

**Former SSE Offices Site,
Bartons Road,
Havant,
PO9 5JB**



**Interpretative Site Investigation and
Remedial Strategy Report**

Client

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Report No. :

HAV164.D/SI/002

Revision :

3

Date : November 2020

Proposed Development at Former SSE Depot, Bartons Road, Havant

Interpretative Site Investigation and Remedial Strategy Report

REPORT HAV164.D/SI/002 CONTROL SHEET

Issue 2 – first issue for comment

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Issue/revision	2	3		
Date	21 October 2020	25 November 2020		
Reason for issue	Amended layout with McDonalds restaurant	Amended access and layout drawing for McDonalds restaurant		
Prepared by				
Signature				

Proposed Development at Former SSE Depot, Bartons Road, Havant

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Proposed Development at Former SSE Depot, Bartons Road, Havant

Interpretative Site Investigation and Remedial Strategy Report

EXECUTIVE SUMMARY

Area of interest	Summary of main text
Introduction	This report details the results of an intrusive site investigation undertaken upon the former SSE Depot site in Havant. These investigations were to establish the environmental conditions of the site prior to its redevelopment. This report also details the remedial works necessary to mitigate any identified risks to human health, controlled waters or other receptors identified on the site.
Site Location & Description	The current proposed development site, which is irregular in shape, occupies an area of approximately 1.7ha and is centred at National Grid Reference 472147 108016. The former postal address was Southern and Scottish Energy Bartons Road, Havant PO5 9JB. At the time of the site investigation all the buildings and structures had been demolished so that the site had a level plateau in the northern section with a stockpile of crushed concrete located on it. The southern section was also level but at approximately 1.5m lower at the base of a ramp. Between the site walkover in December 2019 and the intrusive investigation (March 2020) the conifer trees along the northern and western boundaries had been felled.
Previous Reports	A Desk Study Report, reference HAV164.D/DS/001, dated 18th December 2019 was been produced by Forge Environmental Management Ltd (FEML),
Geology	The published BGS maps indicate that the site possibly straddles a geological boundary with no drift deposits beneath the western section whilst Head should be present beneath the eastern area. Similarly, the bedrock is indicated as Bognor Sand Member in the west and London Clay Formation below the eastern section. However, from a historical borehole just beyond the eastern boundary it would appear the drift deposits are absent and that the Bognor Sand is the shallow bedrock
Hydrogeology	The EA aquifers maps do not indicate any superficial aquifers below the site but the Bognor Sand bedrock is a Secondary A Aquifer whilst the London Clay was identified as Unproductive Strata The deeper chalk the groundwater is classified as a Principal Aquifer and a Zone 1c SPZ as there is a potable water abstraction 1,897m to the south-west. Based upon the geology it is considered that there is potential for groundwater flooding from the underlying aquifer although there is no evidence of such flooding has ever occurred.

Area of interest	Summary of main text
Hydrology	The nearest surface water course is a drainage ditch 306m to the east, which is within the East Hampshire catchment area. The site is not within an area considered to be at risk from flooding from rivers.
Radon	No radon protection measures are deemed necessary in the construction of new dwellings.
Site History	The site was in agricultural use until between 1966 and 1975 when it was first developed as offices although the buildings underwent significant extensions or possible redevelopment in the 1990's and again in the early 2000's before they were cleared prior to 2019. The surrounding area was also predominantly used for agricultural from prior to the 1880's but from after the second world war until the mid 1970's Havant expanded and the area was developed with a mixture of residential properties and commercial or industrial buildings, except for the open space area to the east. The adjacent football ground was built in the 1990's.
Preliminary Conceptual Site Model	The potential contaminant sources identified were: 1. Made ground of unknown provenance or impacted natural soils resulting from previous development activities; 2. PCB's from either electrical equipment on the site when it was operated by an electrical company or on site migration from the adjacent electricity substation adjacent to the south-eastern boundary; 3. On site migration from the former petrol station abutting the south-western boundary or the tanks noted within the SSE compound adjacent to the south-eastern boundary. The identified potential sources have been determined to pose a very low to moderate risk to future occupiers/users or the environment.
Scope of Site Investigation Works	The investigation works undertaken by FEML comprised the following: • The excavation of 7N° trial pits • Undertake infiltration testing in 4N° trial pits • Chemical testing of selected soils samples.
Infiltration Test Results	Infiltration tests were undertaken in trial pits TP1-4 but the water level did not drop by 50% within any of the test pits therefore it has not been possible to calculate the infiltration rates.
Identified Ground Conditions from the investigations	The intrusive investigations were undertaken on the 3rd March 2020 and revealed a layer c.350mm of crushed concrete across the northern area of the site (area of former offices) below this, mainly in the central area, was c.1m of made ground comprising a gravelly clay with brick fragments. The lower lying southern section was surfaces with c.300mm of Type 1 with varying quantities of gravel and brick fragments. A gravelly clay locally gravelly sand, which is considered to be Head deposits, were present across the site in a band c.1m thick underlying this, when encountered, was a yellow fine sand that is likely to be the Bognor Sand member. The groundwater was encountered within some of the trial pits at between 1.1m and 2.3m.
Ground Gas Assessment	No on or off site sources of landfill gases have been identified therefore based upon CL:Aire publication RB17 the site is considered to be characteristic situation CS1. Therefore, no gas protection measures are considered necessary within the new development.
Human Health Risk Assessment	Based upon a residential without the consumption of home-grown vegetables end use no elevated levels of contamination were identified across the site. Therefore, no remedial works are proposed for the protection of human health.

Area of interest	Summary of main text
Controlled Waters	Although the perched groundwater was shown to contain elevated levels of hydrocarbons due to the site's setting and absence of any mechanisms for it to impact upon the identified receptors the site is not considered to pose a risk to Controlled Waters
Risk Assessment of other Environmental Receptors	▪ An elevated concentration of potentially phytotoxic nickel was revealed within the made ground that could be detrimental to plant growth. However, as the site will require the import of a suitable growth for any soft landscaped areas the geochemistry of the made ground is not considered to be of concern as the roots will not come into contact with it. ▪ Based upon the available results the soils across the site would not pose a risk to subsurface concrete and a DS1 design mix should be suitable. Although if deep piled foundations are extended into the anticipated underlying London Clay this could have a higher sulphate content and further testing should be undertaken to determine the properties of the soil. ▪ The made ground could create an aggressive environment for buried potable water pipework.
Remedial Strategy	• The Local Water Authority should be consulted to obtain their required specification for buried water pipework. • Due to the absence of any suitable soils on the site a growth medium will have to be imported for any soft landscaped area.
Recommendations	• Havant Borough Council should be forwarded a copy of this site investigation report for their assessment to confirm that they are in agreement with the conclusions and the scope of the proposed Remedial Strategy. • Liaison with the statutory water supplier should be undertaken to confirm their required specification for underground water supply pipework to be used across the site. • The landscaping architect should provide details of the soils required within the soft landscaped areas.

Proposed Development at Former SSE Depot, Bartons Road Havant

Interpretative Site Investigation and Remedial Strategy Report

1.0 INTRODUCTION

1.1 Contract Details

Based upon the recommendations contained within the Desk Study report produced by Forge Environmental Limited (FEML) for the former SSE Depot site in Havant FEML were instructed to undertake the proposed intrusive site investigations. This was necessary in order to establish the environmental condition of the site prior to the proposed redevelopment.

Currently there are no detailed drawings available showing the proposed development but it is anticipated it will comprise around 174 apartments over three 4.5 storey blocks together with a car home.

This report also details any remedial proposals deemed necessary to mitigate any identified human health or controlled waters risks resulting from any contamination identified by the intrusive investigations.

1.2 Previous Reports

A Desk Study Report, reference HAV164D/DS/001 dated 18th December 2019 was produced by FEML and should be read in conjunction with this report.

1.3 Scope of Works

In general accordance with the FEML proposals outlined in the Desk Study report, the scope of current site investigation comprised the following:

- Excavation of 7N° trial pits
- Preparation of engineering exploratory hole logs to record the observed ground conditions;
- Chemical testing of 10N° selected soil samples and 1N° perched water sample
- Infiltration testing in 4N° of the trial pits;
- Preparation of an interpretative report presenting the findings of the investigations to determine general ground conditions and geochemistry of the soils plus generic quantitative risk assessments to determine potentially unacceptable risks and details of any proposed remedial works necessary to address any identified risks.

1.4 Report Limitations

The recommendations, interpretations and conclusions of this report are based solely on the historical/environmental information obtained relating to the site and the current site conditions observed during the intrusive investigations undertaken on the 3rd March 2020. No responsibility can be accepted for the accuracy of third party investigation data including that which is contained within the GroundSure Report which was used for the production of the previous Desk Study that is referred to in this report.

Due to the inherent variability of the ground conditions between exploratory hole positions these conditions can only be interpreted and not defined and are accurate only for the date of the investigation works.

2.0 CURRENT SITE DESCRIPTION AND LOCATION

2.1 Site Location

The proposed development site occupies an area of approximately 1.7ha and is centred at National Grid Reference 472147 108016. The former postal address was Southern and Scottish Energy, Bartons Road, Havant, PO9 5JB. A copy of the Promap site location plan is presented in Appendices A.

2.2 Executive Summary of FEML Desk Study: HAV164.D/DS/001 (18th December 2019)

For ease of reference, the Executive Summary has been copied from FEML Desk Study Report and is detailed in Table 2.2.1 below.

Table 2.2.1: Previous Desk Study Executive Summary

Area of interest	Summary of main text
Introduction	This Desk Study has been produced in order to determine the potential presence of contamination prior redevelopment of the former Southern and Scottish Electricity Offices site on Bartons Road, Havant
Site Location & Description	The current proposed development area, which is irregular in shape, occupies an area of approximately 1.7ha and is centred at National Grid Reference 472147 108016. The former postal address was Southern and Scottish Energy Bartons Road, Havant PO5 9JB. At the time of the site walkover all the buildings and structures had been demolished so that the site was level with a stockpile of crushed concrete located roughly in the centre.
Previous Planning Applications & supporting Information	A search of the Havant Council planning portal revealed that there have been 14 previous planning applications between 1990 and 2016 for the site. All relate to the use of the site as the offices for the electricity company with the most significant being between 2006 and 2008, which relate to the construction of a two storey operations and data recovery centre and then 2016 with the application to clear the site.
Previous Environmental Reports	No existing environmental reports have been made available to Forge Environmental Management Ltd and none relating to the site were identified during a search of the Havant Borough Council planning portal website
Geology	The published BGS maps indicate that the site possibly straddles a geological boundary with no drift deposits beneath the western section whilst Head should only be present beneath the eastern area. Similarly, the bedrock could be Bognor Sand Member in the west and London Clay Formation below the eastern section. However, from a historical borehole just beyond the eastern boundary it would appear the drift deposits are absent and that the Bognor Sand is the shallow bedrock
Hydrogeology	The EA aquifers maps show the site is not underlain by superficial deposits with the Bognor Sand being a Secondary A Aquifer and the London Clay being deemed to be Unproductive Strata However, the deeper principal aquifer within the chalk is within a Zone 1c SPZ as there is a potable water abstraction 1,897m to the south-west. Based upon the geology it is considered that there is potential for groundwater flooding from the underlying aquifer although there is no evidence of such flooding has ever occurred.

Area of interest	Summary of main text
Hydrology	The nearest surface water course is a drainage ditch 306m to the east, which is within the East Hampshire catchment area. The site is not within an area considered to be at risk from flooding from rivers.
Radon	No radon protection measures are deemed necessary in the construction of new dwellings.
Site History	The site was in agricultural use until between 1966 and 75 when it was first developed as offices although the buildings underwent significant extensions in the 1990's and again in the early 2000's before they were cleared prior to 2019. The surrounding area was in predominantly agricultural use from the 1880's but after the second world war when a major phase of development was undertaken until the mid 1970's, which resulted in the construction of predominantly residential properties but there were also some commercial and industrial buildings. The adjacent football ground was built in the 1990's.
Preliminary Conceptual Model	The potential contaminant sources identified were: 1. Made ground of unknown provenance or impacted natural soils resulting from site development activities; 2. PCB's from either electrical equipment on the site when it was operated by an electrical company or on site migration from the adjacent electricity substation adjacent to the south-eastern boundary; and 3. On site migration from the former petrol station abutting the south-western boundary or the tanks noted within the SSE compound adjacent to the south-eastern boundary. The identified potential source has been determined to pose a very low to moderate risk to future occupiers/users or the environment.
Recommendations	• This report should be forwarded to the regulators for their review and approval to ensure they are in agreement with the findings and conclusions. • With consideration of the anticipated proposed end use of the site for apartment blocks and a residential care home it is considered unlikely due to the absence of any grossly contaminative past usage and the anticipated amount of hard cover that site will not pose a significant risk to future occupiers or controlled waters. However, a limited investigation will be required to confirm this but until the proposed development details are available and the potential pathways can be assessed the full scope of the investigations cannot be proposed but it is anticipated it will comprise of 6-7 No trial pits with chemical testing of selected shallow samples.

2.3 Summary of Source – Pathway – Receptor Relationships

Table 2.3.1, overleaf, highlights the source-pathway-receptor relationships that are considered viable across the site based upon the Desk Study information. This assessment forms the basis of the Tier 1 risk assessment that is detailed later in this report. Qualitative risk estimation has been included in the table, the risk estimation as per 'Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008'.

Table 2.3.1: Potential Source – Pathway – Receptor Relationships

APC No.	Source	Pathway (s)	Receptor	Classification of Consequence	Classification of Probability	Classification of Risk
1	<u>On site</u> Made ground of unknown provenance or impacted natural soils resulting from site development activities	Oral ingestion	Future Occupiers/Workmen	Medium	Likely	Moderate Risk
		Vapour and dust inhalation	Future Occupiers/Workmen	Medium	Likely	Moderate Risk
		Dermal contact	Future Occupiers/Workmen	Medium	Likely	Moderate Risk
		Landfill & radon gas	Future Occupiers/buildings	Medium	Unlikely	Low Risk
		Downward migration	Groundwater	Medium	Unlikely	Low Risk
		Surface water runoff	Surface water	Medium	Unlikely	Low Risk
		Direct contact	Buildings	Medium	Likely	Moderate Risk
		Direct contact	Underground Services	Medium	Likely	Moderate Risk
		Uptake via root system	On-site flora	Mild	Unlikely	Very Low Risk
2	<u>On site & Off site</u> Possible presence of leaked PCB's from historic electrical equipment on site or the substation adjacent to the south-eastern boundary	Oral ingestion	Future Occupiers/Workmen	Medium	Low likelihood	Moderate/Low Risk
		Vapour and dust inhalation	Future Occupiers/Workmen	Medium	Low likelihood	Moderate/Low Risk
		Dermal contact	Future Occupiers/Workmen	Medium	Low likelihood	Moderate/Low Risk
		Landfill & radon gas	Future Occupiers/buildings	Medium	Unlikely	Low Risk
		Downward migration	Groundwater	Medium	Unlikely	Low Risk
		Surface water runoff	Surface water	Medium	Unlikely	Low Risk
		Direct contact	Underground Services	Medium	Low likelihood	Moderate/Low Risk
		Uptake via root system	On-site flora	Mild	Unlikely	Very Low Risk
3	<u>Off site</u> On site migration of leaked/spilt fuels from the former petrol station adjacent to the south-western boundary or the tanks within the current SSE substation adjacent to the south-eastern boundary	Oral ingestion	Future Occupiers/Workmen	Medium	Low likelihood	Moderate/Low Risk
		Vapour and dust inhalation	Future Occupiers/Workmen	Medium	Low likelihood	Moderate/Low Risk
		Dermal contact	Future Occupiers/Workmen	Medium	Low likelihood	Moderate/Low Risk
		Landfill & radon gas	Future Occupiers/buildings	Medium	Unlikely	Low Risk
		Downward migration	Groundwater	Medium	Unlikely	Low Risk
		Surface water runoff	Surface water	Medium	Unlikely	Low Risk
		Direct contact	Underground Services	Medium	Low likelihood	Moderate/Low Risk
		Uptake via root system	On-site flora	Mild	Unlikely	Very Low Risk

2.4 Site Zones and Averaging Areas – Human Health Risk Assessment

Under current UK Legislation and Environment Agency guidance, consideration must be given to the most appropriate method of grouping the data, which must relate to the conceptual model. For instance, the data can be grouped spatially (i.e. for individual areas/zones within a site) or by particular strata. Zones can be used to delineate a site to facilitate cost effective site characterisation during the site investigation phase. The qualitative risk estimation with respect to contamination ranges from 'very low' to 'moderate' but generally most of the APC's were deemed to be 'Moderate/Low'

Although there are no proposed layout drawings have been made available to FEML it is anticipated there will be a mixed development incorporating apartments over retail units and a care home. When this is considered in conjunction with the homogenous historic use of the site it is currently considered that the study area should be assessed as a **single zone**.

A zone can be further divided into "averaging areas" which will enable the site to be more accurately assessed based on soil/made ground type, current process operations and exposure pathways. However, the determination as to whether or not the use of separate averaging areas will be appropriate for the site will depend upon the findings of a site investigation.

2.5 Uncertainties and Assumptions

The results of the Desk Study searches indicated that future occupiers and the environment may possibly be at risk from the potential presence of contaminated made ground, PCB's or on site migration of hydrocarbons, as previously detailed within Table 2.3.1.

Therefore, based upon the proposed redevelopment of the site these potential contaminant sources and their associated exposure scenarios are considered to warrant an intrusive investigation. The results of which will enable adequate characterisation the risks posed and to determine whether mitigation works will be required for the protection of future site occupiers and the environment.

Based upon this the site investigations as proposed in the Desk Study report were to excavate 6-7N° trial pits across the site with chemical analysis of selected samples.

3.0 GROUND INVESTIGATION WORKS

3.1 Scope of Investigations

An intrusive ground investigation was undertaken by FEML across the site on the 3rd March 2020 and comprised of:

- excavating 7N° trial pits (TP1 to TP7), 4N° of which were used for infiltration testing, the locations of which are shown on the drawing in Appendix A.

The excavation of the trial pits was overseen by an experienced geo-environmental engineer who logged the exposed strata and collected soil samples. Photographs of the excavations are contained in Appendix B and copies of the logs are presented in Appendices C.

Selected disturbed soils samples were obtained from the trial pits for geochemical testing.

All fieldwork was undertaken in general accordance with the guidance set out in "Code of Practice for Site Investigations" BS5930:1999, where applicable.

Table 3.1.1 Rationale/Targeting of the Exploratory Hole Locations

<i>Trial Pit</i>	<i>Target</i>
<i>TP1</i>	to provide general coverage
<i>TP2</i>	to provide general coverage TP2A & TP2B dug to find suitable conditions for infiltration testing
<i>TP3</i>	to provide general coverage TP3A dug to find suitable conditions for infiltration testing
<i>TP4</i>	to provide general coverage and in possible area for on-site migration of PCB's
<i>TP5</i>	to provide general coverage and in area of possible on-site migration of hydrocarbons
<i>TP6</i>	to provide general coverage and in possible area for on-site migration of PCB's
<i>TP7</i>	to provide general coverage and in area of possible on-site migration of PCB's or hydrocarbons from

3.2 Trial Pits

Although 7N° trial pit locations were identified a total of 10N° pits were dug as TP2 & TP3 required relocation as the original pits were not suitable for infiltration tests due to made ground and/or shallow groundwater being encountered. The trial pits ranged from 1.2m to 3.0m deep. Upon completion they were backfilled with the arisings with limited compaction from the excavator bucket.

3.3 Geochemical Laboratory Testing

FEML scheduled chemical analysis upon a selection of samples recovered from the trial pits for a general suite of contaminants, based on the both the initial conceptual model and observations from the ground investigation. The soil samples were forwarded to the UKAS/MCERTS accredited laboratory of the Environmental Laboratory Ltd (E.lab) and analysed in accordance with the suite presented in Table 3.3.1, below. The chemical analysis results are provided in Appendix E.

Table 3.3.1: Soil Schedule of Chemical Testing

Test Type	Number of Samples Tested
Arsenic, Cadmium, Chromium, Hexavalent Chromium, Lead, Mercury, Nickel, Copper, Zinc, Selenium, Water Soluble Boron, Total Cyanide, Free Cyanide, pH, Water Soluble Sulphate, Sulphide, Elemental Sulphur, Total Monohydric Phenols, Organic Content and Speciated Polyaromatic Hydrocarbons	10N° soils
Aliphatic/aromatic speciated banded TPH & BTEX	10N° soils
Asbestos screen	7No soil
PCB's	4N° soils

3.4 Groundwater

Groundwater was encountered in three of the trial pit locations at depths ranging from 1.1m to 2.75m but although there was no evidence of contamination (sheen or odour) noted a sample of the shallowest groundwater encountered (TP2) was collected. This was forwarded to E.lab and analysed in accordance with the suite presented in Table 3.4.1, below. The chemical analysis results are provided in Appendix E.

