

Soakaway Infiltration Report

Amazon Littlehampton DBN2

Presented to Gleave Partnership c/o Amazon

Issued: February 2020

Delta-Simons Project Number: 19-0138.08

Issue No.	Status	Issue Date	Comments	Author	Technical Review	Authorised
2	Final	10 th February 2020	Amended to include details of regulatory liaison	 Alex Hunter Graduate	 Tom Horner Associate	 Paul Bennett Unit Director

1.0 Authorisation and Purpose

Delta-Simons Environmental Consultants Limited (Delta-Simons) has been requested by Gleave Partnership on behalf of Amazon (the "Client") to undertake continuous groundwater level monitoring within three newly installed boreholes (BH101 to BH103) to identify the variation of winter groundwater levels at the Site. Further works included three BRE365 soakaway tests (SA101 to SA103) to provide information for the suitability and design for soakaways as a drainage solution at Amazon Littlehampton DBN2 (hereafter referred to as the "Site").

2.0 Limitations

No limitations were encountered during the works.

3.0 Context

Delta-Simons has previously completed the following reports pertaining to the Site:

- ▲ Short Form Geotechnical Report, Amazon DBN2 Refurbishment, Littlehampton, (Ref. 19-0138.04), dated March 2019; and
- ▲ Soakaway Infiltration Report, Amazon DBN2, Littlehampton, (Ref. 19-0138.07), dated May 2019.

A review of the Site's published geology and hydrogeology is provided below.

4.0 Desktop Information

From BGS mapping, the Site is indicated to be underlain by superficial River Terrace Deposits, followed by bedrock of the New Pit Chalk Formation. Ground conditions encountered during Delta-Simons previous investigation comprised a thin layer of Made Ground, overlying generally cohesive deposits to a maximum (proven) depth of 2.8 m bgl, followed by Chalk bedrock (encountered as clay in the south of the Site).

5.0 Regulatory Liaison

Arun District Council were contacted prior to any works commencing to confirm their satisfaction with the scope of works proposed. Email correspondence is included as Appendix A.

Prior to completion of the soakage testing, Delta-Simons contacted Sarah Burrow of Arun District Council to discuss the timing of the testing, following the completion of the groundwater level monitoring. An agreement was reached to undertake the soakage testing on the basis that groundwater levels had been shown to decrease over the monitoring period (see Section 6.0 below), however, it was agreed to extend the groundwater level monitoring following completion of the soakage testing, to ensure groundwater levels do not increase significantly following completion of the testing.

6.0 Fieldworks and Results

6.1 Groundwater Level Monitoring

Delta-Simons undertook a five-week period of continuous groundwater level monitoring within three newly installed boreholes (BH101 to BH103). The installed boreholes logged groundwater levels at 15-minute intervals to assess the diurnal variance of groundwater levels at the Site.

Table 1: Summary of Continuous Groundwater Level Data

Borehole Location	Highest Recorded Depth to Groundwater (cm bgl)	Date and Time	Lowest Recorded Depth to Groundwater (cm bgl)	Date and Time
BH101	247.885	21/12/2019 21:15	343.836	13/01/2020 03:00
BH102	281.989	21/12/2019 20:45	351.347	13/01/2020 03:15
BH103	208.946	21/12/2019 20:15	238.028	13/01/2020 03:15

The continuous groundwater level data identified an increase in depth to groundwater over the five-week monitoring period. This information was used to determine the design of soakaway infiltration tests at the Site.

The results of groundwater level monitoring can be provided upon request (each dataset is circa 120 pages long).

6.2 Soakaway Infiltration Testing

Soakage testing was undertaken in general accordance with BRE Digest 365: Soakaway Design [Ref. 1] on 27th and 28th January 2020.

The soakage testing comprised the excavation of three trial pits (SA101 to SA103) to depths of between 1.1 and 2.0 m bgl. The geology of the trial pit locations was logged. A gravel pack and monitoring pipes were then installed in the trial pits and the remaining voids were backfilled with arisings. The remaining spoil was graded back to original ground level.

The gravel pack in the test locations was then filled with water from a water container and the depth to water from ground level recorded at regular intervals.

The soakage test data was recorded and used to calculate the soil infiltration rate for the locations.

