

Temporary Car Parking
Caffyns Audi, Worthing
Flood Risk & Drainage Statement

1.0 Proposals

The proposal is to construct a temporary car storage area adjacent to a recently completed car dealership site. The layout is shown on the appended proposed site plan, SRA Architects Drg. No. 3480-SK01A.

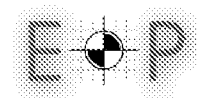
2.0 Flood Risk

Environment Agency maps show that the site lies within Flood Zone 1, with an annual risk of flooding of less than 1 in 1000 years from fluvial or tidal sources.

3.0 Existing Surface Water Drainage

The area in which the proposed car storage area is located is currently unused, surfaced with impermeable concrete paths and permeable gravel areas. An extract of a topographical survey showing the area is appended. This shows that there is no positive drainage within the area and so surface water is currently discharged into the sub-soils. The depth and void ratio of the gravel areas are unknown, but these are unlikely to give a significant volume of water storage.

As part of the previous car dealership development approval process, infiltration testing was carried out within an area immediately to the east of the current development, a copy of the report on which is appended. Ground water monitoring was carried out on the site, a report on which is also appended. It was concluded that the sub-soils were suitable for the disposal of surface water by way of soakaways, and approval was subsequently given for the system of soakaway chambers and linking trenches shown on the appended drainage layout Drg. No. 40923/061E.



4.0 Proposed Surface Water Drainage

It is proposed that the compound area has a permeable surface to allow surface water to be discharged to sub-soils to replacate the existing arrangement. As a result of removing the existing concrete paths within the area, the ability of the sub-soils to receive and retain rainfall will be enhanced.

In order to increase the allowable time for infiltration into the sub-soils to occur, the new surface levels are to be set to create a shallow “dish”, in which a maximum depth of 50mm of above ground water storage can be provided. This, in addition to the storage provided within the new build-up (as described below), will reduce the risk of flooding from the compound onto the surrounding areas.

The new construction build-up is to consist of a 150 thickness of granular 6F2 material, overlaid with a permeable geotextile and surfaced with a 150 thickness of Type 3 stone (40mm size with reduced fines content). As well as creating a significant amount of water storage this will also provide a level of treatment to the run-off should any oils be deposited. It should be borne in mind that it is highly unlikely that any significant deposition of oils will occur, as the vast majority of vehicles stored will be new or nearly new, and are consequently well maintained.

The appended Drg. No. 43413/001A shows the proposed parking area levels and construction build-up.

5.0 Foul Drainage

There is to be no new foul discharge created by the development.



ROUNDSTONE LANE

Existing fence line.

Existing fence line altered at corner.

67 Spaces

Existing fence line.

Access Road

New access gates
New dropped kerb

New vehicle access to temporary parking area
Existing parking bays to be hatched

Acoustic fence

Temporary Car Park at Caffyns Audi

Drawing title		Drawing number & revision		Amendments	
Site Plan Proposed		3480 - SK01 A			
Drawn by	Checked by	A1 Scale	A3 Scale	Date	Status
GD	GD	1:100	1:200	01 Nov 2018	Sketch

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SJE/RAN/01/40923

23 August 2017

For the attention of David Hawtin

Dear David,

Audi Worthing – Report on Infiltration Tests

Introduction

Ashdown Site Investigation produced a 'Combined Geotechnical and Ground Contamination Risk Assessment' in June 2015, referenced LW26140. This report included the results of four infiltration tests which were undertaken outside the footprint of the former greenhouses. Infiltration rates of between 3.38×10^{-5} and 4.81×10^{-4} m/sec were calculated.

Additional infiltration testing was required in the area of the greenhouses following demolition.

Site Works

Eastwood & Partners visited site on 16 August 2017 and excavated three pits (SA1 to SA3) in the area of the former greenhouses in the north of the site. A sketch plan showing the location of the pits is enclosed. The pits reached depths of between 1.25 m and 2.4 m bgl. Each pit was filled with approximately 500 mm depth of water and monitored over a period of several hours.

Infiltration Results

The ground conditions encountered were consistent with those recorded by Ashdown Site Investigation previously. Topsoil was encountered at the surface in two pits with concrete present at the surface in one. The natural ground was encountered directly below the topsoil or concrete and comprised slightly sandy silt/clay, representative of the River Terrace Deposits known to cover the site.

A copy of the pit logs and infiltration rate calculations is enclosed and the results are summarised in the table below. In each case the average infiltration rate has been calculated. The water level in the

..... [REDACTED]

Directors: P Richardson BSc, CEng, MICE, MStructE S D Preston BEng, CEng, FICE, FIStructE N J Baines BSc, CEng, MICE, MCIWEM
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Consultant: J M Wood BSc, CEng, MICE, FIStructE



pits did not drop below 25% effective depth, thus it was not possible to calculate the BR365 infiltration rate.

Pit	Depth (mm)	Average Infiltration Rate (m/sec)
SA1	2200	1.3×10^{-6}
SA2	2400	1.4×10^{-5}
SA3	1250	7.8×10^{-6}

The rates recorded are all slower than those recorded by Ashdown Site Investigation previously. This could be due to seasonal effects in the lead up to the testing, i.e. amount of rainfall, or slight localised variations in the soil composition.

