ANTHONY-JOHNSON
Consulting Engineer Ltd

Site Address:

Building Plot 8,
Highstock lane
Gedney Hill.
PE12 0QG

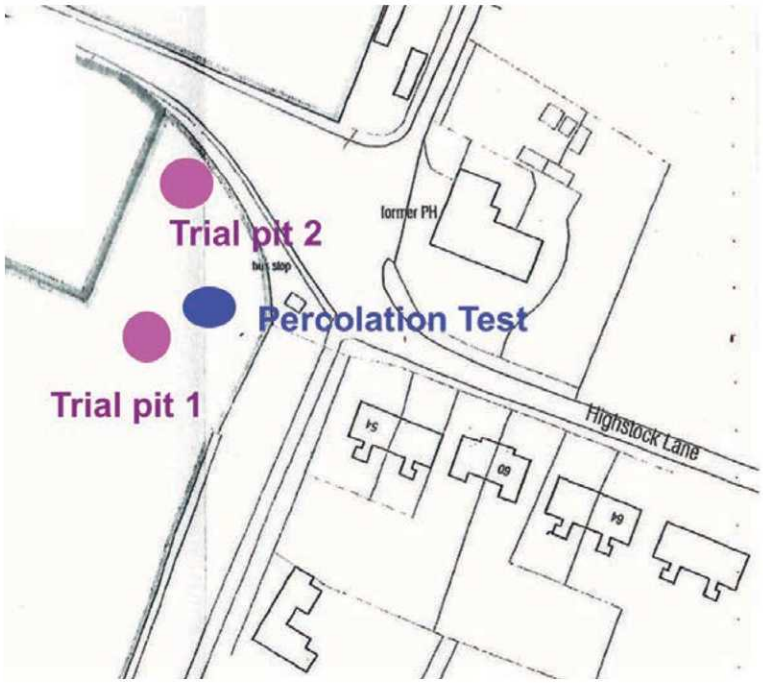
1.0 Overview:

A greenfield site, currently employed for arable farming and bounded on one side with trees, comprising sycamore Buddleia and Silver Birch. It is proposed that a residential property be formed to the site.

The site is set, suitably removed from the adjacent highway, limiting the potential for existing services and disturbed/ made ground.

Former use of the land gives rise to the potential risk of drainage ditches and land drainage systems.

Grounds to Number 54 were noted as incorporating an area set aside for ground water/ surface water storage.



2.0 Goeotechnical Survey:

2.1 Trial Pit 1:

The first trial hole was set directly adjacent to the existing demise of plot 8.

The trial pit extended down through 400 mm of loamy topsoil with SILT clearly evident and some limited clay content.

The topsoil was found to be relatively friable with limited cohesion and limited moisture content.



Image 1.0: Trial pit with 400mm topsoil, set ot the head of a SILT bed.

At a depth of 400 mm a silty sand was encountered. Fine silt within the SAND was found to result in some limited cohesion within the geology and retention of moisture.

Mottling was noted within the SAND, indicative of some limited organic presence.



Image 2.0: SAND with SILT and mottling.

At 2.4 meters below ground level, extensive mottling was encountered within the geology and a sudden change from orange silty sand to grey silt was indicative of a total change in strata, similar in nature to the Barroway drove Beds, set to the underside of the Terrington Beds. The trial pit was terminated at 2.85 meters below ground level, with no further change in ground conditions.



Image 3.0: Grey mottled SAND and silt

2.2 Trial Pit 2:

The second trial pit was formed to the front of plot 8, 5 meters from the boundary line with the road. Ground level to this location was noted as being approximately 200 to 300 mm higher than at the location of the first trial pit. The trial pit extended down through 500 mm of dark loamy topsoil with some SILT and clay content. It was noted that some clumping of the extracted samples occurred.

At 500 mm below ground level SILTY sand was encountered and this was, as with trial pit one, noted as being mottled with some reddish inclusions.

At 1.5 meters below ground level, the sand started to change from a silver to an orange in colour.

Water started to enter the trial pit from a depth of 2.4 meters below ground level.

