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Remediation Method Statement Report

Former Arun Feedmills, Sincox Lane, Shipley, West Sussex RH13 8PT

On behalf of Forays Homes Limited

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1. INTRODUCTION

1.1. General

Ground and Water Limited were instructed by Forays Homes Limited to produce a Remedial Method Statement for the site at the Former Arun Feedmills Sincox Lane Shipley West Sussex RH13 8PT.

1.2. Aims of the Investigation

The aim of this report was to supply the client and their designers with information regarding the ground conditions underlying the site to assist them in preparing an appropriate scheme for development.

This Remediation Method Statement Report must be read in conjunction with the following reports referenced:

- Ground and Water Limited, Phase I Desk Study Report referenced v2.01 (GWPR5834/DS/October 2024);
- Ground and Water Limited, Phase II Site Investigation Report v3.01 (GWPR6631/SIR/September 2025).

The techniques adopted for the investigation were chosen considering the requirements of the client, anticipated ground conditions, and bearing in mind the nature of the site, limitations to site access and other logistical limitations.

1.3. Conditions and Limitations

This report has been prepared based on the terms, conditions and limitations outlined within Appendix A.

This report has been modified following additional investigation undertaken at the request of Horsham District Council and supersedes the Remediation Method Statement Report produced by Ground and Water Limited reference GWPR6631/RMS/July 2025 v2.01.

1.4. Technical Glossary

Generic technical terms and their description can be viewed within the glossary provided within Appendix B.

2. SITE SETTING

2.1. Site Location

The site comprised a ~5,100m^2 approximately rectangular-shaped plot of land, orientated in a north-east to south-west direction, along the south-eastern side of Sincox Lane. The site was located in a rural location approximately 3km south-west of the village of Shipley in West Sussex.

The national grid reference/Easting Northing for the centre of the site was approximately TQ 11965 20775. A site location plan is given within Figure 1.

2.2. Site Description

At the time of the four phases of site works undertaken between June 2024 and January 2025, the site comprised an open area of land. The majority of the site comprised an area of concrete hardstanding with area of soft landscaping to the north-east and south-west. The site was generally level; the areas of soft landscaping were noted to be uneven and slightly undulating with flooded areas. The site sloped down slightly to the south-west in the south-western portion. A ~0.40m bund of demolition rubble/soil was noted along the south-eastern ends and north-eastern ends of the area of concrete hardstanding. A drain was noted flowing along the south-western edge to the area of hardstanding in a south-easterly direction.

Additional site works were then undertaken during June 2025 when it was noted that all areas of hardstanding had been removed from the site.

2.3. Proposed Development

At the time of reporting, September 2025, the proposed development was understood to comprise the erection of 8no. dwellings with associated parking, drainage, hard and soft landscaping. The proposed development plan can be seen within Figure 2.

2.4. Conceptual Site Model

The tabulated Conceptual Site Model developed as part of the Ground and Water Ltd Desk Study (ref.: GWPR5834 v2.01/DS/October 2024) is outlined overleaf. For ease of reference and understanding, the risks have been classified within this risk assessment against four possible levels / categories, summarised in the table below. Any risk deemed to be negligible within the Preliminary Risk Assessment have been excluded from this report.

Risk Categories used in the Tabulated CSM	
Low Risk	Regarding this potential SPR linkage, the site is considered suitable for the proposed end-use and there is not considered to be an unacceptable risk to receptors. However, it is considered that further investigation to confirm this is recommended.
Moderate Risk	Regarding this potential SPR linkage, the site may not be suitable for the proposed end-use in its current condition and there may be an unacceptable risk to receptors. Further investigation is required to confirm this.
High Risk	Regarding this potential SPR linkage, the site is probably or certainly not suitable for proposed end-use and there is likely to be an unacceptable risk to receptors. Contaminants probably or certainly present and urgent action required in the short term.

Tabulated Conceptual Site Model – Pollutant Linkage Summary (On-Site Sources)			
Potential Sources	Potential Absorption Pathways	Potential Receptors	Risk Classification
Made Ground from construction/ demolition activities, Made Ground bunds and potential capping of Made Ground in soft landscaped areas: • Asbestos, • PAHs, • TPHs, • VOCs, • Sulphates, and • Metals.	• Direct ingestion of soil and soil derived dust • Dermal contact of soil and soil derived dust • Inhalation of dust (indoors and outdoors) with elevated concentration of determinands • Ingestion of home-grown produce, and soils attached • Direct ingestion of groundwater • Inhalation of volatile vapour (indoors and outdoors)	**Human Health** • End Users (Site workers/Future site visitors) • Construction workers during development • Site operatives during maintenance works • Neighbours and public	**Moderate**
	• Direct uptake of groundwater • Direct uptake of determinands in the soil	**Flora and Fauna** • Vegetation within soft landscaped areas	**Moderate**
	• Anthropogenic (man-made) pathways • Vertical and lateral migration in permeable strata • Surface water runoff	**Controlled Waters** • Secondary A Aquifer (River Terrace Deposits, 2 (Adur) • Drain crossing the site	**Low**
Leaks and spillages from former tanks on-site: • PAHs, • TPHs, • VOCs,	• Direct ingestion of soil and soil derived dust • Dermal contact of soil and soil derived dust • Inhalation of dust (indoors and outdoors) with elevated concentration of determinands • Ingestion of home-grown produce, and soils attached • Direct ingestion of groundwater • Inhalation of volatile vapour (indoors and outdoors)	**Human Health** • End Users (Site workers/Future site visitors) • Construction workers during development • Site operatives during maintenance works Neighbours and public	**Moderate**
	• Direct uptake of groundwater • Direct uptake of determinands in the soil	**Flora and Fauna** Vegetation within soft landscaped areas	**Moderate**
	• Anthropogenic (man-made) pathways • Vertical and lateral migration in permeable strata • Surface water runoff	**Controlled Waters** • Secondary A Aquifer (River Terrace Deposits, 2 (Adur) • Drain crossing the site	**Moderate**
Aggressive ground conditions with Made Ground and natural ground, including groundwater: • Sulphates, • PAH/TPH.	• Direct contact with aggressive ground conditions	**Building Materials and Services** • Buried Concrete • Underground services (water pipes)	**Moderate**
	• Migration through anthropogenic & natural pathways • Inhalation of Asphyxiating gases	**Human Health** • End Users (Residents/Future site visitors)	**Low**

Ground gases generated by Made Ground: • Methane, • Carbon Dioxide, • Hydrogen Sulphide, and • Carbon Monoxide.	• Explosion (methane only)	• Construction workers during development (especially in confined spaces) • Site operatives during maintenance works in confined spaces • Neighbours and public	
	• Migration through anthropogenic & natural pathways • Explosion (methane only)	**Building Materials and Services** • Buildings • Confined spaces • Underground services	**Low**

3. SUMMARY OF PREVIOUS INVESTIGATION

3.1. Summary of Previous Ground and Water Site Investigations

Previous phases of site works have been undertaken by Ground and Water Limited at the site and this report should be read in conjunction with GWPR6631/GIR/June 2025 v2.01. The various phases and their findings are summarised below.

Phase I June 2024 (Phase II Ground Investigation Report Ref.: GWPR6091 v2.01/GIR/October 2024)

Phase I was undertaken on ~~the~~ 27th June 2024 and comprised the drilling of 6No. Windowless Sampler Boreholes (WS1 – WS5 and WS3A) to a depth of between 1.20 - 5.00m bgl. WS3 encountered an obstruction at a depth of 1.20m bgl and was moved location and redrilled to 5.00m bgl as WS3A.

Contamination Assessment

Based on the proposed development, the results of the chemical laboratory testing were compared to the Generic Assessment Criteria (GAC) for a 'Residential with homegrown produce' land-use scenario, as this was considered the most appropriate land-use scenario.

The comparison between the laboratory analysis and the assessment criteria indicated that the determinands were identified at below the adopted screening values and were not considered to represent an unacceptable risk to future receptors.

However, to confirm these conclusions and reduce uncertainty following the removal of the existing concrete slab the following addition investigation and testing should be undertaken:

- During the Site Walkover, it appeared that a covering of demolition rubble/soil had been spread over the areas of soft landscaping due to the undulating and uneven nature. A ~0.40m bund of demolition rubble/soil was noted along the south-eastern ends and north-eastern ends of the area of concrete hardstanding. Further sampling and testing of these soils should be undertaken to confirm their suitability or not for use within the proposed soft landscaping areas and for waste disposal purposes.

- The Desk Study identified a moderate risk from unspecified on-site tanks/tanks in 1976. There was no obvious evidence for their previous locations on the historical maps or during the Site Walkover. Since there is no above ground evidence of their location, further investigation will be required should any underground tanks exposed following removal of the existing concrete slab. Given the anticipated cohesive soils of the Weald Clay Formation underlying the site any spills or leaks would most likely be localised around the tanks only.

Groundwater

Given anticipated low mobility of the contaminants found and not excessive exceedances, moderately deep groundwater conditions and the conceptual site model showing the nearest surface water receptor was 110m from the site, it is not expected that the soils on-site represent an unacceptable risk to controlled water receptors. No further action is considered necessary.

Phase II January 2025 (Updated Phase II Ground Investigation Report Ref.: GWPR6437 v1.01/GIR/February 2025)

Phase II was undertaken on ~~the~~ 15th January 2025 and comprised the machine excavation of 7No trial pits to a depth of between 1.00 – 1.20m bgl.

Trial holes Plots1/2, Plot 3 and Plot 4 were excavated in the proposed rear garden areas in the north-eastern portion of the site. Trial hole Plots 3/4 was excavated under the proposed structures following discovery of hydrocarbon impacted soils in the rear gardens of Plots 3 and 4 in order to attempt to delineate the spread of the impacted soils. It was not possible to excavate further delineation holes due to the presence of a large crushed concrete stockpile and flooded areas.

Trial holes Plot 5, Plot 6 and Plots 7/8 were excavated in the proposed rear garden areas in the south-western portion of the site in the area where the Site Walkover and Desk Study Report reported that undulating ground may have been the result of demolition rubble being spread across the area. No such soils were found in the trial pits.

In addition two soil samples were taken from a bund of material located along the south-eastern boundary of the site.

Contamination Assessment

Based on the proposed development, the results of the chemical laboratory testing were compared to the Generic Assessment Criteria (GAC) for a 'Residential with homegrown produce' land-use scenario, as this was considered the most appropriate land-use scenario.

The comparison between the laboratory analysis and the assessment criteria indicates that several hydrocarbons were identified at above the adopted screening value in two samples of the Weald Clay Formation and are considered to represent an unacceptable risk to future receptors.

