

Caffyns Volvo Worthing
Proposed Drainage Strategy

The proposals involve the construction of a car dealership building with associated vehicle display, parking and circulation areas on an unoccupied area of scrubland, formerly part of the nearby Haskins Garden Centre. The proposed site layout is shown on the appended SRA Architects Drg. No. 3661-SRA-XX-XX-DR-A-09-001 Rev.P02.

Existing Site Arrangement

The existing site arrangement is shown on the appended Survey Solutions Drg. No. 36763BWLS-01 Rev.B. As can be seen, a large part of the site consists of gravel areas with a network of concrete walkways. The remainder of the site is predominantly grassed, with some trees and shrubbery.

Existing Foul Drainage

There is currently no foul discharge from the site and the former usage makes it is unlikely that there has ever been any positive foul drainage. The appended Southern Water record plan shows that there are no gravity foul or combined sewers in the area. A pumping main of unknown size is shown to be within Roundstone Lane to the west of the site.

However, a review of information available on the Arun District Council planning portal for the recently completed Quiet Waters Close residential development immediately to the north suggests that a new foul drainage system was to be installed to serve those properties. Further investigations are to be undertaken to determine the route of this system and it's suitability to accept the flows from the proposed car dealership development.

Proposed Foul Drainage Strategy

The routing of foul discharge will be dependent upon the method and location of discharge from the site. The preferred method of disposal will be to the foul drainage system serving Quiet Waters Close, subject to agreement with the system owner.

Should disposal to this system not be possible for whatever reason it is proposed that the foul discharge from the development is collected within a traditional gravity drainage system and conveyed to a new private cess tank within the site. This is the same solution as is utilised for the adjacent Audi dealership.

Existing Surface Water Drainage

The appended Southern Water sewer record shows that there are no surface water sewers within the area. The former usage of the site makes it unlikely that there has ever been any positive surface water drainage from the area.

Proposed Surface Water Strategy

In accordance with National Policy, consideration should initially be given to the discharge of surface water to ground via soakaways or other infiltration methods. At this time, intrusive investigations have not been undertaken, but from experience on the adjacent Audi dealership development and the disposal method shown for the Quiet Waters Close scheme, it is highly likely that disposal by soakaways will be viable. Trial pit excavations and infiltration testing are to be carried in the near future to confirm this and establish an appropriate infiltration rate to be used within the detail design of the soakaways.

Winter groundwater monitoring within a borehole close to the site was undertaken between January and May 2016 in support of the application for the Audi dealership development. This showed that the highest recorded water level was 3.3m below ground level. It is anticipated that a similar water level will be present within the application site.

In order to reduce flood risk to others, the proposed soakaways are to be designed to prevent flooding from the site during all rainfall events up to and including the 1 in 100 year return period plus an allowance of 40% for climate change. Subject to detail level design and client approval, some shallow above ground surface ponding may be utilised as part of the overall storage, limited to events in excess of the 1 in 100 year period without climate change allowance.

In order to determine the likely extent and size of the proposed soakaway system, the appended calculation sheets SW1 & SW2 have been prepared. These take the same infiltration rate that was agreed for the Audi dealership development, a rate of 1.3×10^{-6} . As discussed above, on-site testing will be undertaken to establish an appropriate infiltration rate for this site and the calculations amended as necessary.

A copy of the results of the infiltration testing and groundwater monitoring which was undertaken previously within the Audi dealership site is appended, along with a copy of the email correspondence with Arun District Council agreeing to the surface water drainage strategy for that development.

Proposed Site Drainage Layout

Appended is Eastwood & Partners Drg. No. 46357/011B showing a preliminary surface water drainage system based upon the strategy outlined within this document. The appended Drg. No. 46357/012A shows typical details of the proposed surface water soakaway chambers and linking trenches. As discussed above, the foul drainage system layout will be dependent upon the method of disposal and will be determined at detail design stage.

Flood Routing

Flood routing will be determined at detail design stage. It is intended that the new building floor level be raised above the proposed surrounding perimeter surfacing levels.

Proposed Maintenance

The foul and surface water drainage systems will remain private and will be maintained by the Dealership Management in accordance with the appended External Drainage Maintenance Schedule.



Caffyns Volvo Worthing

Drawing Title
Site Plan

Amendments
Planning Issue

Drawing No.
3661-SRA-XX-XX-D-A-09-001

Revision
P02

Project No.	Originator	Project	Target	Form	Date	Revision	Number
MR	MR	-	-	-	15/12/2021	PLANNING	

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TOPOGRAPHICAL & MEASURED BUILDING SURVEYS

ABBREVIATIONS & SYMBOLS

AB	Arch Height	ER	Earth Road	RSD	Roller Shutter Door
AB	Arch Brick	ET	EP Transformer	RSJ	Roller Steel Joist
AR	Assumed Road	FB	Flow Bed	SI	Sign Post
AV	Air Valve	FBD	Floor Board Direction	SP	Arch Spring Point Height
BB	Belted Beacon	PH	Fix Hydrant	SV	Stop Valve
BH	Born Hole	PL	Floor Level	SV	Cable Slew
BL	Bed Level	FP	Flag Pole	SW	Surface Water
BO	Bollard	PW	Foot Water	Tac	Tackle Paving
BPP	Brake Post	GG	Gully Grate	TH	Top of Wall
BS	Bus Stop	GV	Gas Valve	TC	Telecom Cover
BU	Bush	HH	Head Height	TH	Top of Wall
BW	Barbed Wire Fence	IC	Inspection Cover	THL	Threshold Level
BX	Box (Utilities)	IL	Invert Level	TL	Traffic Light
C/B	Close Board Fence	IR	Iron Railings	TP	Telegraph Pole
CH	Chill Height	KD	Kent Casket	TV	Cable TV Cover
CL	Cover Level	LP	Lamp Post	TS	Traffic Signal Cover
CL	Chain Link Fence	MH	Manhole	UTS	Unable To Survey
CLV	Ceiling Level	MP	Marker Post	UC	Unknown Cover
CL	Column	NB	Name Board	UK	Unknown Tree
C/P	Chestnut Paling Fence	OHL	Overhead Line (approx)	UMG	Unmeasured Ground
CR	Cable Rider	PA	Panel Fence	USL	Under Side Beam
CW	Chicken Wire	PS	Post Box	UTS	Unable To Survey
DC	Drainage Channel	PM	Parking Meter	VP	Vent Pipe
DH	Door Head Height	PO	Post	WB	Waste Bin
DI	Disinfectant	PR	Post & Rail Fence	WH	Wing Hole
DP	Down Pipe	PAW	Post & Wire Fence	WL	Water Level
DR	Drain	PW	Partion Wall	WM	Water Meter
ED	Electric Box	RE	Routing Eye	WO	Wash Out
EC	Electric Supply Cover	RL	Ridge Level	RP	Reflector Post
EL	Eaves Level	RS	Road Sign	RS	Road Sign
EP	Electric Pole	RS	Road Sign	RS	Road Sign

DRAWING NOTES

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type including roof line details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including: sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Surveyed physical features may not necessarily represent the legal boundary line.

Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

Cill heights are measured as floor to the cill and head heights are measured from cill to the top of window.

General

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The survey control listed is only to be used for topographical surveys at the stated scale. All control must be checked and verified prior to use.

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Do not scale from this drawing.

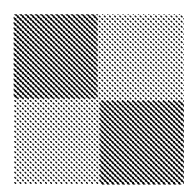
SURVEY CONTROL CO-ORDINATES

STATIONS	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
ST01	507444.407	103354.918	10.525	PK Nail
ST02	507440.102	103354.032	10.422	PK Nail
ST03	507435.051	103374.570	10.408	PK Nail
ST04	507398.083	103364.881	10.105	Peg & Nail
ST05	507417.254	103308.521	10.031	Peg & Nail
ST06	507460.716	103308.432	9.727	Peg & Nail
ST07	507485.986	103338.771	10.482	Peg & Nail

SURVEY GRID AND LEVEL DATUM

The coordinate system established for this survey is related to Ordnance Survey (OS) national grid at a single point using Smartnet, then orientated to grid north with a scale factor of 1.000.
The level datum established for this survey is related to Ordnance Survey (OS) using GPS Smartnet.
To avoid discrepancies any coordinated data used in conjunction with this survey must be derived directly from this control data.

REV	DESCRIPTION	DRAWN	APPR	DATE
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SURVEY SOLUTIONS

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PROJECT TITLE WORTHING SUDI, ROUNDSTONE ROAD ANGMERING, WEST SUSSEX, BN14 8AH			
DRAWING DETAIL TOPOGRAPHICAL SURVEY Sheet 1 of 1			
CLIENT CAFFYNS	SCALE 1:200		
SURVEYOR RT	SURVEY DATE 02/11/2021	CHECKED BY JG	APPROVED BY MB
DRAWING NUMBER 36763B/WLS-01	REVISION A	DWG STATUS FINAL	
		ISSUE DATE 08/11/2021	





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Date: 17/11/21

Scale: 1:1000

Map Centre: 507440,103311

Data updated: 20/10/21

Our Ref: 704494 - 2

Wastewater Plan A3

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2021 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

mail@eastwoodandpartners.com

46357



SW1 46357 Volvo, Worthing - Soakaway System



Calculation of Soakaway Size
Using the method given in BRE Digest 365:2016

Inflow to soakaway

Area of Britain: England & Wales Scotland & N Ireland

Rainfall ratio $r =$ **0.35** **0.00**

Impermeable Area = **2400 m²**
Infiltration rate = **1.3 m/s x 10⁻⁶** or 0.0001 m/min
Climate change = **40%**

Time	Rainfall		Rainfall		Inflow	Rainfall		Rainfall	Inflow
<i>min</i>	<i>Z1</i>	<i>M5-D mm</i>	<i>Z2</i>	<i>M10-D mm</i>	<i>m³</i>	<i>Z2</i>	<i>100-D mm</i>	<i>100yr + CC</i>	<i>m³</i>
5	0.36	7.20	1.21	8.70	20.9	1.87	13.45	18.83	45.2
10	0.51	10.20	1.22	12.44	29.9	1.91	19.48	27.27	65.5
15	0.62	12.40	1.22	15.13	36.3	1.91	23.68	33.16	79.6
30	0.79	15.80	1.23	19.43	46.6	1.95	30.81	43.13	103.5
60	1.00	20.00	1.24	24.80	59.5	2.00	40.00	56.00	134.4
120	1.22	24.40	1.24	30.26	72.6	2.00	48.80	68.32	164.0
240	1.50	29.94	1.24	37.13	89.1	2.02	60.48	84.67	203.2
360	1.69	33.80	1.23	41.69	100.1	2.00	67.60	94.64	227.1
600	1.95	38.94	1.23	47.77	114.6	1.98	77.10	107.94	259.1
1440	2.48	49.60	1.22	60.26	144.6	1.96	96.97	135.76	325.8

Outflow from Soakaway

Soakaway Properties - Trench

Length = **62.00 m**

Width = **3.00 m**

Working Depth = **2.10 m**

Void Ratio = **0.77**

Factor of Safety = **1.5**

Storage = 300.76 m³

Soakaway Area (a_{s50}) = 136.50 m²

Outflow = 0.007 m³/min

Soakaway Properties - Chamber

Internal Dia = **1.80 m**

Outer Dia = **2.60 m**

Working Depth = **2.00 m**

Internal Void Ratio = **1.0**

Outer Void Ratio = **0.3**

Factor of Safety = **1.5**

Number of Chambers **3**

Inner Storage = 5.09 m³

Outer Storage = 1.66 m³

Total Storage/Chamber = 6.75 m³

Total Storage = 20.24 m³

Soakaway Area (a_{s50}) = 8.17 m²

Outflow = 0.001 m³/min

SW2 46357 Volvo, Worthing - Soakaway System



Calculation of Soakaway Size
Using the method given in BRE Digest 365:2016

Storage Required

Time <i>min</i>	10 yr			100 yr + CC		
	Inflow <i>m³</i>	Outflow <i>m³</i>	Storage <i>m³</i>	Inflow <i>m³</i>	Outflow <i>m³</i>	Storage <i>m³</i>
5	20.9	0.0	20.8	45.2	0.0	45.1
10	29.9	0.1	29.8	65.5	0.1	65.4
15	36.3	0.1	36.2	79.6	0.1	79.5
30	46.6	0.3	46.4	103.5	0.3	103.3
60	59.5	0.5	59.0	134.4	0.5	133.9
120	72.6	1.0	71.6	164.0	1.0	163.0
240	89.1	2.0	87.1	203.2	2.0	201.2
360	100.1	3.0	97.0	227.1	3.0	224.1
600	114.6	5.0	109.6	259.1	5.0	254.0
1440	144.6	12.1	132.6	325.8	12.1	313.8

Minimum 100 yr + CC storage required = 313.76 m³
Storage Provided = 321.01 m³

Soakaway volume is satisfactory

Storage required after 24 hour 10 yr storm period should not be greater than half the storage provided

Half storage provided = 160.50 m³
Storage required after 24 hr = 132.58 m³

Soakaway rate is satisfactory

Additional storage where an impermeable layer overlies permeable ground:-

Working depth above permeable layer = 0.00 m
Additional storage = 0.00 m³
Total storage = 321.01 m³
Minimum Storage Required = 313.76 m³

Soakaway volume is satisfactory

3.2 Infiltration Tests (BRE Digest: 365)

Infiltration tests were performed at three locations (SK1, SK2 and SK3) during the investigation in an area of the site proposed for an infiltration basin in order to provide guidance on the suitability of the ground for the adoption of a surface water drainage system. The test strata comprised the River Terrace Deposits. Tests were conducted in accordance with the principles of BRE Digest 365 Soakaway design: 2003.