Walls to the trial pit starts to collapse from a depth of 2.6 m below ground level and on this basis it was considered prudent to terminate the trial pit at 2.7 m below ground level with no further change in ground conditions.



Image 4.0: Trial Pit 2.

3.0: Percolation test:

A Percolation test was performed in close proximity to the demise of the proposed property.

Geotechnical analysis of the local geology, as detailed in the report above leads to the conclusion that local superficial geology is homogeneous in nature, formed of a granular upper strata, suitably free draining in nature, with a groundwater set at a depth greater than 2.5 meters. Tidal flat deposits are noted as being set to the head of the Oxford Clay formation, as recorded by the BGS.

A multi-run set of three tests was performed in a single trial pit, 1500mm long x 900mm wide with base level 1200mm below ground level.

The trial pit was filled and the time to discharge from 75% to 25% measured. The test was repeated two further times, so as to allow for attenuation within the surrounding ground.

4.0 Conclusion & Recommendations:

4.1 Foundations:

In considering findings of the geotechnical survey, it is considered that strip foundations are a suitable solution to the proposed property.

Given the findings of trial pits the following recommendations are made:

1) The span of beam and block flooring should be limited to no more than 3 meters between supporting foundations, whether in the form of load bearing partitions, cavity walls or sleeper walls.
2) Where the client limits the span of beam and block flooring to 3 meters, strip footings may be suitably limited in width to 750mm for Cavity walls, 600mm for internal load bearing partitions and 450mm for sleeper walls.

It is recommended that cavity walls should be formed to the head of strip footings, 900mm in width. To load bearing internal partitions and sleeper walls, 600mm wide strips should be employed. Concrete should be poured to a depth of 300mm throughout, at a founding depth of 750mm and beam and block flooring should be limited to a 3 meter span between supports.

4.2: Soak-away

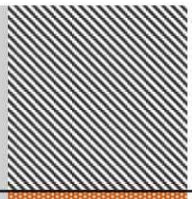
The Soak-away, serving surface water runoff from the roof should be formed a mixture of crates, wrapped within a geotextile so as to prevent silting a rubble fill to the perimeter. This should be served by a drainage system, incorporating a suitable Silt trap.

The soak away has been designed to serve a total roof area of 212 square meters. Allowance has been made for attenuation and 20% increase in rainfall intensity due to climate change.