The sample from Plot 4 at 0.70m bgl revealed elevated concentrations of several hydrocarbons: TPH EC10 – EC12 (aliphatic and aromatic), TPH EC12 – EC16 (aliphatic and aromatic) and TPH EC16 – EC21 (aromatic).

The sample from Plot 3 at 0.90m bgl revealed elevated concentrations of several hydrocarbons: TPH EC12 – EC16 (aromatic) and TPH EC16 – EC21 (aromatic) above the adopted screening value.

The comparison between the laboratory analysis and the assessment criteria indicates that one VOC, 1,2,4-Trimethylbenzene was also identified above the adopted screening value in the sample from Plot 4 at 0.70m bgl and is considered to represent an unacceptable risk to future receptors.

While several other VOCs and SVOCs were above their respective LODs but not above their adopted assessment criteria, they are not considered to represent an unacceptable risk to future receptors. The VOCs/SVOCs in the sample from Plot 4 at 0.70m bgl were: Ethylbenzene, m,p-Xylene, Isopropylbenzene, n-Propylbenzene, sec-Butylbenzene, p-Isopropyltoluene, 2-Methylnapthalene, Dibenzofuran, Azobenzene and Anthraquinone. The VOCs/SVOCs in the sample from Plot 3 at 0.90m bgl were: 1,2,4 Trimethylbenzene, sec-Butylbenzene, p-Isopropyltoluene and 2-Methylnapthalene.

The comparison between the laboratory analysis and the assessment criteria indicates that the remaining determinands were identified at below the adopted screening value and are not considered to represent an unacceptable risk to future receptors.

Due to elevated levels of Total VOCs, Total SVOCs and hydrocarbons in (TPH EC5 – ES10, EC10 – EC16 and EC16 – EC40 (aliphatics and aromatics) identified in chemical laboratory testing above the threshold for PE Pipe, barrier or metal pipes must be used. Additional testing and sampling of the soils at the exact depth and location of pipes should be undertaken to confirm.

Based on the results of the intrusive works, chemical analyses and risk assessments undertaken, the following has been identified that requires further action:

- Due to elevated levels of Total VOCs, Total SVOCs and hydrocarbons additional testing and sampling of the soils at the exact depth and location of pipes should be undertaken to confirm.

- The Desk Study identified a moderate risk from unspecified on-site tanks/tanks in 1976. There was no obvious evidence for their previous locations on the historical maps, during the Site Walkover or the first phase of the investigation. An underground tank has been found following breaking out of the concrete slab. Further investigation will be required to determine whether any leaks or spillages have impacted the surrounding soils and appropriate remediation and validation undertaken. Given the anticipated cohesive soils of the Weald Clay Formation underlying the site any spills or leaks would most likely be localised around the tanks only.

Phase III June 2025 (Updated Phase II Ground Investigation Report Ref.: GWPR6631 v2.01/GIR/July 2025)

Phase III was undertaken on ~~the~~ 3rd June 2025 and comprised the machine excavation of 12No trial pits to a depth of between 0.50 – 1.50m bgl.

Four trial pits were excavated at the potential locations of removed tanks in the eastern portion of the site (S7 Tank 1, S1 Tanks 2-3, S8 Tank 4 and S9 Tank 5).

Soils with a hydrocarbon odour were encountered at one location (S1 Tanks 2-3) between 0.80 – 1.20m bgl. The pit was extended laterally and vertically until no odour was noted in the pit. Soil samples were taken from the base of the excavation (Base 1.30m bgl) and on the four sides (North, East, South and West, all at 0.80m bgl) to confirm there was no contamination remaining.

Another trial pit (S11, Plot 5) was exposed through the small stockpile of material within the base of the excavation in the south-west corner of the site to obtain a sample of the natural soils.

Three trial pits (S11 Plot 5, S16 and S17) were excavated in an attempt to find the location from which a tank had been previously removed from near the site entrance. No significant depth of Made Ground was found in two of the three locations (S16 and S17).

Four other trial pits (S10 Plot 1, S11 Plot 5, S12 Plot 6, S13 Plot 7 and S14 Plot 8) were excavated in the rear garden areas of the respective Plots to obtain samples of the natural soils beneath the Made Ground.

In addition, two soil samples were taken from a stockpile of material located in the south-west corner of the site (S18 Stockpile 1 and S19 Stockpile 2) that has collapsed into the excavation.

Two soil samples were also taken from a bund of material located along the north-eastern and south-eastern boundaries of the site (S20 Bund A and S21 Bund B).

Contamination Assessment

Based on the proposed development, the results of the chemical laboratory testing were compared to the Generic Assessment Criteria (GAC) for a 'Residential with homegrown produce' land-use scenario, as this was considered the most appropriate land-use scenario.

The comparison between the laboratory analysis and the assessment criteria indicated that several PAHs were identified at above the respective adopted screening value in one sample of the Made Ground and are considered to represent an unacceptable risk to future receptors.

The sample from S15 Plot 1 Front at 0.50m bgl revealed elevated concentrations of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene and Dibenzo(a,h)anthracene above their respective adopted screening values.

The comparison between the laboratory analysis and the assessment criteria indicates that no VOCs were identified above their respective LODs.

While several SVOCs were above their respective LODs but not above their adopted assessment criteria, they are not considered to represent an unacceptable risk to future receptors. The SVOCs in the sample of Made Ground from S15 Plot 1 Front at 0.50m bgl were: 2-Methylnapthalene, Dibenzofuran, Anthraquinone and Carbozole. The SVOCs in the sample of Weald Clay Formation from S1 Tanks 2 – 3 at 0.90m bgl were: Anthraquinone.

No significant thickness of Made Ground was found in the trial pits S16 and S17 that were excavated to delineate the Made Ground in location S15 Plot 1 Front.

Phase IV August 2025 (Updated Phase II Ground Investigation Report Ref.: GWPR6631 v3.01/GIR/September 2025)

Phase VI was undertaken on ~~the~~ 13th August 2025 and comprised the machine excavation of 12No trial pits (TPA - TPL) to a depth of between 1.00 – 1.20m bgl following clearance of dense vegetation on the north-eastern and south-western sides of the site. In addition, 2No trenches (T1 and T2) were excavated through a mound of Topsoil uncovered on the south-west side of the site to a depth between 1.0 – 1.40m bgl.

A further trench (T3) was excavated to identify the location of the infilled void created following removal of an underground storage tank (UST) close to the entrance of the site. The trench encountered dark grey Made Ground and was extended laterally and vertically to expose natural soils of the Weald Clay Formation. A concrete slab was found at the base of the excavation at a depth of

~1.80m bgl and this was removed to exposed soils of the Weald Clay Formation. Soil samples of the Weald Clay Formation were taken from the base of the excavation (Base) and on the four sides (North, East, South and West) to confirm there was no contamination. The dimensions of the excavation were ~5m by ~5m and ~1.80m deep. The void created was backfilled with crushed concrete for Health and Safety purposes. A sample of the soils removed from the excavation for contamination testing to enable off-site disposal.

Contamination Assessment

Based on the proposed development, the results of the chemical laboratory testing were compared to the Generic Assessment Criteria (GAC) for a 'Residential with homegrown produce' land-use scenario, as this was considered the most appropriate land-use scenario.

The comparison between the results of the laboratory analysis and the assessment criteria in all four phases of the investigation indicated that the remaining determinands were identified at below the adopted screening value and are not considered to represent an unacceptable risk to future receptors.

No asbestos has been identified during any phases of the testing, however, an **Asbestos Management Strategy** should be put in place so that any potentially asbestos containing materials are identified and removed from site in a suitable manner to prevent cross-contamination.

Soils Encountered during Phase I - IV June 2024 - August 2025

The succession of conditions and description of soils encountered in the trial holes conducted across the June 2024 to June 2025 site works in descending order is tabulated below.

Summary of Strata Encountered			
Strata	**Top Depth (m bgl)**	**Base Depth (m bgl)**	**Thickness (m)**
MADE GROUND (WS1, WS2 AND WS3A only): Concrete.	GL	0.10 – 0.15m	0.10 – 0.15m
MADE GROUND (WS3 only): Tarmac.	GL	0.10m	0.10m
MADE GROUND (WS2 and WS3A, Plot 1/2, Plot 3, Plot 4, under Plot 3/4 and S8 – S17 only): Brown and grey mottled slightly sandy gravelly CLAY. The sand was fine to medium and the gravel was fine to coarse flint (50%), brick (20 - 30%), concrete (20%) chalk (0 - 20%) and localised ironstone and carbonaceous material (10%).	GL – 0.15m	0.30 – 1.00m	0.30 – 0.90m
MADE GROUND (S15 Plot1 Front and T3 only): Dark grey slightly sandy gravelly CLAY. The sand was fine to medium and the gravel was fine to coarse flint (50%), brick (20 - 30%), concrete (20%) and metal (10%)	GL - 0.30m	1.30 – 1.75m	1.00 – 1.75m
MADE GROUND (WS3 only): Grey sandy GRAVEL. The sand was fine to medium and the gravel was fine to coarse sub-angular flint (50%) and limestone (50%).	0.10m	0.30m	0.20m
MADE GROUND (WS3 only): White GRAVEL. The gravel was fine to coarse sub-angular chalk (75%) and flint (25%).	0.30m	>1.20m	>0.90m
MADE GROUND (T3 only): Concrete Slab.	1.75m	1.80m	0.05m
TOPSOIL (WS4, WS5, Plot 5, Plot 6 and Plot 7/8, and all Phase IV trial pits only): Pale brown slightly sandy gravelly CLAY. The sand was fine to medium grained and the gravel was fine to medium sub-angular flint.	GL	0.25 – 0.40m	0.25 – 0.40m

WEALD CLAY FORMATION (WS1 – WS2, WS3A – WS5 and all Phase II, Phase III and Phase IV trial pits only): Pale brown and grey mottled to dark brown silty CLAY.	GL – 1.80m	>0.50– 4.50m	>0.20 – 4.10m
WEALD CLAY FORMATION (Phase II Plot 3 and Plot 4 and Phase III S1 Tanks 2 and 3 only): Pale brown, bluish grey and olive green mottled silty CLAY with a strong hydrocarbon type odour.	0.70 – 0.80	>1.00 – >1.10	>0.30
WEALD CLAY FORMATION (WS1 – WS2, WS3A – WS5 only): Grey gravelly CLAY with thin bands of grey mudstone. The gravel was fine to medium sub-angular mudstone.	3.10 – 4.50m	>5.00,	>0.50 - >1.90m

The description of soils encountered in the earth bunds and the stockpiles/large excavation in the southern portion of the site is tabulated below. No logs have been produced for these locations

Strata Encountered
MADE GROUND (Phase II Bund Sample 1 and Bund Sample 2 and Phase II S20 and S21 only): Brown and grey mottled slightly sandy gravelly CLAY. The sand was fine to medium and the gravel was fine to coarse flint (50%), brick (20 - 30%), concrete (20%) chalk (0 - 20%) and localised ironstone and carbonaceous material (10%).
MADE GROUND (Phase II S18 and S19 only): Brown and grey mottled slightly sandy gravelly CLAY. The sand was fine to medium and the gravel was fine to coarse flint (30%), brick (30%), concrete (20%), chalk (10%).and carbonaceous material (10%).