Conclusions

Although the recent testing has demonstrated a lower infiltration rate, soakaway drainage is still considered viable for the site. A conservative infiltration rate should however be adopted during the design of the drainage system to allow for the variation recorded across the site.

Yours sincerely

S English
Director

Enc. Sketch Pit Location Plan
Logs and Infiltration Rate Calculations

PROJECT:	Audi Worthing	Job No. 40923	Date 16.08.17
SUBJECT:	Infiltration Test Results and Calculation of Infiltration Rates	Prepared RAN	Checked LED

Test No. SA1

Test Pit Dimensions

Length = 1600 mm

Plan area = 1.92 m²

Width = 1200 mm

Depth = 2200 mm (Total depth)

Approximate time to discharge water into the hole:

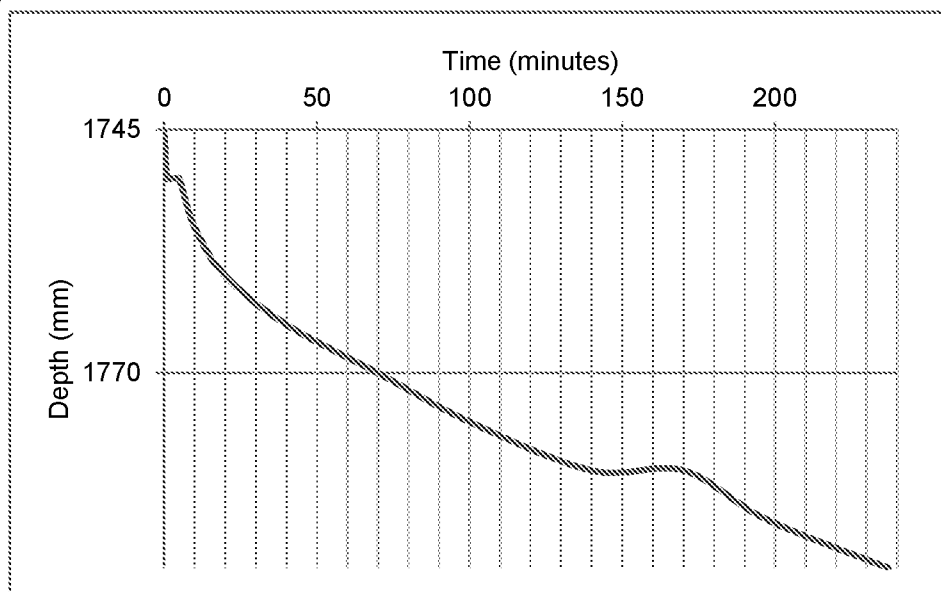
360 Seconds

Depth to water after completion of pumping:

1745 mm

Time (min) Depth (mm)

0	1745
1	1750
2	1750
3	1750
4	1750
5	1750
10	1755
20	1760
40	1765
70	1770
100	1775
140	1780
170	1780
197	1785
237	1790

**Test Pit Log****Depth (m)****Description**

0.0-0.1

Concrete

0.1-0.55

Brown sandy, gravelly CLAY. Gravel is angular to sub-rounded, fine to coarse flint

0.55-2.2

Light brown slightly sandy SILT/CLAY.

PROJECT:	Audi Worthing	Job No. 40923	Date 16.08.17
SUBJECT:	Infiltration Test Results and Calculation of Infiltration Rates	Prepared RAN	Checked LED

Test No. SA1

Soil Infiltration Rate in Accordance with BR365

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where: V_{p75-25} is the effective storage volume of water in the trial pit between 75% and 25% effective depth;

a_{p50} is the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **1750** mm Average water depth: **430** mm
Start time = **5** min

Change in water depth: **40** mm

Final parameters

Depth to water = **1790** mm Time interval: **232** min
End time = **237** min

Effective Storage Volume of Water in the Trial Pit = **0.8736** m³
75% Effective Depth = **1859** mm from ground level
25% Effective Depth = **2086** mm from ground level
Time at 75% Effective Depth = **N/A** minutes
Time at 25% Effective Depth = **N/A** minutes

V_{p75-25} = **0.44** m³

a_{p50} = **3.19** m²

t_{p75-25} = **0** sec

f = **#DIV/0!** m/sec

Average Soakaway Rate = **5.5E-06** m³/sec
Average soakaway area = **4.33** m² (sides + base)

BR365 Soil Infiltration Rate = N/A m/sec
Average Infiltration Rate = 1.3E-06 m/sec

PROJECT:	Audi Worthing	Job No. 40923	Date 16.08.17
SUBJECT:	Infiltration Test Results and Calculation of Infiltration Rates	Prepared RAN	Checked LED

