

LAND QUALITY ASSESSMENT PHASE 2 REPORT
OF
LAND AT KING'S CLOSE, YAPTON
FOR
PLOTLIFE SPV3 LTD

G6308

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1.0 INTRODUCTION

- 1.1 The site at King's Close in Yapton is an area of derelict land, covered in rough vegetation, to the rear of the Co-operative store on Main Road. The proposed development for the site is residential housing. The site location is indicated on the attached Figure 1 and the existing and proposed layouts are shown on Figures 2 and 3 respectively.
- 1.2 During March 2017 a desk study and preliminary investigation took place at the site in order to provide a basic understanding of the ground, groundwater and potential contamination conditions on the site. Details are provided within Ground Management Ltd's report titled Land Quality Assessment, King's Close, Yapton, March 2017. This preliminary investigation indicated a number of contamination concerns including substantial quantities of made ground and tipped material, the presence of metals, asbestos and polyaromatic hydrocarbons in the made ground, and oil and PAH contamination in one area within groundwater in the superficial deposits.
- 1.3 Parts of the site have previously been infested by Japanese Knotweed and the Client has engaged specialists to advise on its assessment and management and therefore related issues are not covered within this report.
- 1.4 Following discussions with the Environment Agency, and comments from the Environmental Health Officer of Arun District Council, a second phase investigation has taken place. This report considers the results of this second investigation together with the earlier results, and provides information on the proposed remediation works considered necessary to allow development of the site.
- 1.5 The report first summarises the results of the desk study and preliminary investigation (Section 2). It then presents the rationale for the second phase investigation (Section 3) and goes on to present the results of this investigation, with a presentation of all the results from the site (Sections 4, 5 and 6). Section 7 assesses the results and identifies the types of remedial measures required to allow the development of the site.
- 1.6 The field and laboratory tests from the second phase of investigation accompany this report as attachments. Those from the preliminary investigation are included in the report named above in paragraph 1.1, which should be read in conjunction with this report.
- 1.7 The work was carried out on behalf of Plotlife SPV3 Ltd and nothing in this report confers or purports to confer on any third party, any benefit or any right to enforce any term of this report pursuant to the Contract (Rights of Third Parties) Act 1999.

2.0 SUMMARY OF DESK STUDY AND PRELIMINARY INVESTIGATION

2.1 The desk study and walkover identified a number of areas of concern regarding the site including:

- Use as a former works (including an engineering works and a joinery) in the northern part of the site
- Use as a former brickworks (both on site and adjacent to the west) mainly in the southern part of the site. (Based on observations of reworked soils the full extent of excavations associated with the brickworks could extend across a greater part of the site)
- Raised areas of made ground in the southern part of the site

2.2 Based on this desk study data, a preliminary investigation scope was developed. The investigation comprised:

- Nine trial pits across the site, some within the works area and some within suspected areas of made ground, including pitting in two of the raised areas
- Installation of standpipes in trial pits in which groundwater was encountered (TPs 1, 3 and 8)
- Contamination testing of soil samples
- Groundwater sampling and contamination testing
- Groundwater monitoring within standpipes

2.3 Most of the investigation was carried out on 24th February 2017, although one trial pit (TP1A) had been previously excavated on 17th February 2017.

Soils Contamination

2.4 Widespread contamination within the made ground was noted across the site. The following exceedances of relevant criteria were noted:

Trial Pit	Sample Depth (m)	Contaminants in excess of criteria
TPSP1	0.5	PAHs
TPSP2	1.0	Lead, PAHs, Asbestos present
TP1	1.0	PAH- benzo-a-pyrene B(a)P
TP2	0.1	Lead, B(a)P
	0.6	B(a)P
	1.2	Lead, B(a)P
TP3	0.1	Lead, B(a)P
TP4	0.0	Lead, PAHs, Asbestos present
	0.4	PAHs
	1.0	Arsenic, lead
	1.2	Arsenic, lead, PAHs, TPH (C16-35)
TP5	0.4	Lead, B(a)P

TP6	0.4	Lead, PAHs
TP7	0.0	Copper, lead, Asbestos present
	0.4	Arsenic, lead, PAHs
	1.0	Lead

Suspected asbestos containing materials (ACM) were visible on the ground surface at the locations of TP4 and TP7, and in a sample taken from 1.0m depth in TPSP2 (a trial pit in one of the mounds). In these three cases the laboratory analysis confirmed the presence of chrysotile asbestos. Seven other random samples of soil from various depths were tested but no asbestos detected. The asbestos cement at the surface in TP4 and 7 may be due to scattering of asbestos cement during demolition of the Works buildings. As such, asbestos cement may be found elsewhere on the site on or close to the surface of the soil. The asbestos cement in TPSP2 may be due to either the demolition works or may have been brought onto the site.

Groundwater

- 2.5 Groundwater was encountered in four of the trial pits (TP1A, TP1, TP3 and TP8). In three of these pits (TPs 1, 3 and 8) a sample of the groundwater was taken from the trial pit. Subsequently standpipes were installed in TPs 1, 3 and 8 in order to monitor groundwater levels.
- 2.6 The groundwater levels obtained during the investigation indicated that the groundwater flow across the site was in an easterly direction, with a gradient of about 1:100. Subsequent monitoring on 5th March indicated a similar flow direction but with a reduced gradient of about 1:500.
- 2.7 Groundwater contaminant concentrations in TP3 were generally low and within Environmental Quality Standards issued by the UK Environment Agency (EQS criteria). However the groundwater in TP1 showed elevated concentrations of PAHs, and that in TP8 showed very elevated PAH concentrations together with xylene and aromatic petroleum hydrocarbons.

Groundwater in TP1

- 2.8 TP1 is near the southwest corner of the site. During the investigation groundwater was found at a depth of 2.4m, and a sample was taken. There was no obvious smell from the groundwater and no obvious free phase/sheen. A number of PAHs exceeded EQS (or other) criteria, as shown in the table below:

PAH	LOD (µg/l)	TP1 (µg/l)	EQS (µg/l)	Source of criteria
Anthracene	0.01	0.87	0.1	WFD EQS
Fluoranthene	0.01	6.26	0.1	WFD EQS
Benzo(a)anthracene	0.01	5.09	0.03	USEPA RSL
Chrysene	0.01	3.21	2.9	USEPA RSL
Benzo(b)fluoranthene	0.01	4.96	0.2	UK DWS
Benzo(k)fluoranthene	0.01	3.78	0.2	UK DWS
Benzo(a)pyrene	0.01	6.6	0.05	WFD EQS
Indeno(1,2,3-cd)pyrene	0.01	3.57	0.2	UK DWS
Dibenzo(ah)anthracene	0.01	1.11	0.03	USEPA RSL
Benzo(ghi)perylene	0.01	3.35	0.2	UK DWS

- 2.9 It was suggested that the source of the PAHs in TP1 was probably the ash within the made ground. However, TP1 does not have ash recorded in its trial pit log and it is therefore possible that the contamination in the groundwater is derived from off site sources to the west of the site, where it is known that the brickworks extended to.

Groundwater in TP8

- 2.10 The groundwater within TP8 was noted to have a sheen/free phase present on its surface and had a considerable organic odour. Most individual PAH species exceeded their EQS criteria, and some by a considerable margin. Those with the greatest exceedance are listed below.

PAH	LOD (µg/l)	TP8 (µg/l)	EQS (µg/l)	Source
Napthalene	0.01	9740	2.4	WFD EQS
Benzo(a)anthracene	0.01	74.9	0.03	USEPA RSL
Benzo (ghi)perylene	0.01	49.8	0.02	UK DWS
Fluoranthene	0.01	207	0.1	WFD EQS
Benzo(a)pyrene	0.01	77.3	0.05	WFD EQS

- 2.11 In addition xylene exceeded its criteria (134µg/l compared to 30µg/l) and aromatic petroleum hydrocarbons were also high, particularly C10 – C12 (3270µg/l) and C12 – C16(2620µg/l). VOCs were generally low (apart from naphthalene and xylenes). The sample taken contained some of the free phase material and it is noticeable that some of the concentrations of the PAHs exceeded their maximum solubility in water, indicating that the recorded concentrations may be unrealistically high.

- 2.12 The groundwater was noted within sandy and/or clayey silts within TP8 (ie generally low permeability layers). TP8 appears to be located in the south eastern corner of the southernmost Works building. TP5 and TP6 also within the Works were not deep enough to intercept the groundwater, and therefore do not assist in determining the extent of groundwater contamination.

3.0 RATIONALE FOR THE SECOND PHASE INVESTIGATION

- 3.1 An initial scope for a second investigation was set out in the report “Land Quality Assessment, King’s Close Yapton, March 2017”. As a result of subsequent comments by the Environment Agency (meeting 13th July 2017) and an email from the Environmental Health Department of Arun District Council (4th July 2017) the scope has been amended. In particular, further work around TP1 was not considered necessary.
- 3.2 Significant groundwater contamination was identified in one trial pit (TP8) in superficial deposits. The contaminated groundwater had high concentrations of PAHs. The superficial deposits overlie Chalk. It is believed that the contamination could be very localised in extent and is probably restricted from migrating either laterally or vertically (into the underlying chalk). To determine whether this is the case, the following work was undertaken:
- Three window samples (WS1 – WS3) in the close vicinity of TP8 extending down to the putty chalk, and installation of 50mm groundwater/gas standpipes in order to obtain further shallow groundwater samples and to see whether overlying soils are contaminated. These holes were no more than 5m from TP8 (see Figure 4 for hole locations).
 - One deep exploratory hole (BH1) to the south of TP8 extending at least 3m into structured chalk and installation of a piezometer, sealed into the structured chalk, from which a groundwater sample was obtained. This is intended to show that the underlying chalk aquifer is not substantially affected by the superficial contaminated groundwater.
 - One window sample (WS4) close to BH1 extending down to the putty chalk in order to sample shallow groundwater in this area.
 - Four soakage tests (TP101-104)
- 3.3 The deep borehole (BH1) was put down using double drilling techniques. The exploratory hole was started in 200mm casing, down into the weathered chalk. At that level a 1m deep bentonite plug was installed, as the 200mm casing was slowly withdrawn by 1m. The drilling down into the remaining weathered chalk and structured chalk was continued in 150mm casing.
- 3.4 Groundwater samples were tested for speciated PAHs, BTEX, speciated TPHCWG and metals.
- 3.5 No ground gas/vapour (PID) monitoring was undertaken during the initial investigation. There are two potential sources of ground gas/vapours: the made ground on the site and the groundwater contamination around TP8. Therefore, the following work was also undertaken:
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- Two further shallow window sample holes (WS5 – WS6) to the base of the made ground (about 2m) in the southern part of the site, and installation of 50mm gas standpipes, where made ground is the thickest.
 - Monitoring of ground gas/vapours in all WS holes, on at least 3 occasions.
- 3.6 A second deep borehole (BH2) was drilled to the east of the site for geotechnical purposes and a series of trial pits TP101 to TP104 were excavated for the purpose of soakage tests. All exploratory hole locations are indicated on the attached Figure 4 (Rev01).
- 3.7 One sample of made ground was taken from each of WS1 – WS4 within the top 1m. These samples were tested for speciated Polyaromatic hydrocarbons (PAHs) and metals. The sample from WS4 was also tested for TPH (both soil and leachate).

4.0 GROUND AND GROUNDWATER CONDITIONS

- 4.1 The British Geological Survey website indicates that the site is underlain by River Terrace Deposits (sand, silt and clay) above Upper Chalk.
- 4.2 The exploratory holes generally reveal a covering of made ground, above a complex of superficial deposits including layers of clays, silts and sands above chalk. The chalk is weathered near its upper surface becoming more structured with depth.
- 4.3 The made ground varied in thickness, from no made ground (in TP3) up to 2.3m thick, (in TP2).
- 4.4 The made ground was often composed of silty clays, silty sands or sandy silts, in places ashy or gravelly, with variable amounts of man-made materials including fragments of brick, concrete, tiles, ceramics, tar-bound material, glass and plastics.
- 4.5 Below the made ground, in all holes there were superficial deposits of interlayered silty (and/or sandy) clays, sandy silts and clayey/silty sands. It is difficult to distinguish any particular sequence of layers across the site, but it appears that the more fine grained materials are predominant.
- 4.6 Below the superficial deposits, at depths of between 2.8m (TP1) and 4.1m (WS1), chalk is encountered. Near its upper surface it is described as off-white, highly weathered structureless chalk, generally containing 40 – 50% chalk lumps within a fine-grained matrix. With depth, the chalk becomes more structured. In BH1 the structured chalk was encountered 2.3m below the chalk's upper surface, and was recovered as gravel and cobble size sub-angular fragments of medium density chalk with occasional nodular or shattered flint gravel/cobbles. The structured chalk was encountered at 6.0m depth and drilling continued to 10.0m depth. In BH2 structureless chalk was encountered between 5.4 and 6.5m, again underlain by more structured chalk similar to that in BH1. BH2 continued to a depth of 15.0m
- 4.7 Groundwater levels had been measured in TP1, TP3 and TP8 for a period of about a month from late February to late March 2017, and twice in July. The groundwater gradient was generally from west to east. Following the second phase investigation groundwater level monitoring was conducted for installations in WS1 to 6 and BH1 on 31st July and 2nd, 8th and 15th August. On the latter date, TPs 1,3 and 8 were also dipped.
- 4.8 The monitoring during July and August record a very flat groundwater gradient with very little discernible groundwater gradient.

- 4.9 The results of the soakage tests in TPs101 to 103 indicate relatively low permeability with infiltration coefficients of 1.0×10^{-6} to 5.9×10^{-6} m/s in the natural superficial deposits and reworked natural soils. (It was noted that the results are possibly under estimates due to influence of rain during testing). TP104 indicated an area of Made Ground with much higher permeability (infiltration coefficients of 8.9×10^{-5} m/s).