It should be noted that no areas of Made Ground were found during Phase IV in the trial pits that were excavated in the previously densely vegetated parts of the site. These parts of the site along the north-eastern and south-western boundaries of the site generally coincide with the rear garden areas to the poropsed 8No. properties. The Made Ground was found under the footprint of the demolished buildings and areas of concrete hardstanding and were greatest in the location of the now removed tank at the western end of the site.

The trial hole locations from Phases I and II can be seen in Figure 3, the trial hole locations for Phase III can be seen within Figures 5 and 6 and the trial hole locations for Phase IV can be seen within Figure 7. A combined trial hole location plan can be seen in Figure 8

3.2. Water Supply Pipe Risk Assessment

As part of the proposed development it is expected that new water supply pipes will be installed at the site. Water supply pipes have the potential to be exposed to contaminants in the ground that can lead to unacceptable concentrations within the drinking water. If a risk is identified, specialist pipes that are protective of the drinking water are required.

A pipe selection risk assessment should be submitted to the water supply company as part of the development based on the supplier's assessment criteria. An indication of whether there is likely to be a risk can be seen tabulated below, where the PE pipe thresholds are based on *UKWIR Contaminated Land Assessment Guidance, 2014*.

Pipe Selection Risk Assessment			
Determinand	**PE Pipe Threshold (mg/kg)**	**Laboratory Analysis Range (mg/kg)**	**Was the Threshold Exceeded?**
Total BTEX and MTBE	0.1	LOD	No
Total VOCs	0.5	<0.005 – 2.497	**Yes**
Total SVOCs	2	< 0.005 – 18.10	**Yes**
Phenols	2	< 2	No
TPH EC5 – EC10 (aliphatics and aromatics)	2	< 0.010 – 13.19	**Yes**
TPH EC10 – EC16 (aliphatics and aromatics)	10	< 1 – 5,337.20	**Yes**
TPH EC16 – EC40 (aliphatics and aromatics)	500	< 8 – 7,008.80	**Yes**
Naphthalene	5	< 0.05 – 1.99	No

Due to elevated levels of Total VOCs, Total SVOCs and hydrocarbons in (TPH EC5 – ES10, EC10 – EC16 and EC16 – EC40 (aliphatics and aromatics) identified in chemical laboratory testing above the threshold for PE Pipe, barrier or metal pipes must be used. Additional testing and sampling of the soils at the exact depth and location of pipes should be undertaken to confirm.

3.3. Groundwater Risk Assessment

In the UK, the water environment is protected under a number of regulatory regimes, mainly governed by the Environment Agency. The Environment Agency is consulted when there may be a risk to Controlled Waters, or where a pollution incident has occurred historically. The Water Framework Directive is implemented in various guises covering groundwater, surface water and drinking water supply.

A study of the aquifer maps on the DEFRA website revealed the site was underlain by **Unproductive Strata** comprising bedrock deposits of the Weald Clay Formation. A **Secondary A Aquifer** comprising the superficial Second River Terrace Deposits was noted just encroaching into the north-east corner and to the immediate north-east of the site.

Examination of the Environment Agency records showed that the site **did not** fall within a Groundwater Source Protection Zone (SPZ) as classified in the Policy and Practice for the Protection of Groundwater.

A drain was noted flowing along the south-western edge to the area of hardstanding in a south-easterly direction. A pond was located ~250m south-east of the site.

From analysis of hydrogeological and topographical maps the actual groundwater table was anticipated to be encountered at depth below the Weald Clay Formation. Some amounts of groundwater however may be present at shallower depths within Made Ground, parts of the River Terrace Deposits 2 (Adur) or within any silty/sandy pockets of the Weald Clay Formation. It was considered that groundwater was flowing in a south-easterly direction toward the River Adur in line with local topography.

During the site investigation, Made Ground was encountered to a maximum depth of 1.80m bgl, overlying silty clay of the Weald Clay Formation to the base of the boreholes (5.00m bgl). A groundwater strike was recorded in WS1 at 3.90m bgl, WS3A at 4.60m bgl and WS4 at 4.70m bgl. Groundwater was not encountered in the remaining boreholes or trial pits.

Given the underlying geology comprising cohesive soils of the Weald Clay Formation, it is not expected that the soils on-site represent an unacceptable risk to controlled water receptors. No further action is considered necessary.

3.4. Ground Gas Risk Assessment

A review of freely available information prior to site works, including historical mapping and landfill registers / Phase I desk study, did not identify any source of ground gas on-site or within influencing distance of the site that warranted investigation through ground gas monitoring. The only source of ground gases was anticipated to be limited Made Ground and therefore classified as 'Low risk', where the pragmatic approach to ground gas risk assessment presented within the CL:AIRE research bulletin RB17 and included within Annex D of BS8485:2015+A1:2019 can be considered.

3.4.1. Pragmatic Approach

The alternative approach to ground gas risk assessment considers the uncertainty from the measurement of ground gas concentrations and flow rates in monitoring wells for low-risk sites and removes the need for monitoring. Low risk sites typically comprise:

- Natural soils with high carbonate content (e.g. chalk);
- Natural soils that can produce gases (e.g. alluvium, peat etc.);
- Made Ground between 1.00m to 5.00m, with low organic content; and
- Areas of flooded mine workings, unless a building is to be within 20m of shaft or adit.

The method considers the gas generation potential of the soils from data that is not subject to external influences, for example atmospheric pressure can change the recorded flow and concentrations of ground gas during spot monitoring, or a rising groundwater level can displace ground gases in pore spaces. Determination of the characteristic situation is based on the total organic carbon (TOC) of the soils, coupled with any organic-rich material identified within the borehole logs, such as wood gravels. TOC is easily analysed by the laboratory and can also be calculated by the equation outlined below.

Total Organic Carbon (TOC) = 0.58 x Soil Organic Matter (SOM) = 1.33 x Degradable Organic Carbon (DOC)

As part of the ground investigation works, fifteen samples were submitted to the laboratory for analysis, which identified TOC to vary between 0.2% and 3.6% in the Made Ground, between 0.3% and 5.2% in the Topsoil and between 0.2% and 1.2% in the Weald Clay Formation. The trial hole logs identified the gravels within the Made Ground to comprise; flint, brick, chalk and concrete. Made Ground was identified to a maximum depth between 0.15m and 1.80m bgl.

3.4.2. Data Quality

A review was made of the quality of the available data for the site, which can be viewed in the table below. CIRIA Report C665 (2007), BS 8485:2015+A1:2019 and BS 8576:2013 stress the need for risk assessments to be based on good quality data and give guidance as to best practice in this respect.

Review of Data Quality			
Data Type	**Current Understanding**	**UK Practice**	**Recommendation**
Geological and hydro-	The CSM identified the site to be located on a generally limited	CIRA C665 & C659, Wilson and Card (1999) and BS 8485	The geological and hydrogeological model is

geological conditions	thickness of Made Ground (<1.20m), overlying impermeable strata of the Weald Clay Formation. Groundwater has been encountered at a depth of between 3.90 – 4.70m bgl during drilling. No groundwater was recorded in the trial pits.	recommend that geology and hydrogeology be fully understood.	understood to a standard that will not comprise the findings of the risk assessment. **No further action required.**
Soil Laboratory Analysis	A dataset of soil analysis from 15No. samples have identified a range of TOC concentrations to vary between 0.2% and 3.6% in the Made Ground, between 0.3% and 5.2% in the Topsoil and between 0.0% and 1.2% in the Weald Clay Formation.	CL:AIRE RB17 outlines an approach to ground gas risk assessment away from the influences that directly affect ground gas monitoring. It should typically be used on sites with limited sources identified in the CSM and Made Ground with average thickness <3m and maximum thickness <5m. TOC should be < 6%.	The TOC concentrations are below the limit of 6% in order to use the soil derived approach for the risk assessment. **No further action required.**

3.4.3. Risk Assessment

The intrusive investigation has revealed a maximum thickness of Made Ground of 1.80m overlying cohesive soils of the Weald Clay Formation. The site has undergone a previous phase of construction and demolition and limited degradable material has been identified. The introduction of oxygen to the Made Ground through redevelopment may lead to an initial increase of ground gas generation as degradable material within the soils present on-site may act as source of ground gas. The soils at the site are considered to be of variable permeability (low to high) in nature and pathways for ground gas migration will be present.

Using the soil derived method, it is considered that a TOC value of <1% within soil is unlikely to pose an unacceptable risk from ground gases and the site can be characterised as Characteristic Situation CS1. Any value between 3 and 6% warrants classification as a Characteristic Situation CS3. Any value over 6% requires investigation through ground gas monitoring. Any site with Made Ground <1.00m bgl will have a limited gas generation potential from the organic carbon present and consideration should be given to this thickness within the risk assessment.

An alternative approach for ground gas risk assessment (CL:AIRE RB17) can be considered utilising measured concentrations from soil parameters that are independent of influencing factors such as atmospheric pressure and groundwater level. Total Organic Carbon (TOC) was tested on 52No. samples with the analytical results ranging between 0.2% and 3.6%. Furthermore, it is considered that the general thickness of Made Ground would not generate sufficient ground gas to pose an unacceptable risk.

Based on the soil derived method outlined and the maximum TOC concentration encountered, the soils from site would warrant classification as **Characteristic Situation CS1**. It should be noted that this only represents the assessment from an on-site source.

3.5. Vapour Risk Assessment

The CSM identified sources of contamination in the form of potential USTs that may pose an unacceptable risk to receptors through vapours. During Phase II of the investigation soils with a strong hydrocarbon type odour were identified at a depth 0.80m bgl in the trial pit excavated in the rear of Plot 3 and at a depth of 0.70m bgl in the trial pit excavated in the rear of Plot 4. During Phase III, trial pits were excavated in the area where the malodourous soils were encountered and soils with a hydrocarbon odour were encountered at one location (S1 Tanks 2-3) between 0.80 – 1.20m bgl. The pit was extended laterally and vertically until no odour was noted in the pit. Soil samples were taken from the base of the excavation (Base 1.30m bgl) and on the four sides (North, East, South and West, all at 0.80m bgl) to confirm there was no contamination remaining.

