Detailed Unexploded Ordnance (UXO) Risk Assessment

Project Name	St Clare Business Park
Client	RSK
Site Address	Hampton Hill, Hampton, TW12 1QF
Report Reference	DA6247-00
Date	13th April 2018
Originator	JM

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Executive Summary

Site Location and Description

The site is located in Hampton Hill, in the London Borough of Richmond. The boundary comprises two areas. Premises fronting Windmill Road define the larger site area's northern boundary, with commercial and residential properties bordering to the east. Premises fronting Holly Road define the southern boundary, while a section of railway borders to the west.

The smaller site area is situated south of Holly Road, and is bordered by residential property to the north, east, and south, with a section of railway bordering to the west.

The boundary comprises St Clare Business Park, an industrial premises comprising several commercial units and associated grounds.

The site is approximately centred on the OS grid reference: **TQ 1419670881**.

Proposed Works

Proposed works are understood to involve boreholes, window sampling, single foundation hand pitting, and a single trial pit soakaway.

Geology and Bomb Penetration Depth

The British Geological Survey (BGS) map shows the bedrock geology of the site to be underlain by the London Clay Formation – clay, silt and sand, of the Palaeogene Period. The superficial deposits are comprised of Taplow Gravel Member – sand and gravel of the Quaternary Period.

Site specific geotechnical information was not available to 1st Line Defence at the time of the production of this report. An assessment of maximum bomb penetration depth can be made once such data becomes available, or by a UXO specialist during on-site support.

It should be noted that the maximum depth that a bomb could reach may vary across a site and will be largely dependent on the specific underlying geological strata and its density.

UXO Risk Assessment

1st Line Defence has assessed that the risk of UXO contamination on site is not homogenous. A risk map has been prepared identifying areas of **Low** and **Medium Risk** – see **Annex P**. This assessment is based on the following factors:

- The Municipal Borough of Twickenham was subject to an overall moderate-high density of bombing according to Home Office statistics, with an average of 82.8 bombs recorded per 1,000 acres. Three incidents are recorded on the eastern boundary of the larger site area within London bomb census mapping from the 26th May to the 2nd June 1941. These incidents are shown to comprise of; a phosphorous bomb recorded to the northeast of the site, a 50kg UXB recorded within the east of the site, and an exploded 50kg HE recorded to the southeast of the site. A Borough of Twickenham bomb map records two exploded HE bombs on the eastern boundary of the larger site area. An incendiary bomb is recorded immediately northwest of the smaller southern site boundary.
- The ground cover present within the larger site consisted of vegetation associated with a labelled nursery, pathways and structures. Evidence of bomb damage may have been easily obscured/overlooked within areas of vegetation, as a UXB entry hole can be as small as 20cm in diameter. Moreover, the structures present are temporary in appearance, and any repairs will have likely been made fairly quickly. The smaller southern area of the site consisted of concreted hard-standing, on which any evidence of UXO should have been particularly visible.
- Little evidence of bomb damage is discernible within WWII-era aerial imagery, however this is to be expected within the terrain present within the larger site area. No evidence of bomb damage is visible on the smaller southern site area. An MCC damage map does not record any damage within the site, however this source is not anticipated to be comprehensive, and no significant structures were situated within either site areas to which damage could have been attributed.
- Access within the site areas is likely to have been relatively frequent at the onset of the war owing to the presence of the nursery, associated structures, pathways and adjacent residencies. This will have changed however during and immediately subsequent to periods of heavy localised bombing, such as that which is anticipated to have occurred at the larger northern site area between the 26th of May and 2nd of June 1941. This will likely have

UXO Risk Assessment

resulted in a vacation of any occupied buildings in the vicinity, limiting the extent to which UXO will have been noticed when dropped during the same or subsequent raids.

- Due to these factors, as well as the 'j-curve effect', by which an item of UXO can come to rest at a lateral offset from its point of entry, a medium risk from items of UXO has been identified at the larger northern site area. The risk at the small southern area has been identified as low.
- There is no evidence that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA. The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding aerial delivered ordnance.
- Post-war redevelopment has involved the removal of the nursey and the creation of the current business park premises. The risk of UXO remaining is considered to have been mitigated at the location of and down to the depth of post-war foundations and excavations.

Recommended Risk Mitigation Measures

The following risk mitigation measures are recommended to support the proposed works at the St Clare Business Park site:

All Works

- Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.

Medium Risk Areas

Open Intrusive Works (trial pits, service pits, open excavations, shallow foundations etc.)

- UXO Specialist On-site Support

Boreholes and Piled Foundations

- Intrusive Magnetometer Survey of all borehole and pile locations/clusters down to maximum bomb penetration depth.

Risk Map

For indicative purposes – not to scale.
Please note that this assessed risk map may not take into account all post-war redevelopment/excavations on site.

Low Risk

Medium Risk

<u>Works in all Areas:</u>

- Site Specific Unexploded Ordnance Awareness Briefings to all personnel conducting intrusive works.

<u>Works in Medium Risk Areas:</u>

- Unexploded Ordnance (UXO) Specialist presence on site to support open intrusive works.
- Intrusive Magnetometer Survey of any borehole or pile locations/clusters down to an assessed maximum bomb penetration depth.

Glossary

Abbreviation	Definition
AA	Anti-Aircraft
AFS	Auxiliary Fire Service
AP	Anti-Personnel
ARP	Air Raid Precautions
AWAS	Air Warfare Analysis Section
DA	Delay-action
EOC	Explosive Ordnance Clearance
EOD	Explosive Ordnance Disposal
FP	Fire Pot
GM	G Mine (Parachute mine)
HAA	Heavy Anti-Aircraft
HE	High Explosive
IB	Incendiary Bomb
LAA	Light Anti-Aircraft
LCC	London County Council
LRRB	Long Range Rocket Bomb (V-2)
LSA	Land Service Ammunition
MOL	Molotov (Incendiary Bomb)
OB	Oil Bomb
PAC	Pilotless Aircraft (V-1)
PB	Phosphorous Bomb
PM	Parachute Mine
POW	Prisoner Of War
RAF	Royal Air Force
RCAF	Royal Canadian Air Force
RFC	Royal Flying Corps
RNAS	Royal Naval Air Service
ROF	Royal Ordnance Factory
SA	Small Arms
SAA	Small Arms Ammunition
SD1000	1,000kg high explosive bomb
SD2	Anti-personnel “Butterfly Bomb”
SIP	Self-Igniting Phosphorous
U/C	Unclassified bomb
UP	Unrotated Projectile (rocket)
USAAF	United States Army Air Force
UX	Unexploded
UXAA	Unexploded Anti-Aircraft
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V-1	Flying Bomb (Doodlebug)
V-2	Long Range Rocket
WAAF	Women’s Auxiliary Air Force
X	Exploded

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1st Line Defence Limited
Detailed Unexploded Ordnance (UXO) Risk Assessment

Site: St Clare Business Park
Client: RSK

1. Introduction

1.1. Background

1st Line Defence has been commissioned by RSK to conduct a Detailed Unexploded Ordnance (UXO) Risk Assessment for the proposed works at the St Clare Business Park site.

Buried UXO can present a significant risk to construction works and development projects. The discovery of a suspect device during works can cause considerable disruption to operations as well as cause unwanted delays and expense.

UXO in the UK can originate from three principal sources:

1. Munitions resulting from wartime activities including German bombing in WWI and WWII, long range shelling, and defensive activities.
2. Munitions deposited as a result of military training and exercises.
3. Munitions lost, burnt, buried or otherwise discarded either deliberately, accidentally, or ineffectively.

This report will assess the potential factors that may contribute to the risk of UXO contamination. If an elevated risk is identified at the site, this report will recommend appropriate mitigation measures, in order to reduce the risk to as low as is reasonably practicable. Detailed analysis and evidence will be provided to ensure an understanding of the basis for the assessed risk level and any recommendations.

This report complies with the guidelines outlined in *CIRIA C681*, 'Unexploded Ordnance (UXO) A Guide for the Construction Industry'.

2. Method Statement

2.1. Report Objectives

The aim of this report is to conduct a comprehensive assessment of the potential risk from UXO at the St Clare Business Park. The report will also recommend appropriate site and work-specific risk mitigation measures to reduce the risk from explosive ordnance during the envisaged works to a level that is as low as reasonably practicable.

2.2. Risk Assessment Process

1st Line Defence has undertaken a five-step process for assessing the risk of UXO contamination:

1. The risk that the site was contaminated with UXO.
2. The risk that UXO remains on the site.
3. The risk that UXO may be encountered during the proposed works.
4. The risk that UXO may be initiated.
5. The consequences of initiating or encountering UXO.

In order to address the above, 1st Line Defence has taken into consideration the following factors:

- Evidence of WWI and WWII German aerial delivered bombing as well as the legacy of Allied occupation.
- The nature and conditions of the site during WWII.
- The extent of post-war development and UXO clearance operations on site.
- The scope and nature of the proposed works and the maximum assessed bomb penetration depth.
- The nature of ordnance that may have contaminated the proposed site area.

2.3. Sources of Information

Every reasonable effort has been made to ensure that relevant evidence has been consulted and presented in order to produce a thorough and comprehensible report for the client. To achieve this the following, which includes military records and archive material held in the public domain, have been accessed:

- The National Archives, Kew, and Kingston History Centre.
- Historical mapping datasets.
- Historic England National Monuments Record.
- Relevant information supplied by RSK.
- Available material from 33 Engineer Regiment (EOD) Archive.
- 1st Line Defence's extensive historical archives, library and UXO geo-datasets.
- Open sources such as published books and internet resources.

Research involved a visit to Kingston History Centre and The National Archives.

2.4. General Considerations of Historical Research

This desktop assessment is based largely upon analysis of historical evidence. Every reasonable effort has been made to locate and present significant and pertinent information. 1st Line Defence cannot

be held accountable for any changes to the assessed risk level or risk mitigation measures, based on documentation or other data that may come to light at a later date, or which was not available to 1st Line Defence during the production of this report.

It is often problematic and sometimes impossible to verify the completeness and accuracy of WWII-era records. As a consequence, conclusions as to the exact location and nature of a UXO risk can rarely be quantified and are to a degree subjective. To counter this, a range of sources have been consulted and analysed. The same methodology is applied to each report during the risk assessment process. 1st Line Defence cannot be held responsible for any inaccuracies or the incompleteness in available historical information.

3. Background to Bombing Records

During WWII bombing records were gathered by the police, Air Raid Precaution (ARP) wardens and military personnel. Records were maintained in the form of local and regional written records, maps depicting the locations of individual strikes, and maps indicating the levels of damage sustained by structures. Records typically documented when, where and what types of bombs had fallen during an air raid. Records of bomb strikes were made either through direct observation or by post-raid surveys. The immediate priority was focused on assisting casualties and minimising damage. As a result some records were incomplete and contradictory.

The quality, detail and nature of record keeping could vary considerably between boroughs and towns. No two areas identically collated or recorded data. While some local authorities maintained records with a methodical approach, sources in certain areas can be considerably more vague, dispersed, and narrower in scope. Many records were even damaged or destroyed in subsequent bombing raids. Records of raids that took place on sparsely or uninhabited areas were often based upon third party or hearsay information and are therefore not always reliable. Furthermore, records of attacks on military or strategic targets were often maintained separately from the general records and have not always survived.

4. Background to Allied Records

During WWII considerable areas of land were requisitioned by the army for the purpose of defence, training, and the construction of airfields and facilities for munitions production. Records relating to military features vary and some may remain censored. Within urban environments datasets will be consulted detailing the location of munition production as well as air and land defences. In rural locations it may be possible to obtain plans of airfields and military establishments, as well as operational training logs, plans and personal memoirs.

5. UK Regulatory Environment

5.1. General

There is no formal obligation requiring a UXO risk assessment to be undertaken for construction projects in the UK, nor is there any specific legislation stipulating the management or mitigation of UXO risk. However, it is implicit in the legislation outlined below that those responsible for intrusive works (archaeology, site investigation, drilling, piling, excavation etc.) should undertake a comprehensive and robust assessment of the potential risks to employees and that mitigation measures are implemented to address any identified hazards.

5.2. CDM Regulations 2015

The Construction (Design and Management) Regulations 2015 (CDM 2015) define the responsibilities of parties involved in the construction of temporary or permanent structures.

The CDM 2015 establishes a duty of care extending from clients, principle co-ordinators, designers, and contractors to those working on, or affected by, a project. Those responsible for construction projects may therefore be accountable for the personal or proprietary loss of third parties, if correct health and safety procedure has not been applied.

Although the CDM does not specifically reference UXO, the risk presented by such items is both within the scope and purpose of the legislation. It is therefore implied that there is an obligation on parties to:

- Provide an appropriate assessment of potential UXO risks at the site (or ensure such an assessment is completed by others).
- Put in place appropriate risk mitigation measures if necessary.
- Supply all parties with information relevant to the risks presented by the project.
- Ensure the preparation of a suitably robust emergency response plan.

5.3. The 1974 Health and Safety at Work etc. Act

All employers have a responsibility under the Health and Safety at Work etc. Act 1974 and the Management of Health and Safety at Work Regulations 1999, to ensure the health and safety of their employees and third parties, so far as is reasonably practicable and conduct suitable and sufficient risk assessments.

5.4. Additional Legislation

In the event of a casualty resulting from the failure of an employer/client to address the risks relating to UXO, the organisation may be criminally liable under the Corporate Manslaughter and Corporate Homicide Act 2007.

6. Role of Commercial UXO Contractors and The Authorities

6.1. Commercial UXO Contractors

In the event that a risk of UXO contamination is detected at the proposed site, the support of a UXO specialist may be recommended. A UXO specialist may be able to avoid unnecessary call-outs to the authorities through the disposal or removal of low risk items. In addition a specialist will assist in the swift recognition of high risk items, and will thereafter co-ordinate with the local authority with the objective of causing minimal levels of disruption to site operations, whilst putting in place safe and appropriate measures.

For more information on the role of commercial UXO specialists, see *CIRIA C681*.

6.2. The Authorities

The police have a responsibility to co-ordinate the emergency services in the event of an ordnance-related incident at a construction site. Upon inspection they may impose a safety cordon, order an evacuation, and call the military authorities Joint Services Explosive Ordnance Disposal (JSEOD) to arrange for investigation and/or disposal. In the absence of a UXO specialist, police officers will usually employ such precautionary safety measures, thereby causing works to cease, and possibly requiring the evacuation of neighbouring businesses and properties.

The priority given to the police request will depend on JSEOD's judgement of the nature of the UXO risk, the location, people and assets at risk, as well as the availability of resources. The speed of response varies; authorities may respond immediately or in some cases it may take several days for the item of ordnance to be dealt with.

Depending on the on-site risk assessment the item of ordnance may be removed from the site and/or destroyed by a controlled explosion. The latter process is lengthy and may necessitate the establishment of addition cordons and evacuations.

Following the removal of an item of UXO, the military authorities will only undertake further investigations or clearances in high risk situations. If there are regular UXO finds on a site the JSEOD may not treat each occurrence as an emergency and will recommend the construction company puts in place alternative procedures, such as the appointment of a commercial contractor to manage the situation.

7. The Site

7.1. Site Location

The site is located in Hampton Hill, in the London Borough of Richmond. The boundary comprises two areas. Premises fronting Windmill Road define the larger site area's northern boundary, with commercial and residential properties bordering to the east. Premises fronting Holly Road define the southern boundary, while a section of railway borders to the west.

The smaller site area is situated south of Holly Road, and is bordered by residential property to the north, east, and south, with a section of railway bordering to the west.

The site is approximately centred on the OS grid reference: **TQ 1419670881**.

Site location maps are presented in **Annex A**.

7.2. Site Description

The boundary comprises St Clare Business Park, an industrial premises comprising several commercial units and associated grounds.

A recent aerial photograph and site plan are presented in **Annex B** and **Annex C** respectively.

8. Scope of the Proposed Works

8.1. General

Proposed works are understood to involve boreholes, window sampling, single foundation hand pitting, and a single trial pit soakaway.

9. Ground Conditions

9.1. General Geology

The British Geological Survey (BGS) map shows the bedrock geology of the site to be underlain by the London Clay Formation – clay, silt and sand, of the Palaeogene Period. The superficial deposits are comprised of Taplow Gravel Member – sand and gravel of the Quaternary Period.

9.2. Site Specific Geology

Site specific geotechnical data was not available during the production of this report.

10. Site History

10.1. Introduction

The purpose of this section is to identify the composition of the site pre and post-WWII. It is important to establish the historical use of the site, as this may indicate the site's relation to potential sources of UXO as well as help with determining factors such as the land use, groundcover, likely frequency of access and signs of bomb damage.

10.2. Ordnance Survey Historical Maps

Relevant historical maps were obtained for this report and are presented in **Annex D.** See below for a summary of the site history shown on acquired mapping.

WWI Period		
Date	**Scale**	**Description**
1914 – 1915	1:2,500	This map shows the larger site area to comprise a 'nursery', with associated structures and sections of adjacent residencies. The smaller site are comprises a yard area behind adjacent residencies.

Pre-WWII		
Date	**Scale**	**Description**
1934	1:2,500	Little change is discernible within the map since the previous edition.

Post-WWII		
Date	**Scale**	**Description**
1959 – 1961	1:1,250	Change discernible within this map edition concerns the removal of the nursery and associated premises and the creation of a builder's yard within the larger site area. This has involved the addition of several structures within, east, and south of the site. Little significant change is evident within the smaller site area.

11. Aerial Bombing Introduction

11.1. General

During WWI and WWII, many towns and cities across the UK were subjected to bombing which often resulted in extensive damage to city centres, docks, rail infrastructure and industrial areas. The poor accuracy of WWII targeting technology and the nature of bombing techniques often resulted in neighbouring areas to targets sustaining collateral damage.

In addition to raids which concentrated on specific targets, indiscriminate bombing of large areas also took place, this occurred most prominently in the London 'Blitz', though affected many other towns and cities. As discussed in the following sections, a proportion of the bombs dropped on the UK did not detonate as designed. Although extensive efforts were made to locate and deal with these UXBs at the time, many still remain buried and can present a potential risk to construction projects.

The main focus of research for this report will concern German aerial delivered weapons dropped during WWII, although WWI bombing will also be considered.

11.2. Generic Types of WWII German Aerial-delivered Ordnance

An understanding of the type and characteristics of the ordnance used by the Luftwaffe during WWII allows an informed assessment of the hazards posed by any unexploded items that may remain in situ on a site.

Generic Types of WWII German Aerial Delivered Ordnance		
Type	**Frequency**	**Likelihood of detection**
High Explosive (HE) bombs	In terms of weight of ordnance dropped, HE bombs were the most frequently deployed by the Luftwaffe during WWII.	Although efforts were made to identify the presence of unexploded ordnance following an air raid, often the damage and destruction caused by detonated bombs made observation of UXB entry holes impossible. The entry hole of an unexploded bomb can be as little as 20cm in diameter and was easily overlooked in certain ground conditions. Furthermore, ARP documents describe the danger of assuming that damage, actually caused by a large UXB, was due to an exploded 50kg bomb. UXBs therefore present the greatest risk to present–day intrusive works.
Aerial or Parachute mines (PM)	There were deployed less frequently than HE and IBs due to size, cost and the difficulty of deployment.	If functioning correctly, PMs generally would have had a slow rate of descent and were very unlikely to have penetrated the ground. Where the parachute failed, mines would have simply shattered on impact if the main charge failed to explode. There have been extreme cases when these items have been found unexploded. However, in these scenarios, the ground was either extremely soft or the munition fell into water.
1kg Incendiary bombs (IB)	In terms of the number of weapons dropped, small IBs were the most numerous. Millions of these were dropped throughout WWII.	IBs had very limited penetration capability and in urban areas would often have been located in post-raid surveys. If they failed to initiate and fell in water, on soft vegetated ground, or bombed rubble, they could have gone unnoticed.
Large Incendiary bombs (IB)	These were not as common as the 1kg IBs, although they were more frequently deployed than PMs and AP bomblets.	If large IBs did penetrate the ground, complete combustion did not always occur and in such cases they could remain a risk to intrusive works.
Anti-personnel (AP) bomblets	These were not commonly used and are generally considered to pose a low risk to most works in the UK.	SD2 bomblets were packed into containers holding between 6 and 108 submunitions. They had little ground penetration ability and should have been located by the post-raid survey unless they fell into water, dense vegetation or bomb rubble.

Images and brief summaries of the characteristics of the above listed German aerial delivered ordnance are presented in **Annex E**.

11.3. Failure Rate of German Aerial-delivered Ordnance

It has been estimated that 10% of WWII German aerial delivered HE bombs failed to explode as designed. Reasons for why such weapons might have failed to function as designed include:

- Malfunction of the fuze or gain mechanism (manufacturing fault, sabotage by forced labour or faulty installation).
- Many were fitted with a clockwork mechanism that could become immobilised on impact.
- Failure of the bomber aircraft to arm the bombs due to human error or an equipment defect.
- Jettisoning the bomb before it was armed or from a very low altitude. This most likely occurred if the bomber aircraft was under attack or crashing.

From 1940 to 1945 bomb disposal teams dealt with a total of 50,000 explosive items of 50kg, over, 7,000 anti-aircraft projectiles and 300,000 beach mines. Unexploded ordnance is still regularly encountered across the UK, see press articles in **Annex F**.

11.4. V-Weapons

Hitler's 'V-weapon' campaign began from mid-1944. It used newly developed unmanned cruise missiles and rockets. The V-1 known as the *flying bomb* or *pilotless aircraft* and the V-2, a long range

rocket, were launched from bases in Germany and occupied Europe. A total of 2,419 V-1s and 517 V-2s were recorded in the London Civil Defence region alone.

Although these weapons caused considerable damage their relatively low numbers allowed accurate records of strikes to be maintained. These records have mostly survived. There is a negligible risk from unexploded V-weapons on land today since even if the 1000kg warhead failed to explode, the weapons are so large that they would have been observed and the risk dealt with at the time. Therefore, V-weapons are referenced in this report not as a viable risk factor, but primarily in order to help account for evidence of damage and clearance reported.

The risk from V-weapons in St Clare Business Park is therefore considered negligible and will not be further addressed in this report.

12. UXB Ground Penetration

12.1. General

An important consideration when assessing the risk from a UXB is the likely maximum depth of burial. There are several factors which determine the depth that an unexploded bomb will penetrate:

- Mass and shape of bomb.
- Height of release.
- Velocity and angle of bomb.
- Nature of the ground cover.
- Underlying geology.

Geology is perhaps the most important variable. If the ground is soft, there is a greater potential of deeper penetration. For example, peat and alluvium are easier to penetrate than gravel and sand, whereas layers of hard strata will significantly retard and may stop the trajectory of a UXB.

12.2. The J-Curve Effect

J-curve is the term used to describe the characteristic curve commonly followed by an aerial delivered bomb dropped from height after it penetrates the ground. Typically, as the bomb is slowed by its passage through underlying soils, its trajectory curves towards the surface. Many UXBs are found with their nose cone pointing upwards as a result of this effect. More importantly however is the resulting horizontal offset from the point of entry. This is typically a distance of about one third of the bomb's penetration depth, but can be up to 15m. This is illustrated in **Annex G.**

12.3. WWII UXB Penetration Studies

During WWII the Ministry of Home Security undertook a major study on actual bomb penetration depths, carrying out statistical analysis on the measured depths of 1,328 bombs as reported by bomb disposal (BD) teams. Conclusions were made as to the likely average and maximum depths of penetration of different sized bombs in different geological strata.

For example, the largest common German bomb (500kg) had a likely concluded penetration depth of 6m in sand or gravel but 11m in clay. The maximum observed depth for a 500kg bomb was 11.4m and for a 1,000kg bomb 12.8m. Theoretical calculations suggested that significantly greater penetration depths were probable.

12.4. Site Specific Bomb Penetration Considerations

When considering an assessment of the bomb penetration at the site of proposed works the following parameters have been used:

- WWII geology – London Clay Formation.
- Impact angle and velocity – 10-15° from vertical and 270 metres per second.
- Bomb mass and configuration – The 500kg SC HE bomb, without retarder units or armour piercing nose (this was the largest of the common bombs used against Britain).

It has not been possible to determine maximum bomb penetration capabilities at this stage due to the lack or limitations of site specific borehole geotechnical information. An assessment can be made once such information becomes available or by an UXO Specialist on-site.

13. Initiation of Unexploded Ordnance

13.1. General

Unexploded ordnance does not spontaneously explode. All high explosive filling requires significant energy to create the conditions for detonation to occur. In the case of unexploded German bombs discovered within the construction site environment, there are a number of potential initiation mechanisms.

13.2. UXB Initiation Mechanisms

UXB Initiation	
Direct Impact	Unless the fuze or fuze pocket is struck, there needs to be a significant impact e.g. from piling or large and violent mechanical excavation, onto the main body of the weapon to initiate a buried iron bomb. Such violent action can cause the bomb to detonate.
Re- starting the Clockwork Fuze	A small proportion of German WWII bombs employed clockwork fuzes. It is probable that significant corrosion would have taken place within the fuze mechanism over the last 70+ years that would prevent clockwork mechanisms from functioning. Nevertheless, it was reported that the clockwork fuze in a UXB dealt with by 33 EOD Regiment in Surrey in 2002 did re-start.
Friction Impact	The most likely scenario resulting in the detonation of a UXB is friction impact initiating the shock-sensitive fuze explosive. The combined effects of seasonal changes in temperature and general degradation over time can cause explosive compounds to crystallise and extrude out from the main body of the bomb. It may only require a limited amount of energy to initiate the extruded explosive which could detonate the main charge.

Annex F2 details incidents where intrusive works have caused items of UXO to detonate, resulting in death or injury and damage to plant.

13.3. Effects of Detonation

When considering the potential consequences of a detonation, it is necessary to identify the significant receptors that may be affected. The receptors that may potentially be at risk from a UXO detonation on a construction site will vary depending on the site specific conditions but can be summarised as follows:

- People – site workers, local residents and general public.
- Plant and equipment – construction plant on site.
- Services – subsurface gas, electricity, telecommunications.
- Structures – not only visible damage to above ground buildings, but potentially damage to foundations and the weakening of support structures.
- Environment – introduction of potentially contaminating materials.

14. The Risk from German Air Delivered UXBs

14.1. World War I

During WWI Britain was targeted and bombed by Zeppelin Airships as well as Gotha and Giant fixed-wing aircraft. A WWI map of air raids and naval bombardments across England is presented in **Annex H**. This source does not record any WWI bombing incidents to have affected the site.

WWI bombs were generally smaller than those used in WWII and were dropped from a lower altitude. This resulted in limited UXB penetration depths. Aerial bombing was often such a novelty at the time that it attracted public interest and even spectators to watch the raids in progress. For these reasons there is a limited risk that UXBs passed undiscovered in the urban environment. When combined with the relative infrequency of attacks and an overall low bombing density the risk from WWI UXBs is considered low and will not be further addressed in this report.

14.2. World War II Bombing of Twickenham

The Luftwaffe's objective for the attacks on London was to paralyse the commercial life of the capital by bombing the docks, warehouses, wharves, railway lines, factories and power stations.

Twickenham did not contain substantial amounts of the aforementioned targets for the Luftwaffe and, as a result, escaped the worst of the bombing on the capital. The bombing density of the Borough, see **Annex I**, can be largely attributed to its location on the periphery of west London, at a substantial distance from key targets in the east and centre of the city. Luftwaffe reconnaissance imagery highlighting water works situated 500m south of the site is presented in **Annex J.**

Bombing that did occur in Twickenham can likely be attributed to the proximity of the Thames, the waterworks in the area, as well as due to the general bombing of the civilian population. The distinctive river provided a guiding landmark for the Luftwaffe bombs and additionally key industrial targets were often present on its banks.

Records of bombing incidents in the civilian areas of London were collected by the Air Raid Precautions wardens and collated by the Civil Defence Office. Some other organisations, such as the London Port Authority and railways, maintained separate records. No official written records are available for Twickenham, it is conceivable that the records were lost or destroyed.

Records of bombing incidents for Twickenham are presented in the following sections.

14.3. Second World War Bombing Statistics

The following table summarises the quantity of German bombs (excluding 1kg incendiaries and anti-personnel bombs) falling on the Municipal Borough of Twickenham between 1940 and 1945.

Record of German Ordnance Dropped on the Municipal Borough of Twickenham		
Area Acreage		**7,013**
Weapons	High Explosive Bombs (all types)	505
	Parachute Mines	2
	Oil Bombs	25
	Phosphorus Bombs	21
	Fire Pot	0
	Pilotless Aircraft (V1)	27
	Long Range Rockets (V2)	1
Total		**531**
Number of Items per 1000 acres		**82.5**

Source: Home Office Statistics
This table does not include UXO found during or after WWII.

Detailed records of the quantity and locations of the 1kg incendiary and anti-personnel bombs were not routinely maintained by the authorities as they were frequently too numerous to record. Although the risk relating to IBs is lesser than that relating to larger HE bombs, they were designed to inflict damage and injury and should therefore not be dismissed. Therefore, they should not be overlooked in assessing the general risk to personnel and equipment. Anti-personnel bombs were used in much smaller quantities and are rarely found today but are potentially more dangerous.

14.4. London Civil Defence Region ARP Bomb Census Maps

During WWII, the ARP Department within the Research and Experiments Branch of the Ministry of Home Security produced consolidated, weekly and V-1 pilotless aircraft bomb census maps for the London Civil Defence Region. These maps collectively shows the approximate locations of bombs, mines and rockets. The site area was checked on each available map sheet, those showing bomb incidents on and in the immediate vicinity of the site are discussed below and are presented in **Annex K**.

London Consolidated Bomb Census Maps – Annex K1	
Date Range	**Comments**
Night Bombing up to 7th October 1940	No bomb strikes are recorded on or immediately adjacent to the site.
7th October 1940 to 6th June 1941	Three HE bombs are recorded on the larger site's eastern boundary.

London Weekly Bomb Census Maps – Annex K2	
Date Range	**Comments**
25th November to 2nd December 1940	An incendiary bomb 'shower' is recorded across the south of the larger site area, and across the entire southern site area.
26th May to 2nd June 1941	Three incidents are recorded on the eastern boundary of the larger site area. A phosphorous bomb is recorded to the northeast of the site. A 50kg UXB is recorded within the east of the site. An exploded 50kg Is recorded to the southeast of the site.

14.5. Twickenham Air Raid Precautions Bomb Map

A bomb census map compiled by Twickenham Borough Council showing High Explosive and Incendiary Bomb strikes on the borough was obtained from the Richmond Local Studies Library. The section showing the area of the site is presented in **Annex L**.

Twickenham Bomb Plot Map – Annex L	
Date Range	**Comments**
Consolidated bomb plot map: 1944	Exploded HE bombs are recorded on the eastern boundary of the larger site. An incendiary bomb is recorded immediately northwest of the smaller southern site boundary.

14.6. Middlesex County Council War Damage Map

Map sheets compiled by Middlesex County Council (MCC) showing the extent of wartime bomb damage on the Municipal Borough of Twickenham were consulted at London Metropolitan Archives. The section showing the area of the site is described in the table below and presented in **Annex M**. It should be highlighted that this source only records the following damage categories: 'Total damage, building to be demolished', 'damaged beyond repair' and 'seriously damaged; doubtful if repairable'. The lesser damage categories such as seriously damaged but repairable at cost and general blast damage were not used.

MCC War Damage Map – Annex M	
Date Range	**Comments**
1940-1945	No damage is recorded immediately within either site. Some small areas of damage are recorded to the east of the larger site area, including Category 2 and Category 1 levels.

14.7. Twickenham Bomb ARP Incident Records

Written ARP incident records for Twickenham, obtained from the National Archives, Kew are believed to be incomplete and did not cover any bomb incidents within the site area. *When the Bombs Fell: Twickenham, Teddington and The Hamptons under Aerial Bombardment during the Second World War'* by Paul Barnfield was also consulted for the purposes of this report. Despite the number of incidents recorded in the vicinity of the site on bomb census mapping, none are referred to in Barnfield's book

14.8. WWII-Era Aerial Photography

A high-resolution scan of WWII-era aerial photography for the site area was obtained from the National Monuments Record Office (Historic England). This photograph provides a record of the potential composition of the site during the war, as well as its condition immediately following the war (**see Annex N**).

WWII-Era Aerial Photography – Annex N	
Date	**Description**
10th October 1945	The larger site can be seen to comprise of a nursery area, associated structures and pathways. The area to the east comprises scrubby garden areas and pathways. Little evidence of bomb damage is discernible, however this is to be expected within such terrain. Evidence of bomb damage may have fallen easily obscured within areas of

	vegetation. Moreover, the structures present are temporary in appearance, and any repairs will have likely been made fairly quickly. No evidence of bomb damage is visible on the smaller southern site area.

14.9. Abandoned Bombs

A post air-raid survey of buildings, facilities, and installations would have included a search for evidence of bomb entry holes. If evidence of an entry hole was encountered, Bomb Disposal Officer Teams would normally have been requested to attempt to locate, render safe, and dispose of the bomb. Occasionally, evidence of UXBs was discovered but due to a relatively benign position, access problems, or a shortage of resources the UXB could not be exposed and rendered safe. Such an incident may have been recorded and noted as an 'abandoned bomb'.

Given the inaccuracy of WWII records and the fact that these bombs were 'abandoned', their locations cannot be considered definitive or the lists exhaustive. The MoD states that 'action to make the devices safe would be taken only if it was thought they were unstable'. It should be noted that other than the 'officially' abandoned bombs, there will inevitably be UXBs that were never recorded.

1st Line Defence holds no records of officially registered abandoned bombs at or near the site of the proposed works.

14.10. Bomb Disposal Tasks

The information service from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (EOD) is currently facing considerable delay. It has therefore not been possible to include any updated official information regarding bomb disposal/clearance tasks with regards to this site. A database of known disposal/clearance tasks has been referred to which does not make reference to such instances occurring within the site of proposed works. If any relevant information is received at a later date RSK will be advised.

14.11. Evaluation of German Air Delivered UXB Risk

Factors	Conclusion
Density of Bombing *It is important to consider the bombing density when assessing the possibility that UXBs remain in an area. High levels of bombing density could allow for error in record keeping due to extreme damage caused to the area.*	The Municipal Borough of Twickenham was subject to an overall moderate-high density of bombing according to Home Office statistics, with an average of 82.8 bombs recorded per 1,000 acres. Three incidents are recorded on the eastern boundary of the larger site area within London bomb census mapping from the 26th May to the 2nd June 1941. These incidents are shown to comprise of; a phosphorous bomb recorded to the northeast of the site, a 50kg UXB recorded within the east of the site, and an exploded 50kg HE bomb recorded to the southeast of the site. A Borough of Twickenham bomb map records two exploded HE bombs on the eastern boundary of the larger site area. An incendiary bomb is recorded immediately northwest of the smaller southern site boundary.

Damage *If buildings or structures on a site sustained bomb or fire damage any resulting rubble and debris could have obscured the entry holes of unexploded bombs dropped during the same, or later, raids. Similarly, a High Explosive bomb strike in an area of open agricultural land will have caused soil disturbance, increasing the risk that a UXB entry hole would be overlooked.*	Little evidence of bomb damage is discernible within WWII-era aerial imagery, however this is to be expected within the terrain present within the larger site area. Evidence of bomb damage may have been easily obscured within areas of vegetation – a UXB entry hole can be as small as 20cm in diameter. Moreover, the structures present are temporary in appearance, and any repairs will have likely been made fairly quickly. No evidence of bomb damage is visible on the smaller southern site area. An MCC damage map does not record any damage within the site, however this source is not anticipated to be comprehensive, and no significant structures were situated within either site areas.
Access Frequency *UXO in locations where access was irregular would have a greater chance of passing unnoticed than at those that were regularly occupied. The importance of a site to the war effort is also an important consideration as such sites are likely to have been both frequently visited and subject to post-raid checks for evidence of UXO.*	Access within the site areas will likely have been relatively frequent at the onset of the war owing to the presence of the nursery, associated structures, pathways and adjacent residencies. This will have changed however during and immediately subsequent to periods of heavy localised bombing, such as that which is anticipated to have occurred at the larger northern site area between the 26th of May and 2nd of June 1941. This will likely have resulted in a vacation of any occupied buildings in the vicinity, limiting the extent to which UXO will have been noticed when dropped during the same or subsequent raids.
Ground Cover *The nature of the ground cover present during WWII would have a substantial influence on any visual indication that may indicate UXO being present.*	The ground cover present within the larger site consisted of vegetation associated with a labelled nursery, pathways and structures. Evidence of bomb damage/UXB entry holes may have been easily overlooked within areas of vegetation. Moreover, the structures present are temporary in appearance, and any repairs will have likely been made fairly quickly. The smaller southern area of the site consisted of concreted hard-standing, on which any evidence of UXO should have been particularly visible.
Bomb Failure Rate	There is no evidence to suggest that the bomb failure rate in the locality of the site would have been dissimilar to the 10% normally used.
Abandoned Bombs	1st Line Defence holds no records of abandoned bombs at or within the site vicinity.
Bombing Decoy sites	1st Line Defence could find no evidence of bombing decoy sites within the site vicinity.
Bomb Disposal Tasks	1st Line Defence could find no evidence of bomb disposal tasks within the site boundary and immediate area.

15. The Risk from Allied Ordnance

15.1. General

The potential risk of encountering Allied ordnance on construction sites is particularly elevated in areas previously associated with military activity. This includes munitions deposited by military training exercises, dumped as a result of poor working practices, or deliberately placed to prevent adversary occupation and from other home defence activities. For example, contamination from items

of Land Service (LSA) and Small Arms Ammunition (SAA) may result from historical occupation of an area or its use for military training.

It should be highlighted that there is no evidence that the site formerly had any military occupation or usage that could have led to contamination with such items of Allied ordnance. Despite this, urban areas such as the location of the site, can however be at risk from buried unexploded Anti-Aircraft projectiles fired during WWII – as addressed below.

15.2. Defending the UK From Aerial Attack

During WWII the Ministry of Defence employed a number of defence tactics against the Luftwaffe from bombing major towns, cities, manufacturing areas, ports and airfields. These can be divided into passive and active defences (examples are provided in the table below).

Active Defences	Passive Defences
• Anti-aircraft gun emplacements to engage enemy aircraft. • Fighter aircraft to act as interceptors. • Rockets and missiles were used later during WWII.	• Blackouts and camouflaging to hinder the identification of Luftwaffe targets. • Decoy sites were located away from targets and used dummy buildings and lighting to replicate urban, military, or industrial areas. • Barrage balloons forced enemy aircraft to greater altitudes. • Searchlights were often used to track and divert adversary bomber crews during night raids.

Active defences such as anti-aircraft artillery present a greater risk of UXO contamination than passive defences. Unexploded ordnance resulting from dogfights and fighter interceptors is rarely encountered and difficult to accurately qualify.

15.3. Anti-Aircraft Artillery (AAA)

During WWII three main types of gun sites existed: heavy anti-aircraft (HAA), light anti-aircraft (LAA) and 'Z' batteries (ZAA). If the projectiles and rockets fired from these guns failed to explode or strike an aircraft they would descend back to land. The table below provides further information on the operation and ordnance associated with these type of weapons.

Anti-Aircraft Artillery				
Item	**Description**			
HAA	These large calibre guns such as the 3.7" QF (Quick Firing) were used to engage high flying enemy bombers., They often fired large HE projectiles, which were usually initiated by integral fuzes triggered by impact, area, time delay or a combination of aforementioned mechanisms The closest HAA was located approximately 4.6km south of the site, however the range of a projectile can be up to 15km.			
LAA	These mobile guns were intended to engage fast, low flying aircraft. They were typically rotated between locations on the perimeters of towns and strategically important industrial works. As they could be moved to new positions with relative ease when required, records of their locations are limited. The most numerous of these were the 40mm Bofors gun which could fire up to 120 x 40mm HE projectiles per minute to over 1,800m.			
Variations in HAA and LSA Ammunition	**Gun type**	**Calibre**	**Shell Weight**	**Shell Dimensions**
	3.0 Inch	76mm	7.3kg	76mm x 356mm
	3.7 Inch	94mm	12.7kg	94mm x 438mm

	4.5 Inch	114mm	24.7kg	114mm x 578mm
	40mm	40mm	0.9kg	40mm x 311mm
Z-AA	The three inch unrotated rocket/projectile known as the UP-3 had initially been developed for the Royal Navy. The UP-3 was also used in ground-based single and 128-round launchers known as ''Z'' batteries. The rocket, containing a high explosive warhead was often propelled by cordite.			
29mm Spigot Mortars (Blacker Bombards)	This was an infantry anti-tank weapon. A heavy steel rod (spigot) would be driven into the hollow tail of a projectile to ignite the explosive charge located in the rear of the projectile, and lead to it being propelled toward a target. It was not an effective method of air defence and was mainly used in defensive positons at key locations. If encountered, a spigot mortar projectile will resemble a mortar round, but with an elongated metal tail rod.			
Quick Firing (QF) 1 and 2 Pounder	QF 1 and 2 Pounders, or 'pom poms' were a light battery most often used by the navy. During the beginning of WWII they were used to defend targets in the absence of more effective LAA or HAA.			
Machine Gun Posts	These were established at some significant military and industrial positions. Machine guns were a largely ineffective form of AAA. Machine guns usually fired the .303 Round.			

The conditions in which an HAA or LAA projectiles may have fallen unnoticed within a site area are analogous to those regarding aerial delivered ordnance. For detailed analysis on the ground conditions and access frequency within the proposed site, see the evaluation of German Bombing Records in, **Section 14.10**.

Unexploded HAA ammunition is likely to be found close to WWII ground level. If encountered, the high explosive fill and fragmentation hazard of these items could present a significant risk to workers and equipment.

Illustrations of Anti-Aircraft artillery, projectiles and rockets are presented at **Annex O**.

15.4. Evaluation of Allied Ordnance Risk

1st Line Defence has considered the following potential sources of Allied ordnance contamination:

Sources of Contamination	Conclusion
Military Camps *Military camps present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training.*	1st Line Defence could find no evidence of a military camp within the site.
Anti-Aircraft Defences *Anti-Aircraft defences were employed across the country. Proximity to anti-aircraft defences increases the chance of encountering AA projectiles.*	1st Line Defence could find no evidence of Anti-Aircraft defences such as a HAA or LAA gun emplacement occupying or bordering the site. The closest HAA was located approximately 4.6km north-east of the site, however the range of a projectile can be up to 15km. The conditions in which HAA or LAA projectiles may have fallen unnoticed within a site footprint are analogous to those regarding German aerial delivered ordnance. Evidence of a barrage balloon site and a complex of shelters is visible in WWII-era aerial imagery on the green set west of the site across the adjacent railway line. Such positions did not typically involve the storage or usage of ordnance, and the present railway line will have prevented any significant associated with the site in any case.

Home Guard Activity *The Home Guard regularly undertook training and ordnance practice in open areas, as well as burying ordnance as part of anti-invasion defences.*	Evidence of Home Guard training areas and activities is difficult to obtain. 1st Line Defence has no evidence of any Home Guard activities on the site.
Defensive Positions *Defensive positions suggest the presence of military activity, which is often indicative of ordnance storage, usage or disposal.*	There is no evidence of any defensive features formerly located on or bordering the site footprint.
Training or firing ranges *Areas of ordnance training saw historical ordnance usage in large numbers, often with inadequate disposal of expended and live items. The presence of these ranges significantly impact on the risk of encountering items of ordnance in their vicinity.*	There is no evidence of such features affecting the site.
Defensive Minefields *Minefields were placed in strategic areas to defend the country in the event of a German invasion. Minefields were not always cleared with an appropriate level of vigilance.*	There is no evidence of defensive minefields affecting the site.
Ordnance Manufacture *Ordnance manufacture indicates an increased chance that items of ordnance were stored, or disposed of, within a location.*	No information of ordnance being stored, produced, or disposed of within the proposed site could be found.
Military Related Airfields *Military airfields present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training or bombing practice.*	The site was not situated within the perimeters or vicinity of a military airfield.

16. Ordnance Clearance and Post-WWII Ground Works

16.1. General

It is important to consider the extent to which any explosive ordnance clearance (EOC) activities or extensive ground works have occurred on site. This may indicate previous ordnance contamination or reduce the risk that ordnance remains undiscovered.

16.2. UXO Clearance

1st Line Defence has no evidence that any official ordnance clearance operations have taken place on site. Note however that we have not received confirmation of this fact from 33 EOD Regiment.

16.3. Post-war Redevelopment

Post-war redevelopment has involved the removal of the nursey and the creation of the current business park premises. The risk from deep-buried unexploded bombs is only considered mitigated at locations where post war piling or deep foundations have taken place.

17. 1st Line Defence Risk Assessment

17.1. Risk Assessment Stages

Taking into account the quality of the historical evidence, the assessment of the overall risk from unexploded ordnance is based on the following five considerations:

1. That the site was contaminated with unexploded ordnance.
2. That unexploded ordnance remains on site.
3. That such items will be encountered during the proposed works.
4. That ordnance may be initiated by the works operations.
5. The consequences of encountering or initiating ordnance.

UXO Risk Assessment	
Quality of the Historical Record	The research has located and evaluated pre- and post-WWII Ordnance Survey maps, the local bomb plot map for Twickenham, London WWII ARP bomb census mapping (1940-1945), MCC War Damage Maps, Twickenham ARP bomb incident records, in-house data and post-WWII era aerial photographs for the site. The record is of poor quality, with incidents plotted on bomb plot mapping not referenced in available incident records.
The Risk that the Site was Contaminated with UXO	1st Line Defence has assessed that the risk of UXO contamination on site is not homogenous. A risk map has been prepared identifying areas of **Low** and **Medium Risk** – see **Annex P**. This assessment is based on the following factors: • The Municipal Borough of Twickenham was subject to an overall moderate-high density of bombing according to Home Office statistics, with an average of 82.8 bombs recorded per 1,000 acres. Three incidents are recorded on the eastern boundary of the larger site area within London bomb census mapping from the 26th May to the 2nd June 1941. These incidents are shown to comprise of; a phosphorous bomb recorded to the northeast of the site, a 50kg UXB recorded within the east of the site, and an exploded 50kg HE recorded to the southeast of the site. A Borough of Twickenham bomb map records two exploded HE bombs on

	the eastern boundary of the larger site area. An incendiary bomb is recorded immediately northwest of the smaller southern site boundary. • The ground cover present within the larger site consisted of vegetation associated with a labelled nursery, pathways and structures. Evidence of bomb damage may have been easily obscured/overlooked within areas of vegetation, as a UXB entry hole can be as small as 20cm in diameter. Moreover, the structures present are temporary in appearance, and any repairs will have likely been made fairly quickly. The smaller southern area of the site consisted of concreted hard-standing, on which any evidence of UXO should have been particularly visible. • Little evidence of bomb damage is discernible within WWII-era aerial imagery, however this is to be expected within the terrain present within the larger site area. No evidence of bomb damage is visible on the smaller southern site area. An MCC damage map does not record any damage within the site, however this source is not anticipated to be comprehensive, and no significant structures were situated within either site areas to which damage could have been attributed. • Access within the site areas is likely to have been relatively frequent at the onset of the war owing to the presence of the nursery, associated structures, pathways and adjacent residencies. This will have changed however during and immediately subsequent to periods of heavy localised bombing, such as that which is anticipated to have occurred at the larger northern site area between the 26th of May and 2nd of June 1941. This will likely have resulted in a vacation of any occupied buildings in the vicinity, limiting the extent to which UXO will have been noticed when dropped during the same or subsequent raids. • There is no evidence that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA. The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding aerial delivered ordnance.
The Risk that UXO Remains on Site	Post-war redevelopment has involved the removal of the nursey and the creation of the current business park premises. The risk of UXO remaining is considered to have been mitigated at the location of and down to the depth of post-war foundations and excavations.
The Risk that UXO may be Encountered during the Works	The most likely scenarios under which items of UXO could be encountered during construction works is during piling, drilling operations or bulk excavations for basement levels. The risk of encountering will depend on the extent of the works, such as the numbers of boreholes/piles (if required) and the volume of the excavations. An aerial delivered bombs may come to rest at any depth between just below ground level and its maximum penetration depth. Consequently there is also a possibility that UXBs could be encountered during shallow excavations (for services or site investigations) into the original WWII ground level. There is not considered to be any significant risk of encountering UXO during works planned within the footprint and down to the depth of any post-war buildings/excavations. Beyond these depths and away from these areas, a risk of encounter could remain.
The Risk that UXO may be Initiated	The risk that UXO could be initiated if encountered will depend on its condition, how it is found, and the energy with which it is struck. Certain construction activities such as piling and percussive drilling pose a greater risk of initiating UXO in comparison to machine excavation, where the force of impact is generally lower and the item is more likely to be observed. If a UXB is struck by piling or percussive drilling equipment, the force of the impact can be sufficient to detonate the main high explosive charge irrespective of the condition of the fuze or other components. Violent vibration might also impart enough energy to a

	chemical detonator for it to function, and there is a potential risk that clockwork fuzes could restart. If piling works are planned at the St Clare Business Park site, there is a potential risk that a UXB, if present, could be initiated. The risk of initiation is assessed to be lower for any shallow intrusive works planned.
The Consequences of Encountering or Initiating Ordnance	The repercussions of the inadvertent detonation of items of UXO during intrusive ground works are potentially severe, both in terms of human and financial cost. A serious risk to life and limb, damage to plant and total site shutdown during follow-up investigations are potential outcomes. If appropriate risk mitigation measures are undertaken, the chances of initiating an item of UXO during ground works is comparatively low. The primary consequence of encounter of UXO will therefore be economic. This would be particularly notable in the case of sites with a high-profile or where it is necessary to evacuate the public from the surrounding area. A site may be closed from a few hours to a week with potentially significant cost in lost time. It should be noted that even the discovery of suspected or possible items of UXO during intrusive works (if handled solely through the authorities), may also involve loss of production. Generally, the first action of the police in most cases will be to isolate the locale whilst awaiting military assistance, even if this becomes unnecessary.

17.2. Assessed Risk Level

Taking into consideration the findings of this study, 1st Line Defence has assessed that the risk from re unexploded ordnance is not homogenous across the site of proposed works and has been divided accordingly:

Low Risk Area – Small Southern Site Area

Ordnance Type	Risk Level			
	Negligible	Low	Medium	High
German Unexploded HE Bombs		✓		
German 1kg Incendiary Bombs		✓		
Anti-Aircraft Artillery Projectiles		✓		
Allied Military Land Service Ammunition (Grenades, Mortars etc.)		✓		

Medium Risk Area – Larger Northern Site Area

Ordnance Type	Risk Level			
	Negligible	Low	Medium	High
German Unexploded HE Bombs			✓	
German 1kg Incendiary Bombs			✓	
Anti-Aircraft Artillery Projectiles			✓	
Allied Military Land Service Ammunition (Grenades, Mortars etc.)		✓		

18. Proposed Risk Mitigation Methodology

18.1. General

The following risk mitigation measures are recommended to support the proposed works at the St Clare Business Park:

Type of Work	Recommended Mitigation Measure
All Works	• **Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.** As a minimum precaution, all personnel working on the site should be briefed on the basic identification of UXO and what to do in the event of encountering a suspect item. This should in the first instance be undertaken by a UXO Specialist. Posters and information on the risk of UXO can be held in the site office for reference.

Shallow Intrusive Works/Open Excavations in Medium Risk Areas	• **Unexploded Ordnance (UXO) Specialist Presence on Site to support shallow intrusive works** When on site the role of the UXO Specialist would include: • Monitoring works using visual recognition and instrumentation, including immediate response to reports of suspicious objects or suspected items of ordnance that have been recovered by the ground workers on site. • Providing UXO awareness briefings to any uninformed staff and advise staff of the need to modify working practices to take account of the ordnance risk. • To aid incident management which would involve liaison with the local authorities and police should ordnance be identified and present an explosive hazard.
Borehole/Piles in Medium Risk Areas	• **Intrusive Magnetometer Survey of all borehole and pile locations down to a maximum bomb penetration depth:** 1st Line Defence can deploy a range of intrusive magnetometer techniques to clear pile locations. The appropriate technique is influenced by a number of factors, but most importantly the site's ground conditions. The appropriate survey methodology would be confirmed once the enabling works have been completed.

In making this assessment and recommending these risk mitigation measures, if known, the works outlined in the 'Scope of the Proposed Works' section were considered. Should the planned works be modified or additional intrusive engineering works be considered, 1st Line Defence should be consulted to see if a re-assessment of the risk or mitigation recommendations is necessary.

1st Line Defence Limited **13th April 2018**

This Report has been produced in compliance with the Construction Industry Research and Information Association (CIRIA) C681 guidelines for the writing of Detailed UXO Risk Assessments.