5.0 CONTAMINATION CONDITIONS

Soil Contamination

5.1 Soil contaminant results were compared with the 'Residential with Plant Uptake' criteria derived from the following sources:

- Provisional C4SL criteria
- Environment Agency (EA) SGV criteria
- Generic Assessment Criteria derived from CLEA using EA or LQM/CIEH default properties

5.2 A further five sets of contaminant tests were conducted on soils during the second phase investigation, one each from the made ground encountered in WS 1 – 4 and BH1. The results of the tests were similar to those derived from the initial investigation in the fact that the main contaminant species were metals and PAHs. The Table shown in Section 2 is reproduced below with the additional information from the second phase investigation added.

Trial Pit	Sample Depth (m)	Contaminants in excess of criteria
TPSP1	0.5	PAHs
TPSP2	1.0	Lead, PAHs, Asbestos present
TP1	1.0	PAH, benzo-a-pyrene B(a)P
TP2	0.1	Lead, B(a)P
	0.6	B(a)P
	1.2	Lead, B(a)P
TP3	0.1	Lead, B(a)P
TP4	0.0	Lead, PAHs, Asbestos present
	0.4	PAHs
	1.0	Arsenic, lead
	1.2	Arsenic, lead, PAHs, TPH (C16-35)
TP5	0.4	Lead, B(a)P
TP6	0.4	Lead, PAHs
TP7	0.0	Copper, lead, Asbestos present
	0.4	Arsenic, lead, PAHs
	1.0	Lead
WS1	0.0 – 0.2	B(a)P
WS2	0.0 – 0.4	Lead, PAHs
WS3	0.1 – 0.3	
WS4	0.8 – 1.2	Arsenic, lead, B(a)P, Dibenzo(ah)anthracene TPH (Aromatic C21-35)
BH1	0.7 – 1.2	Lead, PAHs

Groundwater Contamination

- 5.3 Groundwater samples were taken from standpipes installed in the shallow superficial groundwater in WS1 – 4, and in the deeper level piezometer installed within the structured chalk within BH1, with a response zone between 5 and 10m.
- 5.4 The four window sample holes were located to surround TP8, in which elevated concentrations of PAH and oil contaminated groundwater was revealed at shallow depth during the initial investigation. The results of the testing of groundwater from these four exploratory holes showed considerably less contamination than from TP8. Those from WS4 showed the highest concentrations. The Table in Section 2.9 is reproduced here with the addition of the new results from the window samples.

PAH	TP8 µg/l	WS1 µg/l	WS2 µg/l	WS3 µg/l	WS4 µg/l	EQS µg/l	Source
Napthalene	9740	0.22	0.48	0.13	5.19	2.4	WFD EQS
Benzo(a)anthracene	74.9	5.08	2.29	1.27	34.8	0.03	USEPA RSL
Benzo(ghi)perylene	49.8	2.94	1.04	0.5	33.4	0.02	UK DWS
Fluoranthene	207	6.76	4.3	2.09	48.8	0.1	WFD EQS
Benzo(a)pyrene	77.3	5.79	2.16	1.14	35.9	0.05	WFD EQS

- 5.5 It is unclear whether the groundwater within WS4 is derived by southward migration from TP8, or whether it represents another very local source of contaminated groundwater. The groundwater level data so far obtained does not assist, in that the groundwater level in WS4 has been both higher and lower than that in WS1 to WS3. It is clear that the degree of contamination by naphthalene is very much reduced, but the decrease in contamination from other PAH species is not so great. TP8 also suffered from oil contamination, particularly from C10 to C16 aromatic species. Likewise WS4 shows oil contamination, but principally from C21- C35 aliphatic species.
- 5.6 The groundwater from the chalk aquifer within BH1 (which is close to WS4) also has a much reduced level of contamination. The comparable PAH species for the three exploratory holes (TP8, WS4 and BH1) are shown in the table below.

PAH	TP8	WS4	BH1	EQS	Source
Naphthalene	9740	5.19	0.07	2.4	WFD 2010
Acenaphthylene	192	7.5	0.17	90	WHO
Acenaphthene	106	0.42	0.03	400	USEPA
Fluorene	220	1.01	0.04	220	USEPA

Phenanthrene	717	21.8	0.5	90	WHO
Anthracene	134	9.80	0.17	0.1	WFD 2010
Fluoranthene	207	48.8	0.83	0.1	WFD 2010
Pyrene	236	54.8	0.73	87	USEPA
Benzo(a)anthracene	74.9	34.8	0.44	0.03	USEPA
Chrysene	93.5	44.7	0.35	2.9	USEPA
Benzo(b)fluoranthene	38.7	33.2	0.38	0.2*	DWS 2010
Benzo(k)fluoranthene	59.6	33.2	0.35	0.2*	DWS 2010
Benzo(a)pyrene	77.3	35.9	0.6	0.05	WFD 2010
Indeno(1,2,3cd)pyrene	37.8	27.7	0.31	0.2*	DWS 2010
Dibenzo(ah)anthracene	16.3	11.4	0.1	0.03	USEPA
Benzo(ghi)perylene	49.8	33.4	0.28	0.2*	DWS 2010

* Sum of all four PAHs

- 5.7 About half of the individual PAH species in BH1 are in excess of their relevant EQS criteria.
- 5.8 In addition the groundwater in BH1 suffers from minor amounts of petroleum hydrocarbon contamination. Since groundwater in both TP8 and WS4 show oil contamination, again it is useful to compare the results

TPH CWG	TP8 (µg/l)	WS4 (µg/l)	BH1 (µg/l)
>C5-C6 Aliphatic	<1.0	<1.0	<1.0
>C6-c8 Aliphatic	<1.0	<1.0	<1.0
>C8-C10 Aliphatic	6.7	154	242
>C10-C12 Aliphatic	48.8	125	170
>C12-C16 Aliphatic	49.8	57.8	<5.0
>C16-C21 Aliphatic	59.9	2030	14.5
>C21-C35 Aliphatic	49.8	29000	201
>C35-C40 Aliphatic	<5.0	1780	11.6
>C5-C7 Aromatic	<1.0	<1.0	<1.0
>C7-C8 Aromatic	4.0	<1.0	<1.0
>C8-C10 Aromatic	638	19.9	49.6
>C10-C12 Aromatic	3270	16.1	33.3
>C12-C16 Aromatic	2620	<5.0	<5.0
>C16-C21 Aromatic	882	525	<5.0
>C21-C35 Aromatic	603	8640	66.4
>35-C40 Aromatic	<5.0	783	<5.0

Total Aliphatic/Aromatic	8230	43100	788
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- 5.9 BTEX (Benzene, Toluene, Ethylbenzene and Xylene) results were < 1.0µg/l in WS4 and BH1. In TP8 Benzene, Toluene and Ethylbenzene recorded low concentrations whereas Xylene recorded 134µg/l.

Leachability Testing

- 5.10 One set of leachate testing was undertaken on a sample from the made ground at 0.8 to 1.2m in WS4 that showed some TPH contamination, associated with a dark grey ashy material, in order to determine whether it could be significantly contributing to the oil contaminated groundwater found at a slightly deeper level within the hole. The results of the leachability test showed a total TPH leachate concentration of about 98µg/l, compared with a groundwater total TPH of 43,100µg/l. This indicates that this ashy material is not contributing significantly to the oil contamination in the near surface groundwater. Other ashy material across the site all had lower concentrations of TPH.

6.0 GROUND GAS CONDITIONS

- 6.1 Ground gas standpipes were installed in WS1 to 6. WS1 to 4 were located around TP8 where oil and PAH contamination was noted in the groundwater, which may give rise to organic vapours. WS5 and 6 were located in the southern part of the site where made ground depths were greatest, and therefore where carbon dioxide or methane gas may be generated by organic material within the made ground.
- 6.2 Three rounds of ground gas/vapour monitoring have been conducted, on 2nd, 8th and 15th August 2017. The ground gas monitoring was undertaken using a GFM 435 Gas Analyser with integral gas flow monitor. Vapours were monitored using a MiniRae 2000 PID meter. The ambient air pressure at the time of monitoring was about 1013mb on the first occasion, 1009mb on the second occasion and between 1014 and 1017mb on third occasion.
- 6.3 These results indicate that there is a low risk of ground gas or vapour at the site. PID readings from all holes were low (5.0ppm or less). Methane concentrations were zero and carbon dioxide concentrations were a maximum of 4.7% in WS4. Gas flow rates were zero. On this basis, the site would fall into Characteristic Situation 1/ Green using the CIRIA 665 classification system (CIRIA 665 Assessing Risks of Hazardous Ground Gasses to Buildings, 2007).

7.0 ASSESSMENT OF RESULTS AND IMPLICATIONS FOR REMEDIAL WORKS

Soil Remediation

- 7.1 The results of the contamination testing on the made ground across the site indicate that there is widespread contamination by lead and PAHs, with subsidiary copper, arsenic and petroleum hydrocarbons. The concentrations of the contaminants are such that it would cause a significant risk to proposed residents. In addition, there is in near surface layers, and in the mounded materials, fragment of asbestos containing material (ACM).
- 7.2 As noted in our preliminary report, it is suggested that in order to break the pollution linkage between the contamination present and the residents, a soil cover system is used wherever soft landscaping is to be undertaken within the development (eg within private gardens and public open space. The soil cover system should be at least 600mm thick, comprising an upper topsoil layer of 200mm and a lower sub-soil layer of 400mm. The cover system should be underlain by a textile marker layer. The use of a cover system will either lead to a raising of site levels or a requirement to remove near surface made ground from the site to accommodate the cover system.
- 7.3 The placed topsoil and subsoil should be uncontaminated and conform to the criteria set out in Appendix 1. The amount of pre-supply and in-situ testing of materials will need to be agreed with Arun District Council.
- 7.4 Any soils removed from the site as part of the remedial works, and destined for waste disposal will need to be tested for Waste Acceptance Criteria, to ensure that they are disposed of at a suitable landfill site. If soils that do, and do not contain asbestos, can be distinguished, then alternative destinations for the two types of soil may be identified. The soils would need to be transported to the landfill sites by a registered waste carrier.
- 7.5 Because the near surface soils contain fragments of ACM, the removal of at least the near surface layer of made ground would need to be undertaken in accordance with the Control of Asbestos 2012 Regulations. Although these regulations primarily relate to the removal of asbestos from buildings, they should also be used for the removal of soil which contains ACM. Guidance on this issue is contained in two CIRIA Guides: CIRIA C733 (2014) "Asbestos in soil and made ground: a guide to understanding and managing risks" and CIRIA C765 (2017) "Asbestos in soil and made ground: good practice site guide". It is recommended that the removal procedure is undertaken by a company who specialises in such work.

Groundwater Issues

- 7.6 The results of the additional groundwater testing (from shallow wells WS1 to 4 and the deep well BH1) indicate that the groundwater contamination in TP8 is of limited extent, but that there may be other very small areas of contaminated groundwater (such as at WS4). The groundwater within BH1 (within the structured chalk) has a much reduced PAH concentration (compared to both TP8 and WS4), but does contain some minor petroleum hydrocarbon contamination (although again less than in TP8 or WS4).
- 7.7 It is considered that the concentrations of contaminants in BH1 are sufficiently low for them not cause an issue with groundwater sources downstream of the site. The Environment Agency have agreed that the groundwater is unlikely to cause such problems, but would like to see a reduction in hydrocarbons in the vicinity of TP8 and WS4 as practically as possible.
- 7.8 It is conjectured that the contaminated water in TP8 and WS4 results from spillage or leakage within the former Works area or nearby. However the exact location of the spill/leak area itself has not yet been identified (the soils above the groundwater were relatively clean in both locations), but it is likely to consist of soils contaminated with similar contaminants to those in the groundwater or possibly an old leaking underground tank/pipework.
- 7.9 It is recommended that during site strip and excavation works for garden areas, roadways, drainage etc the opportunity should be taken to look for visual or olfactory indications of contaminated soils, underground tanks or pipework that may be contributing to such contamination, particularly in the area of TP8 and WS4, but also generally in the area of the old 'works' site. If soils that are obviously contaminated with oil/petroleum hydrocarbons, or tanks/pipework are found, they should be carefully removed and disposed of offsite, and any excavations replaced with clean soils. In the case of tanks/pipework, once removed the base and sides of the excavation should be inspected and any contaminated soils around the tanks/pipework also removed and disposed. Verification testing should be undertaken prior to backfilling the excavated areas with clean soils.
- 7.10 The criteria for this aspect of verification testing is set out in Appendix 2. The criteria have been chosen on a pragmatic basis so that obvious oil contaminated materials are removed, but that ash contaminated material, which has been found to be widespread across the site but does not contribute significantly to groundwater pollution, is allowed to remain present on site (although below a capping layer in areas of soft landscaping). The criteria are either the same or, for some species of PAH and TPH, higher than those used for imported topsoil/subsoil.

- 7.11 Risk assessment and method statements should be prepared with consideration given to the possibility of encountering contaminated soils and groundwater and ensure the contractor is prepared for containing, assessing and disposing of contaminated material appropriately.
- 7.12 If the design of the surface water drainage involves percolation of surface water into the ground at the site, the detailed design of the scheme should be discussed and agreed with the Environment Agency. It is important to avoid increasing the potential for mobilisation of contaminants into the groundwater.
- 7.13 In areas where infiltration drainage is to be installed, the base and sides of any excavation for drainage purposes should be inspected by an experienced contaminated land specialist, and any obvious contaminated made ground removed prior to placing of the drainage layers/storage. The areas around TP8 and WS4 should be avoided for soakaway drainage.

Ground Gas Issues

- 7.14 Based on the three rounds of readings from the gas monitoring programme, it is not necessary to provide any specific ground gas or vapour protection generally across the site. This should be confirmed with Arun District Council. However, consideration should be given to providing a basic gas protection system (equivalent to Characteristic Situation 2/Amber 1 in CIRIA 665) in the four units along the eastern side of the site, where there may be small amounts of contaminated soils or groundwater that could give rise to organic vapours. If oil contaminated soils are found elsewhere on site, the use of gas protective membranes may also be required in such areas.