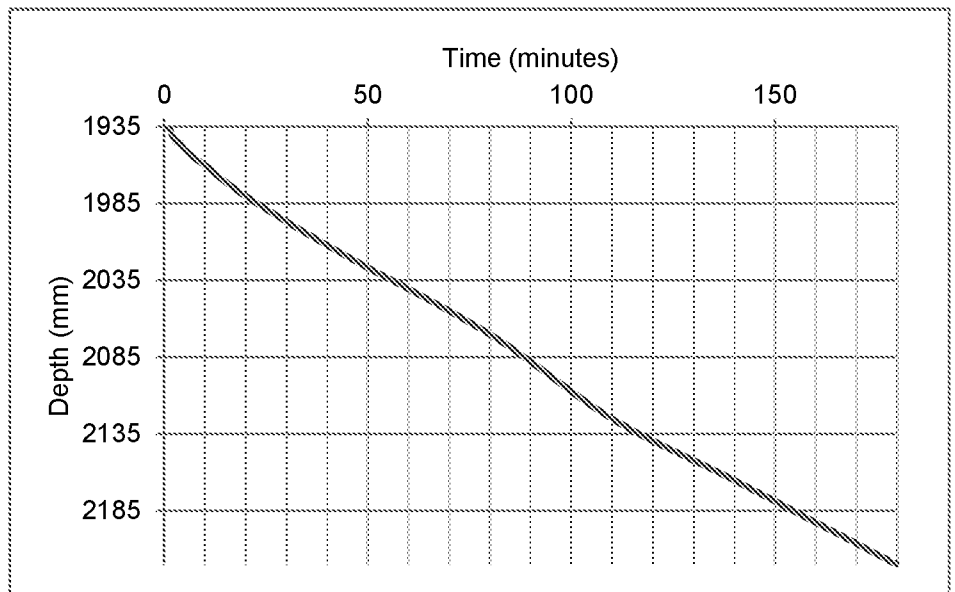
Test No. SA2

Test Pit Dimensions

Length = **1600** mm Plan area = **1.92** m²
 Width = **1200** mm
 Depth = **2400** mm (Total depth)

Approximate time to discharge water into the hole: **600** Seconds
 Depth to water after completion of pumping: **1935** mm

Time (min)	Depth (mm)
0	1935
1	1935
2	1940
3	1945
4	1945
5	1950
10	1960
20	1980
42	2015
80	2070
110	2125
140	2165
180	2220



Test Pit Log

Depth (m)	Description
0.0-0.3	Dark brown very clayey silty SAND.
0.3-2.4	Light brown slightly sandy SILT/CLAY.

PROJECT:	Audi Worthing	Job No. 40923	Date 16.08.17
SUBJECT:	Infiltration Test Results and Calculation of Infiltration Rates	Prepared RAN	Checked LED

Test No. SA2

Soil Infiltration Rate in Accordance with BR365

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where: V_{p75-25} is the effective storage volume of water in the trial pit between 75% and 25% effective depth;

a_{p50} is the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **1935** mm Average water depth: **322.5** mm
Start time = **0** min

Change in water depth: **285** mm

Final parameters

Depth to water = **2220** mm Time interval: **180** min
End time = **180** min

Effective Storage Volume of Water in the Trial Pit = **0.8928** m³
75% Effective Depth = **2051** mm from ground level
25% Effective Depth = **2284** mm from ground level
Time at 75% Effective Depth = **67** minutes
Time at 25% Effective Depth = **N/A** minutes

V_{p75-25} = **0.45** m³
 a_{p50} = **3.22** m²
 t_{p75-25} = **-4020** sec
 f = **-3.4E-05** m/sec

Average Soakaway Rate = **5.1E-05** m³/sec
Average soakaway area = **3.73** m² (sides + base)

BR365 Soil Infiltration Rate = N/A m/sec
Average Infiltration Rate = 1.4E-05 m/sec

PROJECT:	Audi Worthing	Job No. 40923	Date 16.08.17
SUBJECT:	Infiltration Test Results and Calculation of Infiltration Rates	Prepared RAN	Checked LED

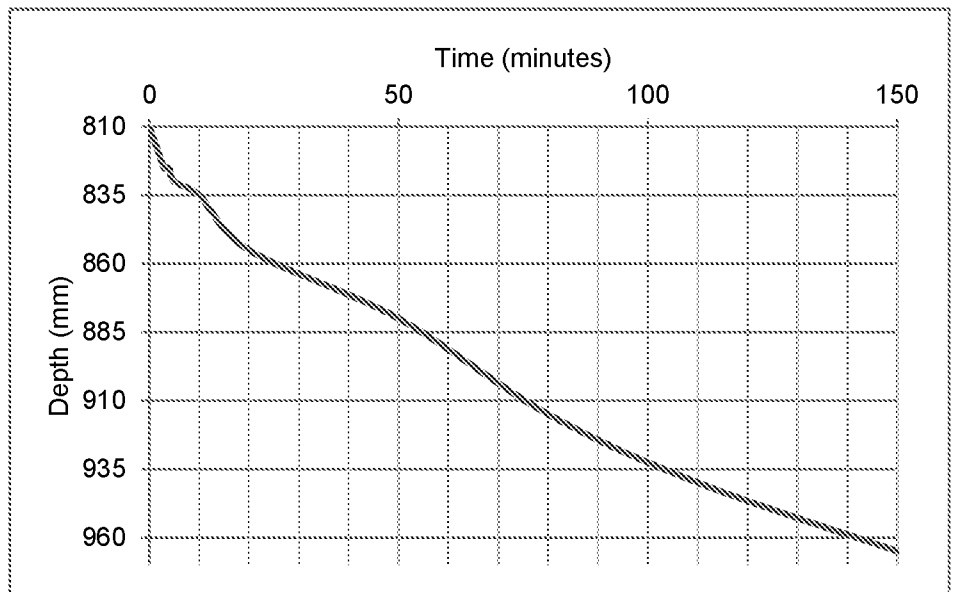
Test No. SA3

Test Pit Dimensions

Length = 1200 mm Plan area = 1.44 m²
Width = 1200 mm
Depth = 1250 mm (Total depth)

Approximate time to discharge water into the hole: 600 Seconds
Depth to water after completion of pumping: 810 mm

Time (min)	Depth (mm)
0	810
1	815
2	820
3	825
4	825
5	830
10	835
20	855
50	880
80	915
110	940
150	965



Test Pit Log

Depth (m)	Description
0.0-0.25	Dark brown very clayey silty SAND.
0.25-1.25	Light brown slightly sandy SILT/CLAY.