Table 3.4.1: Groundwater Schedule of Chemical Testing

Test Type	Number of Samples Tested
Arsenic, Cadmium, Chromium, Hexavalent Chromium, Lead, Mercury, Nickel, Copper, Zinc, Selenium, Water Soluble Boron, Total Cyanide, Free Cyanide, pH, Water Soluble Sulphate, Sulphide, Elemental Sulphur, Total Monohydric Phenols, Organic Content and Speciated Polyaromatic Hydrocarbons	1N° water
Basic carbon banding TPH	1N° water

3.5 Gas Monitoring

From the Desk Study report no landfills were identified within 250m of the site and based upon the soils encountered during the site investigation the made ground was predominantly crushed concrete or a gravelly clay with generally no deleterious material as shown in the photographs in Appendix B and supported by the chemical analysis results that recorded a maximum Soil Organic Matter value of 2%.

Therefore, as no sources of landfill gases have been identified based upon the recommendations in the CL:AIRE publication RB17 "A pragmatic approach to ground gas risk assessment" the site is considered to be characteristic situation CS1 and therefore will not require any gas protection measures

3.6 In-situ Infiltration Testing Results

In-situ infiltration testing was undertaken in trial pits TP1, TP2B, TP3A and TP4 the results sheets for which are contained in Appendix D but are also summarised in Table 3.5.1.

Table 3.5.1: Infiltration Testing Results

Ref	Description	Depth to water (m)		Time (minutes)	Infiltration Rate (m/s)
		start	end		
TP1	1.8m long x 0.6m wide x 1.9m deep Made ground to 0.6m	0.680	0.830	480	Unable to calculate in accordance with BRE365
TP2B	1.4m long x 0.7m wide x 1.7m deep Made ground to 0.9m	0.700	0.790	340	Unable to calculate in accordance with BRE365

TP3A	1.3m long x 0.7m wide x 1.1m deep Made ground to 0.4m	0.360	0.280	270	Water level rose and therefore unable to calculate infiltration rate
TP4	1.6m long x 0.7m x 1.25m deep Made ground to 0.35m	0.400	0.415	240	Unable to calculate in accordance with BRE365

As the reduction in water level within all the pits was less than 50% of level put in, TP3A actually rose, it has not been possible to calculate the infiltration rate in accordance with BRE Digest 365 Soakaway Design 1991. Also based upon the graphs if the time to reach a 75% reduction in the water level is estimated this would exceed 24 hours. Therefore, the soils are not considered suitable to support soakaway drainage for surface water.

4.0 SUMMARY OF GROUND CONDITIONS

4.1 Introduction

The ground conditions recorded across the site were not as indicated on the BGS maps or by historic borehole hole located to the east of the site reviewed as part of the Desk Study. As below the made ground cohesive HEAD deposits, which the BGS indicated were only in the western section, were encountered. Underlying the HEAD in the deeper trial pits a yellow sand was revealed across the whole site, which is considered to be the Bognor Sand Formation. This should have only been present in the eastern section with London Clay below the eastern half of the site although the historic borehole had indicated the sand extended further eastwards than the BGS maps showed.

4.2 Recorded Ground Conditions - General

The site had been cleared of buildings and ground level slabs/surfacing had also been removed at the time of the intrusive investigations (3rd March 2020). Across the higher northern section of the site this was generally capped with a c.350mm layer of crushed concrete, although in TP3, top of slope to southern area, this extended to 2.2m. Below this layer in localised areas was a 0.55-0.9m thick layer of made ground consisting of a gravelly clay with occasional brick fragments. Across the lower southern area across the surface there was layer c.300mm thick comprising of Type1 mixed with varying amounts of gravel and brick fragments.

Underlying the made ground in all holes, except TP2A flooded at 1.2m deep, a layer of gravelly clay and locally a gravelly sand, which where proven was around 1.0m thick. This stratum is considered to be Head deposits. Below this in the northern-western, eastern and southern-western parts of the site, where the trial pits were extended to around 3.0m a yellow fine sand was revealed this is considered to be the Bognor Sand Member.

Table 4.2.1 summaries the strata encountered within the boreholes and the range of depths for each layer

Table 4.2.1: Summary of Strata Encountered

Depth (m bgl)		Exploratory Holes Identified	Soil Type	General Description/Comments
From	To			
GL	0.3 – 2.20	TP1, TP2, TP2A, TP2B, TP3 & TP6	Made Ground	Crushed concrete/brickwork
GL	0.1 - 0.46	TP3A, TP4, TP5 & TP7	Made Ground	Type 1 mixed with gravelly clay and occasional brick fragments
0.1 – 0.35	0.35 - 1.2 base of pit	TP2, TP2A, TP2B & TP4	Made Ground	Sandy gravelly clay with localised brick fragments and metal
0.3 – 2.2	1.0 – 2.30 base of pit	TP1, TP2, TP2B, TP3, TP3A, TP4, TP5, TP6 & TP7	Head Deposits	Clay with variable amounts of gravel
1.0	1.1. base of pit	TP3A	Head deposits	Sandy clay
1.2	1.9 base of pit	TP1	Head deposits	Sand with some gravel
1.2 – 1.3	2.75 – 3.0 base of pit	TP5, TP6 & TP7	Bognor Sand Member	Fine sand

4.2.1 Made Ground

Made ground, which in the area of the former office buildings comprised a c.350mm thick layer of crushed concrete, except for in TP3 where it extended to 2.2m. Locally within the central area of this rested upon a layer c.1m thick of a gravelly clay mixed with brick rubble. In the southern section, which was the former a car parking area, and along the northern boundary (access road) the upper layer of made ground comprised a mixture of Type 1, gravelly clay and brick fragments to around 350mm thick.

4.2.2 Superficial Deposits

Within all trial pits, except for TP2A, which flooded at 1.2m, Head deposits comprising generally of a firm but locally soft to firm brown gravelly clay, which in some locations tended to a gravelly sand or sandy clay with depth.

4.2.3 Bedrock

The deeper trial pits in the north-western, eastern and south-western parts of the site extended into a medium dense yellow fine sand, which is considered to be the Bognor Sand member.

4.2.4 Contamination Found

No olfactory or visible evidence of contamination was noted.

4.3 Groundwater

Groundwater was encountered in the trial pits as detailed in Table 4.3.1 below.

Table 4.3.1: Groundwater Strikes

Borehole Ref	Trial Pit depth (m)	Water Strike (m)	Description
TP1	1.9	Dry	
TP2	1.65	1.1	Pit was dry when dug but an inflow at 1.1m was noted from what appeared to be the gravel surround to an old pipe after 20mins the water entering the pit was standing at 1.5m
TP2A	1.2	1.1	Rapid inflow from the gravel surround to an old pipe
TP2B	1.7	Dry	
TP3	2.3	2.3	Seepage at base of pit
TP3A	1.1	Dry	
TP4	1.25	Dry	
TP5	2.75	2.75	Seepage at base of pit
TP6	3.0	Dry	
TP6	3.0	Dry	

4.4 Soil Solid Chemical Test Results

As part of the FEML investigations a total of ten soil samples from the trial pits were dispatched to the laboratories of E.Lab for chemical analysis. Copies of the laboratory report sheets are contained in Appendix E but are also summarised in Table 4.4.1.

Table 4.4.1: Chemical Soils Results Summary for Trial Pits

<i>Determinant</i>	<i>Recorded Concentrations</i>		<i>Number of Samples Tested</i>
	<i>Minimum Concentration (mg/kg)</i>	<i>Maximum Concentration (mg/kg)</i>	
Arsenic	5.3	18.4	10
Water Soluble Boron	<0.5	0.5	10
Cadmium	9.7	39.5	10
Chromium	7.8	22.9	10
Hexavalent Chromium	5.3	18.4	10
Copper	<0.5	0.5	10

Table 4.4.1: Chemical Soils Results Summary for Trial Pits

Determinant	Recorded Concentrations		Number of Samples Tested
	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	
Lead	10.3	103	10
Mercury	<0.5	<0.5	10
Nickel	9.7	28.4	10
Selenium	<1	<1	10
Zinc	30.7	208	10
Naphthalene	<0.1	0.1	10
Acenaphthylene	<0.1	<0.1	10
Acenaphthene	<0.1	<0.1	10
Fluorene	<0.1	<0.1	10
Phenanthrene	<0.1	0.4	10
Anthracene	<0.1	<0.1	10
Fluoranthene	<0.1	0.4	10
Pyrene	<0.1	0.5	10
Benzo(a)anthracene	<0.1	0.3	10
Chrysene	<0.1	0.3	10
Benzo (b) fluoranthene	<0.1	0.3	10
Benzo(k)fluoranthene	<0.1	0.3	10
Benzo (a) pyrene	<0.1	0.2	10
Indeno (1,2,3-cd) pyrene	<0.1	0.1	10
Dibenzo(a,h)anthracene	<0.1	<0.1	10
Benzo[g,h,i]perylene	<0.1	0.1	10
Total PAH(16)	<0.4	2.6	10
>C5-C6 Aliphatic	<0.01	<0.01	10
>C6-C8 Aliphatic	<0.01	<0.01	10
>C8-C10 Aliphatic	<1	<1	10
>C10-C12 Aliphatic	<1	<1	10
>C12-C16 Aliphatic	<1	16.9	10
>C16-C21 Aliphatic	<1	30.8	10
>C21-C35 Aliphatic	<1	22.4	10
>C35-C40 Aliphatic	<1	8.1	10
>C5-C7 Aromatic	<0.01	<0.01	10
>C7-C8 Aromatic	<0.01	<0.01	10
>C8-C10 Aromatic	<1	<1	10
>C10-C12 Aromatic	<1	<1	10
>C12-C16 Aromatic	<1	17.9	10
>C16-C21 Aromatic	<1	35.3	10
>C21-C35 Aromatic	<1	41.6	10
>C35-C40 Aromatic	<1	23.3	10
Total (>C5-C40) Ali/Aro	<1	176	10
Benzene	<0.01	<0.01	10
Toluene	<0.01	<0.01	10
Ethylbenzene	<0.01	<0.01	10
Xylenes	<0.01	<0.01	10
MTBE	<0.01	<0.01	10
Phenol	<1	<1	10
3,4-Dimethylphenol	<1	<1	10
2,3-Dimethylphenol	<1	<1	10
2,3,5-trimethylphenol	<1	<1	10
Total Monohydric Phenols	<5	<5	10
Water Soluble Sulphate (g/l)	<0.02	0.37	10
Elemental Sulphur	<20	<20	10
Free Cyanide	<1	<1	10
Hexavalent Chromium	<0.8	<0.8	10
Total Sulphide	<2	<2	10
Total Cyanide	<1	<1	10
Water Soluble Boron	<0.5	2.6	10
pH	8.2	11.8	10
Soil Organic Matter	<0.1	2	10

Table 4.4.1: Chemical Soils Results Summary

<i>Determinant</i>	<i>Recorded Concentrations</i>		<i>Number of Samples Tested</i>
	<i>Minimum Concentration (mg/kg)</i>	<i>Maximum Concentration (mg/kg)</i>	
Asbestos Screen	None detected	None detected	7
PCB 28	<0.01	<0.01	4
PCB 52	<0.01	<0.01	4
PCB 101	<0.01	0.01	4
PCB 118	<0.01	<0.01	4
PCB 153	<0.01	0.01	4
PCB 138	<0.01	0.01	4
PCB 180	<0.01	0.01	4
PCB (Total of 7 Congeners)	<0.03	0.06	4

4.5 Water Chemical Test Results

In addition to the soil a sample of the perched water in TP2 was also sampled and dispatched to E.Lab for chemical analysis. A of the laboratory report is contained in Appendix E but are also summarised in Table 4.4.1.

Table 4.5.1: Chemical Results for Water Sample from TP2

<i>Determinant</i>	<i>Recorded Concentration (ug/l)</i>
Arsenic	6
Boron	14
Cadmium	<1
Chromium	27
Copper	22
Mercury	<0.1
Nickel	7
Lead	<1
Selenium	<5
Zinc	<5
Sulphate	158
Free Cyanide	<5
Hexavalent Chromium	<100
Sulphide (mg/l)	<0.1
Total Cyanide	6
pH	11.7
>C8-C10 BCB	<5.0
>C10-C12 BCB	<5.0
>C12-C16 BCB	5.4
>C16-C21 BCB	51.7
>C21-C35 BCB	302
>C35-C40 BCB	24.1
Total (>C8-C40) BCB	378
Phenol	<1
M,P-Cresol	<1
O-Cresol	<1
3,4-Dimethylphenol	<1
2,3-Dimethylphenol	<1
2,3,5-trimethylphenol	<1
Total Monohydric Phenols	<1
Naphthalene	0.09
Acenaphthylene	0.04
Acenaphthene	0.08
Fluorene	0.03
Phenanthrene	0.83
Anthracene	0.19

Table 4.5.1: Chemical Results for Water Sample from TP2

<i>Determinant</i>	<i>Recorded Concentration (ug/l)</i>
Fluoranthene	1.5
Pyrene	1.39
Benzo (a) anthracene	1.18
Chrysene	0.9
Benzo (b) fluoranthene	1.1
Benzo (k) fluoranthene	0.95
Benzo (a) pyrene	1.38
Indeno (1,2,3-cd) pyrene	0.94
Dibenzo(a,h)anthracene	0.36
Benzo(ghi)perylene	0.87
Total PAH(16)	11.8

5.0 HUMAN HEALTH RISK ASSESSMENT

5.1 Introduction

Part IIA of the Environmental Protection Act 1990, inserted by Section 57 of the Environment Act, 1995 and the associated Contaminated Land (England) Regulations 2000 (SI 2000/227), was brought into full effect on 1 April 2000. This has created a new regime for the identification and remediation of contaminated land. Contaminated land is defined as:

'Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in on or under the land, that significant harm is being caused or there is significant possibility of such harm being caused'.

The human health risk assessment process is based upon a tiered system of risk estimation. It aims to identify significant risks that may require further investigation, be considered for remediation or indicate potential legal or financial liability. A tiered approach has been adopted within the UK risk assessment framework providing a series of steps, after each of which decisions are taken on whether or not more sophisticated assessment is required. By doing so a pragmatic approach to the assessment of human health risk is maintained.

5.2 Assessment of Averaging Areas/Zones Following Ground Investigation Works

As discussed previously for the purposes of investigation and assessment a site can be divided into zones based on the historical usages or proposed end use and these zones can be further divided into averaging areas. These averaging areas can be used to assess different soil types revealed or different potential exposure pathways etc. for the purposes of accurately modelling the site conditions. Each averaging area can be considered independently of each other for human health exposure assessment.

Based on professional judgement when assessing the findings of the site investigation, it is considered that the former SSE Depot site should be considered as a single zone but due to the presence of made ground of varying composition the zone should be divided into four averaging areas for the review of the findings:

- General Site area – crushed concrete;
- General Site area – Type 1 mixed with gravel and rubble
- General Site area – gravelly clay made ground
- General Site area – natural soils

5.3 Tier 1 Risk Assessment

Where chemical test data records contaminant concentrations that are beneath the laboratory detection limits these are excluded from further assessment as it is considered that this demonstrates that the source is absent from the pollutant linkage relationship. This forms the basis for the Tier 1 risk assessment.

Using the chemical test data recovered during the investigation works Table 5.3.1, overleaf, shows those determinants, split into their individual averaging areas, with observed contaminant concentrations at or beneath the limits of detection highlighted in yellow as these will not require further assessment.

Table 5.3.1: Determinants Analysed, Identifying those above Detection

Determinant	Recorded Concentrations (mg/kg)						
	Crushed Concrete	Type 1 2No samples		Made Ground 5No sample		Natural Soils 2No samples	
	1No sample.	Min. Conc.	Max Conc.	Min. Conc.	Max Conc.	Min. Conc.	Max Conc.
Arsenic	18.4	10.2	11.5	8.1	13.8	5.3	8.6
Cadmium	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	32.3	9.7	28.2	23.8	39.5	18	25.6
Copper	22.9	10.5	16.7	12.8	22.3	7.8	12.3
Lead	76.3	20.6	101	21.9	103	10.3	38.4
Mercury	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	21.1	9.7	16.4	13.4	28.4	10.8	12.2
Selenium	<1	<1	<1	<1	<1	<1	<1
Zinc	105	33.4	82.1	63	208	30.7	41.2
Water Soluble Sulphate	0.05	33.4	82.1	0.02	0.37	<0.02	<0.02
Elemental Sulphur	<20	<20	<20	<20	<20	<20	<20
Free Cyanide	<1	<1	<1	<1	<1	<1	<1
Hexavalent Chromium	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Total Sulphide	<2	<2	<2	<2	<2	<2	<2
Total Cyanide	<1	<1	<1	<1	<1	<1	<1
Water Soluble Boron	<0.5	<0.5	2.6	<0.5	1	<0.5	<0.5
pH	11.8	9.4	10.7	8.2	11.2	8.4	8.4
Soil Organic Matter	0.6	<0.1	1	0.3	2	0.3	1.1
Phenol	<1	<1	<1	<1	<1	<1	<1
3,4-Dimethylphenol	<1	<1	<1	<1	<1	<1	<1
2,3-Dimethylphenol	<1	<1	<1	<1	<1	<1	<1
2,3,5-trimethylphenol	<1	<1	<1	<1	<1	<1	<1
Total Monohydric Phenols	<5	<5	<5	<5	<5	<5	<5
Naphthalene	<0.1	<0.1	0.1	<0.1	0.1	<0.1	<0.1
Acenaphthylene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	<0.1	<0.1	0.2	<0.1	0.4	<0.1	<0.1
Anthracene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	0.1	<0.1	0.3	<0.1	0.4	<0.1	<0.1
Pyrene	0.1	<0.1	0.3	<0.1	0.5	<0.1	<0.1
Benzo(a)anthracene	<0.1	<0.1	0.2	<0.1	0.3	<0.1	<0.1
Chrysene	<0.1	<0.1	0.2	<0.1	0.3	<0.1	<0.1
Benzo(b)fluoranthene	<0.1	<0.1	0.1	<0.1	0.3	<0.1	<0.1
Benzo(k)fluoranthene	<0.1	<0.1	0.1	<0.1	0.3	<0.1	<0.1
Benzo(a)pyrene	<0.1	<0.1	0.1	<0.1	0.2	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo[g,h,i]perylene	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1
Total PAH(16)	0.7	<0.4	1.7	<0.4	2.6	<0.4	<0.4
Benzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Toluene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ethylbenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Xylenes	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
MTBE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
>C5-C6 Aliphatic	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
>C6-C8 Aliphatic	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
>C8-C10 Aliphatic	<1	<1	<1	<1	<1	<1	<1
>C10-C12 Aliphatic	<1	<1	<1	<1	<1	<1	<1
>C12-C16 Aliphatic	<1	<1	16.9	<1	<1	<1	<1
>C16-C21 Aliphatic	2.3	<1	30.8	<1	<1	<1	<1
>C21-C35 Aliphatic	22.4	<1	21.1	<1	12.9	<1	<1
>C35-C40 Aliphatic	8.1	<1	<1	<1	4.4	<1	<1
>C5-C7 Aromatic	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
>C7-C8 Aromatic	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Table 5.3.1: Determinants Analysed, Identifying those above Detection (continued)

Determinant	Recorded Concentrations (mg/kg)						
	Crushed Concrete	Type 1 2No samples		Made Ground 5No sample		Natural Soils 2No samples	
	1No sample.	Min. Conc.	Max Conc.	Min. Conc.	Max Conc.	Min. Conc.	Max Conc.
>C8-C10 Aromatic	<1	<1	<1	<1	<1	<1	<1
>C10-C12 Aromatic	<1	<1	<1	<1	<1	<1	<1
>C12-C16 Aromatic	<1	<1	17.9	<1	<1	<1	<1
>C16-C21 Aromatic	2.7	<1	35.3	<1	1.1	<1	<1
>C21-C35 Aromatic	32.9	4.2	41.6	<1	38.9	<1	1.5
>C35-C40 Aromatic	15.8	2.6	12	<1	23.3	<1	<1
Total (>C5-C40) Ali/Aro	84.2	6.9	176	<1	79.5	<1	1.5
Asbestos screen	nd	nd	nd	nd	nd	nt	nt
PCB 28	nt	<0.01		<0.01	<0.01	nt	nt
PCB 52	nt	<0.01		<0.01	<0.01	nt	nt
PCB 101	nt	<0.01		<0.01	0.01	nt	nt
PCB 118	nt	<0.01		<0.01	<0.01	nt	nt
PCB 153	nt	<0.01		<0.01	0.01	nt	nt
PCB 138	nt	<0.01		<0.01	0.01	nt	nt
PCB 180	nt	<0.01		<0.01	0.01	nt	nt
PCB (Total of 7 Congeners)	nt	<0.03		<0.03	0.06	nt	nt

Key:

nd = no asbestos detected
nt = not tested

In addition to those identified in the Table 5.3.1, the following determinants have also not been assessed further with regard to human health.