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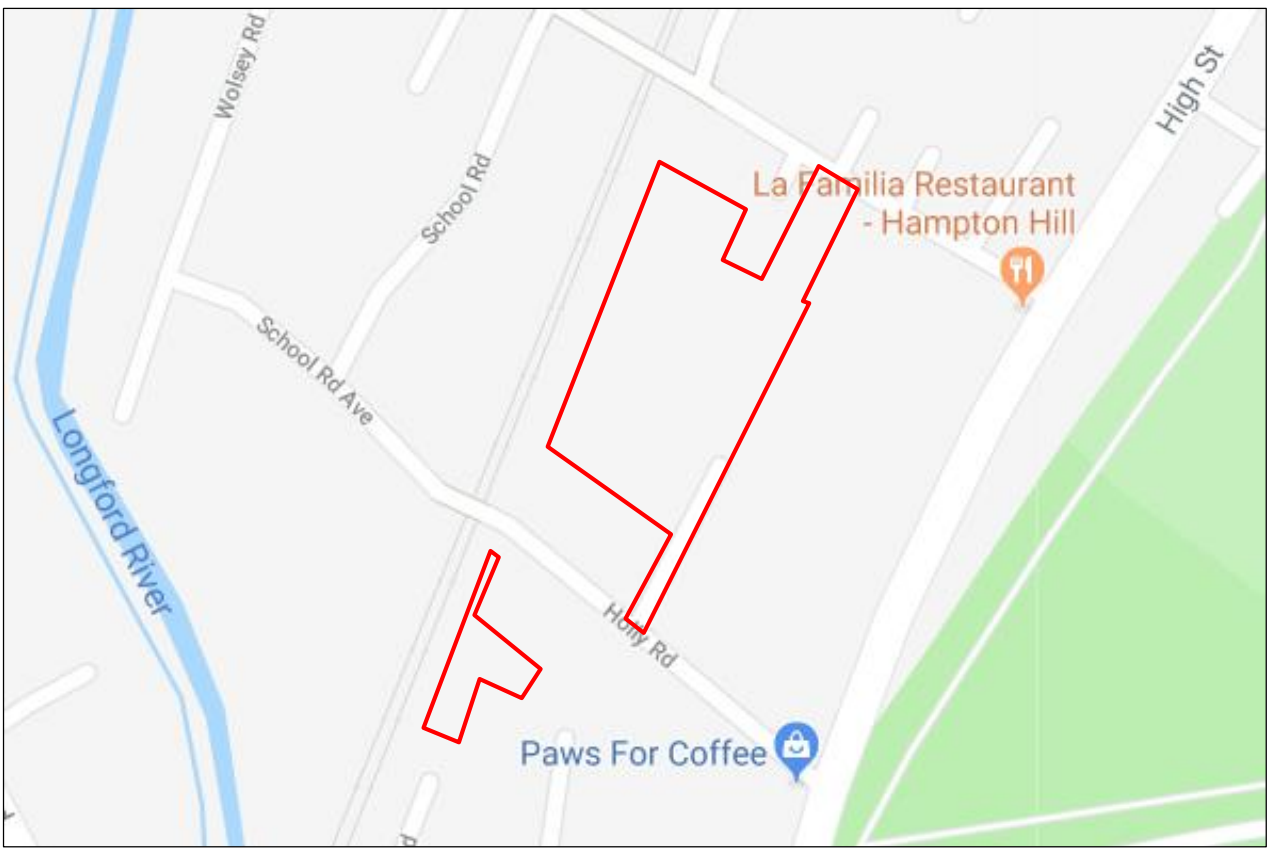
This report has been prepared by 1st Line Defence Limited with all reasonable care and skill. The report contains historical data and information from third party sources. 1st Line Defence Limited has sought to verify the accuracy and comprehensiveness of this information where possible but cannot be held accountable for any inherent errors. Furthermore, whilst every reasonable effort has been made to locate and access all relevant historical information, 1st Line Defence cannot be held responsible for any changes to risk level or mitigation recommendations resulting from documentation or other information which may come to light at a later date.

Site Location Maps

Annex: **A**



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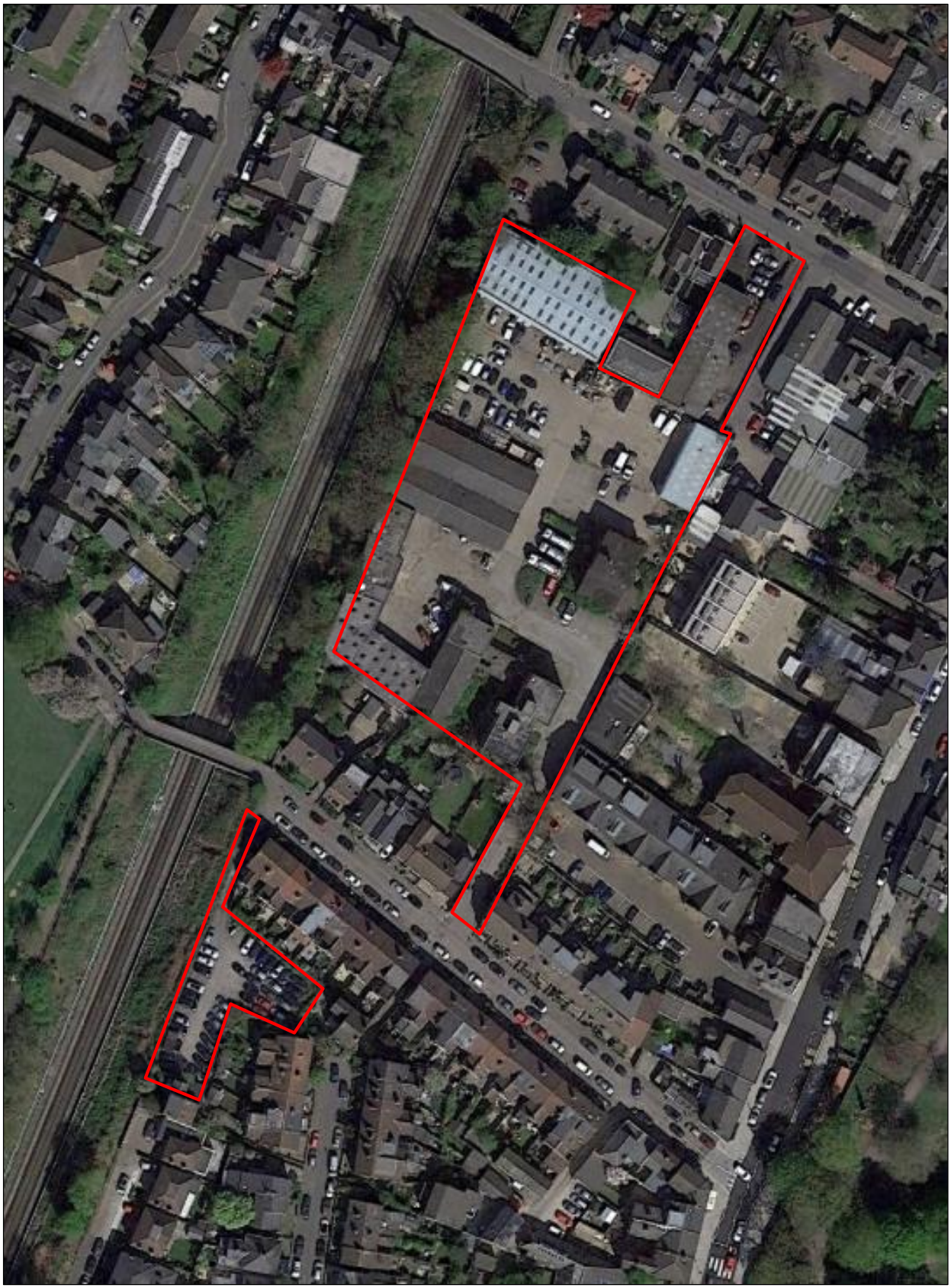
Client:	**RSK**	**Approximate site boundary**	N
Project:	**St Clare Business Park, Hampton Hill, Hampton, TW12 1QF**		
Ref:	**DA6247-00**	Source: Google Maps	

Recent Aerial Photography

Annex: **B**



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Tel: +44 (0)1992 245 020

Client: **RSK**

Approximate site boundary

N

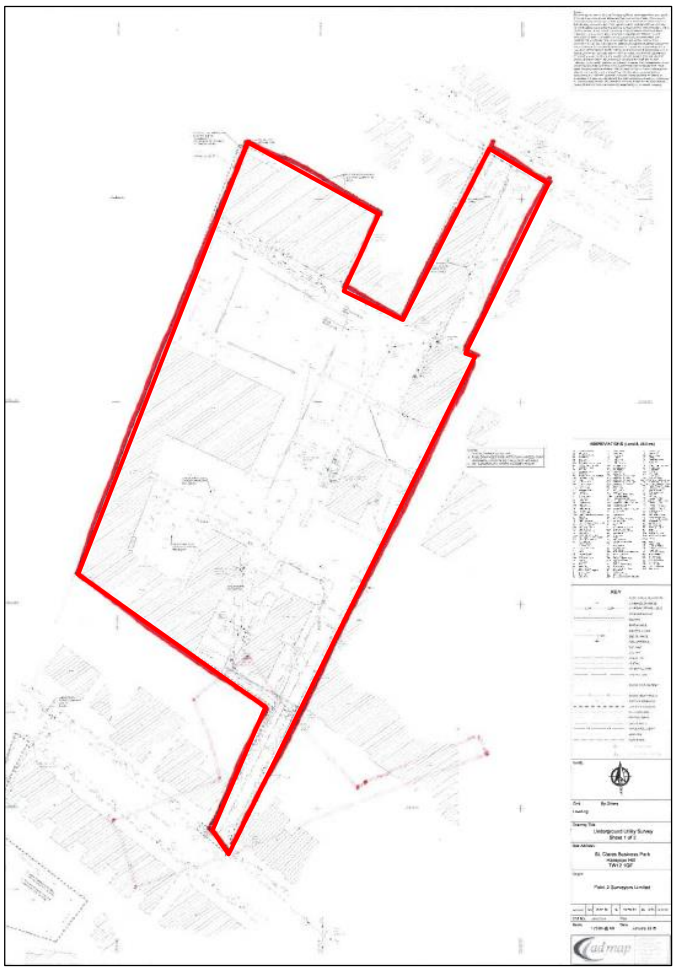
Project: **St Clare Business Park, Hampton Hill, Hampton, TW12 1QF**

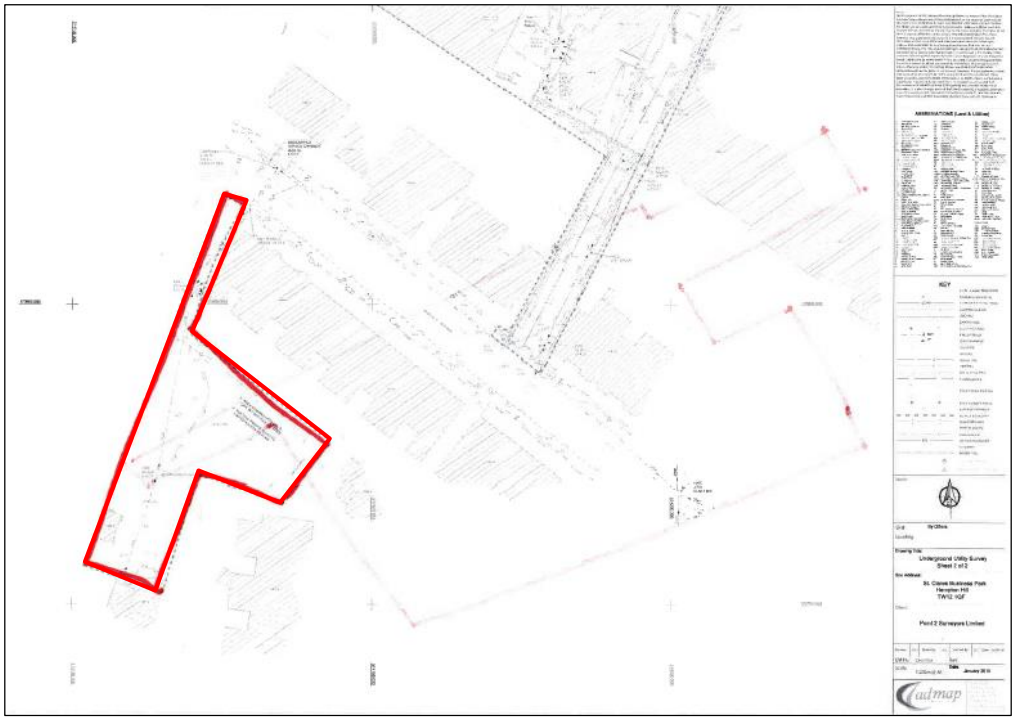
Ref: **DA6247-00**

Source: Google Earth ™ Mapping Services

Client Provided Site Plan

Annex: C





Client: **RSK**		**Approximate site boundary**	N
Project: **St Clare Business Park, Hampton Hill, Hampton, TW12 1QF**			
Ref: **DA6247-00**	Source: RSK		

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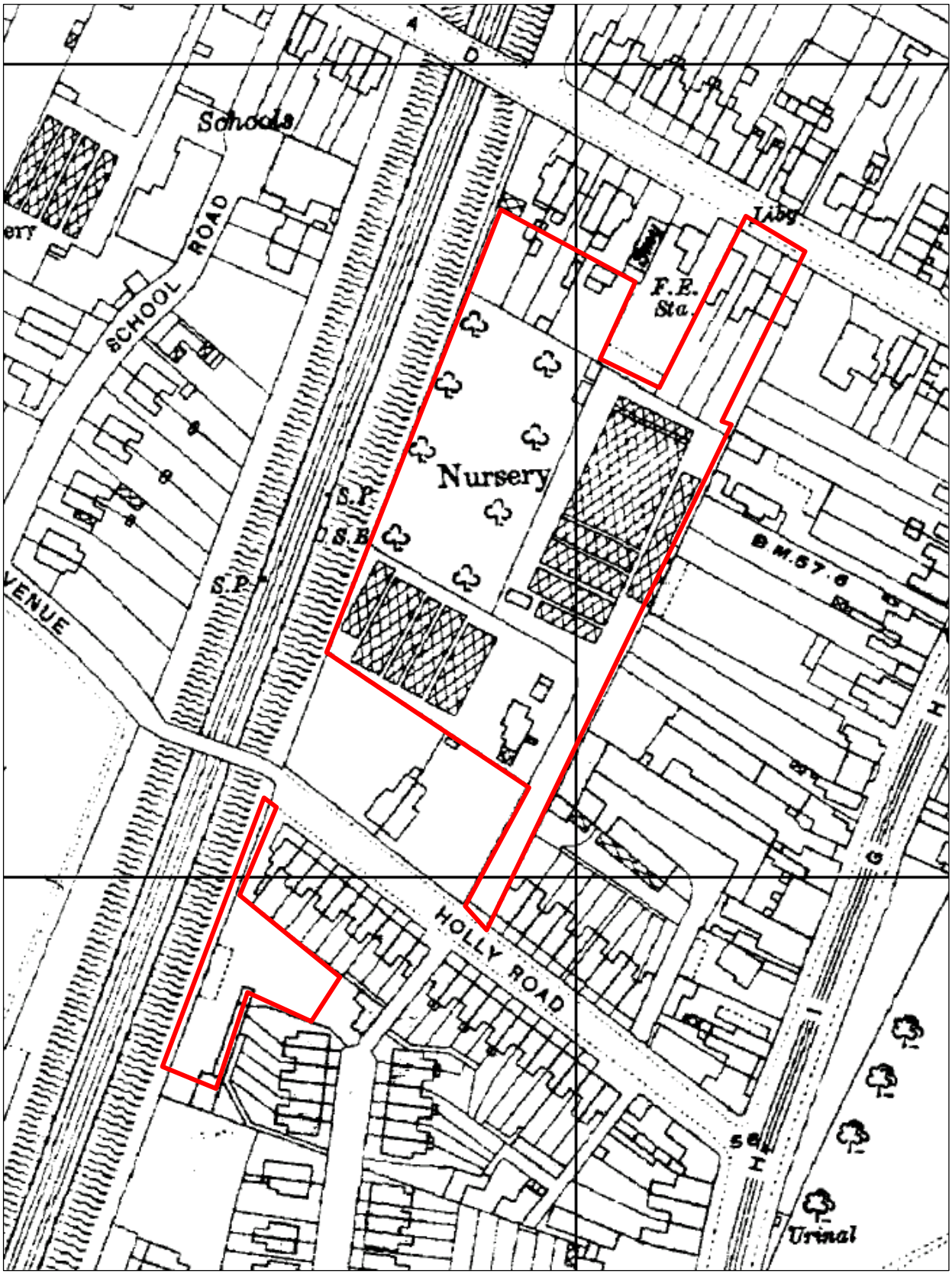
1914-1915 Historical Map

Annex: **D1**



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Client: **RSK**

Approximate site boundary

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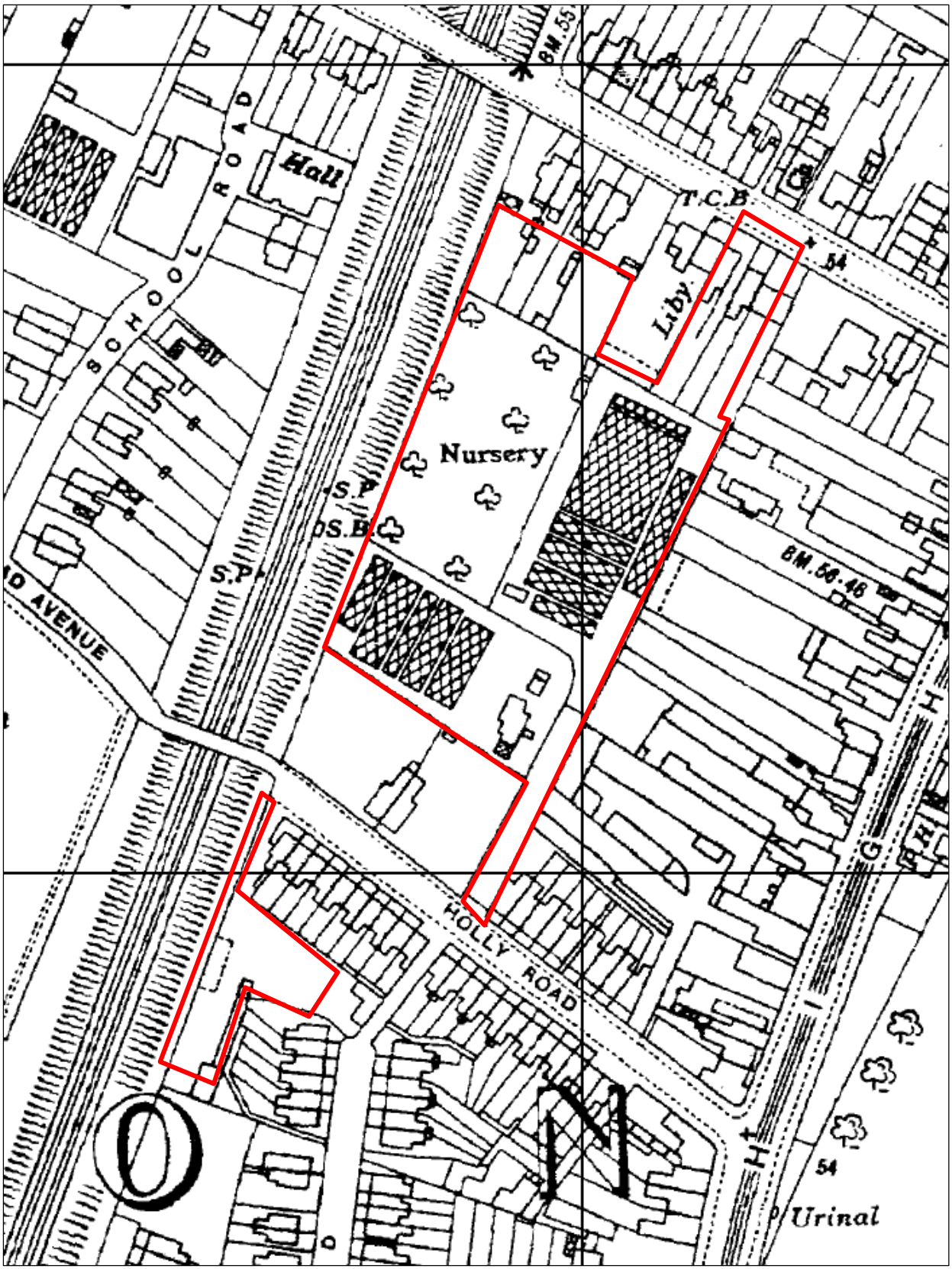
Project: **St Clare Business Park, Hampton Hill, Hampton, TW12 1QF**

Ref: **DA6247-00**

Source: Landmark Maps

1934 Historical Map

Annex: **D2**



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Client: **RSK**

Approximate site boundary

N

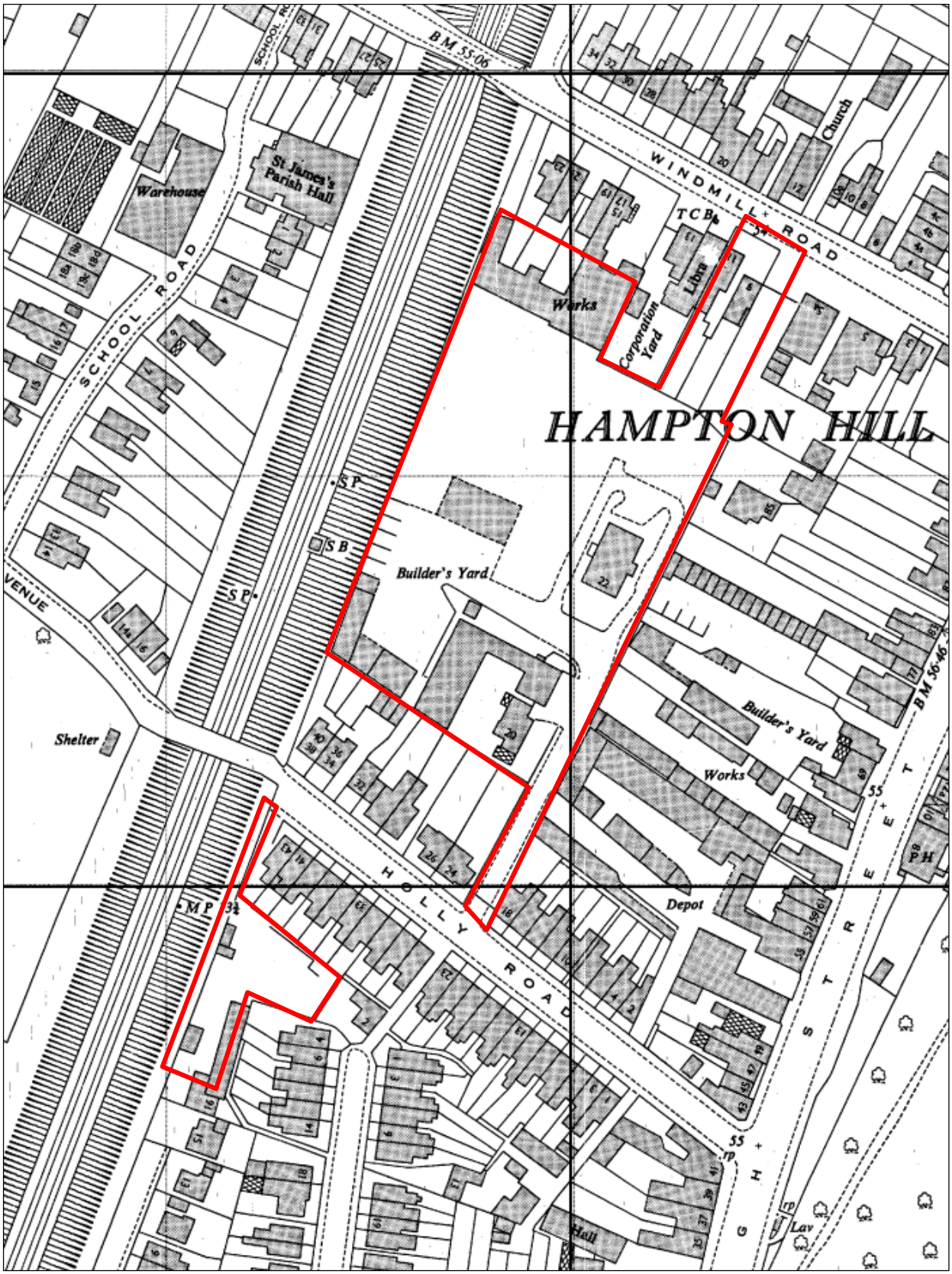
Project: **St Clare Business Park, Hampton Hill, Hampton, TW12 1QF**

Ref: **DA6247-00**

Source: Landmark Maps

1959-1961 Historical Map

Annex: D3



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Approximate site boundary

Project: **St Clare Business Park, Hampton Hill, Hampton, TW12 1QF**

N

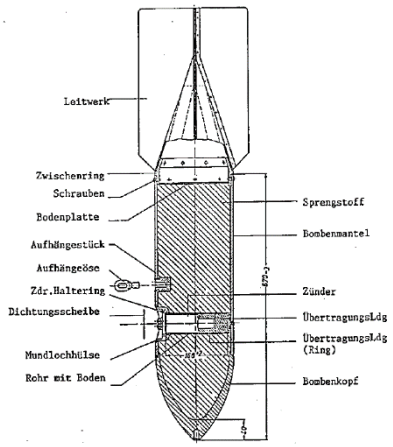
Ref: **DA6247-00**

Source: Landmark Maps

Examples of German Air-Delivered Ordnance

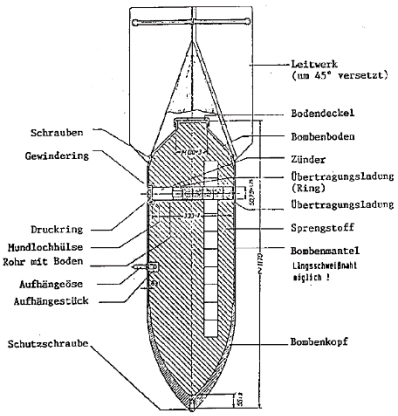
SC 50kg High Explosive Bomb

Bomb Weight	40-54kg (88-119lb)
Explosive Weight	c25kg (55lb)
Fuze Type	Impact fuze/electro-mechanical time delay fuze
Bomb Dimensions	1,090 x 280mm (42.9 x 11.0in)
Body Diameter	200mm (7.87in)
Use	Against lightly damageable materials, hangars, railway rolling stock, ammunition depots, light bridges and buildings up to three stories.
Remarks	The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg.



SC 250kg High Explosive Bomb

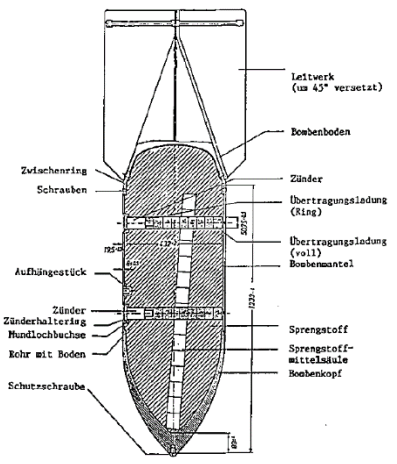
Bomb Weight	245-256kg (540-564lb)
Explosive Weight	125-130kg (276-287lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1640 x 512mm (64.57 x 20.16in)
Body Diameter	368mm (14.5in)
Use	Against railway installations, embankments, flyovers, underpasses, large buildings and below-ground installations.
Remarks	It could be carried by almost all German bomber aircraft, and was used to notable effect by the Junkers Ju-87 Stuka (Sturzkampfflugzeug or dive-bomber).

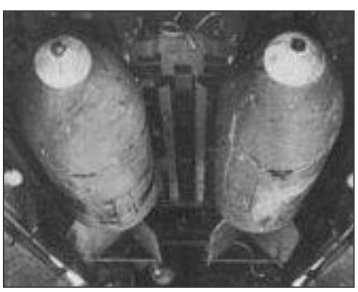


SC250 bomb being loaded onto German bomber

SC 500kg High Explosive Bomb

Bomb Weight	480-520kg (1,058-1,146lb)
Explosive Weight	250-260kg (551-573lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Bomb Dimensions	1957 x 640mm (77 x 25.2in)
Body Diameter	470mm (18.5in)
Use	Against fixed airfield installations, hangars, assembly halls, flyovers, underpasses, high-rise buildings and below-ground installations.
Remarks	40/60 or 50/50 Amatol TNT, trialene. Bombs recovered with Trialen filling have cylindrical paper wrapped pellets 1-15/16 in. in length and diameter forming





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Project: **St Clare Business Park, Hampton Hill, Hampton, TW12 1QF**

Ref: **DA6247-00**

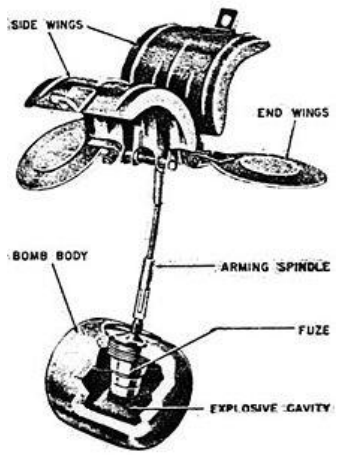
Source: Various sources

Examples of German Air-Delivered Ordnance

Annex: **E2**

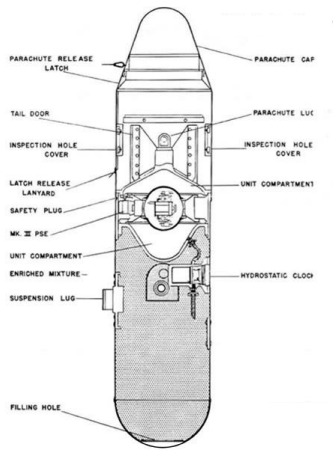
SD2 Anti-Personnel 'Butterfly Bomb'

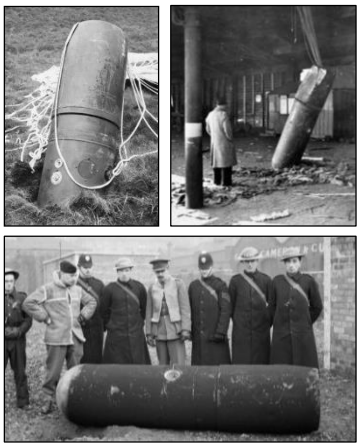
Bomb Weight	2kg (4.41lb)
Explosive Weight	7.5oz (225 grams) of Amatol surrounded by a layer of bituminous composition.
Fuze Type	41 fuze (time) , 67 fuze (clockwork time delay) or 70 fuze (anti-handling device)
Body Diameter	3in (7.62 cm) diameter, 3.1in (7.874) long
Use	Designed as an anti-personnel/ fragmentation weapon. They were delivered by air, being dropped in containers of 23-144 sub-munitions that opened at a predetermined height, thus scattering the bombs.
Remarks	Very rare. First used against Ipswich in 1940, but were also dropped on Kingston upon Hull, Grimsby and Cleethorpes in June 1943, amongst various other targets in UK. As the bombs fell the outer case flicked open by springs which caused four light metal drogues with a protruding 5 inch steel cable to deploy in the form of a parachute & wind vane which armed the device as it span.



Parachute Mine (Luftmine B / LMB)

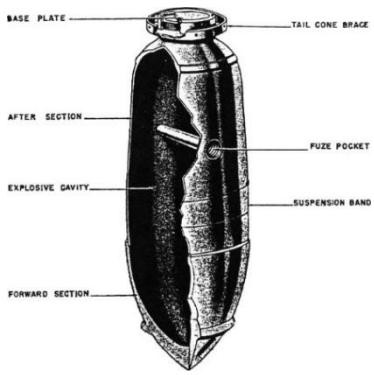
Bomb Weight	Approx. 990kg (2176lb)
Explosive Weight	Approx. 705kg (1,554lb)
Fuze Type	Impact/ Time delay / hydrostatic pressure fuze
Dimensions	2.64m x 0.64m (3.04m with parachute housing)
Use	Against civilian, military and industrial targets. Used as blast bombs and designed to detonate above ground level to maximise damage to a wider area.
Remarks	Deployed a parachute when dropped in order to control its descent. Had the potential to destroy a whole street of housing in a 100m radius.





SC 1000kg

Bomb Weight	993-1027kg (2,189-2,264lb)
Explosive Weight	530-620kg (1168-1367lb)
Fuze Type	Electrical impact/mechanical time delay fuze.
Filling	Mixture of 40% amatol and 60% TNT, but when used as an anti-shipping bomb it was filled with Trialen 105, a mixture of 15% RDX, 70% TNT and 15% aluminium powder.
Bomb Dimensions	2800 x 654mm (110 x 25.8in)
Body Diameter	654mm (18.5in)
Use	SC type bombs are General Purpose Bombs used primarily for general demolition work. Constructed of parallel walls with comparatively heavy noses. They are usually of three piece welded construction



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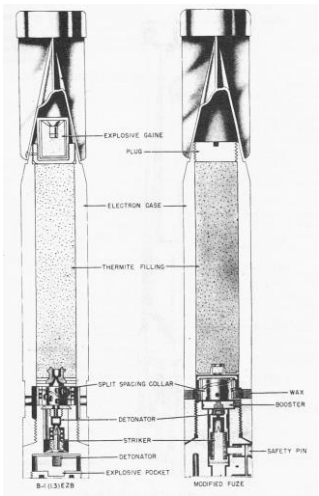
Ref: **DA6247-00**

Source: Various sources

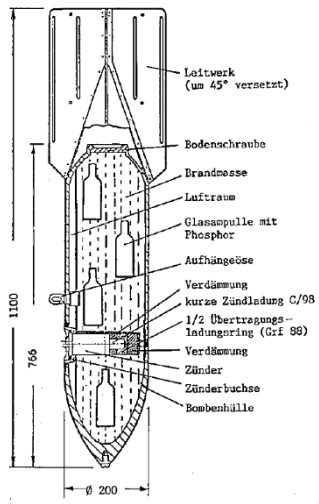
1kg Incendiary Bomb

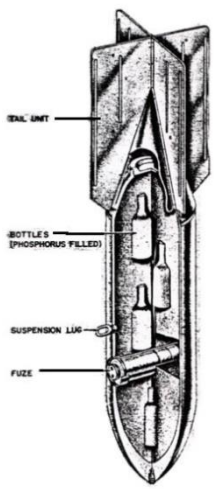
Bomb Weight	1.0 and 1.3kg (2.2 and 2.9lb)
Explosive Weight	680g (1.3lb) Thermite 8-15gm Explosive Nitropenta
Fuze Type	Impact fuze
Bomb Dimensions	350 x 50mm (13.8 x 1.97in)
Body Diameter	50mm (1.97in)
Use	As incendiary – dropped in clusters against towns and industrial complexes
Remarks	Magnesium alloy case. Sometimes fitted with high explosive charge. The body is a cylindrical alloy casting threaded internally at the nose to receive the fuze holder and fuze.



C50 A Incendiary Bomb

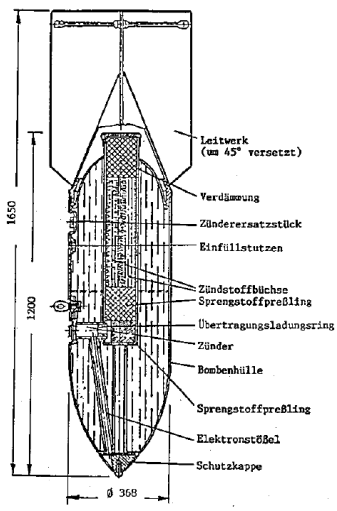
Bomb Weight	c41kg (90.4lb)
Explosive Weight	0.03kg (0.066lb)
Incendiary Filling	12kg (25.5lb) liquid filling with phosphor igniters in glass phials. Benzine 85%; Phosphorus 4%; Pure Rubber 10%
Fuze Type	Electrical impact fuze
Bomb Dimensions	1,100 x 280mm (43.2 x 8in)
Use	Against all targets where an incendiary effect is required
Remarks	Early fill was a phosphorous/carbon disulphide incendiary mixture





Flam C-250 Oil Bomb

Bomb Weight	125kg (276lb)
Explosive Weight	1kg (2.2lb)
Fuze Type	Super-fast electrical impact fuze
Filling	Mixture of 30% petrol and 70% crude oil
Bomb Dimensions	1,650 x 512.2mm (65 x 20.2in)
Body Diameter	368mm (14.5in)
Use	Often used for surprise attacks on ground troops, against troop barracks and industrial installations. Thin casing – not designed for ground penetration



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Ref: **DA6247-00**

Source: Various sources

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England Regions London

Bermondsey bomb: World War Two device safely removed

24 March 2015 | London Share

The bomb measured about 5ft (1.5m) in length

An unexploded World War Two bomb found in south London has been driven away safely under police and Army escort.

The 500lb (250kg) device was found on a building site in Grange Walk, Bermondsey on Monday.

250kg HE bomb found in Bermondsey March 2015

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Bethnal Green WW2 bomb: Experts remove unexploded device

11 August 2015 | London Share

The MoD said the German WW2 air delivered bomb could have caused "mass destruction" if it had detonated

An unexploded World War Two bomb that prompted the evacuation of 700 people in east London has been made safe and removed by the military.

Families spent the night in a school hall after the 500lb bomb was found in the basement of a building site on Temple Street, in Bethnal Green, on Monday afternoon.

250kg HE bomb found in Bethnal Green, Aug 2016

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England Regions Somerset

Bath WW2 bomb scare: Device defused, police say

13 May 2016 | Somerset Share

The bomb was found on the site of a former school on Thursday

A 500lb World War Two bomb found on the site of a former school in Bath has been defused and made safe.

250kg HE bomb found in Bath, May 2016

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England Regions London

Wembley WW2 live bomb posed 'risk to life'

22 May 2015 | London Share

A blast wall was put up around the bomb to minimise damage if it exploded

An unexploded World War Two bomb uncovered by builders near Wembley Stadium posed "a genuine risk to life", the Army has said.

50kg HE bomb found in Wembley, May 2015

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Ref: **DA6247-00** Source: BBC News

Examples of Unexpected Detonation of WWII Bombs

BASF has confirmed that an explosive device, most likely a World War II-era bomb, caused the blast that left one person injured Tuesday at a plant construction site in Germany.

The explosion was reported at BASF's Ludwigshafen toluene diisocyanate (TDI) plant, which recently broke ground for a 300,000 metric tons per year TDI production plant and other construction to expand its facilities.

1st March 2013

BASF is expanding their its Ludwigshafen location by expanding several plants and building a TDI plant, which was the site of an explosion on Tuesday (Feb. 26). One person was injured in the blast, which BASF believes was caused when excavation work detonated a bomb.

Early reports had speculated that excavation work had detonated a bomb from World War II. While the age of the bomb has not been confirmed, BASF has said that an explosive device was detonated.

BASF Provides Some Details

Responding to a request from *PaintSquare News* for more information on Wednesday (Feb. 27), BASF's manager of media relations and corporate communications Europe, Ursula von Stetten, wrote in an email, "So here [are] the facts: The detonation took place at 10:00 a.m. One person was injured; the injury is not serious. He will be kept in the hospital for some days.

"Cause of the detonation was an explosive device, presumably a bomb deriving from the Second World War. The device detonated when grounding work was done. No details on [a] delay [are] available. At the moment, the exact circumstances of the incident are [being] evaluated."

World War II Bomb Explodes on German Motorway

A highway construction worker in Germany accidentally struck an unexploded World War II bomb, causing an explosion which killed him and wrecked several passing cars.

Tweet 0 Recommend 1

23rd October 2006

AP

A cutting machine lies wrecked by the side of the A3 motorway next to a small crater left by the explosion.

A World War II bomb has exploded during construction work on a German highway, killing one worker and injuring several motorists who were driving past, police said.

The worker had been cutting through the road surface near the south-western town of Aschaffenburg when his machine struck the bomb and triggered it. Police said they weren't sure yet what type of bomb it was. "The explosion seems to have been too small for it to have been an aircraft bomb," a police spokesman said.

The A3 Autobahn linking the cities of Frankfurt and Würzburg has been blocked in both directions.

More than 60 years since the end of World War II, construction workers still frequently unearth unexploded bombs and it is not uncommon for whole city districts to be cordoned off and even evacuated while bomb disposal experts defuse them.

Indeed, just last week, some 22,000 people were evacuated from their homes in Hanover when three World War II bombs were discovered.

Allied pilots rained nearly 2 million tons of explosives on Germany during the war. Landmines, hand grenades, mortar bombs and anti-tank devices from the fighting on German soil at the end of the war are also found, and authorities say it will take decades before the country is cleared of duds.

Between 400 and 600 bombs are discovered a year in the state of North Rhine-Westphalia alone, where the heavily industrialized Ruhr region was a major target for Allied bombers.

19th September 2013

WWII bomb injures 17 at Hattingen construction site

Published: 19 Sep 08 16:53 CET

Share +1 0 Tweet 0

Seventeen people were injured on Friday when a construction crew unwittingly detonated a buried World War II-era bomb in Hattingen.

- Liberals grit teeth ahead of May state election (17 Mar 12)
- Nazi death camp guard Demjanjuk dies (17 Mar 12)
- Stupid stunt causes bomb scare chaos (16 Mar 12)

An excavator apparently drove over a 250-kilogramme (550 pound) American bomb, damaging surrounding buildings. Most of the injured suffered auditory trauma from the blast, and the excavator operator suffered injuries to his hands, police in the German state of North Rhine-Westphalia said.

"The hole was astoundingly small for such a large bomb full of so many explosives," Armin Gebhard, head of the Arnsberg department for military ordnance removal, told The Local. "But of course it damaged all the surrounding buildings too. We are really happy it wasn't worse."

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2 June 2010 Last updated at 15:37

Share

World War II bomb kills three in Germany

Three people have been killed and six injured trying to defuse a World War II bomb in central Germany.

2nd June 2010

AFP

All the victims were involved in an operation to defuse the bomb

Workers building a sports stadium had earlier unearthed the bomb in the town of Goettingen.

It was not immediately clear why the bomb, reportedly weighing 500kg (1,100lb), had detonated.

Unexploded WWII bombs dropped by Allied planes are frequently found in Germany, though it is unusual for them to explode unexpectedly.

A special commission is investigating the causes of the explosion, while prosecutors are considering whether the team leader should face charges of manslaughter through culpable negligence, the BBC's Oana Lungescu reports from Berlin.

The blast happened an hour before the defusing operation was due to start.

Officials said the three men who died were experienced sappers, or combat engineers, who over 20 years had defused up to 700 bombs.

More than 7,000 people were immediately evacuated when the 500kg bomb was found. Several schools, a kindergarten and local companies remain closed.

June 2006

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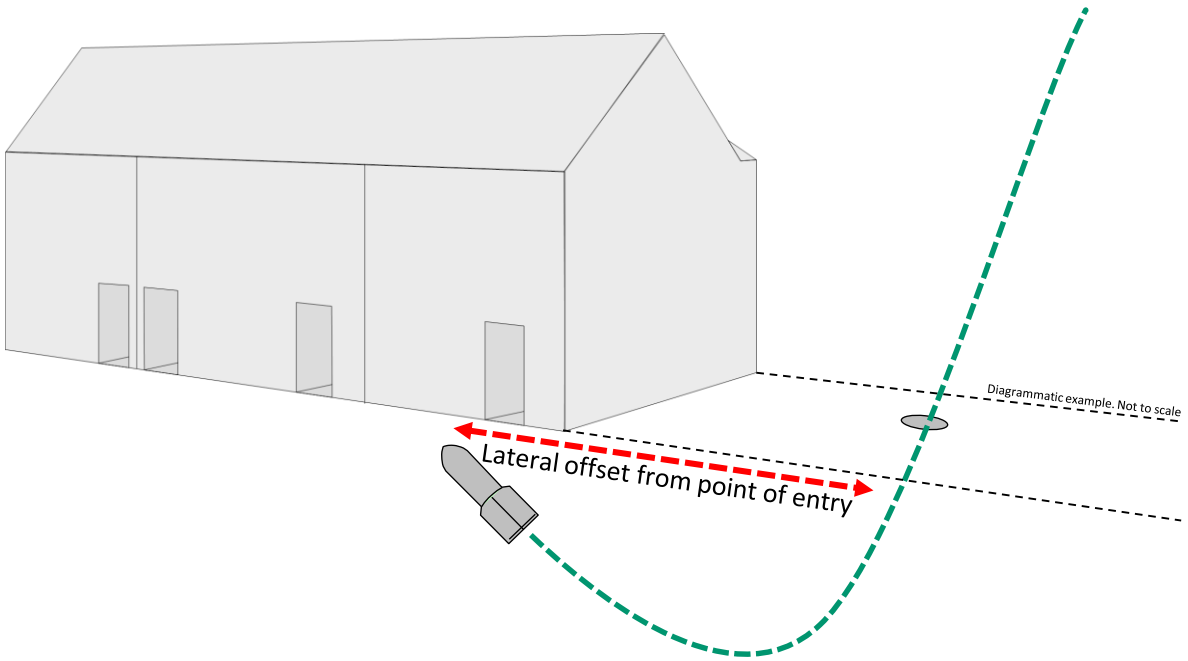
Ref: **DA6247-00**

Source: Various news sources

'J-Curve' Effect



Top: J-curve Effect - Due to angle of entry, unexploded bombs would often end their trajectory at a lateral offset from point of entry, often ending up beneath adjacent extant structures/sites.

One of the most common scenarios for the above occurring was where a UXB fell into a 'bomb site' (such as the area shown **Top Left**), the entry hole of the bomb obscured by debris and rubble present. Note that the entry hole of a 50kg UXB could be as little as 20cm in diameter (**Left**).

Photograph **above** shows 250kg bomb found in Bermondsey pointing upwards, demonstrating 'J-curve'

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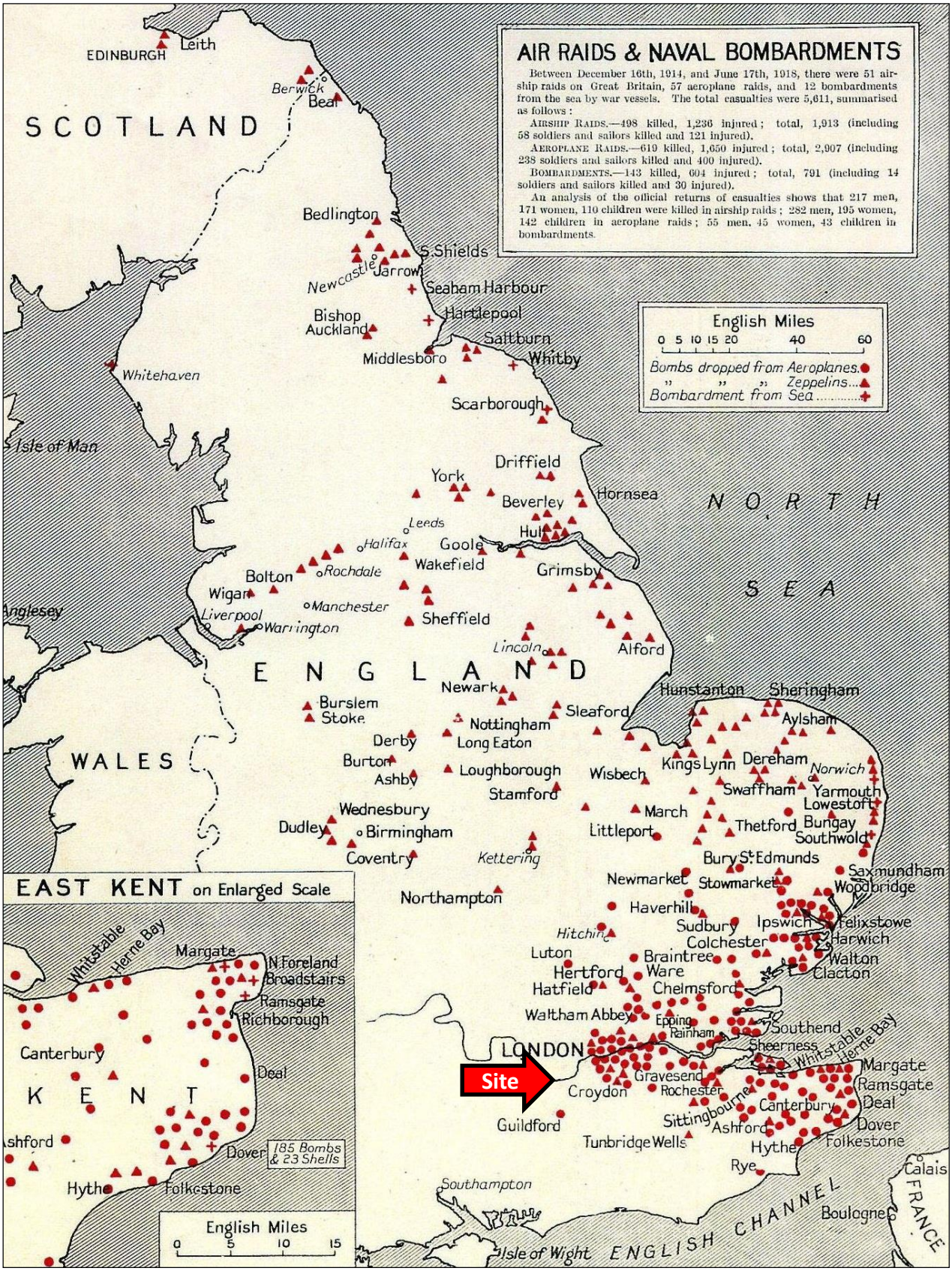
Source: Various sources

WWI Map of Air Raids and Naval Bombardments

Annex: H



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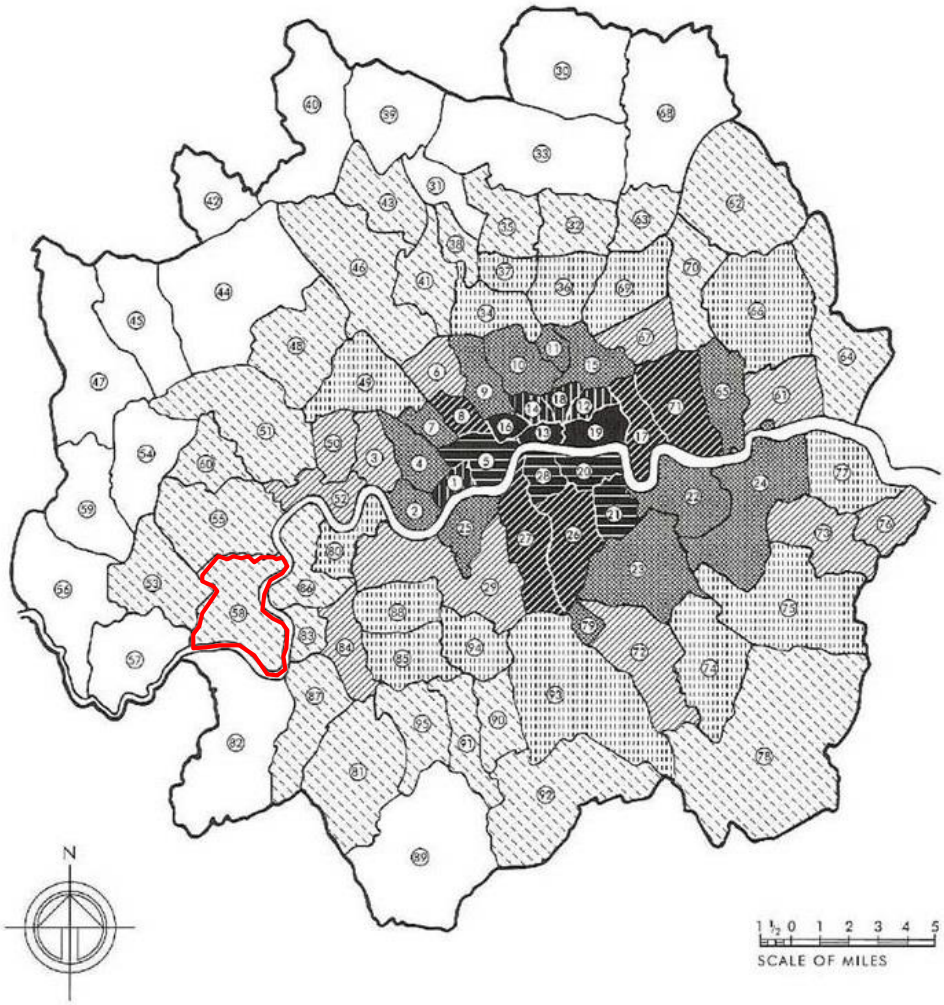
Source: J. Morris, *German Air Raids on Britain*

London WWII Bomb Density Map

Annex: I



No. OF BOMBS PER 1,000 ACRES

OVER 600	300 – 399	100 – 149
500 – 599	200 – 299	50 – 99
400 – 499	150 – 199	UNDER 50

1	Chelsea	25	Battersea	49	Willesden	72	Beckenham
2	Fulham	26	Camberwell	50	Acton	73	Bexley
3	Hammersmith	27	Lambeth	51	Ealing	74	Bromley
4	Kensington	28	Southwark	52	Brentford and Chiswick	75	Chislehurst and Sidcup
5	Westminster	29	Wandsworth	53	Feltham	76	Crayford
6	Hampstead	30	Cheshunt	54	Hayes and Harlington	77	Erith
7	Paddington	31	East Barnet	55	Heston and Isleworth	78	Orpington
8	St. Marylebone	32	Edmonton	56	Staines	79	Penge
9	St. Pancras	33	Enfield	57	Sunbury	80	Barnes
10	Islington	34	Hornsey	58	Twickenham	81	Epsom and Ewell
11	Stoke Newington	35	Southgate	59	Yiewsley and West Drayton	82	Esher
12	Bethnal Green	36	Tottenham	60	Southall and Norwood	83	Kingston on Thames
13	City of London	37	Wood Green	61	Barking	84	Malden and Coombe
14	Finsbury	38	Friern Barnet	62	Chigwell	85	Merton and Morden
15	Hackney	39	Potters Bar	63	Chingford	86	Richmond
16	Holborn	40	Elstree	64	Dagenham	87	Surbiton
17	Poplar	41	Finchley	65	East Ham	88	Wimbledon
18	Shoreditch	42	Bushey	66	Ilford	89	Banstead
19	Stepney	43	Barnet U.D.	67	Leyton	90	Beddington and Wallington
20	Bermondsey	44	Harrow	68	Waltham Holy Cross	91	Carshalton
21	Deptford	45	Ruislip and Northwood	69	Walthamstow	92	Coulsdon and Purley
22	Greenwich	46	Hendon	70	Wanstead and Woodford	93	Croydon
23	Lewisham	47	Uxbridge	71	West Ham	94	Mitcham
24	Woolwich	48	Wembley			95	Sutton and Cheam