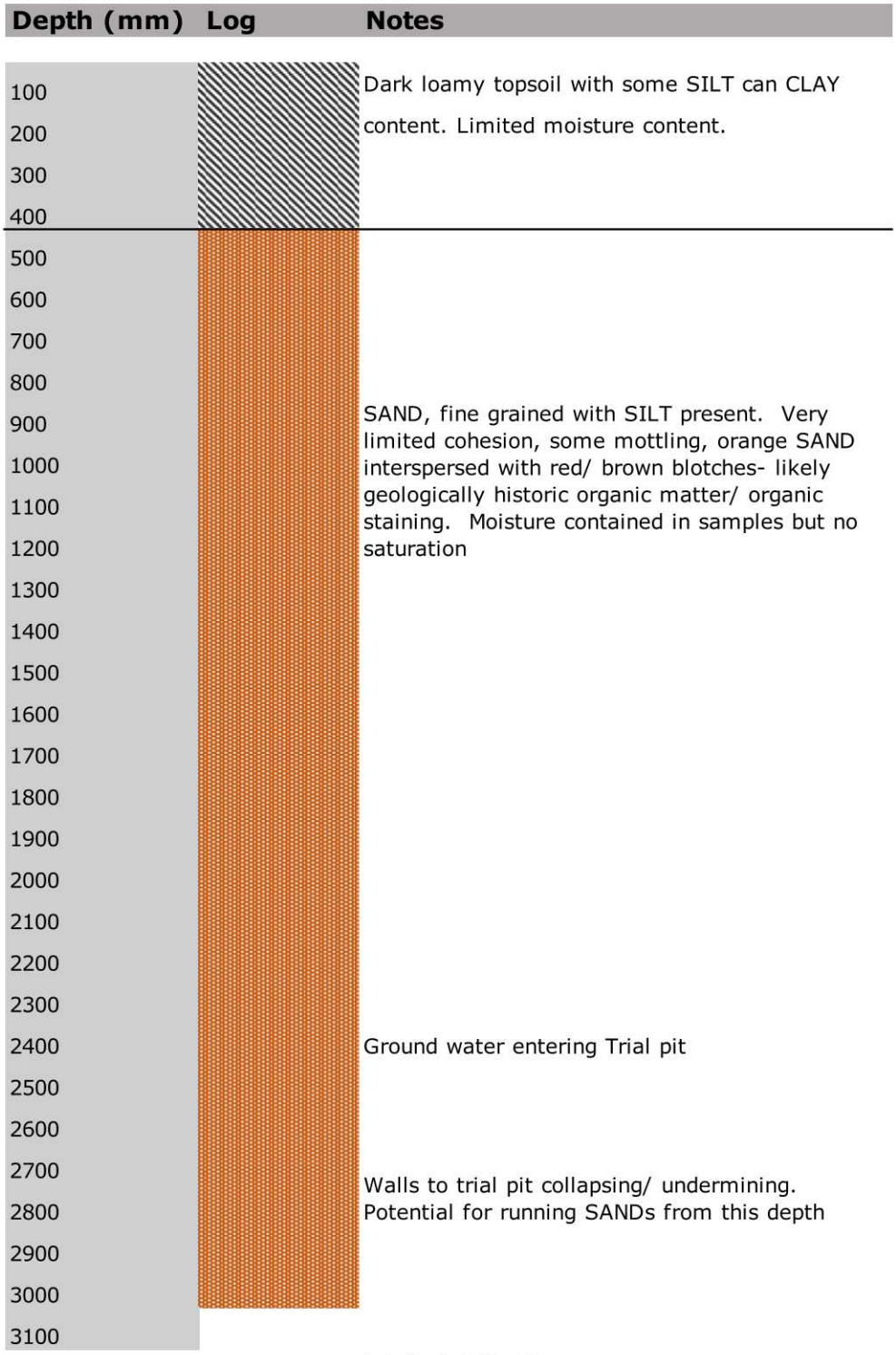
A crate system is required, with rubble fill to the underside and side elevations of the soak-away. Total dimensions of the soak-away are 8 meters in length x 4 meters in width with a depth of 800mm. A total of 7.31 cubic meters of crates are required, surrounded by 18.3 cubic meters of rubble. Line the soak-away with geotextile, set rubble to base, site crates with geotextile wrap and fill remaining with rubble.

The design allows for the siting of the soak-away at a distance of 16 meters from the property, with surface water drainage set at a fall of 1:80, terminating to the head of the soak-away, with invert 400mm below ground level.

Appendix:

Depth (mm)	Log	Notes
100		Topsoil, Brown, friable, Silty, some clay, limited moisture, roots.
200		
300		
400		
500		SAND, fine grained with SILT present. Very limited cohesion, some mottling, orange SAND interspersed with red/ brown blotches- likely geologically historic organic matter/ organic staining. Moisture contained in samples but no saturation
600		
700		
800		
900		
1000		
1100		
1200		
1300		
1400		
1500		
1600		
1700		
1800		
1900		
2000		
2100		
2200		
2300		
2400		
2500		
2600		
2700		Grey SILT, indicative of Barroway Drove beds. Coarse grained SILT, saturated.
2800		
2900		
3000		
3100		

Trial Pit 1


Depth (mm)
Log
Notes
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800
2900
3000
3100
Dark loamy topsoil with some SILT can CLAY content. Limited moisture content.
SAND, fine grained with SILT present. Very limited cohesion, some mottling, orange SAND interspersed with red/ brown blotches- likely geologically historic organic matter/ organic staining. Moisture contained in samples but no saturation
Ground water entering Trial pit
Walls to trial pit collapsing/ undermining. Potential for running SANDs from this depth

Trial Pit 2

SOAKAWAY DESIGN FRONT OF PROPERTY (BRE DIGEST 365/SUDS)

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.04

Design rainfall intensity

Location of catchment area	Norwich
Impermeable area drained to the system	A = **212.0** m^2
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.410**
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 = **800** mm
Width of pit	w = **4000** mm
Length of pit	l = **8000** mm
Percentage free volume	V_{free} = **50** %