- Total PAH
- Total (>C5 – C40)
- Soil organic matter.
- pH
- Water soluble sulphate
- PCB congeners 28, 52, 101, 118, 153, 138 and 180

The justification for removing the above additional determinants is detailed below.

Total PAH values have not been considered as, in accordance with current best practice, the individual PAH species have been assessed in accordance with their differing toxicological properties.

Total TPH Aromatic & Aliphatic (>C5 – C40) values are discounted as the assessment approach is to compare the individual aliphatic or aromatic carbon ranges against their respective target values, which have been determined based upon their differing toxicology properties and availability.

Soil organic matter and pH have been recorded in order to provide information to complete quantitative human health risk assessment should it be needed and do not pose any identified human health based risks under normal circumstances.

Research on sulphate toxicology has revealed the major health effect with sulphate ingestion is laxative action. In general, the toxicity of sulphate alone is not considered to pose a significant risk to human health and has therefore been excluded from the exposure assessment.

Currently there are no published target values for PCB's in the UK but from a web search the American EPA publication "*Polychlorinated Biphenyl (PCB) Site Revitalization Guidance Under the Toxic Substances Control Act (TSCA)*" considers total PCB's therefore the total value of the 7 individual congeners rather than their individual results has been used for the further assessment of the results

5.4 Tier 2 Risk Assessment

The Tier 2 risk assessment utilises published and authoritative generic assessment criteria to determine the likelihood of harm being caused to human health. The anticipated development will comprise apartments over a ground level retail units, fast food restaurant/drive through and a care home therefore, it is anticipated that there will be areas of communal soft landscaping, which could introduce a pathway to the underlying soils. Although the majority of the site will have hard cover it has been considered appropriate to assess the chemical results against the more sensitive **Residential without plant uptake** end use target criteria.

Table 5.4.1 compares the determinants with concentrations above the limit of detection against the adopted published assessment criteria, the source of which has been detailed, for the results split into their respective averaging areas with any failures highlighted in blue.

Table 5.4.1 Tier 2 Assessment for a Residential End Use

Determinant	Recorded Concentrations (mg/kg)							Assessment criteria (mg/kg)	
	Crushed Concrete	Type 1 2No samples		Made Ground 5No sample		Natural Soils 2No samples		Value	Source
	1No sample	Min. Conc.	Max Conc.	Min. Conc.	Max Conc.	Min. Conc.	Max Conc.		
Arsenic	18.4	10.2	11.5	8.1	13.8	5.3	8.6	40	LQM
Cadmium	0.5	-	-	-	-	-	-	85	LQM
Chromium	32.3	9.7	28.2	23.8	39.5	18	25.6	910	LQM
Copper	22.9	10.5	16.7	12.8	22.3	7.8	12.3	7100	LQM
Lead	76.3	20.6	101	21.9	103	10.3	38.4	310	DEFRA
Nickel	21.1	9.7	16.4	13.4	28.4	10.8	12.2	180	LQM
Zinc	105	33.4	82.1	63	208	30.7	41.2	40000	LQM
Water Soluble Boron	-	<0.5	2.6	<0.5	1	-	-	11000	LQM
Naphthalene	-	<0.1	0.1	<0.1	0.1	-	-	2.3	LQM
Phenanthrene	-	<0.1	0.2	<0.1	0.4	-	-	1300	LQM
Fluoranthene	0.1	<0.1	0.3	<0.1	0.4	-	-	1500	LQM
Pyrene	0.1	<0.1	0.3	<0.1	0.5	-	-	3700	LQM
Benzo(a)anthracene	-	<0.1	0.2	<0.1	0.3	-	-	11	LQM
Chrysene	-	<0.1	0.2	<0.1	0.3	-	-	30	LQM
Benzo(b)fluoranthene	-	<0.1	0.1	<0.1	0.3	-	-	3.9	LQM
Benzo(k)fluoranthene	-	<0.1	0.1	<0.1	0.3	-	-	110	LQM
Benzo(a)pyrene	-	<0.1	0.1	<0.1	0.2	-	-	3.2	LQM
Indeno(1,2,3-cd)pyrene	-	-	-	<0.1	0.1	-	-	45	LQM
Benzo[g,h,i]perylene	-	<0.1	<0.1	<0.1	0.1	-	-	360	LQM
>C12-C16 Aliphatic	-	<1	16.9	-	-	-	-	1100	LQM
>C16-C21 Aliphatic	2.3	<1	30.8	-	-	-	-	5000	*LQM
>C21-C35 Aliphatic	22.4	<1	21.1	<1	12.9	-	-		
>C35-C40 Aliphatic	8.1	-	-	<1	4.4	-	-	5000	*LQM
>C12-C16 Aromatic	-	<1	17.9	-	-	-	-	1800	LQM
>C16-C21 Aromatic	2.7	<1	35.3	<1	1.1	-	-	5000	*LQM
>C21-C35 Aromatic	32.9	4.2	41.6	<1	38.9	<1	1.5	5000	*LQM
>C35-C40 Aromatic	15.8	2.6	12	<1	23.3	-	-	5000	*LQM
PCB Total 7 congeners	-	-	-	<0.03	0.06	-	-	1	EPA

Key:

- = recorded value below detection level for that averaging area and therefore passed Tier 1 assessment and not considered further

LQM = LQM/CIEH Suitable 4 Use Levels (S4UL) published 2015

DEFRA = Category 4 Screening Levels (C4SL) published 2014

* = S4UL value above 10,000mg/kg, representing 1% contamination, therefore minimum human health risk even at high concentrations. Pragmatic remediation applied based upon visual, odour and aesthetic requirements

EPA = There are no published target values for PCB's in the UK but the EPA publication "PCB site Revitalization Guidance for the most sensitive high occupancy areas gives an allowable level of <1ppm, which equates to 1mg/kg

5.5 Presentation of Results of Tier 2 Risk Assessment across the Study Area

As can be seen from Table 5.4.1 none of the recorded concentrations within any of the averaging areas were shown to exceed the adopted assessment criteria.

5.6 Summary Findings of the Human Health Risk Assessment and Recommendations

Based upon the assessment of the available chemical test results it has been shown that the soils across the site do not pose a risk to human health when considered in conjunction with the anticipated redevelopment.

Therefore, no remedial measures are considered necessary to make the site suitable for a mixed commercial and residential development.

6.0 CONTROLLED WATERS RISK ASSESSMENT

6.1 Receptors

As discussed in the Desk Study report produced for the site (ref HAV164.D.DS/001) the identified controlled waters receptors and risk levels were described as:

- *Surface water, - The nearest open surface water feature is a stream/drainage ditch associated with a "works" 306m to the east. However, as the site is within an urban area with a surface water drainage system that will collect and control the runoff, with reference to the "Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008", the surface water sensitivity has been deemed to be Very Low (L2 i.e. "no surface water within general area of the site (at least 250m) or closed drainage within the site)*
- *Groundwater – the shallow bedrock has been designated as Secondary A (undifferentiated) aquifer however, the deeper aquifer has been designated as a Zone 1c SPZ with a potable water abstraction being 1,897m from the site.*

As the deep Principal aquifer is protected by the overlying London Clay, which separates it from the shallow Secondary aquifer the groundwater sensitivity assessment has been based upon the shallower aquifer, which has not been identified as having any usages. Therefore, the groundwater's sensitivity in the vicinity of the site is considered to be L1 (Low). If, however, to proposed foundations for the development extend through the clay layer this assessment will need to be revised.

6.2 Assessment of Groundwater Results

During the investigations undertaken by FEML a sample of the shallow groundwater encountered in TP2 was collected and dispatched to E.Lab. A copy of the result sheet is contained in Appendix E but they are also detailed in the table below and compared against the published Environmental Quality Standards (EQS) for freshwater based upon the groundwater being hard in the area and the UK Drinking Water Standards (DWS) with any exceedances highlighted in blue:

Table 6.2.1 Assessment of groundwater results

Determinant	Recorded Concentration (ug/l)	Assessment Criteria (ug/l)	
		EQS	DWS
Arsenic	6	50	10
Boron	14	2000	1000
Cadmium	<1	5	5
Chromium	27	250	5
Copper	22	28	2000
Mercury	<0.1	1	1
Nickel	7	200	20
Lead	<1	250	10
Selenium	<5		10
Zinc	<5	50	5000
Sulphate (mg/l)	158	400	250
Free Cyanide	<5		
Hexavalent Chromium	<100		
Sulphide (mg/l)	<0.1		
Total Cyanide	6		50
pH	11.7		
>C8-C10 BCB	<5.0		

Table 6.2.1 Assessment of groundwater results

<i>Determinant</i>	<i>Minimum Concentration (ug/l)</i>	<i>Assessment Criteria (ug/l)</i>	
		<i>EQS</i>	<i>DWS</i>
>C10-C12 BCB	<5.0		
>C12-C16 BCB	5.4		
>C16-C21 BCB	51.7		
>C21-C35 BCB	302		
>C35-C40 BCB	24.1		
Total (>C8-C40) BCB	378	50	
Phenol	<1	30	0.5
M,P-Cresol	<1		
O-Cresol	<1		
3,4-Dimethylphenol	<1		
2,3-Dimethylphenol	<1		
2,3,5-trimethylphenol	<1		
Total Monohydric Phenols	<1		
Naphthalene	0.09	2	0.1
Acenaphthylene	0.04		
Acenaphthene	0.08		
Fluorene	0.03		
Phenanthrene	0.83		
Anthracene	0.19		
Fluoranthene	1.5		
Pyrene	1.39		
Benzo (a) anthracene	1.18		
Chrysene	0.9		
Benzo (b) fluoranthene	1.1		
Benzo (k) fluoranthene	0.95		
Benzo (a) pyrene	1.38	0.27	
Indeno (1,2,3-cd) pyrene	0.94		
Dibenzo(a,h)anthracene	0.36		
Benzo(ghi)perylene	0.87		
Total PAH(16)	11.8		0.1

As can be seen from the table above elevated TPH's and PAH (B(a)P as the marker compound for the EQS assessment) were identified within the perched water sample.

6.3 Summary of Controlled Waters Risk Assessment and Recommendations

From the single sample of perched water taken from TP2 it has been shown that the recorded levels of TPH and PAH have the potential to impact upon the quality of groundwater if used for drinking purposes or aquatic life in local water courses.

However, from the desk study it has been shown that the shallow aquifer does not have any identified usages within 1km and although the deeper aquifer has been classified as a SPZ 1c this is protected by the overlying layer of impermeable London Clay. Therefore, it is considered there is not the mechanism for the perched groundwater to impact upon the groundwater quality within the Principal Aquifer.

When the site setting is considered in relation to surface water receptors it is considered that the nearest identified stream (306m to the east) is too distant from the site to be impacted by surface water runoff given the general slope of the ground to the south-west.

Therefore, based upon the above although the perched groundwater was shown to contain elevated levels of hydrocarbons when compared against the published EQS and DWS due to the site's setting and absence of any mechanisms for the water to impact upon the identified receptors the site is not considered to pose a risk to Controlled Waters.

7.0 RISK ASSESSMENT OF OTHER ENVIRONMENTAL RECEPTORS

7.1 General

The other environmental receptors identified earlier in this report are building, services and flora (phytotoxic). This chapter identifies each class of receptor and assesses the risk to them based upon the results of the chemical analysis and the proposed development.

7.2 Building Materials Risk Estimation for the Study Area

Recorded soil pH values from the analysis of the samples indicated that the made ground was alkaline with values ranging from 8.2 to 11.8 with the underlying natural soils marginally alkaline with a pH of 8.4. Their associated maximum water soluble sulphate concentration were 0.37g/l in the made ground and below the limit of detection (<0.02g/l) for the natural sands

When compared against the BRE Special Digest 1 (2005) assessment levels, the maximum sulphate result indicates a DS1 design mix concrete should be suitable for buried structures. With the groundwater level being highly variable (1.1m to >3.0mbgl), which is considered an ACEC class of AC-1 should be adopted.

However, it is anticipated that underlying the site the deeper stratum is London Clay, which is potentially Pyritic and the oxidation of these sulphide minerals can result in increased acidity which is potentially damaging to buried concrete and steel. Therefore, if it is intended to use piled foundations further investigations should be undertaken to determine the chemical properties of the deeper soils

7.3 Phytotoxic Risk Estimation for the Study Area

Where considering phytotoxic risks, the contaminants selected are those listed within Annex 3 of 'Guidance for the Safe Development of Housing on Land Affected by Contamination. R&D66: 2008 Volume 2' as being 'phytotoxic'. Where available, assessment values have been chosen based on the criteria within, (in priority order), SGV Documents, ICRL 59/83 phytotoxic threshold levels, Dutch RIVM Serious Risk Concentrations (SRC) for ecological receptors (amended for a UK soil of 10% clay and 2% soil organic matter) and US EPA Soil Screening Levels for plants.

The chemical test results for the phototoxic metals are presented in Table 7.3.1 and compared against their respective assessment criteria with any exceedences highlighted in blue.

Table 7.3.1: Elevated Concentrations of Phytotoxic Contaminants within All Soils

Phytotoxic Metals	Ass't Criteria	recorded concentrations(mg/kg)		Source
		Min	Max	
Selenium	10	<1	<1	SGV9 Document – phytotoxic reference
Boron	3	<0.5	2.6	ICRL 59/83 – Phytotoxic risk only
Copper	130	7.8	22.9	
Nickel	16	9.7	28.4	
Zinc	300	30.7	208	
Cadmium	8	<0.5	0.5	Amended Dutch RIVM – Ecotoxicological risk only
Chromium	154	9.7	39.5	
Mercury	28	<0.5	<0.5	

Based on the available chemical test results presented within Table 7.3.1 it has been shown that nickel is present at concentrations that could be detrimental to plant growth. From a review

of the chemical test results it has been determined that a total of four results from the made ground and crushed concrete exceeded the 16mg/kg assessment threshold.

However, although the shallow made ground across the site are possibly unsuitable for use in soft landscaped areas the investigations did not identify any topsoil across the site. Therefore, it will be necessary to import a suitable growth medium comprising topsoil and organic sub-soil for future soft landscaped areas.

Based upon this in practice even though the made ground could be detrimental to future plant growth, due to the localised elevated nickel, this will be addressed due to the need to import suitable growth medium soils as part of any future soft landscaping. Full details of the specification for the imported sub-soils and topsoil and their required thicknesses necessary to support the proposed future planting scheme will need to be detailed by the landscaped architect.

7.4 Services Risk Estimation for the Study Area

Contaminants in the ground can pose a risk to potable water supply by permeating water supply pipes. Therefore, in order to fulfil their statutory obligation, UK water supply companies require robust evidence from developers to demonstrate either that the ground in which new plastic supply pipes will be laid is free from specific contaminants, or that the proposed remedial strategy will mitigate any existing risk. If these requirements cannot be demonstrated to the satisfaction of the relevant water company, it becomes necessary to specify an alternative pipe material on the whole development or specific zones.

In 2010, UK Water Industry Research (UKWIR) published *Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* (Report Ref. No. 10/WM/03/21). This report reviewed previously published industry guidelines and threshold concentrations adopted by individual water supply companies. The focus of the UKWIR research project was to develop clear and concise procedures, which provide consistency in the pipe selection decision process. It was intended to provide guidance that can be used to ensure compliance with current regulations and to prevent water supply pipe failing prematurely due to the presence of contamination.

Report 10/WM/03/21 concluded that in most circumstances only organic contaminants pose a potential risk to plastic pipe materials and Table 3.1 of the report provides threshold concentrations for PE and PVC pipes for the organic contaminants of concern.

The potential risks to water supply pipes have therefore been assessed against the threshold concentrations for PE and PVC pipe specified in Table 3.1 of Report 10/WM/03/21, which have been adopted as the GAC's for this project. Table 7.4.1 below summaries the results

Table 7.4.1: Assessment of Results against WRAS Criteria

Determinant	WRAS criteria		Recorded Concentrations	
	PE pipe	PVC pipe	Minimum	Maximum
VOC	0.5	0.125	Not tested	Not tested
BTEX + MTBE	0.1	0.03	All below <0.01	All below <0.01
SVOCs	2	1.4	Not tested	Not tested
Phenols	2	0.4	<1	<1
Cresols and chlorinated phenols	2	0.04	Not tested	Not tested
Mineral Oils C11-C20	10	Suitable	<1	100
Mineral Oils C21-C40	500	Suitable	<1	79.5

Notes:

BTEX + MTBC are combined results for each individual determinant.

Mineral Oils C11-C20 is a combination of the TPH aliphatic and aromatic results for ranges C10 to C21

Mineral Oils C21-C40 is a combination of the TPH aliphatic and aromatic results for ranges C21 to C40

The results presented within Table 7.4.1 show that the maximum mineral oils, using the TPH results for Aliphatic and Aromatic carbon ranges C10-C21 are above the acceptable level to allow the use of PE pipework.

From a review of the results it can be seen that the single unacceptable TPH results was revealed within the Type 1 and gravel made ground in TP7.

Based upon the above it is possible upgrade pipework may be required or "clean" corridors for services created. However, it will be necessary to liaise with the statutory water suppliers to obtaining their confirmation as to the required specification for buried portable water supply pipework to be used on the site.

8.0 REFINED CONCEPTUAL SITE MODEL

8.1 General

Chapter 2 presented the preliminary conceptual site model that utilised desk-based information to present a qualitative assessment of potential source-pathway-receptor relationships across the site. Following completion of the ground investigation works and Tier 2 risk assessment for human health and other environmental receptors a refined conceptual site model has been developed as detailed below.

8.2 Sources

The site investigation works and associated chemical testing have revealed the following:

- The chemical analysis of the range of soil samples did not reveal any elevated levels of contamination when compared against the threshold criteria for the residential without the consumption vegetables end use;
- No sources of landfill gases have been identified within the site or surrounding area.
- Nickel was present at concentrations in the made ground that could represent a potential risk to future plant growth. Although due to the absence of any suitable growth medium across the site topsoil and sub-soil will require importing for soft landscaped areas. Therefore, as the existing made ground will be capped its geochemistry is unlikely to impact upon future planting;
- Although the perched groundwater was shown to contain elevated TPH and PAH due to the site's setting and proposed development it is considered there is no mechanism for this to impact upon the water quality within the confined SPZ below the site or the stream/ditch 306m to the east.
- A localised hydrocarbon level within a shallow made ground sampling comprising a Type 1 sub-base mixed with gravel and rubble was above the WRAS Trigger Values for PE pipework for potable water supplies.
- The geochemistry of the made ground shallow natural ground do not pose a risk to buried concrete or foundations.

8.3 Pathway and Receptor

The anticipated development will result in a large proportion of the site being covered by impermeable surfacing (e.g. concrete or asphalt/block) however, it is anticipated that there will be some areas of communal soft landscaping that may create a pathway to the underlying made ground. For the purpose of this site investigation the critical receptor will be a 0-6 year old female child living in one of the new apartments. When considering a residential without homegrown vegetables end use the following exposure pathways for human health are viable

- Outdoor/indoor ingestion of soil.
- Outdoor/indoor exposure to soil through skin contact.
- Outdoor/indoor inhalation of fugitive dust.
- Outdoor/indoor inhalation of vapours.

The shallow bedrock is classified as a Secondary A aquifer below which in the deeper chalk it is a Principal Aquifer and within a SPZ 1c, however this stratum is protected by a layer of impermeable London Clay, which is designated as Unproductive strata.

A ditch/stream associated with a "works" 305m to the east is the nearest surface water feature but based upon the topography of the area any runoff from the site would flow south-westwards and would most likely be collected within the general surface water sewer system.

Although currently no detailed proposed development drawings have been issued to FEML it is understood it is likely to comprise apartments over retail units at the ground floor level plus a care home. Therefore, it is anticipated that there is likely to be communal soft landscaped areas, which will introduce potential floral receptors to the elevated nickel identified within the made ground.

Underground services and building materials associated with the proposed development could also be affected by the chemical characteristics of the soil.

8.4 Risk Evaluation

Subsequent to the assessment of the results of the site investigation the site-specific qualitative risk evaluation, as presented in Section 2.3, has been reviewed and updated as discussed below and summarised in Table 8.5.1., overleaf. The risk estimation has been undertaken as per 'Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008'.

8.4.1 Risk to Human Health: Soils/Gases

The soils across the site have been shown to be suitable for the proposed development and therefore have been deemed to pose a **Low Risk** to human health and are suitable to remain in-situ.