PROJECT:	Audi Worthing	Job No. 40923	Date 16.08.17
SUBJECT:	Infiltration Test Results and Calculation of Infiltration Rates	Prepared RAN	Checked LED

Test No. SA3

Soil Infiltration Rate in Accordance with BR365

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where: V_{p75-25} is the effective storage volume of water in the trial pit between 75% and 25% effective depth;

a_{p50} is the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **810 mm** Average water depth: **362.5 mm**
Start time = **0 min**

Change in water depth: **155 mm**

Final parameters

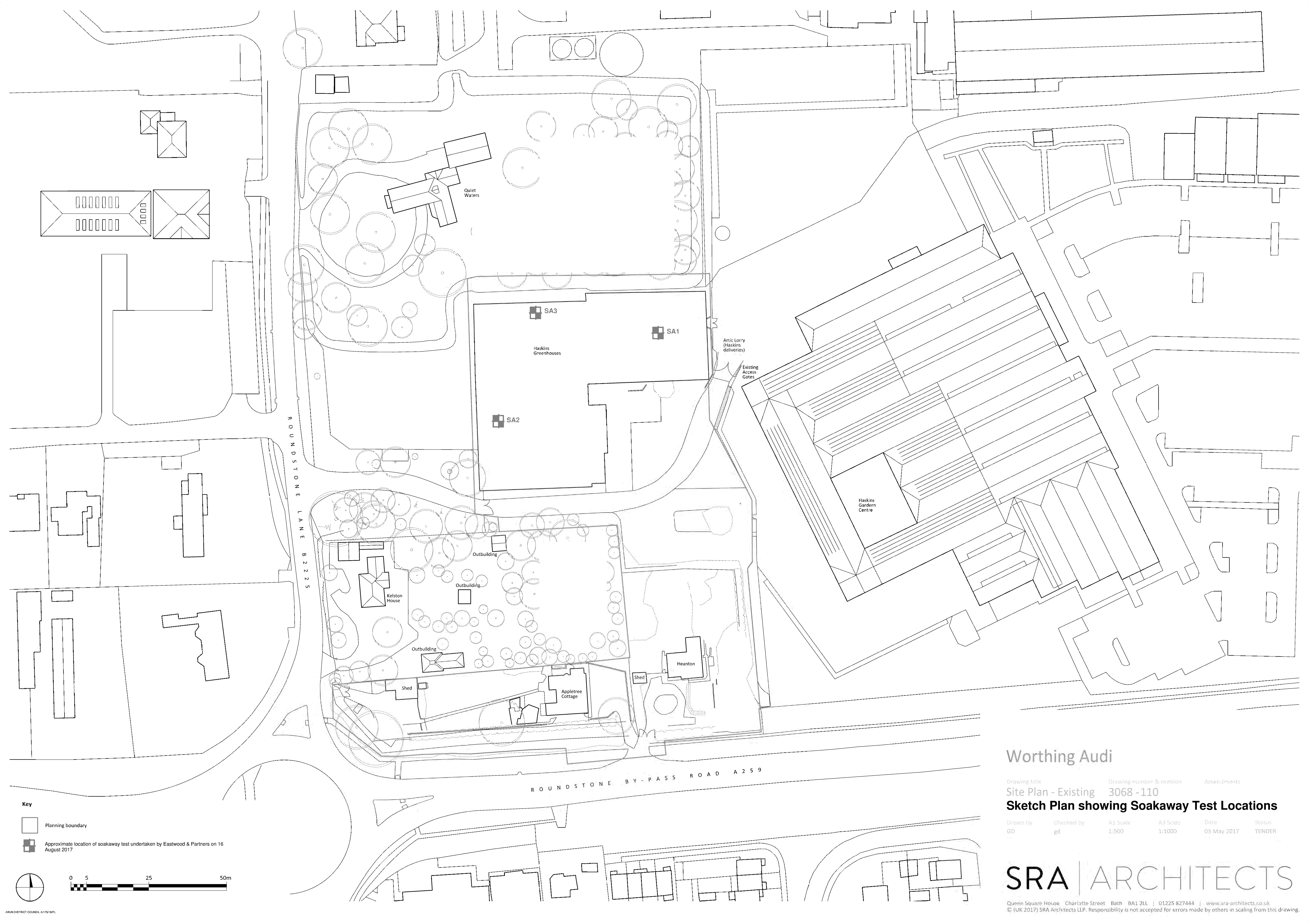
Depth to water = **965 mm** Time interval: **150 min**
End time = **150 min**