6.2.1 Identified Ground Conditions

Ground conditions encountered in each location comprised the following:

SA101

- ▲ Grass over topsoil comprising of dark brown slightly clayey fine to medium sand to a depth of 0.4 m bgl;
- ▲ River Terrace Deposits comprising of dark brown sandy clay to a depth of 0.75 m bgl; and
- ▲ River Terrace Deposits comprising of light brown clayey fine to medium sand, to a depth of 1.62 m bgl.

SA102

- ▲ Topsoil comprising of dark brown slightly gravelly slightly clayey fine to medium sand. Gravel content comprised of flint, to a depth of 0.2 m bgl;
- ▲ River Terrace Deposits comprising of dark brown slightly sandy clay to a depth of 0.4 m bgl;
- ▲ River Terrace Deposits comprising of bluish brown clay to a depth of 1.5 m bgl; and
- ▲ River Terrace Deposits comprising of light brown clayey medium to coarse sand, to a depth of 2.0 m bgl.

SA103

- ▲ Grass over topsoil comprising of dark brown slightly clayey fine to medium sand to a depth of 0.6 m bgl; and
- ▲ New Pit Chalk Formation comprising of white slightly sandy chalk gravel to a depth of 1.1 m bgl.

7.0 Soakage Tests

Test results are provided in Appendix B and summarised in Table 1 below. The approximate locations of the soakage tests/trial pits are shown on Figure 1.

Table 2: Summary of Testing in General Accordance with BRE 365

Soakaway Test Reference Number	Test Depth Range (m bgl)	Infiltration Rate	Geology
SA101	0.95 – 1.62	6.1×10^{-05}	Sand (River Terrace Deposits)
SA102	1.20 – 2.00	1.7×10^{-05}	Sand (River Terrace Deposits)

It was not possible to obtain an infiltration rate in SA103 due to the high rates at which water drained during the test, therefore, this can be interpreted as a very high permeability classification.

8.0 Conclusions

The infiltration testing has been undertaken to a maximum depth of between 1.62 and 2.0 m bgl within sand of River Terrace Deposits at SA101 and SA102, and chalk at SA103, which is considered to represent the mapped superficial deposits / bedrock geology. Given the nature of the soils encountered, the infiltration tests reached the 25% effective depth over a period of approximately 15 to 55 minutes, in SA101 and SA102, respectively. It was not possible to obtain an infiltration rate for SA103 due to the high rates at which the water drained.

As a result, traditional soakaways are considered to be a suitable method of drainage at the Site, provided they are placed within the granular River Terrace Deposits or within the New Pit Chalk Formation.