Soil infiltration rate (BRE digest 365)

Length of trial pit	l_{trial} = **1500** mm
Width of trial pit	b_{trial} = **900** mm
Depth of trial pit (below invert)	d_{trial} = **800** mm
Free volume (if fill used)	V_{trial} = **100** %
75% depth of pit	$d_{75} = (d_{trial} \times 0.75)$ = **600.00** mm
50% depth of pit	$d_{50} = (d_{trial} \times 0.50)$ = **400.00** mm
25% depth of pit	$d_{25} = (d_{trial} \times 0.25)$ = **200.00** mm
Test 1 - time to fall from 75% depth to 25% depth	T1 = **85** min
Test 2 - time to fall from 75% depth to 25% depth	T2 = **148** min
Test 3 - time to fall from 75% depth to 25% depth	T3 = **221** min
Longest time to fall from 75% depth to 25% depth	t_{lg} = max(T1, T2, T3) = **221** min
Storage volume from 75% to 25% depth	$V_{p75_25} = (l_{trial} \times b_{trial} \times (d_{75} - d_{25})) \times V_{trial}$ = **0.54** m^3
Internal surface area to 50% depth	$a_{p50} = ((l_{trial} \times b_{trial}) + (l_{trial} + b_{trial}) \times 2 \times d_{50})$ = **3.27** m^2
Surface area of soakaway to 50% storage depth	$A_{s50} = 2 \times (l_{trial} + b_{trial}) \times d_{trial} / 2$ = **1.920** m^2
Soil infiltration rate	$f = V_{p75_25} / (a_{p50} \times t_{lg})$ = **12.5×10^{-6}** m/s
Wetted area of pit 50% full	$a_{s50} = l \times d + w \times d$ = **9599876** 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 (m^3)	Outflow (m^3)	Storage required (m^3)

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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)
5	0.38	9.0	1.89	17.1	3.62	0.04	3.58
10	0.53	12.6	1.95	24.7	5.23	0.07	5.16
15	0.64	15.3	1.99	30.4	6.45	0.11	6.35
30	0.81	19.4	2.02	39.2	8.31	0.22	8.10
60	1.00	24.0	2.01	48.3	10.25	0.43	9.82
120	1.20	28.9	1.98	57.2	12.12	0.86	11.26
240	1.43	34.4	1.93	66.6	14.11	1.72	12.39
360	1.59	38.1	1.91	72.6	15.38	2.58	12.80
600	1.77	42.4	1.87	79.3	16.82	4.30	12.51
1440	2.20	52.8	1.79	94.6	20.05	10.33	9.72

Required storage volume S_{req} = **12.80** m^3

Soakaway storage volume $S_{act} = l \times d \times w \times V_{free}$ = **12.80** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume $t_{s50} = S_{req} \times 0.5 / (a_{s50} \times f)$ = 14hr 52min 12s

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

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RATIOS OF RUBBLE TO CRATES.

(1) $V_C + 0.3V_R = 0.5 \times 0.8 \times 8 \times 4 = 12.8 \text{ m}^3$

(2) $V_C + V_R = 0.8 \times 8 \times 4 = 25.6 \text{ m}^3$

∴ Re-arrange (1)

$V_C = 12.8 - 0.3V_R$

Substitute into (2)

$-0.3V_R + 12.8 + V_R = 25.6$

$\therefore 0.7V_R = 12.8$

$V_R = 18.3 \text{ m}^3$

Substitute answer into (2)