Effective Storage Volume of Water in the Trial Pit = **0.6336 m³**
75% Effective Depth = **920 mm** from ground level
25% Effective Depth = **1140 mm** from ground level
Time at 75% Effective Depth = **86 minutes**
Time at 25% Effective Depth = **N/A minutes**

V_{p75-25} = **0.32 m³**
 a_{p50} = **2.50 m²**
 t_{p75-25} = **-5160 sec**
 f = **-2.5E-05 m/sec**

Average Soakaway Rate = **2.5E-05 m³/sec**
Average soakaway area = **3.18 m² (sides + base)**

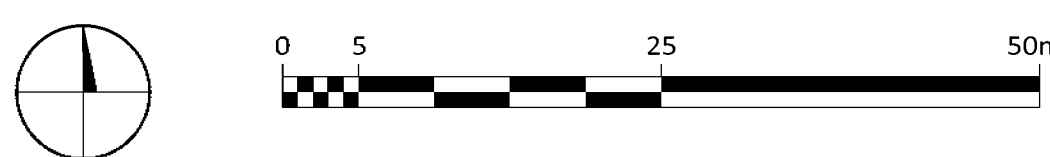
BR365 Soil Infiltration Rate = N/A m/sec
Average Infiltration Rate = 7.8E-06 m/sec



Key

Planning boundary

Approximate location of soakaway test undertaken by Eastwood & Partners on 16 August 2017



Worthing Audi

Drawing title

Site Plan - Existing

Drawing number & revision

3068 -110

Amendments

Sketch Plan showing Soakaway Test Locations

Drawn by

GO

Checked by

gd

A1 Scale

1:500

A3 Scale

1:1000

Date

03 May 2017

Status

TENDER

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CEP on behalf of Caffyns Audi

F.A.O. Bava Sathan

Our Ref: 15366/LR/Rev1.02

9th May 2016

Dear Bava,

RE: Land North of A259, Angmering - Groundwater Monitoring

We are writing in regards to the groundwater monitoring which commenced on 1st March 2016. The following letter report must be read in conjunction with the Factual Ground Investigation Report ref. 15366/FGIR, dated February 2016, undertaken by Soils Limited.

Brief

Soils Limited and The Civil Engineering Practice agreed via email to carry out groundwater monitoring at the above mentioned site. The email was sent on 23rd February 2016 and comprised the agreement to carry out a series of four readings within the well previously installed in borehole BH1 at the time of the intrusive investigation. The four readings were undertaken monthly in February and April and bi-monthly in March within borehole BH1. A further fifth reading was taken by Soils Limited at the beginning of May in order to confirm the trend.

It was understood that the site was to be used for commercial development. The groundwater monitoring was intended to inform the design of the foundation scheme and the effects of groundwater within the months when groundwater was expected to be at its highest elevation (typically around March).

General

The site was located at land north of A259, Angmering, West Sussex BN16 1ED and had an approximate OS Land Ranger Grid Reference of TQ 075 032. At the time of reporting the site comprised two detached two-storey dwellings. Vegetation was represented in the gardens to the south, to the west and to the north of the property, with grass, hedges, mature and immature trees.

A site plan with the location of borehole BH1 and the related monitoring well is presented in Figure 1.

Groundwater Monitoring

At the time of the intrusive site investigation (January 2016) groundwater was only encountered within one trial hole (BH1) and was struck at a depth of 6.50m bgl, rising to 5.00m bgl after 20 minutes. A slight seepage was observed between 3.80m and 6.00m bgl.