General Issues

- 7.15 If during excavation or construction additional ground or groundwater contamination comes to light, it will be necessary to investigate it, and to determine what remedial actions are required, in conjunction with Arun District Council.
- 7.16 Any piling undertaken at the site is likely to involve piling penetration through the upper layers of made ground into the chalk aquifer below. It will be important to ensure that any contaminated soils or groundwater in the upper layers is not allowed to migrate down the pile bore to contaminate the chalk aquifer. In this respect, the Environment Agency usually prefer the use of CFA piles.
- 7.17 During this second phase investigation, no further work was undertaken on the risk assessment with respect to underground water supply pipes. Therefore the recommendation in our initial report still stands, that the site is not suitable for unprotected PE pipework because of the presence of elevated concentrations of PAHs in the made ground.
-

- 7.18 All remedial works, and the results of any monitoring, waste testing or verification testing, should be documented and contained within a Verification Report which will need to be submitted to Arun District Council on completion of the remedial works. Information on the contents of a Verification Report are contained in the Environment Agency publication "Verification of Remediation of Land Contamination" (2010).
- 7.19 All works should be conducted in a safe manner. Appropriate risk assessments and method statements should be prepared prior to start of works, site staff appropriately briefed, and appropriate protective clothing worn.

APPENDIX 1**CRITERIA FOR IMPORTED SOILS**

Potential contaminant	Criteria (mg/kg)
Arsenic	37
Cadmium	26
Chromium (III)	910
Copper	2400
Lead	210
Mercury (inorganic)	40
Nickel	130
Selenium	250
Zinc	3700
Acenaphthylene	420
Acenaphthene	510
Anthracene	5400
Benzo(a)anthracene	11
Benzo(a)pyrene	2.7
Benzo(b)fluoranthene	3.3
Benzo(ghi)perylene	340
Benzo(k)fluoranthene	93
Chrysene	22
Dibenzo(ah)anthracene	0.28
Fluorene	400
Fluoranthene	560
Ideno(1,2,3-cd)pyrene	36
Naphthalene	5.6
Phenanthrene	220
Pyrene	1200
TPH Aliphatic C5-C6	78
TPH Aliphatic C6-C8	230
TPH Aliphatic C8-C10	65
TPH Aliphatic C10-C12	330
TPH Aliphatic C12-C16	2400
TPH Aliphatic C16-C35	10000
TPH Aliphatic C35-C44	10000
TPH Aromatic C5-C7	140
TPH Aromatic C7-C8	290
TPH Aromatic C8-C10	83
TPH Aromatic C10-C12	180
TPH Aromatic C12-C16	330
TPH Aromatic C16-C21	540
TPH Aromatic C21-C35	1500
TPH Aromatic C35-C44	1500
pH	5 - 8

Values generally based on S4UL criteria for 2.5% SOM and a sandy loam soil.

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APPENDIX 2**CRITERIA FOR REMOVING OIL CONTAMINATED SOILS**

Potential contaminant	Criteria (mg/kg)
<i>Polyaromatic Hydrocarbons</i>	
Acenaphthylene	420
Acenaphthene	510
Anthracene	5400
Benzo(a)anthracene	120
Benzo(a)pyrene	90
Benzo(b)fluoranthene	80
Benzo(ghi)perylene	340
Benzo(k)fluoranthene	93
Chrysene	120
Dibenzo(ah)anthracene	20
Fluorene	400
Fluoranthene	560
Ideno(1,2,3-cd)pyrene	50
Naphthalene	15
Phenanthrene	300
Pyrene	1200
<i>Total Petroleum Hydrocarbons</i>	
TPH Aliphatic C5-C6	78
TPH Aliphatic C6-C8	230
TPH Aliphatic C8-C10	65
TPH Aliphatic C10-C12	330
TPH Aliphatic C12-C16	2400
TPH Aliphatic C16-C35	10000
TPH Aliphatic C35-C44	10000
TPH Aromatic C5-C7	140
TPH Aromatic C7-C8	290
TPH Aromatic C8-C10	83
TPH Aromatic C10-C12	180
TPH Aromatic C12-C16	400
TPH Aromatic C16-C21	2500
TPH Aromatic C21-C35	5000
TPH Aromatic C35-C44	1500

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PROJECT NO: G6308

FIGURE REF: Figure 1

PROJECT: Land at Kings Close Yapton

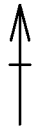
PREPARED: AJHT

SECTION: Land Quality Assessment

CHECKED: AJHT

TITLE: Site Location Plan

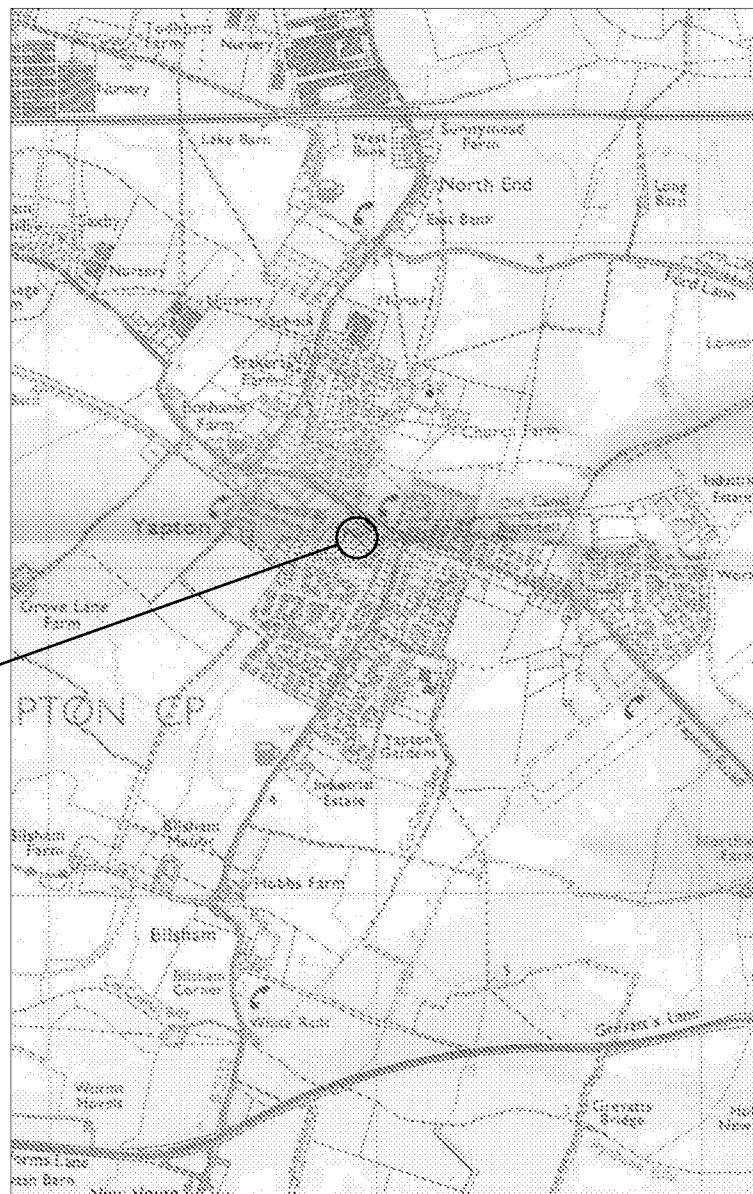
DATE: Mar 2017



North

(Not to scale)