$V_C = 12.8 - 0.2 \times 18.3 = 7.31 \text{ m}^3$

Check

Σ volume $= 18.3 + 7.31 = 25.6 \text{ m}^3$

Σ storage $= 7.31 + 0.3 \times 18.3 = 12.8 \text{ m}^3$

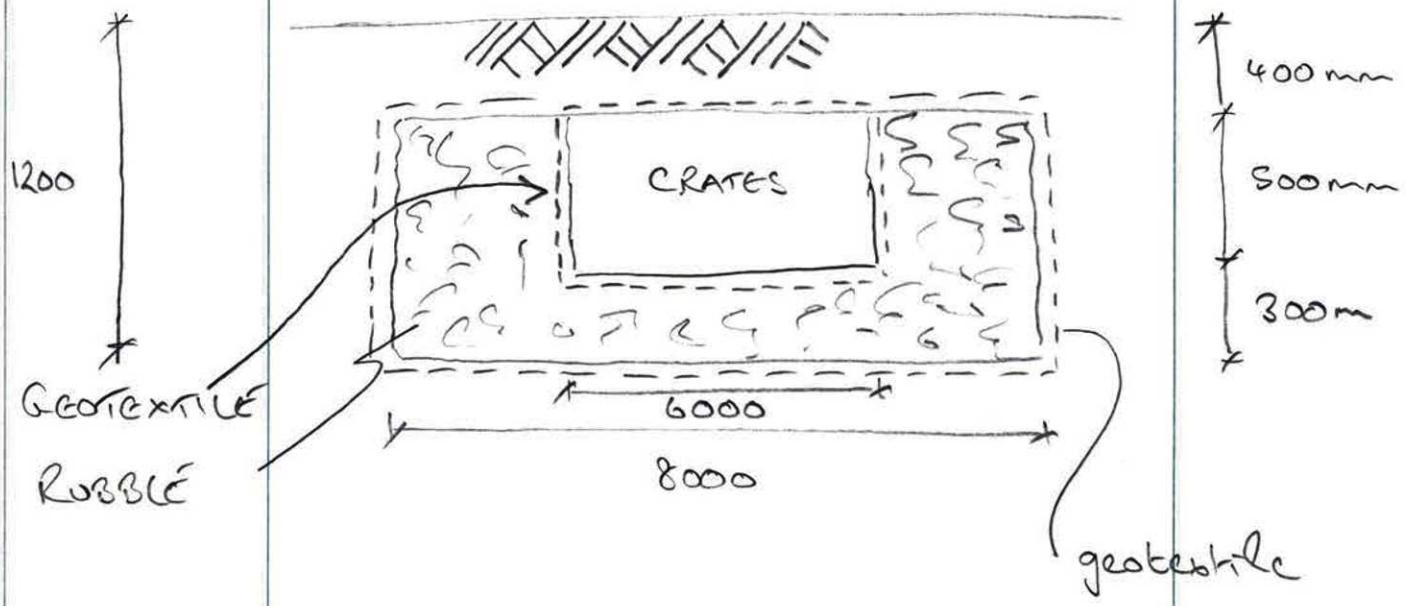
Date:

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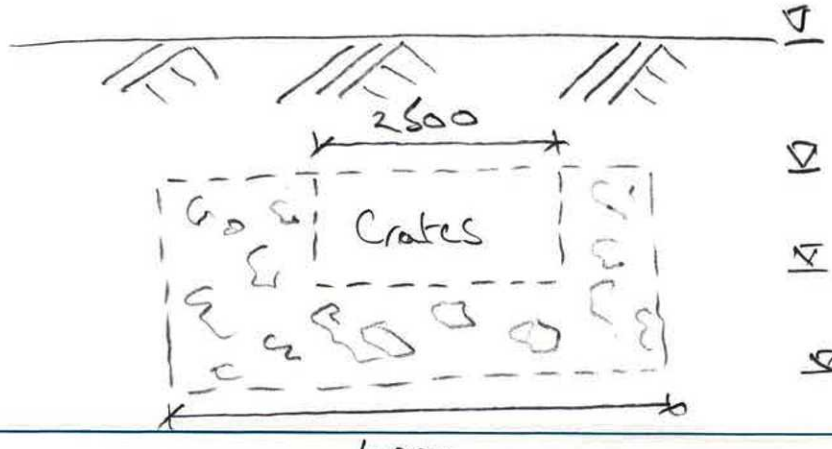
Calculation Sheet No:.....
Job No:.....

VIEW FRONT/ Soakaway layout:
REAR.



Invert level = 400mm below G.L.
Consider a gradient of 1:80
Distance from Structure ∴ 16000mm
Depth of invert near property = 200mm

SIDE SECTION



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