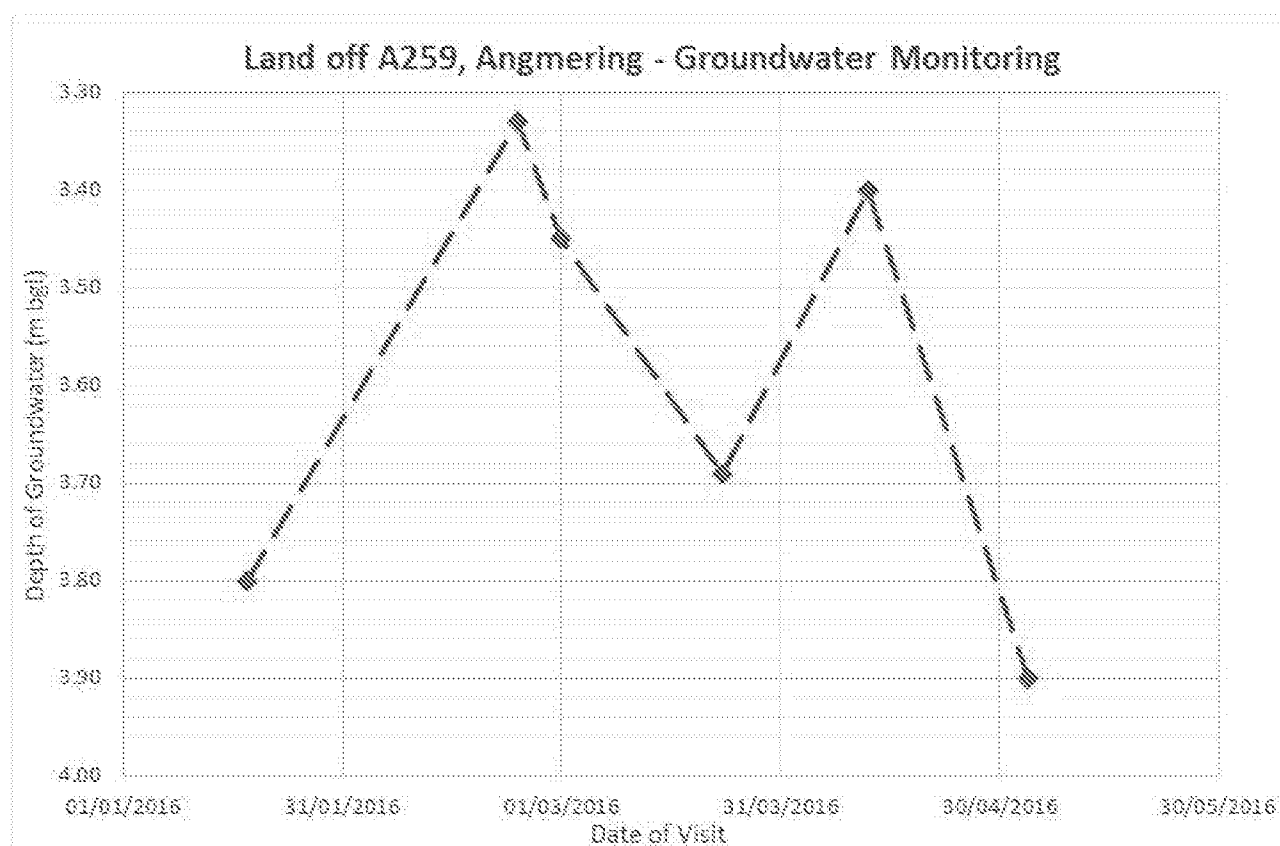
Groundwater monitoring was undertaken by Soils limited on four occasions over a period of three months. Monitoring was undertaken by means of manual dipping of the wells. Groundwater monitoring results have been presented in Table 1 and are displayed in Graph 1.

Table 1 Summary of Groundwater Monitoring

Borehole number	Depth to water (m bgl)					
	18/01/2016	24/02/2016	01/03/2016	23/03/2016	12/04/16	04/05/2016
BHI	3.80 ¹	3.33	3.45	3.69	3.40	3.90

Notes: ¹ = Reading taken during drilling of borehole; n/r = not recorded

Graph 1 Groundwater Monitoring Within Borehole BHI



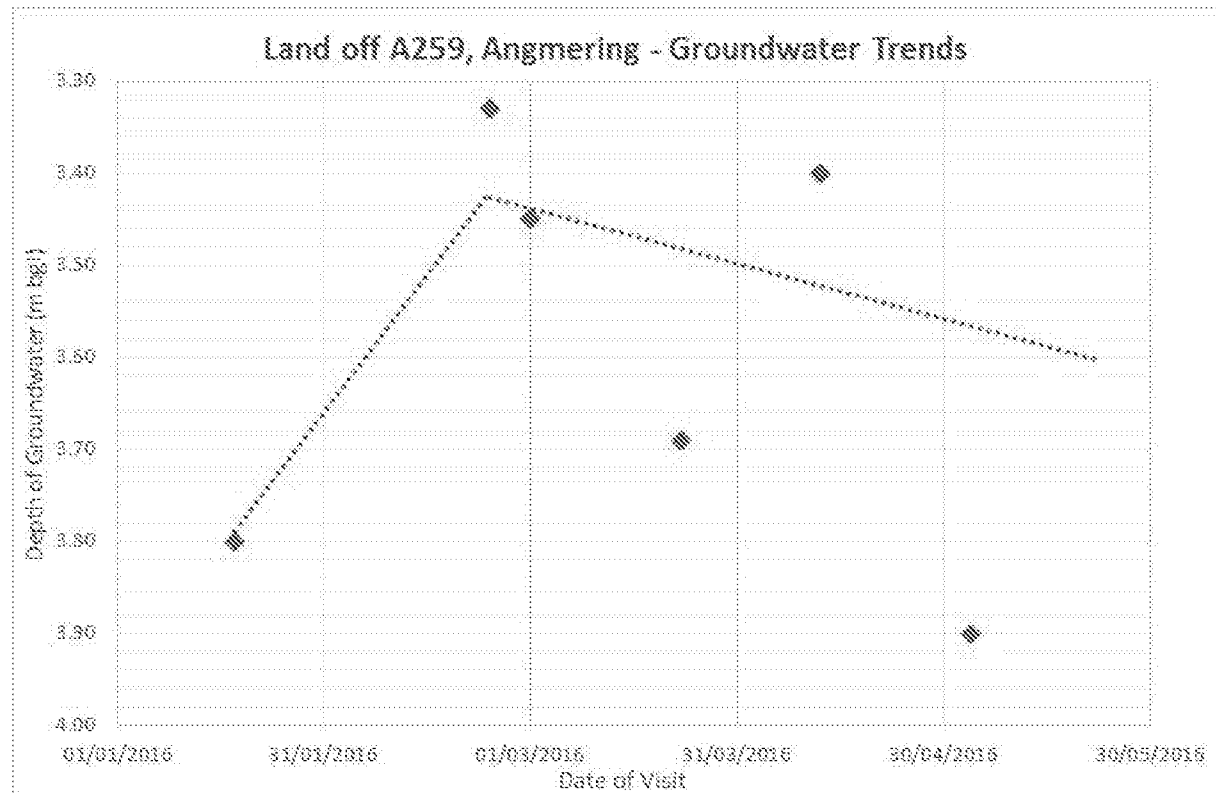
The groundwater reading for 18th January was recorded during the drilling of the borehole. The graph showed the increase in groundwater depth between January and April. It must be noticed that every single reading has its own importance for the definition of the highest groundwater depth. The readings, however, also showed the natural oscillatory behaviour of groundwater level, with influence from a number of factors including precipitation and site characteristics.