3.5.1. Soil Assessment

In order to assess the potential for a vapour risk at the site, soil samples were sent to the laboratory for analysis (Appendix C). The testing suites included contaminants that may be present in the vapour phrase (Mercury, Napthalene, TPHs and volatile Organic Compounds (VOCs)) within the samples of Weald Clay Formation taken from potentially hydrocarbon impacted soils in Plot 3 and Plot 4 below a depth of 0.80m and 0.70m bgl respectively.

Both samples scheduled identified VOCs at concentrations lower than the laboratory limit of detection with the exception of the following: Ethylbenzene at concentration of 0.064mg/kg, m,p-Xylene at concentration of 0.057mg/kg, Isopropylbenzene at concentration of 0.073mg/kg, n-Propylbenzene at concentration of 0.150mg/kg, 1,2,4 Trimethylbenzene at concentration of between 0.072 and 1.700mg/kg, sec-Butylbenzene at concentration of 0.039mg/kg, p-Isopropyltoluene at concentration of between 0.058 and 0.290mg/kg, 2-Methylnapthalene at concentration of 8.8mg/kg, Dibenzofuran at concentration of 1.000mg/kg, Azobenzene at concentration of 0.400mg/kg and Anthraquinone at concentration of 3.500mg/kg.

A specific assessment criterion is not published for these and so the values have been compared to the lowest SVOC, Vinyl Chloride at 0.00014mg/kg and therefore identified to exceed the assessment criteria. However, this is also likely to be an overconservative number to compare against. Significantly, the hydrocarbon impacted soils will be removed as part of the remedial works outlined in section 8.1 of this report further removing the risk of vapours.

4. REMEDIATION METHOD STATEMENT

4.1. Soils

4.1.1. Hydrocarbon Impacted Soils (north-eastern corner)

Trial hole locations Plot 3 and Plot 4 revealed hydrocarbon impacted soils of the Weald Clay Formation below a depth of 0.80m and 0.70m bgl respectively. Trial hole Plots 3/4 was excavated under the proposed structures in order to attempt to delineate the spread of the impacted soils. No hydrocarbon impacted soils were encountered in the trial pit. It was not possible to excavate further delineation holes due to the presence of a large crushed concrete stockpile and flooded areas.

Based on the available information within this report it was proposed that the following remedial methodology should be undertaken under the supervision of a Ground and Water Engineer in relation to these soils:

- Removal of the discoloured/malodorous soils vertically and horizontally to expose unimpacted soils of the Weald Clay Formation;
- Validation of resultant void;
- Placement of soils to backfill void;
- Validation of the clean capping system by a suitably trained Ground and Water Limited engineer.

Full liaison must be made with the statutory authority, prior to the implementation of this remediation strategy and/or removal of soils from the site. All works must be undertaken to meet their approval.

Removal of Hydrocarbon Impacted Soils

The discoloured and malodorous soils encountered in the rear gardens to Plot 3 and Plot 4 should be removed from site to allow for the placement of clean soils. During this removal, the excavation should be extended laterally and vertically to enable removal of all of the impacted soils.

The soils shall be removed and stockpiled on an impermeable liner with raised edges and covered at all times. This contamination stockpile destined for removal from site should be stored away from imported soils to avoid cross-contamination. Materials to be removed off-site must be classified by carrying out Waste Acceptance Produce (WAP) testing. A registered contractor must undertake the removal of waste. Consignment notes for the removal of waste must be obtained and kept for inclusion within the final validation Report.

Following removal, the void shall be inspected and samples must be taken from the base and walls of the excavation and tested for TPHs and VOCs/SVOCs to enable validation that the associated contamination has been removed. Should these samples indicate unacceptable concentrations, further removal is required.

During Phase III, a strong hydrocarbon type odour was noted in at the location of S1 Tanks 2-3 between 0.80 – 1.20m bgl that was excavated in the rear gardens of Plots 3 and 4. The excavation was extended laterally and vertically until no further odour could be detected. Validation samples were taken from the base and sides of the investigation and testing of the Weald Clay Formation has returned no elevated concentrations. Results from this testing is presented in Appendix G.

At the time of reporting, this void has not been backfilled and this will be monitored while the following sections are undertaken.

Clean Capping of Soil

Following receipt of the results of the validation sampling and testing confirming removal of the contamination, the resulting void shall be backfilled with clean certified soils. It is recommended that where the excavation extends into the proposed garden areas at least the top 150mm of the clean capping should comprise suitable topsoil for use as a growing medium. It is a requirement that this should be no less than 100mm thick.

All subsoil and topsoil must be fit for purpose to ensure that the receptors cannot come into contact with determinands that could be detrimental to their health, see 'Imported Material' Section 8.5.

Validation

The remediation works outlined above will need to be inspected and independently validated by a Ground and Water Limited Engineer. All excavations will need to be inspected, documented and photographed.

The remediation works shall be validated through a site visit, sampled and photographed by a suitably trained Ground and Water Limited Engineer following the removal, and after placement of the clean soils.

Validation samples of the backfill material shall be taken. The source of the imported soil must be clarified as to whether it is from a brownfield or greenfield site to therefore determine ratio of chemical analysis required. Chemical analysis for a general suite of contaminants on imported greenfield material should be taken at a ratio of 1 sample per 200m^3 of soil or a minimum of 3 samples (whichever is greater). If the topsoil is from a brownfield site, a minimum of 6 samples or 1 per 50m^3 is required (whichever is greater).

All stages must be photographed for inclusion within the validation report.

4.1.2. PAH Impacted Soils (western end)

Three trial pits (S11 Plot 5, S16 and S17) were excavated in an attempt to find the location from which a tank had been previously removed from near the site entrance. No significant depth of Made Ground was found in two of the three locations (S16 and S17). Trial hole location S15 Plot 1 Front revealed dark grey mottled slightly sandy gravelly clay between 0.30 – 1.30m bgl. The sand was fine to medium and the gravel was fine to coarse flint (30%), brick (30%), concrete (30%) and metal (10%). Laboratory testing of this material revealed elevated PAHs at a depth of 0.50m bgl. No PAHs were found in the sample tested from the underlying Weald Clay Formation at a depth of 1.40m bgl.

Based on the available information within this report it was proposed that the following remedial methodology should be undertaken under the supervision of a Ground and Water Engineer in relation to these soils:

- Removal of the dark grey Made Ground horizontally and vertically to expose the Weald Clay Formation;
- Validation of resultant void;

- Placement of soils to backfill void;
- Validation of the clean capping system by a suitably trained Ground and Water Limited engineer.

Full liaison must be made with the statutory authority, prior to the implementation of this remediation strategy and/or removal of soils from the site. All works must be undertaken to meet their approval.

Removal of PAH Impacted Soils

The dark grey Made Ground found at location S15 at the front of Plot 1 ~~front~~ shall be removed from site to allow for the placement of clean soils. During this removal, the excavation should be extended laterally and vertically to enable removal of all of the impacted soils.

The soils shall be removed and stockpiled on an impermeable liner with raised edges and covered at all times. This contamination stockpile destined for removal from site should be stored away from imported soils to avoid cross-contamination. Materials to be removed off-site must be classified by carrying out Waste Acceptance ~~Produce~~ Criteria (WAC~~P~~) testing. A registered contractor must undertake the removal of waste. Consignment notes for the removal of waste must be obtained and kept for inclusion within the final validation Report.

Following removal the void should be inspected and samples must be taken from the base and walls of the excavation and tested for PAHs to enable validation that the associated contamination has been removed. Should these samples indicate unacceptable concentrations, further removal is required.

During Phase IV, a trench (T3) was excavated to identify the location of the infilled void created following removal of an underground storage tank (UST) close to the entrance of the site. The trench encountered dark grey Made Ground and was extended laterally and vertically to expose natural soils of the Weald Clay Formation. A concrete slab was found at the base of the excavation at a depth of ~1.80m bgl and this was removed to exposed soils of the Weald Clay Formation. Soil samples of the Weald Clay Formation were taken from the base of the excavation (Base) and on the four sides (North, East, South and West) to confirm there was no contamination. Results from this testing is presented in Appendix G.

The dimensions of the excavation were ~5m by ~5m and ~1.80m deep. With the agreement of hosham borough Council, the void created was backfilled with crushed concrete for Health and Safety purposes.

At the time of reporting, this void has been backfilled with crushed concrete and this will be monitored while the following sections are undertaken.

Clean Capping of Soil

Following receipt of the results of the validation sampling and testing confirming removal of the contamination, It is recommended that where the excavation extends into the proposed garden areas a 150mm of the clean capping comprising a suitable topsoil for use as a growing medium shall be placed over the crushed concrete backfill. It is a requirement that this should be no less than 100mm thick.

All subsoil and topsoil must be fit for purpose to ensure that the receptors cannot come into contact with determinands that could be detrimental to their health, see 'Imported Material' Section 8.5.

Validation

The remediation works outlined above will need to be inspected and independently validated by a Ground and Water Limited Engineer. All excavations will need to be inspected, documented and photographed.

The remediation works should be validated through a site visit, sampled and photographed by a suitably trained Ground and Water Limited Engineer following the removal, and after placement of the clean soils.

Validation samples of the backfill material shall be taken. The source of the imported soil must be clarified as to whether it is from a brownfield or greenfield site to therefore determine ratio of chemical analysis required. Chemical analysis for a general suite of contaminants on imported greenfield material should be taken at a ratio of 1 sample per 200m^3 of soil or a minimum of 3 samples (whichever is greater). If the topsoil is from a brownfield site, a minimum of 6 samples or 1 per 50m^3 is required (whichever is greater).

All stages must be photographed for inclusion within the validation report.

4.1.3. Removal of Underground Storage Tanks (USTs)

The discovery of any USTs and any associated pipework will require their removal by an approved contractor. This process should also include the off-site removal of any potentially contaminated liquids, sludges or oil product, as well as any visual or olfactorily contaminated soils that surround the infrastructure. Following removal of the tanks and any associated pipework the underlying soils should be sampled and analysed to confirm presence/absence of contamination.

The metalwork and soils should be removed and stockpiled on an impermeable liner with raised edges and covered at all times. This contamination stockpile destined for removal from site shall be stored away from imported soils to avoid cross-contamination. Materials to be removed off-site must be classified by carrying out Waste Acceptance Produce (WAP) testing. A registered contractor must undertake the removal of waste. Consignment notes for the removal of waste must be obtained and kept for inclusion within the final validation Report.