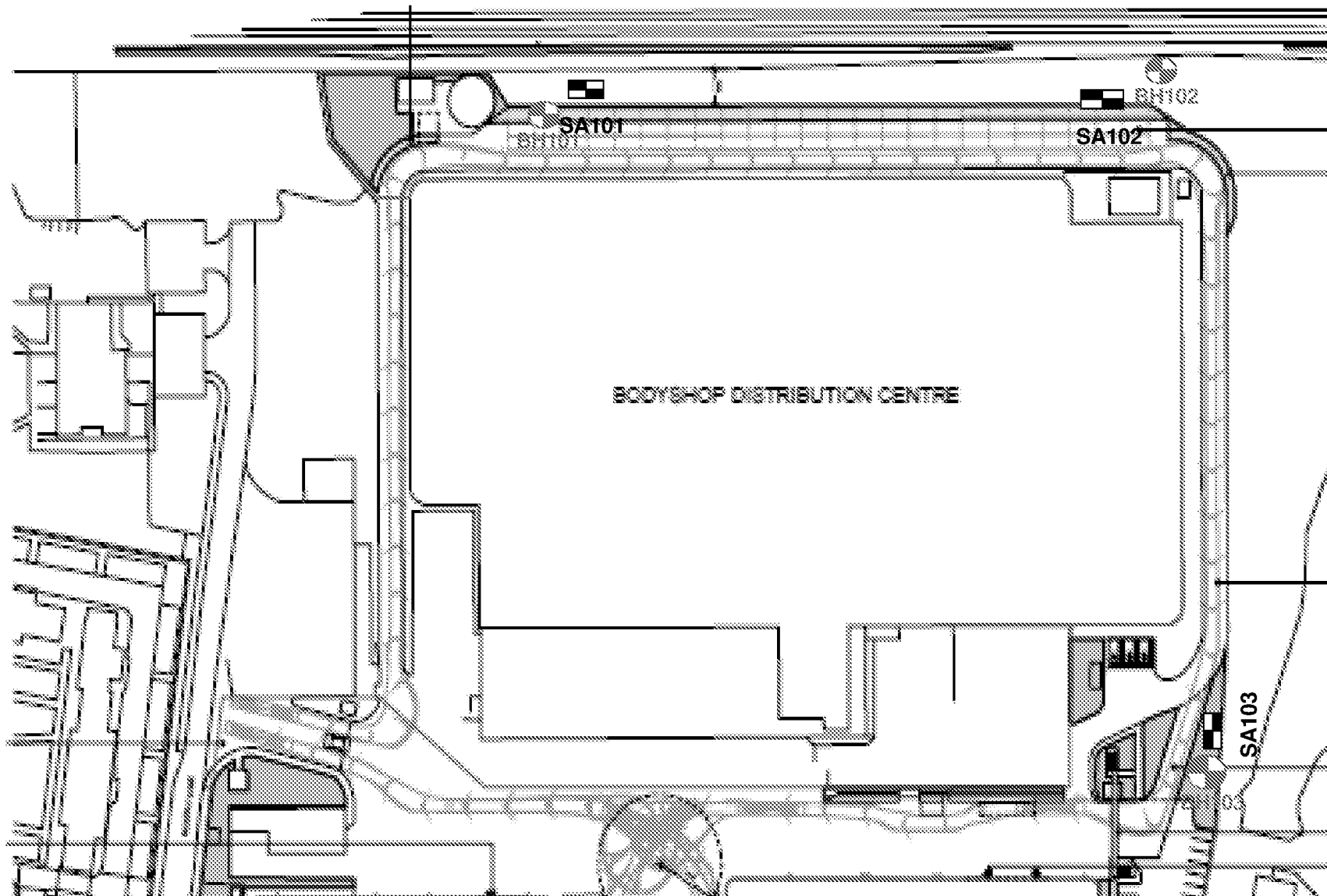
9.0 References

Ref 1: BRE Digest 365: Soakaway Design, BRE 1991.

Enclosed:

- Figure 1 Approximate Intrusive Location Plan
- Appendix A Council Correspondence
- Appendix B Soakaway Test Results

Figure 1 – Approximate Intrusive Location Plan



TITLE:
Approximate Intrusive Location Plan
Littlehampton, Amazon

SCALE:
NTS

DWN/CHKD:
AH

PROJECT NO.:
19-0138.08

DATE:
03-01-20

FIGURE NO.:
1

Appendix A – Council Correspondence

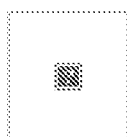
From: [REDACTED]
To: [REDACTED]
Subject: Fwd: Application Ref: LU/59/19/PL - Condition 4
Date: 12 November 2019 19:02:47
Attachments: [image001.jpg](#)
[image002.jpg](#)

All

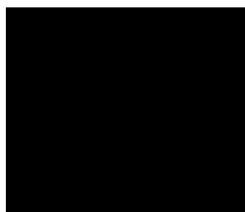
Please see email below.

Kind Regards

Aarti O'Leary
BSc (Hons), MA (Merit), MRTPI
Associate



Chartered Surveyors & Town
Planners
6 New Bridge Street
London
EC4V 6AE



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Begin forwarded message:

From: Sarah Burrow [REDACTED]
Date: 12 November 2019 at 18:05:31 GMT
To: Aarti O'Leary [REDACTED]
Cc: Stuart Corbett [REDACTED] Paul Cann [REDACTED]
Subject: RE: Application Ref: LU/59/19/PL - Condition 4

Dear Aarti,

First of all thank you for getting in touch, it is refreshing to be discussing proposed testing before it is completed. My initial impression is that you're going to be finishing too early. The most important period to cover is when we expect groundwater to peak – normally January-February. Similarly the BRE365 tests will need to be completed above the highest recorded groundwater so it is best that they are completed towards the end of your monitoring.

I would suggest losing a couple of December monitoring weeks and spreading the remainder to cover to the end of February, with fortnightly checking being sufficient.