1ST LINE DEFENCE

Unit 3, Maple Park
Essex Road, Hoddesdon,
Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

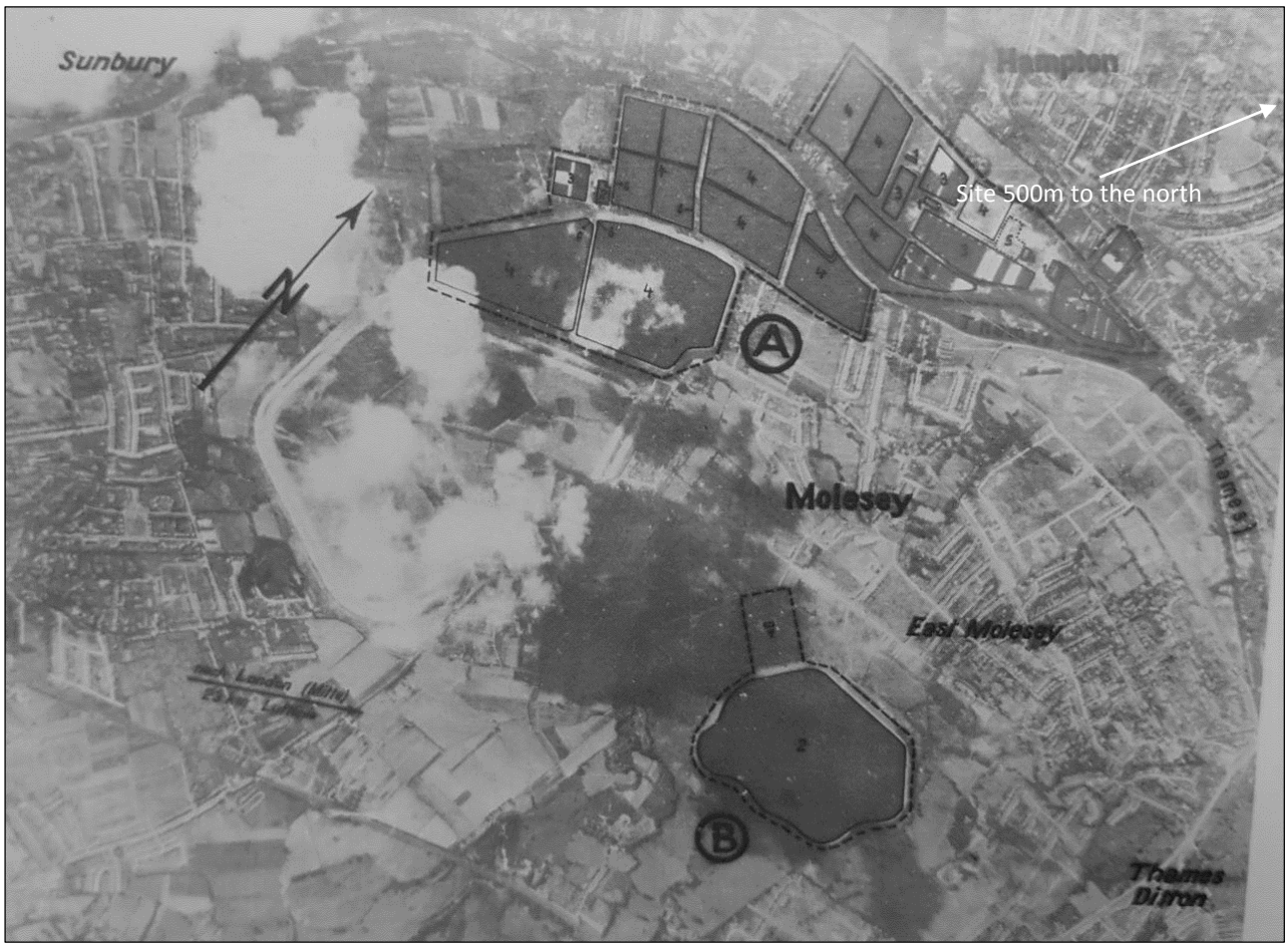
Client: **RSK**

Project: **St Clare Business Park, Hampton Hill, Hampton, TW12 1QF**

Ref: **DA6247-00**

Source: The London Metropolitan Archives

Luftwaffe Photograph



London – Hampton

A. Water reservoirs and water works

TN 1612– Designated Luftwaffe targets

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Client: **RSK**

Approximate site boundary

Project: **St Clare Business Park, Hampton Hill, Hampton, TW12 1QF**

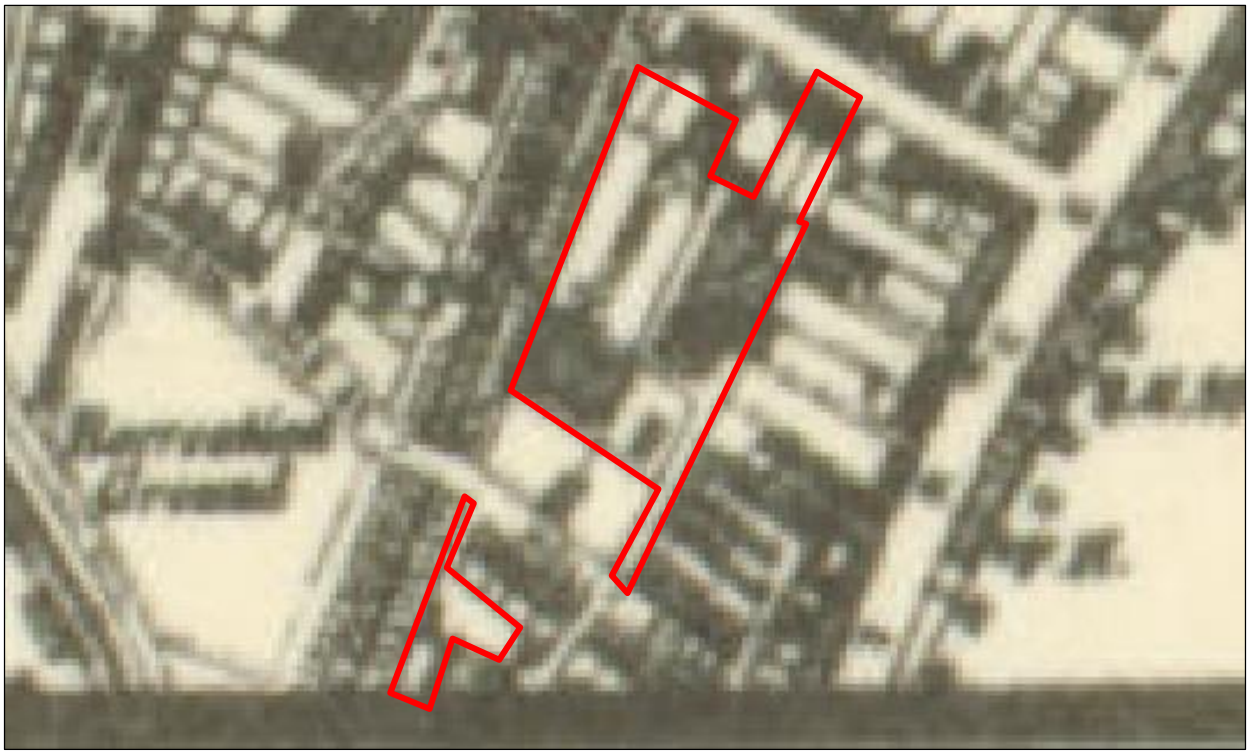
Ref: **DA6247-00**

Source: Nigel J. Clarke, "Adolf Hitler's Home Counties Holiday Snaps"

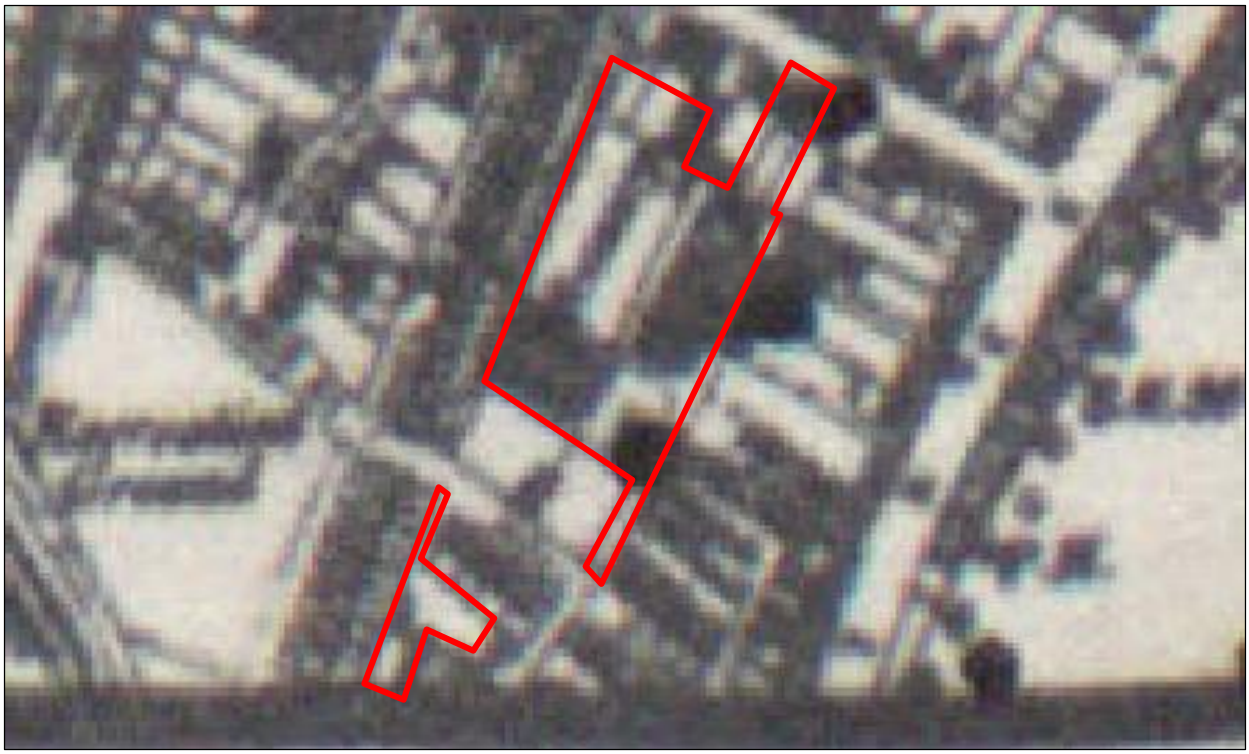
Consolidated London Bomb Census Mapping

Annex: **K1**

Night Bombing up to 7th October 1940



Night Bombing up to 7th October 1940 to 6th June 1



Recorded bomb strike

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Tel: +44 (0)1992 245 020

Client: **RSK**

Approximate site boundary

Project: **St Clare Business Park, Hampton Hill, Hampton, TW12 1QF**

N

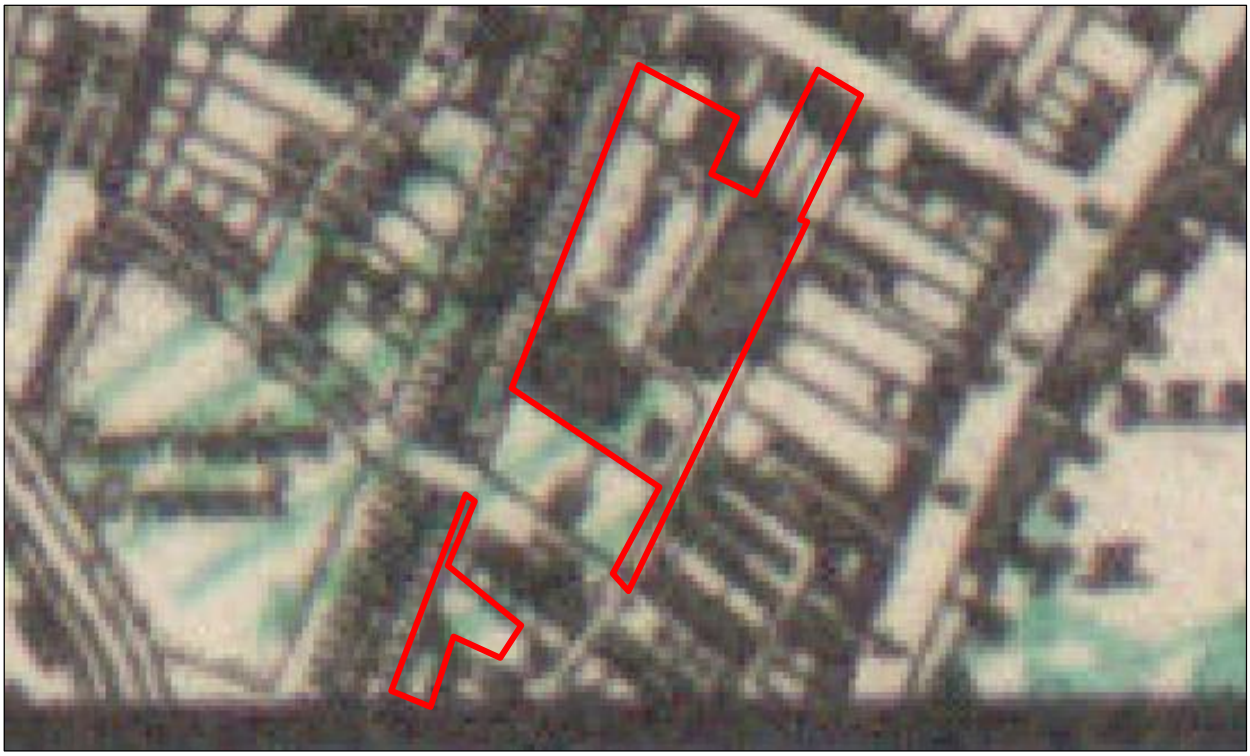
Ref: **DA6247-00**

Source: The National Archives, Kew

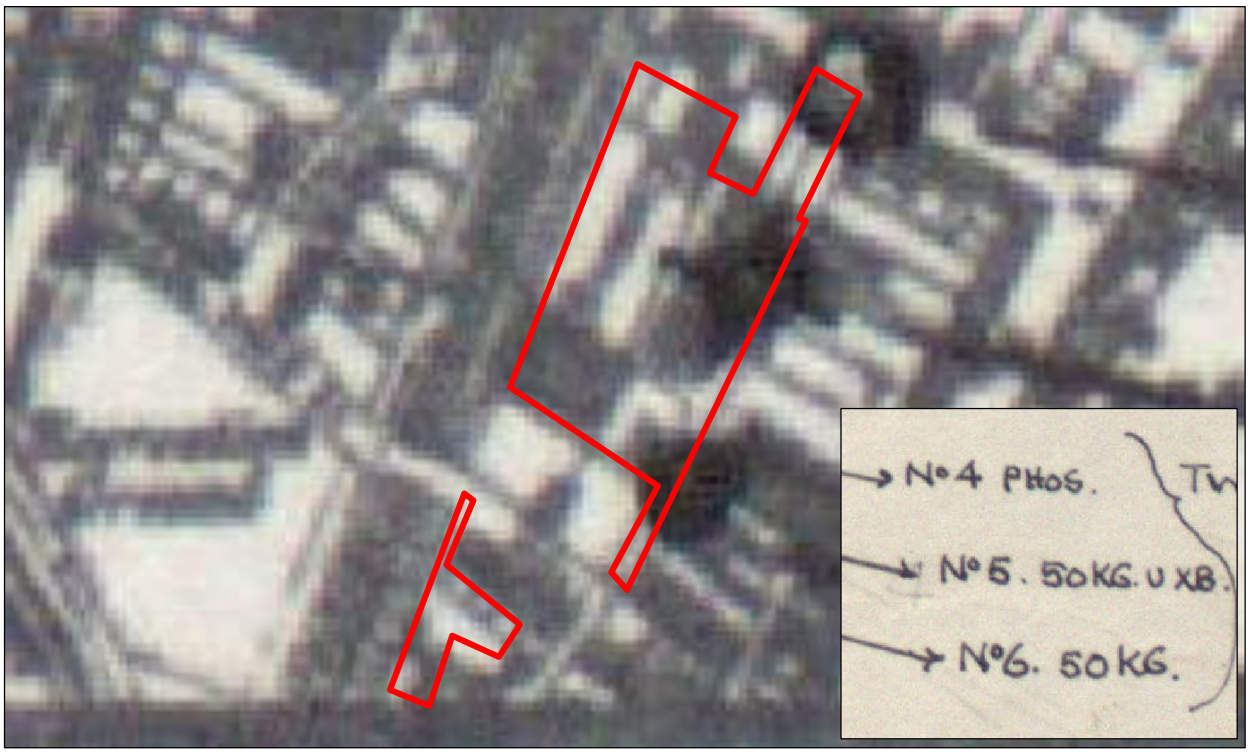
Weekly London Bomb Census Mapping

Annex: **K2**

25th November 1940 to 2nd December 1940



26th May to 2nd June 1941



Recorded HE bomb strike

Recorded UXB strike

Recorded incendiary bomb shower

Recorded oil bomb strike

Colour refers to day of the week.

1ST LINE DEFENCE

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Client: **RSK**

Approximate site boundary

N

Project: **St Clare Business Park, Hampton Hill, Hampton, TW12 1QF**

Ref: **DA6247-00**

Source: The National Archives, Kew

Borough of Twickenham Bomb Map

Annex: **L**

1ST LINE DEFENCE

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Hertfordshire. EN11 0EX
Email: info@1stlinedefence.co.uk
Tel: +44 (0)1992 245 020

Client: **RSK**

Approximate site boundary

N

Project: **St Clare Business Park, Hampton Hill, Hampton, TW12 1QF**

Ref: **DA6247-00**

Source: Twickenham Record Office

Middlesex County Council (MCC) Bomb Damage Map

Annex: **M**

Category 1 - "Total damage, building to be demolished."

Category 2 - "Some repairs possible, but could become Cat 1."

Category 3 - "Border line areas, uncertain whether repairs possible, might have to be demolished."

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Client: **RSK**

Approximate site boundary

N

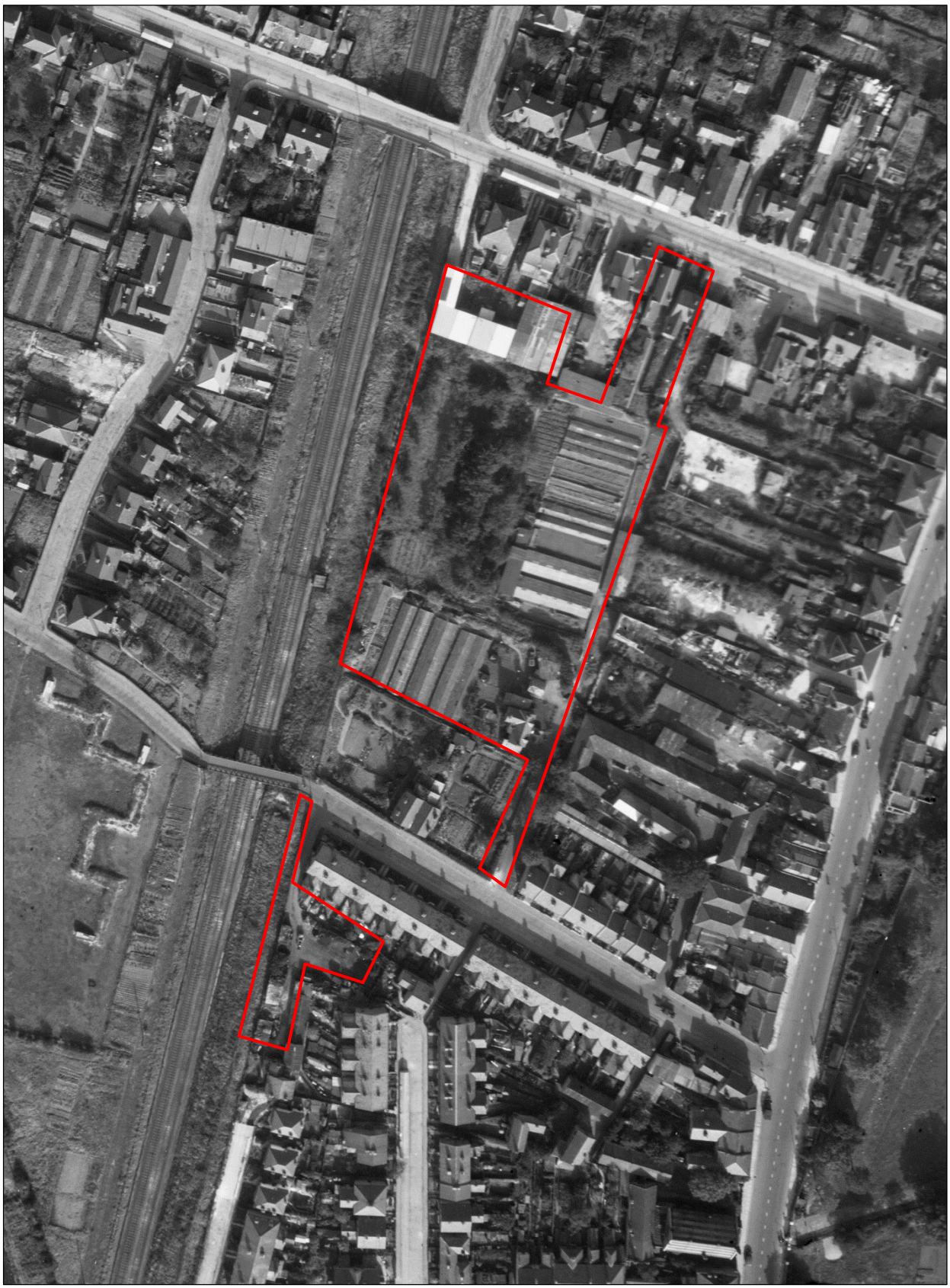
Project: **St Clare Business Park, Hampton Hill, Hampton, TW12 1QF**

Ref: **DA6247-00**

Source: London Metropolitan Archives

RAF Aerial Photography 10th October 1945

Annex: N



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Tel: +44 (0)1992 245 020

Client: **RSK**

Approximate site boundary

Project: **St Clare Business Park, Hampton Hill, Hampton, TW12 1QF**

N

Ref: **DA6247-00**

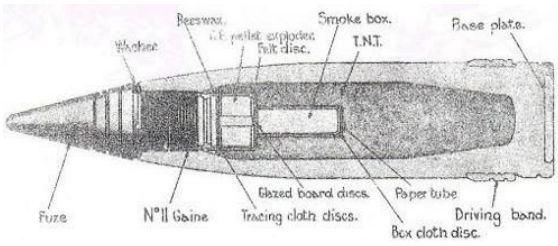
Source: National Monuments Record Office (Historic England)

Examples of Anti-Aircraft Projectiles

Annex: O

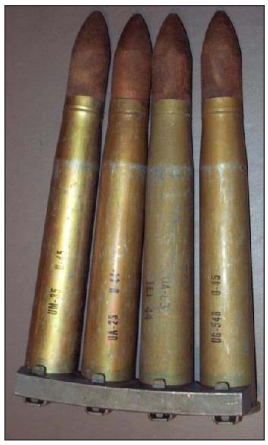
3.7 Inch QF Anti-Aircraft Projectile

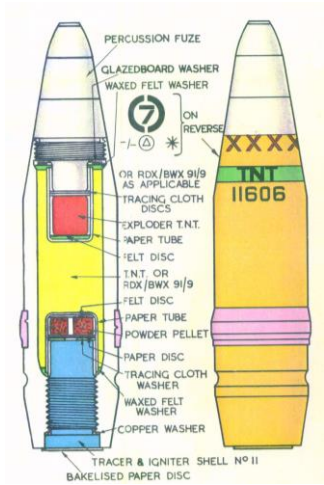
Projectile Weight	28lb (12.6 kg)
Explosive Weight	2.52lbs
Fuze Type	Mechanical Time Fuze
Dimensions	3.7in x 14.7in (94mm x 360mm)
Rate of Fire	10 to 20 rounds per minute
Use	The 3.7in AA Mks 1-3 were the standard Heavy Anti-Aircraft guns of the British Army.
Ceiling	30,000ft to 59,000ft



40mm Bofors Projectile

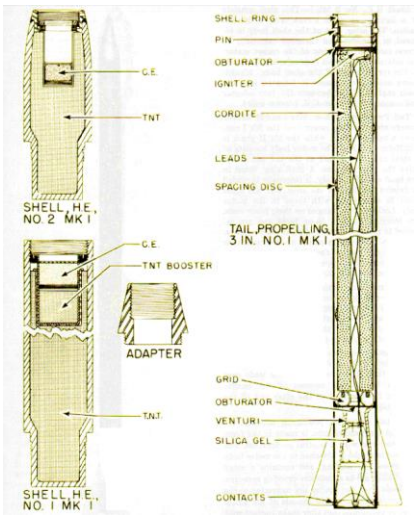
Projectile Weight	1.96lb (0.86kg)
Explosive Weight	300g (0.6lb)
Fuze Type	Impact Fuze
Rate of Fire	120 rounds per minute
Projectile Dimensions	40 x 180mm
Ceiling	23,000ft (7000m)
Remarks	Light quick fire high explosive anti-aircraft projectile. Each projectile fitted with small tracer element. If no target hit, shell would explode when tracer burnt out. Designed to engage aircraft flying below 2,000ft





3in Unrotated Projectile (UP) Anti-Aircraft Rocket ("Z" Battery)

HE Projectile Weight	3.4kg (7.6lb)
Explosive Weight	0.96kg (2.13lb)
Filling	High Explosive – TNT. Fitted with aerial burst fuzing
Dimensions of projectile	236 x 83mm (9.29 x 3.25in)
Remarks	As a short range rocket-firing anti-aircraft weapon developed for the Royal Navy. It was used extensively by British ships during the early days of World War II. The UP was also used in ground-based single and 128-round launchers known as Z Batteries. Shell consists of a steel cylinder reduced in diameter at the base and threaded externally to screw into the shell ring of the rocket motor



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Client: **RSK**

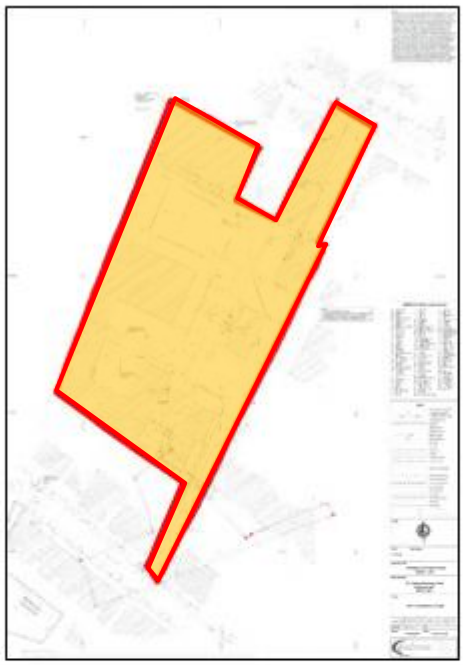
Project: **St Clare Business Park, Hampton Hill, Hampton, TW12 1QF**

Ref: **DA6247-00**

Source: Various sources

Risk Map – Site Plan Overlay

Annex: **P**



Low Risk

Medium Risk

Low and Medium Risk Areas:

- Site Specific Unexploded Ordnance Awareness Briefings to all personnel conducting intrusive works

Medium Risk Area:

- Unexploded Ordnance (UXO) Specialist Presence on Site to support shallow intrusive works
- Intrusive Magnetometer Survey of all Borehole and pile locations down to a maximum bomb penetration depth

For indicative purposes – not to scale

1ST LINE DEFENCE

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Hertfordshire. EN11 0EX
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Tel: +44 (0)1992 245 020

Client: **RSK**

Approximate site boundary

Project: **St Clare Business Park, Hampton Hill, Hampton, TW12 1QF**

Ref: **DA6247-00**

Source: 1st Line Defence

1ST LINE DEFENCE
Unit 3, Maple Park
Essex Road
Hoddesdon
Hertfordshire
EN11 0EX
Tel: 01992 245020

www.1stlinedefence.co.uk

1ST LINE DEFENCE

APPENDIX H
EXPLORATORY HOLE LOGS

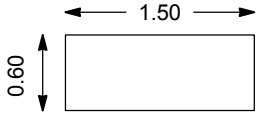
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
St Clare Business Park, Hampton Hill	Notting Hill Housing Trust	TP02

Contract Ref:	Start: 26.03.18	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701	End: 26.03.18	13.90	E:514192.9 N:170878.9	1 of 1

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						MADE GROUND: Vegetation over soft to firm dark brown very gravelly sandy CLAY. Frequent rootlets and large roots ~10cm throughout. Sand is fine to coarse, gravel is angular to sub rounded of brick, concrete and flint.	(2.90)	
						. . . at 1.50m large cobbles of concrete with rebar and bricks. Suspected asbestos cement fragment identified.		
2.90	1	ES	1xT, 1xJ, 1xV			Medium dense dark brown sand and GRAVEL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse flint. Gravel contains water with an oily sheen and a strong hydrocarbon smell. (TAPLOW GRAVEL)	2.90 (1.00)	
3.90	2	ES	1xT, 1xJ, 1xV			Trial pit terminated at 3.90m depth.	3.90	

Plan (Not to Scale)



General Remarks

1. Groundwater resting at 3.20m depth.
2. Oily sheen identified within gravels.
3. Trial pit terminated due to instability.
4. Soakaway test aborted.
5. Trial pit collapsed at around 2.00m and 3.00m
6. Note: Elevation data may be skewed due to poor signal quality when surveying.

All dimensions in metres | Scale: 1:25

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	JCB-3CX	JGriffin	

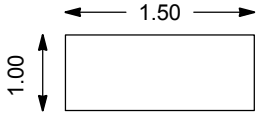
TRIAL PIT LOG

Contract:	Client:	Trial Pit:
St Clare Business Park, Hampton Hill	Notting Hill Housing Trust	TP03

Contract Ref:	Start: 27.03.18	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701	End: 27.03.18	11.04	E:514174.3 N:170886.9	1 of 1

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						MADE GROUND: Concrete.	(0.30) 0.30	
						MADE GROUND: Loose medium dense blackish orange very gravelly SAND. Sand is fine to coarse. Gravel is angular to subrounded of brick, concrete, flint and clinker.	0.50	
						MADE GROUND: Loose to medium dense grey glack very clayey gravelly SAND. Sand is fine to coarse. Gravel is angular to subrounded of brick, concrete and flint.	(3.00)	
							3.50	

Plan (Not to Scale)



General Remarks

1. Slow water seapage at 2.20m.
2. Trial pit unstable throughout excavation, collapse at around 1.50m and 2.50m
3. Terminated due to trial pit instability.
4. Soakaway test aborted.
5. Note: Elevation data may be skewed due to poor signal quality when surveying.

All dimensions in metres | Scale: 1:25

Method Used:	Plant Used:	Logged By:	Checked By:
Machine dug	JCB-3CX	NDubber	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
St Clare Business Park, Hampton Hill	**Notting Hill Housing Trust**	**WS1**

Contract Ref:	Start:	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701	**29.03.18**	**14.98**	**E:514251.1 N:170950.0**	**1** of **1**
	End: **29.03.18**			

Progress	Samples / Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
							MADE GROUND: Tarmac.	0.05	
							MADE GROUND: Concrete.	0.15	
							MADE GROUND: Loose to medium dense dark brown very sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse concrete, flint and brick.	(0.55)	
								0.70	
	0.80	1	ES	1xT, 1xJ, 1xV			MADE GROUND: Soft to firm dark brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to angular fine to coarse of brick, clinker, flint, concrete and occasional cobble of brick (~10cm).	(0.70)	
	1.20-1.65	1	SPT	N=2	▼1			1.40	
							MADE GROUND: Loose dark grey slightly clayey sandy GRAVEL. Sand is fine to coarse. Gravel is subangular to angular fine to coarse of brick, flint and clinker.	1.60	
							MADE GROUND: Firm dark brownish grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is subrounded to angular fine to coarse flint, clinker and brick.	(1.85)	
	2.00-2.45	2	SPT	N=6					
	2.00	2	ES	1xT, 1xJ, 1xV					
	3.00-3.45	3	SPT	N=53				3.45	
							Borehole terminated at 3.45m depth.		

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Perched water strike at 1.30m depth.
2. Refusal at 2.80m, hole terminated.
3. No water in hole on completion.
4. Hole stable.
5. Note: Elevation data may be skewed due to poor signal quality when surveying.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Premier 110**	**PJDrilling**	**JGriffin**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
St Clare Business Park, Hampton Hill	**Notting Hill Housing Trust**	**WS2**

Contract Ref:	Start:	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701	**29.03.18** End: **29.03.18**	**16.89**	**E:514238.2 N:170912.6**	**1** of **2**

Progress	Samples / Tests				Water	Backfill & Instru-mentation	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
							MADE GROUND: Tarmac	0.05	
							MADE GROUND: Gravel sub-base	0.20	
	0.20-0.80	1	ES	1xT, 1xJ, 1xV			MADE GROUND: Very loose dark brown sandy GRAVEL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse brick, flint and clinker. Slight hydrocarbon smell.	(0.80)	
								1.00	
	1.20-1.65	1	SPT	N=2			MADE GROUND: Soft to firm brown slightly sandy very gravelly CLAY. Sand is rounded to angular fine to coarse brick, concrete, flint and clinker.	(1.00)	
	1.50	2	ES	1xT, 1xJ, 1xV					
								2.00	
	2.00-2.45	2	SPT	N=1			MADE GROUND: Very loose dark greyish black sandy GRAVEL. Sand is fine to coarse. Gravel is subrounded to angular fine to coarse clinker, sandstone, brick and rare ceramic pieces.	(1.50)	
	3.00-3.45	3	SPT	N=0					
								3.50	
							Very dense light brown very gravelly SAND. Sand is fine to coarse. Gravel is rounded to angular fine to coarse flint and sandstone. (TAPLOW GRAVEL)	(0.95)	
	4.00-4.45	4	SPT	N=54					
								4.45	

Borehole terminated at 4.45m depth.

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Perched water standing at 2.80m.
2. Sand unstable at 3.50m, position terminated.
3. Slight hydrocarbon odour noted in shallow (<1.00m) made ground.
4. Note: Elevation data may be skewed due to poor signal quality when surveying.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Premier Compact 110**	**PJDrilling**	**JGriffin**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
St Clare Business Park, Hampton Hill	**Notting Hill Housing Trust**	**WS2**

Contract Ref:	Start:	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701	**29.03.18**	**16.89**	**E:514238.2 N:170912.6**	**2** of **2**
	End: **29.03.18**			

Progress	Samples / Tests				Water	Backfill & Instru-mentation	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window sampling	**Premier Compact 110**	**PJDrilling**	**JGriffin**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
St Clare Business Park, Hampton Hill	**Notting Hill Housing Trust**	**WS3**

Contract Ref:	Start:	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701	**27.03.18** End: **27.03.18**	**10.95**	**E:514214.4 N:170924.5**	**1** of **1**

Progress	Samples / Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
							MADE GROUND: Tarmac	0.10	
							MADE GROUND: Loose red brick.	0.25	
							MADE GROUND: Loose light grey clayey sandy GRAVEL. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse concrete and flint.	(0.30) 0.55	
							MADE GROUND: Soft becoming firm dark brown gravelly very sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of clinker, brick, concrete and flint.	(1.65) 2.20	
	1.20-1.65	1	SPT	N=3					
	1.50-2.00	1	ES	1xT, 1xJ, 1xV	1				
	2.00-2.45	2	SPT	N=14	1				
							Medium dense light brownish orange gravelly SAND. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of flint, shell fragments and sandstone. (TAPLOW GRAVEL)	(0.60) 2.80	
	3.00-3.45	3	SPT	N=16			Medium dense light brownish orange sandy GRAVEL. Sand is fine to coarse. Gravel is angular to rounded fine to coarse flint and sandstone. (TAPLOW GRAVEL)	(0.65) 3.45	
							Borehole terminated at 3.45m depth.		

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Teriminated at 3.00m depth.
2. Water striek at 1.80m depth, resting at 2.10m after 20 mins.
3. Sands unstable at 2.20m.
4. Note: Elevation data may be skewed due to poor signal quality when surveying.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Premier 110**	**PJDrilling**	**JGriffin**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
St Clare Business Park, Hampton Hill	**Notting Hill Housing Trust**	**WS4**

Contract Ref:	Start:	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701	**27.03.18**	**14.66**	**E:514178.3 N:170933.9**	**1** of **1**
	End: **27.03.18**			

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
							MADE GROUND: Concrete with rebar.	0.10	
							MADE GROUND: Medium dense dark brown clayey gravelly SAND. Sand is fine to coarse. Gravel is rounded to angular fine to coarse flint, brick, concrete, clinker and rare pieces of glass.	(1.55)	
	1.20-1.65 1.20-1.30	1 1	SPT ES	N=11					
							Borehole terminated at 1.65m depth.	1.65	

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Refusal at 1.30m depth.
2. No groundwater encountered.
3. Hole remained stable.
4. Note: Elevation data may be skewed due to poor signal quality when surveying.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Premier 110**	**PJDrilling**	**JGriffin**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
St Clare Business Park, Hampton Hill	**Notting Hill Housing Trust**	**WS5**

Contract Ref:	Start:	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701	**27.03.18**	**10.52**	**E:514190.9 N:170912.1**	**1** of **2**
	End: **27.03.18**			

Progress	Samples / Tests				Water	Backfill & Instru-mentation	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
							MADE GROUND: Concrete with rebar.	0.15	
							MADE GROUND: Brick and concrete cobbles.	0.30	
							MADE GROUND: Loose gravelly SAND. Sand is fine to coarse. Gravel is brick, concrete and clinker.	0.40	
	0.50-1.00	1	ES	1xT, 1xJ, 1xV			MADE GROUND: Soft to frim dark brown gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse brick, concrete and clinker.	(2.10)	
	1.20-1.65	1	SPT	N=1	1				
	2.00-2.45	2	SPT	N=4	1			2.50	
							Loose to medium dense light brownish grey gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse flint, sandstone and shell fragment. (TAPLOW GRAVEL)	(0.30)	
	2.80	2	ES	1xT, 1xJ, 1xV				2.80	
	3.00-3.45	3	SPT	N=22			Medium dense dark brownish black sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse flint, sandstone and occasional shell fragments. (TAPLOW GRAVEL)	(1.60)	
	4.00-4.45	4	SPT	N=18					
							. . . at 4.30m becoming light brown.	4.40	
							Description on next sheet	4.45	

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. 1.00m-2.00m little recovery, description inferred.
2. Water strike at 2.30m depth, standing at 1.86m after 20 mintues.
3. Hole terminated at 4.50m.
4. Hole unstable in sands and gravels at depths >2.50m.
5. Note: Elevation data may be skewed due to poor signal quality when surveying.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Premier 110**	**PJDrilling**	**JGriffin**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
St Clare Business Park, Hampton Hill	Notting Hill Housing Trust	WS5

Contract Ref:	Start: 27.03.18 End: 27.03.18	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701		10.52	E:514190.9 N:170912.1	2 of 2

Progress	Samples / Tests				Water	Backfill & Instru-mentation	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
							Firm becoming stiff poorly laminated blueish grey CLAY. (LONDON CLAY FORMATION)		
							Borehole terminated at 4.45m depth.		

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

All dimensions in metres | Scale: 1:25

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window sampling	Premier 110	PJDrilling	JGriffin	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
St Clare Business Park, Hampton Hill	**Notting Hill Housing Trust**	**WS6**

Contract Ref:	Start:	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701	**27.03.18** End: **27.03.18**	**11.27**	**E:514179.6 N:170884.6**	**1** of **2**

Progress	Samples / Tests				Water	Backfill & Instru-mentation	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
							MADE GROUND: Concrete.	(0.50) 0.50	
							MADE GROUND: Soft to firm dark brown and dark grey gravelly very sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse brick, concrete, flint, clinker and rare oyster shell.	(0.70) 1.20	
	1.20-1.65	1	SPT	N=1			MADE GROUND: Firm grey gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of brick, concrete and flint.		
	2.00-2.45	2	SPT	N=3	1			(1.60) 2.80	
	2.50	1	ES	1xT, 1xJ, 1xV					
	3.00-3.45	3	SPT	N=14			Medium dense ight brown sandy GRAVEL. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of brick, concrete and flint. (TAPLOW GRAVEL)		
	3.50	2	ES	1xT, 1xJ, 1xV				(1.65) 4.45	
	4.00-4.45	4	SPT	N=19					

Borehole terminated at 4.45m depth.

Drilling Progress and Water Observations

Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Water strike at 2.00m depth.
2. Hole unstable in gravel at depths >2.80m
3. 3.00m - 3.50m poor recovery.
4. Hole terminated at 3.50m.
5. Note: Elevation data may be skewed due to poor signal quality when surveying.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Premier 110**	**PJDrilling**	**JGriffin**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
St Clare Business Park, Hampton Hill	**Notting Hill Housing Trust**	**WS6**

Contract Ref:	Start: **27.03.18** End: **27.03.18**	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701		**11.27**	**E:514179.6 N:170884.6**	**2** of **2**

Progress	Samples / Tests				Water	Backfill & Instru-mentation	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window sampling	**Premier 110**	**PJDrilling**	**JGriffin**	AGS

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
St Clare Business Park, Hampton Hill	**Notting Hill Housing Trust**	**WS7**

Contract Ref:	Start:	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701	**27.03.18** End: **27.03.18**	**14.94**	**E:514164.6 N:170889.1**	**1** of **1**

Progress	Samples / Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
							MADE GROUND: Concrete.	0.20	
	0.20-0.70	1	ES	1xT, 1xJ, 1xV			MADE GROUND: Loose light brownish grey clayey very sandy GRAVEL. Sand is fine to coarse/ Gravel is angular to subrounded of brick, concrete, flint and clinker. Foul smell.	(0.50)	
								0.70	
							MADE GROUND: Soft becoming firm dark brown gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse brick, concrete and clinker.		
	1.20-1.65	1	SPT	N=3					
	1.50	2	ES	1xT, 1xJ, 1xV				(2.00)	
	2.00-2.45	2	SPT	N=5					
					1.1			2.70	
							Medium dense dark brown slightly sandy clayey GRAVEL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse flint and sandstone. (TAPLOW GRAVEL)		
	3.00-3.45	3	SPT	N=21				(0.75)	
								3.45	
							Borehole terminated at 3.45m depth.		

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Hand pit to 1.20m depth.
2. Borehole terminated at 3.00m depth.
3. Groundwater strike/ resting at 2.50m.
4. Hole stable.
5. Note: Elevation data may be skewed due to poor signal quality when surveying.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Premier Compact 110**	**PJDrilling**	**JGriffin**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
St Clare Business Park, Hampton Hill	**Notting Hill Housing Trust**	**WS8**

Contract Ref:	Start:	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701	**27.03.18** End: **27.03.18**	**16.01**	**E:514177.0 N:170844.1**	**1** of **1**

Progress	Samples / Tests				Water	Backfill & Instru-mentation	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
	0.50	1	ES	1xT, 1xJ, 1xV			TOPSOIL/SUBSOIL: Dark brown slightly gravelly sandy CLAY. Sand fine. Gravel is rounded to angular fine to coarse brick, flint, clinker and sandstone. Rootlets at surface.	(1.00) 1.00	
	1.20-1.65	1	SPT	N=8			MADE GROUND: Soft to firm dark brown gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse brick, concrete and clinker.	(0.90) 1.90	
	1.60	2	ES	1xT, 1xJ, 1xV					
	2.00-2.45	2	SPT	N=49			Medum dense becoming dense light brown and orange very gravelly SAND. Sand is fine to coarse. Gravel is angular to rounded fine to coarse flint. (TAPLOW GRAVEL)	(1.55) 3.45	
	3.00-3.45	3	SPT	N=55					
							Borehole terminated at 3.45m depth.		

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

2. Groundwater not encountered/ hole dry.
3. Refusal at 3.00m depth.
4. Hole terminated stable.
5. Note: Elevation data may be skewed due to poor signal quality when surveying.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Premier Compact 110**	**PJDrilling**	**JGriffin**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
St Clare Business Park, Hampton Hill	**Notting Hill Housing Trust**	**WS9**

Contract Ref:	Start:	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701	**29.03.18**	**16.52**	**E:514126.4 N:170780.5**	**1** of **2**
	End: **29.03.18**			

Progress	Samples / Tests				Water	Backfill & Instru-mentation	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
							MADE GROUND: Tarmac.	0.20	
							MADE GROUND: Red brick sub-base.	(0.40)	
								0.60	
							MADE GROUND: Loose light brown soft sandy gravelly CLAY. Sand is fine. Gravel is fine to coarse flint, clinker and brick.	(0.60)	
								1.20	
	1.20-1.65	1	SPT	N=5			MADE GROUND: Loose dark brown gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse flint, brick, clinker, occasional pieces of glass and a rare shoe.		
	2.00	1	ES	1xT, 1xJ, 1xV				(2.00)	
	2.00-2.45	2	SPT	N=2					
	3.00-3.45	3	SPT	N=0			. . . at 3.15m fragment of a ceramic tile found.	3.20	
					1		Medium dense to dense light orangish brown very gravelly SAND. Sand is fine to coarse. Gravel is angular to rounded fine to coarse flint and sandstone. (TAPLOW GRAVEL)	(1.25)	
	4.00-4.45	4	SPT	N=53				4.45	
							Borehole terminated at 4.45m depth.		

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Terminated at 4.00m.
2. Water strike at 3.50m depth.
3. Hole unstable in sands at depths >3.20m.
4. Note: Elevation data may be skewed due to poor signal quality when surveying.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Premier Compact 110**	**PJDrilling**	**JGriffin**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
St Clare Business Park, Hampton Hill	**Notting Hill Housing Trust**	**WS9**

Contract Ref:	Start:	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701	**29.03.18**	**16.52**	**E:514126.4 N:170780.5**	**2** of **2**
	End: **29.03.18**			

Progress	Samples / Tests				Water	Backfill & Instru-mentation	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window sampling	**Premier Compact 110**	**PJDrilling**	**JGriffin**	

WINDOW SAMPLE LOG

Contract:	Client:	Window Sample:
St Clare Business Park, Hampton Hill	**Notting Hill Housing Trust**	**WS10**

Contract Ref:	Start:	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701	**29.03.18** End: **29.03.18**	**16.56**	**E:514113.1 N:170757.2**	**1** of **1**

Progress	Samples / Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
							MADE GROUND: Tarmac.	0.05	
							MADE GROUND: Red brick sub-base.	0.13	
							MADE GROUND: Loose becoming medium dense light brown sandy GRAVEL of brick, concrete, flint and clinker. sand is fine to coarse. Gravel is rounded to angular fine to coarse. Cobbles are of breeze block.	(0.32) 0.45	
	0.45-1.10	1	ES	1xT, 1xJ, 1xV			MADE GROUND: Soft to firm dark brown soft sandy gravelly CLAY. Sand is fine. Gravel is brick, flint and clinker.	(0.65) 1.10	
	1.20-1.65	1	SPT	N=13			MADE GROUND: Firm light grey mottled orange with black staining soft sandy very gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse. Gravel is flint and clinker.	1.30	
	1.50-1.70	2	ES	1xT, 1xJ, 1xV			MADE GROUND: Firm to stiff orange slightly sandy very gravelly CLAY. Sand is fine to coarse. Gravel is rounded to angular fine to coarse flint.	1.50	
	2.00-2.15	2	SPT	NP			Dense becoming very dense orangish brown sandy GRAVEL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse flint and sandstone. (TAPLOW GRAVEL) . . . at 1.60m pocket of light grey sand (~10cm).	(0.95) 2.45	
							Borehole terminated at 2.45m depth.		

Drilling Progress and Water Observations					
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)

General Remarks

1. Terminated at 2.00m depth due to refusal
2. Groundwater not encountered/ hole dry.
3. Note: Elevation data may be skewed due to poor signal quality when surveying.

All dimensions in metres | Scale: **1:25**

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Tracked window	**Premier 110**	**PJDrilling**	**JGriffin**	

BOREHOLE LOG

Contract:	Client:	Borehole:
St Clare Business Park, Hampton Hill	Notting Hill Housing Trust	BH4

Contract Ref:	Start: 26.03.18	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701	End: 27.03.18	13.68	E:514162.0 N:170863.6	1 of 3

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results					
						MADE GROUND: Tarmac.	0.10	
						MADE GROUND: Concrete.	0.20	
0.30	1	D				MADE GROUND: Stiff to firm dark brown gravelly very sandy CLAY. Sand is fine to coarse. Gravel is rounded to angular fine to coarse flint and occasional brick and concrete.		
0.30	3	ES	1xT, 1xJ, 1xV					
0.50	2	D						
1.20-1.65	1	SPT	N=5				(2.30)	
1.20-1.65	1	ES	1xT, 1xJ, 1xV					
1.75	3	D						
2.00-2.45	2	SPT	N=8					
2.00-2.45	4	D		1			2.50	
						Loose becoming medium dense orangish brown slightly clayey very gravelly SAND. Sand is fine to coarse. Gravel is rounded to angular flint and shell fragments. (TAPLOW GRAVEL)		
2.75	2	ES	1xT, 1xJ, 1xV					
3.00-3.45	3	SPT	N=14				(1.50)	
3.00	5	D						
3.75	6	D					4.00	
4.00-4.45	4	SPT	N=12			Soft becoming firm light brown slightly orange slight gravelly very sandy CLAY. Sand is fine. Gravel is angular fine flint and shell fragments.	(0.50)	
4.00-4.45	7	D					4.50	
						(TAPLOW GRAVEL and LONDON CLAY FORMATION interface)		
4.75	8	D				Firm to stiff poorly laminated blueish grey silty CLAY. (LONDON CLAY FORMATION)	(0.50)	
							5.00	
						Stiff to very stiff poorly laminated bluish grey silty CLAY with rare/occasional claystones. Claystones are thinly laminated, moderately strong ro strong. (LONDON CLAY FORMATION)		
6.00	9	D						
6.50-6.95	5	SPT	N=28					
6.50-6.75	10	D						
7.50	11	D						
7.50		HP	c_u=192					

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

1. Duel install (19mm and 50mm)
2. Groundwater standing at 2.40m.
3. Gravels unstable.
4. Note: Elevation data may be skewed due to poor signal quality when surveying.

All dimensions in metres | Scale: 1:50

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	Dando 2000	PJDrilling	JGriffin	

BOREHOLE LOG

Contract:	Client:	Borehole:
St Clare Business Park, Hampton Hill	Notting Hill Housing Trust	BH4

Contract Ref:	Start: 26.03.18 End: 27.03.18	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701		13.68	E:514162.0 N:170863.6	2 of 3

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results					
9.00	12	D				Stiff to very stiff poorly laminated bluish grey silty CLAY with rare/occasional claystones. Claystones are thinly laminated, moderately strong ro strong. (LONDON CLAY FORMATION) *(stratum copied from 5.00m from previous sheet)*	(15.00)	
9.50-9.95	6	SPT	N=29					
9.50-9.95	13	D						
10.50	14	D						
12.00	15	D						
12.50-12.65	7	SPT	NP					
12.50-12.95	16	D						
13.50	17	D						
15.00	18	D						
15.50-15.95	8	SPT	N=32					
15.50-15.95	19	D						
16.50	20	D						

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: 1:50

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	Dando 2000	PJDrilling	JGriffin	

BOREHOLE LOG

Contract:	Client:	Borehole:
St Clare Business Park, Hampton Hill	Notting Hill Housing Trust	BH4

Contract Ref:	Start: 26.03.18 End: 27.03.18	Ground Level (m AD):	National Grid Co-ordinate:	Sheet:
29701		13.68	E:514162.0 N:170863.6	3 of 3

Samples and In-situ Tests				Water	Backfill & Instru-mentation	Description of Strata	Depth (Thick ness)	Material Graphic Legend
Depth	No	Type	Results					
18.00	21	D				Stiff to very stiff poorly laminated bluish grey silty CLAY with rare/occasional claystones. Claystones are thinly laminated, moderately strong ro strong. (LONDON CLAY FORMATION) *(stratum copied from 5.00m from previous sheet)*	20.00	
18.50-18.95	9	SPT	N=32					
18.50-18.95	22	D						
19.25	23	D						
						Borehole terminated at 20.00m depth.		