BRE 365 states that for an accurate infiltration rate to be obtained a soakage pit needs to be filled three times in quick succession. Each test is completed once 75% of the water present has drained away, in order to determine whether or not the underlying ground conditions may be suitable for surface water drainage. Three tests were carried out in trial pit SK2, whereas only a single test was conducted in trial holes SK1 and SK3 due to time constraints on site. Calculations were carried out according to the methods reported in BRE 365 Soakaway design: 2003.

The test comprised piping water via a 10,000L tanker into the open trial hole, the drop in water level over time was then recorded to give an indication of soakage potential.

Table 3.5 Infiltration Test Results

Trial Hole/Test	Test Stratum	Test Depth (m bgl)	Infiltration Rate (m/sec)
SK1-T1	RTD	3.02	Insufficient Infiltration
SK2-T1	RTD	2.97	8.878×10^{-5}
SK2-T2	RTD	2.90	6.656×10^{-5}
SK2-T3	RTD	2.80	7.967×10^{-5}
SK3-T1	RTD	3.04	Insufficient Infiltration

In addition to the infiltration tests, four constant head tests were performed in trial hole BH1. The infiltration rate was calculated by means of the time taken to infill the borehole with a known volume of water (30 litres) in order to keep the water level constant.

Table 3.6 Constant Head Tests

BH No.	Time to fill 30 litres (Seconds)				Average flowrate l/sec
	1	2	3	4	
1	70.95	48.08	52.23	68.45	0.514

In summary the average flow rate determined from the four constant head tests was **0.514l/sec.**

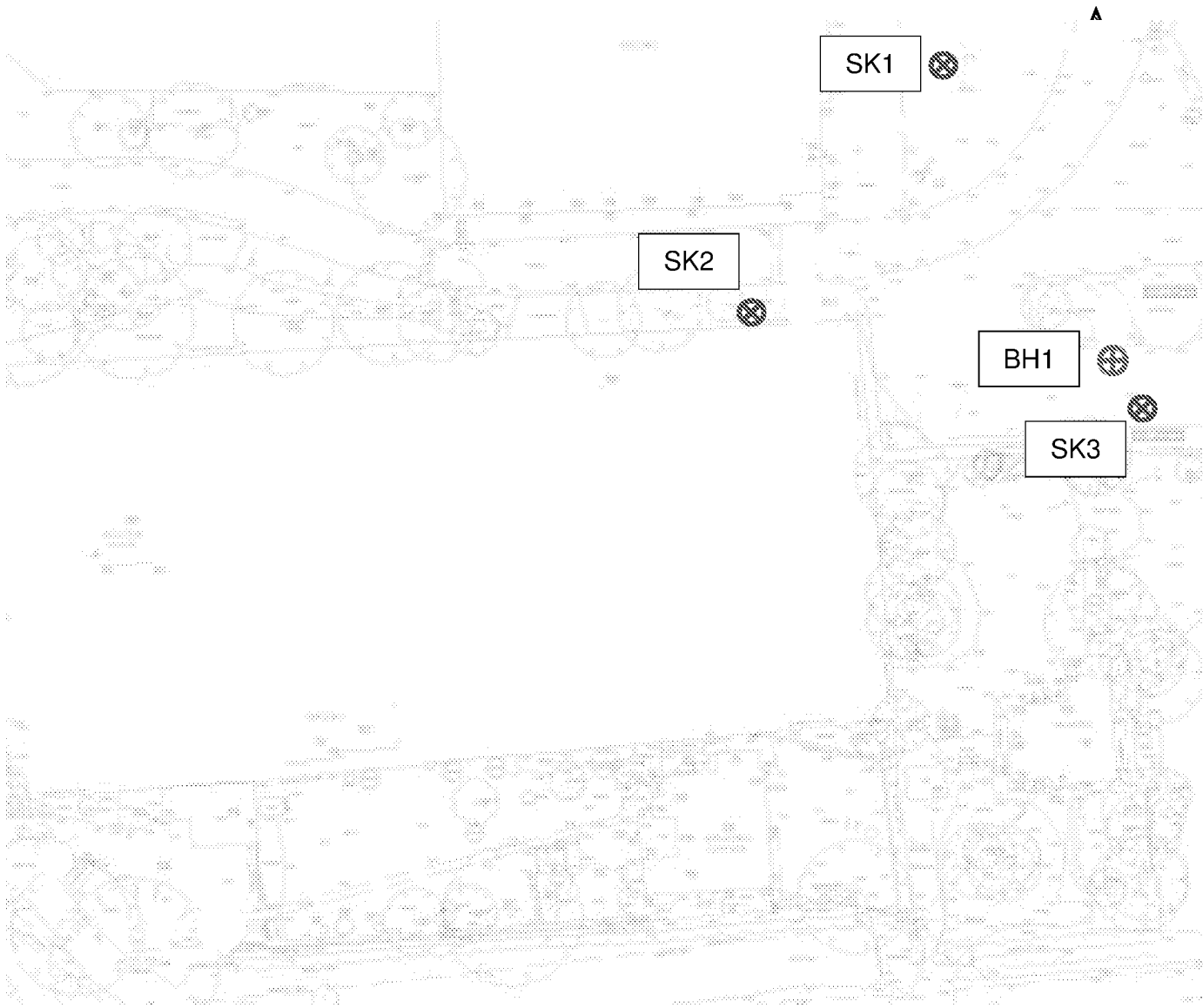


Figure number
3

Project
Land North of A259, Angmering,
West Sussex BNI 6 IED

Client
The Civil Engineering Practice on
behalf of Caffyns Audi

Title
Trial Hole Location Map

Date
February 2016

Job Number
15366

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.