Kind Regards

Sarah Burrow
Engineering Assistant

From: Aarti O'Leary [REDACTED]
Sent: 08 November 2019 16:55
To: Land Drainage [REDACTED]
Cc: Stuart Corbett [REDACTED]
Subject: Application Ref: LU/59/19/PL - Condition 4

Dear Sir/ Madam,

We write with regard to Condition 4 of consent ref: LU/59/19/PL, which states the following:

"Prior to the implementation of proposed surfacing works as shown on plan reference DBN3-SMR-00-ZZ-DR-A-2009-S3-P1, winter groundwater monitoring shall be undertaken to establish the highest annual ground water levels and winter Percolation testing to BRE 364. The monitoring results and any necessary amendment to the proposed drainage strategy to be submitted and agreed by the local planning authority. Until such time as the proposed surfacing works can commence a temporary van staging area comprising temporary roadway aluminium mats to be utilised."

With a view to preparing an application seeking to discharge the above condition, we wish to discuss the proposed monitoring works and timetable with you.

Firstly, we wish to confirm that the refence in the condition should be to BRE 365 tests, rather than BRE 364.

The attached plan shows the proposed locations of the BRE365 tests. The monitoring wells will be installed in these locations too.

The table below provides the proposed timetable for the monitoring works:

w/c 2/12/19	w/c 9/12	w/c 16/12	w/c 23/12	w/c 30/12	w/c 6/01/20	w/c 13/01
Undertake winter BRE365 testing.	First week of monitoring groundwater levels.	Second week of monitoring groundwater levels.	Third week of monitoring groundwater levels.	Fourth week of monitoring groundwater levels.	Fifth week of monitoring groundwater levels.	Provision of report detailing BRE365 soakaway testing results, and details of groundwater levels during monitoring period.
Install groundwater monitoring wells adjacent to BRE365 locations.	Continuous groundwater level data loggers to be installed within monitoring wells.				End of monitoring period	

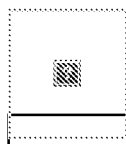
We would be grateful if could advise whether the proposed works and timetable would be acceptable in relation to discharging Condition 4 of consent ref: LU/59/19/PL.

Once we receive your feedback, we would look to apply to formally discharge the condition.

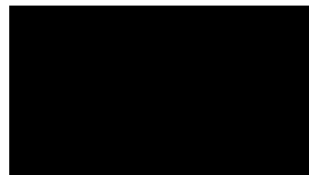
Should you wish to discuss the proposed monitoring works, please do contact me.

Kind Regards

Aarti O'Leary
BSc (Hons), MA (Merit), MRTPI
Associate



Chartered Surveyors & Town Planners
6 New Bridge Street
London
EC4V 6AB



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Appendix B – Soakaway Test Results

	units	Infill 1	Infill 2	Infill 3
Length	m		2.40	
Width	m		0.80	
Depth	m		1.62	
Gravel type			Standard	
Voids ratio			0.35	
Resting groundwater level at time of testing	m		2.45	
Depth of first reading	m	1.12	1.10	1.12
Depth of final reading	m	1.62	1.62	1.62
Did soakage test reach 25% of maximum fill depth?		Yes	Yes	Yes
Did soakage test reach near empty?		Yes	Yes	Yes
Depth at 75% full/effective depth	m	1.25	1.23	1.25
Depth at 25% full/effective depth	m	1.50	1.49	1.50
Time at 75% full/effective depth	mins	2.17	2.00	2.17
Time at 25% full/effective depth	mins	13.61	15.38	13.46
Vp75 - 25 (volume outflowing between 75% and 25% full/effective depth)	m ³	0.17	0.17	0.17
Mean surface area for outflow (50% full/effective depth)	m ²	3.52	3.58	3.52
tp75 (time for the water level to fall from 75% to 25% full/effective depth)	mins	11.44	13.38	11.29
Soil infiltration rate, f =	m/s	0.00000012	0.00000010	0.00000013
or	m/s	7.12E-06	5.25E-06	7.05E-06