The intrusive investigations generally revealed a shallow layer of made ground, although a localised area 2.2m thick was identified, comprising crushed concrete over a gravel clay. These layers of made ground were not shown to be organic so they are not considered to be a potential source of landfill gases. Therefore, in accordance with the guidance in the CL:AIRE publication RB17 "A pragmatic approach to ground gas risk assessment" the site is deemed to be a CS1 and as such it is not necessary to incorporate gas protection measures within the new properties as the risk from landfill gases is considered to be a **Low Risk**.

8.4.2 Risk to Building Materials

The sulphate results for the shallow samples indicate that buried concrete is at a **Low Risk** from the made ground or natural sand. However, it is anticipated that the deeper soils will comprise London Clay and therefore if deep piled foundations are proposed then further investigations comprising boreholes will be required.

8.4.3 Risk to Services

The geochemistry of the soils, when considered against the WRAS guidelines, have been shown to create an aggressive environment for buried PE water mains due to a localised TPH concentration within the shallow made ground containing Type 1 sub-base.

Therefore, based upon the currently available information buried mains and pipework have been deemed to be at **Moderate Risk** of damage. However, this classification can be reduced to Very Low following discussions with the Local Water Authority, who will confirm their required specification or construction requirements (e.g. “clean” service trenches) for buried water mains.

8.4.4 Risk to Flora/Fauna

Based on the chemical test results it was shown some elevated phytotoxic nickel are present within the made ground, which could have the potential to be detrimental to plant growth. However, as these soils will not provide a suitable growth medium it will be necessary to cap soft landscaped areas with imported topsoil. Therefore, as the soils currently on the site will not come into contact with the roots to future plants they are considered only to pose a **Moderate/Low Risk** to plant growth.

8.4.5 Risk to Surface and Groundwater

The perched groundwater was shown to contain TPH and PAH concentrations above the UK Drinking Water Standards and/or the Environmental Quality Standards. However, as discussed previous, the underlying principal aquifer is protected by the London Clay. Plus the in-situ infiltration tests showed the shallow natural soils do not readily permit the passage of water. Therefore, it has been determined that the site posed a **Low Risk** to groundwater.

With regard to surface water based upon the ground profile in the area and the distance to the nearest feature (stream/ditch associated with a factory) it is considered any runoff from the site would flow south/south-westwards and be collected by the stormwater sewage system. Therefore, surface water is also considered to be at a **Low Risk** from any contamination present on the site.

Table 8.5.1 below presents the summary risk evaluation associated with each source-pathway-receptor linkage related to the proposed development of the site.

Table 8.5.1: Summary of Risk Evaluation

APC No.	Source	Comments	Pathway (s)	Receptor	Classification of Consequence	Classification of Probability	Classification of Risk
1	<u>On site</u> Made ground of unknown provenance or impacted natural soils resulting from site development activities	The soils were not shown to pose a risk to human health.	Oral ingestion	Future Occupiers/Workmen	Medium	Unlikely	Low Risk
			Vapour/dust inhalation	Future Occupiers/Workmen	Medium	Unlikely	Low Risk
		The composition of the made ground is not considered likely to generate landfill gases	Dermal contact	Future Occupiers/Workmen	Medium	Unlikely	Low Risk
			Landfill & radon gas	Future Occupiers/buildings	Medium	Unlikely	Low Risk
		The perched water although containing TPH & PAH's is not considered to pose a risk to controlled waters.	Downward migration	Groundwater	Medium	Unlikely	Low Risk
			Surface water runoff	Surface water	Medium	Unlikely	Low Risk
		A localised nickel in the made ground poses a potential risk to flora and fauna although the absence of a growth medium means this will require importing, which will protect future planting.	Direct contact	Buildings	Medium	Unlikely	Low Risk
			Direct contact	Underground Services	Medium	Likely	Moderate Risk
2	<u>On site & Off site</u> Possible presence	Based upon the EPA guidance the localised PCB's identified in the	Oral ingestion	Future Occupiers/Workmen	Medium	Unlikely	Low Risk
			Vapour/dust inhalation	Future Occupiers/Workmen	Medium	Unlikely	Low Risk
		The geochemistry of the shallow soils do not pose a risk to buried concrete	Uptake via root system	On-site flora	Medium	Low likelihood	Moderate/Low Risk

APC No.	Source	Comments	Pathway (s)	Receptor	Classification of Consequence	Classification of Probability	Classification of Risk
	of leaked PCB's from historic electrical equipment on site or the substation adjacent to the south-eastern boundary	soils do not pose a risk. Also, the individual congeners noted as being above their limit of detection were only present at that the limit (i.e. 0.01mg/kg) and therefore at only trace concentrations	Dermal contact	Future Occupiers/Workmen	Medium	Unlikely	Low Risk
			Landfill & radon gas	Future Occupiers/buildings	Medium	Unlikely	Low Risk
			Downward migration	Groundwater	Medium	Unlikely	Low Risk
			Surface water runoff	Surface water	Medium	Unlikely	Low Risk
			Direct contact	Underground Services	Medium	Unlikely	Low Risk
			Uptake via root system	On-site flora	Mild	Unlikely	Very Low Risk
3	<u>Off site</u> On site migration of leaked/spilt fuels from the former petrol station adjacent to the south-western boundary or the tanks within the current SSE substation adjacent to the south-eastern boundary	The soil samples did not identify any elevated TPH's. Although the perched water sample had elevated TPH it is considered that this is too high (1.1m in a pipe surround) to have leached onto the site	Oral ingestion	Future Occupiers/Workmen	Medium	Unlikely	Low Risk
			Vapour/dust inhalation	Future Occupiers/Workmen	Medium	Unlikely	Low Risk
			Dermal contact	Future Occupiers/Workmen	Medium	Unlikely	Low Risk
			Landfill & radon gas	Future Occupiers/buildings	Medium	Unlikely	Low Risk
			Downward migration	Groundwater	Medium	Unlikely	Low Risk
			Surface water runoff	Surface water	Medium	Unlikely	Low Risk
			Direct contact	Underground Services	Medium	Unlikely	Low Risk
			Uptake via root system	On-site flora	Mild	Unlikely	Very Low Risk

9.0 RISK MANAGEMENT AND REMEDIAL STRATEGY

9.1 Summary of Findings

Based upon the assessment of the chemical analysis results for the soil samples obtained during the site investigations it has been shown that:

- The soils across the site are suitable for the proposed development and therefore no remedial measures are proposed.
- Due to the absence of any off sources of landfill gas and the limited amount of made ground revealed on the site based upon the guidance in CL:aire RB17 the site has been classified as CS1. Also, the HPA, as identified within the Desk Study, has determined the site is not within a radon affected area. Therefore, no gas protection measures are required in the new properties.
- Buried concrete is not at risk from the geochemistry of the soils although if deep piled foundations are proposed to extend into the anticipated underlying London Clay then further investigations and testing will be required to determine its sulphate concentrations.
- A localised hydrocarbon level revealed within the shallow made ground have the potential to impact upon the PE pipework. It therefore the Local Water Authority should be consulted regarding the pipework to be used for buried water mains.
- Nickel concentrations within the made ground have the potential to be detrimental to future plant growth, although due to the absence of a suitable growth medium across the site any soft landscaped areas will require the importation and placement of a sub-soil and topsoil capping layer

9.2 Proposed Remedial Measures

Based upon the assessment of the chemical analysis results from the site investigation, as discussed above, it has been shown that the soils across the site do not pose a risk to human health although they have the potential to be impact upon buried water mains and plant growth.

Therefore, it will be necessary to ensure the water mains are adequately protected, which could be achieved by using upgrade pipework or installing them within "clean" service corridors. However, the actual approach will need to be agreed with the Local Water Authority following their review of the available results.

Similarly, any areas of soft landscaping will require the placement of a capping layer to provide a suitable thickness of a growth medium. Details of the imported soils specification and thicknesses are to be confirmed by the landscape architect.

Table 9.2.1 overleaf details the revised risk evaluation for identified contamination issues following the completion of the intended remedial works.

Table 9.2.1 Revised Risk Evaluation Post Remedial Works

AP C No.	Source	Pathway(s)	Receptor	Current Risk Rating	Proposed Remedial Works	Revised Risk Rating
1	<i>Elevated TPH levels in the made ground</i>	Direct contact	PE Potable water supplies	Moderate	Liaise with the Local Water Authority and use their recommended specification for pipework.	Very Low
1	<i>Nickel concentrations within the made ground</i>	<i>Uptake via root system</i>	<i>On-site flora</i>	Moderate	Place a capping layer of a suitable growth medium, as specified by the landscape architect	Very Low

10.0 CONCLUDING DISCUSSION

10.1 Conclusions

From the investigations undertaken by FEML the following conclusions have been determined based upon the proposed redevelopment consisting of the construction of 4-6 story apartment blocks with car parking and commercial/retail units on the ground floor:

- The soils across the site do not pose a risk to human health and no remedial works are considered necessary to make the site suitable for the anticipated mixed use development including apartments, retail and a care home with communal soft landscaped areas;
- Based upon the absence of any viable receptors the site it is not considered to be a significant risk to controlled waters;
- No gas protection measures are required within the new buildings;
- A DS1 concrete mix should be suitable for structures within the shallow soils, although if deeper piles are proposed then further investigations will be required to determine the depth to the London Clay and its chemical properties;
- Nickel concentrations within the made ground may pose a risk to future planting in any soft landscaping areas. However, due to the absence of topsoil across the site this will require importing and this growth medium will protect the roots from the underlying made ground.
- The geochemistry of the made ground has the potential to create an aggressive environment for buried water mains. Therefore, it is recommended that the Local Water Authority are consulted to obtain their required specification for buried water mains;

10.2 Remedial Strategy and Recommendations

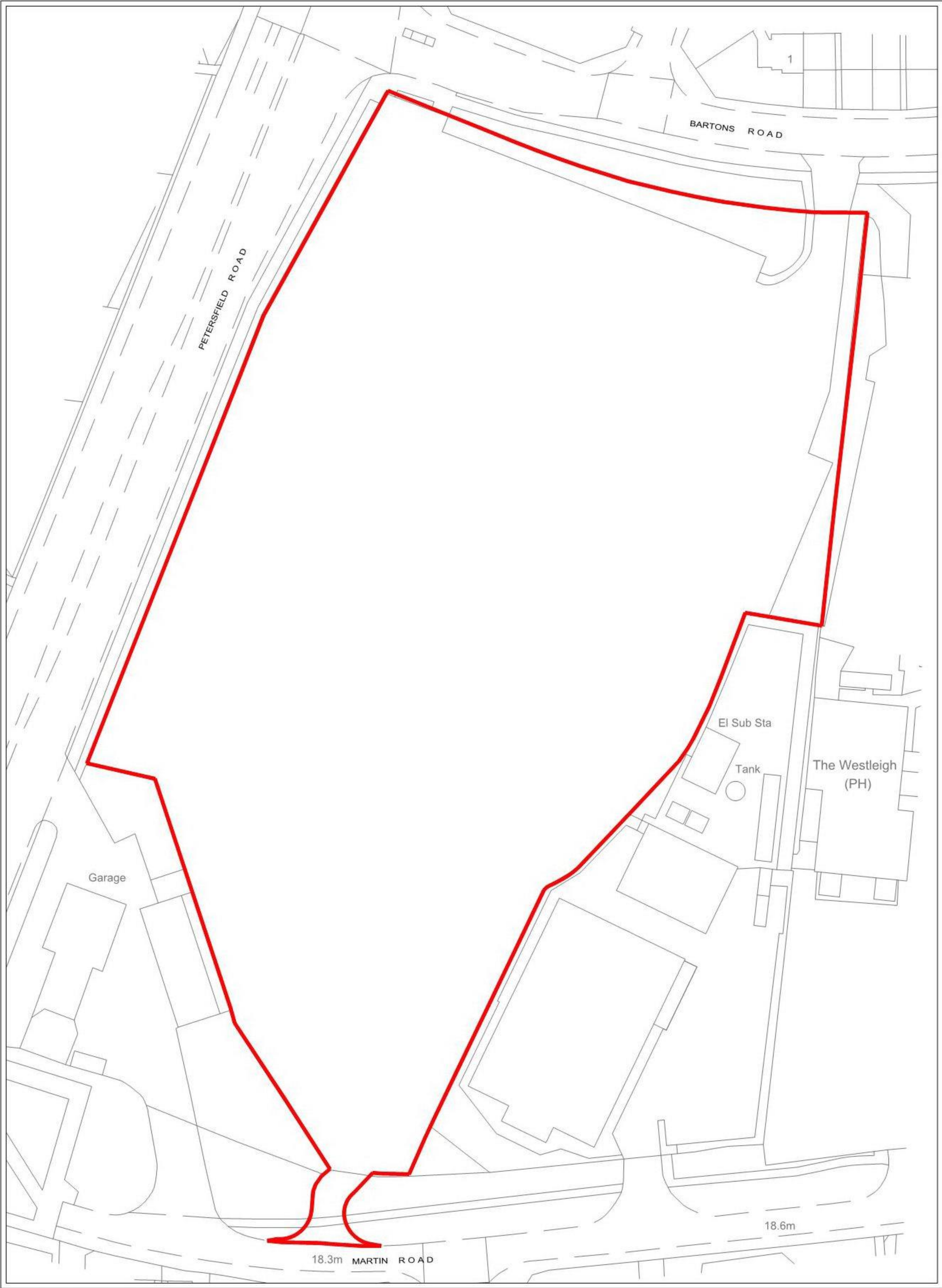
In line with the concluding remarks above the following recommendations are made:

- Havant Borough Council should be forwarded a copy of this site investigation report for their assessment and to confirm that they are in agreement with the scope of the proposed Remedial Strategy.
- Liaison with the statutory water supplier should be undertaken to determine the specification of the pipework they require for underground water supply mains across the site.
- The landscape designer should provide details of the thicknesses and soil types required to be placed across the proposed soft landscaped areas to provide a suitable growth medium for the future planting.

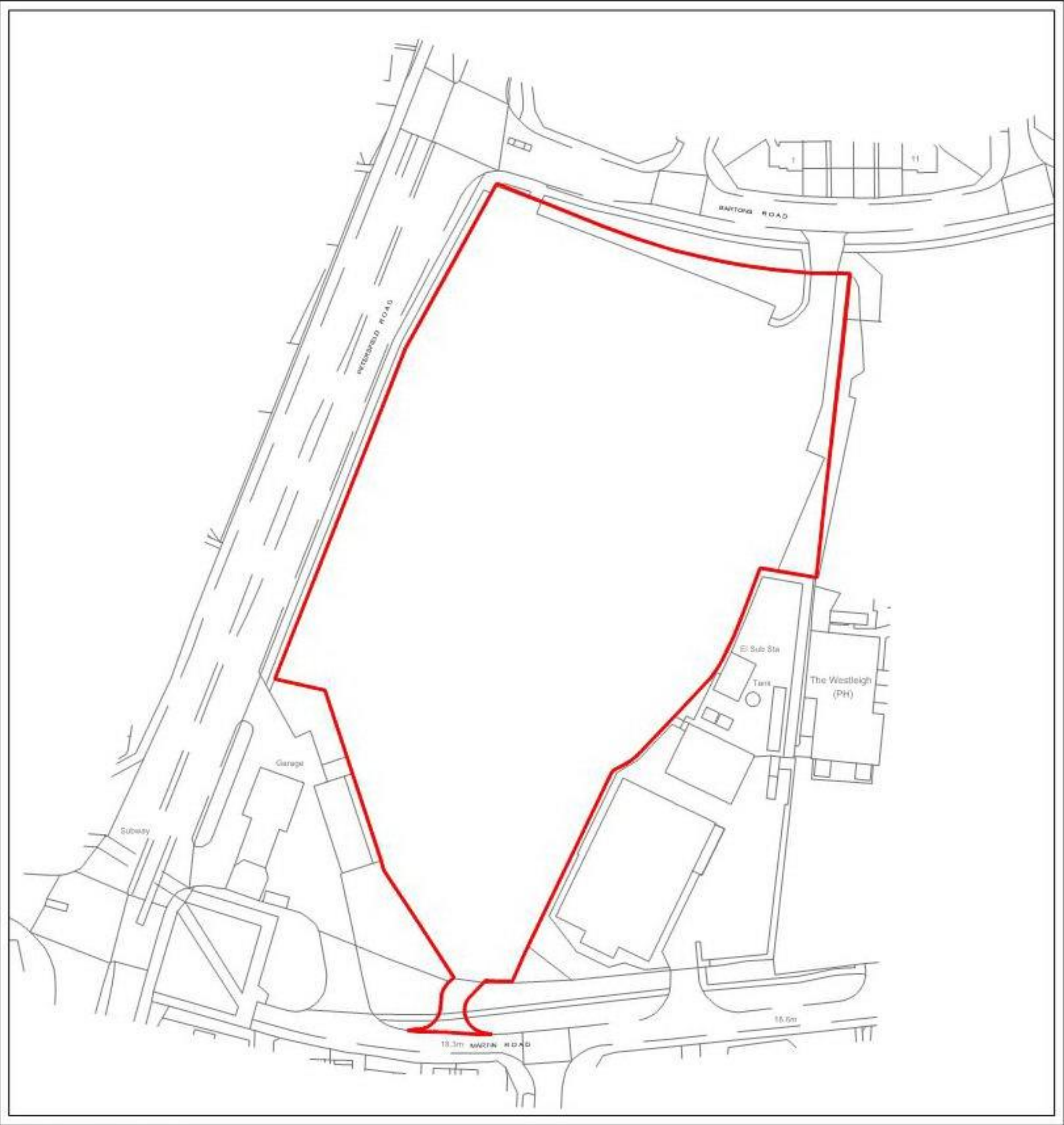
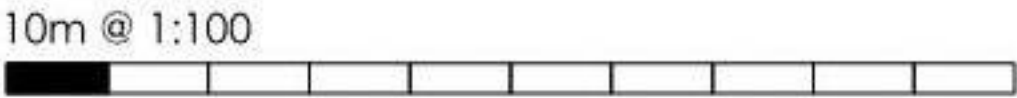
APPENDICES

- A DRAWINGS**
- B SITE PHOTOGRAPHS**
- C TRIAL PIT LOGS**
- D INFILTRATION TEST RESULTS**
- E CHEMICAL TEST RESULTS**

APPENDIX A DRAWINGS



BLOCK PLAN: BASED ON ORDNANCE SURVEY EXTRACT
O.S LICENSE NO. - 100007080
SCALE 1:500

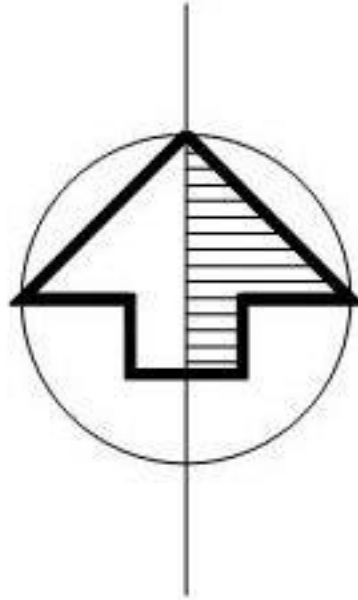
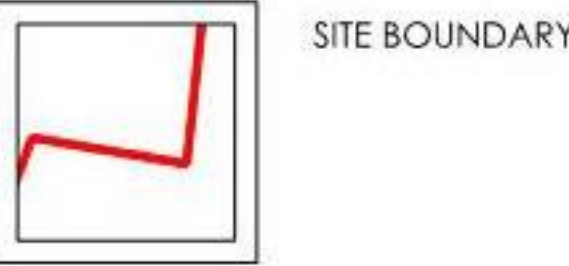


LOCATION PLAN: BASED ON ORDNANCE SURVEY EXTRACT
O.S LICENSE NO. - 100007080
SCALE 1:1250

NOTES

1. The contents of this drawing are copyright.
2. Do not scale. Figured dimensions only to be used.
3. Contractors must verify all dimensions and report any discrepancies before putting work in hand or making any shop drawings.
4. All flat roofs to be fitted with a man safe system to satisfy CDM 2015 regulations unless written confirmation from Principle Designer/ Principle Contractor is provided to show alternative compliance has been sought and approved.
5. Please note a domestic sprinkler system may be required - check with your building control inspector.
6. Fixed shut fire safety glass windows may be required where windows are in close proximity to boundaries (subject to building regulations).
7. Stair design to be independently checked by stair fabricator for regs. compliance and sizing, prior to construction/ ordering. Dimensions to be checked before fabrication.
8. MacLennan waterproofing specialists (or similar company with relevant PI insurance) to be instructed and detail all basement waterproofing designs. - ARC carry no responsibility for basement designs in terms of waterproofing or structure in any way.
9. "AS BUILT" drawings will only be issued upon request from the client/ contractor. All information within as built drawings is to be confirmed and provided by the client/ contractor. ARC Architecture do not perform regular site inspections to guarantee as built information so contractor or client must sign a letter from ARC to confirm compliance with our plans on site.
10. Any discrepancies between specification notes and details must be clarified for design intention with ARC before continuing with construction.
11. At Building Regulation stage our instruction is to gain a certificate of building regulations compliance from the chosen inspector (LA or Private).
12. To ensure compliance with EW51 fire safety forms an independent and an appropriately qualified and insured fire consultant / engineer should be appointed by the client to ensure the finished project can be mortgaged.
13. A design and risk assessment should form part of our drawing package, if you have not received this from us by post, email or collection please contact us for a copy before moving forward with the project.
14. At planning stage planning drawings are to only to be used for planning purposes.
15. Mechanical ventilation may be required to basement car parks and apartment lobbies.
16. All Cladding & building attachments to be A1 fire rated.