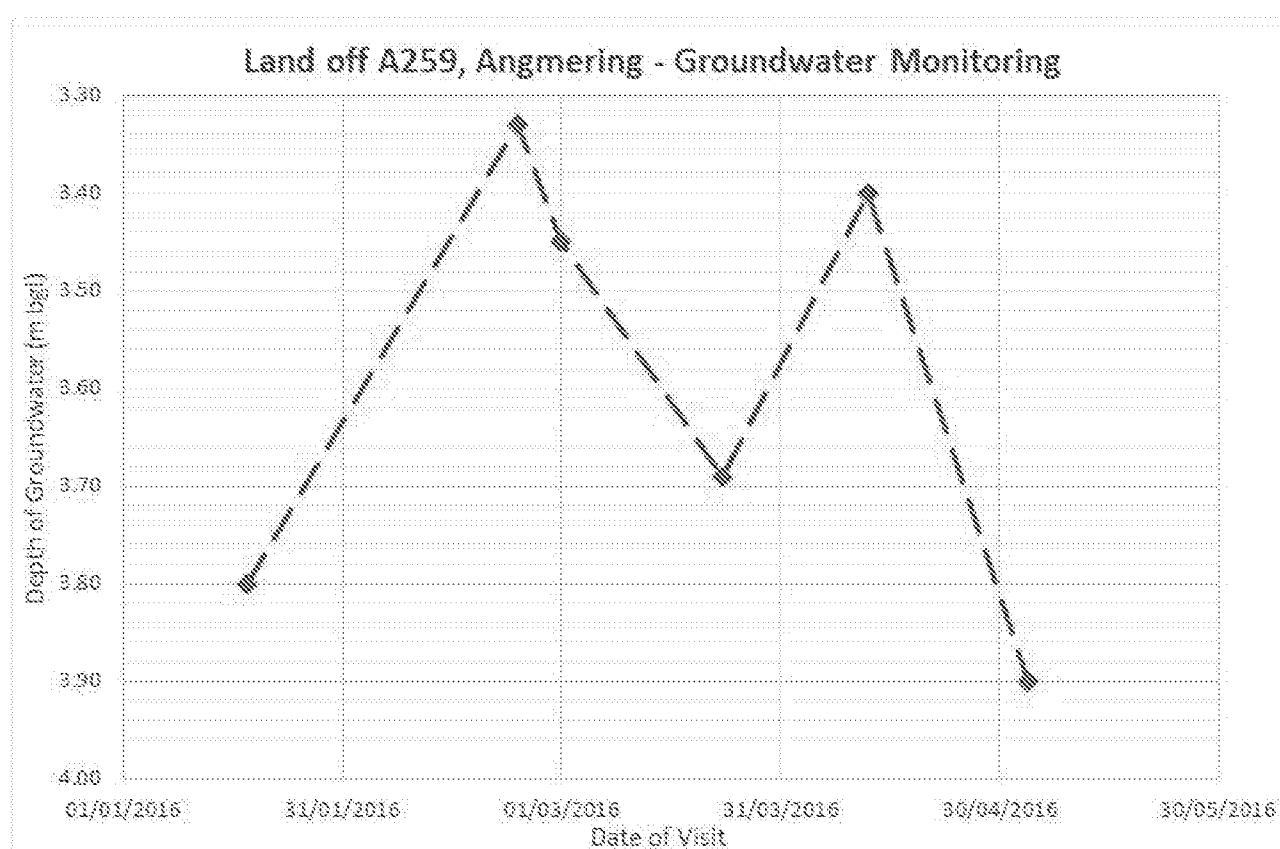
Groundwater monitoring was undertaken by Soils limited on four occasions over a period of three months. Monitoring was undertaken by means of manual dipping of the wells. Groundwater monitoring results have been presented in Table 1 and are displayed in Graph 1.

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



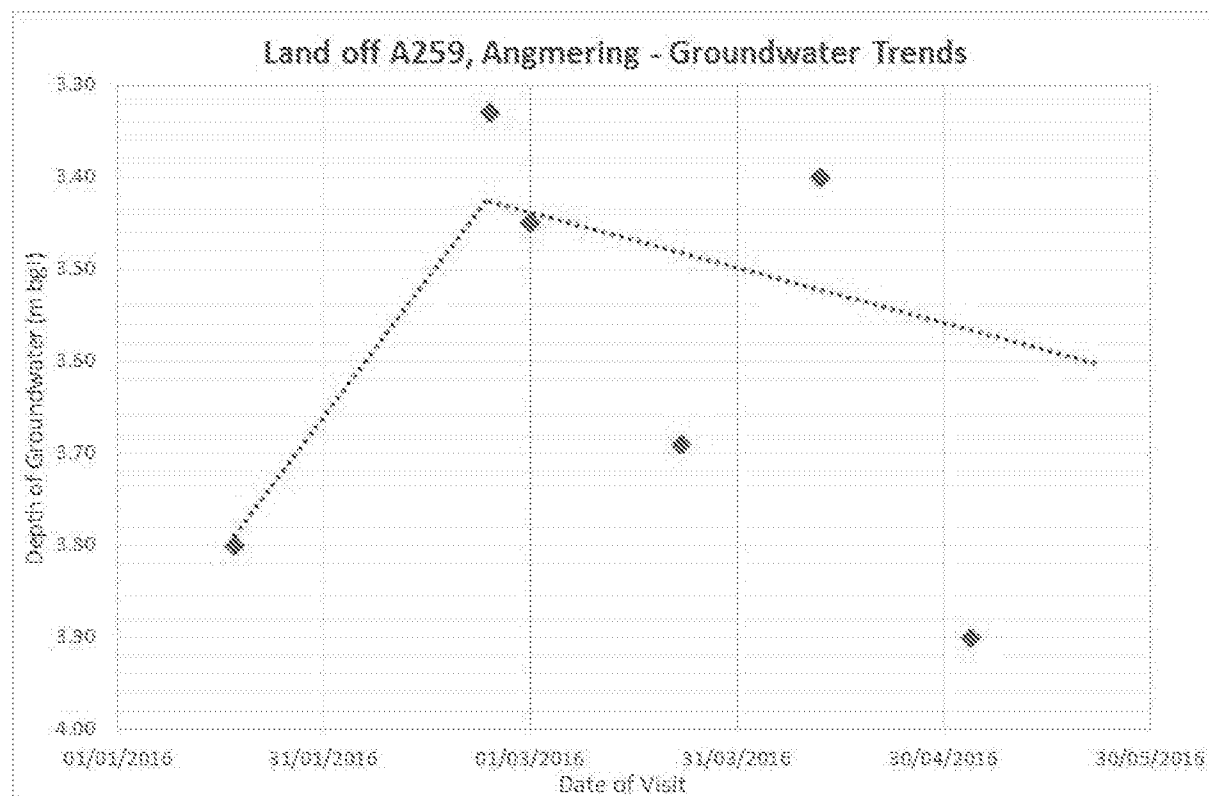
The groundwater reading for 18th January was recorded during the drilling of the borehole. The graph showed the increase in groundwater depth between January and April. It must be noticed that every single reading has its own importance for the definition of the highest groundwater depth. The readings, 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

Dr DV Tedesco MEng, PhD, Chlta.
Principal Geotechnical Engineer

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Surrey
GU1 1EA

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.