Boring Progress and Water Observations					
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth

Chiselling / Slow Progress		
From	To	Duration (hh:mm)

General Remarks

All dimensions in metres | Scale: 1:50

Method Used:	Plant Used:	Drilled By:	Logged By:	Checked By:
Inspection pit + Cable percussion	Dando 2000	PJDrilling	JGriffin	

APPENDIX I
MONITORING DATA

IN-SITU GAS MONITORING RESULTS

[Pressures]	Previous	During	Start	End	Equipment Used & Remarks
Round 1	Rising	Fluctuating	1011	1017	GFM430 + Weather: Sunny + Ground: Damp + Wind: Light + Air Temp: 10DegC
Round 2	Rising	Fluctuating	1019	1018	GFM430 + Weather: Sunny + Ground: Dry + Wind: Medium + Air Temp: 15DegC
Round 3	Rising	Fluctuating	1016	1015	GFM430 + Weather: Sunny + Ground: Dry + Wind: Light + Air Temp: 15DegC
Round 4	Rising	Fluctuating	1026	1026	GFM430 + Weather: Sunny + Ground: Dry + Wind: Light + Air Temp: 15DegC
Round 5	Rising	Fluctuating	1018	1019	GFM430 + Weather: Overcast + Ground: Dry + Air Temp: 20DegC
Round 6	Falling	Constant	1011	1011	GA5000 + Weather: Cloudy/Rainy + Ground: Wet + Wind: Strong + Air Temp: 20DegC

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)
BH4	2	50	1	4.00	3.63	3.00 to 4.00	05/04/2018 12:01:00	1018	1018	$40.0_{(I)}$	1.78	0.0	0.0	20.3	0.0	-	-	-
BH4	2	50	1		---	3.00 to 4.00	15 secs	-	-	$0.0_{(SS)}$	-	1.4	0.0	20.3	0.0	-	-	-
BH4	2	50	1		---	3.00 to 4.00	30 secs	-	-	-	-	1.4	0.0	20.2	0.0	-	-	-
BH4	2	50	1		---	3.00 to 4.00	60 secs	-	-	-	-	1.4	0.0	20.2	0.0	-	-	-
BH4	2	50	1		---	3.00 to 4.00	90 secs	-	-	-	-	1.5	0.0	20.1	0.0	-	-	-
BH4	2	50	1		---	3.00 to 4.00	120 secs	-	-	-	-	1.5	0.0	20.1	0.0	-	-	-
BH4	2	50	1		---	3.00 to 4.00	180 secs	-	-	-	-	1.5	0.0	20.1	0.0	-	-	-
BH4	1	19	1	2.00	1.91	0.50 to 2.00	05/04/2018 13:01:00	1018	1018	$0.0_{(I)}$	1.78	0.0	0.0	21.1	0.0	-	-	-
BH4	1	19	1		---	0.50 to 2.00	15 secs	-	-	$0.0_{(SS)}$	-	0.9	0.0	20.2	0.0	-	-	-
BH4	1	19	1		---	0.50 to 2.00	30 secs	-	-	-	-	0.9	0.0	20.2	0.0	-	-	-
BH4	1	19	1		---	0.50 to 2.00	60 secs	-	-	-	-	1.0	0.0	22.0	0.0	-	-	-
BH4	1	19	1		---	0.50 to 2.00	90 secs	-	-	-	-	1.2	0.0	19.7	0.0	-	-	-
BH4	1	19	1		---	0.50 to 2.00	120 secs	-	-	-	-	1.3	0.0	19.5	0.0	-	-	-
BH4	1	19	1		---	0.50 to 2.00	180 secs	-	-	-	-	1.5	0.0	19.3	0.0	-	-	-
BH4	1	19	2	2.00	1.90	0.50 to 2.00	17/04/2018 12:01:00	1020	1020	$0.0_{(I)}$	1.75	0.0	0.0	21.2	0.0	-	-	-
BH4	1	19	2		---	0.50 to 2.00	15 secs	-	-	$0.0_{(SS)}$	-	1.6	0.0	19.3	0.0	-	-	-
BH4	1	19	2		---	0.50 to 2.00	30 secs	-	-	-	-	1.7	0.0	19.1	0.0	-	-	-
BH4	1	19	2		---	0.50 to 2.00	60 secs	-	-	-	-	1.7	0.0	19.1	0.0	-	-	-

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

Anerley Court
Half Moon Lane
Hildenborough
Tonbridge
Kent, TN11 9HU

Compiled By	Date	Checked By	Date
	24/08/18		

Contract Ref: **29701**

Contract: **St Clare Business Park, Hampton Hill**

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)
BH4	1	19	2		---	0.50 to 2.00	90 secs	-	-	-	-	1.8	0.0	19.0	0.0	-	-	-
BH4	1	19	2		---	0.50 to 2.00	120 secs	-	-	-	-	1.8	0.0	18.9	0.0	-	-	-
BH4	1	19	2		---	0.50 to 2.00	180 secs	-	-	-	-	2.2	0.0	19.0	0.0	-	-	-
BH4	2	50	2	4.00	3.60	3.00 to 4.00	17/04/2018 13:01:00	1019	1019	$30.0_{(I)}$	1.77	0.0	0.0	21.0	0.0	-	-	-
BH4	2	50	2		---	3.00 to 4.00	15 secs	-	-	$0.0_{(SS)}$	-	2.3	0.0	19.5	0.0	-	-	-
BH4	2	50	2		---	3.00 to 4.00	30 secs	-	-	-	-	2.3	0.0	19.1	0.0	-	-	-
BH4	2	50	2		---	3.00 to 4.00	60 secs	-	-	-	-	2.4	0.0	19.3	0.0	-	-	-
BH4	2	50	2		---	3.00 to 4.00	90 secs	-	-	-	-	2.3	0.0	19.2	0.0	-	-	-
BH4	2	50	2		---	3.00 to 4.00	120 secs	-	-	-	-	2.4	0.0	19.2	0.0	-	-	-
BH4	2	50	2		---	3.00 to 4.00	180 secs	-	-	-	-	2.4	0.0	19.2	0.0	-	-	-
BH4	1	19	3	2.00	1.92	0.50 to 2.00	10/05/2018 12:00:00	1016	1016	$0.0_{(I)}$	1.91	0.0	0.0	22.0	0.0	-	-	-
BH4	1	19	3		---	0.50 to 2.00	15 secs	-	-	$0.0_{(SS)}$	-	1.6	0.0	20.0	0.0	-	-	-
BH4	1	19	3		---	0.50 to 2.00	30 secs	-	-	-	-	1.6	0.0	19.8	0.0	-	-	-
BH4	1	19	3		---	0.50 to 2.00	60 secs	-	-	-	-	1.7	0.0	19.7	0.0	-	-	-
BH4	1	19	3		---	0.50 to 2.00	90 secs	-	-	-	-	1.7	0.0	19.6	0.0	-	-	-
BH4	2	50	3	4.00	3.60	3.00 to 4.00	10/05/2018 12:05:00	1016	1016	$-50.0_{(I)}$	1.94	0.0	0.0	21.9	0.0	-	-	-
BH4	2	50	3		---	3.00 to 4.00	15 secs	-	-	$0.0_{(SS)}$	-	1.5	0.0	20.6	0.0	-	-	-
BH4	2	50	3		---	3.00 to 4.00	30 secs	-	-	-	-	1.7	0.0	20.3	0.0	-	-	-
BH4	2	50	3		---	3.00 to 4.00	60 secs	-	-	-	-	1.8	0.0	20.1	0.0	-	-	-
BH4	2	50	3		---	3.00 to 4.00	90 secs	-	-	-	-	1.8	0.0	20.0	0.0	-	-	-
BH4	2	50	3		---	3.00 to 4.00	120 secs	-	-	-	-	1.9	0.0	19.9	0.0	-	-	-
BH4	2	50	4	4.00	3.51	3.00 to 4.00	18/05/2018 12:00:00	1026	1026	$-7.0_{(I)}$	2.00	0.0	0.0	21.3	0.0	11.0	-	-
BH4	2	50	4		---	3.00 to 4.00	15 secs	-	-	$0.0_{(SS)}$	-	0.0	0.0	20.5	0.0	-	-	-
BH4	2	50	4		---	3.00 to 4.00	30 secs	-	-	-	-	0.8	0.0	20.4	0.0	-	-	-
BH4	2	50	4		---	3.00 to 4.00	60 secs	-	-	-	-	0.8	0.0	20.4	0.0	-	-	-

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

Anerley Court
Half Moon Lane
Hildenborough
Tonbridge
Kent, TN11 9HU

Compiled By	Date	Checked By	Date	Contract Ref:
	24/08/18			**29701**

Contract: **St Clare Business Park, Hampton Hill**

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)
BH4	2	50	4		---	3.00 to 4.00	90 secs	-	-	-	-	0.8	0.0	20.4	0.0	-	-	-
BH4	1	19	4	2.00	1.92	0.50 to 2.00	18/05/2018 13:00:00	1026	1026	$0.0_{(I)}$	DRY	0.0	0.0	20.9	0.0	10.8	-	-
BH4	1	19	4		---	0.50 to 2.00	15 secs	-	-	$0.0_{(SS)}$	-	1.0	0.0	20.1	0.0	-	-	-
BH4	1	19	4		---	0.50 to 2.00	30 secs	-	-	-	-	1.0	0.0	20.1	0.0	-	-	-
BH4	1	19	4		---	0.50 to 2.00	60 secs	-	-	-	-	1.0	0.0	20.0	0.0	-	-	-
BH4	1	19	4		---	0.50 to 2.00	90 secs	-	-	-	-	1.1	0.0	20.0	0.0	-	-	-
BH4	1	19	4		---	0.50 to 2.00	120 secs	-	-	-	-	1.2	0.0	20.0	0.0	-	-	-
BH4	1	19	5	2.00	1.90	0.50 to 2.00	01/06/2018	1018	1018	$0.0_{(I)}$	DRY	0.0	0.0	21.0	0.0	-	-	-
BH4	1	19	5		---	0.50 to 2.00	30 secs	-	-	$0.0_{(SS)}$	-	1.8	0.0	18.9	0.0	-	-	-
BH4	1	19	5		---	0.50 to 2.00	60 secs	-	-	-	-	1.9	0.0	18.8	0.0	-	-	-
BH4	1	19	5		---	0.50 to 2.00	120 secs	-	-	-	-	1.9	0.0	18.6	0.0	-	-	-
BH4	1	19	6	2.00	1.90	0.50 to 2.00	23/08/2018	1011	1011	$0.0_{(I)}$	DRY	0.1	0.0	20.9	0.0	0.5	0	0
BH4	1	19	6		---	0.50 to 2.00	15 secs	-	-	$0.0_{(SS)}$	-	4.7	0.0	17.5	0.0	-	0	0
BH4	1	19	6		---	0.50 to 2.00	30 secs	-	-	-	-	4.7	0.0	14.3	0.0	-	0	0
BH4	1	19	6		---	0.50 to 2.00	60 secs	-	-	-	-	4.8	0.0	14.1	0.0	-	0	0
BH4	1	19	6		---	0.50 to 2.00	90 secs	-	-	-	-	4.8	0.0	14.0	0.0	-	0	0
BH4	1	19	6		---	0.50 to 2.00	120 secs	-	-	-	-	4.8	0.0	14.0	0.0	-	0	0
BH4	1	19	6		---	0.50 to 2.00	180 secs	-	-	-	-	4.8	0.0	14.0	0.0	-	0	0
BH4	1	19	6		---	0.50 to 2.00	240 secs	-	-	-	-	4.8	0.0	13.9	0.0	-	0	0
BH4	1	19	6		---	0.50 to 2.00	300 secs	-	-	-	-	4.8	0.0	13.9	0.0	-	0	0
BH4	2	50	6	4.00	3.50	3.00 to 4.00	23/08/2018 13:01:00	1011	1011	$0.0_{(I)}$	2.27	0.1	0.0	20.9	0.0	0.0	0	0
BH4	2	50	6		---	3.00 to 4.00	15 secs	-	-	$0.0_{(SS)}$	-	4.3	0.0	18.0	0.0	-	0	0
BH4	2	50	6		---	3.00 to 4.00	30 secs	-	-	-	-	4.4	0.0	15.0	0.0	-	0	0
BH4	2	50	6		---	3.00 to 4.00	60 secs	-	-	-	-	4.4	0.0	14.8	0.0	-	0	0
BH4	2	50	6		---	3.00 to 4.00	90 secs	-	-	-	-	4.5	0.0	14.7	0.0	-	0	0

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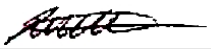
Anerley Court
Half Moon Lane
Hildenborough
Tonbridge
Kent, TN11 9HU

Compiled By	Date	Checked By	Date	Contract Ref:
	**24/08/18**			**29701**

Contract: **St Clare Business Park, Hampton Hill**

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)
BH4	2	50	6		---	3.00 to 4.00	120 secs	-	-	-	-	4.5	0.0	14.6	0.0	-	0	0
BH4	2	50	6		---	3.00 to 4.00	180 secs	-	-	-	-	4.5	0.0	14.6	0.0	-	0	0
BH4	2	50	6		---	3.00 to 4.00	240 secs	-	-	-	-	4.6	0.0	14.5	0.0	-	0	0
BH4	2	50	6		---	3.00 to 4.00	300 secs	-	-	-	-	4.6	0.0	14.5	0.0	-	0	0
WS2	1	33	1	3.65	3.49	0.65 to 3.65	05/04/2018 12:01:00	1016	1016	$0.0_{(I)}$	2.66	0.0	0.0	20.9	0.0	-	-	-
WS2	1	33	1		---	0.65 to 3.65	15 secs	-	-	$0.0_{(SS)}$	-	1.7	0.0	18.2	0.0	-	-	-
WS2	1	33	1		---	0.65 to 3.65	30 secs	-	-	-	-	2.1	0.0	16.6	0.0	-	-	-
WS2	1	33	1		---	0.65 to 3.65	60 secs	-	-	-	-	3.3	0.0	14.5	0.0	-	-	-
WS2	1	33	1		---	0.65 to 3.65	90 secs	-	-	-	-	3.6	0.0	13.7	0.0	-	-	-
WS2	1	33	1		---	0.65 to 3.65	120 secs	-	-	-	-	3.9	0.0	13.5	0.0	-	-	-
WS2	1	33	1		---	0.65 to 3.65	180 secs	-	-	-	-	4.8	0.0	11.8	0.0	-	-	-
WS2	1	33	2	3.65	3.48	0.65 to 3.65	17/04/2018 12:01:00	1018	1018	$0.0_{(I)}$	2.60	0.0	0.0	21.9	0.0	-	-	-
WS2	1	33	2		---	0.65 to 3.65	15 secs	-	-	$0.0_{(SS)}$	-	4.5	0.0	12.4	0.0	-	-	-
WS2	1	33	2		---	0.65 to 3.65	30 secs	-	-	-	-	6.5	0.0	8.5	0.0	-	-	-
WS2	1	33	2		---	0.65 to 3.65	60 secs	-	-	-	-	8.5	0.0	3.8	0.0	-	-	-
WS2	1	33	2		---	0.65 to 3.65	90 secs	-	-	-	-	8.8	0.0	3.4	0.0	-	-	-
WS2	1	33	2		---	0.65 to 3.65	120 secs	-	-	-	-	8.6	0.0	3.3	0.0	-	-	-
WS2	1	33	2		---	0.65 to 3.65	180 secs	-	-	-	-	8.9	0.0	2.9	0.0	-	-	-
WS2	1	33	2		---	0.65 to 3.65	240 secs	-	-	-	-	8.6	0.0	2.9	0.0	-	-	-
WS2	1	33	3	3.65	3.48	0.65 to 3.65	10/05/2018 12:00:00	1016	1016	$0.0_{(I)}$	2.38	0.0	0.0	21.2	0.0	-	-	-
WS2	1	33	3		---	0.65 to 3.65	15 secs	-	-	$0.0_{(SS)}$	-	6.5	0.0	10.2	0.0	-	-	-
WS2	1	33	3		---	0.65 to 3.65	30 secs	-	-	-	-	8.4	0.0	7.3	0.0	-	-	-
WS2	1	33	3		---	0.65 to 3.65	60 secs	-	-	-	-	8.4	0.0	5.6	0.0	-	-	-
WS2	1	33	3		---	0.65 to 3.65	90 secs	-	-	-	-	8.6	0.0	5.0	0.0	-	-	-

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

Anerley Court
Half Moon Lane
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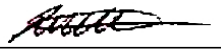
Tonbridge
Kent, TN11 9HU

Compiled By	Date	Checked By	Date	Contract Ref:
	**24/08/18**			**29701**

Contract: **St Clare Business Park, Hampton Hill**

AGS

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)
WS2	1	33	3		---	0.65 to 3.65	120 secs	-	-	-	-	9.2	0.0	4.4	0.0	-	-	-
WS2	1	33	3		---	0.65 to 3.65	180 secs	-	-	-	-	9.5	0.0	3.5	0.0	-	-	-
WS2	1	33	4	3.65	3.41	0.65 to 3.65	18/05/2018 12:00:00	1026	1026	$0.4_{(I)}$	2.93	0.1	0.0	21.7	0.0	0.4	-	-
WS2	1	33	4		---	0.65 to 3.65	15 secs	-	-	$0.0_{(SS)}$	-	0.5	0.0	21.0	0.0	-	-	-
WS2	1	33	4		---	0.65 to 3.65	30 secs	-	-	-	-	0.5	0.0	20.9	0.0	-	-	-
WS2	1	33	4		---	0.65 to 3.65	60 secs	-	-	-	-	0.7	0.0	20.2	0.0	-	-	-
WS2	1	33	4		---	0.65 to 3.65	90 secs	-	-	-	-	2.3	0.0	17.5	0.0	-	-	-
WS2	1	33	4		---	0.65 to 3.65	120 secs	-	-	-	-	3.7	0.0	15.1	0.0	-	-	-
WS2	1	33	4		---	0.65 to 3.65	180 secs	-	-	-	-	5.0	0.0	12.6	0.0	-	-	-
WS2	1	33	4		---	0.65 to 3.65	240 secs	-	-	-	-	6.0	0.0	10.9	0.0	-	-	-
WS2	1	33	4		---	0.65 to 3.65	300 secs	-	-	-	-	6.6	0.0	10.8	0.0	-	-	-
WS2	1	33	5	3.65	3.40	0.65 to 3.65	01/06/2018	1018	1018	$0.0_{(I)}$	2.80	0.0	0.0	21.0	0.0	-	-	-
WS2	1	33	5		---	0.65 to 3.65	30 secs	-	-	$0.0_{(SS)}$	-	5.5	0.0	11.3	0.0	-	-	-
WS2	1	33	5		---	0.65 to 3.65	60 secs	-	-	-	-	6.0	0.0	9.5	0.0	-	-	-
WS2	1	33	5		---	0.65 to 3.65	120 secs	-	-	-	-	7.4	0.0	7.4	0.0	-	-	-
WS2	1	33	5		---	0.65 to 3.65	180 secs	-	-	-	-	8.4	0.0	6.4	0.0	-	-	-
WS2	1	33	6	3.65	3.43	0.65 to 3.65	23/08/2018	1011	1011	$0.0_{(I)}$	DRY	0.1	0.0	20.9	0.0	0.0	0	0
WS2	1	33	6		---	0.65 to 3.65	15 secs	-	-	$0.0_{(SS)}$	-	7.5	0.0	13.4	0.0	-	0	0
WS2	1	33	6		---	0.65 to 3.65	30 secs	-	-	-	-	9.3	0.0	9.7	0.0	-	0	0
WS2	1	33	6		---	0.65 to 3.65	60 secs	-	-	-	-	12.5	0.0	5.0	0.0	-	0	0
WS2	1	33	6		---	0.65 to 3.65	90 secs	-	-	-	-	14.2	0.0	2.7	0.0	-	0	0
WS2	1	33	6		---	0.65 to 3.65	120 secs	-	-	-	-	14.5	0.0	2.4	0.0	-	0	0
WS2	1	33	6		---	0.65 to 3.65	180 secs	-	-	-	-	14.8	0.0	2.0	0.0	-	0	0
WS2	1	33	6		---	0.65 to 3.65	240 secs	-	-	-	-	14.3	0.0	2.7	0.0	-	0	0
WS2	1	33	6		---	0.65 to 3.65	300 secs	-	-	-	-	14.7	0.0	2.4	0.0	-	0	0

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

Anerley Court
Half Moon Lane
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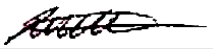
Compiled By	Date	Checked By	Date	Contract Ref:
	**24/08/18**			**29701**

Contract: **St Clare Business Park, Hampton Hill**

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)
WS2	1	33	6		---	0.65 to 3.65	360 secs	-	-	-	-	15.2	0.0	1.8	0.0	-	0	0
WS2	1	33	6		---	0.65 to 3.65	420 secs	-	-	-	-	15.7	0.0	1.4	0.0	-	0	0
WS2	1	33	6		---	0.65 to 3.65	480 secs	-	-	-	-	15.3	0.0	1.7	0.0	-	0	0
WS2	1	33	6		---	0.65 to 3.65	540 secs	-	-	-	-	15.3	0.0	1.7	0.0	-	0	0
WS2	1	33	6		---	0.65 to 3.65	600 secs	-	-	-	-	15.3	0.0	1.5	0.0	-	0	0
WS4	1	33	1	1.30	1.20	0.30 to 1.30	05/04/2018 12:01:00	1017	1017	$0.0_{(I)}$	DRY	0.0	0.0	20.3	0.0	-	-	-
WS4	1	33	1		---	0.30 to 1.30	15 secs	-	-	$0.0_{(SS)}$	-	0.1	0.0	20.1	0.0	-	-	-
WS4	1	33	1		---	0.30 to 1.30	30 secs	-	-	-	-	0.1	0.0	19.9	0.0	-	-	-
WS4	1	33	1		---	0.30 to 1.30	60 secs	-	-	-	-	0.2	0.0	20.1	0.0	-	-	-
WS4	1	33	1		---	0.30 to 1.30	90 secs	-	-	-	-	0.3	0.0	19.9	0.0	-	-	-
WS4	1	33	1		---	0.30 to 1.30	120 secs	-	-	-	-	0.3	0.0	19.8	0.0	-	-	-
WS4	1	33	1		---	0.30 to 1.30	180 secs	-	-	-	-	0.3	0.0	19.8	0.0	-	-	-
WS4	1	33	2	1.30	1.22	0.30 to 1.30	17/04/2018 12:01:00	1018	1018	$0.0_{(I)}$	DRY	0.0	0.0	21.4	0.0	-	-	-
WS4	1	33	2		---	0.30 to 1.30	15 secs	-	-	$0.0_{(SS)}$	-	0.1	0.0	20.7	0.0	-	-	-
WS4	1	33	2		---	0.30 to 1.30	30 secs	-	-	-	-	0.2	0.0	20.4	0.0	-	-	-
WS4	1	33	2		---	0.30 to 1.30	60 secs	-	-	-	-	0.4	0.0	20.0	0.0	-	-	-
WS4	1	33	2		---	0.30 to 1.30	90 secs	-	-	-	-	0.5	0.0	19.9	0.0	-	-	-
WS4	1	33	2		---	0.30 to 1.30	120 secs	-	-	-	-	0.6	0.0	19.8	0.0	-	-	-
WS4	1	33	2		---	0.30 to 1.30	180 secs	-	-	-	-	0.7	0.0	19.7	0.0	-	-	-
WS4	1	33	2		---	0.30 to 1.30	240 secs	-	-	-	-	0.7	0.0	19.6	0.0	-	-	-
WS4	1	33	3	1.30	1.21	0.30 to 1.30	10/05/2018 12:00:00	1015	1015	$0.0_{(I)}$	DRY	0.2	0.0	22.2	0.0	-	-	-
WS4	1	33	3		---	0.30 to 1.30	15 secs	-	-	$0.0_{(SS)}$	-	1.8	0.0	19.4	0.0	-	-	-
WS4	1	33	3		---	0.30 to 1.30	30 secs	-	-	-	-	1.8	0.0	19.1	0.0	-	-	-
WS4	1	33	3		---	0.30 to 1.30	60 secs	-	-	-	-	1.8	0.0	19.1	0.0	-	-	-

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)
WS4	1	33	3		---	0.30 to 1.30	90 secs	-	-	-	-	1.9	0.0	19.1	0.0	-	-	-
WS4	1	33	4	1.30	1.20	0.30 to 1.30	18/05/2018 12:00:00	1027	1027	$0.0_{(I)}$	DRY	0.0	0.0	21.5	0.0	14.5	-	-
WS4	1	33	4		---	0.30 to 1.30	15 secs	-	-	$0.0_{(SS)}$	-	2.0	0.0	19.0	0.0	-	-	-
WS4	1	33	4		---	0.30 to 1.30	30 secs	-	-	-	-	2.0	0.0	18.7	0.0	-	-	-
WS4	1	33	4		---	0.30 to 1.30	60 secs	-	-	-	-	2.0	0.0	18.7	0.0	-	-	-
WS4	1	33	4		---	0.30 to 1.30	90 secs	-	-	-	-	2.1	0.0	18.6	0.0	-	-	-
WS4	1	33	4		---	0.30 to 1.30	120 secs	-	-	-	-	2.1	0.0	18.6	0.0	-	-	-
WS4	1	33	5	1.30	1.20	0.30 to 1.30	01/06/2018	1018	1018	$0.0_{(I)}$	DRY	0.0	0.0	21.0	0.0	-	-	-
WS4	1	33	5		---	0.30 to 1.30	30 secs	-	-	$0.0_{(SS)}$	-	2.3	0.0	17.1	0.0	-	-	-
WS4	1	33	5		---	0.30 to 1.30	60 secs	-	-	-	-	2.3	0.0	16.9	0.0	-	-	-
WS4	1	33	5		---	0.30 to 1.30	120 secs	-	-	-	-	2.4	0.0	16.8	0.0	-	-	-
WS4	1	33	5		---	0.30 to 1.30	180 secs	-	-	-	-	2.5	0.0	16.8	0.0	-	-	-
WS4	1	33	6	1.30	1.22	0.30 to 1.30	23/08/2018	1011	1011	$0.0_{(I)}$	DRY	0.1	0.0	20.9	0.0	0.2	0	0
WS4	1	33	6		---	0.30 to 1.30	15 secs	-	-	$0.1_{(SS)}$	-	4.7	0.0	17.3	0.0	-	0	0
WS4	1	33	6		---	0.30 to 1.30	30 secs	-	-	-	-	4.7	0.0	14.7	0.0	-	0	0
WS4	1	33	6		---	0.30 to 1.30	60 secs	-	-	-	-	4.8	0.0	14.4	0.0	-	0	0
WS4	1	33	6		---	0.30 to 1.30	90 secs	-	-	-	-	4.8	0.0	14.4	0.0	-	0	0
WS4	1	33	6		---	0.30 to 1.30	120 secs	-	-	-	-	4.9	0.0	14.4	0.0	-	0	0
WS4	1	33	6		---	0.30 to 1.30	180 secs	-	-	-	-	4.9	0.0	14.4	0.0	-	0	0
WS4	1	33	6		---	0.30 to 1.30	240 secs	-	-	-	-	4.9	0.0	14.4	0.0	-	0	0
WS4	1	33	6		---	0.30 to 1.30	300 secs	-	-	-	-	4.9	0.0	14.4	0.0	-	0	0
WS5	1	33	1	3.00	2.50	2.00 to 3.00	05/04/2018 12:01:00	1016	1016	$0.0_{(I)}$	1.48	0.0	0.0	20.7	0.0	-	-	-
WS5	1	33	1		---	2.00 to 3.00	15 secs	-	-	$0.0_{(SS)}$	-	0.5	0.0	22.7	0.0	-	-	-
WS5	1	33	1		---	2.00 to 3.00	30 secs	-	-	-	-	0.5	0.0	20.0	0.0	-	-	-

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

Anerley Court
Half Moon Lane
Hildenborough
Tonbridge
Kent, TN11 9HU

Compiled By	Date	Checked By	Date	Contract Ref:
	24/08/18			**29701**

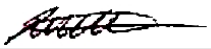
Contract: **St Clare Business Park, Hampton Hill**

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)
WS5	1	33	1		---	2.00 to 3.00	60 secs	-	-	-	-	0.5	0.0	20.5	0.0	-	-	-
WS5	1	33	1		---	2.00 to 3.00	90 secs	-	-	-	-	0.5	0.0	19.7	0.0	-	-	-
WS5	1	33	1		---	2.00 to 3.00	120 secs	-	-	-	-	0.5	0.0	19.9	0.0	-	-	-
WS5	1	33	1		---	2.00 to 3.00	180 secs	-	-	-	-	0.6	0.0	19.7	0.0	-	-	-
WS5	1	33	2	3.00	2.51	2.00 to 3.00	17/04/2018 12:01:00	1018	1018	$0.0_{(I)}$	1.46	0.0	0.0	21.6	0.0	-	-	-
WS5	1	33	2		---	2.00 to 3.00	15 secs	-	-	$0.0_{(SS)}$	-	0.7	0.0	20.0	0.0	-	-	-
WS5	1	33	2		---	2.00 to 3.00	30 secs	-	-	-	-	0.7	0.0	19.8	0.0	-	-	-
WS5	1	33	2		---	2.00 to 3.00	60 secs	-	-	-	-	0.7	0.0	19.7	0.0	-	-	-
WS5	1	33	2		---	2.00 to 3.00	90 secs	-	-	-	-	0.7	0.0	19.7	0.0	-	-	-
WS5	1	33	2		---	2.00 to 3.00	120 secs	-	-	-	-	0.7	0.0	19.7	0.0	-	-	-
WS5	1	33	3	3.00	2.51	2.00 to 3.00	10/05/2018 12:00:00	1015	1015	$0.0_{(I)}$	1.67	0.1	0.0	22.4	0.0	-	-	-
WS5	1	33	3		---	2.00 to 3.00	15 secs	-	-	$0.0_{(SS)}$	-	1.1	0.0	19.8	0.0	-	-	-
WS5	1	33	3		---	2.00 to 3.00	30 secs	-	-	-	-	1.1	0.0	19.6	0.0	-	-	-
WS5	1	33	3		---	2.00 to 3.00	60 secs	-	-	-	-	1.1	0.0	19.6	0.0	-	-	-
WS5	1	33	3		---	2.00 to 3.00	90 secs	-	-	-	-	1.1	0.0	19.6	0.0	-	-	-
WS5	1	33	3		---	2.00 to 3.00	120 secs	-	-	-	-	1.1	0.0	19.4	0.0	-	-	-
WS5	1	33	4	3.00	2.50	2.00 to 3.00	18/05/2018 12:00:00	1027	1027	$0.0_{(I)}$	1.80	0.0	0.0	21.4	0.0	0.0	-	-
WS5	1	33	4		---	2.00 to 3.00	15 secs	-	-	$0.0_{(SS)}$	-	0.9	0.0	20.6	0.0	-	-	-
WS5	1	33	4		---	2.00 to 3.00	30 secs	-	-	-	-	0.9	0.0	20.4	0.0	-	-	-
WS5	1	33	4		---	2.00 to 3.00	60 secs	-	-	-	-	0.9	0.0	20.4	0.0	-	-	-
WS5	1	33	4		---	2.00 to 3.00	90 secs	-	-	-	-	0.9	0.0	20.4	0.0	-	-	-
WS5	1	33	4		---	2.00 to 3.00	120 secs	-	-	-	-	0.9	0.0	20.3	0.0	-	-	-
WS5	1	33	5	3.00	2.50	2.00 to 3.00	01/06/2018	1018	1018	$0.0_{(I)}$	1.65	0.0	0.0	21.0	0.0	-	-	-
WS5	1	33	5		---	2.00 to 3.00	30 secs	-	-	$0.0_{(SS)}$	-	0.9	0.0	19.4	0.0	-	-	-
WS5	1	33	5		---	2.00 to 3.00	60 secs	-	-	-	-	0.9	0.0	19.3	0.0	-	-	-

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

Anerley Court
Half Moon Lane
Hildenborough
Tonbridge
Kent, TN11 9HU

Compiled By	Date	Checked By	Date
	**24/08/18**		

Contract Ref: **29701**

Contract: **St Clare Business Park, Hampton Hill**

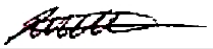
AGS

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)
WS5	1	33	5		---	2.00 to 3.00	120 secs	-	-	-	-	0.9	0.0	19.2	0.0	-	-	-
WS5	1	33	5		---	2.00 to 3.00	180 secs	-	-	-	-	1.1	0.0	19.0	0.0	-	-	-
WS5	1	33	6	3.00	2.48	2.00 to 3.00	23/08/2018	1011	1011	$0.0_{(I)}$	2.11	4.1	0.0	20.9	0.0	1.1	0	0
WS5	1	33	6		---	2.00 to 3.00	15 secs	-	-	$0.0_{(SS)}$	-	4.1	0.0	16.5	0.0	-	0	0
WS5	1	33	6		---	2.00 to 3.00	30 secs	-	-	-	-	4.1	0.0	13.9	0.0	-	0	0
WS5	1	33	6		---	2.00 to 3.00	60 secs	-	-	-	-	4.2	0.0	13.1	0.0	-	0	0
WS5	1	33	6		---	2.00 to 3.00	90 secs	-	-	-	-	4.2	0.0	13.1	0.0	-	0	0
WS5	1	33	6		---	2.00 to 3.00	120 secs	-	-	-	-	4.2	0.0	13.1	0.0	-	0	0
WS5	1	33	6		---	2.00 to 3.00	180 secs	-	-	-	-	4.2	0.0	13.1	0.0	-	0	0
WS5	1	33	6		---	2.00 to 3.00	240 secs	-	-	-	-	4.2	0.0	13.0	0.0	-	0	0
WS5	1	33	6		---	2.00 to 3.00	300 secs	-	-	-	-	4.2	0.0	13.0	0.0	-	0	0
WS6	1	33	1	3.00	2.69	1.00 to 3.00	05/04/2018 12:01:00	1017	1017	$0.0_{(I)}$	1.49	0.0	0.0	20.3	0.0	-	-	-
WS6	1	33	1		---	1.00 to 3.00	15 secs	-	-	$0.0_{(SS)}$	-	0.0	0.0	19.0	0.0	-	-	-
WS6	1	33	1		---	1.00 to 3.00	30 secs	-	-	-	-	0.0	0.0	18.8	0.0	-	-	-
WS6	1	33	1		---	1.00 to 3.00	60 secs	-	-	-	-	0.0	0.0	18.7	0.0	-	-	-
WS6	1	33	1		---	1.00 to 3.00	90 secs	-	-	-	-	0.0	0.0	18.6	0.0	-	-	-
WS6	1	33	1		---	1.00 to 3.00	120 secs	-	-	-	-	0.0	0.0	18.6	0.0	-	-	-
WS6	1	33	1		---	1.00 to 3.00	180 secs	-	-	-	-	0.0	0.0	18.9	0.0	-	-	-
WS6	1	33	2	3.00	2.69	1.00 to 3.00	17/04/2018 12:01:00	1019	1019	$0.0_{(I)}$	1.55	0.0	0.0	21.9	0.0	-	-	-
WS6	1	33	2		---	1.00 to 3.00	15 secs	-	-	$0.0_{(SS)}$	-	0.0	0.0	19.3	0.0	-	-	-
WS6	1	33	2		---	1.00 to 3.00	30 secs	-	-	-	-	0.0	0.0	19.1	0.0	-	-	-
WS6	1	33	2		---	1.00 to 3.00	60 secs	-	-	-	-	0.0	0.0	19.0	0.0	-	-	-
WS6	1	33	2		---	1.00 to 3.00	90 secs	-	-	-	-	0.0	0.0	18.9	0.0	-	-	-
WS6	1	33	2		---	1.00 to 3.00	120 secs	-	-	-	-	0.0	0.0	18.9	0.0	-	-	-

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

Anerley Court
Half Moon Lane
Hildenborough
Tonbridge
Kent, TN11 9HU

Compiled By	Date	Checked By	Date	Contract Ref:
	**24/08/18**			**29701**

Contract: **St Clare Business Park, Hampton Hill**

AGS

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)
WS6	1	33	2		---	1.00 to 3.00	180 secs	-	-	-	-	0.0	0.0	19.2	0.0	-	-	-
WS6	1	33	3	3.00	2.67	1.00 to 3.00	10/05/2018 12:00:00	1018	1018	$0.0_{(I)}$	1.76	0.0	0.0	22.0	0.0	-	-	-
WS6	1	33	3		---	1.00 to 3.00	15 secs	-	-	$0.0_{(SS)}$	-	0.0	0.0	19.8	0.0	-	-	-
WS6	1	33	3		---	1.00 to 3.00	30 secs	-	-	-	-	0.0	0.0	19.6	0.0	-	-	-
WS6	1	33	3		---	1.00 to 3.00	60 secs	-	-	-	-	0.0	0.0	19.5	0.0	-	-	-
WS6	1	33	3		---	1.00 to 3.00	90 secs	-	-	-	-	0.0	0.0	19.4	0.0	-	-	-
WS6	1	33	3		---	1.00 to 3.00	120 secs	-	-	-	-	0.0	0.0	19.4	0.0	-	-	-
WS6	1	33	4	3.00	---	1.00 to 3.00	18/05/2018	-	-	-	-	-	-	-	-	-	-	-
	Remarks: Could not take readings. Van parked on top of well and driver was not available to move it.																	
WS6	1	33	5	3.00	2.70	1.00 to 3.00	01/06/2018	1018	1018	$0.0_{(I)}$	1.70	0.0	0.0	21.0	0.0	-	-	-
WS6	1	33	5		---	1.00 to 3.00	30 secs	-	-	$0.0_{(SS)}$	-	0.0	0.0	19.4	0.0	-	-	-
WS6	1	33	5		---	1.00 to 3.00	60 secs	-	-	-	-	0.0	0.0	19.3	0.0	-	-	-
WS6	1	33	5		---	1.00 to 3.00	120 secs	-	-	-	-	0.0	0.0	19.2	0.0	-	-	-
WS6	1	33	5		---	1.00 to 3.00	180 secs	-	-	-	-	0.0	0.0	19.0	0.0	-	-	-
WS6	1	33	6	3.00	2.65	1.00 to 3.00	23/08/2018	1011	1011	$0.1_{(I)}$	2.47	0.1	0.0	20.9	0.0	0.6	0	0
WS6	1	33	6		---	1.00 to 3.00	15 secs	-	-	$-0.1_{(SS)}$	-	0.9	0.0	19.9	0.0	-	0	0
WS6	1	33	6		---	1.00 to 3.00	30 secs	-	-	-	-	0.9	0.0	18.5	0.0	-	0	0
WS6	1	33	6		---	1.00 to 3.00	60 secs	-	-	-	-	0.9	0.0	18.4	0.0	-	0	0
WS6	1	33	6		---	1.00 to 3.00	90 secs	-	-	-	-	0.9	0.0	18.3	0.0	-	0	0
WS6	1	33	6		---	1.00 to 3.00	120 secs	-	-	-	-	0.9	0.0	18.2	0.0	-	0	0
WS6	1	33	6		---	1.00 to 3.00	180 secs	-	-	-	-	0.9	0.0	18.1	0.0	-	0	0
WS6	1	33	6		---	1.00 to 3.00	240 secs	-	-	-	-	1.0	0.0	18.0	0.0	-	0	0
WS6	1	33	6		---	1.00 to 3.00	300 secs	-	-	-	-	1.0	0.0	17.9	0.0	-	0	0
WS8	1	33	1	2.50	2.19	1.00 to 2.50	05/04/2018 12:01:00	1015	1015	$0.0_{(I)}$	DRY	0.0	0.0	21.2	0.0	-	-	-

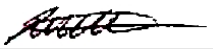
Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)
WS8	1	33	1		---	1.00 to 2.50	15 secs	-	-	$0.0_{(SS)}$	-	0.0	0.0	21.2	0.0	-	-	-
WS8	1	33	1		---	1.00 to 2.50	30 secs	-	-	-	-	0.0	0.0	20.9	0.0	-	-	-
WS8	1	33	1		---	1.00 to 2.50	60 secs	-	-	-	-	0.0	0.0	20.9	0.0	-	-	-
WS8	1	33	1		---	1.00 to 2.50	90 secs	-	-	-	-	0.0	0.0	20.8	0.0	-	-	-
WS8	1	33	1		---	1.00 to 2.50	120 secs	-	-	-	-	0.1	0.0	20.7	0.0	-	-	-
WS8	1	33	2	2.50	2.20	1.00 to 2.50	17/04/2018 12:01:00	1019	1019	$0.0_{(I)}$	DRY	0.0	0.0	20.4	0.0	-	-	-
WS8	1	33	2		---	1.00 to 2.50	15 secs	-	-	$0.0_{(SS)}$	-	1.3	0.0	19.3	0.0	-	-	-
WS8	1	33	2		---	1.00 to 2.50	30 secs	-	-	-	-	1.4	0.0	19.1	0.0	-	-	-
WS8	1	33	2		---	1.00 to 2.50	60 secs	-	-	-	-	1.4	0.0	19.1	0.0	-	-	-
WS8	1	33	2		---	1.00 to 2.50	90 secs	-	-	-	-	1.4	0.0	19.0	0.0	-	-	-
WS8	1	33	2		---	1.00 to 2.50	120 secs	-	-	-	-	1.4	0.0	19.0	0.0	-	-	-
WS8	1	33	2		---	1.00 to 2.50	180 secs	-	-	-	-	1.4	0.0	19.0	0.0	-	-	-
WS8	1	33	3	2.50	---	1.00 to 2.50	10/05/2018 12:00:00	1015	1015	$0.0_{(I)}$	-	0.0	0.0	20.1	0.0	-	-	-
WS8	1	33	3		---	1.00 to 2.50	15 secs	-	-	$0.0_{(SS)}$	-	1.6	0.0	20.0	0.0	-	-	-
WS8	1	33	3		---	1.00 to 2.50	30 secs	-	-	-	-	1.9	0.0	19.4	0.0	-	-	-
WS8	1	33	3		---	1.00 to 2.50	60 secs	-	-	-	-	1.9	0.0	19.3	0.0	-	-	-
WS8	1	33	3		---	1.00 to 2.50	90 secs	-	-	-	-	2.0	0.0	19.3	0.0	-	-	-
WS8	1	33	3		2.20	1.00 to 2.50	120 secs	-	-	-	DRY	2.0	0.0	19.3	0.0	-	-	-
WS8	1	33	4	2.50	---	1.00 to 2.50	18/05/2018 12:00:00	1026	1026	$0.0_{(I)}$	-	0.0	0.0	20.1	0.0	10.8	-	-
WS8	1	33	4		---	1.00 to 2.50	15 secs	-	-	$0.0_{(SS)}$	-	2.3	0.0	18.5	0.0	-	-	-
WS8	1	33	4		---	1.00 to 2.50	30 secs	-	-	-	-	2.3	0.0	18.2	0.0	-	-	-
WS8	1	33	4		---	1.00 to 2.50	60 secs	-	-	-	-	2.3	0.0	18.1	0.0	-	-	-
WS8	1	33	4		---	1.00 to 2.50	90 secs	-	-	-	-	2.3	0.0	18.1	0.0	-	-	-
WS8	1	33	4		2.21	1.00 to 2.50	120 secs	-	-	-	DRY	2.4	0.0	18.1	0.0	-	-	-
WS8	1	33	5	2.50	---	1.00 to 2.50	01/06/2018	1019	1019	$0.0_{(I)}$	-	0.0	0.0	21.0	0.0	-	-	-

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

Anerley Court
Half Moon Lane
Hildenborough
Tonbridge
Kent, TN11 9HU

Compiled By	Date	Checked By	Date	Contract Ref:
	**24/08/18**			**29701**

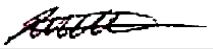
Contract: **St Clare Business Park, Hampton Hill**

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)
WS8	1	33	5		---	1.00 to 2.50	30 secs	-	-	$0.0_{(SS)}$	-	2.3	0.0	18.0	0.0	-	-	-
WS8	1	33	5		---	1.00 to 2.50	60 secs	-	-	-	-	2.4	0.0	17.8	0.0	-	-	-
WS8	1	33	5		---	1.00 to 2.50	120 secs	-	-	-	-	2.4	0.0	17.8	0.0	-	-	-
WS8	1	33	5		2.20	1.00 to 2.50	180 secs	-	-	-	DRY	2.4	0.0	17.8	0.0	-	-	-
WS9	1	33	1	4.00	3.56	0.70 to 4.00	05/04/2018 12:01:00	1011	1011	$0.0_{(I)}$	2.85	0.0	0.0	20.0	0.0	-	-	-
WS9	1	33	1		---	0.70 to 4.00	15 secs	-	-	$0.0_{(SS)}$	-	0.1	0.0	20.7	0.0	-	-	-
WS9	1	33	1		---	0.70 to 4.00	30 secs	-	-	-	-	0.1	0.0	22.1	0.0	-	-	-
WS9	1	33	1		---	0.70 to 4.00	60 secs	-	-	-	-	0.1	0.0	20.6	0.0	-	-	-
WS9	1	33	1		---	0.70 to 4.00	90 secs	-	-	-	-	0.5	0.0	20.1	0.0	-	-	-
WS9	1	33	1		---	0.70 to 4.00	120 secs	-	-	-	-	1.6	0.0	18.8	0.0	-	-	-
WS9	1	33	2	4.00	3.57	0.70 to 4.00	17/04/2018 12:01:00	1018	1018	$0.0_{(I)}$	2.90	0.0	0.0	21.6	0.0	-	-	-
WS9	1	33	2		---	0.70 to 4.00	15 secs	-	-	$0.0_{(SS)}$	-	3.6	0.0	3.4	0.0	-	-	-
WS9	1	33	2		---	0.70 to 4.00	30 secs	-	-	-	-	14.3	0.0	2.8	0.0	-	-	-
WS9	1	33	2		---	0.70 to 4.00	60 secs	-	-	-	-	14.4	0.0	2.5	0.0	-	-	-
WS9	1	33	2		---	0.70 to 4.00	90 secs	-	-	-	-	14.5	0.0	2.5	0.0	-	-	-
WS9	1	33	2		---	0.70 to 4.00	120 secs	-	-	-	-	14.6	0.0	2.6	0.0	-	-	-
WS9	1	33	2		---	0.70 to 4.00	180 secs	-	-	-	-	14.7	0.0	2.5	0.0	-	-	-
WS9	1	33	3	4.00	3.55	0.70 to 4.00	10/05/2018 12:00:00	1017	1017	$-2.0_{(I)}$	3.09	0.0	0.0	21.2	0.0	-	-	-
WS9	1	33	3		---	0.70 to 4.00	15 secs	-	-	$0.0_{(SS)}$	-	14.4	0.0	3.2	0.0	-	-	-
WS9	1	33	3		---	0.70 to 4.00	30 secs	-	-	-	-	14.9	0.0	2.2	0.0	-	-	-
WS9	1	33	3		---	0.70 to 4.00	60 secs	-	-	-	-	15.6	0.0	2.0	0.0	-	-	-
WS9	1	33	3		---	0.70 to 4.00	90 secs	-	-	-	-	15.7	0.0	1.9	0.0	-	-	-
WS9	1	33	3		---	0.70 to 4.00	120 secs	-	-	-	-	15.8	0.0	1.8	0.0	-	-	-
WS9	1	33	3		---	0.70 to 4.00	180 secs	-	-	-	-	16.0	0.0	1.8	0.0	-	-	-

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

Anerley Court
Half Moon Lane
Hildenborough
Tonbridge
Kent, TN11 9HU

Compiled By	Date	Checked By	Date	Contract Ref:
	**24/08/18**			**29701**

Contract: **St Clare Business Park, Hampton Hill**

AGS

IN-SITU GAS MONITORING RESULTS

Exploratory Position ID	Pipe ref	Pipe diameter (mm)	Monitoring Round	Reported Installation Depth (m)	Measured Installation Depth (mbgl)	Response Zone	Date & Time of Monitoring (elapsed time)	Borehole Pressure (mb)	Atmos Pressure (mb)	Gas Flow (l/hr)	Water Depth (mbgl)	Carbon Dioxide (% / vol)	Methane (% / vol)	Oxygen (% / vol)	LEL (%)	PID (ppm)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)
WS9	1	33	4	4.00	3.53	0.70 to 4.00	18/05/2018 12:00:00	1027	1027	$0.0_{(I)}$	3.14	0.0	0.0	21.7	0.0	0.0	-	-
WS9	1	33	4		---	0.70 to 4.00	15 secs	-	-	$0.0_{(SS)}$	-	14.5	0.0	4.2	0.0	-	-	-
WS9	1	33	4		---	0.70 to 4.00	30 secs	-	-	-	-	14.7	0.0	2.9	0.0	-	-	-
WS9	1	33	4		---	0.70 to 4.00	60 secs	-	-	-	-	15.5	0.0	2.1	0.0	-	-	-
WS9	1	33	4		---	0.70 to 4.00	90 secs	-	-	-	-	16.2	0.0	1.5	0.0	-	-	-
WS9	1	33	4		---	0.70 to 4.00	120 secs	-	-	-	-	16.9	0.0	0.9	0.0	-	-	-
WS9	1	33	4		---	0.70 to 4.00	180 secs	-	-	-	-	17.3	0.0	0.7	0.0	-	-	-
WS9	1	33	4		---	0.70 to 4.00	240 secs	-	-	-	-	17.4	0.0	0.7	0.0	-	-	-
WS9	1	33	5	4.00	3.50	0.70 to 4.00	01/06/2018	1019	1019	$0.0_{(I)}$	3.06	0.0	0.0	21.0	0.0	-	-	-
WS9	1	33	5		---	0.70 to 4.00	30 secs	-	-	$0.0_{(SS)}$	-	16.6	0.0	1.0	0.0	-	-	-
WS9	1	33	5		---	0.70 to 4.00	60 secs	-	-	-	-	17.1	0.0	0.7	0.0	-	-	-
WS9	1	33	5		---	0.70 to 4.00	120 secs	-	-	-	-	17.4	0.0	0.6	0.0	-	-	-
WS9	1	33	5		---	0.70 to 4.00	180 secs	-	-	-	-	17.5	0.0	0.5	0.0	-	-	-
WS9	1	33	6	4.00	3.45	0.70 to 4.00	23/08/2018	1011	1011	$0.0_{(I)}$	3.40	0.1	0.0	20.9	0.0	0.1	0	0
WS9	1	33	6		---	0.70 to 4.00	15 secs	-	-	$0.0_{(SS)}$	-	19.2	0.0	7.3	0.0	-	1	0
WS9	1	33	6		---	0.70 to 4.00	30 secs	-	-	-	-	20.0	0.0	1.4	0.0	-	0	0
WS9	1	33	6		---	0.70 to 4.00	60 secs	-	-	-	-	20.5	0.0	0.6	0.0	-	0	0
WS9	1	33	6		---	0.70 to 4.00	90 secs	-	-	-	-	20.6	0.0	0.5	0.0	-	0	0
WS9	1	33	6		---	0.70 to 4.00	120 secs	-	-	-	-	20.7	0.0	0.4	0.0	-	0	0
WS9	1	33	6		---	0.70 to 4.00	180 secs	-	-	-	-	20.8	0.0	0.3	0.0	-	0	0
WS9	1	33	6		---	0.70 to 4.00	240 secs	-	-	-	-	20.7	0.0	0.2	0.0	-	0	0
WS9	1	33	6		---	0.70 to 4.00	300 secs	-	-	-	-	20.8	0.0	0.2	0.0	-	0	0

Key: I = Initial, P = Peak, SS = Steady State. Note: LEL = Lower Explosive Limit = 5% v/v.

Anerley Court
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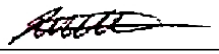
Compiled By	Date	Checked By	Date	Contract Ref:
	**24/08/18**			**29701**

Contract: **St Clare Business Park, Hampton Hill**

AGS

Job Number:
Client:
Site:

Revised Wilson and Card Classification Ground Gas Risk Assessment

Job No.:	29701
Client:	Notting Hill Housing Trust
Site:	St Clare Business Park

For low-rise residential developments without a clear ventilated sub-floor void, flats and commercial / industrial sites

Characteristic Situation	Risk	GSV
1	Very Low	0.07
2	Low	0.7
3	Moderate	3.5
4	Moderate to High	15
5	High	70
6	Very High	>70

From CIRIA Report 659 (2006) "Assessing Risks Posed By Hazardous Ground Gases To Buildings", Wilson et al.