LEGEND



SITE AREA: 1.676 HECTARES / 4.141 ACRES

C.	Site boundary amended.	04.11.20	WD
B.	Road names amended following comments.	06.10.20	WD
A.	Notes amended.	15.09.20	WD

No.	Revision.	date	by
-----	-----------	------	----

PROPOSED DEVELOPMENT,
BARTONS ROAD,
HAVANT,
HAMPSHIRE,
PO9 5EY

BLOCK & LOCATION PLANS

scale	AS SHOWN @ A1	checked	//
date	DECEMBER 2019	drawn	WD
9303/101		A.	B.
		C.	

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0 2 4 6 8 10 20 30 40 50
METRES

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CO-ORDINATE SCHEDULE: 15748			
STATION	EASTING	NORTHING	HEIGHT
LDS1	272122.384	108116.576	21.633
LDS2	272228.856	108095.590	21.854
LDS3	272265.569	108095.143	22.297
LDS4	272215.184	108042.885	20.556
LDS5	272189.028	107981.663	19.245

NOTES:
Land Development Services Ltd. own the copyright of this drawing. Their written consent must be obtained before this drawing is copied, forwarded to any third parties, or used for any purpose other than the one for which it was supplied.
This survey has been carried out to an accuracy consistent with a presentation scale of 1:500; therefore all dimensions will be within the tolerance associated with this scale. The same accuracies implied by the plotting scale are equally applicable to digital data supplied for CAD.
Boundaries shown are not necessarily legal boundaries.
All levels, heights, measurements and dimensions are in metres unless otherwise stated.
Eaves levels are taken at the bottom of the lowest roof line. Where underside of fascia or other features are surveyed these are recorded as such.
All below-ground features (including drainage, voids and services) have been identified from above ground and therefore all details relating to these (such as sizes, depth, pipe positions and alignments, description etc.) will be approximate only. Underground services have not been traced, but any visible surface features have been located. No allowance has been made for any sub-surface manholes or other chambers or voids below ground level. While every effort is made to identify all visible above-ground features, it should be noted that there may be features obscured at the time of survey.
Spot heights at edges of roads are road/gutter levels, not top of kerb unless otherwise stated.
Trees have been drawn diagrammatically (i.e. circular) showing average canopy spread; however their true shape in plan will be different. Every effort has been taken to identify species, but no responsibility can be taken for the accuracy of this information.
Circled figures are heights measured from internal floor levels and are therefore unrelated to the datum.
Measurements to internal walls have been taken to the wall finishes at approximately 1m above floor level and assumed to be vertical.

REV.	DATE	DETAILS
-	11/11/19	Original Issue Surveyed by: MJS Drawn by: RAE

LEGEND:	Features:
ACU Air Conditioning Unit AHV Air Vent BB Ballistic Beacon BOL Bollard CATV Cable TV Cover CCTV CCTV Security Camera CH Churn CL Corner Level CLO Clothing Height CNC Concrete COP Cop DPC Damp Proof Course EP Electrical Pole ER Earthing Rod FB Floor Beam FC Floor to CE Level FEL Fenced Floor Level FH Fire Hydrant FL Flood Light FS Flagpole GL Ground Level GP Gas Post GV Gas Valve GY Gully IC Insulator Cover IBT BT Cover ICE Electrical Cover GC Gas Cover ICGL Traffic Light Cover ICW Inlet Cover L Lamp Post M Manhole MFW Manhole - Frost Water MWS Manhole - Surface Water MR Marker Post MS Manhole	Overhead Wire Drainage Information (pipe diameter & flow direction) Tactile Paving Times City Slope Arrow indicates direction of downward slope
Fences:	
AFF Angle Iron Fence BWF Barbed Wire Fence CBF Chain Beaded Fence CFF Composite Iron Fence CFF Chain Link Fence LFF Lath & Post Fence OPF Open Boarded Fence PBF Post & Rail Fence PBF Post & Rail Fence PBF Post & Rail Fence PBF Post & Rail Fence PBF Post & Rail Fence	

LDS SINCE 1969

www.lds-survey.co.uk
Tel: 01722 338232
E-Mail: peter@lds-survey.co.uk
Apothecary House, Fowler's Road, Salisbury, Wilt. SP1 2QU

RICS **THE SURVEY ASSOCIATION**

Topographic & Measured Building Surveys, Setting Out
3D Laser Scanning, Elevations, Sections, Floorplans

Client: **FORTITUDO LTD.**

Drawing Title: **TOPOGRAPHIC SURVEY**

Project: **LAND AT PETERSFIELD RD HAVANT**

The horizontal & vertical control of this survey is based on Ordnance Survey grid as translated from GPS co-ordinates using the OSTN15 & OSGM15 transformation as supplied by OS. We have applied a reverse scale factor to maintain true ground distances. Vertical values may differ from existing OS benchmarks in the vicinity which should be disregarded. All levels should be taken from LDS survey stations.

Scale: **1:500**
Plotted on A1

Drawing No: **LDS/15748-TP1**
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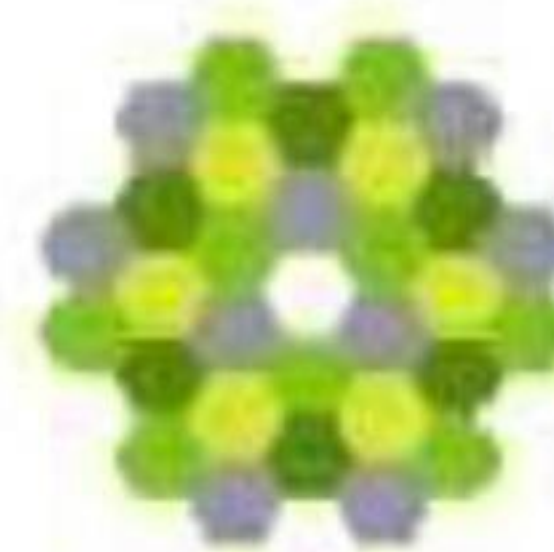
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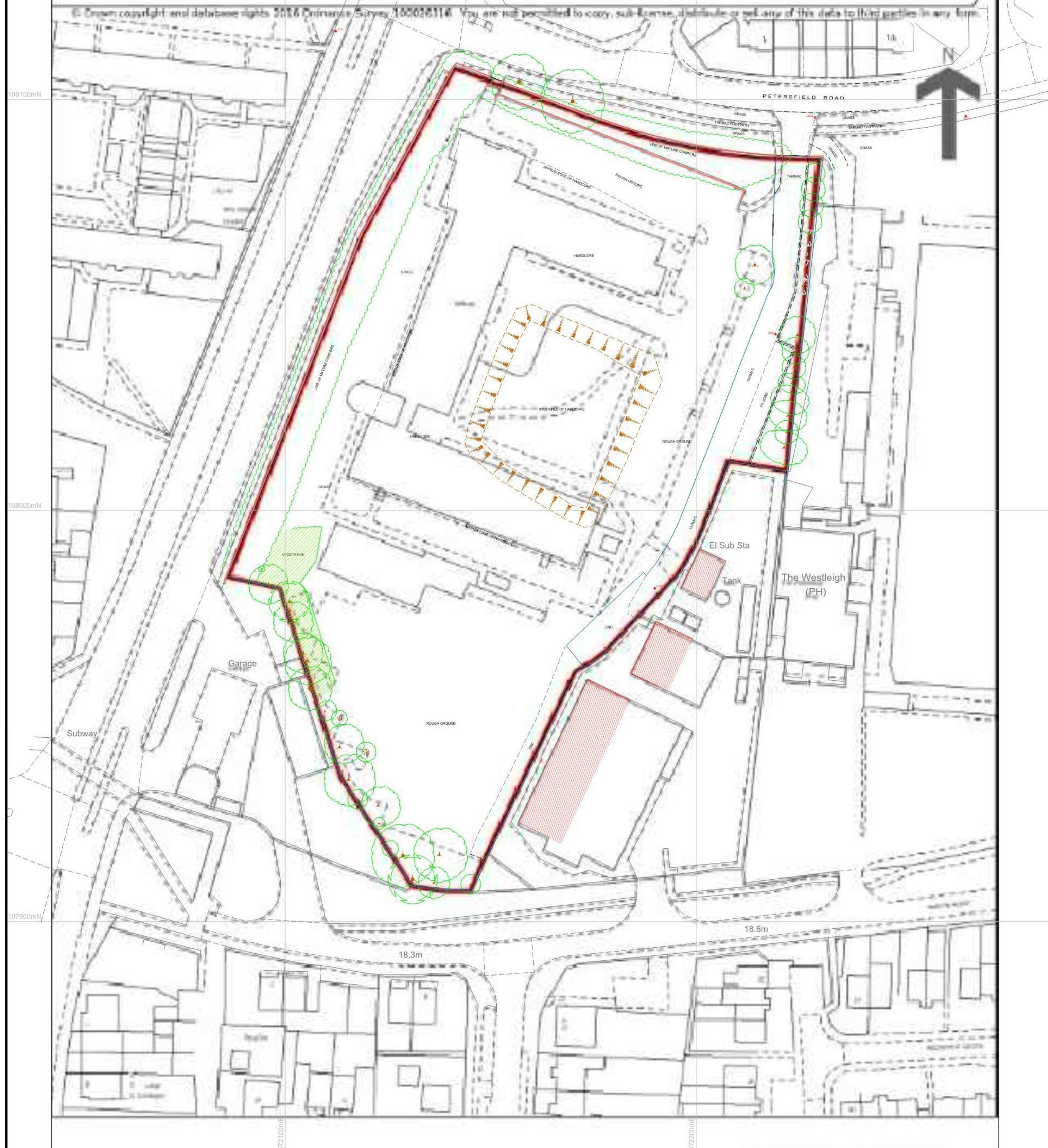
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Title number **SH44235**
Ordnance Survey map reference **SU7208SW**
Scale **1:1250 enlarged from 1:2500**
Administrative area **Hampshire : Havant**



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Measurements to internal walls have been taken to the wall finishes at approximately 1m above floor level and assumed to be vertical.

[illegible]

- OS Bench-Mark
- Readers
- Road Signs
- Rainwater Pipe
- Stop Clock
- Spring Pistol
- Stop Valve
- Stop Vent Pipe
- Threshold Level
- Traffic Signs
- Top of Feature (eg. Fence/Mat)
- Telephone Pole
- Tree Height (to datum)
- Tree Stump
- Unknown Objects
- Underground of Feature (eg. Beam)
- Unable to lift
- Water Meter
- Waste
- Water Valve

Fences:

- Angle Iron Fence
- Barbed Wire Fence
- Close Boarded Fence
- Concrete Wrought Iron Fence
- Chainlink Fence
- Iron Railings
- Larch Lath Fence
- Open Recessed Fence
- Past & Present Fence
- Past & Road Fence
- Past & Wood Fence
- Past & Field Fence
- Partial Fence
- Post (Over Post/End Post/Post/Timer)

Features:

Overhead Wire

Drainage Information
(pipe diameter & flow direction)

Tackle Paving

Trees

Dig Slopes: Arrow indicates
direction of downward slope

Fences:

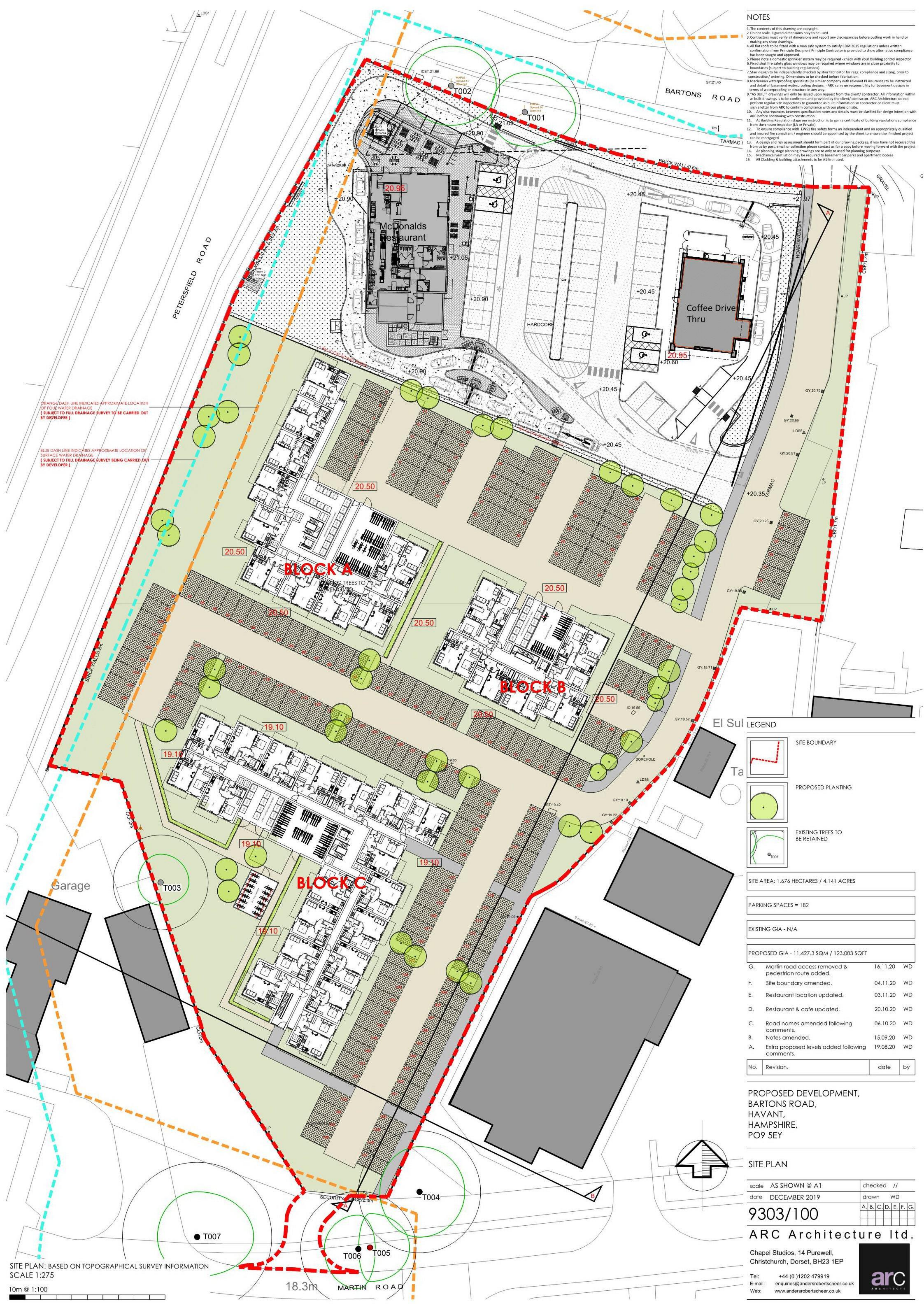
AIF	Angle Iron Fence
BWF	Barbed Wire Fence
CBF	Close Boarded Fence
CIF	Corrugated Iron Fence
CLF	Chainlink Fence
IR	Iron Railings
LLF	Larch Lap Fence
OBF	Open Boarded Fence
PAR	Post & Rail Fence
PARo	Post & Rod Fence
PWF	Post & Wire Fence
RW	Retaining Wall
(CP/SP/TP)	(Cnc Post/Split Post/Timber Post)



The horizontal & vertical control of this survey is based on Ordnance Survey grid as translated from GPS co-ordinates using the OSTN15 & OSGM15 transformation as supplied by OS. We have applied a reverse scale factor to maintain true ground distances. Vertical values may differ from existing OS benchmarks in the vicinity which should be disregarded. All levels should be taken from LDS survey stations.

Scale: 1:500 Plotted on A1	Drawing No: LDS/15748-TP2 © Land Development Services Ltd. 2019
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- NOTES
1. The contents of this drawing are copyright.
 2. Do not scale. Figured dimensions only to be used.
 3. Contractors must verify all dimensions and report any discrepancies before putting work in hand or making any shop drawings.
 4. All flat roofs to be fitted with a man safe system to satisfy CDM 2015 regulations unless written confirmation from Principle Designer/ Principle Contractor is provided to show alternative compliance has been sought and approved.
 5. Please note a domestic sprinkler system may be required - check with your building control inspector.
 6. Fixed shut fire safety glass windows may be required where windows are in close proximity to boundaries (subject to building regulations).
 7. Star design to be independently checked by star fabricator for reg. compliance and sizing, prior to construction/ ordering. Dimensions to be checked before fabrication.
 8. Macleanen waterproofing specialists (or similar company with relevant PI insurance) to be instructed and detail all basement waterproofing designs. - ARC carry no responsibility for basement designs in terms of waterproofing or structure in any way.
 9. "AS BUILT" drawings will only be issued upon request from the client/ contractor. All information within as built drawings is to be confirmed and provided by the client/ contractor. ARC Architecture do not perform regular site inspections to guarantee as built information to contractor or client must sign a letter from ARC to confirm compliance with our plans on site.
 10. Any discrepancies between specification notes and details must be clarified for design intention with ARC before continuing with construction.
 11. At Building Regulation stage our instruction is to gain a certificate of building regulations compliance from the chosen inspector (LA or Private).
 12. To ensure compliance with EWS1 fire safety forms an independent and an appropriately qualified and insured fire consultant / engineer should be appointed by the client to ensure the finished project can be mortgaged.
 13. A design and risk assessment should form part of our drawing package. If you have not received this from us by post, email or collection please contact us for a copy before moving forward with the project.
 14. At planning stage planning drawings are to only be used for planning purposes.
 15. Mechanical ventilation may be required to basement car parks and apartment lobbies.
 16. All Caddling & building attachments to be A1 fire rated.



LEGEND

- SITE BOUNDARY
- PROPOSED PLANTING
- EXISTING TREES TO BE RETAINED

SITE AREA: 1.676 HECTARES / 4.141 ACRES

PARKING SPACES = 182

EXISTING GIA - N/A

PROPOSED GIA - 11,427.3 SQM / 123,003 SQFT

G.	Martin road access removed & pedestrian route added.	16.11.20	WD
F.	Site boundary amended.	04.11.20	WD
E.	Restaurant location updated.	03.11.20	WD
D.	Restaurant & cafe updated.	20.10.20	WD
C.	Road names amended following comments.	06.10.20	WD
B.	Notes amended.	15.09.20	WD
A.	Extra proposed levels added following comments.	19.08.20	WD
No.	Revision.	date	by

PROPOSED DEVELOPMENT,
BARTONS ROAD,
HAVANT,
HAMPSHIRE,
PO9 5EY

SITE PLAN

scale AS SHOWN @ A1
date DECEMBER 2019

checked //
drawn WD
A. B. C. D. E. F. G.

9303/100

ARC Architecture Ltd.