Following removal, the void shall be inspected and samples must be taken from the base and walls of the excavation and tested for TPHs and VOCs/SVOCs to enable validation that the associated contamination has been removed. Should these samples indicate unacceptable concentrations, further removal is required.

Clean Capping of Soil

Following receipt of the results of the validation sampling and testing confirming removal of the contamination, the resulting void shall be backfilled with clean certified soils. It is recommended that where the excavation extends into the proposed garden areas at least the top 150mm of the clean capping shall comprise suitable topsoil for use as a growing medium. It is a requirement that this should be no less than 100mm thick.

All subsoil and topsoil must be fit for purpose to ensure that the receptors cannot come into contact with determinands that could be detrimental to their health, see 'Imported Material' Section 8.5.

Validation

The remediation works outlined above will need to be inspected and independently validated by a Ground and Water Limited Engineer. All excavations will need to be inspected, documented and photographed.

The remediation works shall be validated through a site visit, sampled and photographed by a suitably trained Ground and Water Limited Engineer following the removal, and after placement of the clean soils.

Validation samples of the backfill material shall be taken. The source of the imported soil must be clarified as to whether it is from a brownfield or greenfield site to therefore determine ratio of chemical analysis required. Chemical analysis for a general suite of contaminants on imported greenfield material should be taken at a ratio of 1 sample per 200m^3 of soil or a minimum of 3 samples (whichever is greater). If the topsoil is from a brownfield site, a minimum of 6 samples or 1 per 50m^3 is required (whichever is greater).

All stages must be photographed for inclusion within the validation report.

4.1.4. Bund (south-eastern site boundary)

Laboratory analysis of 4No. samples retrieved from the bund during Phases II and III have identified that the determinands were below the adopted screening values and were not considered to represent an unacceptable risk to future receptors.

It should be noted that 1No. sample of the Made Ground in the bund (Bund sample 2) conformed to the NOT INERT Waste Classification due to the raised pH value. This sample is unlikely to be representative of the bulk of the Made Ground and further testing of the waste is recommended prior to removal from the site.

4.1.5. Soft-Landscaped Private Garden Areas – Plots 1-2 and Plots 5 - 8

Based on the results of the intrusive works undertaken to date, chemical analyses and risk assessments undertaken to date within the proposed back garden areas to Plots 1-2 and Plots 5 - 8, no remediation is likely to be required. Soft landscaped areas and gardens will need a 100-150mm nominal capping to act as a growing medium.

Validation samples of the Topsoil shall be taken at a ratio of 1 sample per 50m^3 of soil from an appropriate and quality source. Due to the design of the proposed development, validation shall be undertaken at a rate of 1 validation trial hole and 1 sample of clean cover per plot.

All stages must be photographed for inclusion within the validation report.

An Asbestos Management Strategy should be put in place so that any potentially asbestos containing materials are identified and removed from site in a suitable manner to prevent cross-contamination.

4.2. Water Supply Pipes

Due to elevated levels of Total VOCs, Total SVOCs and hydrocarbons in (TPH EC5 – ES10, EC10 – EC16 and EC16 – EC40 (aliphatics and aromatics) identified in chemical laboratory testing above the threshold for PE Pipe, barrier or metal pipes must be used. Additional testing and sampling of the soils at the exact depth and location of pipes should be undertaken to confirm.

4.3. Groundwater

No risk to controlled waters was considered to be present from the site.

The findings of this risk assessment should be agreed with the Environment Agency.

4.4. Ground Gas and Vapours, Radon

Based on risk assessment undertaken, the site warrants classification as **Characteristic Situation CS1**, where no precautions to prevent the ingress of ground-gas are needed.

With regards to the risk from vapours, since the remediation outlines above will removed the hydrocarbon and VOCs/SVOCs impacted soils chemical analysis of the remaining soils did not show elevated levels that may indicate further testing may be needed.

This may require reassessment should any USTs be discovered following removal of the remainder of the existing concrete slab.

The site was in an area where a radon risk assessment and radon remedial measures were not required.

4.5. Discovery Strategy

There may be areas of contamination that have not been identified during the course of the intrusive investigation (e.g. underground storage tanks and within bund). Such occurrences may be discovered during the demolition and construction phases for the redevelopment of the site.

Groundworkers must be instructed to report to the Site Manager any evidence for such contamination; this may comprise visual indicators, such as fibrous materials within the soil, discolouration, or odours and emission. Upon discovery advice must be taken from a suitably qualified person before proceeding, such that appropriate remedial measures and health and safety protection may be applied.

Should a new source of contamination be suspected or identified then the Local Authority will need to be informed.

4.6. Imported Materials

Any soil which is to be imported onto the site must undergo chemical analysis to prove that it is suitable for the purpose for which it is intended.

The soil must be fit for purpose and must either be supplied with traceable chemical laboratory test certificates or be tested, prior to placing (ideally) and after placing, to ensure that the future receptors (human health and vegetation) cannot come into contact with compounds that could be detrimental

to their health. The compounds that are to be tested for are those given in the Generic Assessment Criteria, which can be viewed in Appendix C of this report.

Chemical analyses must be undertaken at a rate of 1 validation trial hole per plot or area of soft-landscaping and a sample taken equating to 1 sample per 50m^3 imported for Topsoil and 1 per 50m^3 for subsoil. Validation trial holes must also prove the depth of the clean cover and inspect quality of the material (free from visible contamination, invasive species or unsuitable material such as brick, timber, glass).

Any test certificates supplied with the imported Topsoil should be passed onto Ground and Water Limited for inclusion within our Validation Report.

4.7. Waste Disposal

The excavation of foundations and other soils is likely to produce waste which will require classification and then recycling or removal from site.

Under the Landfill (England and Wales) Regulations 2002 (as amended), prior to disposal, all waste must be classified as either:

- Inert;
- Non-hazardous; or
- Hazardous.

The Environment Agency's Hazardous Waste Technical Guidance (WM3) document outlines the methodology for classifying wastes. Once classified the waste can be removed to the appropriately licensed facilities, with some waste requiring pre-treatments prior to disposal.

Following Phase I of the investigation, 3No. samples of Made Ground and 2No. samples of Topsoil were submitted to the analytical laboratory to undergo a suite of testing for contamination testing, as discussed in the previous sections. Sampling depths were chosen to reflect the receptor of concern, human health, and typically comprised a surface or near surface sample and periodically to 1.00m bgl. Any horizon where olfactory or visual evidence of contamination was present was also sampled.

Based on a risk phase analysis of the chemical laboratory test results, in accordance with EC Hazardous Waste Directive and undertaken by Ground and Water Limited, all samples of Made Ground and Topsoil were NON-HAZARDOUS.

Following Phase II of the investigation, 5No. samples of Made Ground (Plot 1/2/0.30m, Plot 3/0.30m, Plot 4/0.30m, Bund Sample 1 and Bund Sample 2), 3No. samples of Topsoil (Plot 6/0.30mWS4/0.20m and WS5/0.20m bgl) and 4No. samples of the Weald Clay Formation (Plot 3/0.90m, Plot 4/0.70m, Water Main 1 and Water Main 2) were submitted to the analytical laboratory to undergo a suite of testing for contamination testing, as discussed in the previous sections. Sampling depths were chosen to reflect the receptor of concern, human health, and typically comprised a surface or near surface sample and periodically to 1.00m bgl. Any horizon where olfactory or visual evidence of contamination was present was also sampled.

Based on a risk phase analysis of the chemical laboratory test results, in accordance with EC Hazardous Waste Directive and undertaken by Ground and Water Limited, two samples of the Weald Clay Formation (Plot 3/0.90m and Plot 4/0.70m) were HAZARDOUS due to the concentrations of TPHs found. The remaining samples were NON-HAZARDOUS.

Following Phase III of the investigation 5No. samples of Made Ground (S15 Plot 1 Front /0.50m, S18 Stockpile 1, S19 Stockpile 2, S20 Bund A and S21 Bund B), and 15No. samples of the Weald Clay Formation (S1 Tanks 2 - 3/0.90m, S2 Base, S3 North, S South, S5 East, S6 West, S7 Tank 1/0.70m, S8 Tank 4/1.50m, S9 Tank 5/0.80m, S10 Plot 1/0.50m, S11 Plot 5/1.20m, S12 Plot 6/0.90m, S13 Plot7/0.70m, S14 Plot 8/1.40m and S15/Plot 1 Front 1.40m bgl) were submitted to the analytical laboratory to undergo a suite of testing for contamination testing, as discussed in the previous sections. Sampling depths were chosen to reflect the receptor of concern, human health, and typically comprised a surface or near surface sample and periodically to 1.00m bgl. Any horizon where olfactory or visual evidence of contamination was present was also sampled.

Based on a risk phase analysis of the chemical laboratory test results, in accordance with EC Hazardous Waste Directive and undertaken by Ground and Water Limited, one sample of the Weald Clay Formation (S1 Tanks 2 - 3/0.90m) was HAZARDOUS due to the concentrations of TPHs found. The remaining samples were NON-HAZARDOUS.

Following Phase IV of the investigation 8No. samples of Topsoil (TPA/0.20m, TPD/0.20m, TPE/0.20m, TPH/0.20m, TPI/020m. TPK/0.20m, TP1/0.50m and T20.50m bgl) and 4No. samples of the Weald Clay Formation (TPB/0.50m, TPG/0.20m, TPJ/0.50m and TPL/0.50m bgl).An additional 5No samples of the Weald Clay Formation (North, East, West, South and Base) were tested from the sides and base of the excavation in the former area of the tank in T3. The samples were submitted to the analytical laboratory to undergo a suite of testing for contamination testing, as discussed in the previous sections. Sampling depths were chosen to reflect the receptor of concern, human health, and typically comprised a surface or near surface sample and periodically to 1.00m bgl. Any horizon where olfactory or visual evidence of contamination was present was also sampled.

Based on a risk phase analysis of the chemical laboratory test results, in accordance with EC Hazardous Waste Directive and undertaken by Ground and Water Limited, all of the samples tested in Phase IV were NON-HAZARDOUS.

It is important to note that whilst we consider our in-house assessment tool to be an accurate interpretation of the requirements of WM3, therefore producing an initial classification in accordance with the guidance, this method classifies soils as either non-hazardous or hazardous and landfill operators have their own assessment tools and can often come to different conclusions. As a result, some landfill operators could refuse to take apparently suitable waste. It is recommended that the receiving landfill views the results of this assessment and the chemical laboratory results to determine their own classification.