KEY:
GSV Gas Screening Value

GSV cannot be calculated on a site-specific basis

GSV indicates very low risk
GSV indicates low to moderate risk
GSV indicates moderate or greater risk; Concentrations of CH4 ≥20%V/V; CO2 ≥30%V/V
Oxygen concentration ≤10%v/v
Total ground gas concentrations >100%v/v

BH NO.	DATE	CH4 I %v/v	CH4 SS %v/v	CO2 I %v/v	CO2 SS %v/v	O2 I %v/v	O2 SS %v/v	Flow l/hr	Baro mbar	BH Press mbar	I SUM %v/v	SS SUM %v/v	GSV CH4	GSV CO2	CS No.
BH4 Pipe 1	05/04/2018	<0.1	<0.1	0.9	1.5	20.2	19.3	0	1018	1018	21.1	20.8	0.00	0.00	CS1
	17/05/2018	<0.1	<0.1	1.6	2.2	19.3	19.0	0	1020	1020	20.9	21.2	0.00	0.00	CS1
	10/05/2018	<0.1	<0.1	1.6	1.7	20.0	19.6	0	1016	1016	21.6	21.3	0.00	0.00	CS1
	18/05/2018	<0.1	<0.1	1.0	1.2	20.1	20.0	0	1026	1026	21.1	21.2	0.00	0.00	CS1
	01/06/2018	<0.1	<0.1	1.8	1.9	18.9	18.6	0	1018	1018	20.7	20.5	0.00	0.00	CS1
	23/08/2018	<0.1	<0.1	4.7	4.8	17.5	13.9	0	1011	1011	22.2	18.7	0.00	0.00	CS1
BH4 Pipe 2	05/04/2018	<0.1	<0.1	1.4	1.5	20.3	20.3	0	1018	1018	21.7	21.8	0.00	0.00	CS1
	17/05/2018	<0.1	<0.1	2.3	2.4	19.5	19.2	0	1019	1019	21.8	21.6	0.00	0.00	CS1
	10/05/2018	<0.1	<0.1	1.5	1.9	20.6	19.9	0	1016	1016	22.1	21.8	0.00	0.00	CS1
	18/05/2018	<0.1	<0.1	<0.1	0.8	20.5	20.4	0	1026	1026	20.5	21.2	0.00	0.00	CS1
	01/06/2018										0.0	0.0	0.00	0.00	CS1
	23/08/2018	<0.1	<0.1	4.3	4.6	18.0	14.5	0	1011	1011	22.3	19.1	0.00	0.00	CS1
WS2	05/04/2018	<0.1	<0.1	1.7	4.8	18.2	11.8	0	1016	1016	19.9	16.6	0.00	0.00	CS1
	17/05/2018	<0.1	<0.1	1.7	8.6	12.4	2.9	0	1018	1018	14.1	11.5	0.00	0.00	CS1
	10/05/2018	<0.1	<0.1	6.5	9.5	10.2	3.5	0	1016	1016	16.7	13.0	0.00	0.00	CS1
	18/05/2018	<0.1	<0.1	0.5	6.6	21.0	10.8	0	1026	1026	21.5	17.4	0.00	0.00	CS1
	01/06/2018	<0.1	<0.1	5.5	8.4	11.3	6.4	0	1018	1018	16.8	14.8	0.00	0.00	CS1
	23/08/2018	<0.1	<0.1	7.5	15.3	13.4	1.5	0	1011	1011	20.9	16.8	0.00	0.00	CS1
WS4	05/04/2018	<0.1	<0.1	0.1	0.3	20.1	19.8	0	1017	1017	20.2	20.1	0.00	0.00	CS1
	17/05/2018	<0.1	<0.1	<0.1	<0.1	20.7	19.6	0	1018	1018	20.7	19.6	0.00	0.00	CS1
	10/05/2018	<0.1	<0.1	1.8	1.9	19.4	19.1	0	1015	1015	21.2	21.0	0.00	0.00	CS1
	18/05/2018	<0.1	<0.1	2.0	2.1	19.0	18.6	0	1027	1027	21.0	20.7	0.00	0.00	CS1
	01/06/2018	<0.1	<0.1	2.3	2.5	17.1	16.8	0	1018	1018	19.4	19.3	0.00	0.00	CS1
	23/08/2018	<0.1	<0.1	4.7	4.9	17.3	14.4	0.1	1011	1011	22.0	19.3	0.00	0.00	CS1
WS5	05/04/2018	<0.1	<0.1	0.5	0.6	22.7	19.7	0	1016	1016	23.2	20.3	0.00	0.00	CS1
	17/05/2018	<0.1	<0.1	0.7	0.7	20.0	19.7	0	1018	1018	20.7	20.4	0.00	0.00	CS1
	10/05/2018	<0.1	<0.1	1.1	1.1	19.8	19.4	0	1015	1015	20.9	20.5	0.00	0.00	CS1
	18/05/2018	<0.1	<0.1	0.9	0.9	20.6	20.3	0	1027	1027	21.5	21.2	0.00	0.00	CS1
	01/06/2018	<0.1	<0.1	<0.1	1.1	19.4	19.0	0	1018	1018	19.4	20.1	0.00	0.00	CS1
	23/08/2018	<0.1	<0.1	4.1	4.2	16.5	13.0	0	1011	1011	20.6	17.2	0.00	0.00	CS1
WS6	05/04/2018	<0.1	<0.1	<0.1	<0.1	19.0	18.9	0	1017	1017	19.0	18.9	0.00	0.00	CS1
	17/05/2018	<0.1	<0.1	<0.1	<0.1	19.3	19.2	0	1019	1019	19.3	19.2	0.00	0.00	CS1
	10/05/2018	<0.1	<0.1	<0.1	<0.1	19.8	19.4	0	1018	1018	19.8	19.4	0.00	0.00	CS1
	18/05/2018										0.0	0.0	0.00	0.00	CS1
	01/06/2018	<0.1	<0.1	<0.1	<0.1	19.4	19.0	0	1018	1018	19.4	19.0	0.00	0.00	CS1
	23/08/2018	<0.1	<0.1	0.9	1.0	19.9	17.9	-0.1	1011	1011	20.8	18.9	0.00	0.00	CS1
WS8	05/04/2018	<0.1	<0.1	<0.1	0.1	21.2	20.7	0	1015	1015	21.2	20.8	0.00	0.00	CS1
	17/05/2018	<0.1	<0.1	1.3	1.4	19.3	19.0	0	1019	1019	20.6	20.4	0.00	0.00	CS1
	10/05/2018	<0.1	<0.1	1.6	2.0	20.0	19.3	0	1015	1015	21.6	21.3	0.00	0.00	CS1
	18/05/2018	<0.1	<0.1	2.3	2.4	18.5	18.1	0	1026	1026	20.8	20.5	0.00	0.00	CS1
	01/06/2018	<0.1	<0.1	2.3	2.4	18.0	17.8	0	1019	1019	20.3	20.2	0.00	0.00	CS1
	23/08/2018										0.0	0.0	0.00	0.00	CS1
WS9	05/04/2018	<0.1	<0.1	0.1	1.6	20.7	18.8	0	1011	1011	20.8	20.4	0.00	0.00	CS1
	17/05/2018	<0.1	<0.1	3.6	14.7	3.4	2.5	0	1018	1018	7.0	17.2	0.00	0.00	CS1
	10/05/2018	<0.1	<0.1	14.4	16.0	3.2	1.8	0	1017	1017	17.6	17.8	0.00	0.00	CS1
	18/05/2018	<0.1	<0.1	14.5	17.4	4.2	0.7	0	1027	1027	18.7	18.1	0.00	0.00	CS1
	01/06/2018	<0.1	<0.1	16.6	17.5	1.0	0.5	0	1019	1019	17.6	18.0	0.00	0.00	CS1
	23/08/2018	<0.1	<0.1	19.2	20.8	7.3	0.2	0	1011	1011	26.5	21.0	0.00	0.00	CS1

WORST-CASE VALUES PER BOREHOLE

		Maximum CH4		Maximum CO2		Minimum O2		Max Flow	Not Applicable		Maximum Total		Maximum GSVs		CS No
BH1		<0.1	<0.1	4.7	4.8	17.5	13.9	<0.1			22.2	18.7	0.00	0.00	CS1
BH2		<0.1	<0.1	4.3	4.6	18.0	14.5	<0.1			22.3	19.1	0.00	0.00	CS1
BH3		<0.1	<0.1	7.5	15.3	10.2	1.5	<0.1			17.7	16.8	0.00	0.00	CS1
BH4		<0.1	<0.1	4.7	4.9	17.1	14.4	0.1			21.8	19.3	0.00	0.00	CS1
BH5		<0.1	<0.1	4.1	4.2	16.5	13.0	<0.1			20.6	17.2	0.00	0.00	CS1
BH6		<0.1	<0.1	0.9	1.0	19.0	17.9	<0.1			19.9	18.9	0.00	0.00	CS1
BH7		<0.1	<0.1	2.3	2.4	18.0	17.8	<0.1			20.3	20.2	0.00	0.00	CS1
BH8		<0.1	<0.1	19.2	20.8	1.0	0.2	<0.1			20.2	21.0	0.00	0.00	CS1

Generic NHBC Traffic Lights Ground Gas Risk Assessment

Job No.: 29701
Client: Notting Hill Housing Trust
Site: St Clare Business Park

For low-rise residential developments with a clear ventilated sub-floor void ONLY

Traffic Light	Methane		Carbon Dioxide	
	TMV (%v/v)	GSV (l/hr)	TMV (%v/v)	GSV (l/hr)
Green				
	1	0.16	5	0.78
Amber 1				
	5	0.63	10	1.56
Amber 2				
	20	1.56	30	3.13
Red				

From NHBC (2007, Edition No.: 04) "Guidance On Evaluation Of Development Proposals On Sites Where Methane And Carbon Dioxide Are Present", Boyle & Witherington

KEY:
TMV Typical Maximum Value
GSV Gas Screening Value

GSV can be calculated on a site-specific basis

GSV within Green Traffic Light
GSV within Amber 1 Traffic Light
GSV within Amber 2 Traffic Light
GSV within Red Traffic Light / TMV exceeded

Oxygen concentration ≤10%v/v
Total ground gas concentrations >100%v/v

BH NO.	DATE	Water Level	CH4 I %v/v	CH4 SS %v/v	CO2 I %v/v	CO2 SS %v/v	O2 I %v/v	O2 SS %v/v	Flow l/hr	Baro mbar	BH Press mbar	I SUM %v/v	SS SUM %v/v	GSV CH4	GSV CO2
BH4 pipe 1	05/04/2018	1.780	<0.1	<0.1	0.9	1.5	20.2	19.3	0	1018	1018	21.1	20.8	0.00	0.00
	17/05/2018	1.750	<0.1	<0.1	1.6	2.2	19.3	19.0	0	1020	1020	20.9	21.2	0.00	0.00
	10/05/2018	1.910	<0.1	<0.1	1.6	1.7	20.0	19.6	0	1016	1016	21.6	21.3	0.00	0.00
	18/05/2018	DRY	<0.1	<0.1	1.0	1.2	20.1	20.0	0	1026	1026	21.1	21.2	0.00	0.00
	01/06/2018	DRY	<0.1	<0.1	1.8	1.9	18.9	18.6	0	1018	1018	20.7	20.5	0.00	0.00
	23/08/2018	DRY	<0.1	<0.1	4.7	4.8	17.5	13.9	0	1011	1011	22.2	18.7	0.00	0.00
BH 4 pipe 2	05/04/2018	1.780	<0.1	<0.1	1.4	1.5	20.3	20.3	0	1018	1018	21.7	21.8	0.00	0.00
	17/05/2018	1.770	<0.1	<0.1	2.3	2.4	19.5	19.2	0	1019	1019	21.8	21.6	0.00	0.00
	10/05/2018	1.940	<0.1	<0.1	1.5	1.9	20.6	19.9	0	1016	1016	22.1	21.8	0.00	0.00
	18/05/2018	2.000	<0.1	<0.1	<0.1	0.8	20.5	20.4	0	1026	1026	20.5	21.2	0.00	0.00
	01/06/2018											0.0	0.0	0.00	0.00
	23/08/2018	2.270	<0.1	<0.1	4.3	4.6	18.0	14.5	0	1011	1011	22.3	19.1	0.00	0.00
WS2	05/04/2018	2.660	<0.1	<0.1	1.7	4.8	18.2	11.8	0	1016	1016	19.9	16.6	0.00	0.00
	17/05/2018	2.600	<0.1	<0.1	1.7	8.6	12.4	2.9	0	1018	1018	14.1	11.5	0.00	0.00
	10/05/2018	2.380	<0.1	<0.1	6.5	9.5	10.2	3.5	0	1016	1016	16.7	13.0	0.00	0.00
	18/05/2018	2.930	<0.1	<0.1	0.5	6.6	21.0	10.8	0	1026	1026	21.5	17.4	0.00	0.00
	01/06/2018	2.800	<0.1	<0.1	5.5	8.4	11.3	6.4	0	1018	1018	16.8	14.8	0.00	0.00
	23/08/2018	DRY	<0.1	<0.1	7.5	15.3	13.4	1.5	0	1011	1011	20.9	16.8	0.00	0.00
WS4	05/04/2018	DRY	<0.1	<0.1	0.1	0.3	20.1	19.8	0	1017	1017	20.2	20.1	0.00	0.00
	17/05/2018	DRY	<0.1	<0.1	<0.1	<0.1	20.7	19.6	0	1018	1018	20.7	19.6	0.00	0.00
	10/05/2018	DRY	<0.1	<0.1	1.8	1.9	19.4	19.1	0	1015	1015	21.2	21.0	0.00	0.00
	18/05/2018	DRY	<0.1	<0.1	2.0	2.1	19.0	18.6	0	1027	1027	21.0	20.7	0.00	0.00
	01/06/2018	DRY	<0.1	<0.1	2.3	2.5	17.1	16.8	0	1018	1018	19.4	19.3	0.00	0.00
	23/08/2018	DRY	<0.1	<0.1	4.7	4.9	17.3	14.4	0.1	1011	1011	22.0	19.3	0.00	0.00
WS5	05/04/2018	1.480	<0.1	<0.1	0.5	0.6	22.7	19.7	0	1016	1016	23.2	20.3	0.00	0.00
	17/05/2018	1.460	<0.1	<0.1	0.7	0.7	20.0	19.7	0	1018	1018	20.7	20.4	0.00	0.00
	10/05/2018	1.670	<0.1	<0.1	1.1	1.1	19.8	19.4	0	1015	1015	20.9	20.5	0.00	0.00
	18/05/2018	1.800	<0.1	<0.1	0.9	0.9	20.6	20.3	0	1027	1027	21.5	21.2	0.00	0.00
	01/06/2018	1.650	<0.1	<0.1	<0.1	1.1	19.4	19.0	0	1018	1018	19.4	20.1	0.00	0.00
	23/08/2018	2.110	<0.1	<0.1	4.1	4.2	16.5	13.0	0	1011	1011	20.6	17.2	0.00	0.00
WS6	05/04/2018	1.490	<0.1	<0.1	<0.1	<0.1	19.0	18.9	0	1017	1017	19.0	18.9	0.00	0.00
	17/05/2018	1.550	<0.1	<0.1	<0.1	<0.1	19.3	19.2	0	1019	1019	19.3	19.2	0.00	0.00
	10/05/2018	1.760	<0.1	<0.1	<0.1	<0.1	19.8	19.4	0	1018	1018	19.8	19.4	0.00	0.00
	18/05/2018											0.0	0.0	0.00	0.00
	01/06/2018	1.700	<0.1	<0.1	<0.1	<0.1	19.4	19.0	0	1018	1018	19.4	19.0	0.00	0.00
	23/08/2018	2.470	<0.1	<0.1	0.9	1.0	19.9	17.9	-0.1	1011	1011	20.8	18.9	0.00	0.00
WS8	05/04/2018	DRY	<0.1	<0.1	<0.1	0.1	21.2	20.7	0	1015	1015	21.2	20.8	0.00	0.00
	17/05/2018	DRY	<0.1	<0.1	1.3	1.4	19.3	19.0	0	1019	1019	20.6	20.4	0.00	0.00
	10/05/2018	DRY	<0.1	<0.1	1.6	2.0	20.0	19.3	0	1015	1015	21.6	21.3	0.00	0.00
	18/05/2018	DRY	<0.1	<0.1	2.3	2.4	18.5	18.1	0	1026	1026	20.8	20.5	0.00	0.00
	01/06/2018	DRY	<0.1	<0.1	2.3	2.4	18.0	17.8	0	1019	1019	20.3	20.2	0.00	0.00
	23/08/2018											0.0	0.0	0.00	0.00
WS9	05/04/2018	2.850	<0.1	<0.1	0.1	1.6	20.7	18.8	0	1011	1011	20.8	20.4	0.00	0.00
	17/05/2018	2.900	<0.1	<0.1	3.6	14.7	3.4	2.5	0	1018	1018	7.0	17.2	0.00	0.00
	10/05/2018	3.090	<0.1	<0.1	14.4	16.0	3.2	1.8	0	1017	1017	17.6	17.8	0.00	0.00
	18/05/2018	3.140	<0.1	<0.1	14.5	17.4	4.2	0.7	0	1027	1027	18.7	18.1	0.00	0.00
	01/06/2018	3.060	<0.1	<0.1	16.6	17.5	1.0	0.5	0	1019	1019	17.6	18.0	0.00	0.00
	23/08/2018	3.400	<0.1	<0.1	19.2	20.8	7.3	0.2	0	1011	1011	26.5	21.0	0.00	0.00

WORST-CASE VALUES PER BOREHOLE

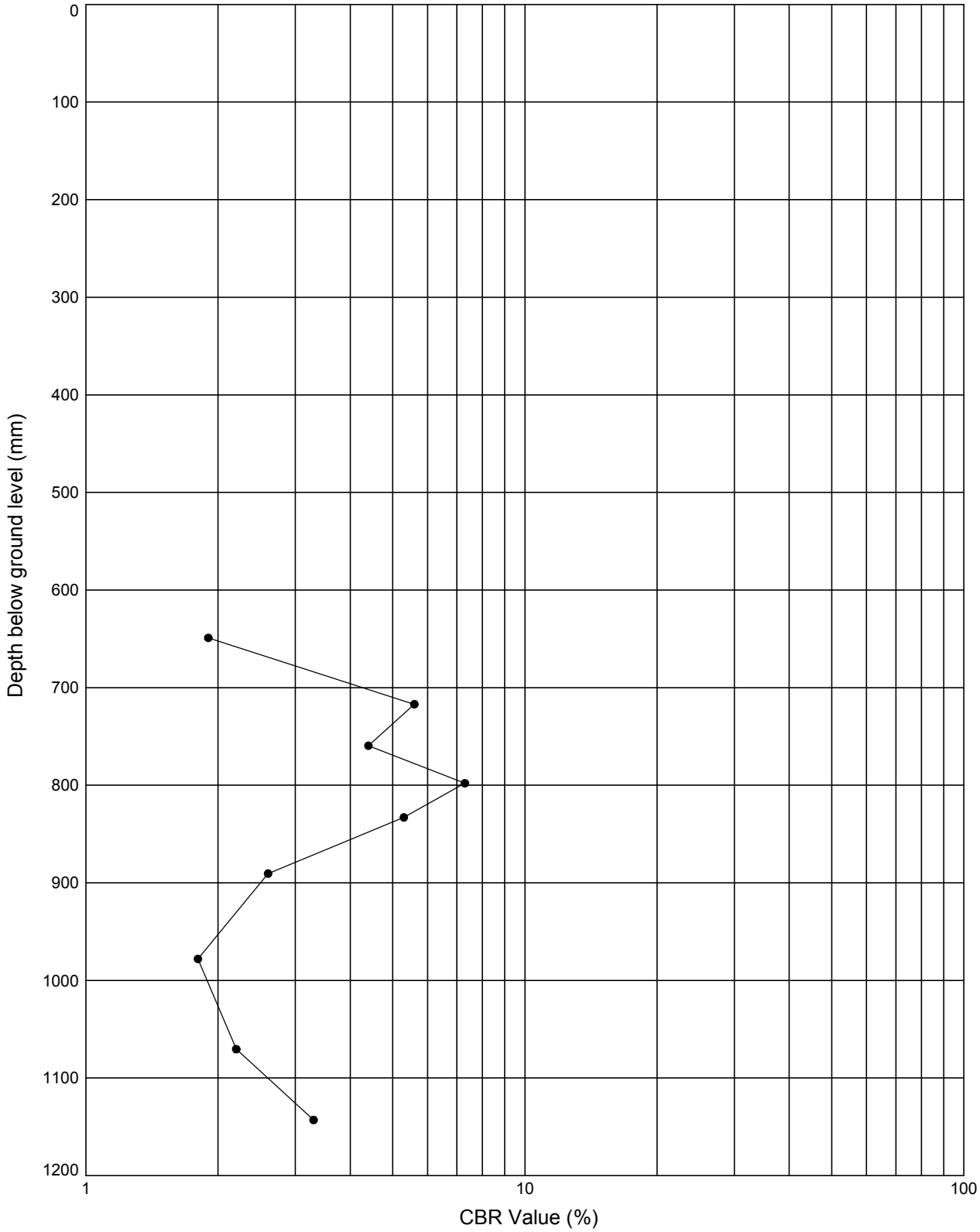
	Maximum CH4		Maximum CO2		Minimum O2		Max Flow	Not Applicable		Maximum Total		Maximum GSVs	
BH4 pipe 1	<0.1	<0.1	4.7	4.8	20.2	20.0	<0.1			24.9	24.8	0.00	0.00
BH4 pipe 2	<0.1	<0.1	4.3	4.6	20.6	20.4	<0.1			24.9	25.0	0.00	0.00
WS2	<0.1	<0.1	7.5	15.3	21.0	11.8	<0.1			28.5	27.1	0.00	0.00
WS4	<0.1	<0.1	4.7	4.9	20.7	19.8	0.1			25.4	24.7	0.00	0.00
WS5	<0.1	<0.1	4.1	4.2	22.7	20.3	<0.1			26.8	24.5	0.00	0.00
WS6	<0.1	<0.1	0.9	1.0	19.9	19.4	<0.1			20.8	20.4	0.00	0.00
WS8	<0.1	<0.1	2.3	2.4	21.2	20.7	<0.1			23.5	23.1	0.00	0.00
WS9	<0.1	<0.1	19.2	20.8	20.7	18.8	<0.1			39.9	39.6	0.00	0.00

APPENDIX J
IN-SITU DCP RESULTS

DCP TEST RESULTS - DEPTH vs CBR VALUE

Position Ref : **WS1** Test Date : **29.03.18**

Ground Level (m AD): **14.98** National Grid Co-ordinates: **E:514251.1 N:170950.0**



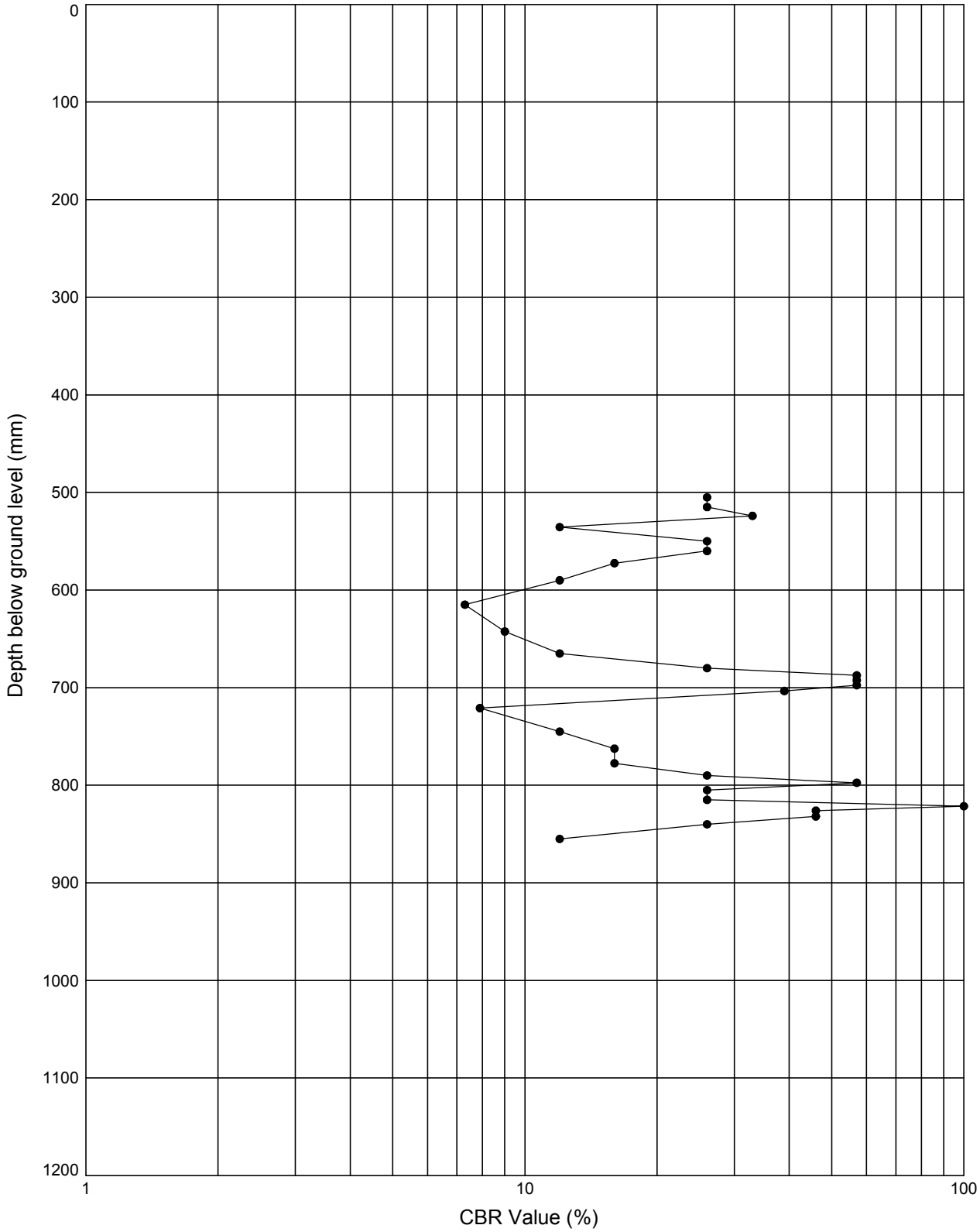
Notes: **CBR values calculated after Smith and Pratt method. Values over 100% are plotted on the 100% line.**

	Compiled By	Date	Checked By	Date
		08/05/18		
	Contract: **St Clare Business Park, Hampton Hill**		Contract Ref: **29701**	

DCP TEST RESULTS - DEPTH vs CBR VALUE

Position Ref : **WS4** Test Date : **27.03.18**

Ground Level (m AD): **14.66** National Grid Co-ordinates: **E:514178.3 N:170933.9**



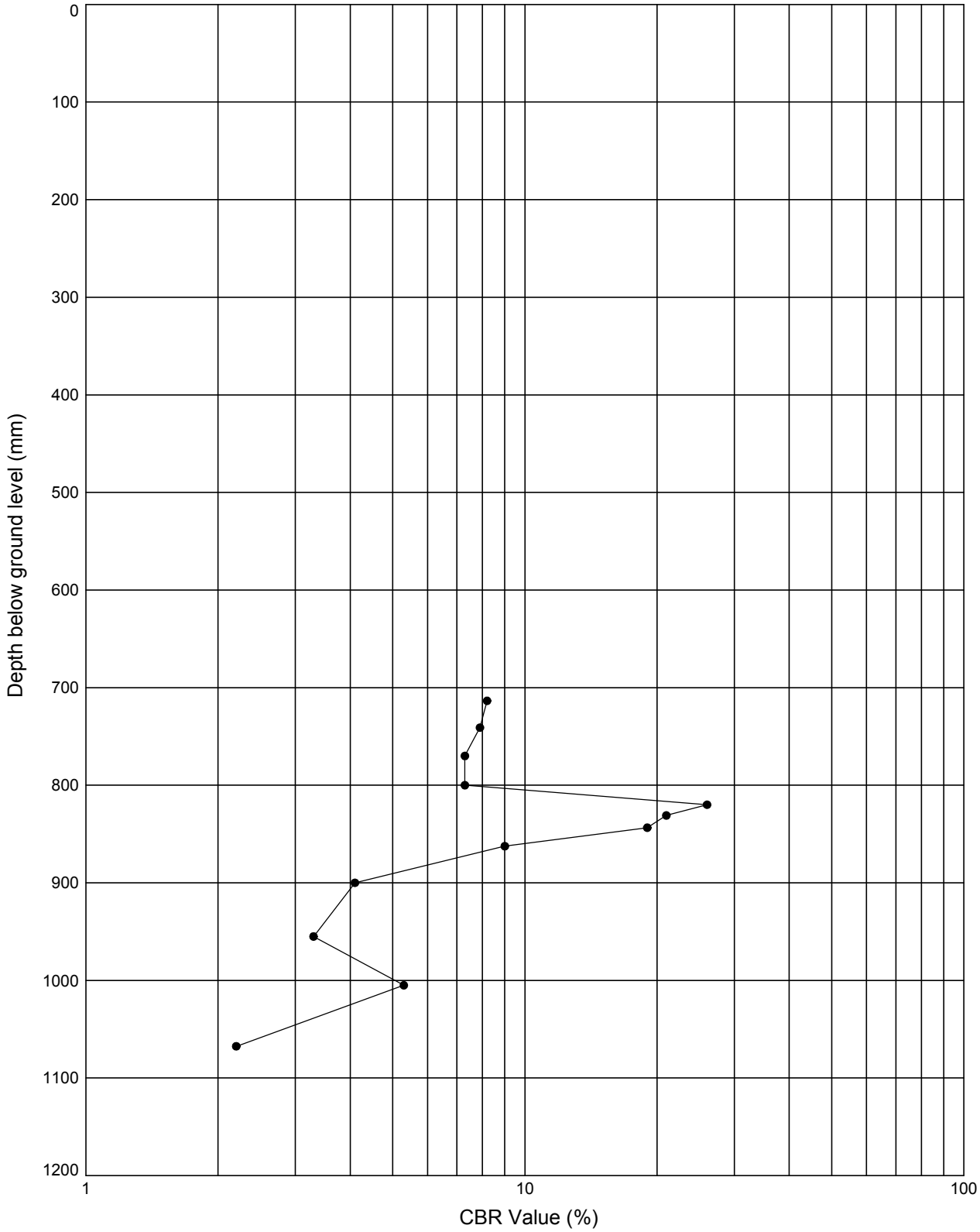
Notes: **CBR values calculated after Smith and Pratt method. Values over 100% are plotted on the 100% line.**

	Compiled By	Date	Checked By	Date
		08/05/18		
	Contract		Contract Ref:	
	St Clare Business Park, Hampton Hill		**29701**	

DCP TEST RESULTS - DEPTH vs CBR VALUE

Position Ref : **WS9** Test Date : **29.03.18**

Ground Level (m AD): **16.52** National Grid Co-ordinates: **E:514126.4 N:170780.5**



Notes: **CBR values calculated after Smith and Pratt method. Values over 100% are plotted on the 100% line.**

	Compiled By	Date	Checked By	Date
		08/05/18		
	Contract: **St Clare Business Park, Hampton Hill**		Contract Ref: **29701**	

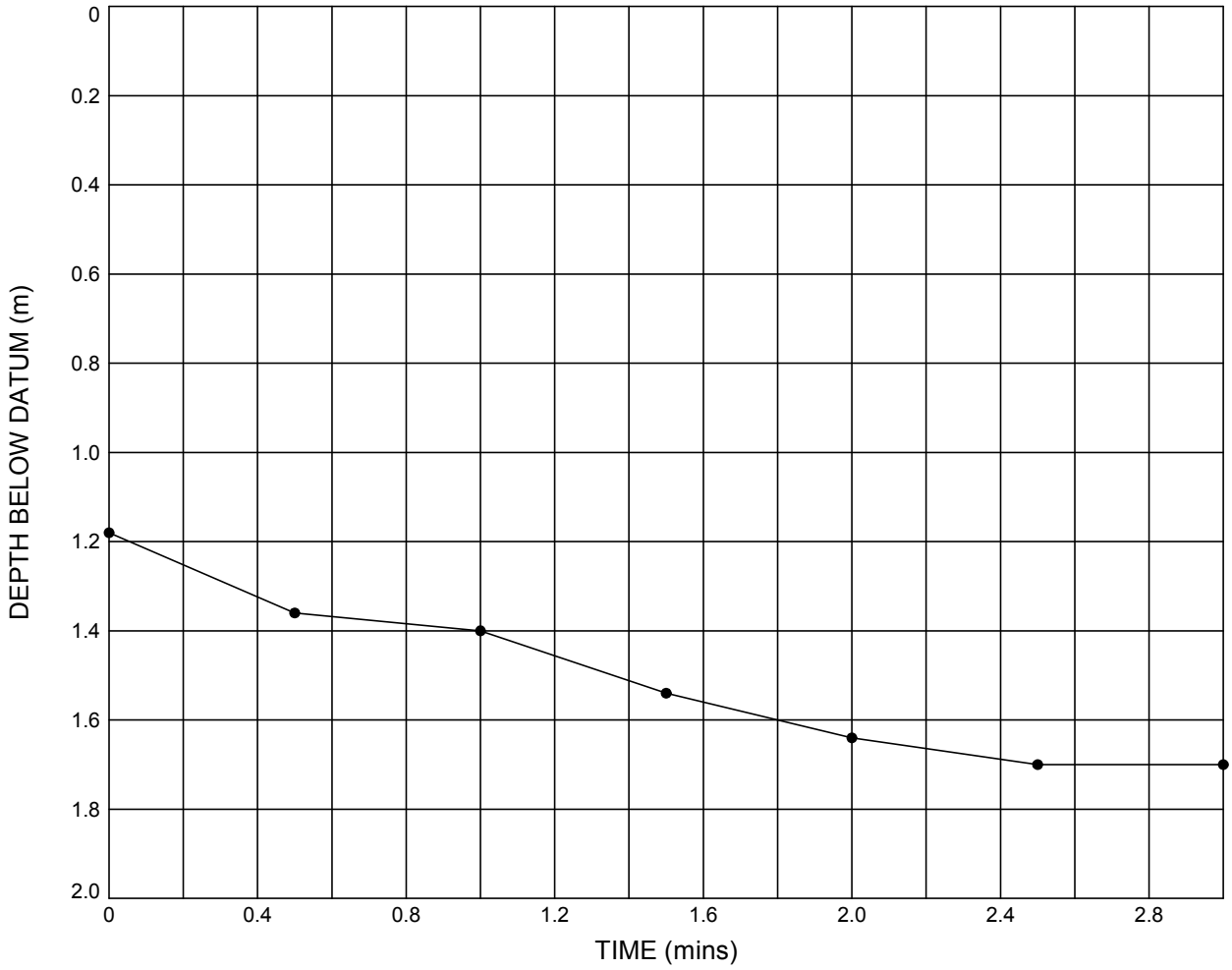
APPENDIX K
INFILTRATION TESTS

BOREHOLE SOAKAWAY TEST

Test position: BH4

Ground Level (m AD): **13.68** National Grid Co-ordinates: **E:514162.0 N:170863.6**

PLOT OF DEPTH OF WATER BELOW DATUM AGAINST TIME



Effective depth, De	=	**0.72**	m
Effective storage volume, V_{p75-25}	=	**0.000308**	m^3
Surface area, a_{p50}	=	**0.038177**	m^2
Time, t_{p75-25}	=	**130**	secs
Infiltration coefficient, f	=	**6.20×10^{-5}**	m/s

Test hole details:

Measurement datum was **GL**
Hole depth at start of test: **1.90**mBGL
Borehole diameter: **33**mm

Legend:

● Test 1 (27/03/2018)

Compiled By	Date	Checked By	Date
CW	**01/05/18**		**24/04/18**

Contract: **St Clare Business Park, Hampton Hill**

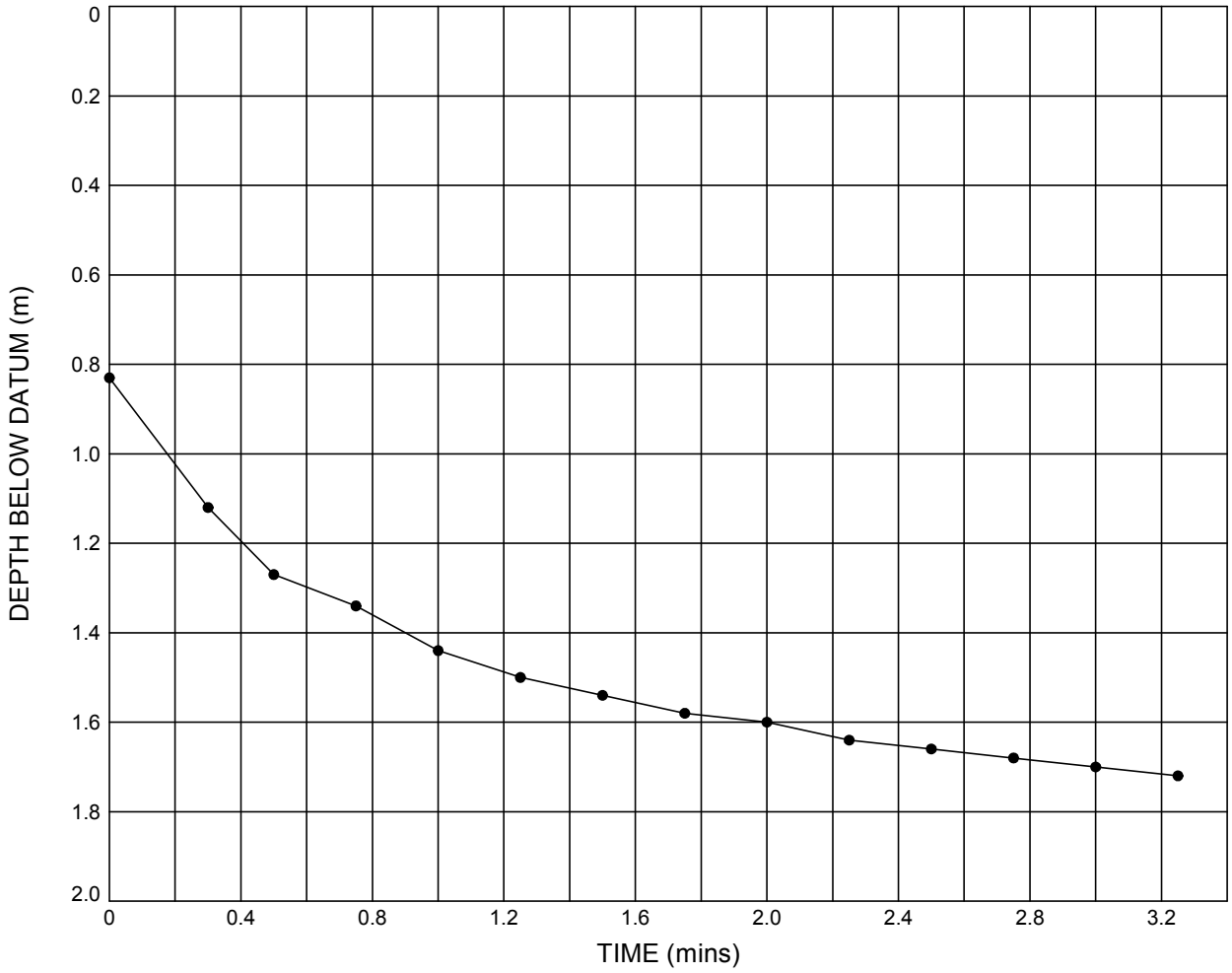
Contract Ref: **29701**

BOREHOLE SOAKAWAY TEST

Test position: BH4

Ground Level (m AD): **13.68** National Grid Co-ordinates: **E:514162.0 N:170863.6**

PLOT OF DEPTH OF WATER BELOW DATUM AGAINST TIME



Effective depth, De	=	**1.07**	m
Effective storage volume, V_{p75-25}	=	**0.000458**	m^3
Surface area, a_{p50}	=	**0.05632**	m^2
Time, t_{p75-25}	=	**115**	secs
Infiltration coefficient, f	=	**7.06×10^{-5}**	m/s

Test hole details:

Measurement datum was **GL**
Hole depth at start of test: **1.90**mBGL
Borehole diameter: **33**mm

Legend:

● Test 2 (27/03/2018)

Compiled By	Date	Checked By	Date
CW	**01/05/18**		**24/04/18**

Contract: **St Clare Business Park, Hampton Hill**

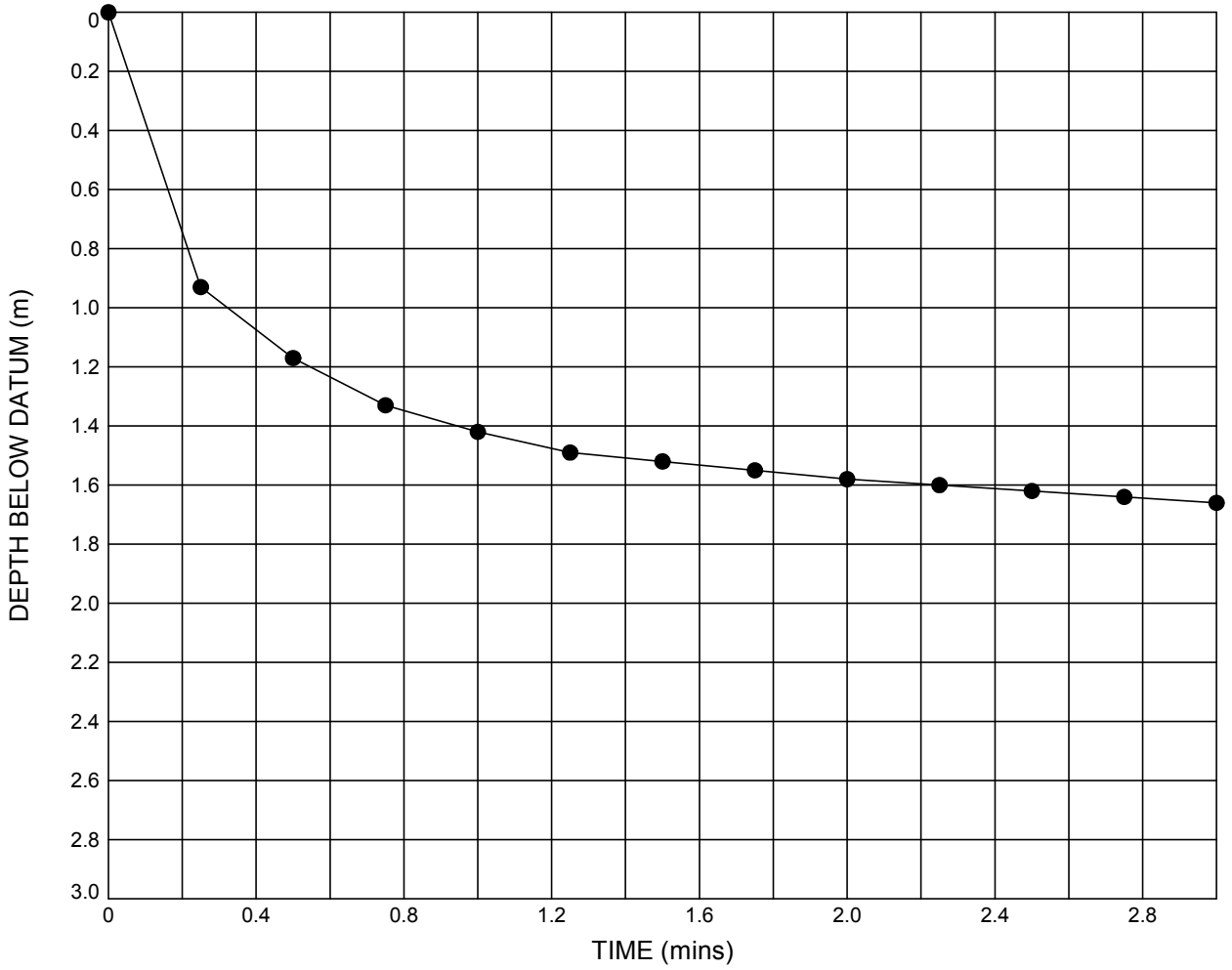
Contract Ref: **29701**

BOREHOLE SOAKAWAY TEST

Test position: WS5

Ground Level (m AD): **10.52** National Grid Co-ordinates: **E:514190.9 N:170912.1**

PLOT OF DEPTH OF WATER BELOW DATUM AGAINST TIME



Effective depth, De	=	**2.51**	m
Effective storage volume, V_{p75-25}	=	**0.001073**	m^3
Surface area, a_{p50}	=	**0.130964**	m^2
Time, t_{p75-25}	=	**337**	secs
Infiltration coefficient, f	=	**2.43×10^{-5}**	m/s

Test hole details:

Hole depth at start of test: **2.51**m

Window sample hole (average diameter used): **33**mm

Legend:

Test 1 (27/03/2018)

Compiled By	Date	Checked By	Date
CW	**01/05/18**		**24/04/18**

Contract	Contract Ref:
St Clare Business Park, Hampton Hill	**29701**

APPENDIX L
LABORATORY CERTIFICATES FOR CHEMICAL ANALYSIS

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 18/02476
Issue Number: 1 **Date:** 20 April, 2018

Client: RSK Environment Ltd Tonbridge
Anerley Court, Half Moon Lane, Hildenborough
Tonbridge
Kent
TN11 9HU

Project Manager: Niki Dubber
Project Name: Not specified
Project Ref: 29701
Order No: N/A
Date Samples Received: 04/04/18
Date Instructions Received: 05/04/18
Date Analysis Completed: 19/04/18

Prepared by:

Melanie Marshall
Laboratory Coordinator

Approved by:

Richard Wong
Client Manager

Envirolab Job Number: 18/02476

Client Project Name: Not specified

Client Project Ref: 29701

Lab Sample ID	18/02476/3	18/02476/6	18/02476/7	18/02476/8	18/02476/9	18/02476/10	18/02476/11	18/02476/13	Units	Method ref
Client Sample No										
Client Sample ID	WS2	WS4	WS5	WS5	WS6	WS6	WS7	WS8		
Depth to Top	0.20	1.20	0.50	2.80	2.50	3.50	0.20	0.50		
Depth To Bottom	0.80		1.00				0.70			
Date Sampled	29-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	4A	4A	45A	4A	6A	5A	4A	4A		
% Moisture at <40C$_A$	-	-	-	10.6	-	-	16.3	-	% w/w	A-T-044
% Stones >10mm$_A$	<0.1	<0.1	<0.1	16.7	3.7	18.1	16.0	3.6	% w/w	A-T-044
pH$_D^{M\#}$	8.39	8.45	8.19	8.35	-	-	9.96	7.93	pH	A-T-031s
Sulphate (water sol 2:1)$_D^{M\#}$	0.02	0.20	<0.01	-	-	-	-	<0.01	g/l	A-T-026s
Sulphate (acid soluble)$_D^{M\#}$	390	3000	700	-	-	-	-	630	mg/kg	A-T-028s
Total Organic Carbon$_D^{M\#}$	5.39	2.00	1.64	-	-	-	-	4.12	% w/w	A-T-032s
Arsenic$_D^{M\#}$	12	15	9	25	-	-	16	17	mg/kg	A-T-024s
Cadmium$_D^{M\#}$	0.9	0.7	0.6	1.0	-	-	<0.5	0.8	mg/kg	A-T-024s
Copper$_D^{M\#}$	96	48	28	6	-	-	23	56	mg/kg	A-T-024s
Chromium$_D^{M\#}$	20	36	34	27	-	-	18	23	mg/kg	A-T-024s
Chromium (hexavalent)$_D$	-	-	-	<1	-	-	<1	-	mg/kg	A-T-040s
Lead$_D^{M\#}$	446	537	287	40	-	-	204	662	mg/kg	A-T-024s
Mercury$_D$	0.70	0.47	0.60	<0.17	-	-	0.71	1.81	mg/kg	A-T-024s
Nickel$_D^{M\#}$	32	22	22	38	-	-	19	24	mg/kg	A-T-024s
Selenium$_D^{M\#}$	<1	<1	<1	<1	-	-	<1	<1	mg/kg	A-T-024s
Zinc$_D^{M\#}$	202	396	160	250	-	-	75	245	mg/kg	A-T-024s
Asbestos in Soil (inc. matrix) ^										
Asbestos in soil$_A^{\#}$	Chrysotile	Amosite & Chrysotile	NAD	NAD	-	-	NAD	NAD		A-T-045
Asbestos Matrix (microscope)$_A$	Loose fibres & Board	Loose fibres & Cement & Board	-	-	-	-	-	-		A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	No	N/A	N/A	-	-	N/A	N/A		
Asbestos in Soil Quantification % (Hand Picking & Weighing)										
Asbestos in soil % composition (hand picking and weighing)$_D$	0.017	0.053	-	-	-	-	-	-	% w/w	A-T-054

Envirolab Job Number: 18/02476

Client Project Name: Not specified

Client Project Ref: 29701

Lab Sample ID	18/02476/3	18/02476/6	18/02476/7	18/02476/8	18/02476/9	18/02476/10	18/02476/11	18/02476/13	Units	Method ref
Client Sample No										
Client Sample ID	WS2	WS4	WS5	WS5	WS6	WS6	WS7	WS8		
Depth to Top	0.20	1.20	0.50	2.80	2.50	3.50	0.20	0.50		
Depth To Bottom	0.80		1.00				0.70			
Date Sampled	29-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	4A	4A	45A	4A	6A	5A	4A	4A		
PAH-16MS										
Acenaphthene$_A^{M\#}$	0.19	0.10	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	mg/kg	A-T-019s
Acenaphthylene$_A^{M\#}$	0.21	0.16	0.01	<0.01	<0.01	<0.01	<0.01	0.03	mg/kg	A-T-019s
Anthracene$_A^{M\#}$	0.62	0.33	<0.02	<0.02	<0.02	<0.02	<0.02	0.06	mg/kg	A-T-019s
Benzo(a)anthracene$_A^{M\#}$	3.26	1.45	0.11	0.05	<0.04	<0.04	<0.04	0.32	mg/kg	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	3.38	1.66	0.13	0.05	<0.04	<0.04	<0.04	0.39	mg/kg	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	3.86	1.79	0.15	0.06	<0.05	<0.05	<0.05	0.46	mg/kg	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	2.10	1.07	0.08	<0.05	<0.05	<0.05	<0.05	0.22	mg/kg	A-T-019s
Benzo(k)fluoranthene$_A^{M\#}$	1.38	0.71	<0.07	<0.07	<0.07	<0.07	<0.07	0.16	mg/kg	A-T-019s
Chrysene$_A^{M\#}$	3.25	1.54	0.15	<0.06	<0.06	<0.06	<0.06	0.41	mg/kg	A-T-019s
Dibenzo(ah)anthracene$_A^{M\#}$	0.50	0.26	<0.04	<0.04	<0.04	<0.04	<0.04	0.06	mg/kg	A-T-019s
Fluoranthene$_A^{M\#}$	6.74	3.33	0.27	0.13	<0.08	<0.08	<0.08	0.76	mg/kg	A-T-019s
Fluorene$_A^{M\#}$	0.16	0.12	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	mg/kg	A-T-019s
Indeno(123-cd)pyrene$_A^{M\#}$	2.55	1.39	0.09	<0.03	<0.03	<0.03	<0.03	0.28	mg/kg	A-T-019s
Naphthalene$_A^{M\#}$	0.08	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Phenanthrene$_A^{M\#}$	2.48	1.79	0.08	0.07	<0.03	<0.03	<0.03	0.29	mg/kg	A-T-019s
Pyrene$_A^{M\#}$	6.31	2.86	0.25	0.10	<0.07	<0.07	<0.07	0.67	mg/kg	A-T-019s
PAH (total 16)$_A^{M\#}$	37	18.6	1.30	0.56	<0.08	<0.08	<0.08	4.12	mg/kg	A-T-019s

Envirolab Job Number: 18/02476

Client Project Name: Not specified

Client Project Ref: 29701

Lab Sample ID	18/02476/3	18/02476/6	18/02476/7	18/02476/8	18/02476/9	18/02476/10	18/02476/11	18/02476/13	Units	Method ref
Client Sample No										
Client Sample ID	WS2	WS4	WS5	WS5	WS6	WS6	WS7	WS8		
Depth to Top	0.20	1.20	0.50	2.80	2.50	3.50	0.20	0.50		
Depth To Bottom	0.80		1.00				0.70			
Date Sampled	29-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	4A	4A	45A	4A	6A	5A	4A	4A		
Speciated PCB-WHO12										
PCB BZ 81$_A$	-	-	-	-	-	-	-	<0.005	mg/kg	A-T-004s
PCB BZ 105$_A$	-	-	-	-	-	-	-	<0.005	mg/kg	A-T-004s
PCB BZ 114$_A$	-	-	-	-	-	-	-	<0.005	mg/kg	A-T-004s
PCB BZ 118$_A^{M\#}$	-	-	-	-	-	-	-	<0.007	mg/kg	A-T-004s
PCB BZ 123$_A$	-	-	-	-	-	-	-	<0.005	mg/kg	A-T-004s
PCB BZ 126$_A$	-	-	-	-	-	-	-	<0.005	mg/kg	A-T-004s
PCB BZ 156$_A$	-	-	-	-	-	-	-	<0.005	mg/kg	A-T-004s
PCB BZ 157$_A$	-	-	-	-	-	-	-	<0.005	mg/kg	A-T-004s
PCB BZ 167$_A$	-	-	-	-	-	-	-	<0.005	mg/kg	A-T-004s
PCB BZ 169$_A$	-	-	-	-	-	-	-	<0.005	mg/kg	A-T-004s
PCB BZ 189$_A$	-	-	-	-	-	-	-	<0.005	mg/kg	A-T-004s
PCB BZ 77$_A$	-	-	-	-	-	-	-	<0.005	mg/kg	A-T-004s
Total Speciated PCB-WHO12$_A$	-	-	-	-	-	-	-	<0.007	mg/kg	A-T-004s
TPH Total with ID + GC Trace										
TPH total (>C6-C40)$_A^{M\#}$	-	-	-	12	-	-	164	-	mg/kg	A-T-007s
TPH FID Chromatogram$_A$	-	-	-	Appended	-	-	Appended	-		A-T-007s
TPH ID (for FID characterisations)$_A$	-	-	-	Unknown profile	-	-	Possible diesel, light lube oil and lube oil	-		A-T-007s

Envirolab Job Number: 18/02476

Client Project Name: Not specified

Client Project Ref: 29701

Lab Sample ID	18/02476/3	18/02476/6	18/02476/7	18/02476/8	18/02476/9	18/02476/10	18/02476/11	18/02476/13	Units	Method ref
Client Sample No										
Client Sample ID	WS2	WS4	WS5	WS5	WS6	WS6	WS7	WS8		
Depth to Top	0.20	1.20	0.50	2.80	2.50	3.50	0.20	0.50		
Depth To Bottom	0.80		1.00				0.70			
Date Sampled	29-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18	27-Mar-18		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
Sample Matrix Code	4A	4A	45A	4A	6A	5A	4A	4A		
TPH CWG										
Ali >C5-C6$_A^{\#}$	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	mg/kg	A-T-022s
Ali >C6-C8$_A^{\#}$	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	mg/kg	A-T-022s
Ali >C8-C10$_A^{\#}$	<0.01	<0.01	<0.01	-	0.02	<0.01	-	<0.01	mg/kg	A-T-022s
Ali >C10-C12$_A^{\#}$	0.9	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	mg/kg	A-T-023s
Ali >C12-C16$_A^{\#}$	25.4	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	mg/kg	A-T-023s
Ali >C16-C21$_A^{\#}$	41.8	1.6	<0.1	-	<0.1	<0.1	-	<0.1	mg/kg	A-T-023s
Ali >C21-C35$_A^{\#}$	94.5	25.4	<0.1	-	<0.1	<0.1	-	<0.1	mg/kg	A-T-023s
Total Aliphatics$_A$	163	27.0	<0.1	-	<0.1	<0.1	-	<0.1	mg/kg	A-T-023s
Aro >C5-C7$_A^{\#}$	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	mg/kg	A-T-022s
Aro >C7-C8$_A^{\#}$	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	mg/kg	A-T-022s
Aro >C8-C9$_A^{\#}$	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	mg/kg	A-T-022s
Aro >C9-C10$_A^{\#}$	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	mg/kg	A-T-022s
Aro >C10-C12$_A^{\#}$	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	mg/kg	A-T-023s
Aro >C12-C16$_A^{\#}$	5.1	0.4	<0.1	-	<0.1	<0.1	-	<0.1	mg/kg	A-T-023s
Aro >C16-C21$_A^{\#}$	25.0	5.1	0.4	-	<0.1	<0.1	-	1.7	mg/kg	A-T-023s
Aro >C21-C35$_A^{\#}$	96.6	32.1	12.5	-	<0.1	<0.1	-	5.2	mg/kg	A-T-023s
Total Aromatics$_A$	127	37.6	13.0	-	<0.1	<0.1	-	6.9	mg/kg	A-T-023s
TPH (Ali & Aro)$_A$	289	64.7	13.0	-	<0.1	<0.1	-	6.9	mg/kg	A-T-023s
BTEX - Benzene$_A^{\#}$	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	mg/kg	A-T-022s
BTEX - Toluene$_A^{\#}$	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	mg/kg	A-T-022s
BTEX - Ethyl Benzene$_A^{\#}$	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	mg/kg	A-T-022s
BTEX - m & p Xylene$_A^{\#}$	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	mg/kg	A-T-022s
BTEX - o Xylene$_A^{\#}$	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	mg/kg	A-T-022s
MTBE$_A^{\#}$	<0.01	<0.01	<0.01	-	<0.01	<0.01	-	<0.01	mg/kg	A-T-022s