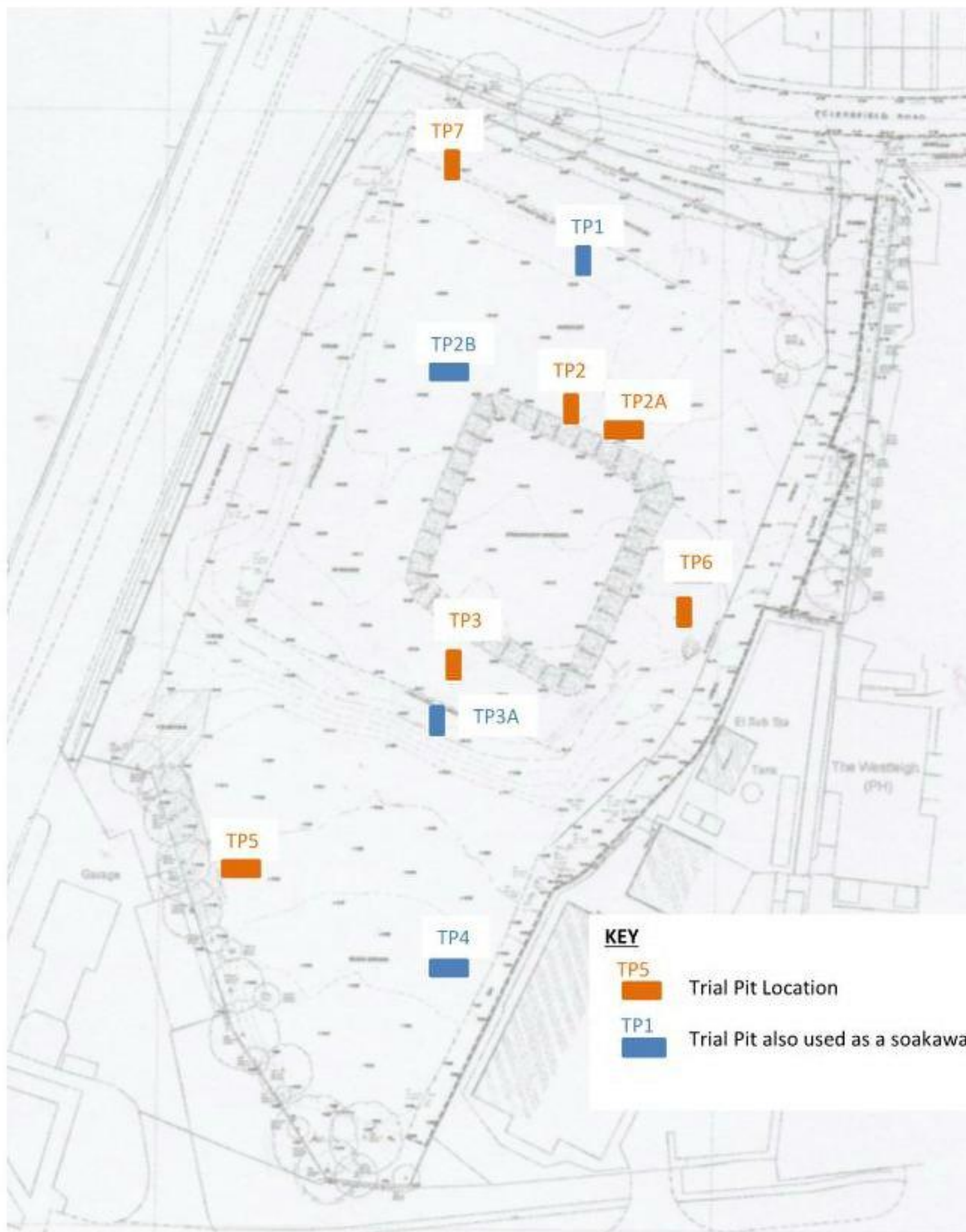
Chapel Studios, 14 Purewell,
Christchurch, Dorset, BH23 1EP

Tel: +44 (0) 1202 479919
E-mail: enquiries@andersrobertscheer.co.uk
Web: www.andersrobertscheer.co.uk

arc
ARCHITECTS

SITE PLAN: BASED ON TOPOGRAPHICAL SURVEY INFORMATION
SCALE 1:275

10m @ 1:100



PROJECT SSE Depot Havant	CLIENT Fortitudo Ltd	Date : 4 th March 2020 Scale : Not To Scale	 FORGE Technical Management Ltd The Forge Lower Vagg Chilthorne Damer Yeovil Somerset BA21 3PY Tel : 01935 840 346
DRAWING TITLE Trial Pit & Soakaway Location Plan		DRAWING No. HAV174/sk001	

APPENDIX B SITE PHOTOGRAPHS



PLATE 1 – TP1



PLATE 2 – TP1 arisings



PLATE 3 – TP1 at start of soakaway test



PLATE 4 – TP2 abandoned due to high, possibly due to water running along old pipe gravel surround



PLATE 5 – TP2 arisings



PLATE 6 – TP2A relocated but groundwater was still at 1.1m possibly in made ground so abandoned



PLATE 7 – TP2A arisings



PLATE 8 – TP2B abandoned due to high, possibly due to water running along old pipe gravel surround



PLATE 9 – TP2B arisings



PLATE 10 – TP3 made ground to full depth to groundwater at 2.3m



PLATE 11 – TP3 arisings



PLATE 12 – TP3A



PLATE 13 – TP3A arisings



PLATE 14 – TP4



PLATE 15 – TP4 arisings



PLATE 16 – TP5



PLATE 17 – TP5 arisings



PLATE 18 – TP6



PLATE 19 – TP6 arisings



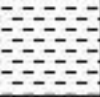
PLATE 20 – TP7



PLATE 21 – TP7 arisings

APPENDIX C TRIAL PIT LOGS

Issue No	A	Dug by	Logged by	RB	Approved by	RB
 Forge Environmental Management Ltd The Forge, Lower Vagg, Chilthorne Damer, Yeovil, Somerset. BA21 3PY Tel : 01935 840346						Trial Pit No. TP1
Project SSE Depot, Bartons Road, Havant						
Job No	HAV174.D	Date Started	03/03/2020	Ground Level	Co-Ordinates	Depth
		Date Completed	03/03/2020			1.90m
Client	Fortitudo				Method/Plant	Sheet
					360 excavator	1 of 1

STRATA					SAMPLES & TESTS			Field Records
Water	Level (mOD)	Legend	Depth (thickness)	Strat Description	Depth	Type No	Test Result	
			(0.40) 0.40	crushed concrete MADE GROUND				
			(0.20) 0.60	southern end of trench brickwork / crushed concrete in remainder MADE GROUND				
			(0.15) 0.75	firm light brown CLAY NATURAL SOILS	0.6	Tub & jar		
			(0.45) 1.20	very gravelly CLAY. Gravel fine sub-angular NATURAL SOILS	1.0	Tub & jar		
			(0.70) 1.90	light brown/light grey medium dense fine SAND with some sub-rounded to sub-angular medium to coarse gravel NATURAL SOILS				
				BASE OF TRIAL PIT				

GENERAL REMARKS

- 1 No groundwater encountered
- 2 Made ground was predominantly crush concrete although at the southern end of the trench there was brickwork
- 3 Pit used for infiltration testing and filled to just below the made ground (0.680m)

Issue No	A	Dug by	Logged by	RB	Approved by	RB
 Forge Environmental Management Ltd The Forge, Lower Vagg, Chilthorne Damer, Yeovil, Somerset. BA21 3PY Tel : 01935 840346						Trial Pit No. TP2
Project SSE Depot, Bartons Road, Havant						
Job No	HAV174.D	Date Started	03/03/2020	Ground Level	Co-Ordinates	Depth
		Date Completed	03/03/2020			1.65m
Client	Fortitudo				Method/Plant	Sheet
					360 excavator	1 of 1

STRATA					SAMPLES & TESTS			Field Records
Water	Level (mOD)	Legend	Depth (thickness)	Strat Description	Depth	Type No	Test Result	
▼ ▽	1.1		(0.30) 0.30	Crushed concrete MADE GROUND	0.6	Tub & jar		
			(0.80)	firm brown sandy clay with half bricks, metal pieces and rebar. Cobble size crushed concrete.				
			1.20	An abandoned pipe at 1.1m MADE GROUND				
			1.65	very gravelly CLAY. Gravel fine sub-angular NATURAL SOILS				
				BASE OF TRIAL PIT				

GENERAL REMARKS 1 Groundwater encountered at 1.1m appeared to be flowing along the gravel surround to an old pipe after 20mins standing at 1.5m 3 Pit due to be used for infiltration testing therefore new hole dug to the east (TP2A)
--

Issue No	A	Dug by	Logged by	RB	Approved by	RB
 Forge Environmental Management Ltd The Forge, Lower Vagg, Chilthorne Damer, Yeovil, Somerset. BA21 3PY Tel : 01935 840346						Trial Pit No. TP2A
Project SSE Depot, Bartons Road, Havant						
Job No	HAV174.D	Date Started	03/03/2020	Ground Level	Co-Ordinates	Depth
		Date Completed	03/03/2020			1.20m
Client					Method/Plant	Sheet
Fortitudo					360 excavator	1 of 1

STRATA					SAMPLES & TESTS			Field Records
Water	Level (mOD)	Legend	Depth (thickness)	Strat Description	Depth	Type No	Test Result	
▼	1.1		(0.35) 0.35	Crushed concrete MADE GROUND				
			(0.80) 1.20	firm to stiff brown sandy clay with occasional pieces of rebar. Cobble size crushed concrete. Old abandoned pipe with rapid water entry from the gravel surround MADE GROUND				
				BASE OF TRIAL PIT				

GENERAL REMARKS 1 Rapid groundwater entry at 1.1m flowing along the gravel surround to an old pipe 2 Pit due to be used for infiltration testing therefore new hole dug to the west (TP2B)

Issue No	A	Dug by	Logged by	RB	Approved by	RB
 Forge Environmental Management Ltd The Forge, Lower Vagg, Chilthorne Damer, Yeovil, Somerset. BA21 3PY Tel : 01935 840346						Trial Pit No. TP2B
Project SSE Depot, Bartons Road, Havant						
Job No	HAV174.D	Date Started	03/03/2020	Ground Level	Co-Ordinates	Depth
		Date Completed	03/03/2020			1.70m
Client					Method/Plant	Sheet
Fortitudo					360 excavator	1 of 1

STRATA					SAMPLES & TESTS			Field Records
Water	Level (mOD)	Legend	Depth (thickness)	Strat Description	Depth	Type No	Test Result	
			(0.35) 0.35	Crushed concrete MADE GROUND				
			(.055) 0.90	dense brown sand and gravel of broken brick and concrete. Occasional pieces of rebar and cobble size fragments of concrete MADE GROUND	0.5	Tub & jar		
			(0.80) 1.70	firm brown/yellow slightly gravelly CLAY. Gravel fine sub-rounded to sub-angular becoming very gravelly from 1.6m NATURAL SOILS				
				BASE OF TRIAL PIT				

GENERAL REMARKS - Made ground very hard to dig due to compacted nature of the bricks and concrete. - Pit was used for infiltration testing and filled to (0.7m) - No groundwater encountered

Issue No	A	Dug by	Logged by	RB	Approved by	RB
 Forge Environmental Management Ltd The Forge, Lower Vagg, Chilthorne Damer, Yeovil, Somerset. BA21 3PY Tel : 01935 840346						Trial Pit No. TP3
Project SSE Depot, Bartons Road, Havant						
Job No	HAV174.D	Date Started	03/03/2020	Ground Level	Co-Ordinates	Depth
		Date Completed	03/03/2020			2.30m
Client	Fortitudo				Method/Plant	Sheet
					360 excavator	1 of 1

STRATA					SAMPLES & TESTS			Field Records
Water	Level (mOD)	Legend	Depth (thickness)	Strat Description	Depth	Type No	Test Result	
			(2.20)	Crushed concrete				
			2.20	MADE GROUND				
			(0.10) 2.30	soft to firm brown gravelly CLAY				
				NATURAL SOILS				
				BASE OF TRIAL PIT				

GENERAL REMARKS 1 Groundwater encountered as a seepage in base of hole 2.3m

Issue No	A	Dug by	Logged by	RB	Approved by	RB
 Forge Environmental Management Ltd The Forge, Lower Vagg, Chilthorne Damer, Yeovil, Somerset. BA21 3PY Tel : 01935 840346						Trial Pit No. TP3A
Project SSE Depot, Bartons Road, Havant						
Job No	HAV174.D	Date Started	03/03/2020	Ground Level	Co-Ordinates	Depth
		Date Completed	03/03/2020			1.10m
Client					Method/Plant	Sheet
Fortitudo					360 excavator	1 of 1

STRATA					SAMPLES & TESTS			Field Records
Water	Level (mOD)	Legend	Depth (thickness)	Strat Description	Depth	Type No	Test Result	
			(0.40)	Type 1 mixed with a gravelly clay. Occasional brick pieces and areas of Terrem				
			0.40	MADE GROUND				
			(0.60)	light brown/yellow soft to firm gravelly CLAY gravel medium to coarse round to sub-rounded				
			1.00	NATURAL SOILS				
			1.10	firm yellow sandy CLAY				
				NATURAL SOILS				

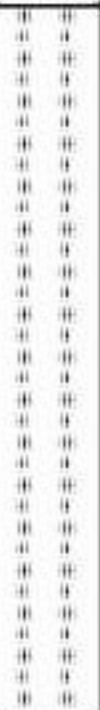
GENERAL REMARKS - No groundwater encountered - Made ground was predominantly crush concrete although at the southern end of the trench there was brickwork - Pit used for infiltration testing and filled to the made ground (0.360m)
--

Issue No	A	Dug by	Logged by	RB	Approved by	RB
 Forge Environmental Management Ltd The Forge, Lower Vagg, Chilthorne Damer, Yeovil, Somerset. BA21 3PY Tel : 01935 840346						Trial Pit No. TP4
Project SSE Depot, Bartons Road, Havant						
Job No	HAV174.D	Date Started	03/03/2020	Ground Level	Co-Ordinates	Depth
		Date Completed	03/03/2020			1.25m
Client	Fortitudo				Method/Plant	Sheet
					360 excavator	1 of 1

STRATA					SAMPLES & TESTS			Field Records
Water	Level (mOD)	Legend	Depth (thickness)	Strat Description	Depth	Type No	Test Result	
			0.10	brick rubble	0.2	Tub & jar		
			(0.25)	brown/grey gravelly clay with occasional brick pieces				
			0.35	MADE GROUND				
			(0.90)	firm gravelly CLAY. Gravel medium to coarse rounded to sub-rounded	1.0	Tub & jar		
			1.25	NATURAL SOILS				
				BASE OF TRIAL PIT				

GENERAL REMARKS 1 Groundwater was not encountered 2 Trial pit used for infiltration testing and was filled to 0.40m
--

Issue No	A	Dug by	Logged by	RB	Approved by	RB
 Forge Environmental Management Ltd The Forge, Lower Vagg, Chilthorne Damer, Yeovil, Somerset. BA21 3PY Tel : 01935 840346						Trial Pit No. TP5
Project SSE Depot, Bartons Road, Havant						
Job No	HAV174.D	Date Started	03/03/2020	Ground Level	Co-Ordinates	Depth
		Date Completed	03/03/2020			2.75m
Client	Fortitudo				Method/Plant	Sheet
					360 excavator	1 of 1

STRATA					SAMPLES & TESTS			Field Records
Water	Level (mOD)	Legend	Depth (thickness)	Strat Description	Depth	Type No	Test Result	
▼			(0.30) 0.30	Type 1 mixed with gravel MADE GROUND	0.2	Tub & jar		
			(0.90) 1.20	soft to firm light brown/light grey gravelly sandy CLAY. Gravel fine to medium sub-rounded to sub-angular	0.5	Tub & jar		
			2.75	medium dense yellow fine SAND				

GENERAL REMARKS 1 Ground water encountered as a seepage at the base of the trial pit 2.75m
--

Issue No	A	Dug by	Logged by	RB	Approved by	RB
 Forge Environmental Management Ltd The Forge, Lower Vagg, Chilthorne Damer, Yeovil, Somerset. BA21 3PY Tel : 01935 840346						Trial Pit No. TP6
Project SSE Depot, Bartons Road, Havant						
Job No	HAV174.D	Date Started	03/03/2020	Ground Level	Co-Ordinates	Depth
		Date Completed	03/03/2020			3.00m
Client					Method/Plant	Sheet
Fortitudo					360 excavator	1 of 1

STRATA					SAMPLES & TESTS			Field Records
Water	Level (mOD)	Legend	Depth (thickness)	Strat Description	Depth	Type No	Test Result	
			(0.30) 0.30	soft to firm brown/grey sandy gravelly clay occasion brick fragments, rebar and wire MADE GROUND	0.2	Tub & jar		
			(1.00) 1.30	firm grey gravelly CLAY. Gravel medium to coarse sub-rounded to sub-angular NATURAL SOILS	0.5	Tub & jar		
			3.00	medium dense yellow/light grey fine SAND NATURAL SOILS				

GENERAL REMARKS 1 No groundwater encountered 2 Side wall collapse on both sides between 2.0m and base
--

Issue No	A	Dug by	Logged by	RB	Approved by	RB
 Forge Environmental Management Ltd The Forge, Lower Vagg, Chilthorne Damer, Yeovil, Somerset. BA21 3PY Tel : 01935 840346						Trial Pit No. TP7
Project SSE Depot, Bartons Road, Havant						
Job No	HAV174.D	Date Started	03/03/2020	Ground Level	Co-Ordinates	Depth
		Date Completed	03/03/2020			3.00m
Client					Method/Plant	Sheet
Fortitudo					360 excavator	1 of 1

STRATA					SAMPLES & TESTS			Field Records
Water	Level (mOD)	Legend	Depth (thickness)	Strat Description	Depth	Type No	Test Result	
			(0.46) 0.46	soft to firm light brown sandy gravelly clay mixed with Type 1 MADE GROUND	0.2	Tub & jar		
			(0.84) 1.30	firm grey gravelly CLAY. Gravel medium to coarse sub-rounded to sub-angular NATURAL SOILS	1.0	Tub & jar		
			3.00	medium dense yellow/light grey fine SAND NATURAL SOILS				

GENERAL REMARKS 1 Concrete footing 0.6m thick on a layer of blinding concrete at southern end of the pit 2 Side wall collapse on west side between 1.8m and base 3 Groundwater not encountered
--

APPENDIX D INFILTRATION TEST RESULTS



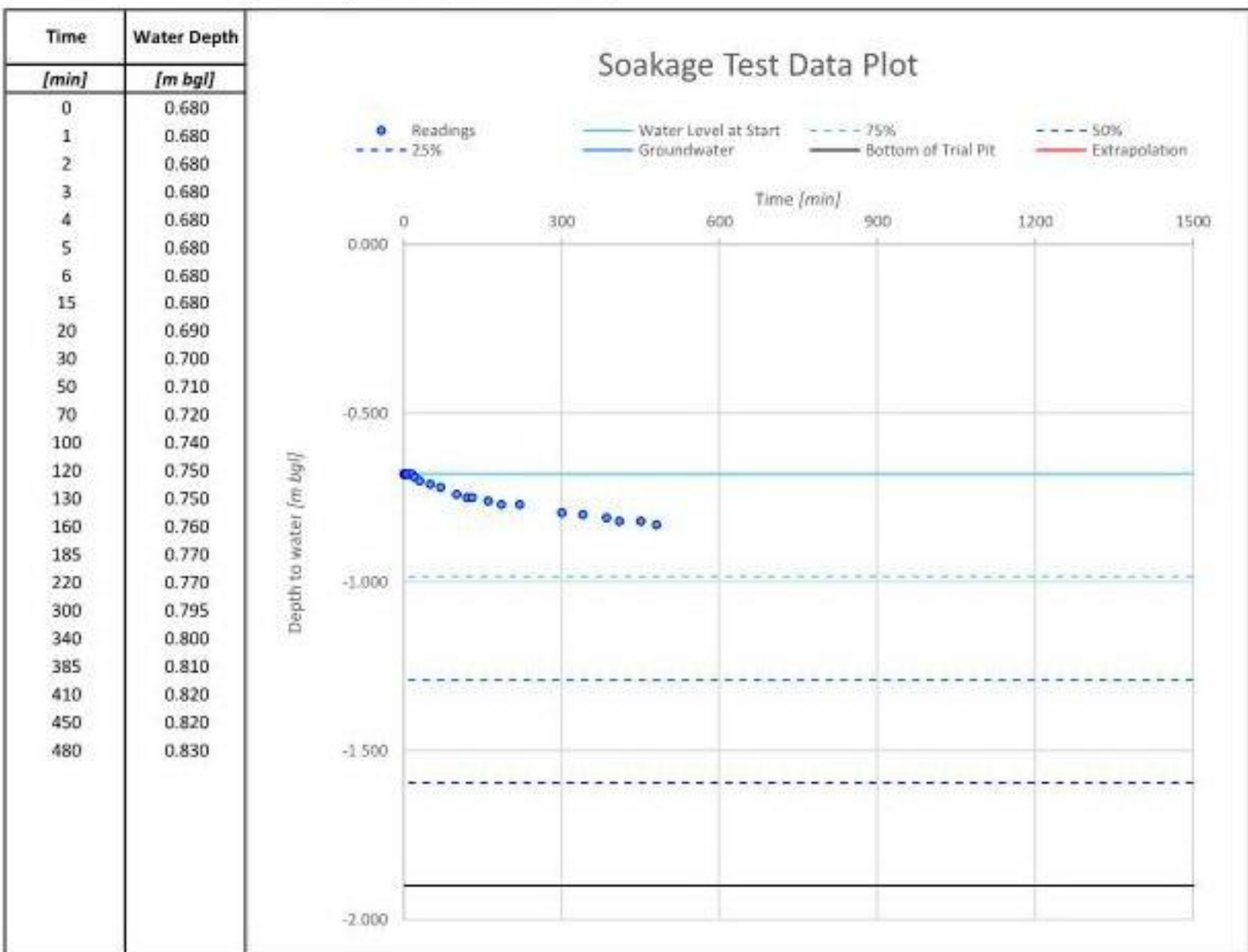
SOIL INFILTRATION RATE

Client: Fortitudo
Project Title: SSE Depot, Harvant
Project No: BRA140.D

Borehole No: TP1
Test No: 1
Date: 03/03/2020
Logged by: RB

Length [m]: 1.80
Depth [m]: 1.90
Width [m]: 0.60
Groundwater [m bgl]:

Ground	Conditions	from - to [m bgl]		Description
		0.00	0.40	crushed concrete
		0.40	0.60	made ground
		0.60	1.00	firm clay becoming very gravelly with depth
		1.00	1.90	medium dense fine sand



Soil Infiltration Rate [m/s]:

$$f = \frac{V_{p75-25}}{a_{50} \times t_{p75-25}}$$

with:

V_{p75-25} as Effective Storage Volume of water between 75% and 25% effective storage depth [m³] **0.66**
 a_{50} as Internal Surface Area of the soakage trial pit up to 50% storage depth including the base area [m²] **4.01**
 t_{p75-25} as Time for the water level to fall from 75% to 25% effective storage depth [s] **n/a**

Soil Infiltration Rate [m/s]: n/a

Remarks: Result could not be calculated. Soakage test failed.