Conclusions

Graph 1 shows that, as anticipated, groundwater was rising from the annual minimum, which typically occurs around November, to the annual maximum, usually occurring around March.

The highest measured groundwater level was 3.33m bgl and was attained on 24th February 2016 and thereafter the readings varied between 3.45m and 3.40m bgl, with an intermediate reduction at 3.69m bgl. Notwithstanding the single readings, well-defined trends could be identified and showed how the average of groundwater depth was reducing after the peak conditions identified between February and March 2016. Those trends were reported in Graph 2.

Graph 2 Expected Groundwater Trends



The readings oscillated around the trendline and, as a consequence, it could not be excluded that in the following months the groundwater level, for example after intense periods of rainfall and also depending on the general site conditions, could occasionally rise again to values higher than the ones represented by the trendline or alternatively change or invert the trend. All of these must be considered as a part of the natural oscillations of groundwater.

Should you have any further questions please do not hesitate to contact the undersigned.

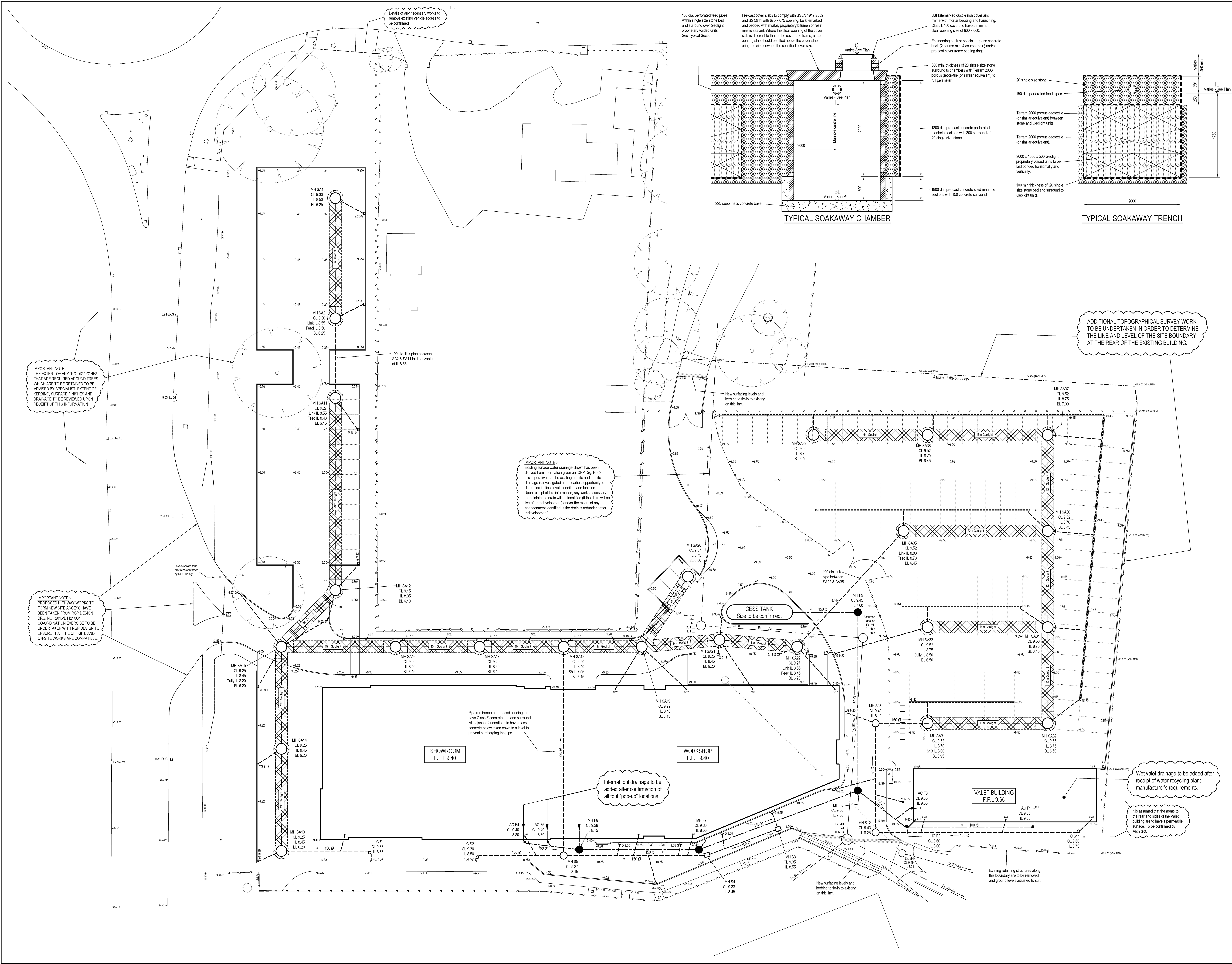
Yours Sincerely

[Redacted Signature]

Dr. D. V. Reddy, M. Eng, Ph.D., C. Eng.