In addition to the samples described above, 1No. sample of Made Ground from Phase I was scheduled to undergo Waste Acceptance Criteria (WAC) testing with single batch leachate from the sample with a range of depths. The results indicate that the sample conformed to the Inert Waste Classification.

During Phase II, 1No. sample of the Made Ground in the bund on the south-eastern boundary of the site (Bund sample 2) was scheduled to undergo Waste Acceptance Criteria (WAC) testing with single batch leachate. The results indicate that the sample conformed to the NOT INERT Waste Classification due to the raised pH value. This sample is unlikely to be representative of the bulk of the Made Ground and further testing of the waste is recommended prior to removal from the site.

During Phase IV, 1No. sample of the Made Ground excavated from the material used to infill the void created by the removal of the tank (Tank Stockpile) was scheduled to undergo Waste Acceptance Criteria (WAC) testing with single batch leachate. The results indicate that the sample conformed to the NOT INERT Waste Classification due to the raised pH value. This sample is unlikely to be representative of the bulk of the Made Ground and further testing of the waste is recommended prior to removal from the site.

4.8. Validation Strategy

Any remedial works undertaken on the site will need to be inspected and independently validated by a Ground and Water Limited Engineer. All remedial excavations will need to be inspected, documented and photographed.

Following completion of all the remediation and validation works outlined above, a report must be submitted to the local authority for approval. The report shall include:

- Photographic evidence of removal of the contamination hotspots;
- Full details of the source of the imported soil (company, location, permit);
- Supplier test certificate for any imported clean cover material;
- Trial pit logs to confirm ground conditions;
- Laboratory analysis results from the independent testing;
- Independent confirmation of clean cover thickness;
- Copies of Waste Transfer Notes for the removed material.

Full liaison must be made with the statutory authority, prior to the implementation of this method statement and/or the removal of any material from site. All works must be undertaken to meet their full approval.

4.9. Health and Safety

Groundworkers must maintain a good standard of personal hygiene including the wearing of overalls, boots, gloves and eye protectors and the use of dust masks during periods of dry weather.

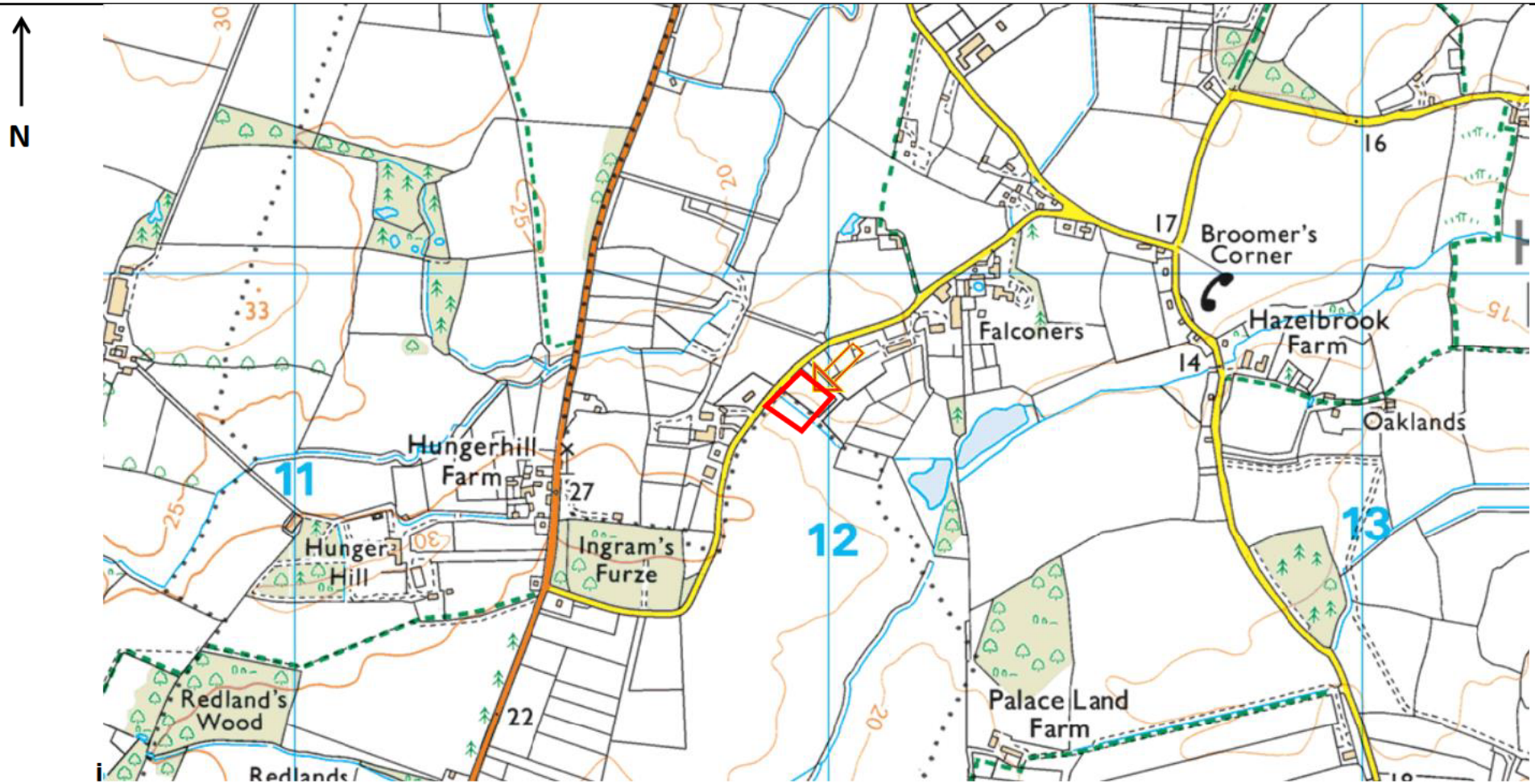
To prevent exposure to airborne dust by both the general public and construction personnel the site should be kept damp during dry weather and at other times when dust would be generated as a result of construction activities.

The site should be securely fenced at all times to prevent unauthorised access. Washing facilities should be provided and eating restricted to mess huts.

FIGURES

2 The Long Barn, Norton Farm, Selborne Road, Alton, Hampshire GU34 3NB
0333 600 1221 enquiries@groundandwater.co.uk **groundandwater.co.uk**

Registered Office: Kineton House, 31 Horse Fair, Banbury, Oxfordshire OX16 0AE Registered in England No. 07032001



APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: Former Arun Feedmills Sincox Lane Shipley West Sussex RH13 8PT		**Figure 1**
Client: Forays Homes Limited	**Date:** September 2025	
Site Location Plan	**Ref:** GWPR6631	



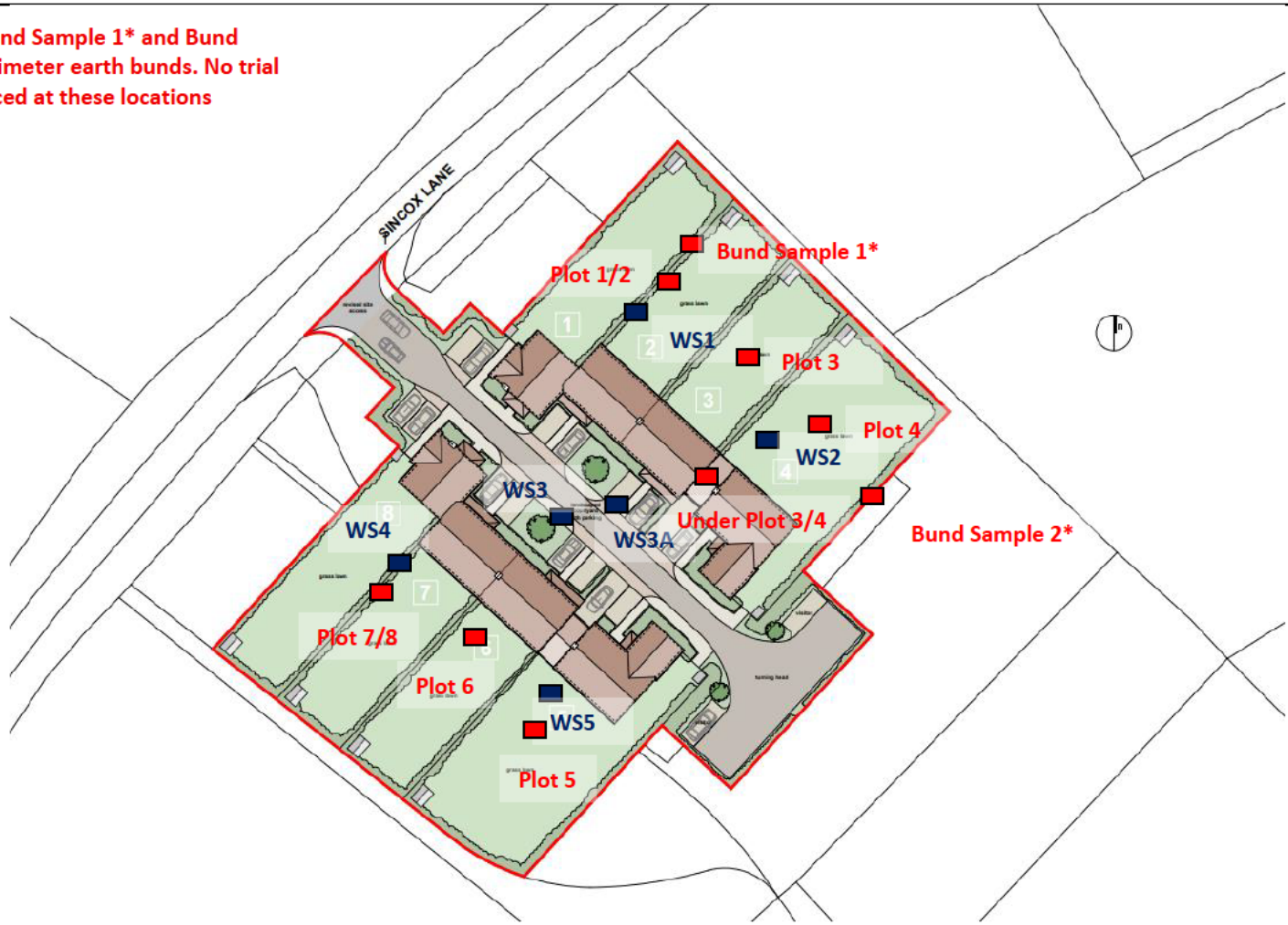
APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: Former Arun Feedmills Sincox Lane Shipley West Sussex RH13 8PT		**Figure 2**
Client: Forays Homes Limited	**Date:** September 2025	
Proposed Development Plan	**Ref:** GWPR6631	