Site Location



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PROJECT NO: G6308

FIGURE REF: Figure 2

PROJECT: Land at Kings Close Yapton

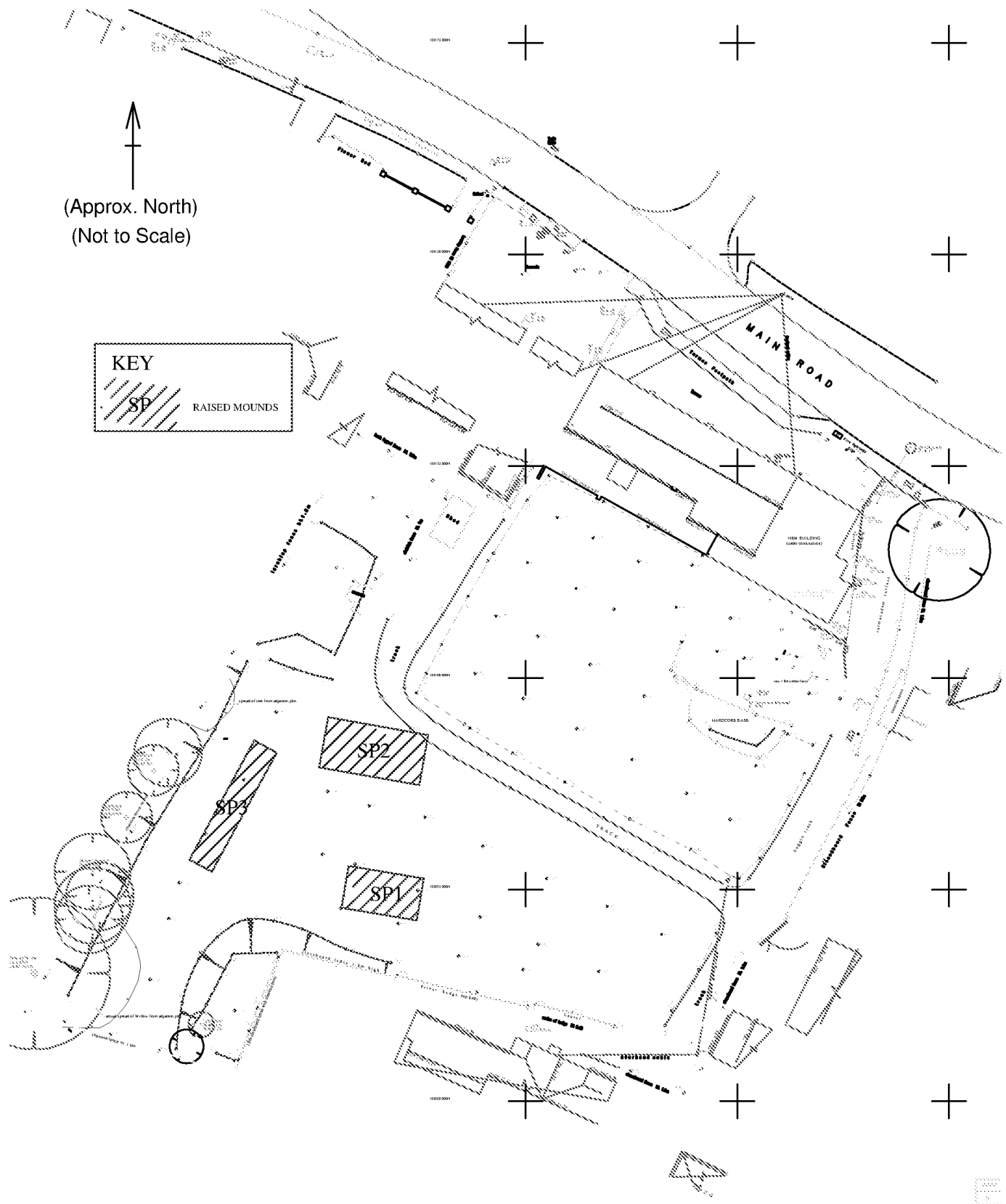
PREPARED: AJHT

SECTION: Land Quality Assessment

CHECKED: AJHT

TITLE: Existing Site Layout

DATE: Mar 2017



BASED ON TOPOGRAPHIC SURVEY DATED Nov 2014 BY ACAD MAPPING LTD

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PROJECT NO: G6308

FIGURE REF: Figure3

PROJECT: Land at Kings Close Yapton

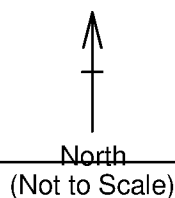
PREPARED: AJHT

SECTION: Land Quality Assessment

CHECKED: AJHT

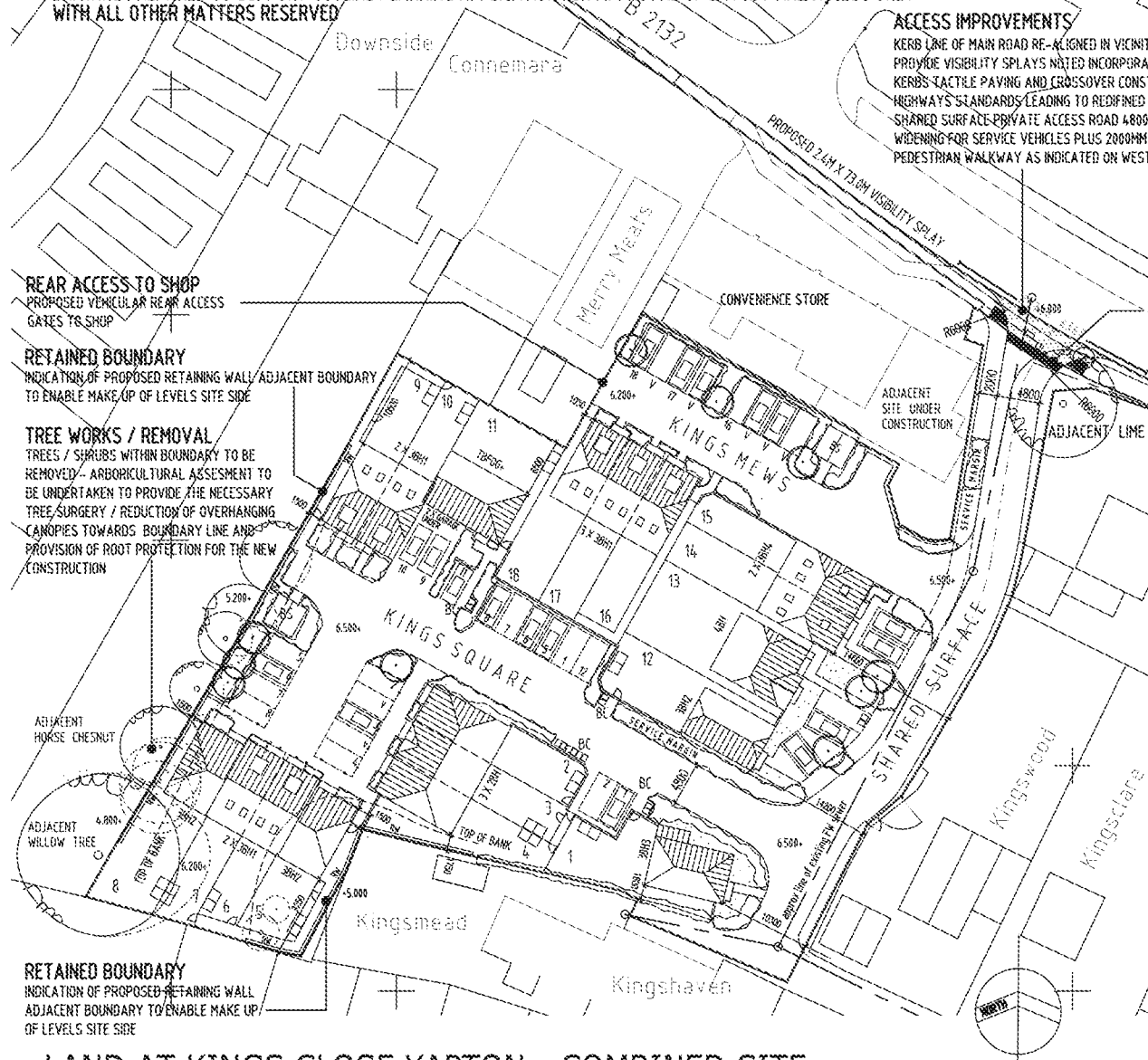
TITLE: Proposed Development

DATE: Mar 2017



PROPOSED OUTLINE PLANNING SITE LAYOUT

DRAWING PREPARED TO SUPPORT OUTLINE PLANNING APPLICATION FOR APPROVAL OF LAYOUT AND ACCESS ONLY
WITH ALL OTHER MATTERS RESERVED



LAND AT KINGS CLOSE YAPTON - COMBINED SITE

Copyright Crescent Designs (Sussex) Ltd

client PRIME SECURITIES LTD

project LAND AT KINGS CLOSE YAPTON

date JAN 2014

drw no 13020-01REV B

scale 1:500 @ A3

SUBJECT TO DETAILED SURVEYS OF SITE & REQUIREMENTS OF LOCAL AUTHORITY PLANNING BUILDING CONTROL & HIGHWAY DEPARTMENTS - DRAWING PREPARED FOR OUTLINE PLANNING APPLICATION PURPOSES ONLY
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Based on Crescent Design's plan dated Jan 2014

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PROJECT NO: G6308

FIGURE REF: Figure 4 (Rev01)

PROJECT: Land at Kings Close Yapton

PREPARED: AJHT

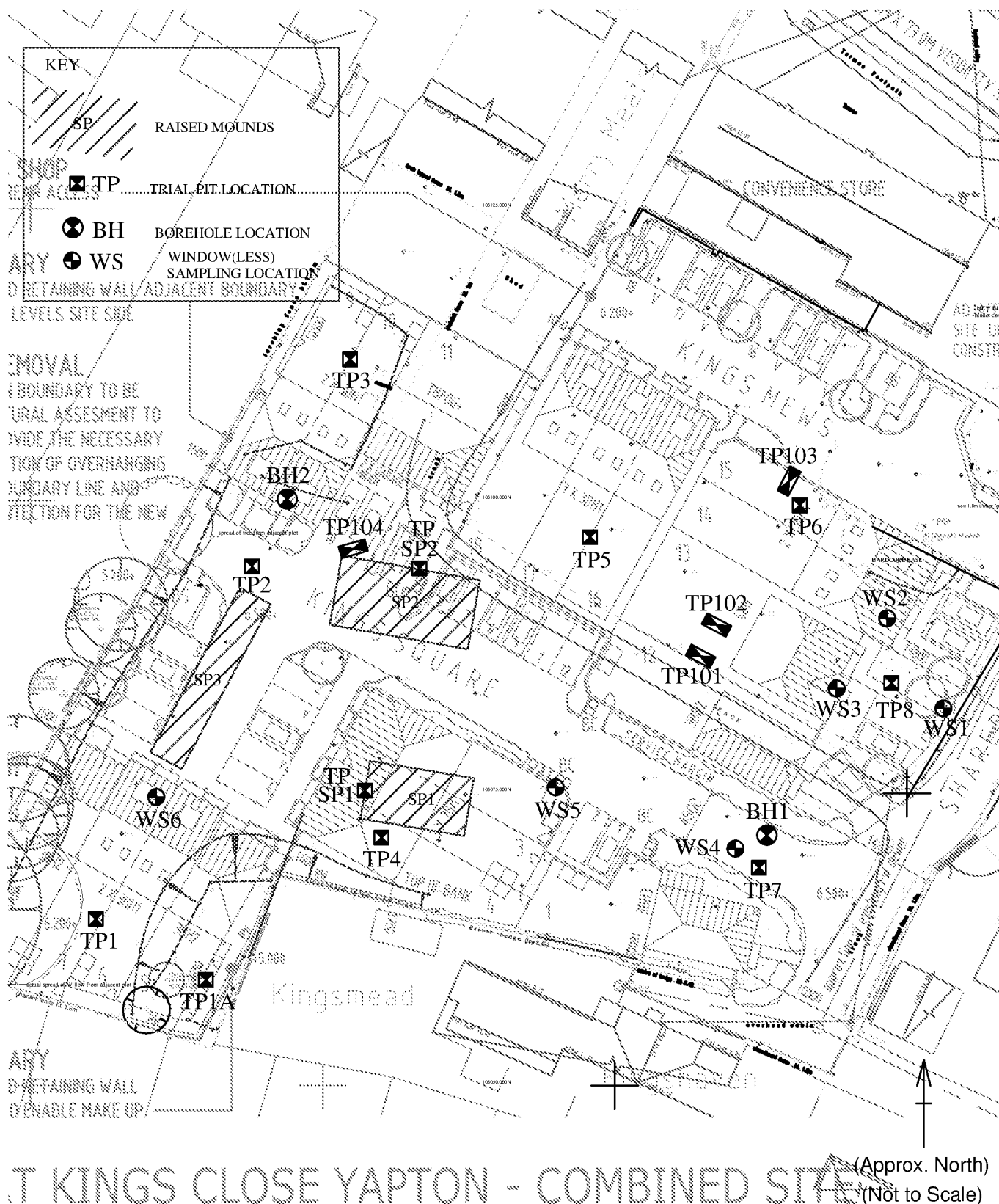
SECTION: Land Quality Assessment

CHECKED: AJHT

TITLE: Exploratory Hole Location Plan

DATE: Aug 2017

HOLE LOCATIONS SHOWN ARE INDICATIVE ONLY UNLESS DIMENSIONED



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Site

Land at Kings Close, Yapton

Borehole

Number
BH1

Boring Method Dando 2000. 200mm dia to 4.5m, bentonite seal to 3.0 then 150mm cased to base of hole	Casing Diameter 200mm cased to 4.50m 150mm cased to 10.00m	Ground Level (mOD)	Client Plotlife SPV3 Ltd	Job Number G6308
	Location See location Plan	Dates 27/07/2017- 28/07/2017	Engineer Archibald Shaw LLP	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.70-1.20	B1					(2.00)	Grass over variable MADE GROUND of moist brown locally black sandy silt with some gravel of flint and brick. Occasional glass fragment and flint cobble. Locally ash.		
1.20-1.65 1.20-1.70	SPT N=9 S2	1.20	DRY	1,2/2,3,2,2		2.00 (0.80)	Soft to firm brown and light brown slightly sandy silty clay with occasional brick fragment and flint gravel. REWORKED / MADE GROUND.		
2.20-2.65 2.20-2.70	SPT N=7 S3	2.20	DRY	1,1/2,1,2,2		2.80 (0.90)	Firm orange brown silty CLAY with occasional fine flint gravel		
2.80-2.90 3.00-3.45 3.00-3.50	B4 SPT N=13 S5	3.00	DRY	2,2/3,3,3,4		3.70 (2.30)	Off white highly weathered structureless CHALK recovered as approximately. 50% coarse medium and fine gravel of medium density chalk in matrix of silt and sand size comminuted chalk. Occasional flint gravel. Possibly Grade Dm/Dc		
4.00-4.50	U No Rec	4.00	DRY	12 blows		6.00	Off white CHALK with flints. Appears to be structured based on the SPT results and close examination of samples; grade cannot be determined. Recovery included gravel and cobble size sub angular fragments of medium density chalk and occasional nodular or shattered flint gravel and small flint cobble		
4.70-5.20	U6 30% Rec.	4.70	DRY	Bentonite Seal to 3m 14 blows					
5.20-5.70 5.20-5.65	S7 SPT N=14	5.00	3.60	Water strike(1) at 5.20m, rose to 3.50m in 20 mins. 2,3/3,3,4,4					
6.50-6.95 6.50-7.00	SPT N=27 S8	6.50	3.60	4,4/5,7,7,8					
7.00-7.50	B9								
8.00-8.45 8.00-8.50	SPT N=28 S10	8.00	3.60	10,8/7,7,6,8					
9.00-9.50	B11								
9.50-9.95 9.50-10.00	SPT N=26 S12	9.50	3.60	4,5/6,6,7,7		10.00			

Remarks

Borehole double cased to allow installation of bentonite seal between 3.0mbgl and 4.5mbgl to prevent downward migration of groundwater 50mm dia. standpipe install slotted from 10mbgl to 5mbgl then bentonite seal and plain pipe to ground level.

Scale (approx)

1:50

Logged By

AT

Figure No.

G6308.BH1

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Site

Land at Kings Close, Yapton

Borehole

Number
BH2

Boring Method Dando 2000. 200mm dia to 5.0m, bentonite seal to 3.5 then 150mm cased to base of hole	Casing Diameter 200mm cased to 5.00m 150mm cased to 15.00m		Ground Level (mOD)	Client Plotlife SPV3 Ltd	Job Number G6308
	Location See location Plan		Dates 28/07/2017- 31/07/2017	Engineer Archibald Shaw LLP	Sheet 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.70-1.20	B1					(2.20)	Rough vegetation over MADE GROUND of dark brown slightly clayey sandy silt with some gravel size brick fragments, flint and chalk and occasional flint cobble. Locally with a little charcoal.		
1.20-1.65 1.20-1.70	SPT N=7 S2	1.20	DRY	1,4/2,2,2,1					
1.70-1.90	B3								
2.20-2.65 2.20-2.70	CPT N=8 C4	2.20	DRY	2,1/2,2,2,2		2.20	Variable brown and orange brown slightly sandy very silty CLAY with occasional sand and coarse medium and fine gravel size chalk and angular / broken flint. Possibly reworked / made ground.		
2.70-2.90	B5					(1.50)			
3.20-3.65 3.20-3.70	CPT N=9 C6	3.20	DRY	3,4/2,2,3,2			... with some slightly silty fine to medium sand inclusion		
3.70-3.90	B7					3.70 (0.50)	Firm orange brown laminated silty CLAY with some thin layers (<10mm) of slightly silty fine to medium sand		▼1
4.20-4.65 4.20-4.70	CPT N=9 C8	4.20	DRY	3,4/2,2,3,2		4.20	Moist firm orange brown slightly sandy SILT with a little coarse sand and fine gravel size chalk and subangular flint ... olive grey lightly silty fine to medium sand layer (estimate up to 0.3m thick) and occasional medium and coarse angular/broken flint gravel		▽1
4.70-4.90	B9					(1.20)			
5.20-5.70	S10			Water strike(1) at 5.20m, rose to 3.80m in 20 mins. 2,3/2,3,3,3		5.40			
5.20-5.65	SPT N=11	5.20	DRY			(1.10)	Off white highly weathered structureless CHALK recovered as approximately. 50% coarse medium and fine gravel of medium density chalk in matrix of silt and sand size comminuted chalk. Occasional flint gravel. Possibly Grade Dm/Dc		
6.00-6.45 6.00-6.50	SPT N=15 S11	6.00	3.80	3,3/4,4,3,4		6.50	Off white CHALK with flints. Appears to be structured below 6.5mbgl based on the SPT results and close examination of samples; grade cannot be determined. Recovery included gravel and cobble size sub angular fragments of medium density chalk and occasional nodular or shattered flint gravel and small flint cobble		
7.00-7.20	D12								
7.50-7.95 7.50-8.00	SPT N=13 S13	7.50	3.80	2,2/3,3,3,4					
8.00-8.50	B14								
9.00-9.45 9.00-9.50	SPT N=17 S15	9.00	3.80	3,2/3,4,5,5					

Remarks

Borehole double cased to allow installation of bentonite seal between 3.5mbgl and 5.0mbgl to prevent downward migration of groundwater
On completion bentonite seal installed from 5.0mbgl to 2.0mbgl

Scale (approx)
1:50

Logged By
AT

Figure No.
G6308.BH2

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Site
Land at Kings Close, Yapton