Principal Geotechnical Engineer

[Redacted Contact Information]



INFORMATION WITHIN THIS DRAWING IS NOT NECESSARILY PRODUCED TO SCALE
ALWAYS USE FIGURED DIMENSIONS AND CO-ORDINATES - IF IN DOUBT, ASK.

NOTES

- This drawing to be read in conjunction with Eastwood & Partners' drawing number 40923/062.
- All pipes shall be either :-
 - A - Verified clay to BS EN 295 with a minimum crushing strength as follows :-
 - 150 dia - 40 kN/m
 - 225 dia - 45 kN/m
 - 300 dia - 72 kN/m
 - B - Class H concrete to BS 5911. **OR**
 - C - PVC to have BS1 kitemark status (certified to WS 4-35-01) Wavin or similar approved. Maximum pipe length to be 3m.
- All pipes are to be laid soffit to soffit at manholes unless noted otherwise.
- Pipes entering manholes and road gullies shall have a flexible joint within 600 of the inside of the manhole or gully joining with a short Rocker pipe.
- All pipes to be 100 dia. unless noted otherwise.
- All works and materials to be in accordance with "Sewers for Adoption" (16th edition), bedded with a Class S granular bed and surround as a minimum requirement. Pipes within highways with cover less than 1200 to have a Class Z concrete bed and surround. Pipes within paved areas with cover less than 600 to have a Class Z concrete bed and surround. Pipes within landscaped areas with cover less than 300 to have a Class Z concrete bed and surround.
- All trenches in roads and paved areas shall be backfilled with Type 1 DOT granular sub-base material.
- All cover levels are indicative only. Covers to be set to suit camber/gradient of existing and proposed surfacings.
- The invert levels at the proposed points of connection to existing drains shall be checked **before any new drains are constructed**. Any variation to the levels shown on the drawing shall be notified to Eastwood & Partners.

- Ex. surface water drainage
- Surface water drainage abandoned
- Surface water drainage
- Foul drainage
- Soakaway system consisting of 1800 dia. silt trap soakaway chambers and 2000 wide soakaway trenches - see Typical Details.
- ACO M1000 drainage channel with 150 dia. rodable sump outlets (or 100 dia. outlets where indicated) and used Class C250 covers.
- G Road gully with 150 dia. rodable outlet.
- Y Yard gully with 100 dia. rodable outlet.
- T Trapped gully with 100 dia. rodable outlet.
- IC 450 min. dia. Polypropylene inspection chamber.
- AC 300 min. dia. Polypropylene access chamber (600 max. depth).

IMPORTANT NOTES :-
Foul drainage systems to be reviewed after confirmation of all proposed foul "pop-up" locations. Roof rainwater branches to main runs to be reviewed after confirmation of all rainwater down pipe locations.

E	Link pipes between soakaway systems added. Protection to pipe SS - SA18 below building added. Assumed RMP and branch connections indicated.	MW	SJE	25.08.17
D	Soakaways amended following on site percolation test.	MW	SJE	22.08.17
C	Tender issue.	MW	SJE	28.04.17
B	Foul drainage amended to suit fully recycling car wash.	MW	SJE	20.04.17
A	First Issue.			
REV	DESCRIPTION	SIG	CHK	DATE

CAFFYNS

AUDI
WORTHING

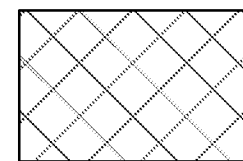
EXTERNAL DRAINAGE LAYOUT

Eastwood & Partners
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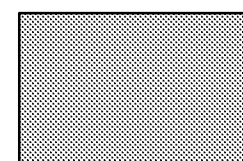
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1:200 1/25		FOR APPROVAL	
DRAWN	CHECKED	DATE	DRAWING NUMBER
MW	SJE	11-04-17	40923/061
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INFORMATION WITHIN THIS DRAWING IS NOT NECESSARILY PRODUCED TO SCALE.
ALWAYS USE FIGURED DIMENSIONS AND CO-ORDINATES - IF IN DOUBT, ASK.

NOTES



Permeable storage area
150mm thickness of Type 3 stone.
Permeable geotextile.
150mm thickness 6F2 granular material.



Tarmac access
30mm thickness of 10mm size close graded surface course.
55mm thickness of 20mm size dense base course.
250mm thickness of DTp Type 1 granular material.

A	First Issue.			
REV	DESCRIPTION	SIG	CHK	DATE

CAFFYNS

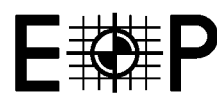
AUDI
WORTHING

TEMPORARY VEHICLE STORAGE AREA

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SCALE WHEN PLOTTED AT A1

1:125

DRAWING STATUS

PRELIMINARY

DRAWN	CHECKED	DATE	DRAWING NUMBER	REV
MW	SJE	13-04-17	43413/001	A