Envirolab Job Number: 18/02476

Client Project Name: Not specified

Client Project Ref: 29701

Lab Sample ID	18/02476/17	18/02476/19	18/02476/20	18/02476/21	18/02476/22	18/02476/23	18/02476/24		Units	Method ref
Client Sample No										
Client Sample ID	WS10	TP02	TP02	BH4	BH4	BH4	TP02			
Depth to Top	0.45	2.90	3.50	0.30	1.20	2.75				
Depth To Bottom	1.10				1.65					
Date Sampled	29-Mar-18	26-Mar-18	26-Mar-18	26-Mar-18	26-Mar-18	26-Mar-18	26-Mar-18			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Solid - Fragment / Tile			
Sample Matrix Code	5A	6A	4A	4A	6A	4A	8			
% Stones >10mm$_A$	17.8	20.6	32.0	10.1	16.8	16.6	-		% w/w	A-T-044
pH$_D$ M#	7.29	7.97	-	10.51	-	-	-		pH	A-T-031s
Sulphate (water sol 2:1)$_D$ M#	0.07	0.02	-	0.08	-	-	-		g/l	A-T-026s
Sulphate (acid soluble)$_D$ M#	310	330	-	1700	-	-	-		mg/kg	A-T-028s
Total Organic Carbon$_D$ M#	0.55	1.78	-	1.63	-	-	-		% w/w	A-T-032s
Arsenic$_D$ M#	4	10	-	15	-	-	-		mg/kg	A-T-024s
Cadmium$_D$ M#	<0.5	<0.5	-	0.5	-	-	-		mg/kg	A-T-024s
Copper$_D$ M#	5	18	-	28	-	-	-		mg/kg	A-T-024s
Chromium$_D$ M#	19	15	-	23	-	-	-		mg/kg	A-T-024s
Lead$_D$ M#	20	237	-	311	-	-	-		mg/kg	A-T-024s
Mercury$_D$	<0.17	0.43	-	0.98	-	-	-		mg/kg	A-T-024s
Nickel$_D$ M#	12	17	-	22	-	-	-		mg/kg	A-T-024s
Selenium$_D$ M#	<1	<1	-	<1	-	-	-		mg/kg	A-T-024s
Zinc$_D$ M#	25	42	-	208	-	-	-		mg/kg	A-T-024s
Asbestos in Soil (inc. matrix) ^										
Asbestos in soil$_A$ #	NAD	NAD	-	NAD	-	-	-			A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	N/A	-	N/A	-	-	-			
Bulk Fibre ID (inc. matrix) ^										
Bulk Fibre Identification$_A$ #	-	-	-	-	-	-	Chrysotile			A-T-045
Bulk Fibre Identification Matrix (visual)$_A$	-	-	-	-	-	-	Board			A-T-045
Bulk Fibre Identification - Suitable for Water Absorption Test?$_D$	-	-	-	-	-	-	YES			Gravimetry
Bulk Fibre Quantification % Asbestos in ACM										
Bulk Fibre - % Asbestos in ACM (HSG264)$_D$	-	-	-	-	-	-	40		% w/w	A-T-054

Envirolab Job Number: 18/02476

Client Project Name: Not specified

Client Project Ref: 29701

Lab Sample ID	18/02476/17	18/02476/19	18/02476/20	18/02476/21	18/02476/22	18/02476/23	18/02476/24		Units	Method ref
Client Sample No										
Client Sample ID	WS10	TP02	TP02	BH4	BH4	BH4	TP02			
Depth to Top	0.45	2.90	3.50	0.30	1.20	2.75				
Depth To Bottom	1.10				1.65					
Date Sampled	29-Mar-18	26-Mar-18	26-Mar-18	26-Mar-18	26-Mar-18	26-Mar-18	26-Mar-18			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Solid - Fragment / Tile			
Sample Matrix Code	5A	6A	4A	4A	6A	4A	8			
PAH-16MS										
Acenaphthene$_A^{M\#}$	<0.01	0.02	0.02	0.02	<0.01	<0.01	-		mg/kg	A-T-019s
Acenaphthylene$_A^{M\#}$	<0.01	<0.01	<0.01	0.09	<0.01	<0.01	-		mg/kg	A-T-019s
Anthracene$_A^{M\#}$	<0.02	0.03	0.02	0.81	<0.02	<0.02	-		mg/kg	A-T-019s
Benzo(a)anthracene$_A^{M\#}$	<0.04	0.08	0.08	3.38	0.08	<0.04	-		mg/kg	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	<0.04	0.08	0.10	2.87	0.10	<0.04	-		mg/kg	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	<0.05	0.11	0.12	3.17	0.12	<0.05	-		mg/kg	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	<0.05	<0.05	0.06	1.59	0.07	<0.05	-		mg/kg	A-T-019s
Benzo(k)fluoranthene$_A^{M\#}$	<0.07	<0.07	<0.07	1.23	<0.07	<0.07	-		mg/kg	A-T-019s
Chrysene$_A^{M\#}$	<0.06	0.12	0.12	3.29	0.11	<0.06	-		mg/kg	A-T-019s
Dibenzo(ah)anthracene$_A^{M\#}$	<0.04	<0.04	<0.04	0.48	<0.04	<0.04	-		mg/kg	A-T-019s
Fluoranthene$_A^{M\#}$	<0.08	0.30	0.25	6.69	0.17	<0.08	-		mg/kg	A-T-019s
Fluorene$_A^{M\#}$	<0.01	0.03	0.02	0.04	<0.01	<0.01	-		mg/kg	A-T-019s
Indeno(123-cd)pyrene$_A^{M\#}$	<0.03	0.06	0.07	2.01	0.08	<0.03	-		mg/kg	A-T-019s
Naphthalene$_A^{M\#}$	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	-		mg/kg	A-T-019s
Phenanthrene$_A^{M\#}$	<0.03	0.23	0.19	1.88	0.05	<0.03	-		mg/kg	A-T-019s
Pyrene$_A^{M\#}$	<0.07	0.25	0.22	5.78	0.16	<0.07	-		mg/kg	A-T-019s
PAH (total 16)$_A^{M\#}$	<0.08	1.38	1.28	33.3	0.93	<0.08	-		mg/kg	A-T-019s

Envirolab Job Number: 18/02476

Client Project Name: Not specified

Client Project Ref: 29701

Lab Sample ID	18/02476/17	18/02476/19	18/02476/20	18/02476/21	18/02476/22	18/02476/23	18/02476/24		Units	Method ref
Client Sample No										
Client Sample ID	WS10	TP02	TP02	BH4	BH4	BH4	TP02			
Depth to Top	0.45	2.90	3.50	0.30	1.20	2.75				
Depth To Bottom	1.10				1.65					
Date Sampled	29-Mar-18	26-Mar-18	26-Mar-18	26-Mar-18	26-Mar-18	26-Mar-18	26-Mar-18			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Solid - Fragment / Tile			
Sample Matrix Code	5A	6A	4A	4A	6A	4A	8			
TPH CWG										
Ali >C5-C6$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	A-T-022s
Ali >C6-C8$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	A-T-022s
Ali >C8-C10$_A^{\#}$	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	-		mg/kg	A-T-022s
Ali >C10-C12$_A^{\#}$	<0.1	7.2	2.0	<0.1	<0.1	<0.1	-		mg/kg	A-T-023s
Ali >C12-C16$_A^{\#}$	<0.1	38.9	18.9	<0.1	<0.1	<0.1	-		mg/kg	A-T-023s
Ali >C16-C21$_A^{\#}$	<0.1	39.8	22.1	<0.1	<0.1	<0.1	-		mg/kg	A-T-023s
Ali >C21-C35$_A^{\#}$	<0.1	7.2	3.9	7.9	<0.1	<0.1	-		mg/kg	A-T-023s
Total Aliphatics$_A$	<0.1	93.0	46.9	7.9	<0.1	<0.1	-		mg/kg	A-T-023s
Aro >C5-C7$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	A-T-022s
Aro >C7-C8$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	A-T-022s
Aro >C8-C9$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	A-T-022s
Aro >C9-C10$_A^{\#}$	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	-		mg/kg	A-T-022s
Aro >C10-C12$_A^{\#}$	<0.1	2.1	1.2	<0.1	<0.1	<0.1	-		mg/kg	A-T-023s
Aro >C12-C16$_A^{\#}$	<0.1	15.9	10.3	<0.1	<0.1	<0.1	-		mg/kg	A-T-023s
Aro >C16-C21$_A^{\#}$	<0.1	28.1	30.3	3.5	<0.1	<0.1	-		mg/kg	A-T-023s
Aro >C21-C35$_A^{\#}$	<0.1	15.7	24.4	18.4	<0.1	<0.1	-		mg/kg	A-T-023s
Total Aromatics$_A$	<0.1	61.7	66.3	21.9	<0.1	<0.1	-		mg/kg	A-T-023s
TPH (Ali & Aro)$_A$	<0.1	155	113	29.8	<0.1	<0.1	-		mg/kg	A-T-023s
BTEX - Benzene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	A-T-022s
BTEX - Toluene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	A-T-022s
BTEX - Ethyl Benzene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	A-T-022s
BTEX - m & p Xylene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	A-T-022s
BTEX - o Xylene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	A-T-022s
MTBE$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	A-T-022s

REPORT NOTES

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If results are in italic font they are associated with an AQC failure and there is insufficient sample to repeat the analysis. These are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

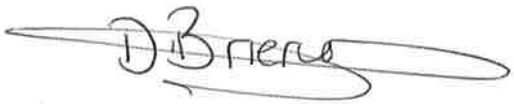
FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 18/03708
Issue Number: 1 **Date:** 29 May, 2018

Client: RSK Environment Ltd Tonbridge
Anerley Court, Half Moon Lane, Hildenborough
Tonbridge
Kent
TN11 9HU

Project Manager: Julia Griffin/Niki Dubber
Project Name: St. Clare Business Park, Hampton Hill
Project Ref: 29701
Order No: N/A
Date Samples Received: 14/05/18
Date Instructions Received: 14/05/18
Date Analysis Completed: 29/05/18

Prepared by:



Danielle Brierley
Client Manager

Approved by:

Richard Wong
Client Manager

UKAS TESTING
1247

Envirolab Job Number: 18/03708

Client Project Name: St. Clare Business Park, Hampton Hill

Client Project Ref: 29701

Lab Sample ID	18/03708/1	18/03708/2	18/03708/3	18/03708/4					Units	Method ref
Client Sample No										
Client Sample ID	WS2	WS5	WS6	BH4						
Depth to Top				0.05						
Depth To Bottom										
Date Sampled	10-May-18	10-May-18	10-May-18	10-May-18						
Sample Type	Water - EW	Water - EW	Water - EW	Water - EW						
Sample Matrix Code	N/A	N/A	N/A	N/A						
pH (w)$_A^{\#}$	6.57	7.32	9.30	7.44					pH	A-T-031w
Sulphate (w)$_A^{\#}$	71	61	75	64					mg/l	A-T-026w
Arsenic (dissolved)$_A^{\#}$	2	4	29	<1					µg/l	A-T-025w
Cadmium (dissolved)$_A^{\#}$	<0.2	<0.2	<0.2	<0.2					µg/l	A-T-025w
Copper (dissolved)$_A^{\#}$	18	5	7	1					µg/l	A-T-025w
Chromium (dissolved)$_A^{\#}$	<1	<1	3	<1					µg/l	A-T-025w
Lead (dissolved)$_A^{\#}$	14	1	8	<1					µg/l	A-T-025w
Mercury (dissolved)$_A^{\#}$	<0.1	<0.1	<0.1	<0.1					µg/l	A-T-025w
Nickel (dissolved)$_A^{\#}$	81	10	5	2					µg/l	A-T-025w
Selenium (dissolved)$_A^{\#}$	2	2	8	1					µg/l	A-T-025w
Zinc (dissolved)$_A^{\#}$	32	30	<1	<1					µg/l	A-T-025w
Ali >C5-C6 (w)$_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
Ali >C6-C8 (w)$_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
Ali >C8-C10 (w)$_A^{\#}$	<150	<50	480	<5					µg/l	A-T-055w
Ali >C10-C12 (w)$_A^{\#}$	<150	<50	236	<5					µg/l	A-T-055w
Ali >C12-C16 (w)$_A^{\#}$	<150	<50	78	<5					µg/l	A-T-055w
Ali >C16-C21 (w)$_A^{\#}$	<150	<50	943	<5					µg/l	A-T-055w
Ali >C21-C35 (w)$_A^{\#}$	<150	<50	19500	<5					µg/l	A-T-055w
Total Aliphatics >C5-C35 (w)$_A^{\#}$	<5	<5	21190	<5					µg/l	A-T-055w
Aro >C5-C7 (w)$_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
Aro >C7-C8 (w)$_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
Aro >C8-C10 (w)$_A^{\#}$	<150	<50	231	<5					µg/l	A-T-055w
Aro >C10-C12 (w)$_A^{\#}$	<150	<50	150	<5					µg/l	A-T-055w
Aro >C12-C16 (w)$_A^{\#}$	<150	<50	126	<5					µg/l	A-T-055w
Aro >C16-C21 (w)$_A^{\#}$	<150	<50	675	<5					µg/l	A-T-055w
Aro >C21-C35 (w)$_A^{\#}$	281	<50	15200	<10					µg/l	A-T-055w
Total Aromatics >C5-C35 (w)$_A^{\#}$	281	<10	16416	<10					µg/l	A-T-055w
TPH (Ali & Aro >C5-C35) (w)$_A^{\#}$	281	<10	37606	<10					µg/l	A-T-055w
BTEX - Benzene (w)$_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
BTEX - Toluene (w)$_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
BTEX - Ethyl Benzene (w)$_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
BTEX - m & p Xylene (w)$_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w
BTEX - o Xylene (w)$_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w

Envirolab Job Number: 18/03708

Client Project Name: St. Clare Business Park, Hampton Hill

Client Project Ref: 29701

Lab Sample ID	18/03708/1	18/03708/2	18/03708/3	18/03708/4					Units	Method ref
Client Sample No										
Client Sample ID	WS2	WS5	WS6	BH4						
Depth to Top				0.05						
Depth To Bottom										
Date Sampled	10-May-18	10-May-18	10-May-18	10-May-18						
Sample Type	Water - EW	Water - EW	Water - EW	Water - EW						
Sample Matrix Code	N/A	N/A	N/A	N/A						
MTBE (w)$_A^{\#}$	<1	<1	<1	<1					µg/l	A-T-022w

Envirolab Job Number: 18/03708

Client Project Name: St. Clare Business Park, Hampton Hill

Client Project Ref: 29701

Lab Sample ID	18/03708/1	18/03708/2	18/03708/3	18/03708/4					Units	Method ref
Client Sample No										
Client Sample ID	WS2	WS5	WS6	BH4						
Depth to Top				0.05						
Depth To Bottom										
Date Sampled	10-May-18	10-May-18	10-May-18	10-May-18						
Sample Type	Water - EW	Water - EW	Water - EW	Water - EW						
Sample Matrix Code	N/A	N/A	N/A	N/A						
PAH 16MS (w)										
Acenaphthene $(w)_A^{\#}$	0.04	0.02	0.04	<0.01					µg/l	A-T-019w
Acenaphthylene $(w)_A^{\#}$	<0.01	0.04	0.14	<0.01					µg/l	A-T-019w
Anthracene $(w)_A^{\#}$	0.10	0.07	0.23	<0.01					µg/l	A-T-019w
Benzo(a)anthracene $(w)_A^{\#}$	0.29	0.36	0.91	<0.01					µg/l	A-T-019w
Benzo(a)pyrene $(w)_A^{\#}$	0.29	0.36	1.04	<0.01					µg/l	A-T-019w
Benzo(b)fluoranthene $(w)_A^{\#}$	0.37	0.45	1.36	<0.01					µg/l	A-T-019w
Benzo(ghi)perylene $(w)_A^{\#}$	0.18	0.23	0.88	<0.01					µg/l	A-T-019w
Benzo(k)fluoranthene $(w)_A^{\#}$	0.15	0.18	0.47	<0.01					µg/l	A-T-019w
Chrysene $(w)_A^{\#}$	0.35	0.38	1.09	<0.01					µg/l	A-T-019w
Dibenzo(ah)anthracene $(w)_A^{\#}$	0.04	0.05	0.14	<0.01					µg/l	A-T-019w
Fluoranthene $(w)_A^{\#}$	0.64	0.78	1.91	<0.01					µg/l	A-T-019w
Fluorene $(w)_A^{\#}$	0.04	0.02	0.08	<0.01					µg/l	A-T-019w
Indeno(123-cd)pyrene $(w)_A^{\#}$	0.19	0.24	0.83	<0.01					µg/l	A-T-019w
Naphthalene $(w)_A^{\#}$	0.02	<0.01	<0.02	<0.01					µg/l	A-T-019w
Phenanthrene $(w)_A^{\#}$	0.42	0.22	0.76	<0.01					µg/l	A-T-019w
Pyrene $(w)_A^{\#}$	0.57	0.73	1.97	<0.01					µg/l	A-T-019w
Total PAH 16MS $(w)_A^{\#}$	3.69	4.13	11.8	<0.01					µg/l	A-T-019w

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Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 18/06879
Issue Number: 1 **Date:** 07 September, 2018

Client: RSK Environment Ltd Hemel
18 Frogmore Road
Hemel Hempstead
Hertfordshire
UK
HP3 9RT

Project Manager: Nigel Austin/Niki Dubber
Project Name: St Clare Business Park
Project Ref: 29701
Order No: N/A
Date Samples Received: 28/08/18
Date Instructions Received: 29/08/18
Date Analysis Completed: 06/09/18

Prepared by:

Melanie Marshall
Laboratory Coordinator

Approved by:

Richard Wong
Client Manager

UKAS TESTING
1247

Envirolab Job Number: 18/06879

Client Project Name: St Clare Business Park

Client Project Ref: 29701

Lab Sample ID	18/06879/1								Units	Method ref
Client Sample No										
Client Sample ID	BH04									
Depth to Top	3.00									
Depth To Bottom										
Date Sampled	23-Aug-18									
Sample Type	Water - EW									
Sample Matrix Code	N/A									
TPH CWG (w)										
Ali >C5-C6 $(w)_A^{\#}$	<1								µg/l	A-T-022w
Ali >C6-C8 $(w)_A^{\#}$	<1								µg/l	A-T-022w
Ali >C8-C10 $(w)_A^{\#}$	<5								µg/l	A-T-055w
Ali >C10-C12 $(w)_A^{\#}$	<5								µg/l	A-T-055w
Ali >C12-C16 $(w)_A^{\#}$	<5								µg/l	A-T-055w
Ali >C16-C21 $(w)_A^{\#}$	<5								µg/l	A-T-055w
Ali >C21-C35 $(w)_A^{\#}$	<5								µg/l	A-T-055w
Total Aliphatics >C5-C35 $(w)_A^{\#}$	<5								µg/l	A-T-055w
Aro >C5-C7 $(w)_A^{\#}$	<1								µg/l	A-T-022w
Aro >C7-C8 $(w)_A^{\#}$	<1								µg/l	A-T-022w
Aro >C8-C10 $(w)_A$	35								µg/l	A-T-055w
Aro >C10-C12 $(w)_A^{\#}$	<5								µg/l	A-T-055w
Aro >C12-C16 $(w)_A^{\#}$	<5								µg/l	A-T-055w
Aro >C16-C21 $(w)_A^{\#}$	<5								µg/l	A-T-055w
Aro >C21-C35 $(w)_A^{\#}$	<10								µg/l	A-T-055w
Total Aromatics >C5-C35 $(w)_A$	35								µg/l	A-T-055w
TPH (Ali & Aro >C5-C35) $(w)_A$	35								µg/l	A-T-055w
BTEX - Benzene $(w)_A^{\#}$	<1								µg/l	A-T-022w
BTEX - Toluene $(w)_A^{\#}$	<1								µg/l	A-T-022w
BTEX - Ethyl Benzene $(w)_A^{\#}$	<1								µg/l	A-T-022w
BTEX - m & p Xylene $(w)_A^{\#}$	<1								µg/l	A-T-022w
BTEX - o Xylene $(w)_A^{\#}$	<1								µg/l	A-T-022w
MTBE $(w)_A^{\#}$	<1								µg/l	A-T-022w

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All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
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All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

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Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

APPENDIX M
LABORATORY CERTIFICATES FOR GEOTECHNICAL ANALYSIS

STRUCTURAL SOILS LTD

TEST REPORT

Report No. 583827-01 (00) 1774

Date	24-April-2018	Contract	St Clare Business Park, Hampton Hill

Client RSK
Address 18 Frogmore Rd
Apsley
Hemel Hempstead
Hertfordshire
HP3 9RT
For the Attention of Niki Dubber

Samples submitted by client	09-April-2018	Client Reference	29701
Testing Started	09-April-2018	Client Order No.	n/a
Testing Completed	24-April-2018	Instruction Type	Written

Tests marked 'Not UKAS Accredited' in this report are not included in the UKAS Accreditation Schedule for our Laboratory.

UKAS Accredited Tests

1.01	Moisture Content (oven drying method) BS1377:Part 2:1990:clause 3.2 (superseded)*
1.02	Liquid Limit (definitive method) & Plastic Limit BS1377:Part 2:1990,clause 4.3/5.3
1.10	Particle Size Distribution wet sieve method BS1377:Part 2:1990,clause 9.2
5.04	Undrained shear strength triaxial compression without pore pressure measurement (definitive method) 100mm diameter specimens BS1377:Part 7:1990,clause 8.4

Not UKAS Accredited Tests

P97	Hand Vane

Undertaken by a sub-contractor

2.06	Sulphate content (acid extract) in accordance with BRE Special Digest 1:2005
2.04	Sulphate content (water extract) in accordance with BRE Special Digest 1:2005
2.07	pH value in accordance with BRE Special Digest 1:2005
2.05	Total sulphur in accordance with BRE Special Digest 1:2005

* This clause of BS1377 is no longer the most up to date method due to the publication of ISO17892

Please Note: Remaining samples will be retained for a period of one month from today and will then be disposed of .
Test were undertaken on samples 'as received' unless otherwise stated.
Opinions and interpretations expressed in this report are outside the scope of accreditation for this laboratory.

Structural Soils Ltd 18 Frogmore Rd Hemel Hempstead HP3 9RT Tel.01442 416661 e-mail dimitris.xirouchakis@soils.co.uk

TESTING VERIFICATION CERTIFICATE

1774

The test results included in this report are certified as:-

ISSUE STATUS: **FINAL**

In accordance with the Structural Soils Ltd Laboratory Quality Management System, results sheets and summaries of results issued by the laboratory are checked by an approved signatory. The integrity of the test data and results are ensured by control of the computer system employed by the laboratory as part of the Software Verification Program as detailed in the Laboratory Quality Manual.

This testing verification certificate covers all testing compiled on or before the following datetime: **24/04/2018 11:51:32**.

Testing reported after this date is not covered by this Verification Certificate.

Approved Signatory
Sharon Cairns (Laboratory Manager)

(Head Office)
Bristol Laboratory
Unit 1A, Princess Street
Bedminster
Bristol
BS3 4AG

Castleford Laboratory
The Potteries, Pottery Street
Castleford
West Yorkshire
WF10 1NJ

Hemel Laboratory
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Tonbridge Laboratory
Anerley Court, Half Moon Lane
Hildenborough
Tonbridge
TN11 9HU

STRUCTURAL SOILS LTD	Contract: **St Clare Business Park, Hampton Hill**	Job No: **583827**

SUMMARY OF SOIL CLASSIFICATION TESTS

In accordance with clauses 3.2,4.3,4.4,5.3,5.4,7.2,8.2,8.3 of BS1377:Part 2:1990

Exploratory Position ID	Sample Ref	Sample Type	Depth (m)	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425um	Description of Sample
BH4		D	4.00	21	55	27	28	51	Brown sandy gravelly CLAY
BH4		D	12.00	31	61	29	32	100	Grey slightly sandy slightly gravelly CLAY
BH4		D	19.25	22	61	23	38	100	Grey slightly sandy slightly gravelly CLAY
BH4		U	19.55	20	90	43	47	100	Dark brown mottled dark grey sandy clayey SILT

STRUCTURAL SOILS LTD

Contract:

St Clare Business Park, Hampton Hill

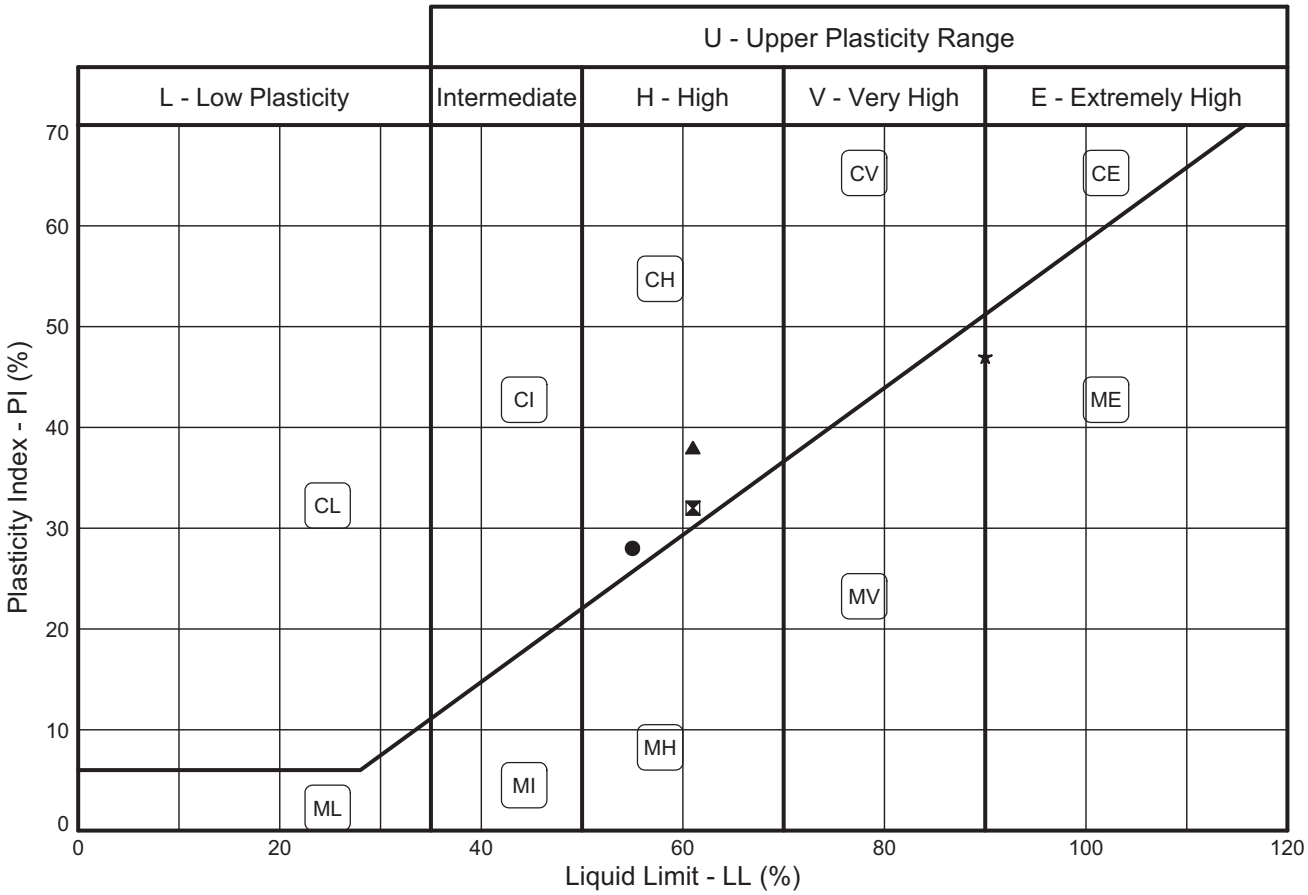
Contract Ref:

583827

AGS

PLASTICITY CHART - PI Vs LL

In accordance with BS5930:2015
Testing in accordance with BS1377-2:1990



Sample Identification				BS Test Method #	Preparation Method +	MC %	LL %	PL %	PI %	<425um %	Lab location	
	Exploratory Position ID	Sample	Depth (m)									
●	BH4	D	4.00	3.2/4.4/5.3/5.4	4.2.4	21	55	27	28	51	H	
⊠	BH4	D	12.00	3.2/4.4/5.3/5.4	4.2.4	31	61	29	32	100	H	
▲	BH4	D	19.25	3.2/4.4/5.3/5.4	4.2.4	22	61	23	38	100	H	
★	BH4	U	19.55	3.2/4.4/5.3/5.4	4.2.3	20	90	43	47	100	H	

Tested in accordance with the following clauses of BS1377-2:1990.

3.2 - Moisture Content
4.3 - Cone Penetrometer Method
4.4 - One Point Cone Penetrometer Method
4.6 - One Point Casagrande Method
5.3 - Plastic Limit Method
5.4 - Plasticity Index

+ Tested in accordance with the following clauses of BS1377-2:1990.

4.2.3 - Natural State
4.2.4 - Wet Sieved

Key: * = Non-standard test, NP = Non plastic.

Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By		Date
SC	SHARON CAIRNS	24/04/18

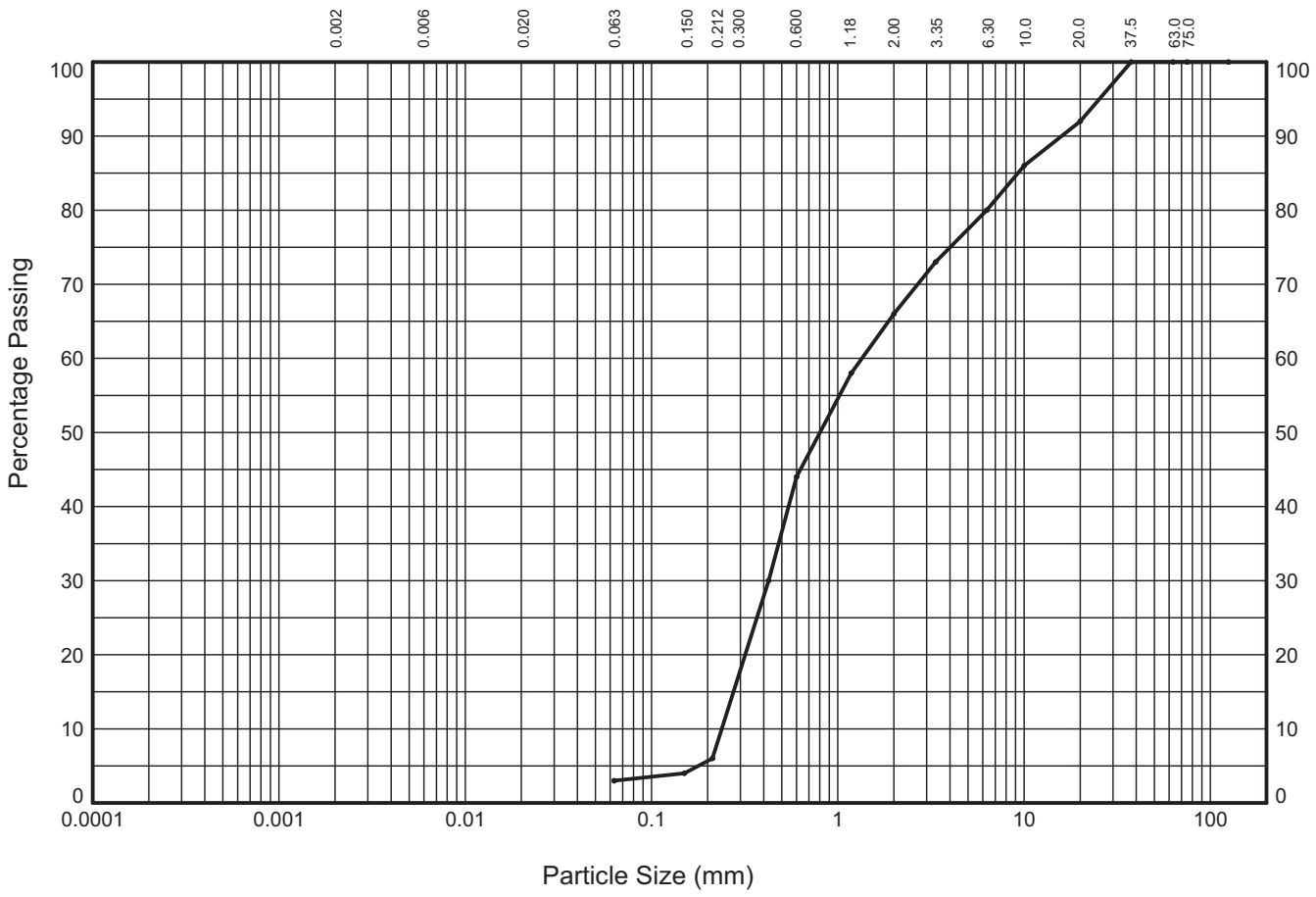
Contract: **St Clare Business Park, Hampton Hill**

Contract Ref: **583827**

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2 of BS1377:Part 2:1990

Borehole: **BH4** Sample Ref: **-** Sample Type: **B** Depth (m): **3.00**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	SILT			SAND			GRAVEL			

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**100**
20.0	**92**
10.0	**86**
6.30	**80**
3.35	**73**
2.00	**66**
1.18	**58**
0.600	**44**
0.425	**30**
0.212	**6**
0.150	**4**
0.063	**3**

Particle Diameter (mm)	Percent Passing (%)

Sedimentation sample was not pre-treated

Soil Fraction	Sieve Percentage (%)
GRAVEL	**34**
SAND	**63**
SILT/CLAY	**3**

Soil Description:

Brown slightly clayey very gravelly SAND

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By		Date
SC	**SHARON CAIRNS**	**24/04/18**

Contract	Contract Ref:
St Clare Business Park, Hampton Hill	**583827**

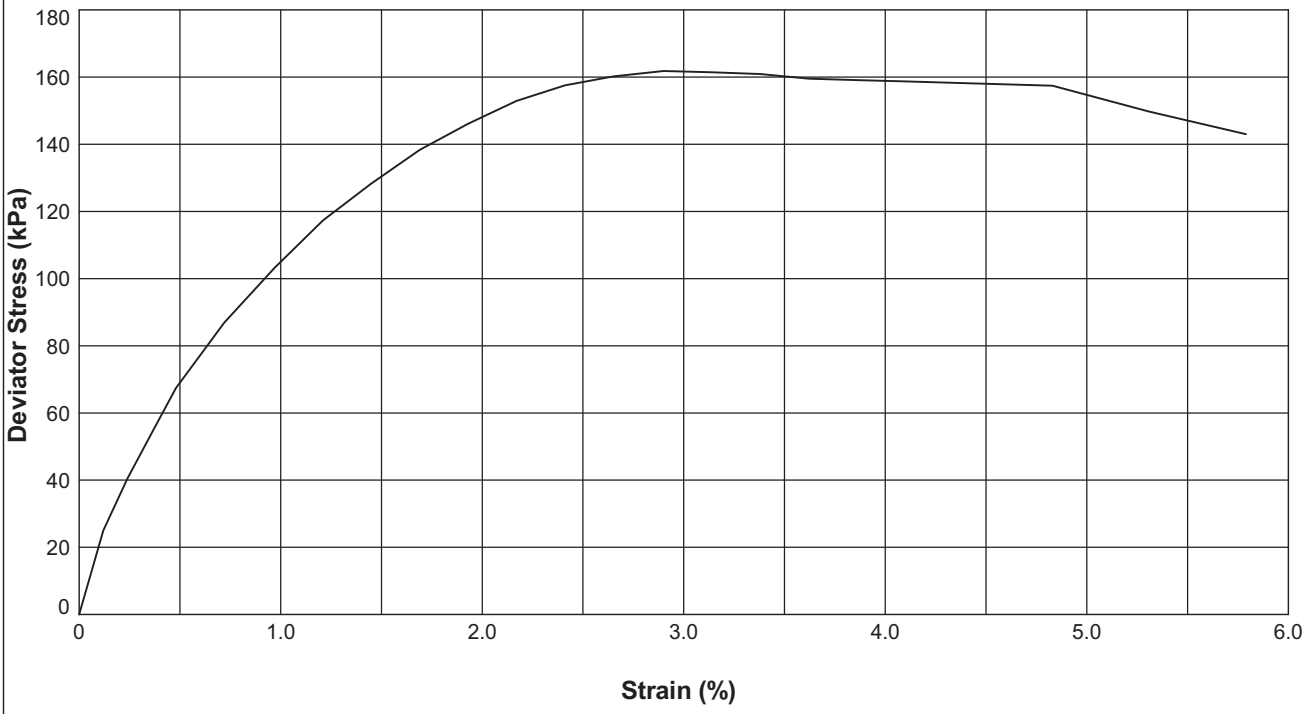
UNCONSOLIDATED QUICK UNDRAINED (SINGLE STAGE) TRIAXIAL COMPRESSION TEST

In accordance with BS1377:Part 7:1990, Clause 8

Borehole: **BH4** Sample Ref: **-** Sample Type: **U** Depth (m): **5.00**

Description : **Dark brown mottled light brown slightly sandy CLAY**

STAGE NUMBER			1	2	3
SAMPLE DETAILS	Sample Condition		Undisturbed		
	Orientation of sample		Vertical		
	Diameter	(mm)	103.71		
	Height	(mm)	207.23		
	Moisture Content	(%)	29		
	Bulk Density	(Mg/m^3)	1.98		
	Dry Density	(Mg/m^3)	1.54		
TEST DETAILS	Membrane Thickness	(mm)	0.31		
	Rate of Axial Displacement	(%/min)	0.75		
	Cell Pressure	(kPa)	100		
	Membrane Correction	(kPa)	0.24		
	Corrected Deviator Stress	(kPa)	162		
	Undrained Shear Strength	(kPa)	81		
	Strain at Failure	(%)	2.9		
	Mode of Failure		Brittle		



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Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By		Date
SC	SHARON CAIRNS	24/04/18

Contract	Contract Ref:
St Clare Business Park, Hampton Hill	583827

AGS

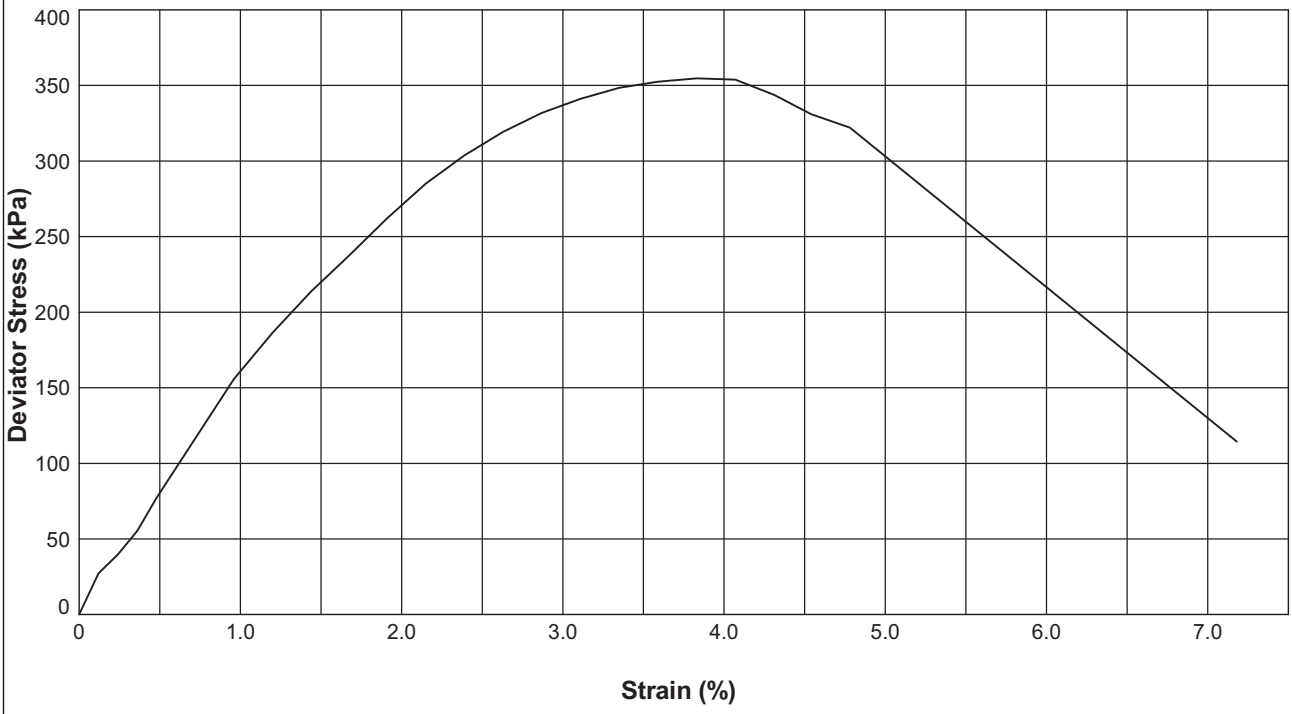
UNCONSOLIDATED QUICK UNDRAINED (SINGLE STAGE) TRIAXIAL COMPRESSION TEST

In accordance with BS1377:Part 7:1990, Clause 8

Borehole: **BH4** Sample Ref: **-** Sample Type: **U** Depth (m): **11.00**

Description : **Dark brown mottled brown slightly sandy CLAY**

STAGE NUMBER			1	2	3
SAMPLE DETAILS	Sample Condition		Undisturbed		
	Orientation of sample		Vertical		
	Diameter	(mm)	103.43		
	Height	(mm)	209.05		
	Moisture Content	(%)	28		
	Bulk Density	(Mg/m^3)	2.00		
	Dry Density	(Mg/m^3)	1.56		
TEST DETAILS	Membrane Thickness	(mm)	0.26		
	Rate of Axial Displacement	(%/min)	0.79		
	Cell Pressure	(kPa)	220		
	Membrane Correction	(kPa)	0.26		
	Corrected Deviator Stress	(kPa)	355		
	Undrained Shear Strength	(kPa)	177		
	Strain at Failure	(%)	3.8		
	Mode of Failure		Brittle		



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Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By		Date
SC	SHARON CAIRNS	24/04/18

Contract	Contract Ref:
St Clare Business Park, Hampton Hill	583827

SUMMARY OF HAND PENETROMETER & HAND VANE TEST RESULTS

Exploratory Position ID	Sample Ref	Sample Type	Depth (m)	Moisture Content (%)	Vane Type	Readings (kPa)	Sample Description	Lab location
BH4		U	19.55	21	HVP	30, 146, 182, >236	Dark brown mottled dark grey sandy clayey SILT	**H**

Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)

Key : HVP = Hand Vane (Peak), HVR = Hand Vane (Remoulded), PP = Pocket Penetrometer.

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By		Date	Contract Ref:
SC	**SHARON CAIRNS**	**24.04.18**	**583827**
Contract: **St Clare Business Park, Hampton Hill**			

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 18/02635
Issue Number: 1 **Date:** 17 April, 2018

Client: Structural Soils Limited (Hemel Hempstead Lab)
18 Frogmore Road
Hemel Hempstead
UK
HP3 9RT

Project Manager: Hemel Lab/Sharon Cairns
Project Name: St Clare Business Park, Hampton Hill
Project Ref: 29701
Order No: N/A
Date Samples Received: 11/04/18
Date Instructions Received: 11/04/18
Date Analysis Completed: 17/04/18

Prepared by:

Holly Neary-King
Administrative Assistant

Approved by:

Danielle Brierley
Client Manager

Envirolab Job Number: 18/02635

Client Project Name: St Clare Business Park, Hampton Hill

Client Project Ref: 29701

Lab Sample ID	18/02635/1	18/02635/2	18/02635/3	18/02635/4					Units	Method ref
Client Sample No										
Client Sample ID	BH4	BH4	BH4	BH4						
Depth to Top	18.00	4.75	12.50	1.75						
Depth To Bottom			12.95							
Date Sampled										
Sample Type	Soil - D	Soil - D	Soil - D	Soil - D						
Sample Matrix Code	3	3	6A	5A						
% Stones >10mm$_A$	<0.1	<0.1	18.5	4.1					% w/w	A-T-044
pH BRE$_D$$^{M\#}$	8.51	8.12	8.33	7.99					pH	A-T-031s
Sulphate BRE (water sol 2:1)$_D$$^{M\#}$	177	365	141	13					mg/l	A-T-026s
Sulphate BRE (acid sol)$_D$$^{M\#}$	0.07	0.15	0.08	<0.02					% w/w	A-T-028s
Sulphur BRE (total)$_D$	0.36	0.59	0.32	<0.01					% w/w	A-T-024s

REPORT NOTES

General:
This report shall not be reproduced, except in full, without written approval from Envirolab.
All samples contained within this report, and any received with the same delivery, will be disposed of one month after the date of this report.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.
If results are in italic font they are associated with an AQC failure and there is insufficient sample to repeat the analysis. These are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,
E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

APPENDIX N
HUMAN HEALTH GENERIC ASSESSMENT CRITERIA

Generic assessment criteria for human health: residential scenario with home-grown produce

Background

RSK's generic assessment criteria (GAC) were initially prepared following the publication by the Environment Agency (EA) of soil guideline value (SGV) and toxicological (TOX) reports, and associated publications in 2009[1]. RSK GAC were updated following the publication of GAC by LQM/CIEH in 2009[2]. RSK GAC are periodically revised when updated information on toxicological, land use or receptor parameters is published.

Updates to the RSK GAC

In 2014, the publication of Category 4 Screening Levels (C4SL)[3,4], as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3)[5] used in the generation of SGVs.

C4SL were published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010[3]). Where a C4SL has been published, the RSK GAC duplicates the C4SL published values using all input parameters within the SP1010 final project report[3] and associated appendices[6], and adopts them as GAC for these six substances.

For all other substances the C4SL exposure modifications, with the exception of the "top two" produce type approach taken in the C4SL, have been applied to the current RSK GAC. These include alterations to daily inhalation rates for residential and commercial scenarios, reducing soil adherence factors in children (age classes 1 to 12 only) for residential land use, reducing exposure frequency for dermal contact outdoors for residential land use, and updated produce type consumption rates (90th percentile) based on recent data from the National Diet and Nutrition Survey.

The RSK GAC have also been revised with updated toxicology published by LQM/CIEH in 2015[7] or by the USEPA[14], where a C4SL has not been published.

RSK GAC derivation for metals and organic compounds

Model selection

Soil assessment criteria (SAC) were calculated using the Contaminated Land Exposure Assessment (CLEA) tool v1.071, supporting EA guidance[5,8,9] and revised exposure scenarios published for the C4SL[3]. The SAC are also termed GAC.

Conceptual model

In accordance with SR3[5], the residential with home-grown produce scenario considers risks to a female child between the ages of 0 and 6 years old as the highest risk scenario. In accordance with Box 3.1 of SR3[5], the pathways considered for production of the SAC in the residential with home-grown produce scenario are

- direct soil and dust ingestion

- consumption of home-grown produce
- consumption of soil attached to home-grown produce
- dermal contact with soil and indoor dust
- inhalation of indoor and outdoor dust and vapours.

Figure 1 is a conceptual model illustrating these linkages.

In line with guidance in the EA SGV report for cadmium[1], the RSK GAC for cadmium has been derived based on estimates representative of lifetime exposure. Although young children are generally more likely to have higher exposures to soil contaminants, the renal toxicity of cadmium, and the derivation of the TDI_{oral} and TDI_{inh}, are based on considerations of the kidney burden accumulated over 50 years or so. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period.

With respect to volatilisation, the CLEA model assumes a simple linear partitioning of a chemical in the soil between the sorbed, dissolved and vapour phase[9]. The upper boundaries of this partitioning are represented by the maximum aqueous solubility and pure saturated vapour concentration of the chemical. The CLEA model estimates saturated soil concentrations where these limits are reached[9]. The CLEA software uses a traffic light system to identify when individual and/or combined assessment criteria exceed the lower of either the aqueous- or vapour-based soil saturation limits. Model output cells are flagged red where the saturated soil concentration has been exceeded and the contribution of the indoor and outdoor vapour pathway to total exposure is greater than 10%. In this case, further consideration of the following is required[9]:

- Free phase contamination may be present.
- Exposure from the vapour pathways will be over-predicted by the model, as in reality the vapour phase concentration will not increase at concentrations above saturation limits
- Where the vapour pathway contribution is greater than 90%, it is unlikely the relevant health criteria value (HCV) will be exceeded at soil concentrations at least a factor of ten higher than the relevant HCV.

Where the vapour pathway is the predominant pathway (contributes greater than 90% of exposure) or the only exposure route considered and the cell is highlighted red (SAC exceeds saturation limit), the risk based on the assumed conceptual model is likely to be negligible as the vapour risk is assumed to be tolerable at maximum possible soil concentrations. In such circumstances, the vapour pathway exposure should be considered based on the presence of free phase or non-aqueous phase liquid sources and the measured concentrations of volatile organic compounds (VOC) in the vapour phase. Screening could be considered based on setting the SAC as the modelled soil saturation limits. However, as stated within the CLEA handbook[9], this is likely to not be practical in many cases because of the very low saturation limits and, in any case, is highly conservative.

It should also be noted that for mixtures of compounds, free phase may be present where soil (or groundwater) concentrations are well below saturation limits for individual compounds.

Where the vapour pathway is only one of the exposure pathways considered, an additional approach can then be utilised as detailed within Section 4.12 of the CLEA model handbook[9], which explains how to calculate an effective assessment criterion manually.

SR3[5] states that, as a general rule of thumb, it is recognised that estimating vapour phase concentrations from dissolved and sorbed phase contamination by petroleum hydrocarbons are

at least a factor of ten higher than those likely to be measured on-site. RSK has therefore applied an empirical subsurface to indoor air correction factor of 10 into the CLEA model chemical database for all petroleum hydrocarbon fractions (including BTEX, trimethylbenzenes and the polycyclic aromatic hydrocarbons (PAH) naphthalene, acenaphthene and acenaphthylene) to reduce this conservatism.

Input selection

The most up-to-date published chemical and toxicological data was obtained from EA Report SC050021/SR7[10], the EA TOX[1] reports, the C4SL SP1010 project report and associated appendices[3,6], the 2015 LQM/CIEH report[7] or the USEPA IRIS database[14]. Where a C4SL has been published, the RSK GAC have duplicated the C4SL published values using all input parameters within the SP1010 final project report[3] and associated appendices[6], and has adopted them as GAC for these six substances. Toxicological and specific chemical parameters for aromatic hydrocarbon C_8–C_9 (styrene), 1,2,4-trimethylbenzene and methyl tertiary-butyl ether (MTBE) were obtained from the CL:AIRE Soil Generic Assessment Criteria report[11].

For TPH, aromatic hydrocarbons C_5–C_8 were not modelled, as this range comprises benzene and toluene, which are modelled separately. The aromatic C_8–C_9 hydrocarbon fraction comprises ethylbenzene, xylene and styrene. As ethylbenzene and xylene are being modelled separately, the physical, chemical and toxicological data for aromatic C_8–C_9 have been taken from styrene.

Physical parameters

For the residential with home-grown produce scenario, the CLEA default building is a small, two-storey terrace house with a concrete ground-bearing slab. The house is assumed to have a 100m^2 private garden consisting of lawn and flowerbeds, incorporating a 20m^2 plot for growing fruit and vegetables consumed by the residents. SR3[5] notes this residential building type to be the most conservative in terms of potential for vapour intrusion. The building parameters used in the production of the RSK GACs are the default CLEA v1.06 inputs presented in Table 3.3 of SR3[3], with a dust loading factor detailed in Section 9.3 of SR3[5]. The parameters for a sandy loam soil type were used in line with Table 4.4 of SR3[5]. This includes a value of 6% for the percentage of soil organic matter (SOM) within the soil. In RSK's experience, this is rather high for many sites. To avoid undertaking site-specific risk assessments for SOM, RSK has produced an additional set of GAC for SOM of 1% and 2.5% for all substances using the CLEA tool.

Summary of modifications to the default CLEA SR3[5] input parameters for residential with home-grown produce land-use scenario

In summary, the RSK GAC were produced using the default input parameters for soil properties, the air dispersion model, building properties and the vapour model detailed in SR3[5]. Modifications to the default SR3[5] exposure scenarios based on the C4SL exposure scenarios[3] are presented in Tables 2 and 3 below.