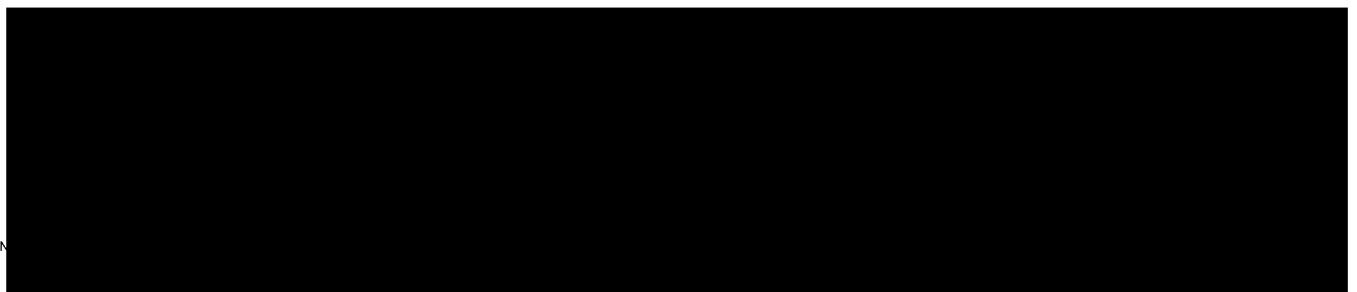
Site Works

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





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)

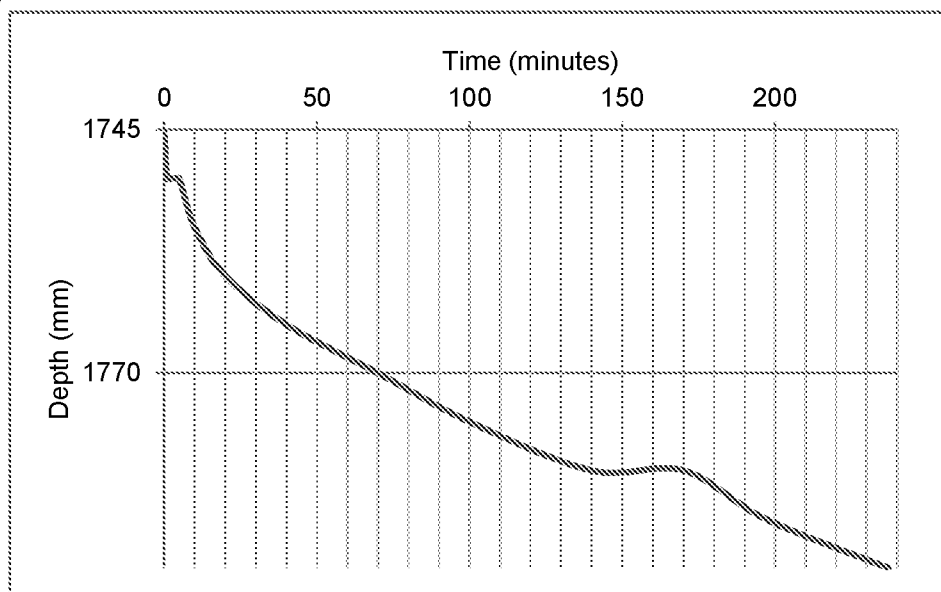
Approximate time to discharge water into the hole:

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

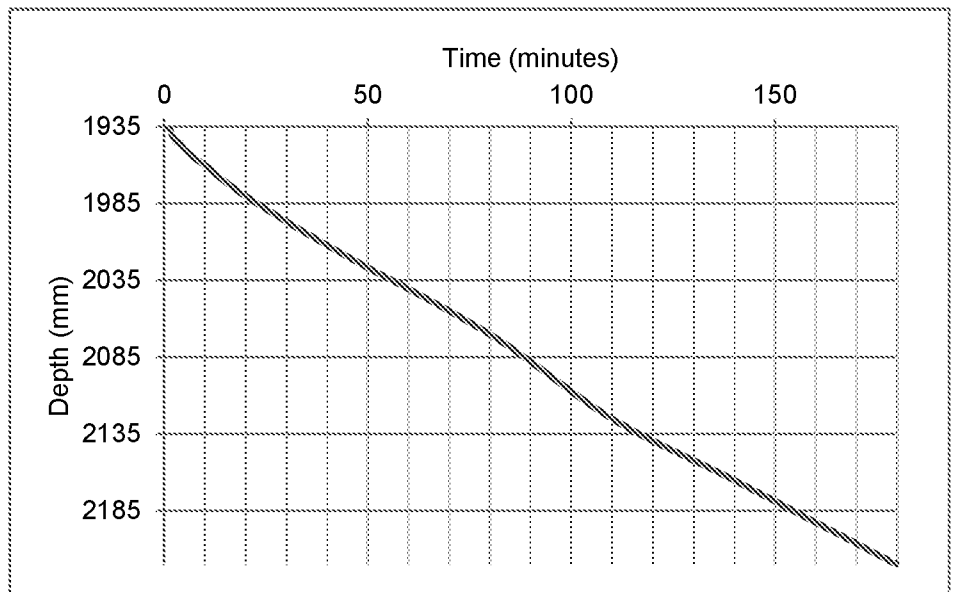
Test No. SA2

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

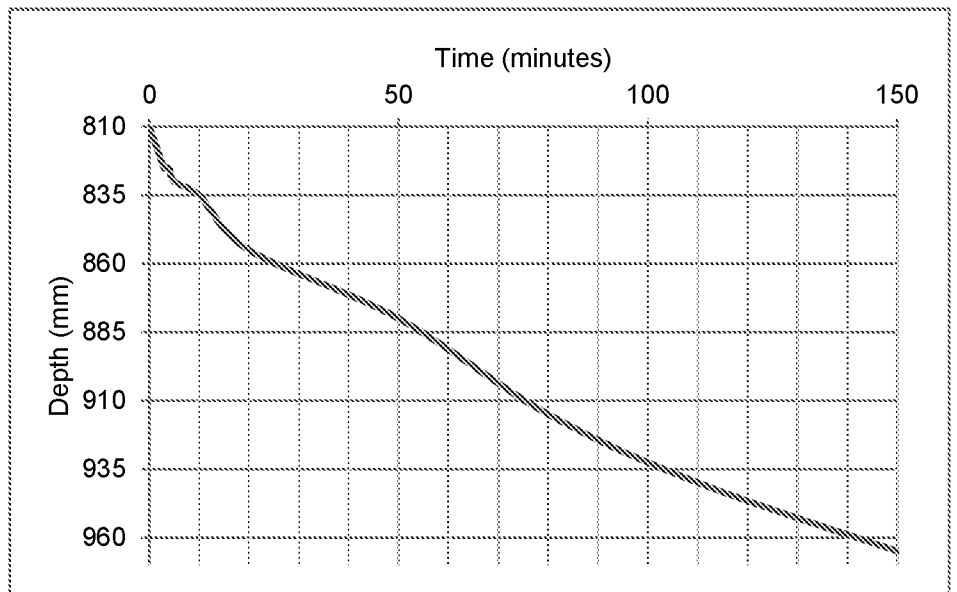
Test No. SA3

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

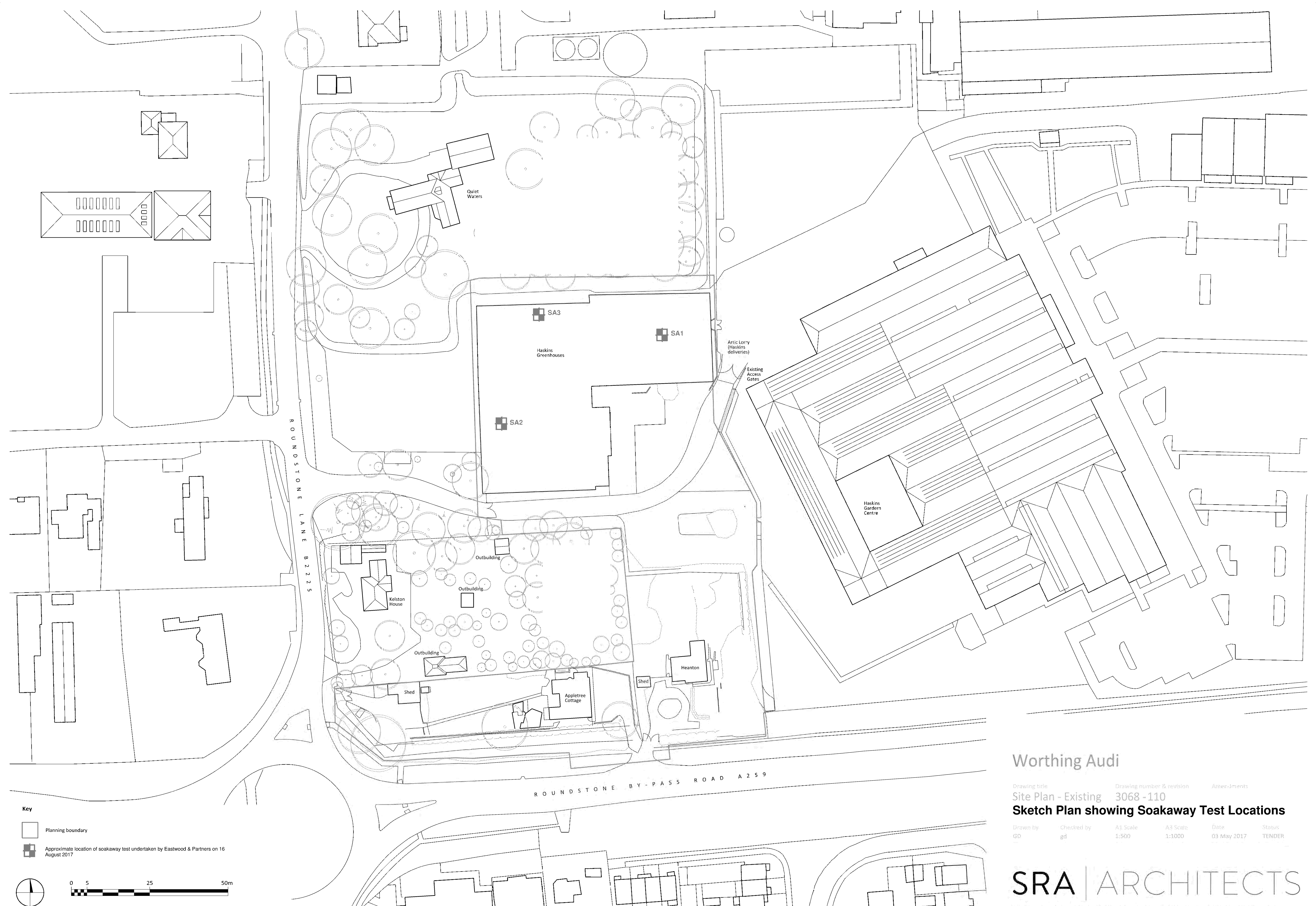
a_{p50} = 2.50 m²

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)

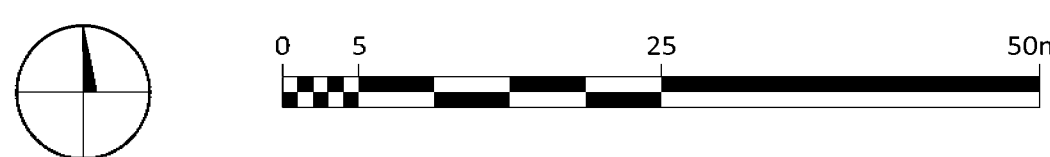
BR365 Soil Infiltration Rate = N/A m/sec
Average Infiltration Rate = 7.8E-06 m/sec



Key

Planning boundary

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



Worthing Audi

Drawing title	Drawing number & revision	Amendments
Site Plan - Existing	3068 -110	
Sketch Plan showing Soakaway Test Locations		
Drawn by	Checked by	A1 Scale
GO	gd	1:500
		A3 Scale
		1:1000
Date	Status	
03 May 2017	TENDER	

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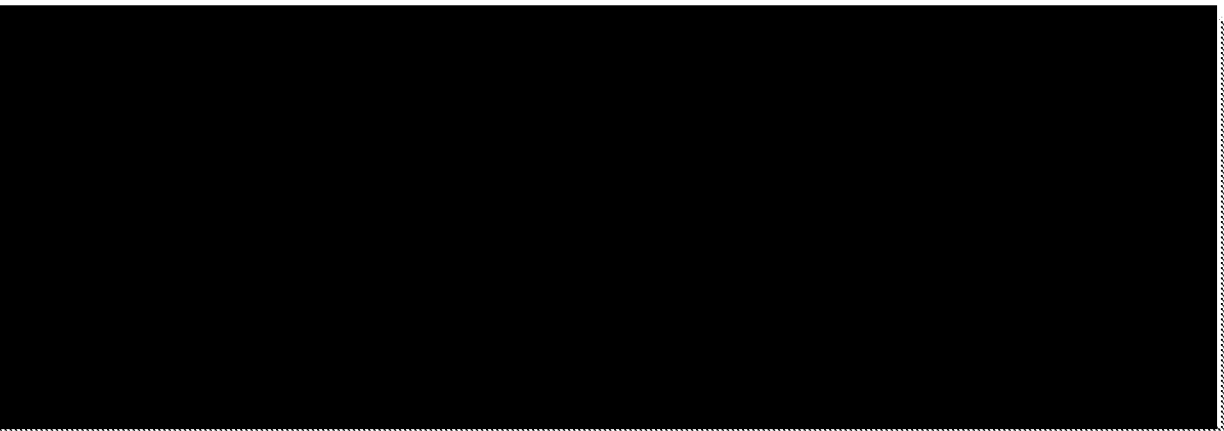
From: Thomas Callaway [REDACTED]
Sent: 16 March 2017 13:51
To: 'Steve English'
Cc: Hugh Parker; david hawtin; Garry Davies
Subject: [pending]RE: 40923 - Audi Worthing - Initial Proposed Drainage Strategy

Steve

The principal for the surface water drainage design is fine. I have asked the planning officer to get back to you confirming what will be possible regarding the wording of the condition.