**Borehole
Number**
BH2

Boring Method Dando 2000. 200mm dia to 5.0m, bentonite seal to 3.5 then 150mm cased to base of hole	Casing Diameter 200mm cased to 5.00m 150mm cased to 15.00m	Ground Level (mOD)	Client Plotlife SPV3 Ltd	Job Number G6308
	Location See location Plan	Dates 28/07/2017- 31/07/2017	Engineer Archibald Shaw LLP	Sheet 2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.00-10.50	B16								
10.50-10.95 10.50-11.00	SPT N=25 S17	10.50	3.80	4,4/6,6,6,7		(8.50)	Off white CHALK with flint		
11.00-11.50	B18								
12.00-12.45 12.00-12.50	SPT N=29 S19	12.00	3.80	4,6/7,7,8,7					
13.00-13.50	B20								
13.50-13.95 13.50-14.00	SPT N=33 S21	13.50	3.80	6,6/7,8,9,9			Complete at 15.00m		
15.00-15.45 15.00-15.50	SPT N=33 S23	15.00	3.80	8,7/8,8,8,9		15.00			

Remarks

Scale (approx)
1:50

Logged By
AT

Figure No.
G6308.BH2

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Site Land at Kings Close, Yapton	Number WS1
--	-----------------------------

Excavation Method Driven windowless sampler	Dimensions 87mm to 4.00m 75mm to 4.60m	Ground Level (mOD)	Client Plotlife SPV3 Ltd	Job Number G6308
	Location See LocationPlan	Dates 28/07/2017	Engineer Archibald Shaw LLP	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20	D1				(0.20) 0.20	MADE GROUND of slightly moist dark brown slightly sandy silt with some flint gravel, chalk and brick fragments		
					(1.10)	MADE GROUND / reworked firm orange brown very silty clay with occasional flint gravel		
1.00	D2				1.30	MADE GROUND / reworked firm orange brown mottled buff brown very sandy slightly silty clay with a little fine to medium angular flint gravel		
					(0.90)	... (at 1.6m) thin band of coarse angular flint gravel with local pocket of black sandy (fine to medium) silt and occasional fine gravel size brick fragment ... possibly natural ground below 1.6m		
					2.20	Orange brown slightly silty fine to medium SAND with a little coarse medium and fine angular flint gravel		
					2.60	variable brown mottled orange brown and buff firm clayey SILT, locally with much coarse medium and fine sub-rounded off white and yellowish white chalk gravel and a little subangular flint gravel.		
					(1.50)	... (3.1 - 3.3m) locally sandy silt / silty sand		
					4.10	Off white highly weathered CHALK comprising 50% sub angular coarse medium and fine gravel size medium density chalk in a matrix of sand/silt size comminuted chalk and occasional flint gravel		
					(0.50)			
					4.60	Complete at 4.60m		

Remarks

Hole driven uncased
Slight seepage below 3m. Water level rose from base of hole to 3.12 in 1 hour
50mm standpipe installed from 1.0 to 4.6m slotted with gravel surround. Upper 1m of plain pipe with bentonite seal. Gas valve and raised cover.

Scale (approx)
1:40
Logged By
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Figure No.
G6308.WS1

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Site	Land at Kings Close, Yapton	Number WS2
-------------	-----------------------------	-----------------------------

Excavation Method Driven windowless sampler	Dimensions 87mm to 4.00m 75mm to 4.70m	Ground Level (mOD)	Client Plotlife SPV3 Ltd	Job Number G6308
	Location See LocationPlan	Dates 28/07/2017	Engineer Archibald Shaw LLP	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	D1				(0.40)	MADE GROUND of variable brown and black sandy silt with much coarse medium and fine gravel of flint and brick		
					0.40	firm orange brown silty CLAY with occasional fine to medium subangular flint gravel		
1.00	D2				(1.30)			
					1.70 (0.20)	Orange brown slightly silty fine to medium SAND		
					1.90 (0.40)	Firm orange brown silty CLAY with a little sub angular to sub-rounded coarse medium and fine flint gravel		
					2.30	Firm buff brown chalky sandy SILT with much coarse medium and fine sub-rounded gravel of chalk and occasional angular to sub-rounded nodular and broken flint gravel (mainly coarse)		
3.00	D3				(1.70)			
					4.00 (0.70)	Off white, buff and yellowish white highly weathered structureless CHALK comprising 40 to 50% sub rounded to sub-angular coarse medium and fine gravel size medium density chalk in a matrix of sand/silt size comminuted chalk and occasional flint gravel		
					4.70	Complete at 4.70m		

Remarks Hole driven uncased Slight seepage below 3m. 50mm standpipe installed from 1.0 to 4.7m slotted with gravel surround. Upper 1m of plain pipe with bentonite seal. Gas valve and raised cover.	Scale (approx) 1:40	Logged By AT
Figure No. G6308.WS2		

Preliminary

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Site	Number
Land at Kings Close, Yapton	WS3

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Driven windowless sampler	87mm to 4.00m 75mm to 4.70m		Plotlife SPV3 Ltd	G6308
	Location	Dates	Engineer	Sheet
	See LocationPlan	28/07/2017	Archibald Shaw LLP	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.30	D1				0.10 (0.40)	Grass over MADE GROUND of brown slightly sandy silt with muck flint gravel, occasional cobble and some brick Firm brown silty CLAY		
					0.50	Firm orange brown silty CLAY with occasional fine to medium angular flint gravel [possibly reworked / MADE GROUND]		
1.20	D2				(1.60)	... (1.2 to 1.4m) slightly silty sand. With much coarse subangular flint gravel at 1.4m. ... abundant fine decomposed roots at 1.6m ... with much fine sand below 1.6m		
					2.10	Firm buff brown slightly sandy chalky clayey SILT with some coarse medium and fine subangular gravel of medium density chalk and a little subangular flint gravel (mainly coarse)		
3.00	D3				(1.30)			
					3.40	Off white highly weathered structureless CHALK comprising 40 to 50% sub-rounded to sub-angular coarse medium and fine gravel size medium density chalk in a matrix of sand/silt size comminuted chalk and occasional flint gravel		
4.00	D4				(1.30)			
					4.70	Complete at 4.70m		

Remarks Hole driven uncased Slight seepage below 3m. 50mm standpipe installed from 1.0 to 4.7m slotted with gravel surround. Upper 1m of plain pipe with bentonite seal. Gas valve and raised cover.	Scale (approx) 1:40	Logged By AT
Figure No. G6308.WS3		

Preliminary

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Site Land at Kings Close, Yapton	Number WS4
Client Plotlife SPV3 Ltd	Job Number G6308
Engineer Archibald Shaw LLP	Sheet 1/1

Excavation Method Driven windowless sampler	Dimensions 87mm to 4.00m 75mm to 4.70m	Ground Level (mOD)
	Location See LocationPlan	Dates 28/07/2017

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.80-1.20	D1				0.10	Rough vegetation and grass over MADE GROUND of variable brown and grey sandy silt with some brick fragment		
					(1.50)	MADE GROUND of variable dark brown and black silty sand and ash with a little flint gravel. Occasional broken ceramic. ... intermixed with orange brown silty clay below 1.2m		
					1.60	Firm orange brown silty CLAY with occasional subangular flint gravel		
					(0.40)			
					2.00	Firm buff brown slightly sandy chalky clayey SILT with some coarse medium and fine subangular to subrounded medium density chalk gravel and occasional coarse medium and fine subangular flint gravel		
					(2.00)			
					4.00	Off white highly weathered structureless CHALK comprising 40 to 50% sub-angular coarse medium and fine gravel size medium density chalk in a matrix of sand/silt size comminuted chalk and occasional flint gravel		
					(0.70)			
					4.70	Complete at 4.70m		

Remarks Hole driven uncased Slight seepage below 3m. 1m bentonite seal at base of hole then 50mm standpipe installed from 1.0 to 3.7m bgl slotted with gravel surround. Upper 1m of plain pipe with bentonite seal. Gas valve and raised cover.	Scale (approx) 1:40	Logged By AT
Figure No. G6308.WS4		

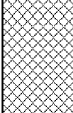
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Civil and Geotechnical Engineering Services

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Site Land at Kings Close, Yapton	Number WS5
Client Plotlife SPV3 Ltd	Job Number G6308
Engineer Archibald Shaw LLP	Sheet 1/1

Excavation Method Driven windowless sampler	Dimensions 87mm to 2.00m	Ground Level (mOD)
	Location See LocationPlan	Dates 28/07/2017

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-1.00	D1				(0.20) 0.20 (1.10) 1.30 (0.20) 1.50 (0.50) 2.00	Grass over MADE GROUND of dark brown slightly fibrous slightly clayey silt MADE GROUND of variable black, brown and red brown slightly silty sand with muck brick rubble and occasional flint gravel. ... locally ash MADE GROUND of firm brown clayey silt with occasional flint gravel and fine gravel size brick fragments. Recovered as soft to firm orange brown sandy (fine) very silty CLAY with some subangular flint gravel (Possibly reworked / MADE GROUND)	   	
						Complete at 2.00m		

Remarks Hole driven uncased Groundwater was not encountered 50mm standpipe installed from 1.0 to 2.0m bgl slotted with gravel surround and upper 1m of plain pipe with bentonite seal. Gas valve and raised cover.	Scale (approx) 1:40	Logged By AT
	Figure No. G6308.WS5	

Ground Management Ltd

Civil and Geotechnical Engineering Services

Robin Hill Farm Clay Lane Fishbourne
CHICHESTER West Sussex PO18 8AB
Phone/Fax: 01243 575073
mail@groundmanagement.com

Site

Land at Kings Close, Yapton

Number
WS6

Excavation Method

Driven windowless sampler

Dimensions

87mm to 2.00m

Ground Level (mOD)

Client

Plotlife SPV3 Ltd

Job
Number
G6308

Location

See LocationPlan

Dates

28/07/2017

Engineer

Archibald Shaw LLP

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00	D1				(0.20) 0.20 (1.80) 2.00	Rough vegetation over MADE GROUND of dark brown slightly sandy silt (topsoil) with a little flint gravel and occasional brick MADE GROUND of variable brown slightly sandy silty clay with much gravel of flint chalk and brick Complete at 2.00m		

Remarks

Hole driven uncased
Groundwater was not encountered
50mm standpipe installed from 1.0 to 2.0m bgl slotted with gravel surround and upper 1m of plain pipe with bentonite seal. Gas valve and raised cover.

Scale
(approx)
1:40

Logged
By
AT

Figure No.
G6308.WS6

Civil and Geotechnical Engineering Services

Robin Hill Farm Clay Lane Fishbourne
CHICHESTER West Sussex PO18 8AB
Phone/Fax: 01243 575073
mail@groundmanagement.com

Site

Land at Kings Close, Yapton

**Trial Pit
Number**
TP101

Excavation Method

Machine excavated using
Hitachi Zaxis 48U

Dimensions

0.35m x 1.1m

Ground Level (mOD)

Dates

02/08/2017

Client	
---------------	--

Plotlife SPV3 Ltd

**Job
Number**
G6308

Engineer

Archibald Shaw LLP

Sheet

1/1

Depth
(m)

Sample / Tests

Water
Depth
(m)

Field Records

Level
(mOD)Depth
(m)
(Thickness)

Description

Legend

Water

Grass and rough vegetation over MADE GROUND of orange brown locally brown, slightly sandy very silty CLAY with some coarse medium and fine gravel of chalk and subangular flint. Occasional gravel and cobble size lumps of brick and concrete.

(1.10)

1.10

Complete at 1.10m

Plan

Remarks

Pit sides stable and vertical during excavation
Ground water was not encountered

Scale (approx)

1:20

Logged By

AT

Figure No.

G6308.TP101

Ground Management Ltd

Civil and Geotechnical Engineering Services

Robin Hill Farm Clay Lane Fishbourne
CHICHESTER West Sussex PO18 8AB
Phone/Fax: 01243 575073
mail@groundmanagement.com

Site

Land at Kings Close, Yapton

**Trial Pit
Number**

TP103

Excavation Method

Machine excavated using
Hitachi Zaxis 48U

Dimensions

0.35m x 1.7m

Ground Level (mOD)

Client

Plotlife SPV3 Ltd

Job Number

G6308

Location

See Location Plan

Dates

02/08/2017

Engineer

Archibald Shaw LLP

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.60	D1					Rough vegetation over variable MADE GROUND of dark brown and black sandy silt with some flint gravel and brick. Locally ash. ... 50mm thick layer of compact chalk gravel at 0.4m bgl		
0.60-0.90	D2				0.60 (0.30)	Firm grey silty CLAY with occasional flint gravel (colour leached from strata above)		
0.90-1.50	D3				0.90 (0.60)	Firm orange brown slightky sandy silty CLAY with occasional flint gravel		
					1.50	Complete at 1.50m		

Plan

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Remarks

Pit sides stable and vertical during excavation
Ground water was not encountered

Scale (approx)

1:20

Logged By

AT

Figure No.

G6308.TP103

Ground Management Ltd

Civil and Geotechnical Engineering Services

Robin Hill Farm Clay Lane Fishbourne
CHICHESTER West Sussex PO18 8AB
Phone/Fax: 01243 575073
mail@groundmanagement.com

Site

Land at Kings Close, Yapton

**Trial Pit
Number
TP104**

Excavation Method

Machine excavated using
Hitachi Zaxis 48U

Dimensions

0.35m x 1.6m

Ground Level (mOD)

Client

Plotlife SPV3 Ltd

**Job
Number
G6308**

Location

See Location Plan

Dates

02/08/2017

Engineer

Archibald Shaw LLP

**Sheet
1/1**

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.60	D1				(0.60)	Rough vegetation over MADE GROUND of slightly moist variable dark brown and orange brown slightly sandy clay /silt with a little coarse medium and fine flint gravel. Locally topsoil. Occasional half brick. Some roots up to 20mm dia.		
0.60-2.00	D2				0.60	MADE GROUND of reworked firm orange brown silty clay with occasional flint gravel. Locally mottled dark brown with occasional fine gravel size brick fragments		
					(1.40)	... some coarse flint gravel and a little chalk below 1.8m		
					2.00	Complete at 2.00m		

Plan

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Remarks

Pit sides stable and vertical during excavation
Ground water was not encountered
100mm dia clay pipe exposed damaged in the west end of the pit (invert 0.9m bgl)

Scale (approx)

1:20

Logged By

AT

Figure No.