The final selected GAC are presented by pathway in Table 4 and the combined GAC in Table 5.

Figure 1: Conceptual model for residential scenario with home-grown produce

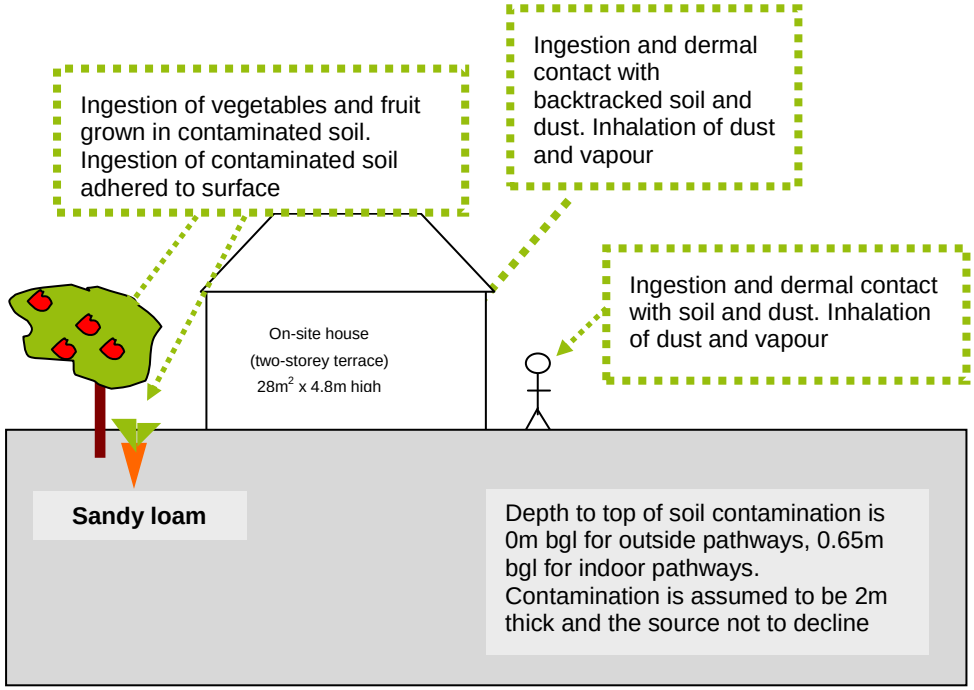

Table 1: Exposure assessment parameters for residential scenario with home-grown produce – inputs for CLEA model

Parameter	Value	Justification
Land use	Residential with homegrown produce	Chosen land use
Receptor	Female child age 1 to 6	Key generic assumption given in Box 3.1, SR3[5]
Building	Small terraced house	Key generic assumption given in Box 3.1, SR3. Small, two-storey terraced house chosen, as it is the most conservative residential building type in terms of protection from vapor intrusion (Section 3.4.6, SR3)[5]
Soil type	Sandy Loam	Most common UK soil type (Section 4.3.1, from Table 3.1, SR3)[5]
Start AC (age class)	1	Range of age classes corresponding to key generic assumption that the critical receptor is a young female child aged 0–6. From Box 3.1, SR3[5]
End AC (age class)	6	
SOM (%)	6	Representative of sandy loamy soil according to EA guidance note dated January 2009 entitled 'Changes We Have Made to the CLEA Framework Documents'[13]
	1	To provide SAC for sites where SOM <6% as often observed by RSK
	2.5	
pH	7	Model default

Table 2: Residential with home-grown produce – modified home-grown produce data

Name	Consumption rate 90th percentile (g FW kg^{-1} BW day^{-1}) by age class						Dry weight conversion factor (g DW g^{-1} FW)	Home-grown fraction (average)	Home-grown fraction (high end)	Soil loading factor (g g^{-1} DW)	Preparation correction factor
	1	2	3	4	5	6					
Green vegetables	7.12	5.87	5.87	5.87	4.53	4.53	0.096	0.05	0.33	1.00E-03	2.00E-01
Root vegetables	10.7	2.83	2.83	2.83	2.14	2.14	0.103	0.06	0.4	1.00E-03	1.00E+00
Tuber vegetables	16	6.6	6.6	6.6	4.95	4.95	0.21	0.02	0.13	1.00E-03	1.00E+00
Herbaceous fruit	1.83	3.39	3.39	3.39	2.24	2.24	0.058	0.06	0.4	1.00E-03	6.00E-01
Shrub fruit	2.23	0.46	0.46	0.46	0.19	0.19	0.166	0.09	0.6	1.00E-03	6.00E-01
Tree fruit	3.82	10.3	10.3	10.3	5.16	5.16	0.157	0.04	0.27	1.00E-03	6.00E-01
Justification	Table 3.4, SP1010 (3)						Table 6.3, SR3(5)	Table 4.19, SR3(5)		Table 6.3, SR3(5)	

Table 3: Residential with home-grown produce – modified and use and receptor data

Parameter	Unit	Age class					
		1	2	3	4	5	6
EF (soil and dust ingestion)	day yr^{-1}	180	365	365	365	365	365
EF (consumption of home-grown produce)	day yr^{-1}	180	365	365	365	365	365
EF (skin contact, indoor)	day yr^{-1}	180	365	365	365	365	365
EF (skin contact, outdoor)	day yr^{-1}	170	170	170	170	170	170
EF (inhalation of dust and vapour, indoor)	day yr^{-1}	365	365	365	365	365	365
EF (inhalation of dust and vapour, outdoor)	day yr^{-1}	365	365	365	365	365	365
Justification		Table 3.5, SP1010(3); Table 3.1, SR3(5)					
Soil to skin adherence factor (outdoor)	mg cm^{-2} day^{-1}	0.1	0.1	0.1	0.1	0.1	0.1
Justification		Table 3.5, SP1010(3)					
Inhalation rate	m^3 day^{-1}	5.4	8.0	8.9/f	10.1	10.1	10.1
Justification		Mean value USEPA, 2011(12); Table 3.2, SP1010(3)					
Notes: For **cadmium**, the exposure assessment for a residential land use is based on estimates representative of lifetime exposure AC1-18. This is because the TDI_{oral} and TDI_{inh} are based on considerations of the kidney burden accumulated over 50 years. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period. See the Environment Agency Science Report SC05002/ TOX 3(1), Science Report SC050021/Cadmium SGV(1) and the project report SP1010(3) for more information.							

References

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GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH HOME-GROWN PRODUCE

Table 4

Human Health Generic Assessment Criteria by Pathway for Residential With Home-Grown Produce Scenario

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Metals													
Arsenic	(a,b)	3.71E+01	5.26E+02	NR	NR	3.71E+01	5.26E+02	NR	NR	3.71E+01	5.26E+02	NR	NR
Cadmium	(a)	2.30E+01	4.88E+02	2.21E+01	NR	2.30E+01	4.88E+02	2.21E+01	NR	2.30E+01	4.88E+02	2.21E+01	NR
Chromium (III) - trivalent	(c)	1.84E+04	9.07E+02	NR	NR	1.84E+04	9.07E+02	NR	NR	1.84E+04	9.07E+02	NR	NR
Chromium (VI) - hexavalent	(a,d)	5.85E+01	2.06E+01	NR	NR	5.85E+01	2.06E+01	NR	NR	5.85E+01	2.06E+01	NR	NR
Copper		2.72E+03	1.41E+04	2.47E+03	NR	2.72E+03	1.41E+04	2.47E+03	NR	2.72E+03	1.41E+04	2.47E+03	NR
Lead	(a)	2.01E+02	NR	NR	NR	2.01E+02	NR	NR	NR	2.01E+02	NR	NR	NR
Elemental Mercury (Hg^0)	(d)	NR	2.35E-01	NR	4.31E+00	NR	5.60E-01	NR	1.07E+01	NR	1.22E+00	NR	2.58E+01
Inorganic Mercury (Hg^{2+})		3.95E+01	3.63E+03	3.91E+01	NR	3.95E+01	3.63E+03	3.91E+01	NR	3.95E+01	3.63E+03	3.91E+01	NR
Methyl Mercury (Hg^{4+})		1.26E+01	1.87E+01	7.52E+00	7.33E+01	1.26E+01	3.62E+01	9.34E+00	1.42E+02	1.26E+01	7.68E+01	1.08E+01	3.04E+02
Nickel	(d)	1.27E+02	1.81E+02	NR	NR	1.27E+02	1.81E+02	NR	NR	1.27E+02	1.81E+02	NR	NR
Selenium	(b)	2.58E+02	NR	NR	NR	2.58E+02	NR	NR	NR	2.58E+02	NR	NR	NR
Zinc	(b)	3.86E+03	3.63E+07	NR	NR	3.86E+03	3.63E+07	NR	NR	3.86E+03	3.63E+07	NR	NR
Cyanide (free)		1.37E+00	1.37E+04	1.37E+00	NR	1.37E+00	1.37E+04	1.37E+00	NR	1.37E+00	1.37E+04	1.37E+00	NR
Volatile Organic Compounds													
Benzene	(a)	2.62E-01	9.01E-01	2.03E-01	1.22E+03	5.39E-01	1.68E+00	4.08E-01	2.26E+03	1.16E+00	3.48E+00	8.72E-01	4.71E+03
Toluene		1.53E+02	9.08E+02	1.31E+02	8.69E+02	3.49E+02	2.00E+03	2.97E+02	1.92E+03	7.95E+02	4.55E+03	6.77E+02	4.36E+03
Ethylbenzene		1.10E+02	8.34E+01	4.74E+01	5.18E+02	2.61E+02	1.96E+02	1.12E+02	1.22E+03	6.00E+02	4.58E+02	2.60E+02	2.84E+03
Xylene - m		2.10E+02	8.25E+01	5.92E+01	6.25E+02	5.01E+02	1.95E+02	1.40E+02	1.47E+03	1.15E+03	4.56E+02	3.27E+02	3.46E+03
Xylene - o		1.92E+02	8.87E+01	6.07E+01	4.78E+02	4.56E+02	2.08E+02	1.43E+02	1.12E+03	1.05E+03	4.86E+02	3.32E+02	2.62E+03
Xylene - p		1.98E+02	7.93E+01	5.66E+01	5.76E+02	4.70E+02	1.86E+02	1.33E+02	1.35E+03	1.08E+03	4.36E+02	3.10E+02	3.17E+03
Total xylene		1.92E+02	7.93E+01	5.66E+01	6.25E+02	4.56E+02	1.86E+02	1.33E+02	1.47E+03	1.05E+03	4.36E+02	3.10E+02	3.46E+03
Methyl tertiary-Butyl ether (MTBE)		1.54E+02	1.04E+02	6.22E+01	2.04E+04	2.97E+02	1.69E+02	1.08E+02	3.31E+04	6.03E+02	3.21E+02	2.10E+02	6.27E+04
Trichloroethene		2.83E-01	1.72E-02	1.62E-02	1.54E+03	6.26E-01	3.59E-02	3.40E-02	3.22E+03	1.41E+00	7.98E-02	7.55E-02	7.14E+03
Tetrachloroethene		4.49E+00	1.79E-01	1.76E-01	4.24E+02	1.04E+01	4.02E-01	3.94E-01	9.51E+02	2.38E+01	9.21E-01	9.04E-01	2.18E+03
1,1,1-Trichloroethane		3.33E+02	9.01E+00	8.77E+00	1.43E+03	7.26E+02	1.84E+01	1.80E+01	2.92E+03	1.62E+03	4.04E+01	3.94E+01	6.39E+03
1,1,1,2 Tetrachloroethane		5.39E+00	1.54E+00	1.20E+00	2.60E+03	1.27E+01	3.56E+00	2.78E+00	6.02E+03	2.92E+01	8.29E+00	6.46E+00	1.40E+04
1,1,2,2-Tetrachloroethane		2.81E+00	3.92E+00	1.64E+00	2.67E+03	6.10E+00	8.04E+00	3.47E+00	5.46E+03	1.36E+01	1.76E+01	7.67E+00	1.20E+04
Carbon Tetrachloride		3.10E+00	2.58E-02	2.57E-02	1.52E+03	7.11E+00	5.65E-02	5.62E-02	3.32E+03	1.62E+01	1.28E-01	1.27E-01	7.54E+03
1,2-Dichloroethane		3.17E-02	9.20E-03	7.13E-03	3.41E+03	5.73E-02	1.33E-02	1.08E-02	4.91E+03	1.09E-01	2.28E-02	1.88E-02	8.43E+03
Vinyl Chloride		3.82E-03	7.73E-04	6.43E-04	1.36E+03	6.87E-03	1.00E-03	8.73E-04	1.76E+03	1.25E-02	1.53E-03	1.36E-03	2.69E+03
1,2,4-Trimethylbenzene		NR	1.76E+00	NR	4.74E+02	NR	4.26E+00	NR	1.16E+03	NR	9.72E+00	NR	2.76E+03
1,3,5-Trimethylbenzene	(e)	NR	NR	NR	2.30E+02	NR	NR	NR	5.52E+02	NR	NR	NR	1.30E+03
Semi-Volatile Organic Compounds													
Acenaphthene		2.27E+02	4.86E+04	2.26E+02	5.70E+01	5.41E+02	1.18E+05	5.38E+02	1.41E+02	1.18E+03	2.68E+05	1.17E+03	3.36E+02
Acenaphthylene		1.85E+02	4.59E+04	1.84E+02	8.61E+01	4.42E+02	1.11E+05	4.40E+02	2.12E+02	9.78E+02	2.53E+05	9.74E+02	5.06E+02
Anthracene		2.43E+03	1.53E+05	2.39E+03	1.17E+00	5.53E+03	3.77E+05	5.45E+03	2.91E+00	1.10E+04	8.76E+05	1.09E+04	6.96E+00
Benzo(a)anthracene		1.01E+01	2.47E+01	7.18E+00	1.71E+00	1.42E+01	4.37E+01	1.07E+01	4.28E+00	1.69E+01	6.26E+01	1.33E+01	1.03E+01
Benzo(a)pyrene	(a)	4.96E+00	3.51E+01	NR	9.11E-01	4.96E+00	3.77E+01	NR	2.28E+00	4.96E+00	3.89E+01	NR	5.46E+00
Benzo(b)fluoranthene		2.96E+00	1.93E+01	2.56E+00	1.22E+00	3.89E+00	2.13E+01	3.29E+00	3.04E+00	4.43E+00	2.22E+01	3.69E+00	7.29E+00
Benzo(g,h,i)perylene		3.77E+02	1.87E+03	3.14E+02	1.54E-02	4.09E+02	1.94E+03	3.38E+02	3.85E-02	4.23E+02	1.97E+03	3.48E+02	9.23E-02
Benzo(k)fluoranthene		8.92E+01	5.41E+02	7.66E+01	6.87E-01	1.10E+02	5.76E+02	9.22E+01	1.72E+00	1.21E+02	5.91E+02	1.00E+02	4.12E+00
Chrysene		1.66E+01	1.19E+02	1.46E+01	4.40E-01	2.54E+01	1.49E+02	2.17E+01	1.10E+00	3.19E+01	1.66E+02	2.67E+01	2.64E+00
Dibenzo(a,h)anthracene		2.90E-01	1.45E+00	2.41E-01	3.93E-03	3.43E-01	1.64E+00	2.84E-01	9.82E-03	3.69E-01	1.74E+00	3.04E-01	2.36E-02
Fluoranthene		2.87E+02	3.83E+04	2.85E+02	1.89E+01	5.63E+02	8.87E+04	5.60E+02	4.73E+01	9.00E+02	1.83E+05	8.96E+02	1.13E+02
Fluorene		1.77E+02	6.20E+03	1.72E+02	3.09E+01	4.19E+02	1.53E+04	4.07E+02	7.65E+01	8.98E+02	3.62E+04	8.77E+02	1.83E+02
Indeno(1,2,3-cd)pyrene		3.09E+01	2.12E+02	2.70E+01	6.13E-02	4.22E+01	2.38E+02	3.59E+01	1.53E-01	4.92E+01	2.50E+02	4.11E+01	3.68E-01
Naphthalene		2.78E+01	2.33E+01	1.27E+01	7.64E+01	6.66E+01	5.58E+01	3.04E+01	1.83E+02	1.53E+02	1.31E+02	7.06E+01	4.32E+02
Phenanthrene		9.85E+01	7.17E+03	9.72E+01	3.60E+01	2.24E+02	1.76E+04	2.22E+02	8.96E+01	4.48E+02	4.07E+04	4.43E+02	2.14E+02
Pyrene		6.25E+02	8.79E+04	6.20E+02	2.20E+00	1.25E+03	2.04E+05	1.24E+03	5.49E+00	2.05E+03	4.23E+05	2.04E+03	1.32E+01
Phenol		1.60E+02	4.58E+02	1.20E+02	2.42E+04	2.96E+02	6.95E+02	2.09E+02	3.81E+04	5.86E+02	1.19E+03	3.93E+02	7.03E+04

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH HOME-GROWN PRODUCE

Table 4

Human Health Generic Assessment Criteria by Pathway for Residential With Home-Grown Produce Scenario

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Total Petroleum Hydrocarbons													
Aliphatic hydrocarbons EC_5-EC_6		4.99E+03	4.24E+01	4.23E+01	3.04E+02	1.13E+04	7.79E+01	7.78E+01	5.58E+02	2.50E+04	1.61E+02	1.60E+02	1.15E+03
Aliphatic hydrocarbons >EC_6-EC_8		1.49E+04	1.04E+02	1.03E+02	1.44E+02	3.43E+04	2.31E+02	2.31E+02	3.22E+02	7.11E+04	5.29E+02	5.28E+02	7.36E+02
Aliphatic hydrocarbons >EC_8-EC_{10}		1.61E+03	2.68E+01	2.67E+01	7.77E+01	2.91E+03	6.55E+01	6.51E+01	1.90E+02	4.26E+03	1.56E+02	1.54E+02	4.51E+02
Aliphatic hydrocarbons >EC_{10}-EC_{12}		4.57E+03	1.33E+02	1.32E+02	4.75E+01	5.51E+03	3.31E+02	3.26E+02	1.18E+02	5.98E+03	7.93E+02	7.65E+02	2.83E+02
Aliphatic hydrocarbons >EC_{12}-EC_{16}		6.27E+03	1.11E+03	1.06E+03	2.37E+01	6.34E+03	2.78E+03	2.41E+03	5.91E+01	6.36E+03	6.67E+03	4.34E+03	1.42E+02
Aliphatic hydrocarbons >EC_{16}-EC_{35}	(b)	6.46E+04	NR	NR	8.48E+00	9.17E+04	NR	NR	2.12E+01	1.10E+05	NR	NR	5.09E+01
Aliphatic hydrocarbons >EC_{35}-EC_{44}	(b)	6.46E+04	NR	NR	8.48E+00	9.17E+04	NR	NR	2.12E+01	1.10E+05	NR	NR	5.09E+01
Aromatic hydrocarbons >EC_8-EC_9 (styrene)		1.08E+01	5.22E+02	1.06E+01	6.26E+02	2.53E+01	1.20E+03	2.48E+01	1.44E+03	5.81E+01	2.79E+03	5.69E+01	3.35E+03
Aromatic hydrocarbons >EC_9-EC_{10}		5.76E+01	4.74E+01	3.45E+01	6.13E+02	1.38E+02	1.16E+02	8.38E+01	1.50E+03	3.07E+02	2.77E+02	1.94E+02	3.58E+02
Aromatic hydrocarbons >EC_{10}-EC_{12}		8.29E+01	2.58E+02	7.52E+01	3.64E+02	1.96E+02	6.39E+02	1.79E+02	8.99E+02	4.25E+02	1.52E+03	3.91E+02	2.15E+03
Aromatic hydrocarbons >EC_{12}-EC_{16}		1.47E+02	2.85E+03	1.45E+02	1.69E+02	3.36E+02	7.07E+03	3.32E+02	4.19E+02	6.81E+02	1.68E+04	6.74E+02	1.00E+03
Aromatic hydrocarbons >EC_{16}-EC_{21}	(b)	2.63E+02	NR	NR	5.37E+01	5.45E+02	NR	NR	1.34E+02	9.34E+02	NR	NR	3.21E+02
Aromatic hydrocarbons >EC_{21}-EC_{35}	(b)	1.09E+03	NR	NR	4.83E+00	1.47E+03	NR	NR	1.21E+01	1.70E+03	NR	NR	2.90E+01
Aromatic hydrocarbons >EC_{35}-EC_{44}	(b)	1.09E+03	NR	NR	4.83E+00	1.47E+03	NR	NR	1.21E+01	1.70E+03	NR	NR	2.90E+01

Notes:

EC - equivalent carbon. SAC - soil assessment criteria.

The CLEA model output is colour coded depending upon whether the soil saturation limit has been exceeded.

Calculated SAC exceeds soil saturation limit and may significantly affect the interpretation of any exceedances as the contribution of the indoor and outdoor vapour pathway to total exposure is >10%.

Calculated SAC exceeds soil saturation limit but the exceedance will not affect the SAC significantly as the contribution of the indoor and outdoor vapour pathway to total exposure is <10%.

Calculated SAC does not exceed the soil saturation limit.

The SAC for organic compounds are dependant upon soil organic matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs napthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway (Section 10.1.1, SR3)

(a) SAC for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead are derived using the C4SL toxicology data.

(b) SAC for selenium should not include the inhalation pathway as no expert group HCV has been derived; aliphatic and aromatic hydrocarbons >EC16 should not include inhalation pathway due to their non-volatile nature and inhalation exposure being minimal (oral, dermal and inhalation exposure is compared to the oral HCV); arsenic should only be based on oral contribution (rather than combined) owing to the relative small contribution from inhalation in accordance with the SGV report. The Oral SAC should be adopted for zinc and benzo(a)pyrene.

(c) SAC for CrIII should be based on the lower of the oral and inhalation SAC (see LQM/CIEH 2015 Section 6.8)

(d) SAC for elemental mercury, chromium VI and nickel should be based on the inhalation pathway only.

(e) SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used.

Table 5
Human Health Generic Assessment Criteria for Residential with home-grown produce

Compound	SAC for Soil SOM 1% (mg/kg)	SAC for Soil SOM 2.5% (mg/kg)	SAC for Soil SOM 6% (mg/kg)
Metals			
Arsenic	37	37	37
Cadmium	22	22	22
Chromium (III) - trivalent	910	910	910
Chromium (VI) - hexavalent	21	21	21
Copper	2,500	2,500	2,500
Lead	200	200	200
Elemental Mercury (Hg^0)	0.2	0.6	1.2
Inorganic Mercury (Hg^{2+})	39	39	39
Methyl Mercury (Hg^{4+})	10	10	10
Nickel	130	130	130
Selenium	258	258	258
Zinc	3,900	3,900	3,900
Cyanide (free)	1.4	1.4	1.4
Volatile Organic Compounds			
Benzene	0.20	0.41	0.87
Toluene	130	300	680
Ethylbenzene	50	110	260
Xylene - m	59	140	327
Xylene - o	61	143	332
Xylene - p	57	133	310
Total xylene	57	133	310
Methyl tertiary-Butyl ether (MTBE)	60	110	210
Trichloroethene	0.02	0.03	0.08
Tetrachloroethene	0.2	0.4	0.9
1,1,1-Trichloroethane	9	18	39
1,1,1,2 Tetrachloroethane	1.2	2.8	6.5
1,1,2,2-Tetrachloroethane	1.6	3.5	7.7
Carbon Tetrachloride	0.026	0.056	0.127
1,2-Dichloroethane	0.007	0.011	0.019
Vinyl Chloride	0.0006	0.0009	0.0014
1,2,4-Trimethylbenzene	1.8	4.3	9.7
1,3,5-Trimethylbenzene	NR	NR	NR
Semi-Volatile Organic Compounds			
Acenaphthene	230	540	1,170
Acenaphthylene	180	440	970
Anthracene	2,400	5,500	10,900
Benzo(a)anthracene	7	11	13
Benzo(a)pyrene	5	5	5
Benzo(b)fluoranthene	2.6	3.3	3.7
Benzo(g,h,i)perylene	310	340	350
Benzo(k)fluoranthene	77	92	100
Chrysene	15	22	27
Dibenzo(a,h)anthracene	0.24	0.28	0.30
Fluoranthene	290	560	900
Fluorene	170	410	880
Indeno(1,2,3-cd)pyrene	27	36	41
Naphthalene	13	30	71
Phenanthrene	100	220	440
Pyrene	620	1,240	2,040
Phenol	120	210	390
Total Petroleum Hydrocarbons			
Aliphatic hydrocarbons EC_5-EC_6	42	78	160
Aliphatic hydrocarbons >EC_6-EC_8	100	230	530
Aliphatic hydrocarbons >EC_8-EC_{10}	27	65	154
Aliphatic hydrocarbons >EC_{10}-EC_{12}	130 (48)	330 (118)	760 (283)
Aliphatic hydrocarbons >EC_{12}-EC_{16}	1,100 (24)	2,400 (59)	4,300 (142)
Aliphatic hydrocarbons >EC_{16}-EC_{35}	65,000 (8)	92,000 (21)	110,000
Aliphatic hydrocarbons >EC_{35}-EC_{44}	65,000 (8)	92,000 (21)	110,000
Aromatic hydrocarbons >EC_8-EC_9 (styrene)	11	25	57
Aromatic hydrocarbons >EC_9-EC_{10}	30	80	190
Aromatic hydrocarbons >EC_{10}-EC_{12}	80	180	390
Aromatic hydrocarbons >EC_{12}-EC_{16}	140	330	670
Aromatic hydrocarbons >EC_{16}-EC_{21}	260	540	930
Aromatic hydrocarbons >EC_{21}-EC_{35}	1,100	1,500	1,700
Aromatic hydrocarbons >EC_{35}-EC_{44}	1,100	1,500	1,700
Minerals			
Asbestos	No asbestos detected with ID or <0.001% dry weight[1]		

Notes:

'-' Generic assessment criteria not calculated owing to low volatility of substance and therefore no pathway, or an absence of toxicological data.

NR - SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used

EC - equivalent carbon. SAC - soil assessment criteria.

[1] LOD for weight of asbestos per unit weight of soil calculated on a dry weight basis using PLM, handpicking and gravimetry.

The SAC for organic compounds are dependent on Soil Organic Matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs napthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoo air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway, section 10.1.1, SR3.

(VALUE IN BRACKETS)

RSK has adopted an approach for petroleum hydrocarbons in accordance with LQM/CIEH whereby the concentration modelled for each petroleum hydrocarbon fraction has been tabulated as the SAC with the corresponding solubility or vapour saturation limits given in brackets.

GENERIC ASSESSMENT CRITERIA FOR CONTROLLED WATERS

Protection of the water environment

The water environment in the United Kingdom is protected under a number of regulatory regimes. The relevant environmental regulator is consulted where there may be a risk that pollution of 'controlled waters' may occur or may have occurred in the past.

The term 'controlled waters' refers to coastal waters, inland freshwaters and groundwater. The EU Water Framework Directive (WFD) (2000/60/EC) is implemented via domestic regulations and guidance, covering aspects of groundwater and surface water protection as well as drinking water supply policy. Domestic legislation and guidance will vary across the United Kingdom. Therefore, the relevant legislation for England, Wales, Northern Ireland and Scotland should be reviewed, alongside guidance provided by the Environment Agency (EA), Natural Resource Wales (NRW), the Scottish Environmental Protection Agency (SEPA) or the Northern Ireland Environment Agency (NIEA), as appropriate.

The main objectives of the protection and remediation of groundwater under threat from land contamination are set out within "The Environment Agency's approach to groundwater protection", version 1.0 (March 2017)[(1)] and the associated guidance "Land contamination groundwater compliance points: quantitative risk assessments (March 2017)[(1a)] that have replaced the previous guidance document "Groundwater Principles and Practice (GP3)". When assessing risks to groundwater, the following need to be considered:

- Where pollutants have not yet entered groundwater, all necessary and reasonable measures must be taken to:
    - ***prevent*** *the input of* ***hazardous*** *substances into groundwater (see description of hazardous substances below)*
    - ***limit*** *the entry of other (non-hazardous) pollutants into groundwater to avoid pollution, deterioration in the status of groundwater bodies and to prevent sustained, upward trends in pollutant concentrations in groundwater.*
- Where pollutants have already entered groundwater, the priority is to take all necessary and reasonable measures to:
    - ***minimise*** *further entry of "contaminants" where there is a defined source*
    - ***limit the pollution*** *of groundwater or any effect on the status of the groundwater body from the future expansion of the 'plume', if necessary, by actively reducing its extent.*

Within the context of groundwater risk assessments on sites affected by land contamination, "reasonable" means feasible without involving disproportionate costs. What costs are "disproportionate" depends on site-specific circumstances, which may include:

- Considerations of technical feasibility such as identified by the remedial options appraisal, this may be due to the distribution or nature of the contamination and the available remedial methods to treat the identified contamination;
- Sustainability considerations.

DEFINITIONS AND SUBSTANCE CLASSIFICATIONS

Risks to surface waters:

When assessing risks to surface waters, the following list of definitions should be understood:

Priority substances (PS) are harmful substances originally identified under the Water Framework Directive (WFD) 2000/60/EC as substances 'presenting a significant risk to or via the aquatic environment' at a European level. Member States are required to incorporate the identified **PS** into their country-wide monitoring programmes. There are currently 33 **PS** defined within the Priority Substances Directive (2013/39/EU; Annex 1), with a further 12 additional substances due to come into force from 22 December 2018. Directive 2013/39/EU has been transposed into domestic legislation for England and Wales by The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

Under the umbrella of **PS**, there is a sub-set of substances identified as being "hazardous", and these are referred to as **Priority hazardous substances (PHS).** The list of **PHS** is defined at EU level within the Priority Substances Directive (2013/39/EU). The WFD defines hazardous substances as 'substances (or groups of substances) that are toxic, persistent and liable to bio-accumulate, and other substances or groups of substances that give rise to an equivalent level of concern.' There are currently 15 **PHS**, with a further 6 additional substances due to come into force from 22 December 2018.

There is also another group of substances defined at EU level and which are referred to as **other pollutants (OP)** in Directive 2013/39/EU**.** These are additional substances which although not **priority substances**, have EQS which are identical to those laid down in the legislation which applied prior to 13 January 2009 (Directive 2008/105/EU). The **OP** are listed along with the **priority substance (PS)** within the Priority Substances Directive (2013/39/EU),and their associated EQS are also listed therein. There are 6 **OP** defined within the Priority Substances Directive (2013/39/EU).

In addition to the EU level substances, there are also a group of pollutants defined at a Member State level, referred to as **Specific pollutants (SP)**. These substances are pollutants which are released in significant quantities into water bodies in each of the individual European Member States. Under the WFD, Member States are required to set their own EQS for these substances. An indicative list of **SP** is given in Annex VIII of the WFD. Many of the substances categorised as **SP** in the UK were formerly List 2 substances under the old Groundwater Directive (80/68/EEC). The **SP** are defined within Part 2 (Table 1) of The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

Risks to groundwater:

When assessing risks to groundwater, the following definitions should be understood:

Under the requirements of the Groundwater Daughter Directive (2006/118/EU), the UK has published a list of substances it considers to be **hazardous substances** with respect to groundwater. In their advisory capacity to the government, this list has been derived by the UK Joint Agencies Groundwater Directive Advisory Group (JAGDAG), of which the Environment Agency is a member. The JAGDAG list of **hazardous substances** was published in January 2017 and the Environment Agency will use the updated list of hazardous substances from this date for all new activities that may lead to the discharge of hazardous substances to groundwater. The list is extensive and can be found in full at:

https://www.wfduk.org/stakeholders/jagdag

Selecting the appropriate assessment criteria

When assessing the risks to controlled waters, various assessment criteria apply, depending on the nature of the assessment and the conceptual site model.

Where a surface water body is involved, then Environmental Quality Standards (EQS) are the relevant assessment criteria as they are designed to be protective of surface water ecology.

Where a public water supply or a Principal aquifer is involved, then the standards defined in The Water Supply (Water Quality) Regulations[(2)] are the primary source of assessment criteria. The Private Water Supplies Regulations[(3)] may also be applicable in some cases. For instances where there are no UK assessment criteria, then the World Health Organisation (WHO) drinking water guidelines[(4)] may be used.

This appendix presents the generic assessment criteria (GAC) that RSK considers suitable for assessing risks to controlled waters for our most commonly encountered determinants. A full list of EQS for England and Wales are included in The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

The RSK GAC for controlled waters are presented in **Table 1** and **Table 2**. In line with the Environment Agency's Remedial Targets Methodology, the GAC for controlled waters are termed 'target concentrations'.

The appropriate target concentrations should be selected with consideration to:

- the site conceptual model (i.e. the receptor at potential risk);
- whether the substance is already present in groundwater at the site;
- whether or not the substance is classified as a priority hazardous substance under the Priority Substances Directive (2013/39/EC) (see above), or as a hazardous substance according to the current list of JAGDAG determinations[(5)]; and
- background concentrations in the aquifer (if applicable).

It is important to remember that the WFD and Environment Agency guidance[(1 & 1a)] support a sustainable, risk-based approach be applied to groundwater contamination. Exceedance of any target concentration does not necessarily imply that an unacceptable risk exists or that remediation is inevitably required.

Target concentrations shaded in green are statutory values	Target concentrations shaded in orange are non-statutory values

Note: Units µg/l throughout (unless otherwise stated)

Table 1: Target concentrations for controlled waters (excluding TPH CWG fractions)

Substance classification		Determinant	Target concentrations (µg/l)			
Groundwater receptors[5]	Surface water receptors[6]		Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
					Freshwater	Transitional (estuaries) and coastal waters
Metals & other inorganics						
Hazardous substance	Specific pollutant	Arsenic	-	10[2]	50[6a]	25[6a]
Non-hazardous pollutant	Priority substance	Cadmium	0.1[7]	5[2]	≤0.08, 0.08, 0.09, 0.15, 0.25 [6b]	0.2[6a]
(Not determined)	-	Chromium (total)	-	50[2]	Sum values for chromium III and VI	
(None	Specific pollutant	Chromium (III)	-	Use value for total chromium	4.7[6a]	-
Hazardous substance	Specific pollutant	Chromium (VI)			3.4[6a]	0.6[6a]

Substance classification		Determinant	Target concentrations (µg/l)			
Groundwater receptors[5]	Surface water receptors[6]		Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
					Freshwater	Transitional (estuaries) and coastal waters
(Not determined)	Specific pollutant	Copper	-	2,000[2]	1 bioavailable[6a]	3.76 dissolved, where DOC ≤1mg/l[6a] 3.76µg/l + (2.677µg/l x ((DOC/2) – 0.5µg/l)) dissolved, where DOC >1mg/l[6a]
Hazardous substance	Priority substance	Lead	-	10[2]	1.2 bioavailable[6a]	1.3[6a]
Hazardous substance	**Priority hazardous substance**	Mercury	0.01[7]	1[2]	0.07[6c]	0.07[6c]
Non-hazardous pollutant	Priority substance	Nickel	-	20[2]	4.0 bioavailable[6a]	8.6[6a]
Non-hazardous pollutant	-	Selenium	-	10[2]	-	-
Non-hazardous pollutant	Specific pollutant	Zinc	-	3,000[8]	10.9 bioavailable[6a]	6.8 dissolved [6a]
None	Specific pollutant	Iron	-	200[2]	1000[6a]*1	1000[6a])*1
None	Specific pollutant	Manganese	-	50[2] (0.05mg/l)	123 bioavailable[6a] (0.123mg/l)	-
(Not determined)	-	Aluminium	-	200[2]	-	-

Substance classification		Determinant	Target concentrations (µg/l)			
Groundwater receptors[5]	Surface water receptors[6]		Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
					Freshwater	Transitional (estuaries) and coastal waters
Hazardous substance	**Priority hazardous substance**	Tributyltin compounds (Tributyltin-cation)	0.001[7]	-	0.0002[6a]	0.0002[6a]
(Not determined)	-	Sodium	-	200,000[2] (200 mg/l)	-	-
Non-hazardous pollutant	Specific pollutant	Cyanide (Hydrogen cyanide)	-	50[2] (0.05 mg/l)	1[6a] (0.001 mg/l)	1[6a] (0.001 mg/l)
Non-hazardous pollutant	-	Total ammonia[$] (ammonium (as NH_4^+) plus ammonia (NH_3)	-	500[2] (0.5 mg/l)	300[6f] (0.3 mg/l)	-
Non-hazardous pollutant	Specific pollutant	Ammonia un-ionised (NH_3)	-	-	-	21[6a] (0.021 mg/l)
Non-hazardous pollutant	Specific pollutant	Chlorine	-	-	2[6a] (0.002 mg/l)	10[6d] (0.01 mg/l)
(Not determined)	-	Chloride	-	250,000[2] (250 mg/l)	-	-
(Not determined)	-	Sulphate	-	250,000[2] (250 mg/l)	-	-
(Not determined)	-	Nitrate (as NO_3)	-	50,000[2] (50 mg/l)	-	-
(Not determined)	-	Nitrite (as NO_2)	-	500[2] (0.5 mg/l)	10[9] (0.01 mg/l)	-

Substance classification		Determinant	Target concentrations (µg/l)			
Groundwater receptors[5]	Surface water receptors[6]		Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
					Freshwater	Transitional (estuaries) and coastal waters
Volatile organic compounds (VOC)						
Non-hazardous pollutant	Other pollutant	Tetrachloroethene (tetrachloroethylene; PCE)	0.1[7]	10[2] sum of TCE and PCE	10[6a]	10[6a]
Hazardous substance	Other pollutant	Trichloroethene (trichloroethylene; TCE)	0.1[7]		10[6a]	10[6a]
None	Specific pollutant	Tetrachloroethane	-	-	140[6a]	-
Hazardous substance	Other pollutant	Carbon tetrachloride (tetrachloromethane)	0.1[7]	3.0[2]	12[6a]	12[6a]
Non-hazardous pollutant	Priority substance	1,2-Dichloroethane	1.0[7]	3.0[2]	10[6a]	10[6a]
Non-hazardous pollutant	-	1.2-Dichloroethene (DCE)	-	50.0[4]	-	-
Hazardous substance	-	Vinyl chloride (chloroethene)	-	0.5[2]	-	-
Non-hazardous pollutant	Priority substance	Dichloromethane	-	20[4]	20[6a]	20[6a]
Non-hazardous pollutant	Priority substance	Trichlorobenzenes	0.01[7]	-	0.4[6a]	0.4[(6a)]
(Not determined)	-	Trihalomethanes	-	100[2a]	-	-

Substance classification		Determinant	Target concentrations (µg/l)			
Groundwater receptors[5]	Surface water receptors[6]		Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
					Freshwater	Transitional (estuaries) and coastal waters
Hazardous substance	Priority substance	Trichloromethane (Chloroform)	0.1[7]	(see "Trihalomethanes" above)	2.5[6a]	2.5[6a]
Non-hazardous pollutant	**Priority hazardous substance**	Di(2-ethylhexyl) phthalate (bis(2-ethylhexyl) phthalate, DEHP)	-	8[4]	1.3[6a]	1.3[6a]
None	Specific pollutant	Benzyl butyl phthalate	-	-	7.5[6a]	0.75[6e]
Hazardous substance	**Priority hazardous substance**	Hexachlorobutadiene	0.005[7]	0.6[4]	0.6[6c]	0.6[6c]
Semi-volatile organic compounds (SVOC)						
(Not determined)	-	Acenaphthylene (C12-C16)	-	-	5.8[10]	
Hazardous substance	**Priority hazardous substance**	Anthracene (C16-C21)	-	-	0.1[6a]	0.1[6a]
Non-hazardous pollutant	Priority substance	Naphthalene (C10-C12)	-	-	2[6a]	2[6a]

Substance classification		Determinant	Target concentrations (µg/l)			
			Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
Groundwater receptors[5]	Surface water receptors[6]				Freshwater	Transitional (estuaries) and coastal waters
Hazardous substance	Priority substance	Fluoranthene (C21-C35)	-	-	0.0063[6a]	0.0063[6a]
Hazardous substance(s)	**Priority hazardous substance(s)**	Benzo(a)pyrene (C21-C35)	-	0.01[2]	0.00017[6a]	0.00017[6a]
		Benzo(b)fluoranthene (C21-C35)	-	0.1[2] sum of the concentration of the four specified compounds	No EQS for these substances. B(a)P should be used as the indicator compound instead.	
		Benzo(k)fluoranthene (C21-C35)	-			
		Benzo(g,h,i)perylene (C21-C35)	-			
		Indeno(1,2,3-cd) pyrene (C21-C35)	-			
Non-hazardous pollutant	Specific pollutant	Phenol		-	7.7[6a]	7.7[6a]
Hazardous substance	Specific pollutant	2,4-Dichlorophenol	0.1[7]	-	4.2[6a]	0.42[6a]
Hazardous substance	Priority substance	Pentachloro-phenol (PCP)	0.1[7]	9[4]	0.4[6a]	0.4[6a]

Substance classification		Determinant	Target concentrations (µg/l)			
			Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
Groundwater receptors[5]	Surface water receptors[6]				Freshwater	Transitional (estuaries) and coastal waters
Petroleum hydrocarbons						
Hazardous substance	-	Total petroleum hydrocarbons	-	See Table 2 for individual (non-statutory) TPH CWG fractions with respect to drinking water receptors	See individual risk driving compounds (i.e. BTEX and PAH) for specific EQS	
Hazardous substance	Priority substance	Benzene (C5-C7)	1[7]	1[2]	10[6a]	8[6a]
Hazardous substance	Specific pollutant	Toluene (C7-C8)	4[7]	700[4]	74[6a]	74[6a]
Hazardous substance	-	Ethylbenzene (C8-C9)	-	300[4]	-	-
(Not determined)	-	Xylenes (C8-C10)	3[7]	500[4]	30[11]	-
Non-hazardous pollutant	-	Methyl tertiary butyl ether (MTBE)	-	15[12]	-	
Pesticides, fungicides, insecticides and herbicides						
Hazardous substance(s)	Other pollutant (Cyclodiene	Aldrin	0.003[7]	0.03[2]	0.01[6a] (sum of all four)	0.005[6a] (sum of all four)
		Dieldrin	0.003[7]	0.03[2]		

Substance classification		Determinant	Target concentrations (µg/l)			
Groundwater receptors[5]	Surface water receptors[6]		Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
					Freshwater	Transitional (estuaries) and coastal waters
	pesticides)	Endrin	0.003[7]	0.1[2b]		
		Isodrin*[2]	0.003[7]	0.1[2b]		
Hazardous substance	Other pollutant	DDT (total)	0.002[7]	1[4]	0.025[6a]	0.025[6a]
(Not determined) – assume to be Hazardous Substance	-	Total pesticides	-	0.5[2]	-	-
(Not determined) - assume to be Hazardous Substance	-	Other individual pesticides	-	0.1[2]		
Hazardous substance	Specific pollutant	Carbendazim	-	-	0.15[6a]	-
Hazardous substance	Specific pollutant	Chlorothalonil	-	-	0.035[6a]	-
Hazardous substance	Specific pollutant (until 22/12/18, after which it becomes a Priority substance)	Cypermethrin	-	-	0.0001[6a] From 22/12/18: 8.0E-5[6a]	0.0001[6a] From 22/12/18: 8.0E-6[6a]
Hazardous substance	Specific pollutant	Dimethoate	0.01[7]	-	0.48[6a]	0.48[6a]

Substance classification		Determinant	Target concentrations (µg/l)			
Groundwater receptors[5]	Surface water receptors[6]		Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
					Freshwater	Transitional (estuaries) and coastal waters
(Not determined)	Specific pollutant	Glyphosate	-	-	196[6a]	196[6a]
Hazardous substance	Specific pollutant	Linuron		-	0.5[6a]	0.5[6a]
Non-hazardous pollutant	Specific pollutant	Mecoprop	0.04[7]	-	18[6a]	18[6a]
Non-hazardous pollutant	Specific pollutant	Methiocarb	-	-	0.01[6a]	-
Non-hazardous pollutant	Specific pollutant	Pendimethalin	-	20[4]	0.3[6a]	-
Hazardous substance	Specific pollutant	Permethrin	0.001[7]	-	0.001[6a]	0.0002[6a]
Hazardous substance	Priority substance	Alachlor	-	20[4]	0.3[6a]	0.3[6a]
Hazardous substance	Priority substance	Atrazine	0.03[7]	100[4]	0.6[6a]	0.6[6a]
Hazardous substance	Priority substance	Diuron	-	-	0.2[6a]	0.2[6a]
Hazardous substance	**Priority hazardous substance**	Endosulphan	0.005[7]	-	0.005[6a]	0.0005[6a]

Substance classification		Determinant	Target concentrations (µg/l)			
Groundwater receptors[5]	Surface water receptors[6]		Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
					Freshwater	Transitional (estuaries) and coastal waters
Non-hazardous pollutant	Priority substance	Isoproturon	-	9[4]	0.3[6a]	0.3[6a]
Hazardous substance	Priority substance	Simazine	0.03[7]	2[4]	1[6a]	1 [6a]
Hazardous substance	**Priority hazardous substance**	Trifluralin	0.01[7]	20[4]	0.03[6a]	0.03[6a]
(Not determined)	From 22/12/18: Priority substance	Dichlorovos	-	-	From 22/12/18: 6.0E-4[6a]	From 22/12/18: 6.0E-5[6a]
Hazardous substance	From 22/12/18: Priority substance	Heptachlor and heptachlor epoxide	-	0.03[2]	From 22/12/18: 2.0E-7[6a]	From 22/12/18: 1.0E-08[6a]
Miscellaneous						
None	Specific pollutant	Triclosan (antibacterial agent)	-	-	0.1[6a]	0.1[6a]
Hazardous substance	**From 22/12/18: Priority hazardous substance**	Perfluoro-octane sulfonic acid (and its derivatives) (PFOS)	-	-	From 22/12/18: 6.5E-4[6a]	From 22/12/18: 1.3E-4[6a]
Hazardous substance	**From 22/12/18: Priority hazardous substance**	Hexabromo cyclododecane (HBCDD)	-	-	From 22/12/18: 0.0016[6a]	From 22/12/18: 0.0008[6a]

Substance classification		Determinant	Target concentrations (µg/l)			
Groundwater receptors[5]	Surface water receptors[6]		Minimum reporting value	UK drinking water standard (or best equivalent)	EQS or best equivalent	
					Freshwater	Transitional (estuaries) and coastal waters

Notes:

'-' A target concentration is not available.

$Please note that total ammonia (NH_4^+ and NH_3) is equivalent to ammoniacal nitrogen in laboratory reports

*1 Please note that although iron is listed in the 2015 Direction as 1.000 µg/l, the EQS remains at 1mg/l in Scotland and it is assumed this is an error and should read either 1,000 or 1000µg/l.

*2 Please note that although Isodrin is not listed in name within the group of "Cyclodiene pesticides" in Table 1 of Schedule 3 Part 3 of the 2015 Direction[6], the CAS number for Isodrin (465-73-6) **is** listed and therefore it is assumed that it has been missed off the named list of substances.

*3 Total petroleum hydrocarbons is used for consistency, but is an analytical method-defined measurement for a mixture of hydrocarbons subject to environmental analysis[11].

"Bioavailable" in relation to copper, zinc, nickel and manganese (but not lead) is the generic EQSbioavailable[6a] derived from the Metal Bioavailability Assessment Tool (M-BAT) developed by the Water Framework Directive UK Technical Advisory Group (WFDTAG). Exceedance of this value should prompt a site-specific assessment using the M-BAT with pH, DOC and Ca to derive a site-specific EQS termed the $PNEC_{dissolved}$. http://www.wfduk.org/resources/rivers-lakes-metal-bioavailability-assessment-tool-m-bat.

For zinc, if there is an exceedance of the EQSbioavailable in an initial GQRA, Tier 2 required that the EQS for zinc should also have the ambient background concentration of zinc added as well

Table 2: World Health Organization (WHO) guide values for TPH CWG fractions in drinking water[13] (as referenced in CL:AIRE, 2017[11])

TPH CWG fraction	WHO guide value for drinking water[13] (µg/l)
Aliphatic fractions:	
Aliphatic EC5-EC6	15,000
Aliphatic >EC6-EC8	15,000
Aliphatic >EC8-EC10	300
Aliphatic >EC10-EC12	300
Aliphatic >EC12-EC16	300
Aliphatic >EC16-EC21	-
Aliphatic >EC21-EC35	-
Aromatic fractions:	
Aromatic EC5-EC6	10 (benzene)
Aromatic >EC6-EC8	700 (toluene)
Aromatic >EC8-EC10	300 (ethyl benzene) 500 (xylenes)
Aromatic >EC10-EC12	90
Aromatic >EC12-EC16	90
Aromatic >EC16-EC21	90
Aromatic >EC21-EC35	90
Reference: World Health Organisation (WHO), 2008. Petroleum products in drinking-water. Background document for development of WHO guidelines for drinking water quality. WHO/SDE/WSH/05.08/123. World Health Organisation, Geneva[13].	

References

1. Environment Agency (2017), 'The Environment Agency's approach to groundwater protection', version 1.0, March 2017 (formerly contained within GP3) [accessed 29 March 2017]. https://www.gov.uk/government/collections/groundwater-protection

1a. Environment Agency (2017), 'Land contamination groundwater compliance points: quantitative risk assessments', March 2017 (formerly contained within GP3) [accessed 29 March 2017]. https://www.gov.uk/government/collections/groundwater-protection

2. The Water Supply (Water Quality) Regulations 2016 (SI 2016/619)
    - 2a. Sum of chloroform, bromoform, dibromochloromethane and bromodichloromethane
    - 2b. Standard applies to individual pesticides except aldrin, dieldrin, heptachlor and heptachlor epoxide, for which a separate standard is defined.
3. The Private Water Supplies (England) Regulations 2016. SI 2016 / 618
4. WHO (2011), *Guidelines for drinking-water quality*, 4th edn
5. JAGDAG hazard substance determinations: This list contains substances that are determined to be hazardous substances or non-hazardous pollutants for the purposes of the groundwater directive 2006/118/EC. The absence of an assessment or substance from the list means an assessment has not been done yet and is presented as 'Not yet determined'; if a substance has been assessed but does not fall into either category it is presented as 'None'. For further details on how substances are assessed, see the Joint Agencies Groundwater Directive Advisory Group (JAGDAG) 'Methodology for the determination of hazardous substances in groundwater for the purposes of the groundwater directive 2006/118/EC' which is available from the JAGDAG website. The methodology is a UK –wide framework that sets criteria for how to assess whether a substance is a hazardous substances in groundwater. The list of substances can be found at:

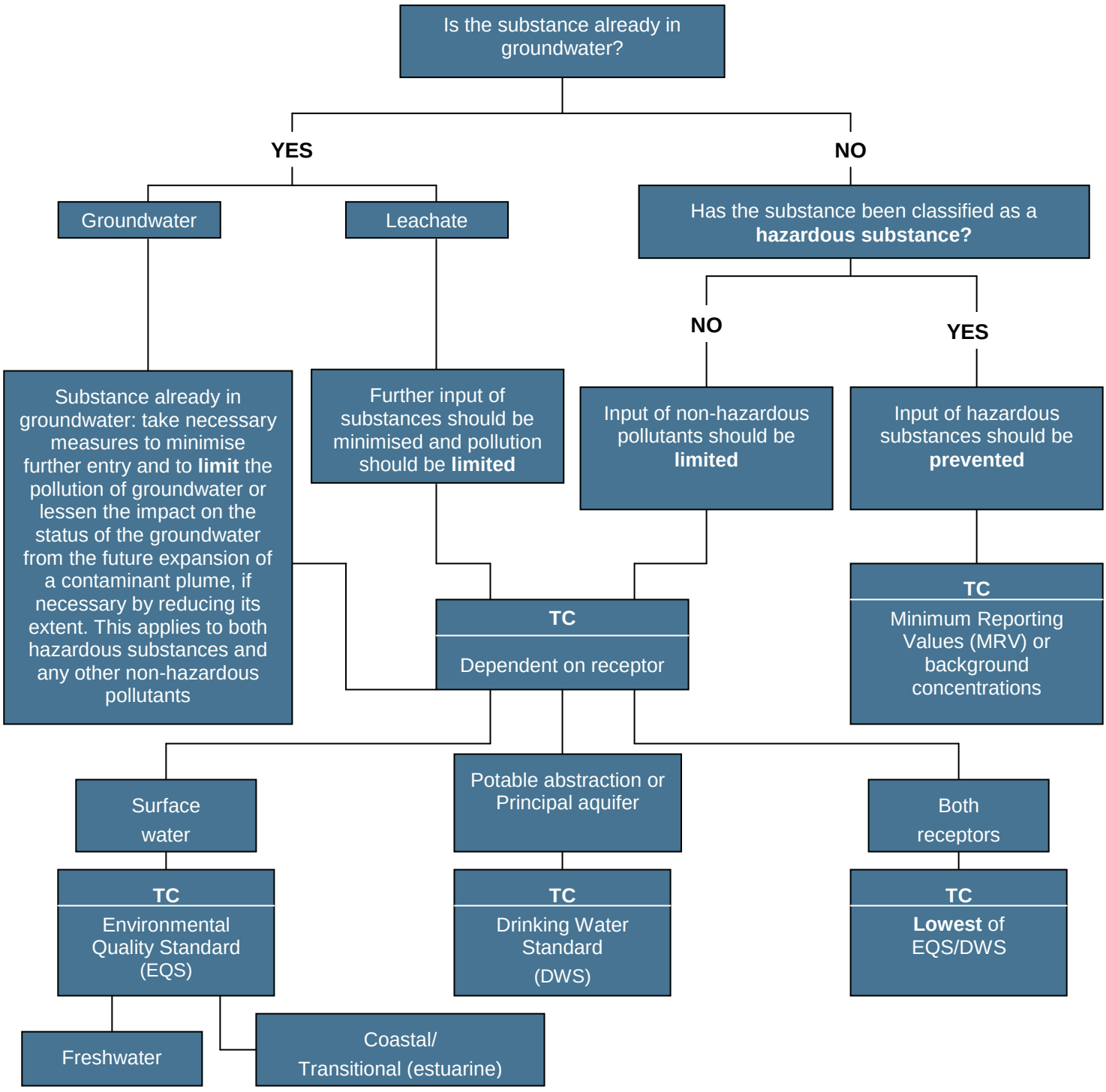
   https://www.wfduk.org/stakeholders/jagdag

6. The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.
    - 6a. The EQS for these substances are based on a "long term mean" or an "annual average (AA)" EQS.
    - 6b. For cadmium and its compounds the EQS values vary depending on the hardness of the water as specified in five class categories (Class 1: < 40 mg CaCO3/l, Class 2: 40 to < 50 mg CaCO3/l, Class 3: 50 to < 100 mg CaCO3/l, Class 4: 100 to < 200 mg CaCO3/l and Class 5: ≥ 200 mg CaCO3/l).
    - 6c. The EQS for Mercury and hexachlorobutadiene are based on a "maximum acceptable concentration (MAC)" EQS in absence of an "annual average (AA)" EQS.
    - 6d. The EQS for chlorine in saltwater is based on the 95th percentile concentration of total residual oxidant, which refers to the sum of all oxidising agents existing in water, expressed as available chlorine.
    - 6e. The recommended saltwater standard is derived using a safety factor of 100. Where the standard is failed, it is recommended that supporting evidence of ecological damage should be obtained before committing to expensive action.
    - 6f. EQS for total ammonia is as per Schedule 3, Part 1, Table 7 of of the above directions. EQS applies to river types 1, 2 and 4 and 6 (namely upland and low alkalinity). The EQS for a lowland and high alkalinity rivers (types 3, 5 and 7) is 600µg/l (0.6mg/l).

