampstead.

August 2022
Project Reference S/082201

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Notes

These calculations and design responsibility relate to the elements mentioned only. Building regulation approval should be obtained prior to any works commencing or materials being ordered.

These calculations have been based on details supplied and/or a non intrusive visual survey. They should be read in conjunction with all relevant architect's drawings and specifications. Further detail may be required as the construction progresses and the contractor should inform the engineer of any discrepancies or omissions uncovered.

The design lengths used within these calculations are for design purposes only and do not relate directly to the lengths of the structural elements required. All materials should be specified from site measurements.

Any discrepancies should be reported prior to the ordering of materials

The contractor will be responsible for the temporary works necessary to undertake the scheme in a safe manner

Any existing walls surcharged by the proposals are to have their foundations exposed and checked for adequacy.

Any existing structural members subject to revised loading by the proposals are to be exposed and checked for adequacy.

Pad stones where specified are in the format length x depth x width,

All proprietary products are to be installed in accordance with their manufacturer's instructions.

Any variations to this design must be agreed in writing prior to implementation of the changes on site.

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Calculation Sheet

Site Address Treetops, Fleet Hill.

Ref S/082201

Sheet 1

Part

Date Aug. 22

Consider the surface water disposal for the new development as outlined in the drawings by Tony Day Architecture Drg. 3740/200 R

Soakage test undertaken on the Friday 29th of July 2022 in accordance with BRE 365/SUDS.

The soils revealed by the investigation are loose dark grey sand with gravel and brick fragments to 200mm overlying medium dense brown/grey sand with scattered gravel. The tests indicated an Infiltration Rate (f) of 8×10^{-6} m/sec.

We have based our design on a 100 year return storm with a 20% uplift for climate change.

The hard standing and parking areas are to be provided with permeable paving. We have considered the surface water drainage for a drained area of 200m² serviced by two soak aways.

Provide 2 No. proprietary crate soak aways of 2000mmx2000mm to a depth of 1600mm below the incoming pipe invert level.

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	Calcs for Soakaway Design.				Start page no./Revision 2	
	Calcs by M	Calcs date 01/08/2022	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	London
Impermeable area drained to the system	A = 100.0 m ²
Return period	Period = 100 yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = 0.440
5-year return period rainfall of 60 minutes duration	M5_60min = 20.0 mm
Increase of rainfall intensity due to global warming	p _{climate} = 20 %

Soakaway / infiltration trench details

Soakaway type	Rectangular
Minimum depth of pit (below incoming invert)	d = 1567 mm
Width of pit	w = 2000 mm
Length of pit	l = 2000 mm
Percentage free volume	V _{free} = 95 %

Soil infiltration rate (BRE digest 365)

Length of trial pit	l _{trial} = 300 mm
Width of trial pit	b _{trial} = 300 mm
Depth of trial pit (below invert)	d _{trial} = 600 mm
Free volume (if fill used)	V _{trial} = 100 %
75% depth of pit	d ₇₅ = (d _{trial} × 0.75) = 450.00 mm
50% depth of pit	d ₅₀ = (d _{trial} × 0.50) = 300.00 mm
25% depth of pit	d ₂₅ = (d _{trial} × 0.25) = 150.00 mm
Test 1 - time to fall from 75% depth to 25% depth	T1 = 120 min
Test 2 - time to fall from 75% depth to 25% depth	T2 = 125 min
Test 3 - time to fall from 75% depth to 25% depth	T3 = 125 min
Longest time to fall from 75% depth to 25% depth	t _g = max(T1, T2, T3) = 125 min
Storage volume from 75% to 25% depth	V _{p75_25} = (l _{trial} × b _{trial} × (d ₇₅ - d ₂₅)) × V _{trial} = 0.03 m ³
Internal surface area to 50% depth	a _{p50} = ((l _{trial} × b _{trial}) + (l _{trial} + b _{trial}) × 2 × d ₅₀) = 0.45 m ²
Surface area of soakaway to 50% storage depth	A _{s50} = 2 × (l _{trial} + b _{trial}) × d _{trial} / 2 = 0.360 m ²
Soil infiltration rate	f = V _{p75_25} / (a _{p50} × t _g) = 8.00×10⁻⁶ m/s
Wetted area of pit 50% full	a _{s50} = l × d + w × d = 6266863 mm ²

Table equations

Inflow (cl.3.3.1)	I = M100 × A
Outflow (cl.3.3.2)	O = a _{s50} × f × 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	0.39;	9.3;	1.89;	17.6;	1.76;	0.02;	1.74
10	0.54;	12.9;	1.96;	25.2;	2.52;	0.03;	2.49
15	0.65;	15.5;	1.99;	30.9;	3.09;	0.05;	3.05

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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)
30	0.82;	19.6;	2.03;	39.7;	3.97;	0.09;	3.88
60	1.00;	24.0;	2.01;	48.3;	4.83;	0.18;	4.65
120	1.19;	28.6;	1.98;	56.7;	5.67;	0.36;	5.31
240	1.39;	33.4;	1.94;	65.0;	6.50;	0.72;	5.77
360	1.53;	36.7;	1.92;	70.4;	7.04;	1.08;	5.95
600	1.70;	40.8;	1.88;	76.9;	7.69;	1.80;	5.88
1440	2.07;	49.8;	1.81;	90.2;	9.02;	4.33;	4.68

Required storage volume $S_{req} = 5.95 \text{ m}^3$

Soakaway storage volume $S_{act} = l \times d \times w \times V_{free} = 5.95 \text{ m}^3$

PASS - Soakaway storage volume

Time for emptying soakaway to half volume $t_{s50} = S_{req} \times 0.5 / (a_{s50} \times f) = 16\text{hr } 29\text{min}$

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