Sample locations Bund Sample 1* and Bund Sample 2-*from perimeter earth bunds. No trial pit logs were produced at these locations

N

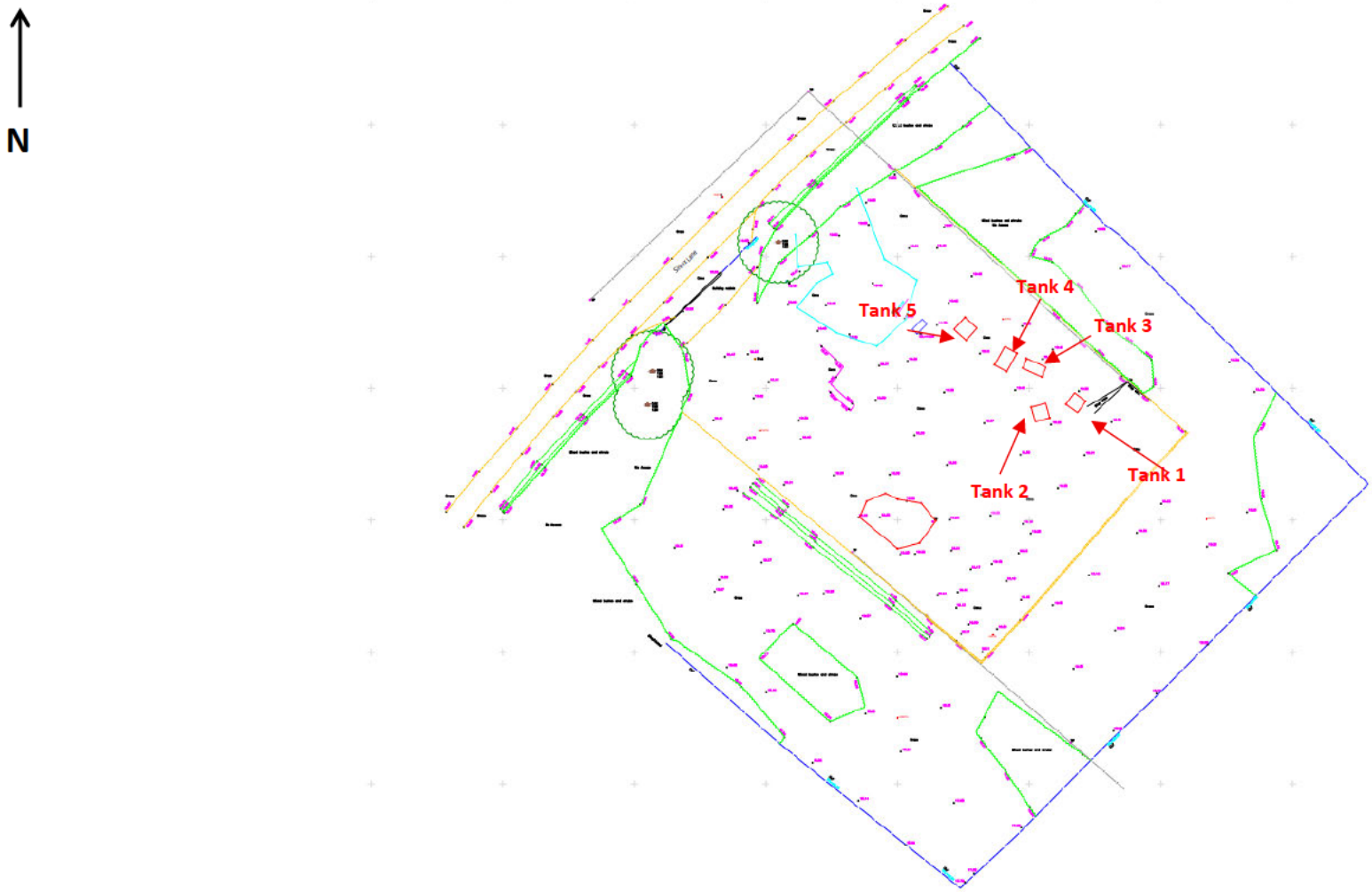


APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: Former Arun Feedmills Sincox Lane Shipley West Sussex RH13 8PT	**Figure 3**
Client: Forays Homes Limited	**Date:** September 2025
Trial Hole Location Plan – Phase I and II	**Ref:** GWPR6631