Additional information on the Metal Bioavailability Assessment Tool (M-BAT) is available at http://www.wfduk.org/resources/rivers-lakes-metal-bioavailability-assessment-tool-m-bat

7. Minimum reporting values listed at https://www.gov.uk/government/publications/values-for-groundwater-risk-assessments/hazardous-substances-to-groundwater-minimum-reporting-values (updated 13 January 2017; accessed 29 March 2017). Note target concentration for xylenes is 3 μg/l each for o-xylene and m/p xylene as it may not be possible to separate m- and p-xylene; 135 tcb, 124 tcb, 123 tcb each to 0.01 μg/l)
8. The Surface Waters (Abstraction for Drinking Water) (Classification) Regulations 1996 (as amended). SI 1996 / 3001
9. Council Directive on the Quality of Fresh Waters Needing Protection or Improvement in Order to Support Fish Life (Freshwater Fish Directive) (78/659/EEC)
10. WRc plc (2002), R&D Technical Report P45.
11. CL:AIRE, 2017. Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies. V1.1.
12. Drinking Water Inspectorate (London, UK). Environmental Information Request on MTBE in drinking water. Ref. DWI 1/10/18; dated 28 November 2006. Value is based on the odour threshold for MTBE, which is lower than a health-based guideline value
13. World Health Organisation (WHO), 2008. Petroleum products in drinking-water. Background document for development of WHO guidelines for drinking water quality. WHO/SDE/WSH/05.08/123. World Health Organisation, Geneva. [accessed 29 March 2017] http://www.who.int/water_sanitation_health/dwq/chemicals/petroleumproducts_2add_june2008.pdf

FLOW CHART TO ASSIST WITH SELECTION OF TARGET CONCENTRATIONS



TC = Target concentration

When leachate is being assessed the 'compliance point' is the groundwater body. Therefore dilution within the groundwater body may be applied with caution before comparing with the TC.

When directly assessing a receptor, e.g., a river, the appropriate TC should be selected.

APPENDIX O
GENERIC ASSESSMENT CRITERIA FOR PHYTOTOXIC EFFECTS

GENERIC ASSESSMENT CRITERIA FOR PHYTOTOXIC EFFECTS

Several compounds can inhibit plant growth; hence it is important to have generic assessment criteria (GAC) to promote healthy plant growth. In the absence of other published GAC, the GAC have been obtained from legislation (UK and European) and guidance related to the use of sewage sludge on agricultural fields.

The Council of European Communities Sewage Sludge Directive (86/278/EEC) dated 1986, has been transposed into UK law by Statutory Instrument No. 1263, The Sludge (use in Agriculture) Regulations 1989 (Public Health England, Wales and Scotland), as ammended in 1990 and The Sludge (use in Agriculture) Regulations (Northern Ireland) SR No, 245, 1990. In addition the Department of Environment (DoE) produced a Code of Practice (CoP) (Updated 2nd Edition) in 2006 which provided guidance on the application of sewage sludge on agricultural land (however the status of this document is unclear as it is on the archive section of the Defra website).

The directive seeks to encourage the use of sewage sludge in agriculture and to regulate its use in such a way as to "***prevent harmful effects on soil, vegetation, animals and man".*** To this end, it prohibits the use of untreated sludge on agricultural land unless it is injected or incorporated into the soil. Treated sludge is defined as having undergone "biological, chemical or heat treatment, long-term storage or any other appropriate process so as significantly to reduce its fermentability and the health hazards resulting from its use". To provide protection against potential health risks from residual pathogens, sludge must not be applied to soil in which fruit and vegetable crops are growing, or less than ten months before fruit and vegetable crops are to be harvested. Grazing animals must not be allowed access to grassland or forage land less than three weeks after the application of sludge.

The specified limits of concentrations of selected elements in soil are presented in Table 4 of the updated 2nd Edition of the DoE Code of Practice and are designed to protect plant growth. It is noted that these values are more stringent than the values set in current UK regulations. However since they were ammended following recommendations from the Independent Scientific Committee in 1993. (MAFF/DOE 1993). The GAC are presented in Table 1.

Table 1: Generic assessment criteria

Determinant	Generic assessment criteria (mg/kg)			
	pH 5.0 < 5.5	pH 5.5 < 6.0	pH 6.0 < 7.0	pH >7.0
Zinc	200	200	200	300
Copper	80	100	135	200
Nickel	50	60	75	110
Lead	300	300	300	300
Cadmium	3	3	3	3
Mercury	1	1	1	1
Note: Only compounds with assessment criteria documented within the Directive 86/278/EEC have been included, although criteria for 5 additional compounds have been presented within the 2006 CoP.				

APPENDIX P
GENERIC ASSESSMENT CRITERIA FOR POTABLE WATER SUPPLY PIPES

A range of pipe materials is available and careful selection, design and installation is required to ensure that water supply pipes are satisfactorily installed and meet the requirements of the Water Supply (Water Fittings) Regulations 1999 in England and Wales, the Byelaws 2000 in Scotland and the Northern Ireland Water Regulations. The regulations include a requirement to use only suitable materials when laying water pipes and laying water pipes without protection is not permitted at contaminated sites. The water supply company has a statutory duty to enforce the regulations.

Contaminants in the ground can pose a risk to human health by permeating potable water supply pipes. 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 in 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.

The report 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 polyethylene (PE) and polyvinyl chloride (PVC) pipes for the organic contaminants of concern. The report also makes recommendations for the procedures to be adopted in the design of site investigations and sampling strategies, and the assessment of data, to ensure that the ground through which water supply pipes will be laid is adequately characterised.

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 for this linkage and are reproduced in Table A3 below.

Since water supply pipes are typically laid at a minimum depth of 0.75 m below finished ground levels, sample results from depths between 0.5 m and 1.5 m below finished level are generally considered suitable for assessing risks to water supply. Samples outside these depths can be used, providing the stratum is the same as that in which water supply pipes are likely to be located. The report specifies that sampling should characterise the ground conditions to a minimum of 0.5 m below the proposed depth of the pipe.

It should be noted that the assessment provided in this report is a guide and the method of assessment and recommendations should be checked with the relevant water supply company.

Table A3: Generic assessment criteria for water supply pipes

		Pipe material	
		GAC (mg/kg)	
	Parameter group	**PE**	**PVC**
1	Extended VOC suite by purge and trap or head space and GC-MS with TIC (Not including compounds within group 1a)	0.5	0.125
1a	• BTEX + MTBE	0.1	0.03
2	SVOCs TIC by purge and trap or head space and GC-MS with TIC (aliphatic and aromatic C_5–C_{10}) (Not including compounds within group 2e and 2f)	2	1.4
2e	• Phenols	2	0.4
2f	• Cresols and chlorinated phenols	2	0.04
3	Mineral oil C_{11}–C_{20}	10	Suitable
4	Mineral oil C_{21}–C_{40}	500	Suitable
5	Corrosive (conductivity, redox and pH)	Suitable	Suitable
Specific suite identified as relevant following site investigation			
2a	Ethers	0.5	1
2b	Nitrobenzene	0.5	0.4
2c	Ketones	0.5	0.02
2d	Aldehydes	0.5	0.02
6	Amines	Not suitable	Suitable
Notes: where indicated as 'suitable', the material is considered resistant to permeation or degradation and no threshold concentration has been specified by UKWIR.			

APPENDIX Q
HASWASTE ASSESSMENT

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Please enter available data in the rows associated with the test (grey) cells. Calculation cells initially display either "0.0000" or "#DIV/0!".
If any calculation cells below state "0.00000", testing has NOT been undertaken that contributes to that Hazardous Property.

Haswaste, developed by Dr. Iain Haslock.

Site Code and Name										
TP/WS/BH			TP02	TP02	BH4	BH4	BH4	TP02			
Depth (m)			2.90	3.50	0.30	1.20-1.65	2.75				
Envirolab reference											
% Moisture		%									
pH (soil)			7.97		10.51						
pH (leachate)											
Arsenic		mg/kg	10		15						
Cadmium	updated v5.4ei	mg/kg	<0.5		0.5						
Copper		mg/kg	18		28						
CrVI or Chromium		mg/kg	15		23						
Lead		mg/kg	237		311						
Mercury		mg/kg	0.43		0.98						
Nickel		mg/kg	17		22						
Selenium		mg/kg	<1		<1						
Zinc	updated v5.4ei	mg/kg	42		208						
Barium		mg/kg									
Beryllium		mg/kg									
Vanadium		mg/kg									
Cobalt	updated v5.4ei	mg/kg									
Manganese	updated v5.4ei	mg/kg									
Molybdenum		mg/kg									
Antimony		mg/kg									
Aluminium		mg/kg									
Bismuth		mg/kg									
CrIII		mg/kg									
Iron	updated v5.4ei	mg/kg									
Strontium		mg/kg									
Tellurium		mg/kg									
Thallium		mg/kg									
Titanium		mg/kg									
Tungsten		mg/kg									
Ammoniacal N		mg/kg									
ws Boron		mg/kg									
PAH (Input Total PAH **OR** individual PAH results)											
Acenaphthene		mg/kg	0.02	0.02	0.02	<0.01	<0.01				
Acenaphthylene		mg/kg	<0.01	<0.01	0.09	<0.01	<0.01				
Anthracene		mg/kg	0.03	0.02	0.81	<0.02	<0.02				
Benzo(a)anthracene		mg/kg	0.08	0.08	3.38	0.08	<0.04				
Benzo(a)pyrene		mg/kg	0.08	0.10	2.87	0.10	<0.04				
Benzo(b)fluoranthene		mg/kg	0.11	0.12	3.17	0.12	<0.05				
Benzo(ghi)perylene		mg/kg	<0.05	0.06	1.59	0.07	<0.05				
Benzo(k)fluoranthene		mg/kg	<0.07	<0.07	1.23	<0.07	<0.07				
Chrysene		mg/kg	0.12	0.12	3.29	0.11	<0.06				
Dibenzo(ah)anthracene		mg/kg	<0.04	<0.04	0.48	<0.04	<0.04				
Fluoranthene		mg/kg	0.30	0.25	6.69	0.17	<0.08				
Fluorene		mg/kg	0.03	0.02	0.04	<0.01	<0.01				
Indeno(123cd)pyrene		mg/kg	0.06	0.07	2.01	0.08	<0.03				
Naphthalene		mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03				
Phenanthrene		mg/kg	0.23	0.19	1.88	0.05	<0.03				
Pyrene		mg/kg	0.25	0.22	5.78	0.16	<0.07				
Coronene		mg/kg									
Total PAHs (16 or 17)		mg/kg									
TPH											
Petrol		mg/kg									
Diesel		mg/kg									
Lube Oil		mg/kg									
Crude Oil											
White Spirit / Kerosene		mg/kg									
Creosote		mg/kg									
Unknown TPH with ID		mg/kg									
Unknown TPHCWG		mg/kg									
Total Sulphide		mg/kg									
Complex Cyanide		mg/kg									
Free (or Total) Cyanide		mg/kg									
Thiocyanate		mg/kg									
Elemental/Free Sulphur		mg/kg									
Phenols Input Total Phenols HPLC **OR** individual Phenol results.											
Phenol		mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01				
Cresols		mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01				
Xylenols		mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01				
Resourcinol		mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01				
Phenols Total by HPLC		mg/kg									
BTEX Input Total BTEX **OR** individual BTEX results.											
Benzene		mg/kg									
Toluene		mg/kg									
Ethylbenzene		mg/kg									
Xylenes		mg/kg									
Total BTEX		mg/kg									
PCBs (POPs)											
PCBs Total (eg EC7/WHO12)		mg/kg									
PBBs (POPs)											
Hexabromobiphenyl (Total or PBB153; 2,2',4,4',5,5'- if only available)		mg/kg									

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Please enter available data in the rows associated with the test (grey) cells. Calculation cells initially display either "0.0000" or "#DIV/0!".
If any calculation cells below state "0.00000", testing has NOT been undertaken that contributes to that Hazardous Property.

Haswaste, developed by Dr. Iain Haslock.

Site Code and Name									
TP/WS/BH	TP02	TP02	BH4	BH4	BH4	TP02			
Depth (m)	2.90	3.50	0.30	1.20-1.65	2.75				
Envirolab reference									

POPs Dioxins and Furans Input Total Dioxins and Furans **OR** individual Dioxin and Furan results.

2,3,7,8-TeCDD		mg/kg								
1,2,3,7,8-PeCDD		mg/kg								
1,2,3,4,7,8-HxCDD		mg/kg								
1,2,3,6,7,8-HxCDD		mg/kg								
1,2,3,7,8,9-HxCDD		mg/kg								
1,2,3,4,6,7,8-HpCDD		mg/kg								
OCDD		mg/kg								
2,3,7,8-TeCDF		mg/kg								
1,2,3,7,8-PeCDF		mg/kg								
2,3,4,7,8-PeCDF		mg/kg								
1,2,3,4,7,8-HxCDF		mg/kg								
1,2,3,6,7,8-HxCDF		mg/kg								
2,3,4,6,7,8-HxCDF		mg/kg								
1,2,3,7,8,9-HxCDF		mg/kg								
1,2,3,4,6,7,8-HpCDF		mg/kg								
1,2,3,4,7,8,9-HpCDF		mg/kg								
OCDF		mg/kg								
Total Dioxins and Furans		mg/kg								

Some Pesticides (POPs unless otherwise stated)

Aldrin		mg/kg								
α Hexachlorocyclohexane (alpha-HCH) *(leave empty if total HCH results used)*		mg/kg								
β Hexachlorocyclohexane (beta-HCH) *(leave empty if total HCH results used)*		mg/kg								
α Cis-Chlordane (alpha) ***OR*** *Total Chlordane*		mg/kg								
δ Hexachlorocyclohexane (delta-HCH) *(leave empty if total HCH results used)*		mg/kg								
Dieldrin	updated v5.4ei	mg/kg								
Endrin		mg/kg								
χ Hexachlorocyclohexane (gamma-HCH) (lindane) ***OR*** *Total HCH*	updated v5.4ei	mg/kg								
Heptachlor		mg/kg								
Hexachlorobenzene		mg/kg								
o,p'-DDT *(leave empty if total DDT results used)*		mg/kg								
p,p'-DDT ***OR*** *Total DDT*	updated v5.4ei	mg/kg								
χ Trans-Chlordane (gamma) *(leave empty if total Chlordane results used)*		mg/kg								
Chlordecone (kepone)		mg/kg								
Pentachlorobenzene		mg/kg								
Mirex		mg/kg								
Toxaphene (camphechlor)		mg/kg								

Tin

Tin *(leave empty if Organotin and Tin excl Organotin results used)*		mg/kg								

Organotin

Dibutyltin; DiBT		mg/kg								
Tributyltin; TriBT		mg/kg								
Triphenyltin; TriPT		mg/kg								
Tetrabutyltin; TeBT		mg/kg								

Tin excluding Organotin

Tin excl Organotin		mg/kg								

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Haswaste, developed by Dr. Iain Haslock.

Please enter available data in the rows associated with the test (grey) cells. Calculation cells initially display either "0.0000" or "#DIV/0!".
If any calculation cells below state "0.00000", testing has NOT been undertaken that contributes to that Hazardous Property.

Site Code and Name									
TP/WS/BH		TP02	TP02	BH4	BH4	BH4	TP02			
Depth (m)		2.90	3.50	0.30	1.20-1.65	2.75				
Envirolab reference										
Asbestos in Soil	Thresholds									
Asbestos detected in Soil (enter Y or N)	Y						Y			
		If Asbestos in Soil above is "Y", the soil is Hazardous Waste HP5 and HP7								
Asbestos % Composition in Soil (Matrix Loose Fibres or Microscopic Identifiable Pieces only)	see "Carc HP7 % Asbestos in Soil (Fibres)" below	%								
Carcinogenic HP7 % Asbestos in Soil (fibres or micro pieces) Please be advised, if the calculation cell is "0.00000" DOES NOT MEAN asbestos testing has been undertaken and the result is zero.	≥0.1%	0.00000	0.00000	0.00000	0.00000	0.00000	40.00000	0.00000	0.00000	0.00000
		If Asbestos in Soil above is "Y", but Asbestos % above is "<0.1%", the soil is Non Hazardous Waste. You can only use Asbestos % results where loose fibres or micro pieces are only present. You cannot use Asbestos % results when visual identifiable pieces are present.								
Asbestos Identifiable Pieces visible with the naked eye detected in the Soil (enter Y or N)	Y						Y			

If visual identifiable pieces of asbestos are present, you cannot use Asbestos % results and the whole soil sample is Hazardous Waste HP5 and HP7 Construction material containing Asbestos 17 06 05.
Therefore, if Asbestos in Soil above is "Y", the Asbestos % above is "<0.1%", but the Asbestos Identifiable Pieces visible with the naked eye is "Y", the soil is Hazardous Waste.

Identifiable Pieces are Cement, Fragments, Board, Rope etc. ie anything ACM that is not Loose Fibres.

All visual asbestos pieces need to be removed leaving only fibres (or micro pieces) with an Asbestos % Composition in Soil result of <0.1% for the soil to become non-hazardous waste.

Hazardous Property	Thresholds	Cut Off Value	If cells below turn yellow and the text turns red, the samples should be classified as Hazardous Waste.								
Corrosive HP8	≥5%	<1%	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.00000	0.00000	0.00000	0.00000
Irritant HP4	≥10%	<1%	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.00000	0.00000	0.00000	0.00000
Irritant HP4	≥20%	<1%	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.00000	0.00000	0.00000	0.00000
Specifc Target Organ Toxicity HP5	≥1%		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Specifc Target Organ Toxicity HP5	≥20%		0.00002	0.00002	0.00019	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000
Specifc Target Organ Toxicity HP5	≥1%		0.00343	0.00000	0.00444	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Specifc Target Organ Toxicity HP5	≥10%		#VALUE!	0.00000	#VALUE!	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Aspiration Toxicity HP5	≥10%		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6	≥0.1%	<0.1%	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6	≥0.25%	<0.1%	0.00136	0.00000	0.00208	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6	≥5%	<0.1%	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6	≥25%	<1%	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6	≥0.25%	<0.1%	0.00004	0.00000	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6	≥2.5%	<0.1%	0.00288	0.00000	0.00442	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6	≥15%	<0.1%	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6	≥55%	<1%	#VALUE!	0.00000	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6	≥0.1%	<0.1%	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6	≥0.5%	<0.1%	#VALUE!	0.00000	0.00456	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6	≥3.5%	<0.1%	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6	≥22.5%	<1%	0.02917	0.00000	0.03871	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Carcinogenic HP7	≥0.1%		0.02370	0.00001	0.03110	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000
Carcinogenic HP7	≥0.1%		0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000
Carcinogenic HP7	≥1%		0.00001	0.00001	0.00020	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000
Carcinogenic HP7 Unknown TPH with ID	≥1,000mg/kg		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Carcinogenic HP7 b(a)p marker test (Unknown TPH with ID only) Cell only applicable if TPH >1,000mg/kg	≥0.01%		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
pH Corrosive HP8 pH (soil or leachate)	H8 ≥11.5		7.97	0.00	10.51	0.00	0.00	0.00	0.00	0.00	0.00
pH Corrosive HP8 pH (soil or leachate)	H8 ≤2		7.97	0.00	10.51	0.00	0.00	0.00	0.00	0.00	0.00
Toxic for Reproduction HP10	≥0.3%		0.02370	0.00001	0.03110	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000
Toxic for Reproduction HP10	≥3%		0.00288	0.00000	0.00442	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Mutagenic HP11	≥0.1%		0.00288	0.00001	0.00442	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000
Mutagenic HP11 Unknown TPH with ID	≥1,000mg/kg		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mutagenic HP11 b(a)p marker test (Unknown TPH with ID only) Cell only applicable if TPH >1,000mg/kg	≥0.01%		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Mutagenic HP11	≥1%		0.00343	0.00001	0.00444	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000
Produces Toxic Gases HP12 Sulphide	≥1,400mg/kg		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Produces Toxic Gases HP12 Cyanide	≥1,200mg/kg		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Produces Toxic Gases HP12 Thiocyanate	≥2,600mg/kg		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HP13 Sensitising	≥10%		0.00343	0.00001	0.00444	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000
Ecotoxic HP14	≥1.0	<0.1% (except CompCN + Thiocyanate + Xylene + BTEX 1%).	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.00000	0.00000	0.00000	0.00000
Ecotoxic HP14	≥25%	<0.1%	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.00000	0.00000	0.00000	0.00000

Table 3.1 of the CLP, CL Inventory, ATPs, IARC, Concawe, MSDSs, REACH + Pesticide Properties databases. Worst case REACH + MSDS's used for "*" STOT + Acute Toxicity.

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If any calculation cells below state "0.00000", testing has NOT been undertaken that contributes to that Hazardous Property.

Haswaste, developed by Dr. Iain Haslock.

Site Code and Name										
TP/WS/BH			TP02	TP02	BH4	BH4	BH4	TP02			
Depth (m)			2.90	3.50	0.30	1.20-1.65	2.75				
Envirolab reference											
Ecotoxic HP14	≥25%	<0.1% (except CompCN + Thiocyanate + Xylene + BTEX 1%).	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.00000	0.00000	0.00000	0.00000
Ecotoxic HP14 individual substance specific thresholds (Benzo(a)anthracene, Dibenz(ah)anthracene (or Total PAH if only used), Sn, TriPT)	≥0.0025%		0.000008	0.000008	0.000338	0.000008	0.000000	0.000000	0.000000	0.000000	0.000000
Ecotoxic HP14 individual substance specific thresholds (Co, γ-HCH, DiBT, TriBT)	≥0.025%		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Persistent Organic Pollutant (PCB, PBB or POP Pesticides)	>0.005%		0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
Persistent Organic Pollutant (Total Dioxins+Furans)	>0.0000015%		0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
Persistent Organic Pollutant (Individual Dioxins+Furans)	>0.0000015%		0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000

If other contaminants need adding to Haswaste, please contact Envirolab.

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Haswaste, developed by Dr. Iain Haslock.

Site Code and Name										
TP/WS/BH			WS2	WS4	WS5	WS5	WS6	WS6	WS7	WS8	WS10
Depth (m)			0.20-0.80	1.20	0.50-1.00	2.80	2.50	3.50	0.20-0.70	0.50	0.45
Envirolab reference											
% Moisture		%				10.6			16.3		
pH (soil)			8.39	8.45	8.19	8.35			9.96	7.93	7.29
pH (leachate)											
Arsenic		mg/kg	12	15	9	25			16	17	4
Cadmium	updated v5.4ei	mg/kg	0.9	0.7	0.6	1.0			<0.5	0.8	<0.5
Copper		mg/kg	96	48	28	6			23	56	5
CrVI or Chromium		mg/kg	20	36	34	27			18	23	19
Lead		mg/kg	446	537	287	40			204	662	20
Mercury		mg/kg	0.70	0.47	0.60	<0.17			0.71	1.81	<0.17
Nickel		mg/kg	32	22	22	38			19	24	12
Selenium		mg/kg	<1	<1	<1	<1			<1	<1	<1
Zinc	updated v5.4ei	mg/kg	202	396	160	250			75	245	25
Barium		mg/kg									
Beryllium		mg/kg									
Vanadium		mg/kg									
Cobalt	updated v5.4ei	mg/kg									
Manganese	updated v5.4ei	mg/kg									
Molybdenum		mg/kg									
Antimony		mg/kg									
Aluminium		mg/kg									
Bismuth		mg/kg									
CrIII		mg/kg									
Iron	updated v5.4ei	mg/kg									
Strontium		mg/kg									
Tellurium		mg/kg									
Thallium		mg/kg									
Titanium		mg/kg									
Tungsten		mg/kg									
Ammoniacal N		mg/kg									
ws Boron		mg/kg									
PAH (Input Total PAH **OR** individual PAH results)											
Acenaphthene		mg/kg	0.19	0.10	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Acenaphthylene		mg/kg	0.21	0.16	0.01	<0.01	<0.01	<0.01	<0.01	0.03	<0.01
Anthracene		mg/kg	0.62	0.33	<0.02	<0.02	<0.02	<0.02	<0.02	0.06	<0.02
Benzo(a)anthracene		mg/kg	3.26	1.45	0.11	0.05	<0.04	<0.04	<0.04	0.32	<0.04
Benzo(a)pyrene		mg/kg	3.38	1.66	0.13	0.05	<0.04	<0.04	<0.04	0.39	<0.04
Benzo(b)fluoranthene		mg/kg	3.86	1.79	0.15	0.06	<0.05	<0.05	<0.05	0.46	<0.05
Benzo(ghi)perylene		mg/kg	2.10	1.07	0.08	<0.05	<0.05	<0.05	<0.05	0.22	<0.05
Benzo(k)fluoranthene		mg/kg	1.38	0.71	<0.07	<0.07	<0.07	<0.07	<0.07	0.16	<0.07
Chrysene		mg/kg	3.25	1.54	0.15	<0.06	<0.06	<0.06	<0.06	0.41	<0.06
Dibenzo(ah)anthracene		mg/kg	0.50	0.26	<0.04	<0.04	<0.04	<0.04	<0.04	0.06	<0.04
Fluoranthene		mg/kg	6.74	3.33	0.27	0.13	<0.08	<0.08	<0.08	0.76	<0.08
Fluorene		mg/kg	0.16	0.12	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Indeno(123cd)pyrene		mg/kg	2.55	1.39	0.09	<0.03	<0.03	<0.03	<0.03	0.28	<0.03
Naphthalene		mg/kg	0.08	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Phenanthrene		mg/kg	2.48	1.79	0.08	0.07	<0.03	<0.03	<0.03	0.29	<0.03
Pyrene		mg/kg	6.31	2.86	0.25	0.10	<0.07	<0.07	<0.07	0.67	<0.07
Coronene		mg/kg									
Total PAHs (16 or 17)		mg/kg									
TPH											
Petrol		mg/kg									
Diesel		mg/kg									
Lube Oil		mg/kg									
Crude Oil											
White Spirit / Kerosene		mg/kg									
Creosote		mg/kg									
Unknown TPH with ID		mg/kg									
Unknown TPHCWG		mg/kg				12.0			164.0		
Total Sulphide		mg/kg									
Complex Cyanide		mg/kg									
Free (or Total) Cyanide		mg/kg									
Thiocyanate		mg/kg									
Elemental/Free Sulphur		mg/kg									
Phenols Input Total Phenols HPLC **OR** individual Phenol results.											
Phenol		mg/kg									
Cresols		mg/kg									
Xylenols		mg/kg									
Resourcinol		mg/kg									
Phenols Total by HPLC		mg/kg									
BTEX Input Total BTEX **OR** individual BTEX results.											
Benzene		mg/kg	<0.01	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01
Toluene		mg/kg	<0.01	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01
Ethylbenzene		mg/kg	<0.01	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01
Xylenes		mg/kg	<0.01	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01
Total BTEX		mg/kg									
PCBs (POPs)											
PCBs Total (eg EC7/WHO12)		mg/kg									
PBBs (POPs)											
Hexabromobiphenyl (Total or PBB153; 2,2',4,4',5,5'- if only available)		mg/kg									

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Haswaste, developed by Dr. Iain Haslock.

Site Code and Name									
TP/WS/BH		WS2	WS4	WS5	WS5	WS6	WS6	WS7	WS8	WS10
Depth (m)		0.20-0.80	1.20	0.50-1.00	2.80	2.50	3.50	0.20-0.70	0.50	0.45
Envirolab reference										
POPs Dioxins and Furans Input Total Dioxins and Furans **OR** individual Dioxin and Furan results.										
2,3,7,8-TeCDD	mg/kg									
1,2,3,7,8-PeCDD	mg/kg									
1,2,3,4,7,8-HxCDD	mg/kg									
1,2,3,6,7,8-HxCDD	mg/kg									
1,2,3,7,8,9-HxCDD	mg/kg									
1,2,3,4,6,7,8-HpCDD	mg/kg									
OCDD	mg/kg									
2,3,7,8-TeCDF	mg/kg									
1,2,3,7,8-PeCDF	mg/kg									
2,3,4,7,8-PeCDF	mg/kg									
1,2,3,4,7,8-HxCDF	mg/kg									
1,2,3,6,7,8-HxCDF	mg/kg									
2,3,4,6,7,8-HxCDF	mg/kg									
1,2,3,7,8,9-HxCDF	mg/kg									
1,2,3,4,6,7,8-HpCDF	mg/kg									
1,2,3,4,7,8,9-HpCDF	mg/kg									
OCDF	mg/kg									
Total Dioxins and Furans	mg/kg									
Some Pesticides (POPs unless otherwise stated)										
Aldrin	mg/kg									
α Hexachlorocyclohexane (alpha-HCH) *(leave empty if total HCH results used)*	mg/kg									
β Hexachlorocyclohexane (beta-HCH) *(leave empty if total HCH results used)*	mg/kg									
α Cis-Chlordane (alpha) ***OR*** *Total Chlordane*	mg/kg									
δ Hexachlorocyclohexane (delta-HCH) *(leave empty if total HCH results used)*	mg/kg									
Dieldrin	updated v5.4ei mg/kg									
Endrin	mg/kg									
χ Hexachlorocyclohexane (gamma-HCH) (lindane) ***OR*** *Total HCH*	updated v5.4ei mg/kg									
Heptachlor	mg/kg									
Hexachlorobenzene	mg/kg									
o,p'-DDT *(leave empty if total DDT results used)*	mg/kg									
p,p'-DDT ***OR*** *Total DDT*	updated v5.4ei mg/kg									
χ Trans-Chlordane (gamma) *(leave empty if total Chlordane results used)*	mg/kg									
Chlordecone (kepone)	mg/kg									
Pentachlorobenzene	mg/kg									
Mirex	mg/kg									
Toxaphene (camphechlor)	mg/kg									
Tin										
Tin *(leave empty if Organotin and Tin excl Organotin results used)*	mg/kg									
Organotin										
Dibutyltin; DiBT	mg/kg									
Tributyltin; TriBT	mg/kg									
Triphenyltin; TriPT	mg/kg									
Tetrabutyltin; TeBT	mg/kg									
Tin excluding Organotin										
Tin excl Organotin	mg/kg									

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Haswaste, developed by Dr. Iain Haslock.

Site Code and Name										
TP/WS/BH		WS2	WS4	WS5	WS5	WS6	WS6	WS7	WS8	WS10
Depth (m)		0.20-0.80	1.20	0.50-1.00	2.80	2.50	3.50	0.20-0.70	0.50	0.45
Envirolab reference										
Asbestos in Soil	Thresholds									
Asbestos detected in Soil (enter Y or N)	Y	Y	Y							
		If Asbestos in Soil above is "Y", the soil is Hazardous Waste HP5 and HP7								
Asbestos % Composition in Soil (Matrix Loose Fibres or Microscopic Identifiable Pieces only)	see "Carc HP7 % Asbestos in Soil (Fibres)" below	% 0.01700	0.05300							
Carcinogenic HP7 % Asbestos in Soil (fibres or micro pieces) Please be advised, if the calculation cell is "0.00000" DOES NOT MEAN asbestos testing has been undertaken and the result is zero.	≥0.1%	0.01700	0.05300	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
		If Asbestos in Soil above is "Y", but Asbestos % above is "<0.1%", the soil is Non Hazardous Waste. You can only use Asbestos % results where loose fibres or micro pieces are only present. You cannot use Asbestos % results when visual identifiable pieces are present.								
Asbestos Identifiable Pieces visible with the naked eye detected in the Soil (enter Y or N)	Y									

If visual identifiable pieces of asbestos are present, you cannot use Asbestos % results and the whole soil sample is Hazardous Waste HP5 and HP7 Construction material containing Asbestos 17 06 05.
Therefore, if Asbestos in Soil above is "Y", the Asbestos % above is "<0.1%", but the Asbestos Identifiable Pieces visible with the naked eye is "Y", the soil is Hazardous Waste.

Identifiable Pieces are Cement, Fragments, Board, Rope etc. ie anything ACM that is not Loose Fibres.

All visual asbestos pieces need to be removed leaving only fibres (or micro pieces) with an Asbestos % Composition in Soil result of <0.1% for the soil to become non-hazardous waste.

Hazardous Property	Thresholds	Cut Off Value	If cells below turn yellow and the text turns red, the samples should be classified as Hazardous Waste.								
Corrosive HP8	≥5%	<1%	0.00542	0.00889	0.00772	0.00758	0.00000	0.00000	0.00466	0.00666	0.00418
Irritant HP4	≥10%	<1%	0.01243	0.00740	0.00435	0.00356	0.00000	0.00000	0.00394	0.00857	0.00109
Irritant HP4	≥20%	<1%	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Specifc Target Organ Toxicity HP5	≥1%		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Specifc Target Organ Toxicity HP5	≥20%		0.00025	0.00018	0.00001	0.00001	0.00000	0.00000	0.00000	0.00003	0.00000
Specifc Target Organ Toxicity HP5	≥1%		0.01700	0.05300	0.00653	0.00686	0.00000	0.00000	0.00321	0.00485	0.00365
Specifc Target Organ Toxicity HP5	≥10%		#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.00000	0.00000	#VALUE!	#VALUE!	#VALUE!
Aspiration Toxicity HP5	≥10%		#VALUE!	#VALUE!	#VALUE!	0.00107	#VALUE!	#VALUE!	0.01373	#VALUE!	#VALUE!
Acute Toxicity HP6	≥0.1%	<0.1%	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6	≥0.25%	<0.1%	0.00165	0.00203	0.00125	#VALUE!	0.00000	0.00000	0.00183	0.00243	#VALUE!
Acute Toxicity HP6	≥5%	<0.1%	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.00000	0.00000	#VALUE!	#VALUE!	#VALUE!
Acute Toxicity HP6	≥25%	<1%	0.06295	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Acute Toxicity HP6	≥0.25%	<0.1%	0.00007	0.00005	0.00006	#VALUE!	0.00000	0.00000	0.00006	0.00018	#VALUE!
Acute Toxicity HP6	≥2.5%	<0.1%	0.00384	0.00691	0.00653	0.00463	0.00000	0.00000	0.00289	0.00442	0.00365
Acute Toxicity HP6	≥15%	<0.1%	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6	≥55%	<1%	#VALUE!	#VALUE!	#VALUE!	0.00009	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Acute Toxicity HP6	≥0.1%	<0.1%	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Acute Toxicity HP6	≥0.5%	<0.1%	0.00400	0.00703	0.00665	#VALUE!	0.00000	0.00000	#VALUE!	0.00468	#VALUE!
Acute Toxicity HP6	≥3.5%	<0.1%	#VALUE!	#VALUE!	#VALUE!	#VALUE!	0.00000	0.00000	#VALUE!	#VALUE!	#VALUE!
Acute Toxicity HP6	≥22.5%	<1%	#VALUE!	#VALUE!	#VALUE!	0.01104	#VALUE!	#VALUE!	0.02246	#VALUE!	#VALUE!
Carcinogenic HP7	≥0.1%		0.04460	0.05370	0.02870	0.00686	0.00000	0.00000	0.01707	0.06620	0.00365
Carcinogenic HP7	≥0.1%		0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000
Carcinogenic HP7	≥1%		0.00026	0.00014	0.00001	0.00000	0.00000	0.00000	0.00000	0.00003	0.00000
Carcinogenic HP7 Unknown TPH with ID	≥1,000mg/kg		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Carcinogenic HP7 b(a)p marker test (Unknown TPH with ID only) Cell only applicable if TPH >1,000mg/kg	≥0.01%		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
pH Corrosive HP8 pH (soil or leachate)	H8 ≥11.5		8.39	8.45	8.19	8.35	0.00	0.00	9.96	7.93	7.29
pH Corrosive HP8 pH (soil or leachate)	H8 ≤2		8.39	8.45	8.19	8.35	0.00	0.00	9.96	7.93	7.29
Toxic for Reproduction HP10	≥0.3%		0.04460	0.05370	0.02870	0.00686	0.00000	0.00000	0.01707	0.06620	0.00242
Toxic for Reproduction HP10	≥3%		0.00384	0.00691	0.00653	0.00463	0.00000	0.00000	0.01373	0.00442	0.00365
Mutagenic HP11	≥0.1%		0.00384	0.00691	0.00653	0.00463	0.00000	0.00000	0.01373	0.00442	0.00365
Mutagenic HP11 Unknown TPH with ID	≥1,000mg/kg		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mutagenic HP11 b(a)p marker test (Unknown TPH with ID only) Cell only applicable if TPH >1,000mg/kg	≥0.01%		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Mutagenic HP11	≥1%		0.00646	0.00444	0.00444	0.00686	0.00000	0.00000	0.00321	0.00485	0.00242
Produces Toxic Gases HP12 Sulphide	≥1,400mg/kg		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Produces Toxic Gases HP12 Cyanide	≥1,200mg/kg		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Produces Toxic Gases HP12 Thiocyanate	≥2,600mg/kg		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HP13 Sensitising	≥10%		0.00646	0.00691	0.00653	0.00686	0.00000	0.00000	0.00321	0.00485	0.00365
Ecotoxic HP14	≥1.0	<0.1% (except CompCN + Thiocyanate + Xylene + BTEX 1%).	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Ecotoxic HP14	≥25%	<0.1%	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

Please enter available data in the rows associated with the test (grey) cells. Calculation cells initially display either "0.0000" or "#DIV/0!".
If any calculation cells below state "0.00000", testing has NOT been undertaken that contributes to that Hazardous Property.

Haswaste, developed by Dr. Iain Haslock.

Site Code and Name										
TP/WS/BH			WS2	WS4	WS5	WS5	WS6	WS6	WS7	WS8	WS10
Depth (m)			0.20-0.80	1.20	0.50-1.00	2.80	2.50	3.50	0.20-0.70	0.50	0.45
Envirolab reference											
Ecotoxic HP14	≥25%	<0.1% (except CompCN + Thiocyanate + Xylene + BTEX 1%).	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Ecotoxic HP14 individual substance specific thresholds (Benzo(a)anthracene, Dibenz(ah)anthracene (or Total PAH if only used), Sn, TriPT)	≥0.0025%		0.000326	0.000145	0.000011	0.000004	0.000000	0.000000	0.000000	0.000032	0.000000
Ecotoxic HP14 individual substance specific thresholds (Co, γ-HCH, DiBT, TriBT)	≥0.025%		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Persistent Organic Pollutant (PCB, PBB or POP Pesticides)	>0.005%		0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
Persistent Organic Pollutant (Total Dioxins+Furans)	>0.0000015%		0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
Persistent Organic Pollutant (Individual Dioxins+Furans)	>0.0000015%		0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000

If other contaminants need adding to Haswaste, please contact Envirolab.

APPENDIX R
LONDON FIRE BRIGADE ENVIRONMENTAL ENQUIRY RESPONSE

LONDON FIRE BRIGADE

Petroleum Group LFB Headquarters - 3rd Floor
169 Union Street London SE1 0LL
T 020 8555 1200 x30859
F 020 7960 3624
Minicom 020 7960 3629
london-fire.gov.uk

RSK
Anerley Court
Half Moon Lane
Hildenborough, Tonbridge
Kent
TN11 9HU

FAO Julia Griffin

The London Fire Commissioner is the fire and rescue authority for London

Date 5 June 2018
Our Ref 24/010724
Your Ref 29701

Dear Ms Griffin,

THE ENVIRONMENTAL INFORMATION REGULATIONS 2004 - ENVIRONMENTAL ENQUIRY

Premises: 11 Windmill Road, Hampton Hill, Hampton TW12 1RF

The London Fire Commissioner (the Commissioner) is the fire and rescue authority for London. The Commissioner is responsible for enforcing the Petroleum (Consolidation) Regulations 2014 in London.

As requested, a petroleum environmental search has been made in respect of the above premises.

A thorough search of current and historical files and databases has revealed information for the site as detailed in the attached forms.

Please note that this report is restricted to matters currently known by the Commissioner. Although we hold extremely comprehensive records, it is possible that we do not hold any records whatsoever for some solid-filled and very old tanks. This will be for one of the following reasons:-

1. The records held by the Commissioner were passed to it from the Greater London Council in 1986. In 1965 the Greater London Council inherited petroleum related records from the London County Council and the outer London Boroughs / Councils. Some of the outer London records were incomplete.

2. For premises where petroleum tanks have been either removed or permanently made safe, the Commissioner's records have (in a minority of cases) been destroyed; and for these cases the Commissioner does not hold any records that indicate that there was ever a 'petroleum' interest at the premises.

As you are aware, a fee is levied for the provision of this information and payment should be made in accordance with the invoice, which will be sent under separate cover.

Any queries regarding this letter should be addressed to the person named below. If you are dissatisfied in any way with the response given, please ask to speak to the Head of Petroleum quoting our reference.

Yours faithfully,

for Assistant Commissioner (Fire Safety)
Directorate of Operations
petroleum@london-fire.gov.uk

Reply to Bola Afolabi
Direct **T** 020 8555 1200 x30812

ENVIRONMENTAL ENQUIRY DETAIL FORM

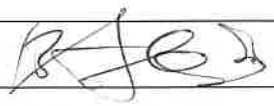
Premises:
11 Windmill Road, Hampton Hill, Hampton TW12 1RF
Our Reference:
24/010724

Tank No.	Compartment No.	Year	Tank Type	Tank Capacity	Fuel Type	Current Status
1	1	1966	Single Skin Steel	22,730	Petrol	Water Filled
2	2	1966	Single Skin Steel	22,730	Petrol	Water Filled

Current licence/Petroleum Storage Certificate in force?
YES ☐ NO ☒
Date last licence(s)/storage certificate(s) issued:
Licensed between 01 September 1966 and 31 October 1994

Known leaks or spills at this site:
There are no known records of any leaks or spills occurring at this site.

Comments:
File records are extremely limited for this site and no plans could be located. A file note informs that the tanks were water-filled in 1983, although this does not reconcile with information that the site was licensed up until 1994. The last file note available indicates that on 26 June 2007, it was agreed to revisit the site to inspect the water-filled tanks in 6 months time (December 2007). There is no further information in our records.

Signed:	
Name:	Mr. Bola Afolabi
Position:	Asst. Policy Support Officer
Date:	5th June 2018

LONDON FIRE BRIGADE

Petroleum Group LFB Headquarters - 3rd Floor
169 Union Street London SE1 0LL
T 020 8555 1200 x30859
F 020 7960 3624
Minicom 020 7960 3629
london-fire.gov.uk

Julia Griffin
RSK
Anerley Court
Half Moon Lane
Hildenborough
Tonbridge
Kent
TN11 9HU

The London Fire Commissioner is the fire and rescue authority for London

Date 16 May 2018
Our Ref 24/213164
Your Ref 29701

Dear Madam

THE ENVIRONMENTAL INFORMATION REGULATIONS 2004 - ENVIRONMENTAL ENQUIRY

Premises: St Clare Business Park, Holly Road, Hampton Hill TW12 1QF

The London Fire Commissioner (the Commissioner) is the fire and rescue authority for London. The Commissioner is responsible for enforcing the Petroleum (Consolidation) Regulations 2014 in London.

As requested, a petroleum environmental search has been made in respect of the above premises.

A thorough search of current and historical files and databases has revealed information for the site as detailed in the attached forms.

Please note that this report is restricted to matters currently known by the Commissioner. Although we hold extremely comprehensive records, it is possible that we do not hold any records whatsoever for some solid-filled and very old tanks. This will be for one of the following reasons:-

1. The records held by the Commissioner were passed to it from the Greater London Council in 1986. In 1965 the Greater London Council inherited petroleum related records from the London County Council and the outer London Boroughs / Councils. Some of the outer London records were incomplete.

2. For premises where petroleum tanks have been either removed or permanently made safe, the Commissioner's records have (in a minority of cases) been destroyed; and for these cases the Commissioner does not hold any records that indicate that there was ever a 'petroleum' interest at the premises.

As you are aware, a fee is levied for the provision of this information and payment should be made in accordance with the invoice, which will be sent under separate cover.

Any queries regarding this letter should be addressed to the person named below. If you are dissatisfied in any way with the response given, please ask to speak to the Head of Petroleum quoting our reference.

Yours faithfully,

for Assistant Commissioner (Fire Safety)
Directorate of Operations
petroleum@london-fire.gov.uk

Please respond to: Richard Nye

Email: richard.nye@london-fire.gov.uk

Direct T 0208 555 1200 extn 30808

ENVIRONMENTAL ENQUIRY DETAIL FORM

Premises:
St Clare Business Park, Holly Road, Hampton Hill TW12 1QF
Our Reference:
24/213164

Tank No.	Compartment No.	Year	Tank Type	Tank Capacity (litres)	Fuel Type	Current Status
1	1	1966	Not known	4,546	Diesel	Not known
2	2	1978	Not known	18,184	Petrol	Not known

Current licence/Petroleum Storage Certificate in force?
YES ☐ NO ☒
Date last licence(s)/storage certificate(s) issued:
Licensed for the period 01/12/1966 to 30/11/1987

Known leaks or spills at this site:
There are no records of any leaks or spills at this site.

Comments:
1. There is only minimal information available for this site. 2. There are no plans available to show the location of the tanks on this site. 3. There are no records to indicate if the tanks were water filled, solid filled or removed from the site. 4. A record indicates that tank no.2 referred to above was last used for keeping 'gas oil'.

Signed:	
Name:	Richard Nye
Position:	Policy Support Manager
Date:	16 May 2018

APPENDIX D
TECHNICAL BACKGROUND

H1 Desk Study

Aquifer designation and Source protection zones

Principal aquifer: layers of rock or drift deposit that have high intergranular and/or fracture permeability (usually providing a high level of water storage). They may support water supply and/or river base flow on a strategic scale.

Secondary A aquifer: permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

Secondary B aquifer: predominantly lower permeability layers that may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.

Secondary undifferentiated aquifer: it has not been possible to attribute either a category A or B to a rock type. In most cases this means that it was previously designated as both a minor and non-aquifer in different locations owing to the variable characteristics.

Unproductive' strata: low permeability with negligible significance for water supply or river base flow.

The EA generally adopts a three-fold classification of source protection zones (SPZ) surround abstractions for public water supply. The Site is situated in an area defined as follows:

- Zone 1 or the 'inner protection zone' is located immediately adjacent to the groundwater source and is based on a 50-day travel time from any point below the water table to the source. It is designed to protect against the effects of human activity and biological/chemical contaminants that may have an immediate effect on the source
- Zone 2 or the 'outer protection zone' is defined by a 400-day travel time from a point below the water table to the source. The travel time is designed to provide delay and attenuation of slowly degrading pollutants
- Zone 3 or the 'total catchment' is the area around the source within which all groundwater recharge is presumed to be discharged at the source.

Preliminary risk assessment methodology

LCRM outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. An outline conceptual model should be formed at the preliminary risk assessment stage that collates all the existing information pertaining to a site in text, tabular or diagrammatic form. The outline conceptual model identifies potentially complete (termed possible) contaminant linkages (contaminant–pathway–receptor) and is used as the basis for the design of the site investigation. The outline conceptual model is updated as further information becomes available, for example as a result of the site investigation.

Production of a conceptual model requires an assessment of risk to be made. Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, both the

likelihood and the consequences of an event must be taken into account when assessing risk. RSK has adopted guidance provided in CIRIA C552 for use in the production of conceptual models.

The likelihood of an event can be classified on a four-point system using the following terms and definitions based on CIRIA C552:

- highly likely: the event appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution
- likely: it is probable that an event will occur or circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term
- low likelihood: circumstances are possible under which an event could occur, but it is not certain even in the long term that an event would occur and it is less likely in the short term
- unlikely: circumstances are such that it is improbable the event would occur even in the long term.

The severity can be classified using a similar system also based on CIRIA C552. The terms and definitions relating to severity are:

- severe: short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. Short-term risk to an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000)
- medium: chronic damage to human health ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000), pollution of sensitive water resources, significant change in an ecosystem or organism forming part of that ecosystem
- mild: pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures or the environment
- minor: harm, not necessarily significant, but that could result in financial loss or expenditure to resolve. Non-permanent human health effects easily prevented by use of personal protective clothing. Easily repairable damage to buildings, structures and services.

Once the probability of an event occurring and its consequences have been classified, a risk category can be assigned according to the table below.

		Consequences			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**Highly likely**	Very high	High	Moderate	Moderate/low
	Likely	High	Moderate	Moderate/low	Low
	Low likelihood	Moderate	Moderate/low	Low	Very low
	Unlikely	Moderate/low	Low	Very low	Very low

Definitions of these risk categories are as follows together with an assessment of the further work that may be required:

- very high: there is a high probability that severe harm could occur or there is evidence that severe harm is currently happening. This risk, if realised, could result in substantial liability; urgent investigation and remediation are likely to be required
- high: harm is likely to occur. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required. Remedial works may be necessary in the short term and are likely over the long term
- moderate: it is possible that harm could arise, but it is unlikely that the harm would be severe and it is more likely that the harm would be relatively mild. Investigation is normally required to clarify the risk and determine the liability. Some remedial works may be required in the longer term
- low: it is possible that harm could occur, but it is likely that if realised this harm would at worst normally be mild
- very low: there is a low possibility that harm could occur and if realised the harm is unlikely to be severe.

H2 Site Investigation Methodology

Ground gas monitoring

An infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2) in percentage by volume, while hydrogen sulphide (H_2S) and carbon monoxide (CO) were recorded in parts per million. Initial and steady state concentrations were recorded. In addition, during the first monitoring round, all wells were screened with a PID to establish if there are any interferences and cross-sensitivity of other hydrocarbons with the infrared gas meter.

Low flow groundwater sampling

Groundwater samples were retrieved using a United States Environment Protection Agency (USEPA) approved low-flow purging and sampling methodology.

The low-flow method relies on moving groundwater through the well screen at approximately the same rate as it flows through the geological formation. This results in a significant reduction in the volume of water extracted before sampling and significantly reduces the amount of disturbance of the water in the monitoring well during purging and sampling. Drawdown levels in the monitoring well and water quality indicator parameters (pH, temperature, electrical conductivity, redox potential and dissolved oxygen) are monitored during low-flow purging and sampling, with stabilisation indicating that purging is complete and sampling can begin. As the flow rate used for purging, in most cases, is the same or only slightly higher than the flow rate used for sampling, and because purging and sampling are conducted as one continuous operation in the field, the process is referred to as low-flow purging and sampling.

Reuse of suitable materials

The Definition of Waste: Development Industry Code of Practice (CL:AIRE, 2011) (CoP) was developed in cons**u**ltation with the Environment Agency and development industry to enable the

re-use of materials under certain scenarios and subject to demonstrating that specific criteria are met. The current reuse scenarios covered by the CoP comprise

- reuse on the site of origin (with or without treatment)
- direct transfer of clean and natural soils between sites
- use in the development of land other than the site of origin following treatment at an authorised Hub site (including a fixed soil treatment facility).

The importation of made ground soils (irrespective of contamination status) or crushed demolition materials is not permitted currently under the CoP and requires either a standard rules environmental permit or a U1 waste exemption (see below).

In the context of excavated materials used on-sites undergoing development, four factors are considered to be of particular relevance in determining if the material is a waste or when it ceases to be waste:

- the aim of the Waste Framework Directive is not undermined, i.e. if the use of the material will create an unacceptable risk of pollution of the environment or harm to human health it is likely to be waste
- the material is certain to be used
- the material is suitable for use both chemically and geotechnically
- only the required quantity of material will be used.

The CoP requires the preparation of a materials management plan (MMP) that confirms the above factors will be met. This plan needs to be reviewed by a 'Qualified Person' (QP) who will then issue a declaration form to the EA. As the project progresses, data must be collated and on completion a verification report produced that shows the MMP was followed and describes any changes.

The MMP establishes whether specific materials are classified as waste and how excavated materials will be treated and/or reused in line with the CoP. The MMP is likely to form part of the site waste management plan.

APPENDIX E
RSK GACS