Regards

Tom Callaway



From: Steve English [REDACTED]
Sent: 14 March 2017 23:46
To: Thomas Callaway
Cc: Hugh Parker; david hawtin; Garry Davies
Subject: 40923 - Audi Worthing - Initial Proposed Drainage Strategy

Tom,

[Planning Application Ref: A/162/15/PL](#)

Further to our telephone conversation yesterday regarding the proposed new Audi Dealership on the A259/Roundstone By-pass, Angmering, we have the following comments to make.

We have been appointed as Civil and Structural Engineers for the project and, as discussed, we wish to propose a drainage strategy for the development. Our proposed strategy differs from that produced by The Civil Engineering Practice in October 2016 (which had been developed following discussions with you). For your ease of reference (and as we have, at this stage, based our initial design information on design parameters within this document), please find attached a PDF copy of this document for your information.

Please also find attached a PDF copy of our initial sketch proposals detailing the fundamental principles behind our proposed drainage strategy for the site.

The surface water drainage proposals for this scheme follow the same principles that we adopted for our drainage design for the recently completed BMW Worthing dealership (just off the A259 approx. 1 mile from this location), which we liaised with you to obtain the required consents.

It is our proposal to collect the surface water run-off from the building and hard paved vehicle display/storage areas and discharge it to ground via a series of soakaway trenches designed to accommodate a 1 in 100 year rainfall event (plus 30% for climate change). The extent of soakaway trench, associated storage required (including within the manhole chambers/silt traps etc.) and any required above ground storage will be based upon the percolation test results obtained to date. As discussed, it is our proposal to utilise above ground storage (i.e. nominal surface ponding) for the additional 30% climate change only, for the rear compound area. Potential exceedance of this additional above ground storage would overtop the perimeter kerb and discharge to the adjacent strips of soft landscaping within the site boundary – this has been discussed and agreed with the end user/Client as acceptable. All other areas, including roof drainage, will be designed to accommodate the 1 in 100 year plus 30% below ground.

Based on the percolation test results available, the current underside of soakaway trench is expected to be at a depth of approximately 2.3 m, i.e. 1.0 m above the highest recorded ground water level.

It should be noted that the majority of the external hard standing area is for the storage or display of new/nearly new cars. There will be very little associated vehicle movements and these vehicles (in turn) will be kept clean (via the car wash down/valeting area) and free from potential surface water contaminants. As such, there is not likely to be any significant contaminants exposed to the surface water run-off that would need treatment. The gullies/drainage channels specified, will be trapped and have silt buckets that further assist in the removal of any suspended solids. There are not expected to be any significant source of metals to contaminate the surface water discharge from the site. Nor are there expected to be any significant hydrocarbon contaminants to be treated, as could be potentially expected in a public/supermarket car park for example.

As discussed briefly, permeable paving is not considered viable for this type of development in this location due to the presence of clay/underlying impermeable ground conditions close to the surface and the fact that maintenance of this type of surfacing would prove to be impracticable due to the logistics of removing and storing all the display vehicles etc. The proposed soakaway trench solution would facilitate the opportunity for future maintenance (or in the most severe case, a phased replacement/re-excavation of soakaway trenches).

The foul drainage provision from the development will be a traditional cesspit/tank to serve the toilets/canteen/building foul drainage. The car valet building will have a closed loop full recycling system by specialist manufacturer. In short, there will be no piped foul discharge from the site or foul discharge to ground for this development.

It is our understanding following our telephone discussion, that the above drainage strategy (as detailed on the attached sketch proposal) for this development is acceptable to you/Arundel District Council. We will, of course, produce a full drainage design and associated design calculations/scheme justification in due course for approval. In the meantime however, we would be grateful if you would confirm that the above correctly reflects our conversation and that you are satisfied with our approach to the foul and surface water drainage requirements for this development.

It should be noted that, at this time, we require confirmation that this Drainage Strategy is acceptable, in order for the pre-commencement planning condition to be discharged so that demolition of the existing buildings on the site can be carried out. Once this has been achieved, we will be in a position to undertake additional percolation tests/site investigation work to further justify the final drainage design. At this time the existing former greenhouses (formerly part of the Haskins development, which are currently positively drained into the Haskins current soakaway system) cover the majority of the

area of the proposed rear storage compound (i.e. location of the proposed soakaways). As such and as discussed yesterday, we are unable to undertake these additional tests in this area until such a time that demolition is permitted.

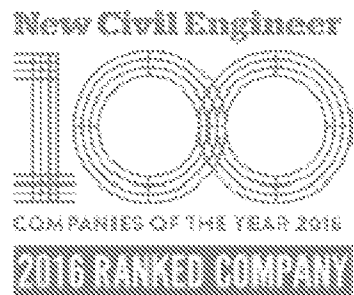
If you have any further queries, please do not hesitate to contact us.