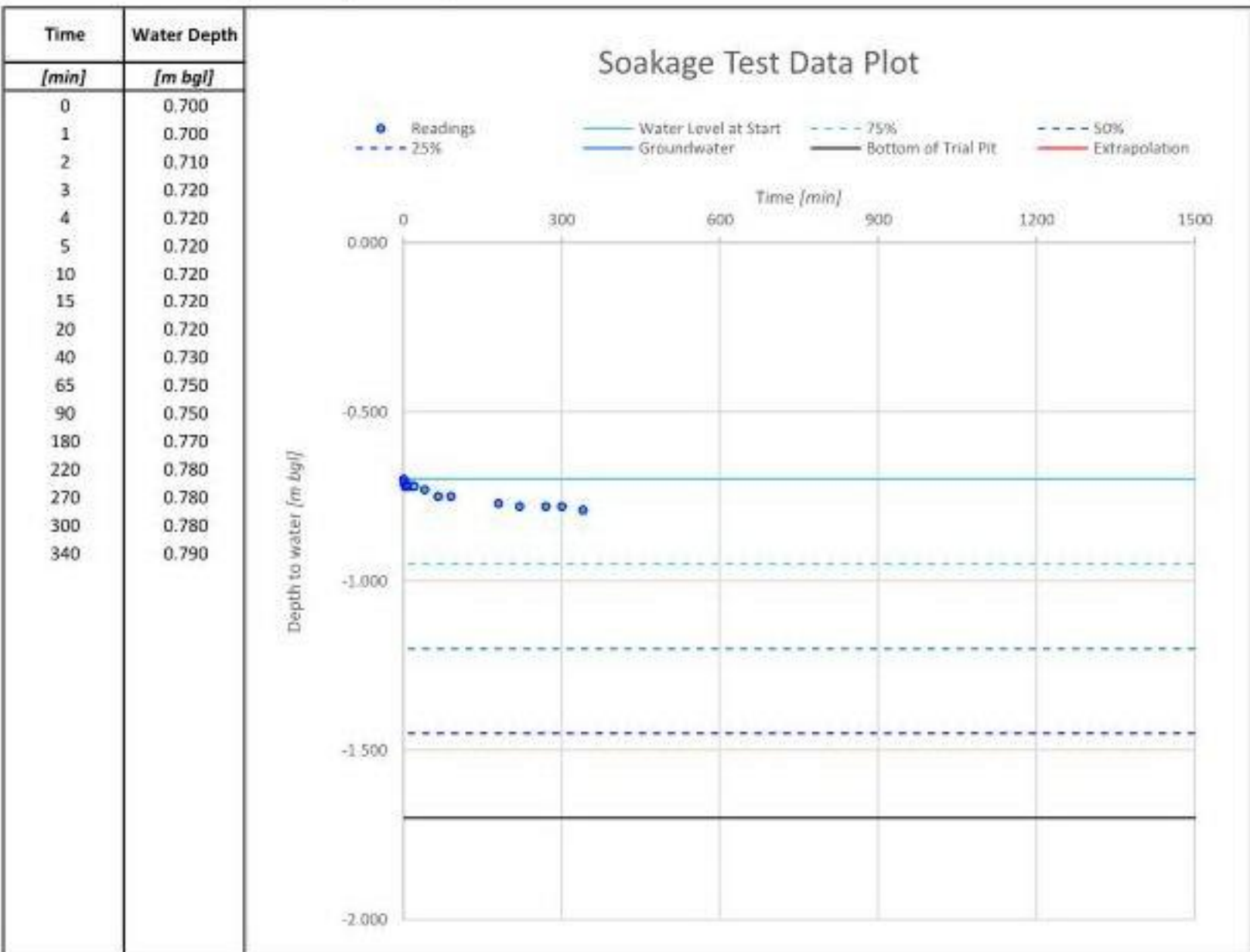
SOIL INFILTRATION RATE

Client: Fortitudo
Project Title: SSE Depot, Harvant
Project No: BRA140.D

Borehole No: TP2B
Test No: 1
Date: 03/03/2020
Logged by: RB

Length [m]: 1.40
Depth [m]: 1.70
Width [m]: 0.70
Groundwater [m bgl]:

Ground	Conditions	from - to [m bgl]		Description
		0.00	0.35	crushed concrete
		0.35	0.90	made ground
		0.90	1.70	firm gravelly clay becoming sandy with depth



Soil Infiltration Rate [m/s]:

$$f = \frac{V_{p75-25}}{a_{50} \times t_{p75-25}}$$

with:

V_{p75-25}	as Effective Storage Volume of water between 75% and 25% effective storage depth [m ³]	0.49
a_{50}	as Internal Surface Area of the soakage trial pit up to 50% storage depth including the base area [m ²]	3.08
t_{p75-25}	as Time for the water level to fall from 75% to 25% effective storage depth [s]	n/a

Soil Infiltration Rate [m/s]: n/a

Remarks: Result could not be calculated. Soakage test failed.



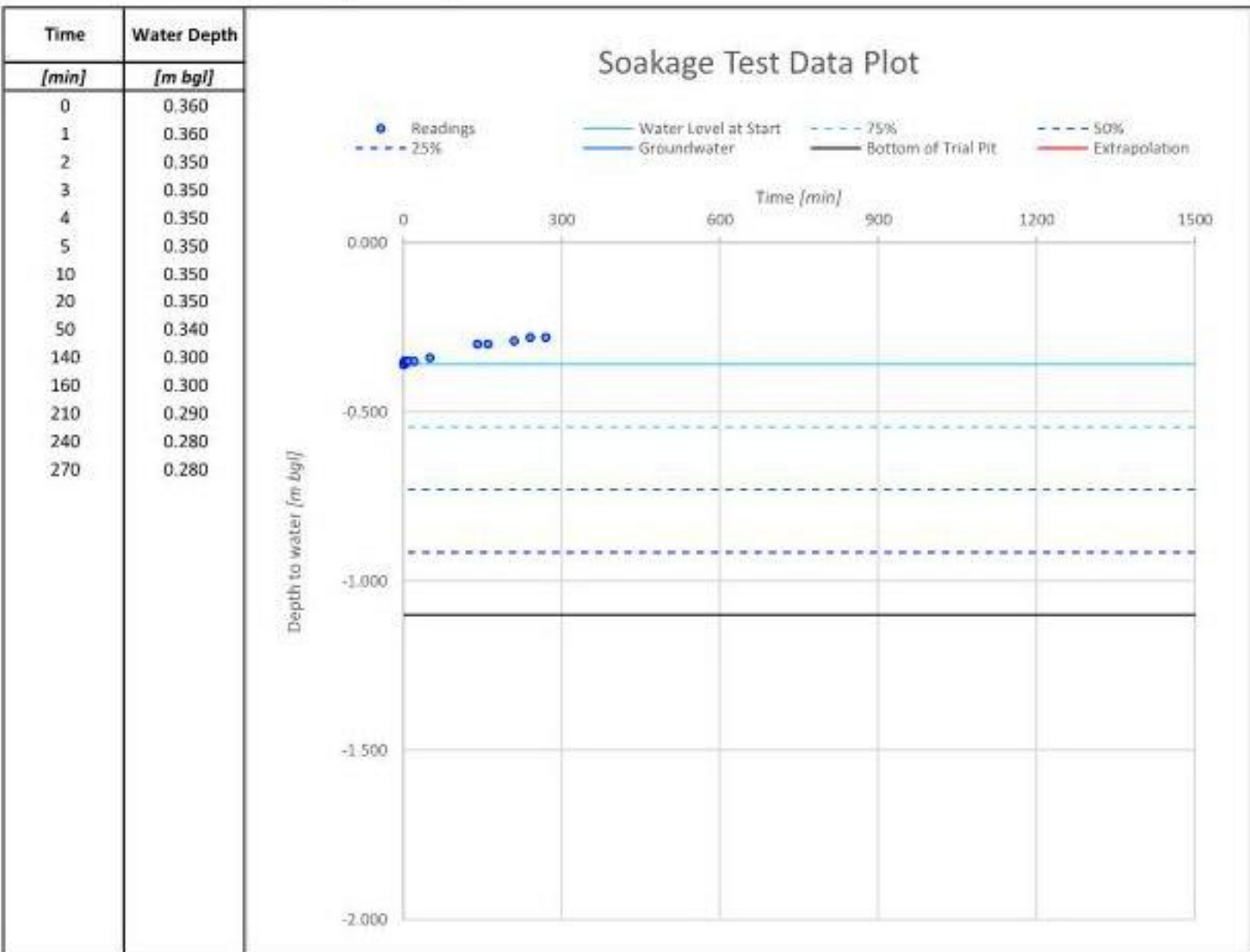
SOIL INFILTRATION RATE

Client: Fortitudo
Project Title: SSE Depot, Harvant
Project No: BRA140.D

Borehole No: TP3A
Test No: 1
Date: 03/03/2020
Logged by: RB

Length [m]: 1.30
Depth [m]: 1.10
Width [m]: 0.70
Groundwater [m bgl]:

Ground	Conditions	from - to [m bgl]		Description
		0.00	0.40	made ground
		0.40	1.00	soft to firm gravelly clay
		1.00	1.10	sandy clay



Soil Infiltration Rate [m/s]:

$$f = \frac{V_{p75-25}}{a_{50} \times t_{p75-25}}$$

with:

V_{p75-25} as Effective Storage Volume of water between 75% and 25% effective storage depth [m³] **0.34**

a_{50} as Internal Surface Area of the soakage trial pit up to 50% storage depth including the base area [m²] **2.39**

t_{p75-25} as Time for the water level to fall from 75% to 25% effective storage depth [s] **n/a**

Soil Infiltration Rate [m/s]: **n/a**

Remarks: Result could not be calculated. Soakage test failed.



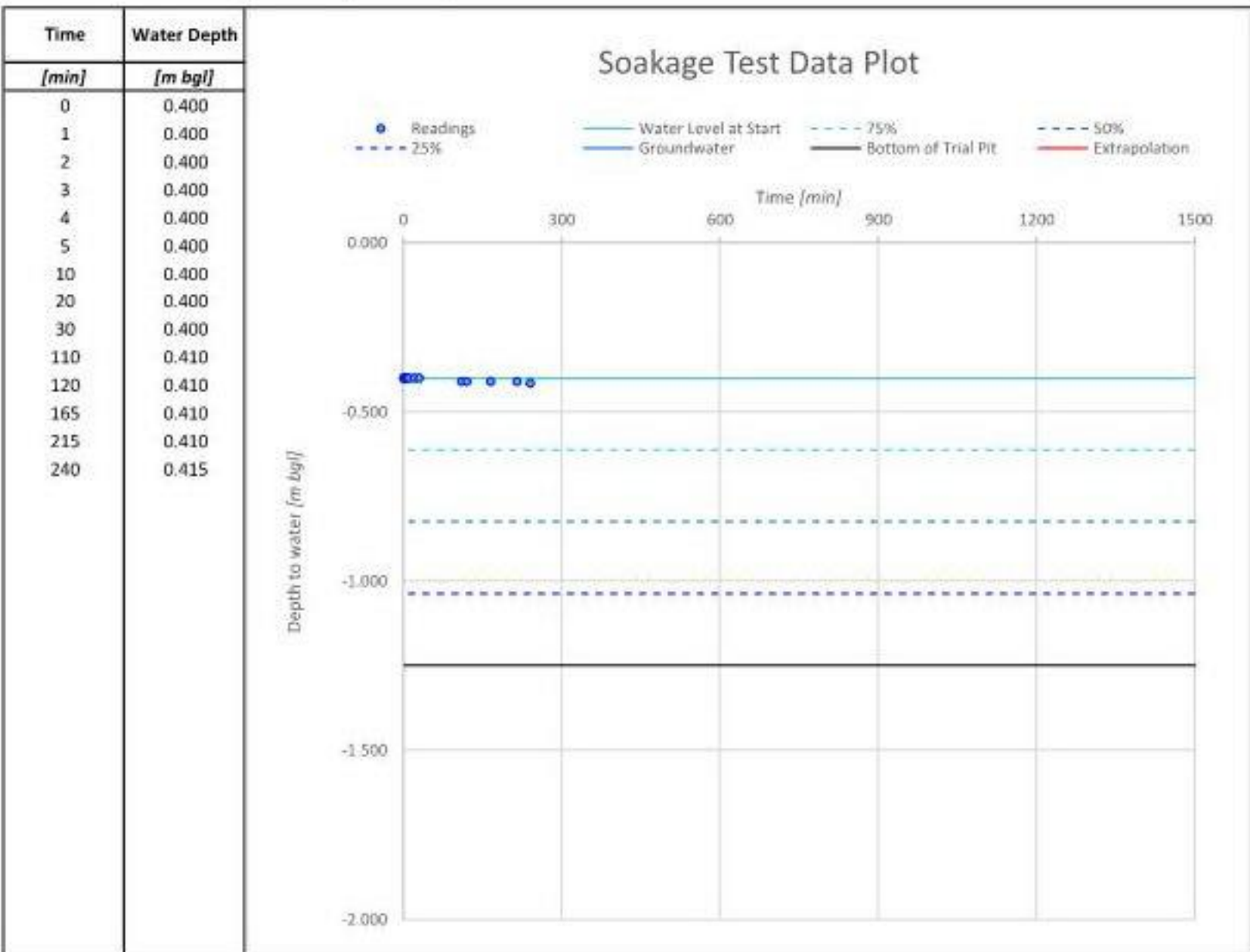
SOIL INFILTRATION RATE

Client: Fortitudo
Project Title: SSE Depot, Harvant
Project No: BRA140.D

Borehole No: TP4
Test No: 1
Date: 03/03/2020
Logged by: RB

Length [m]: 1.60
Depth [m]: 1.25
Width [m]: 0.70
Groundwater [m bgl]:

Ground	Conditions	from - to [m bgl]		Description
		0.00	0.10	brick rubble
		0.10	0.35	Made ground
		0.35	1.25	firm gravelly clay



Soil Infiltration Rate [m/s]:

$$f = \frac{V_{p75-25}}{a_{50} \times t_{p75-25}}$$

with:

V_{p75-25} as Effective Storage Volume of water between 75% and 25% effective storage depth [m³] **0.48**

a_{50} as Internal Surface Area of the soakage trial pit up to 50% storage depth including the base area [m²] **3.08**

t_{p75-25} as Time for the water level to fall from 75% to 25% effective storage depth [s] **n/a**

Soil Infiltration Rate [m/s]: n/a

Remarks: Result could not be calculated. Soakage test failed.

APPENDIX E CHEMICAL ANALYSIS RESULTS

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number: 20-27369

Issue: 2. Replaces Analytical Report number 20-27369; issue no.1

Date of Issue: 26/03/2020

Contact: Richard Blaney

Customer Details: Forge Environmental Management Ltd
The Forge
Lower Vagg
Yeovil
SomersetBA21 3PY

Quotation No: Q19-01649

Order No: HAV174.D/208

Customer Reference: HAV174.D/208

Date Received: 05/03/2020

Date Approved: 26/03/2020

Details: SSE Depot, Havant

Approved by:



Mike Varley, Technical Manager

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

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Sample Summary

Report No.: 20-27369, issue number 2

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
199056	TP1 0.60	03/03/2020	05/03/2020	Silty clayey loam	
199057	TP1 1.00	03/03/2020	05/03/2020	Loamy sand	
199058	TP2 0.60	03/03/2020	05/03/2020	Sandy loam	
199059	TP2B 0.50	03/03/2020	23/03/2020	Loamy sand	
199060	TP3 1.00	03/03/2020	05/03/2020	Sandy loam	
199061	TP4 0.20	03/03/2020	23/03/2020	Silty loam	
199062	TP4 1.00	03/03/2020	05/03/2020		
199063	TP5 0.20	03/03/2020	05/03/2020	Sandy loam	
199064	TP5 0.50	03/03/2020	05/03/2020	Loamy sand	
199065	TP6 0.20	03/03/2020	05/03/2020	Silty loam	
199066	TP6 0.50	03/03/2020	23/03/2020	Sandy silty loam	
199067	TP7 0.20	03/03/2020	05/03/2020	Sandy silty loam	
199068	TP7 1.00	03/03/2020	23/03/2020	Silty loam	
199069	TP2 1.00	03/03/2020	05/03/2020		

Results Summary

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Report No.: 20-27369, issue number 2

ELAB Reference	199056	199057	199058	199059
Customer Reference				
Sample ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sample Location	TP1	TP1	TP2	TP2B
Sample Depth (m)	0.60	1.00	0.60	0.50
Sampling Date	03/03/2020	03/03/2020	03/03/2020	03/03/2020

Determinand	Codes	Units	LOD				
Soil sample preparation parameters							
Material removed	N	%	0.1	< 0.1	15.4	64.1	66.1
Description of Inert material removed	N		0	None	Stones	Stones	Stones, concrete
Metals							
Arsenic	M	mg/kg	1	13.8	5.3	8.1	12.8
Cadmium	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	M	mg/kg	5	39.5	25.6	27.4	27.8
Copper	M	mg/kg	5	12.8	7.8	22.3	21.4
Lead	M	mg/kg	5	21.9	10.3	48.7	55.6
Mercury	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	28.4	12.2	17.0	20.6
Selenium	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	M	mg/kg	5	79.1	30.7	93.9	208
Anions							
Water Soluble Sulphate	M	g/l	0.02	0.02	< 0.02	0.25	0.37
Inorganics							
Elemental Sulphur	M	mg/kg	20	< 20	< 20	< 20	< 20
Free Cyanide	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	< 0.8	< 0.8	< 0.8
Total Sulphide	N	mg/kg	2	< 2	< 2	< 2	< 2
Total Cyanide	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
Water Soluble Boron	N	mg/kg	0.5	< 0.5	< 0.5	1.0	1.0
Miscellaneous							
pH	M	pH units	0.1	8.2	8.4	10.6	11.2
Soil Organic Matter	U	%	0.1	0.3	0.3	0.9	0.9
Phenols							
Phenol	M	mg/kg	1	< 1	< 1	< 1	< 1
3,4-Dimethylphenol	N	mg/kg	1	< 1	< 1	< 1	< 1
2,3-Dimethylphenol	M	mg/kg	1	< 1	< 1	< 1	< 1
2,3,5-trimethylphenol	M	mg/kg	1	< 1	< 1	< 1	< 1
Total Monohydric Phenols	N	mg/kg	5	< 5	< 5	< 5	< 5
Polyaromatic hydrocarbons							
Naphthalene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.1
Anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	M	mg/kg	0.1	< 0.1	< 0.1	0.3	0.3
Pyrene	M	mg/kg	0.1	< 0.1	< 0.1	0.5	0.3
Benzo(a)anthracene	M	mg/kg	0.1	< 0.1	< 0.1	0.3	0.2
Chrysene	M	mg/kg	0.1	< 0.1	< 0.1	0.3	0.2
Benzo(b)fluoranthene	M	mg/kg	0.1	< 0.1	< 0.1	0.2	0.3
Benzo(k)fluoranthene	M	mg/kg	0.1	< 0.1	< 0.1	0.2	0.3
Benzo(a)pyrene	M	mg/kg	0.1	< 0.1	< 0.1	0.1	0.2
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.1
Dibenzo(a,h)anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo[g,h,i]perylene	M	mg/kg	0.1	< 0.1	< 0.1	0.1	0.1
Total PAH(16)	M	mg/kg	0.4	< 0.4	< 0.4	2.2	2.1