G6308.TP104



2683



Unit A2
Windmill Road
Ponswood Industrial Estate
St Leonards on Sea
East Sussex
TN38 8BY

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number: 17-13343

Issue: 3

Date of Issue: 18/08/2017

Contact: Alistair Tyler

Customer Details: Ground Management Ltd
Robin Hill Farm
Clay Lane
Chichester
West Sussex PO18 8AN

Quotation No: Q16-00620

Order No: Not Supplied

Customer Reference: G6308

Date Received: 31/07/2017

Date Approved: 18/08/2017

Details: Land at Kings Close Yapton

Approved by:

Mike Varley, Technical Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683)

Sample Summary

Report No.: 17-13343

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
107609	BH1 0.70 - 1.20	27/07/2017	31/07/2017	Silty loam	
107610	BH2 0.70 - 1.20	28/07/2017	31/07/2017		
107611	WS1 0.00 - 0.20	28/07/2017	31/07/2017	Silty loam	
107612	WS2 0.00 - 0.40	28/07/2017	31/07/2017	Silty loam	
107613	WS3 0.10 - 0.30	28/07/2017	31/07/2017	Silty loam	
107614	WS4 0.80 - 1.20	28/07/2017	15/08/2017	Sandy silty loam	g
107615	WS5 0.50 - 1.00	28/07/2017	31/07/2017		
107616	WS6 1.00	28/07/2017	31/07/2017		
107617	WS1 1.00	31/07/2017	31/07/2017		
107618	WS2 1.00	31/07/2017	31/07/2017		
107619	WS3 1.00	31/07/2017	31/07/2017		
107620	WS4 1.00	31/07/2017	31/07/2017		
107621	BH1 1.00	31/07/2017	31/07/2017		



Results Summary

Report No.: 17-13343

2683

ELAB Reference	107609	107611	107612	107613	107614
Customer Reference					
Sample ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	BH1	WS1	WS2	WS3	WS4
Sample Depth (m)	0.70 - 1.20	0.00 - 0.20	0.00 - 0.40	0.10 - 0.30	0.80 - 1.20
Sampling Date	27/07/2017	28/07/2017	28/07/2017	28/07/2017	28/07/2017
Determinand	Codes	Units	LOD		
Metals					
Arsenic	M	mg/kg	1	21.1	10.9
Cadmium	M	mg/kg	0.5	3.2	0.5
Chromium	M	mg/kg	5	41.0	22.3
Copper	M	mg/kg	5	309	42.1
Lead	M	mg/kg	5	658	197
Mercury	M	mg/kg	0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	24.6	15.5
Selenium	M	mg/kg	1	1.2	< 1.0
Zinc	M	mg/kg	5	1270	179
Inorganics					
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	< 0.8
Polyaromatic hydrocarbons					
Naphthalene	M	mg/kg	0.1	0.6	0.3
Acenaphthylene	M	mg/kg	0.1	1.5	0.2
Acenaphthene	M	mg/kg	0.1	0.3	< 0.1
Fluorene	M	mg/kg	0.1	1.0	< 0.1
Phenanthrene	M	mg/kg	0.1	14.6	2.7
Anthracene	M	mg/kg	0.1	1.8	0.3
Fluoranthene	M	mg/kg	0.1	16.5	4.4
Pyrene	M	mg/kg	0.1	13.4	3.7
Benzo(a)anthracene	M	mg/kg	0.1	5.3	2.2
Chrysene	M	mg/kg	0.1	7.9	2.7
Benzo (b) fluoranthene	M	mg/kg	0.1	6.2	2.8
Benzo(k)fluoranthene	M	mg/kg	0.1	6.5	2.6
Benzo (a) pyrene	M	mg/kg	0.1	6.8	2.8
Indeno (1,2,3-cd) pyrene	M	mg/kg	0.1	4.2	2.1
Dibenzo(a,h)anthracene	M	mg/kg	0.1	1.4	0.7
Benzo[g,h,i]perylene	M	mg/kg	0.1	4.3	2.0
Total PAH(16)	M	mg/kg	0.4	92.4	29.5

Tests marked N are not UKAS accredited.

The Environmental Laboratory Ltd. Reg. No. 3882193



Results Summary

Report No.: 17-13343

2683

ELAB Reference	107609	107611	107612	107613	107614
Customer Reference					
Sample ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	BH1	WS1	WS2	WS3	WS4
Sample Depth (m)	0.70 - 1.20	0.00 - 0.20	0.00 - 0.40	0.10 - 0.30	0.80 - 1.20
Sampling Date	27/07/2017	28/07/2017	28/07/2017	28/07/2017	28/07/2017
Determinand	Codes	Units	LOD		
BTEX					
Benzene	M	ug/kg	10	n/t	g < 10.0
Toluene	M	ug/kg	10	n/t	g < 10.0
Ethylbenzene	M	ug/kg	10	n/t	g < 10.0
Xylenes	M	ug/kg	10	n/t	g < 10.0
MTBE	N	ug/kg	10	n/t	g < 10.0
TPH CWG					
>C5-C6 Aliphatic	N	mg/kg	0.01	n/t	g < 0.01
>C6-C8 Aliphatic	N	mg/kg	0.01	n/t	g < 0.01
>C8-C10 Aliphatic	N	mg/kg	1	n/t	g < 1.0
>C10-C12 Aliphatic	N	mg/kg	1	n/t	g < 1.0
>C12-C16 Aliphatic	N	mg/kg	1	n/t	g 3.6
>C16-C21 Aliphatic	N	mg/kg	1	n/t	g 179
>C21-C35 Aliphatic	N	mg/kg	1	n/t	g 2520
>C35-C40 Aliphatic	N	mg/kg	1	n/t	g 140
>C5-C7 Aromatic	N	mg/kg	0.01	n/t	g < 0.01
>C7-C8 Aromatic	N	mg/kg	0.01	n/t	g < 0.01
>C8-C10 Aromatic	N	mg/kg	1	n/t	g < 1.0
>C10-C12 Aromatic	N	mg/kg	1	n/t	g < 1.0
>C12-C16 Aromatic	N	mg/kg	1	n/t	g 3.1
>C16-C21 Aromatic	N	mg/kg	1	n/t	g 128
>C21-C35 Aromatic	N	mg/kg	1	n/t	g 1870
>C35-C40 Aromatic	N	mg/kg	1	n/t	g 120
Total (>C5-C40) Ali/Aro	N	mg/kg	1	n/t	g 4970

Tests marked N are not UKAS accredited.

The Environmental Laboratory Ltd. Reg. No. 3882193



Results Summary

Report No.: 17-13343

ELAB Reference	107617	107618	107619	107620	107621
Customer Reference					
Sample ID					
Sample Type	WATER	WATER	WATER	WATER	WATER
Sample Location	WS1	WS2	WS3	WS4	BH1
Sample Depth (m)					
Sampling Date	31/07/2017	31/07/2017	31/07/2017	31/07/2017	31/07/2017

Determinand	Codes	Units	LOD					
Dissolved Metals								
Arsenic	U	ug/l	5	< 5	< 5	< 5	< 5	< 5
Cadmium	U	ug/l	1	< 1	< 1	< 1	< 1	< 1
Chromium	U	ug/l	5	< 5	< 5	< 5	< 5	< 5
Copper	U	ug/l	5	< 5	< 5	< 5	6	< 5
Mercury	U	ug/l	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	U	ug/l	5	< 5	< 5	< 5	< 5	< 5
Lead	U	ug/l	1	< 1	< 1	< 1	< 1	< 1
Selenium	U	ug/l	5	< 5	< 5	< 5	15	57
Zinc	U	ug/l	5	< 5	< 5	< 5	35	< 5
Anions								
Sulphate	U	mg/l	0.5	109	153	71.6	94.9	174
Inorganics								
Hexavalent Chromium	U	ug/l	100	< 100	< 100	< 100	< 100	< 100
Miscellaneous								
pH	U	pH units	0.1	7.2	7.1	7.2	7.2	7.7
Polyaromatic hydrocarbons								
Naphthalene GCMS	N	ug/l	0.01	0.22	0.48	0.13	5.19	0.07
Acenaphthylene GCMS	N	ug/l	0.01	0.29	0.29	0.14	7.50	0.17
Acenaphthene GCMS	N	ug/l	0.01	0.07	0.06	0.04	0.42	0.03
Fluorene GCMS	N	ug/l	0.01	0.11	0.18	0.09	1.01	0.04
Phenanthrene GCMS	N	ug/l	0.01	2.10	2.55	1.00	21.8	0.50
Anthracene GCMS	N	ug/l	0.01	0.59	0.69	0.36	9.80	0.17
Fluoranthene GCMS	N	ug/l	0.01	6.76	4.30	2.09	48.8	0.83
Pyrene GCMS	N	ug/l	0.01	6.04	3.82	1.75	54.8	0.73
Benzo (a) anthracene GCMS	N	ug/l	0.01	5.08	2.29	1.27	34.8	0.44
Chrysene GCMS	N	ug/l	0.01	3.40	1.70	0.84	44.7	0.35
Benzo (b) fluoranthene GCMS	N	ug/l	0.01	3.83	1.49	0.76	33.2	0.38
Benzo (k) fluoranthene GCMS	N	ug/l	0.01	3.89	1.41	0.78	33.2	0.35
Benzo (a) pyrene GCMS	N	ug/l	0.01	5.79	2.16	1.14	35.9	0.60
Indeno (1,2,3-cd) pyrene GCMS	N	ug/l	0.01	2.92	1.01	0.49	27.7	0.31
Dibenzo(a,h)anthracene GCMS	N	ug/l	0.01	0.87	0.29	0.16	11.4	0.10
Benzo(ghi)perylene GCMS	N	ug/l	0.01	2.94	1.04	0.50	33.4	0.28
Total PAH(16) GCMS	N	ug/l	0.01	44.9	23.8	11.5	404	5.37



Results Summary

Report No.: 17-13343

ELAB Reference	107617	107618	107619	107620	107621
Customer Reference					
Sample ID					
Sample Type	WATER	WATER	WATER	WATER	WATER
Sample Location	WS1	WS2	WS3	WS4	BH1
Sample Depth (m)					
Sampling Date	31/07/2017	31/07/2017	31/07/2017	31/07/2017	31/07/2017

Determinand	Codes	Units	LOD					
BTEX								
Benzene	U	ug/l	1	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Toluene	U	ug/l	1	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Ethylbenzene	U	ug/l	1	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Xylenes	U	ug/l	1	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
MTBE	U	ug/l	1	< 1.00	< 1.00	< 1.00	1.07	< 1.00
TPH CWG								
>C5-C6 Aliphatic	N	ug/l	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C6-C8 Aliphatic	N	ug/l	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C8-C10 Aliphatic	N	ug/l	5	< 5.0	< 5.0	< 5.0	154	242
>C10-C12 Aliphatic	N	ug/l	5	6.9	< 5.0	< 5.0	125	170
>C12-C16 Aliphatic	N	ug/l	5	< 5.0	< 5.0	< 5.0	57.8	< 5.0
>C16-C21 Aliphatic	N	ug/l	5	22.7	< 5.0	< 5.0	2030	14.5
>C21-C35 Aliphatic	N	ug/l	5	255	50.8	95.3	29000	201
>C35-C40 Aliphatic	N	ug/l	5	26.0	6.0	9.8	1780	11.6
Total (>C5-C40) Aliphatic	N	ug/l	5	311	56.8	105	33100	639
>C5-C7 Aromatic	N	ug/l	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C7-C8 Aromatic	N	ug/l	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C8-C10 Aromatic	N	ug/l	5	< 5.0	9.3	< 5.0	19.9	49.6
>C10-C12 Aromatic	N	ug/l	5	< 5.0	< 5.0	< 5.0	16.1	33.3
>C12-C16 Aromatic	N	ug/l	5	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
>C16-C21 Aromatic	N	ug/l	5	< 5.0	7.4	< 5.0	525	< 5.0
>C21-C35 Aromatic	N	ug/l	5	52.4	57.8	31.3	8640	66.4
>C35-C40 Aromatic	N	ug/l	5	< 5.0	< 5.0	< 5.0	783	< 5.0
Total (>C5-C40) Aromatic	N	ug/l	5	52.4	74.5	31.3	9980	149
Total (>C5-C40) Ali/Aro	N	ug/l	5	363	131	136	43100	788



2683



Results Summary

Report No.: 17-13343

ELAB Reference	107614
Customer Reference	
Sample ID	
Sample Type	SOIL
Sample Location	WS4
Sample Depth (m)	0.80 - 1.20
Sampling Date	28/07/2017

Determinand	Codes	Units	LOD	
BTEX				
Benzene	N	ug/l	1	g < 1.00
Toluene	N	ug/l	1	g < 1.00
Ethylbenzene	N	ug/l	1	g < 1.00
Xylenes	N	ug/l	1	g < 1.00
TPH CWG				
>C5-C6 Aliphatic in Leachate	N	ug/l	1	g < 1.0
>C6-C8 Aliphatic in Leachate	N	ug/l	1	g < 1.0
>C8-C10 Aliphatic Leachate	N	ug/l	5	g < 5.0
>C10-C12 Aliphatic Leachate	N	ug/l	5	g < 5.0
>C12-C16 Aliphatic Leachate	N	ug/l	5	g 15.4
>C16-C21 Aliphatic Leachate	N	ug/l	5	g 44.4
>C21-C35 Aliphatic Leachate	N	ug/l	5	g < 5.0
>C35-C40 Aliphatic Leachate	N	ug/l	5	g < 5.0
Total (>C5-C40) Aliphatic Leachate	N	ug/l	5	g 59.7
>C5-C7 Aromatic in Leachate	N	ug/l	1	g < 1.0
>C7-C8 Aromatic in Leachate	N	ug/l	1	g < 1.0
>C8-C10 Aromatic Leachate	N	ug/l	5	< 5.0
>C10-C12 Aromatic Leachate	N	ug/l	5	g < 5.0
>C12-C16 Aromatic Leachate	N	ug/l	5	g 9.1
>C16-C21 Aromatic Leachate	N	ug/l	5	g 29.2
>C21-C35 Aromatic Leachate	N	ug/l	5	g < 5.0
>C35-C40 Aromatic Leachate	N	ug/l	5	g < 5.0
Total (>C5-C40) Aromatic Leachate	N	ug/l	5	g 38.3
Total (>C5-C40) Ali/Aro Leachate	N	ug/l	5	g 98.1