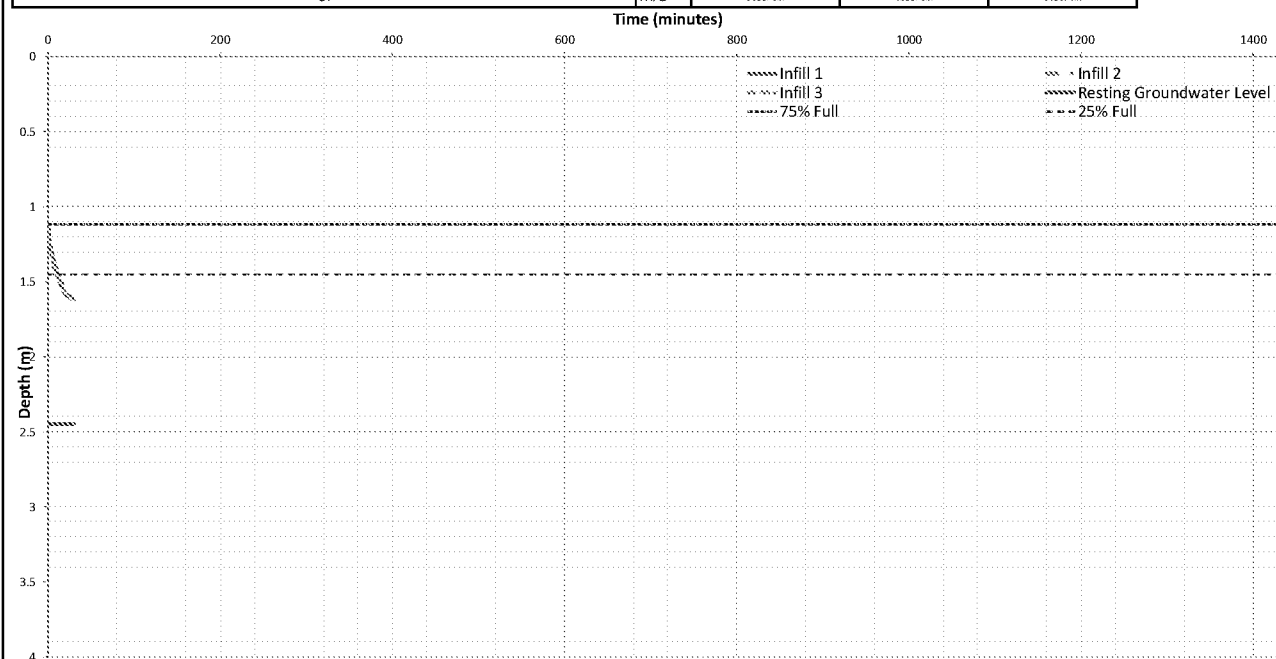
Recommended soil infiltration rate

6.1E-05

m/s

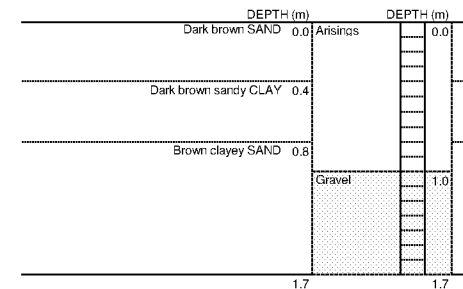
Note:

Where water level reaches nearly empty (5% full), soil infiltration based on 'Full' depth. Where water level did not reach nearly empty (5% full), soil infiltration rate is based on 'Effective' drainage achieved only. Where water level did not fall below 25% of the maximum fill level, this is considered to be a 'Failed' test.



LOG

BACKFILL



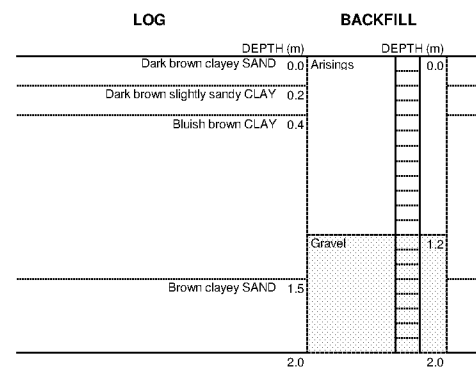
TITLE: Soakaway Test Results
Amazon, Littlehampton
Gleave Partnership

In accordance with BRE Digest 365 (2016)

DRAWN BY: CB SCALE: Not to Scale PROJECT NUMBER: 19-0138.08
CHECKED BY: SS REVISION: 1 SOAKAWAY NUMBER: SA101
DATE: 27/01/2020

Recommended soil infiltration rate	
1.7E-05	m/s

Note:
Where water level reaches nearly empty (5% full), soil infiltration based on 'Full' depth. Where water level did not reach nearly empty (5% full), soil infiltration rate is based on 'Effective' drainage achieved only. Where water level did not fall below 25% of the maximum fill level, this is considered to be a 'Failed' test.



ARUN DISTRICT COUNCIL LU/55/20/DOC