Results Summary

2683

Report No.: 20-27369, issue number 2

ELAB Reference	199056	199057	199058	199059
Customer Reference				
Sample ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sample Location	TP1	TP1	TP2	TP2B
Sample Depth (m)	0.60	1.00	0.60	0.50
Sampling Date	03/03/2020	03/03/2020	03/03/2020	03/03/2020

Determinand	Codes	Units	LOD				
BTEX							
Benzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0
Toluene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0
Ethylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0
Xylenes	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0
MTBE	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0
TPH CWG							
>C5-C6 Aliphatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C6-C8 Aliphatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C8-C10 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C10-C12 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C12-C16 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C16-C21 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C21-C35 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	1.2	11.2
>C35-C40 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	3.0
>C5-C7 Aromatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C7-C8 Aromatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C8-C10 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C10-C12 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C12-C16 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C16-C21 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	1.1
>C21-C35 Aromatic	N	mg/kg	1	< 1.0	< 1.0	1.6	22.2
>C35-C40 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	9.0
Total (>C5-C40) Ali/Aro	N	mg/kg	1	< 1.0	< 1.0	2.8	46.6
PCB (ICES 7 congeners)							
PCB 28	M	mg/kg	0.01	n/t	n/t	n/t	< 0.01
PCB 52	M	mg/kg	0.01	n/t	n/t	n/t	< 0.01
PCB 101	M	mg/kg	0.01	n/t	n/t	n/t	0.01
PCB 118	M	mg/kg	0.01	n/t	n/t	n/t	< 0.01
PCB 153	M	mg/kg	0.01	n/t	n/t	n/t	0.01
PCB 138	M	mg/kg	0.01	n/t	n/t	n/t	0.01
PCB 180	M	mg/kg	0.01	n/t	n/t	n/t	0.01
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	n/t	n/t	0.06

Results Summary

2683

Report No.: 20-27369, issue number 2

ELAB Reference	199060	199061	199063	199064
Customer Reference				
Sample ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sample Location	TP3	TP4	TP5	TP5
Sample Depth (m)	1.00	0.20	0.20	0.50
Sampling Date	03/03/2020	03/03/2020	03/03/2020	03/03/2020

Determinand	Codes	Units	LOD				
Soil sample preparation parameters							
Material removed	N	%	0.1	53.2	24.7	69.2	60.1
Description of Inert material removed	N		0	Stones, concrete	Stones, brick	Stones	Stones
Metals							
Arsenic	M	mg/kg	1	18.4	10.3	10.2	8.6
Cadmium	M	mg/kg	0.5	0.5	< 0.5	< 0.5	< 0.5
Chromium	M	mg/kg	5	32.3	24.7	9.7	18.0
Copper	M	mg/kg	5	22.9	15.3	10.5	12.3
Lead	M	mg/kg	5	76.3	103	20.6	38.4
Mercury	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	21.1	15.6	9.7	10.8
Selenium	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	M	mg/kg	5	105	121	33.4	41.2
Anions							
Water Soluble Sulphate	M	g/l	0.02	0.05	0.05	0.02	< 0.02
Inorganics							
Elemental Sulphur	M	mg/kg	20	< 20	< 20	< 20	< 20
Free Cyanide	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	< 0.8	< 0.8	< 0.8
Total Sulphide	N	mg/kg	2	< 2	< 2	< 2	< 2
Total Cyanide	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
Water Soluble Boron	N	mg/kg	0.5	< 0.5	0.7	< 0.5	0.5
Miscellaneous							
pH	M	pH units	0.1	11.8	9.6	9.4	8.4
Soil Organic Matter	U	%	0.1	0.6	1.1	< 0.1	1.1
Phenols							
Phenol	M	mg/kg	1	< 1	< 1	< 1	< 1
3,4-Dimethylphenol	N	mg/kg	1	< 1	< 1	< 1	< 1
2,3-Dimethylphenol	M	mg/kg	1	< 1	< 1	< 1	< 1
2,3,5-trimethylphenol	M	mg/kg	1	< 1	< 1	< 1	< 1
Total Monohydric Phenols	N	mg/kg	5	< 5	< 5	< 5	< 5
Polyaromatic hydrocarbons							
Naphthalene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	M	mg/kg	0.1	< 0.1	0.1	< 0.1	< 0.1
Anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	M	mg/kg	0.1	0.1	0.3	< 0.1	< 0.1
Pyrene	M	mg/kg	0.1	0.1	0.2	< 0.1	< 0.1
Benzo(a)anthracene	M	mg/kg	0.1	< 0.1	0.2	< 0.1	< 0.1
Chrysene	M	mg/kg	0.1	< 0.1	0.2	< 0.1	< 0.1
Benzo(b)fluoranthene	M	mg/kg	0.1	< 0.1	0.2	< 0.1	< 0.1
Benzo(k)fluoranthene	M	mg/kg	0.1	< 0.1	0.2	< 0.1	< 0.1
Benzo(a)pyrene	M	mg/kg	0.1	< 0.1	0.2	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	< 0.1	0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo[g,h,i]perylene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total PAH(16)	M	mg/kg	0.4	0.7	1.9	< 0.4	< 0.4

Results Summary

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Report No.: 20-27369, issue number 2

ELAB Reference	199060	199061	199063	199064
Customer Reference				
Sample ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sample Location	TP3	TP4	TP5	TP5
Sample Depth (m)	1.00	0.20	0.20	0.50
Sampling Date	03/03/2020	03/03/2020	03/03/2020	03/03/2020

Determinand	Codes	Units	LOD				
BTEX							
Benzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0
Toluene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0
Ethylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0
Xylenes	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0
MTBE	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0
TPH CWG							
>C5-C6 Aliphatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C6-C8 Aliphatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C8-C10 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C10-C12 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C12-C16 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C16-C21 Aliphatic	N	mg/kg	1	2.3	< 1.0	< 1.0	< 1.0
>C21-C35 Aliphatic	N	mg/kg	1	22.4	1.7	< 1.0	< 1.0
>C35-C40 Aliphatic	N	mg/kg	1	8.1	< 1.0	< 1.0	< 1.0
>C5-C7 Aromatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C7-C8 Aromatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C8-C10 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C10-C12 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C12-C16 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0
>C16-C21 Aromatic	N	mg/kg	1	2.7	< 1.0	< 1.0	< 1.0
>C21-C35 Aromatic	N	mg/kg	1	32.9	8.2	4.2	1.5
>C35-C40 Aromatic	N	mg/kg	1	15.8	5.3	2.6	< 1.0
Total (>C5-C40) Ali/Aro	N	mg/kg	1	84.2	15.2	6.9	1.5
PCB (ICES 7 congeners)							
PCB 28	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t
PCB 52	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t
PCB 101	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t
PCB 118	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t
PCB 153	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t
PCB 138	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t
PCB 180	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	< 0.03	n/t	n/t

Results Summary

2683

Report No.: 20-27369, issue number 2

ELAB Reference	199065	199066	199067	199068
Customer Reference				
Sample ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sample Location	TP6	TP6	TP7	TP7
Sample Depth (m)	0.20	0.50	0.20	1.00
Sampling Date	03/03/2020	03/03/2020	03/03/2020	03/03/2020

Determinand	Codes	Units	LOD				
Soil sample preparation parameters							
Material removed	N	%	0.1	41.7	40.6	59.9	42.7
Description of Inert material removed	N		0	Stones	Stones	Stones, concrete	Stones
Metals							
Arsenic	M	mg/kg	1	8.7	n/t	11.5	n/t
Cadmium	M	mg/kg	0.5	< 0.5	n/t	< 0.5	n/t
Chromium	M	mg/kg	5	23.8	n/t	28.2	n/t
Copper	M	mg/kg	5	14.3	n/t	16.7	n/t
Lead	M	mg/kg	5	35.6	n/t	101	n/t
Mercury	M	mg/kg	0.5	< 0.5	n/t	< 0.5	n/t
Nickel	M	mg/kg	5	13.4	n/t	16.4	n/t
Selenium	M	mg/kg	1	< 1.0	n/t	< 1.0	n/t
Zinc	M	mg/kg	5	63.0	n/t	82.1	n/t
Anions							
Water Soluble Sulphate	M	g/l	0.02	0.07	n/t	0.23	n/t
Inorganics							
Elemental Sulphur	M	mg/kg	20	< 20	n/t	< 20	n/t
Free Cyanide	N	mg/kg	1	< 1.0	n/t	< 1.0	n/t
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	n/t	< 0.8	n/t
Total Sulphide	N	mg/kg	2	< 2	n/t	< 2	n/t
Total Cyanide	M	mg/kg	1	< 1.0	n/t	< 1.0	n/t
Water Soluble Boron	N	mg/kg	0.5	0.9	n/t	2.6	n/t
Miscellaneous							
pH	M	pH units	0.1	8.9	n/t	10.7	n/t
Soil Organic Matter	U	%	0.1	2.0	n/t	1.0	n/t
Phenols							
Phenol	M	mg/kg	1	< 1	n/t	< 1	n/t
3,4-Dimethylphenol	N	mg/kg	1	< 1	n/t	< 1	n/t
2,3-Dimethylphenol	M	mg/kg	1	< 1	n/t	< 1	n/t
2,3,5-trimethylphenol	M	mg/kg	1	< 1	n/t	< 1	n/t
Total Monohydric Phenols	N	mg/kg	5	< 5	n/t	< 5	n/t
Polyaromatic hydrocarbons							
Naphthalene	M	mg/kg	0.1	0.1	n/t	0.1	n/t
Acenaphthylene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	n/t
Acenaphthene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	n/t
Fluorene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	n/t
Phenanthrene	M	mg/kg	0.1	0.4	n/t	0.2	n/t
Anthracene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	n/t
Fluoranthene	M	mg/kg	0.1	0.4	n/t	0.3	n/t
Pyrene	M	mg/kg	0.1	0.3	n/t	0.3	n/t
Benzo(a)anthracene	M	mg/kg	0.1	0.2	n/t	0.2	n/t
Chrysene	M	mg/kg	0.1	0.3	n/t	0.2	n/t
Benzo(b)fluoranthene	M	mg/kg	0.1	0.2	n/t	0.1	n/t
Benzo(k)fluoranthene	M	mg/kg	0.1	0.3	n/t	0.1	n/t
Benzo(a)pyrene	M	mg/kg	0.1	0.2	n/t	0.1	n/t
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	0.1	n/t	< 0.1	n/t
Dibenzo(a,h)anthracene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	n/t
Benzo[g,h,i]perylene	M	mg/kg	0.1	0.1	n/t	< 0.1	n/t
Total PAH(16)	M	mg/kg	0.4	2.6	n/t	1.7	n/t

Results Summary

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ELAB Reference	199065	199066	199067	199068
Customer Reference				
Sample ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sample Location	TP6	TP6	TP7	TP7
Sample Depth (m)	0.20	0.50	0.20	1.00
Sampling Date	03/03/2020	03/03/2020	03/03/2020	03/03/2020

Determinand	Codes	Units	LOD				
BTEX							
Benzene	N	ug/kg	10	< 10.0	n/t	< 10.0	n/t
Toluene	N	ug/kg	10	< 10.0	n/t	< 10.0	n/t
Ethylbenzene	N	ug/kg	10	< 10.0	n/t	< 10.0	n/t
Xylenes	N	ug/kg	10	< 10.0	n/t	< 10.0	n/t
MTBE	N	ug/kg	10	< 10.0	n/t	< 10.0	n/t
TPH CWG							
>C5-C6 Aliphatic	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t
>C6-C8 Aliphatic	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t
>C8-C10 Aliphatic	N	mg/kg	1	< 1.0	n/t	< 1.0	n/t
>C10-C12 Aliphatic	N	mg/kg	1	< 1.0	n/t	< 1.0	n/t
>C12-C16 Aliphatic	N	mg/kg	1	< 1.0	n/t	16.9	n/t
>C16-C21 Aliphatic	N	mg/kg	1	< 1.0	n/t	30.8	n/t
>C21-C35 Aliphatic	N	mg/kg	1	12.9	n/t	21.1	n/t
>C35-C40 Aliphatic	N	mg/kg	1	4.4	n/t	< 1.0	n/t
>C5-C7 Aromatic	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t
>C7-C8 Aromatic	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t
>C8-C10 Aromatic	N	mg/kg	1	< 1.0	n/t	< 1.0	n/t
>C10-C12 Aromatic	N	mg/kg	1	< 1.0	n/t	< 1.0	n/t
>C12-C16 Aromatic	N	mg/kg	1	< 1.0	n/t	17.9	n/t
>C16-C21 Aromatic	N	mg/kg	1	< 1.0	n/t	35.3	n/t
>C21-C35 Aromatic	N	mg/kg	1	38.9	n/t	41.6	n/t
>C35-C40 Aromatic	N	mg/kg	1	23.3	n/t	12.0	n/t
Total (>C5-C40) Ali/Aro	N	mg/kg	1	79.5	n/t	176	n/t
PCB (ICES 7 congeners)							
PCB 28	M	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01
PCB 52	M	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01
PCB 101	M	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01
PCB 118	M	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01
PCB 153	M	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01
PCB 138	M	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01
PCB 180	M	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	< 0.03	n/t	< 0.03

Results Summary

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ELAB Reference	199069
Customer Reference	
Sample ID	
Sample Type	WATER
Sample Location	TP2
Sample Depth (m)	
Sampling Date	03/03/2020

Determinand	Codes	Units	LOD	
Dissolved Metals				
Arsenic	U	ug/l	5	6
Boron	N	ug/l	5	14
Cadmium	U	ug/l	1	< 1
Chromium	U	ug/l	5	27
Copper	U	ug/l	5	22
Mercury	U	ug/l	0.1	< 0.1
Nickel	U	ug/l	5	7
Lead	U	ug/l	1	< 1
Selenium	U	ug/l	5	< 5
Zinc	U	ug/l	5	< 5
Anions				
Sulphate	U	mg/l	0.5	158
Inorganics				
Free Cyanide	N	ug/l	5	< 5
Hexavalent Chromium	U	ug/l	100	< 100
Sulphide	N	mg/l	0.1	< 0.1
Total Cyanide	U	ug/l	5	6
Miscellaneous				
pH	U	pH units	0.1	11.7
Organics				
>C8-C10 BCB	N	ug/l	5	< 5.0
>C10-C12 BCB	N	ug/l	5	< 5.0
>C12-C16 BCB	N	ug/l	5	5.4
>C16-C21 BCB	N	ug/l	5	51.7
>C21-C35 BCB	N	ug/l	5	302
>C35-C40 BCB	N	ug/l	5	24.1
Total (>C8-C40) BCB	N	ug/l	5	378
Phenols				
Phenol	N	ug/l	1	< 1
M,P-Cresol	N	ug/l	1	< 1
O-Cresol	N	ug/l	1	< 1
3,4-Dimethylphenol	N	ug/l	1	< 1
2,3-Dimethylphenol	N	ug/l	1	< 1
2,3,5-trimethylphenol	N	ug/l	1	< 1
Total Monohydric Phenols	N	ug/l	1	< 1

Results Summary

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Report No.: 20-27369, issue number 2

ELAB Reference	199069
Customer Reference	
Sample ID	
Sample Type	WATER
Sample Location	TP2
Sample Depth (m)	
Sampling Date	03/03/2020

Determinand	Codes	Units	LOD	
Polyaromatic hydrocarbons				
Naphthalene GCMS	N	ug/l	0.01	0.09
Acenaphthylene GCMS	N	ug/l	0.01	0.04
Acenaphthene GCMS	N	ug/l	0.01	0.08
Fluorene GCMS	N	ug/l	0.01	0.03
Phenanthrene GCMS	N	ug/l	0.01	0.83
Anthracene GCMS	N	ug/l	0.01	0.19
Fluoranthene GCMS	N	ug/l	0.01	1.50
Pyrene GCMS	N	ug/l	0.01	1.39
Benzo (a) anthracene GCMS	N	ug/l	0.01	1.18
Chrysene GCMS	N	ug/l	0.01	0.90
Benzo (b) fluoranthene GCMS	N	ug/l	0.01	1.10
Benzo (k) fluoranthene GCMS	N	ug/l	0.01	0.95
Benzo (a) pyrene GCMS	N	ug/l	0.01	1.38
Indeno (1,2,3-cd) pyrene GCMS	N	ug/l	0.01	0.94
Dibenzo(a,h)anthracene GCMS	N	ug/l	0.01	0.36
Benzo(ghi)perylene GCMS	N	ug/l	0.01	0.87
Total PAH(16) GCMS	N	ug/l	0.01	11.8



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Results Summary

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Asbestos Results

Analytical result only applies to the sample as submitted by the client. Any comments, opinions or interpretations (marked #) in this report are outside UKAS accreditation (Accreditation No2683). They are subjective comments only which must be verified by the client.

Elab No	Depth (m)	Clients Reference	Description of Sample Matrix #	Asbestos Identification	Gravimetric Analysis Total (%)	Gravimetric Analysis by ACM Type (%)	Free Fibre Analysis (%)	Total Asbestos (%)
199056	0.60	TP1	Brown soil, stones	No asbestos detected	n/t	n/t	n/t	n/t
199058	0.60	TP2	Brown soil, stones, concrete	No asbestos detected	n/t	n/t	n/t	n/t
199059	0.50	TP2B	Brown sandy soil, concrete, brick, stones	No asbestos detected	n/t	n/t	n/t	n/t
199060	1.00	TP3	Brown sandy soil, concrete, stones, glass	No asbestos detected	n/t	n/t	n/t	n/t
199061	0.20	TP4	Brown soil, stones, brick	No asbestos detected	n/t	n/t	n/t	n/t
199063	0.20	TP5	Brown sandy soil, stones	No asbestos detected	n/t	n/t	n/t	n/t
199065	0.20	TP6	Brown sandy soil, stones, plant-material	No asbestos detected	n/t	n/t	n/t	n/t
199067	0.20	TP7	Brown sandy soil, concrete, brick, stones	No asbestos detected	n/t	n/t	n/t	n/t

Method Summary

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Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
Free cyanide	N	As submitted sample	06/03/2020	107	Colorimetry
Sulphide	N	As submitted sample	06/03/2020	109	Colorimetry
Hexavalent chromium	N	As submitted sample	06/03/2020	110	Colorimetry
pH	M	Air dried sample	06/03/2020	113	Electromeric
Aqua regia extractable metals	M	Air dried sample	06/03/2020	118	ICPMS
PCB (ICES 7 congeners)	M	Air dried sample	24/03/2020	120	GC-MS
Phenols in solids	M	As submitted sample	05/03/2020	121	HPLC
Elemental Sulphur	M	Air dried sample	06/03/2020	122	HPLC
PAH (GC-FID)	M	As submitted sample	09/03/2020	133	GC-FID
Water soluble anions	M	Air dried sample	06/03/2020	172	Ion Chromatography
Low range Aliphatic hydrocarbons soil	N	As submitted sample	10/03/2020	181	GC-MS
Low range Aromatic hydrocarbons soil	N	As submitted sample	10/03/2020	181	GC-MS
BTEX in solids	N	As submitted sample	10/03/2020	181A	GC-MS
Water soluble boron	N	Air dried sample	06/03/2020	202	Colorimetry
Total cyanide	M	As submitted sample	06/03/2020	204	Colorimetry
Aliphatic hydrocarbons in soil	N	As submitted sample	12/03/2020	214	GC-FID
Aliphatic/Aromatic hydrocarbons in soil	N	As submitted sample	12/03/2020	214	GC-FID
Aromatic hydrocarbons in soil	N	As submitted sample	12/03/2020	214	GC-FID
Soil organic matter	U	Air dried sample	09/03/2020	BS1377:P3	Titrimetry
Asbestos identification	U	Air dried sample	10/03/2020	PMAN	Microscopy
Water					
Basic carbon banding in water	N		11/03/2020		GC-FID
Phenols in waters	N		06/03/2020		HPLC
Dissolved metals by ICP in waters	U		06/03/2020	101	ICPMS
pH of waters	U		06/03/2020	113	Electromeric
Chromium Hexavalent in waters	U		12/03/2020	123	Colorimetry
Cyanide in waters	U		06/03/2020	132	Colorimetry
Sulphide in water	N		06/03/2020	134	Colorimetry
PAHs and/or PCBs in waters	N		06/03/2020	135	GC-MS
Cyanide in waters	U		06/03/2020	205	Colorimetry
Anions	U		06/03/2020	270	Ion Chromatography

Tests marked N are not UKAS accredited

Report Information

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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
NS	Subcontracted to approved laboratory. UKAS accreditation is not applicable.
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), and are uncorrected for inert material removed.

ELAB are unable to provide an interpretation or opinion on the content of this report.

The results relate only to the sample received.

PCB congener results may include any coeluting PCBs

Uncertainty of measurement for the determinands tested are available upon request

Unless otherwise stated, sample information has been provided by the client. This may affect the validity of the results.

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