Method Summary

Report No.: 17-13343

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
Aliphatic hydrocarbons in leachate	N		17/08/2017		GC-FID
Aliphatic/Aromatic hydrocarbons in leach	N		18/08/2017		GC-FID
Aromatic hydrocarbons in leachate	N		17/08/2017		GC-FID
Hexavalent chromium	N	As submitted sample	01/08/2017	110	Colorimetry
Aqua regia extractable metals	M	Air dried sample	01/08/2017	118	ICPMS
PAH (GC-FID)	M	As submitted sample	01/08/2017	133	GC-FID
BTEX in solids	M	As submitted sample	17/08/2017	181A	GC-MS
BTEX in leachates	N		17/08/2017	200A	GC-MS
Aliphatic hydrocarbons in soil	N	As submitted sample	16/08/2017	214	GC-FID
Aliphatic/Aromatic hydrocarbons in soil	N	As submitted sample	18/08/2017	214	GC-FID
Aromatic hydrocarbons in soil	N	As submitted sample	16/08/2017	214	GC-FID
Low range Aliphatic hydrocarbons leachat	N		17/08/2017	214	GC-MS
Low range Aliphatic hydrocarbons soil	N	As submitted sample	17/08/2017	214	GC-MS
Low range Aromatic hydrocarbons leachate	N		17/08/2017	214	GC-MS
Low range Aromatic hydrocarbons soil	N	As submitted sample	17/08/2017	214	GC-MS
Water					
Aliphatic/Aromatic hydrocarbons in water	N		02/08/2017		GC-FID
Aromatic hydrocarbons in water	N		02/08/2017		GC-FID
Dissolved metals by ICP in waters	U		01/08/2017	101	ICPMS
pH of waters	U		01/08/2017	113	Electromeric
Chromium Hexavalent in waters	U		01/08/2017	123	Colorimetry
Anions	U		01/08/2017	131	Ion Chromatography
PAHs and/or PCBs in waters	N		01/08/2017	135	GC-MS
BTEX in waters	U		02/08/2017	200A	GC-MS
Aliphatic hydrocarbons in water	N		01/08/2017	215	GC-FID
Aromatic hydrocarbons in water	N		01/08/2017	215	GC-FID
Low range Aliphatic hydrocarbons water	N		02/08/2017	215	GC-MS
Low range Aromatic hydrocarbons water	N		02/08/2017	215	GC-MS

Tests marked N are not UKAS accredited



Report Information

Report No.: 17-13343

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"

Soil sample results are expressed on an air dried basis (dried at < 30°C)

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

PCB congener results may include any coeluting PCBs

Uncertainty of measurement for the determinands tested are available upon request

Deviation Codes

-
- | | |
|---|--|
| a | No date of sampling supplied |
| b | No time of sampling supplied (Waters Only) |
| c | Sample not received in appropriate containers |
| d | Sample not received in cooled condition |
| e | The container has been incorrectly filled |
| f | Sample age exceeds stability time (sampling to receipt) |
| g | Sample age exceeds stability time (sampling to analysis) |

Where a sample has a deviation code, the applicable test result may be invalid.

Sample Retention and Disposal

All soil samples will be retained for a period of one month

All water samples will be retained for 7 days following the date of the test report

Charges may apply to extended sample storage

SOIL GAS AND GROUND WATER DAILY RECORD SHEET

Project Name: Kings Close, Yapton, Arundel, BN18 0EX										Project Engineer: NPB			Date: 31-Jul-17		Project No: SS0938	
Client: Ground Management Ltd					Operative: GC					Day of the week: Monday						
Land Gas Data										Groundwater Data				Remarks		
Well / TH No.	Atmospheric Pressure (mb) and Ambient Temperature	PID	BH pressure	Flow Rate		CH ₄	CO ₂	O ₂	CO	H ₂ S	Depth to base of well	Water level	Height of Cover	Details of water samples (colour, clarity, odour etc)	Ground Conditions (soft, wet/dry, frozen etc) & Weather Conditions	General Remarks
		ppm	mb	l/hr		%	%	%	ppm	ppm	m below top of cover	m below top of cover	m above GL			
WS1		P				P					4.91	3.00	0.47	Light Brown Opaque Very Silty No Odour		Purged approx 1 bucket (10ltrs)
		S				S										
		Time Of Readings:				Time Of Readings:				Time Of Readings: 9:00						
WS2		P				P					5.07	2.92	0.40	Light Brown Opaque Very Silty No Odour		Purged approx 1 bucket (10ltrs)
		S				S										
		Time Of Readings:				Time Of Readings:				Time Of Readings: 9:20						
WS3		P				P					5.11	2.99	0.40	Light Brown Opaque Very Silty No Odour		Purged approx 1 bucket (10ltrs)
		S				S										
		Time Of Readings:				Time Of Readings:				Time Of Readings: 9:40						
WS4		P				P					4.13	3.13	0.30	Dark Brown Opaque Pungent Odour Black bits floating in water Silty		Purged approx 1 bucket (10ltrs)
		S				S										
		Time Of Readings:				Time Of Readings:				Time Of Readings: 9:50						
BH1		P				P					9.18	3.07	0.30	Chalky Opaque Silty No Odour Very light grey almost white.		Purged approx 1 bucket (10ltrs)
		S				S										
		Time Of Readings:				Time Of Readings:				Time Of Readings: 10:10						
		P				P										
		S				S										
		Time Of Readings:				Time Of Readings:				Time Of Readings:						
P = Peak Reading, S = Steady reading Equipment Used: Interface Meter, MiniRAE 2000, GFM435 Gas Analyser															Checked By	

SOIL GAS AND GROUND WATER DAILY RECORD SHEET

Project Name: Kings Close, Yapton, Arundel, BN18 0EX										Project Engineer: NPB			Date: 02-Aug-17			Project No: SS0938	
Client: Ground Management Ltd					Operative: LB					Day of the week: Wednesday							

Land Gas Data										Groundwater Data			Remarks				
Well / TH No.	Atmospheric Pressure (mb) and Ambient Temperature	PID	BH pressure	Flow Rate		CH ₄	CO ₂	O ₂	CO	H ₂ S	Depth to base of well	Water level	Height of Cover	Details of water samples (colour, clarity, odour etc)	Ground Conditions (soft, wet/dry, frozen etc) & Weather Conditions	General Remarks	
		ppm	mb	l/hr		%	%	%	ppm	ppm	m below top of cover	m below top of cover	m above GL				
WS1	1013, 17 degrees C	P	0.3	0.0	0.0	P	0.0	2.4	17.5	0.0	0.0	4.95	3.01	0.47		Overcast, wet, raining and windy	
		S	0.3	0.0	0.0	S	0.0	2.4	17.5	0.0	0.0						
		Time Of Readings: 13.36 / 13.32				Time Of Readings: 13.35				Time Of Readings: 13.37							
WS2	1013, 17 degrees C	P	0.5	0.0	0.0	P	0.0	4.2	15.1	0.0	0.0	5.05	2.95	0.43		Overcast, wet, raining and windy	
		S	0.5	0.0	0.0	S	0.0	4.2	15.1	0.0	0.0						
		Time Of Readings: 13.29 / 13.25				Time Of Readings: 13.28				Time Of Readings: 13.30							
WS3	1014, 17 degrees C	P	0.7	0.0	0.0	P	0.0	2.2	17.2	0.0	0.0	5.12	3.04	0.42		Overcast, wet, raining and windy	
		S	0.6	0.0	0.0	S	0.0	2.2	17.2	0.0	0.0						
		Time Of Readings: 13.22 / 13.18				Time Of Readings: 13.21				Time Of Readings: 13.23							
WS4	1014, 17 degrees C	P	2.2	0.0	0.0	P	0.0	4.2	15.3	0.0	0.0	4.13	3.28	?		Overcast, wet, raining and windy	
		S	2.1	0.0	0.0	S	0.0	4.2	15.3	0.0	0.0						
		Time Of Readings: 13.14 / 13.10				Time Of Readings: 13.13				Time Of Readings: 13.15							
WS5	1013, 17 degrees C	P	0.4	0.0	0.0	P	0.0	2.2	18.5	0.0	0.0	1.86	DRY			Overcast, wet, raining and windy	
		S	0.4	0.0	0.0	S	0.0	2.2	18.5	0.0	0.0						
		Time Of Readings: 13.44 / 13.40				Time Of Readings: 13.43				Time Of Readings: 13.45							
WS6	1013, 17 degrees C	P	0.5	0.0	0.0	P	0.0	1.4	19.1	0.0	0.0	1.88	DRY			Overcast, wet, raining and windy	
		S	0.5	0.0	0.0	S	0.0	1.4	19.1	0.0	0.0						
		Time Of Readings: 13.51 / 13.47				Time Of Readings: 13.50				Time Of Readings: 13.52							

P = Peak Reading, S = Steady reading

Equipment Used: Interface Meter, MiniRAE 2000, GM435 Gas Analyser

Checked By

SOIL GAS AND GROUND WATER DAILY RECORD SHEET

Project Name: Kings Close, Yapton, Arundel, BN18 0EX	Project Engineer: NPB	Date: 02-Aug-17	Project No:
Client: Ground Management Ltd	Operative: LB	Day of the week: Wednesday	SS0938

Land Gas Data											Groundwater Data			Remarks		
Well / TH No.	Atmospheric Pressure (mb) and Ambient Temperature	PID	BH pressure	Flow Rate		CH ₄	CO ₂	O ₂	CO	H ₂ S	Depth to base of well	Water level	Height of Cover	Details of water samples (colour, clarity, odour etc)	Ground Conditions (soft, wet/dry, frozen etc) & Weather Conditions	General Remarks
		ppm	mb	l/hr		%	%	%	ppm	ppm	m below top of cover	m below top of cover	m above GL			
BH1		P			P						8.92	3.05	0.40		Overcast, wet, raining and windy	
		S			S											
		Time Of Readings:			Time Of Readings:					Time Of Readings: 13.00						
		P			P											
		S			S											
		Time Of Readings:			Time Of Readings:					Time Of Readings:						
		P			P											
		S			S											
		Time Of Readings:			Time Of Readings:					Time Of Readings:						
		P			P											
		S			S											
		Time Of Readings:			Time Of Readings:					Time Of Readings:						
		P			P											
		S			S											
		Time Of Readings:			Time Of Readings:					Time Of Readings:						

P = Peak Reading, S = Steady reading	Equipment Used: Interface Meter, MiniRAE 2000, GM435 Gas Analyser	Checked By
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SOIL GAS AND GROUND WATER DAILY RECORD SHEET

Project Name: Kings Close, Yapton, Arundel, BN18 0EX										Project Engineer: NPB			Date: 08-Aug-17			Project No: SS0938	
Client: Ground Management Ltd						Operative: OS				Day of the week: Tuesday							
Land Gas Data										Groundwater Data					Remarks		
Well / TH No.	Atmospheric Pressure (mb) and Ambient Temperature		PID	BH pressure	Flow Rate		CH ₄	CO ₂	O ₂	CO	H ₂ S	Depth to base of well	Water level	Height of Cover	Details of water samples (colour, clarity, odour etc)	Ground Conditions (soft, wet/dry, frozen etc) & Weather Conditions	General Remarks
			ppm	mb	l/hr		%	%	%	ppm	ppm	m below top of cover	m below top of cover	m above GL			
WS1	1009.0	P	0.3	0.0	0.0	P	0.0	2.9	16.3	0.0	0.0	4.80	2.95	0.49		Dry, cloudy	
		S	0.2	0.0	0.0	S		2.9	16.3	0.0	0.0						
		Time Of Readings:			Time Of Readings:			Time Of Readings:									
		12:38 12:32			12:34 12:37			12:40									
WS2	1009.0	P	0.5	0.0	0.0	P	0.0	4.3	13.9	0.0	0.0	5.01	2.87	0.45		Dry, cloudy	
		S	0.4	0.0	0.0	S	0.0	4.3	13.9	0.0	0.0						
		Time Of Readings:			Time Of Readings:			Time Of Readings:									
		12:29 12:23			12:24 12:27			12:30									
WS3	1010.0	P	0.5	0.0	0.0	P	0.0	2.0	18.1	0.0	0.0	5.10	2.94	0.43		Dry, cloudy	
		S	0.4	0.0	0.0	S	0.0	2.0	18.1	0.0	0.0						
		Time Of Readings:			Time Of Readings:			Time Of Readings:									
		12:19 12:13			12:14 12:17			12:20									
WS4	1012.0	P	3.0	0.0	0.0	P	0.0	4.5	14.2	0.0	0.0	4.12	3.05	0.47		Dry, cloudy	
		S	2.9	0.0	0.0	S	0.0	4.5	14.2	0.0	0.0						
		Time Of Readings:			Time Of Readings:			Time Of Readings:									
		11:48 11:43			11:44 11:47			11:50									
WS5	1011.0	P	0.2	0.0	0.0	P	0.0	2.4	17.8	0.0	0.0	1.86	Dry	GL		Dry, cloudy	
		S	0.2	0.0	0.0	S	0.0	2.4	17.8	0.0	0.0						
		Time Of Readings:			Time Of Readings:			Time Of Readings:									
		11:58 11:52			11:53 11:56			12:00									
WS6	1009.0	P	0.2	0.0	0.0	P	0.0	2.3	16.8	0.0	0.0	1.88	Dry	GL		Dry, cloudy	
		S	0.2	0.0	0.0	S	0.0	2.3	16.8	0.0	0.0						
		Time Of Readings:			Time Of Readings:			Time Of Readings:									
		12:09 12:03			12:04 12:07			12:11									
P = Peak Reading, S = Steady reading Equipment Used: Interface Meter, MiniRAE 2000, GFM435 Gas Analyser															Checked By		