Regards,

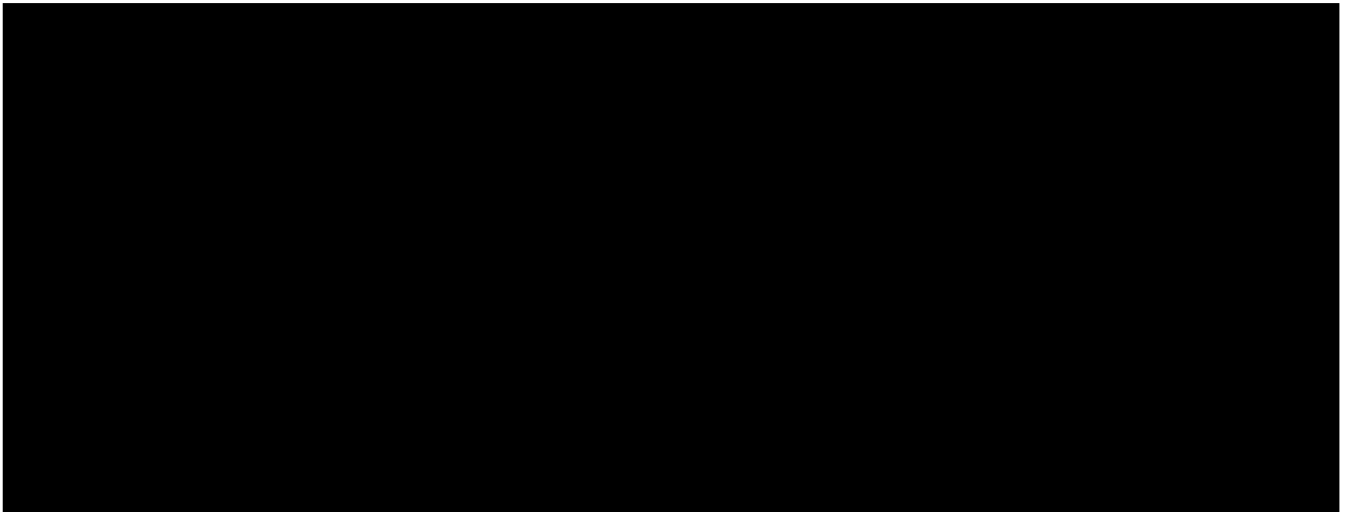
Steve English

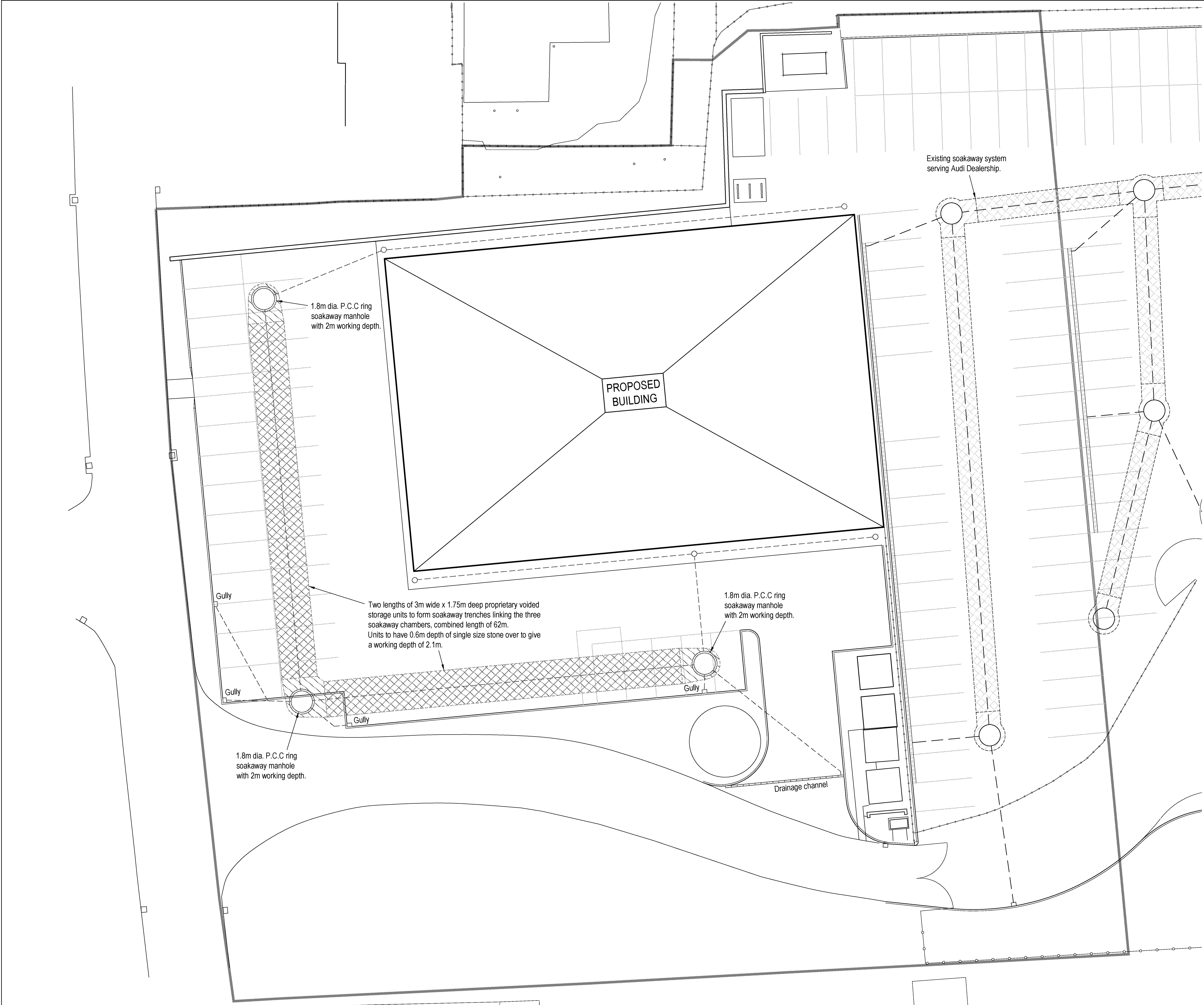
Director

Eastwood&Partners
CONSULTING ENGINEERS



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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

IMPORTANT NOTE :-
THE PROPOSED SURFACE WATER SOAKAWAY SYSTEM SHOWN IS BASED UPON AN ASSUMED INFILTRATION RATE OF 1.3×10^{-6} WHICH IS THE RATE AGREED FOR THE ADJACENT AUDI DEALERSHIP DRAINAGE DESIGN. INFILTRATION TESTS WITHIN THE PROPOSED SITE ARE TO BE UNDERTAKEN TO DETERMINE AN APPROPRIATE RATE TO BE USED IN THE FINAL DESIGN.

B	Updated to suit revised Architect's layout.	MW	SJE	16.12.21
A	First Issue.			
REV	DESCRIPTION	SIG	CHK	DATE

CAFFYNS

VOLVO
WORTHING

SURFACE WATER DRAINAGE
STRATEGY

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SCALE WHEN PLOTTED AT A1 1:150		DRAWING STATUS PRELIMINARY	
DRAWN MW	CHECKED SJE	DATE 09-12-21	DRAWING NUMBER 46357/011
			REV B



NOTES

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A	First Issue.			
REV	DESCRIPTION			SIG CHK DATE

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TYPICAL SOAKAWAY DETAILS

Eastwood & Partners CONSULTING ENGINEERS St. Andrew's House 23 Kingfield Road Sheffield S11 9AS Tel 0114 255 4554 Fax 0114 255 4330  mail@eastwoodandpartners.com www.eastwoodandpartners.com				
SCALE WHEN PLOTTED AT A1		DRAWING STATUS		
1:25		PRELIMINARY		
DRAWN	CHECKED	DATE	DRAWING NUMBER	REV
MW	SJE	09-12-21	46357/012	A

CAFFYNS VOLVO WORTHING

EXTERNAL DRAINAGE MAINTENANCE SCHEDULE

<u>CATEGORY</u>	<u>ACTION</u>	<u>FREQUENCY</u>
REGULAR	General removal of litter and debris from external paving and landscaping areas.	Monthly (or more frequently if required)
	Cleaning of gullies, drainage channels and drainage channel sump units to remove debris and silt.	6 monthly, after autumn leaf fall (or more frequently if necessary)
	Cleaning of manholes and silt trap soakaway manholes to remove debris and silt.	Annually, after autumn leaf fall (or more frequently if necessary)
	Inspection of all gullies, drainage channels, chambers, silt trap soakaway to identify and make good any defects as necessary, including CCTV survey and jetting/cleaning of pipework if necessary.	Annually and after major rainfall events.
	Inspection of all proprietary geo-cellular unit soakaways to identify and make good any defects as necessary, including CCTV survey and jetting/cleaning of pipework if necessary	Annually and after major rainfall events.
CORRECTIVE	Clear blockages in gully outlets, drainage channel outlets and branch connections.	As required
	Clear blockages in manholes, silt trap soakaway chambers and soakaways.	As required