May 17

SOIL GAS AND GROUND WATER DAILY RECORD SHEET

Project Name: Kings Close, Yapton, Arundel, BN18 0EX										Project Engineer: NPB			Date: 08-Aug-17			Project No: SS0938	
Client: Ground Management Ltd						Operative: OS				Day of the week: Tuesday							

Land Gas Data										Groundwater Data				Remarks			
Well / TH No.	Atmospheric Pressure (mb) and Ambient Temperature		PID	BH pressure	Flow Rate		CH ₄	CO ₂	O ₂	CO	H ₂ S	Depth to base of well	Water level	Height of Cover	Details of water samples (colour, clarity, odour etc)	Ground Conditions (soft, wet/dry, frozen etc) & Weather Conditions	General Remarks
			ppm	mb	l/hr		%	%	%	ppm	ppm	m below top of cover	m below top of cover	m above GL			
BH1	1012.0	P	1.6	0.0	0.0	P	0.0	2.7	15.8	0.0	0.0	8.72	2.95	0.40		Dry, cloudy	
		S	1.5	0.0	0.0	S	0.0	2.7	15.8	0.0	0.0						
		Time Of Readings:			Time Of Readings:			Time Of Readings:									
		11:38 11:32		11:34 11:37		11:40											
		P				P											
		S				S											
		Time Of Readings:			Time Of Readings:			Time Of Readings:									
		P				P											
		S				S											
		Time Of Readings:			Time Of Readings:			Time Of Readings:									
		P				P											
		S				S											
		Time Of Readings:			Time Of Readings:			Time Of Readings:									
		P				P											
		S				S											
		Time Of Readings:			Time Of Readings:			Time Of Readings:									
		P				P											
		S				S											
		Time Of Readings:			Time Of Readings:			Time Of Readings:									

P = Peak Reading, S = Steady reading Equipment Used: Interface Meter, MiniRAE 2000, GFM435 Gas Analyser Checked By

SOIL GAS AND GROUND WATER DAILY RECORD SHEET

Project Name: Kings Close, Yapton, Arundel, BN18 0EX										Project Engineer: NPB			Date: 15-Aug-17			Project No: SS0938	
Client: Ground Management Ltd						Operative: OS				Day of the week: Tuesday							
Land Gas Data										Groundwater Data					Remarks		
Well / TH No.	Atmospheric Pressure (mb) and Ambient Temperature		PID	BH pressure	Flow Rate		CH ₄	CO ₂	O ₂	CO	H ₂ S	Depth to base of well	Water level	Height of Cover	Details of water samples (colour, clarity, odour etc)	Ground Conditions (soft, wet/dry, frozen etc) & Weather Conditions	General Remarks
			ppm	mb	l/hr		%	%	%	ppm	ppm	m below top of cover	m below top of cover	m above GL			
WLS1	1017.0	P	0.1	0.0	0.0	P	0.0	3.2	15.5	0.0	0.0	4.79	2.93	0.49		Dry, cloudy	
		S	0.0	0.0	0.0	S	0.0	3.2	15.5	0.0	0.0						
		Time Of Readings:			Time Of Readings:			Time Of Readings:									
		10:51 10:45			10:46 10:49			10:53									
WLS2	1017.0	P	0.5	0.0	0.0	P	0.0	4.4	14.2	0.0	0.0	5.00	2.85	0.45		Dry, cloudy	
		S	0.4	0.0	0.0	S	0.0	4.4	14.2	0.0	0.0						
		Time Of Readings:			Time Of Readings:			Time Of Readings:									
		11:02 10:56			10:57 11:00			11:04									
WLS3	1015.0	P	0.3	0.0	0.0	P	0.0	2.1	18.1	0.0	0.0	5.10	2.92	0.43		Dry, cloudy	
		S	0.2	0.0	0.0	S	0.0	2.1	18.1	0.0	0.0						
		Time Of Readings:			Time Of Readings:			Time Of Readings:									
		11:11 11:06			11:07 11:10			11:13									
WLS4	1014.0	P	4.7	0.0	0.0	P	0.0	4.7	13.2	0.0	0.0	4.13	3.03	0.47		Dry, cloudy	
		S	4.6	0.0	0.0	S	0.0	4.7	13.2	0.0	0.0						
		Time Of Readings:			Time Of Readings:			Time Of Readings:									
		11:22 11:15			11:17 11:20			11:23									
WLS5	1014.0	P	0.3	0.0	0.0	P	0.0	2.6	17.5	0.0	0.0	1.61	Dry	GL		Dry, cloudy	
		S	0.2	0.0	0.0	S	0.0	2.6	17.5	0.0	0.0						
		Time Of Readings:			Time Of Readings:			Time Of Readings:									
		11:31 11:26			11:27 11:30			11:33									
WLS6	1014.0	P	0.2	0.0	0.0	P	0.0	2.7	15.9	0.0	0.0	1.88	Dry	GL		Dry, cloudy	
		S	0.2	0.0	0.0	S	0.0	2.7	15.9	0.0	0.0						
		Time Of Readings:			Time Of Readings:			Time Of Readings:									
		11:41 11:35			11:37 11:40			11:43									
P = Peak Reading, S = Steady reading										Equipment Used: Interface Meter, MiniRAE 2000, GFM435 Gas Analyser					Checked By		

May 17

SOIL GAS AND GROUND WATER DAILY RECORD SHEET

Project Name: Kings Close, Yapton, Arundel, BN18 0EX										Project Engineer: NPB			Date: 15-Aug-17			Project No: SS0938	
Client: Ground Management Ltd					Operative: OS					Day of the week: Tuesday							
Land Gas Data										Groundwater Data				Remarks			
Well / TH No.	Atmospheric Pressure (mb) and Ambient Temperature	PID	BH pressure	Flow Rate		CH ₄	CO ₂	O ₂	CO	H ₂ S	Depth to base of well	Water level	Height of Cover	Details of water samples (colour, clarity, odour etc)	Ground Conditions (soft, wet/dry, frozen etc) & Weather Conditions	General Remarks	
						ppm	mb	l/hr		%							%
BH1		P				P					8.71	2.93	0.40		Dry, Cloudy		
		S				S											
		Time Of Readings:				Time Of Readings:				Time Of Readings:							
										11:54							
TP8		P	0.3			P					3.87	3.12	0.80		Dry, Cloudy		
		S	0.2			S											
		Time Of Readings:				Time Of Readings:				Time Of Readings:							
										12:00			12:02				
TP3		P				P					3.04	Dry	0.60		Dry, Cloudy		
		S				S											
		Time Of Readings:				Time Of Readings:				Time Of Readings:							
										12:06							
TP1A		P				P						Dry	0.50		Dry, Cloudy		
		S				S											
		Time Of Readings:				Time Of Readings:				Time Of Readings:							
										12:10							
TP1		P				P					3.24	2.52	0.50		Dry, Cloudy		
		S				S											
		Time Of Readings:				Time Of Readings:				Time Of Readings:							
										12:15							
		P				P											
		S				S											
		Time Of Readings:				Time Of Readings:				Time Of Readings:							

P = Peak Reading, S = Steady reading

Equipment Used: Interface Meter, MiniRAE 2000, GFM435 Gas Analyser

Checked By

May 17

Project: Land at Kings Close Yapton
Project Number: G6308

Ground Management Ltd
 Civil and Geotechnical Engineering Services
 Robin Hill Farm, Clay Lane, Fishbourne
 CHICHESTER, West Sussex, PO18 8AB
 Phone/Fax: 01243 575073

Location	TP1A	TP1	TP3	TP8	BH1	WS1	WS2	WS3	WS4
Cover Level AOD(m)	5.145	6.348	7.053	6.948	6.749	6.702	6.628	6.720	6.891
Cover Upstand (mm)	345	250	630	730	390	465	455	450	470
Approx Ground Level	4.80	6.10	6.42	6.22	6.36	6.24	6.17	6.27	6.42

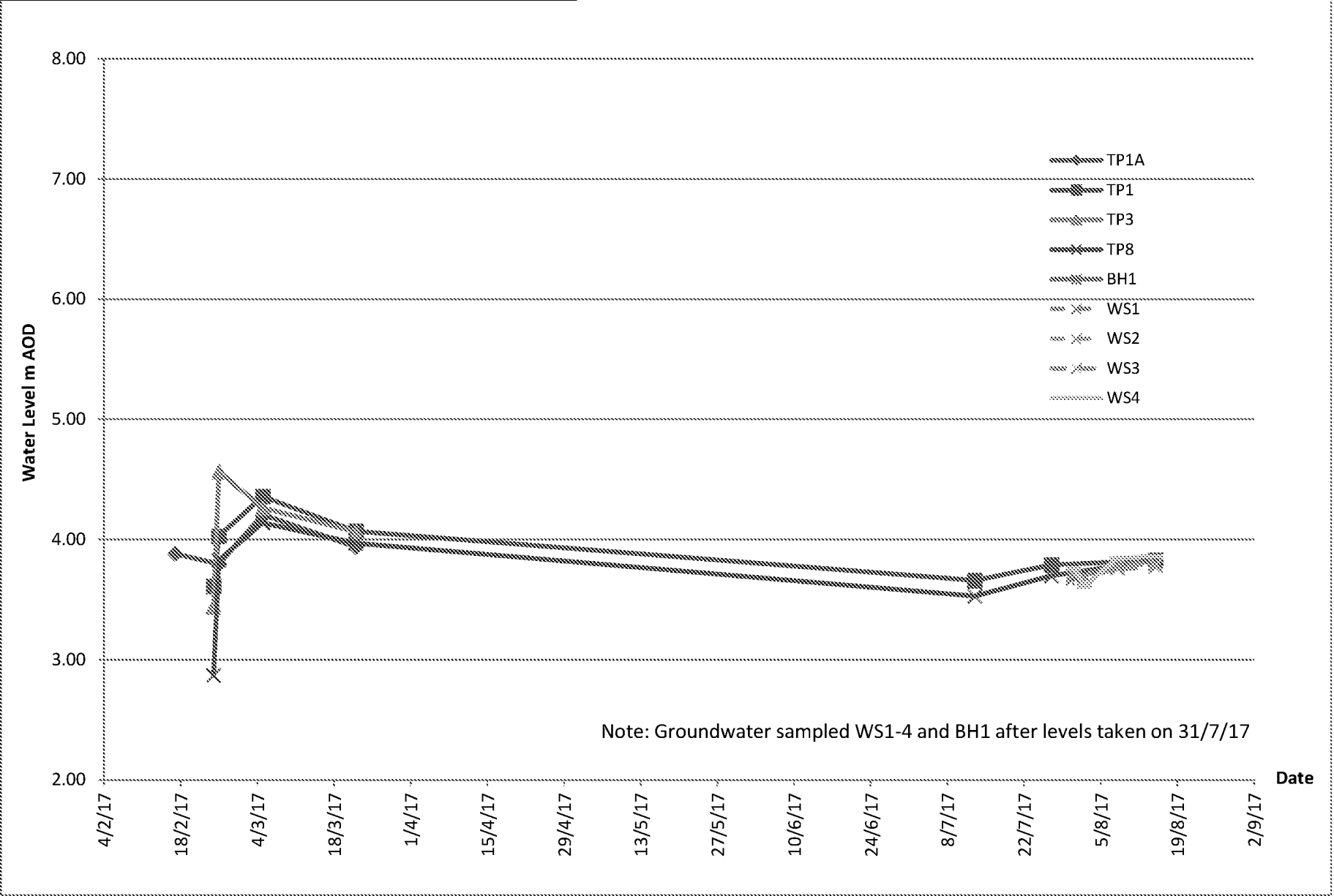
Levels referenced to site datum that is correlated to Ordnance Datum by averaging ground levels taken from survey by Acad Mapping Nov2014

Date	Dip from cover level (mm)									Approx Groundwater elevation (mAOD)								
	TP1A	TP1	TP3	TP8	BH1	WS1	WS2	WS3	WS4	TP1A	TP1	TP3	TP8	BH1	WS1	WS2	WS3	WS4
17/02/2017	TP Obs									3.88								
24/02/2017		TP Obs	TP Obs	TP Obs							3.61	3.44	2.87					
25/02/2017	1350	2320	2490	3120						3.80	4.03	4.56	3.83					
05/03/2017	940	1990	2790	2810						4.21	4.36	4.26	4.14					
22/03/2017	1210	2280	2990	2980						3.94	4.07	4.06	3.97					
13/07/2017	dry	2690	dry	3420							3.66		3.53					
27/07/2017	dry	2560	dry	3250							3.79		3.70					
31/07/2017					3070	3000	2920	2990	3130					3.68	3.70	3.71	3.73	3.76
02/08/2017					3050	3010	2950	3040	3280					3.70	3.69	3.68	3.68	3.61
08/08/2017					2950	2950	2870	2940	3050					3.80	3.75	3.76	3.78	3.84
15/08/2017	dry	2520	dry	3120	2930	2930	2850	2920	3030		3.83		3.83	3.82	3.77	3.78	3.80	3.86

Ground Management Ltd
Civil and Geotechnical Engineering Services

Robin Hill Farm, Clay Lane, Fishbourne
CHICHESTER, West Sussex PO18 8AB
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G6308 Land at Kings Close Yapton



Ground Management Ltd
Civil and Geotechnical Engineering Services

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G6308 Land at Kings Close Yapton