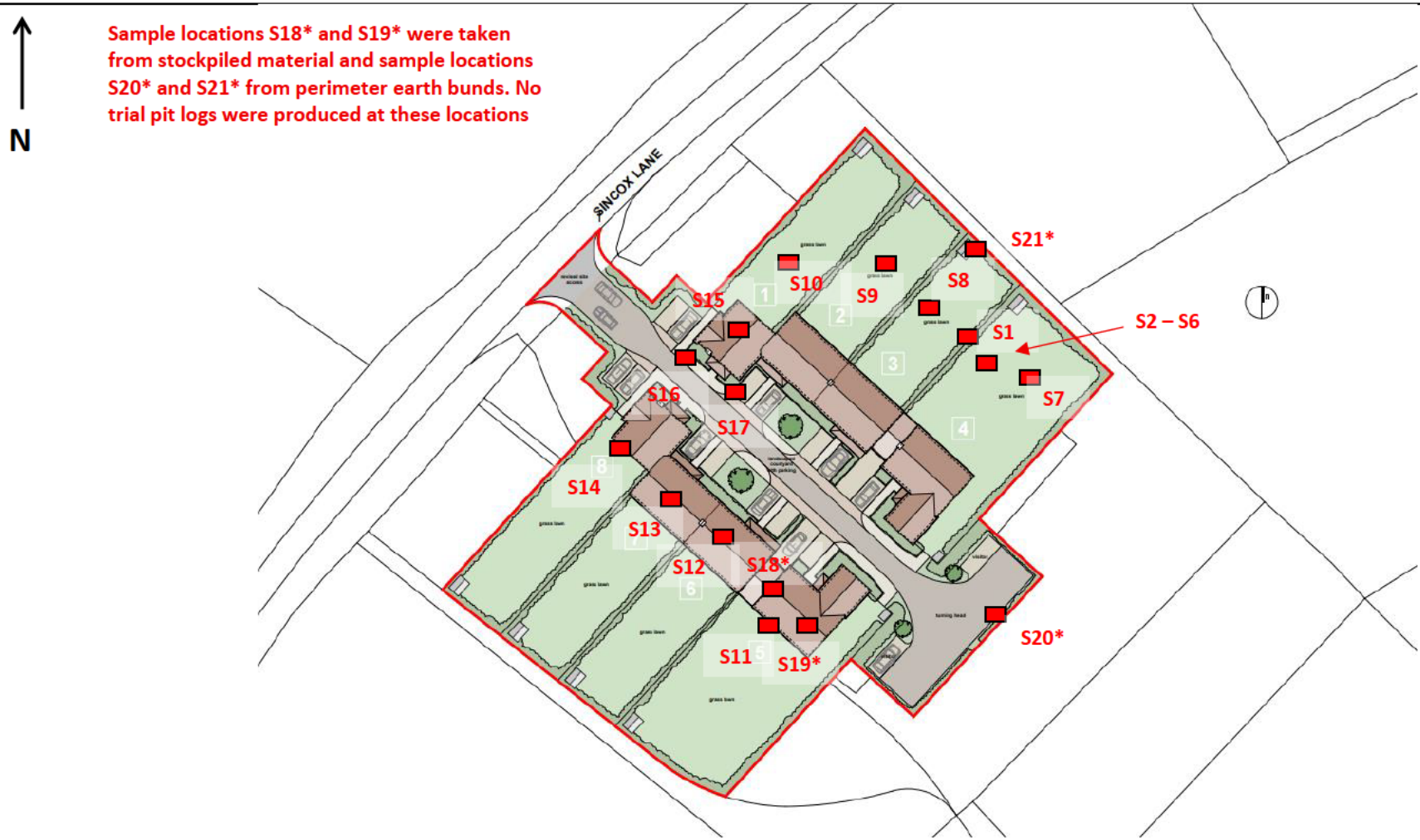
ground&water



APPROXIMATE SITE BOUNDARY

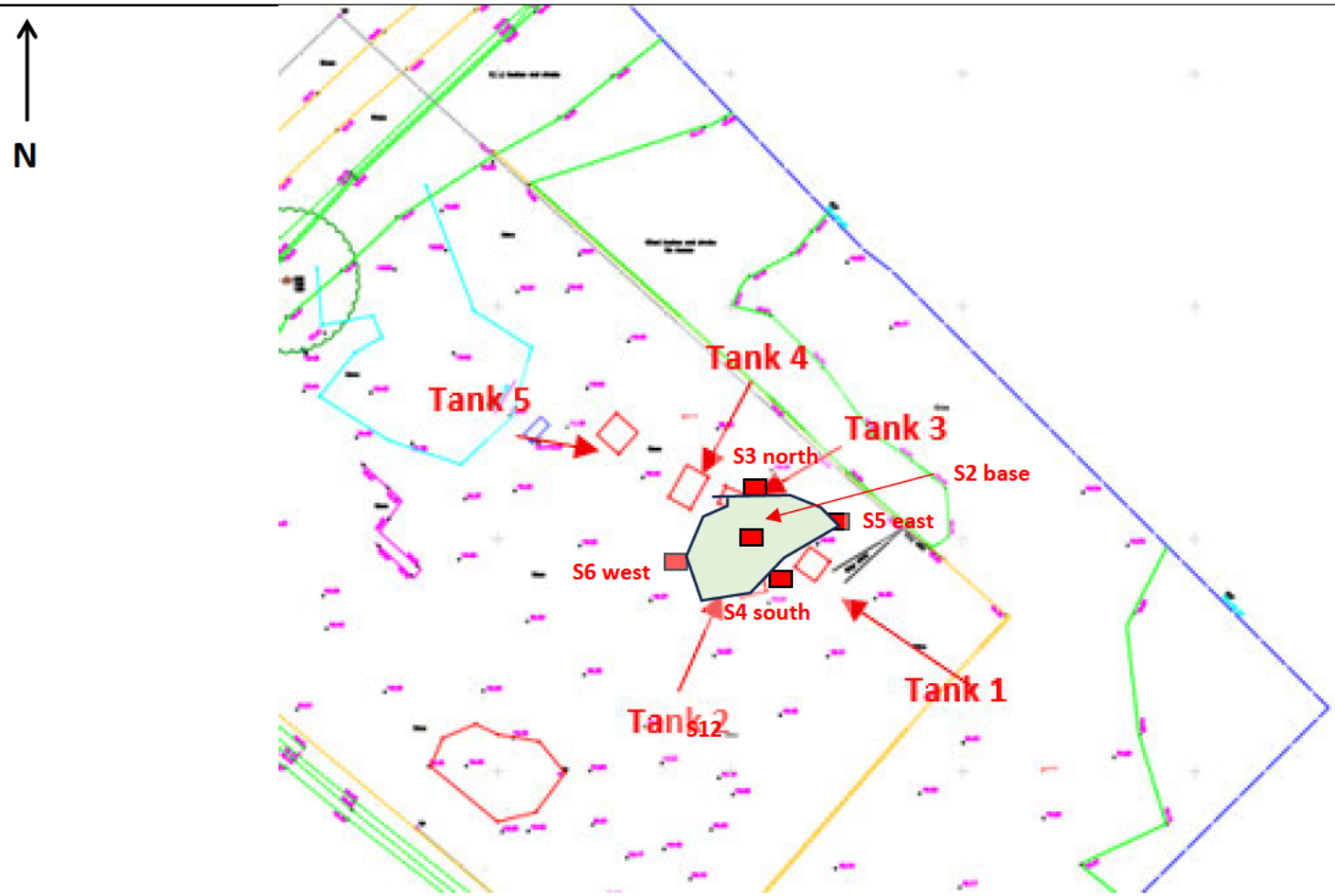
NOTE: NOT TO SCALE

Project: Former Arun Feedmills Sincox Lane Shipley West Sussex RH13 8PT		**Figure 4**
Client: Forays Homes Limited	**Date:** September 2025	ground&water
Former Tank Location Plan	**Ref:** GWPR6631	



Project: Former Arun Feedmills Sincox Lane Shipley West Sussex RH13 8PT	**Figure 5**
Client: Forays Homes Limited	**Date:** September 2025
Trial Hole Location Plan – Phase III	**Ref:** GWPR6631

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APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

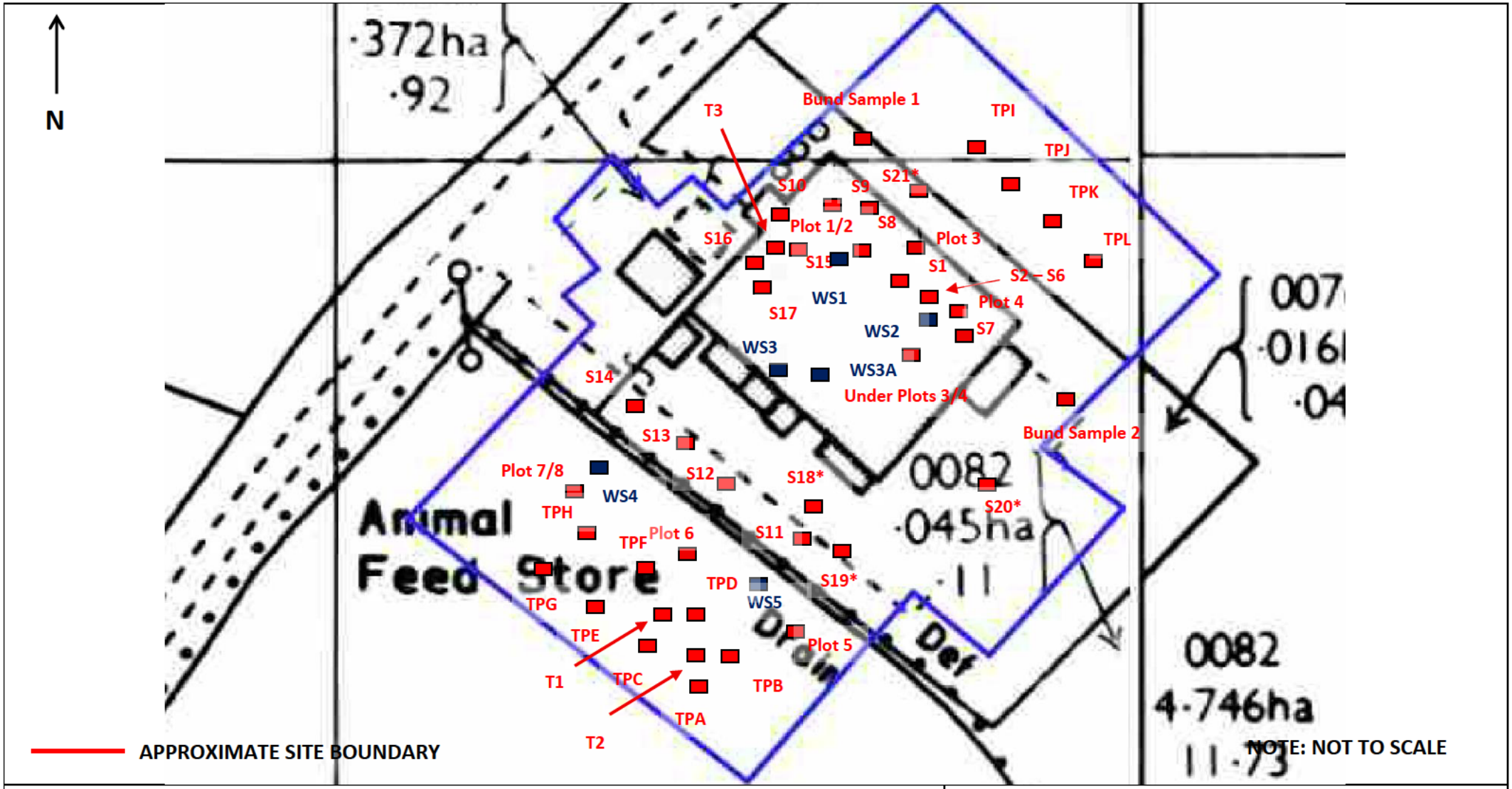
Project: Former Arun Feedmills Sincox Lane Shipley West Sussex RH13 8PT		**Figure 6**
Client: Forays Homes Limited	**Date:** September 2025	ground&water
Trial Hole Location Plan – Phase III Locations S2 – S6	**Ref:** GWPR6631	



APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: Former Arun Feedmills Sincox Lane Shipley West Sussex RH13 8PT		**Figure 7**
Client: Forays Homes Limited	**Date:** September 2025	ground&water
Trial Hole Location Plan – Phase IV	**Ref:** GWPR6631	



Project: Former Arun Feedmills Sincox Lane Shipley West Sussex RH13 8PT	**Figure 8**
Client: Forays Homes Limited	**Date:** September 2025
Combined Trial Hole Location Plan with Historic Site Layout	**Ref:** GWPR6631

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APPENDIX A: Conditions and Limitations

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The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The report has been prepared on the basis of information, data and materials which were available at the time of writing. Accordingly, any conclusions, opinions or judgements made in the report should not be regarded as definitive or relied upon to the exclusion of other information, opinions and judgements.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief; as such these do not necessarily address all aspects of ground behaviour at the site. No liability is accepted for any reliance placed on it by others unless specifically agreed in writing.

Any decisions made by you, or by any organisation, agency or person who has read, received or been provided with information contained in the report ("you" or "the Recipient") are decisions of the Recipient and we will not make, or be deemed to make, any decisions on behalf of any Recipient. We will not be liable for the consequences of any such decisions.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Any Recipient must take into account any other factors apart from the Report of which they and their experts and advisers are or should be aware. The information, data, conclusions, opinions and judgements set out in the report may relate to certain contexts and may not be suitable in other contexts. It is your responsibility to ensure that you do not use the information we provide in the wrong context.

This report is based on readily available geological records, the recorded physical investigation, the strata observed in the works, together with the results of completed site and laboratory tests. Whilst skill and care has been taken to interpret these conditions likely between or below investigation points, the possibility of other characteristics not revealed cannot be discounted, for which no liability can be accepted. The impact of our assessment on other aspects of the development required evaluation by other involved parties.

The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous in ground activities. The ground conditions have been sampled or monitored in recorded locations and tests for some of the more common chemicals generally expected. Other concentrations of types of chemicals may exist.

The conclusions and recommendations relate to the Former Arun Feedmills Sincox Lane Shipley West Sussex RH13 8PT.

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sampler borehole implies the specific technique used to produce a trial hole.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot-by-plot basis prior to the construction of foundations. Where trees are mentioned in the text this means existing trees, recently removed trees (approximately 15 years to full recovery on cohesive soils) and those planned as part of the site landscaping.

Ownership of copyright of all printed material including reports, laboratory test results, trial pit and borehole log sheets, including drillers log sheets, remain with Ground and Water Limited. Licence is for the sole use of the client and may not be assigned, transferred or given to a third party.

Only our client may rely on this report and should this report or any information contained in it be provided to any third party we accept no responsibility to the third party for the contents of this report save to the extent expressly outlined by us in writing in a reliance letter addressed from us to the third party.

Recipients are not permitted to publish this report outside of their organisation without our express written consent.

APPENDIX B: Technical Glossary

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TECHNICAL GLOSSARY

The list of possible definitions within the report may be seen below. Please note that some definitions may not be relevant to this report.

HYDROGEOLOGY:

A **Principal Aquifer** is a layer of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

Secondary aquifers include a wide range of drift deposits with an equally wide range of water permeability and storage capacities.

Secondary (A) Aquifers consist of deposits with 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. These are generally aquifers formerly classified as Minor Aquifers.

Secondary (B) Aquifers consist of deposits with predominantly lower permeability layers with may stoke and yield limited amounts of groundwater due to localised features such as fissures, think permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

Secondary Aquifers (Undifferentiated) are assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both a minor aquifer and non-aquifer in different locations due to the variable characteristics of the rock type.

Unproductive Strata are rock layers with low permeability that have negligible significance for water supply or river base flow. These were formerly classified as non-aquifers.

FLOOD ZONES:

Environment Agency Flood Zone 2, defined as; land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.

Environment Agency Flood Zone 3 shows the extent of a river flood with a 1 in 100 (1%0 or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year.

Environment Agency Flood Zone 3 area that benefits from flood defences, defined as; land and property in this flood zone would have a high probability of flooding without the local flood defences. These protect the area against a river flood with a 1% chance of happening each year, or a flood from the sea with a 0.5% chance of happening each year.

GROUNDWATER SOURCE PROTECTION ZONES (SPZS):

Inner zone (SPZ1): This zone is 50 day travel time of pollutant to source with a 50 metres default minimum radius.

Outer zone (SPZ2): This zone is 400 day travel time of pollutant to source. This has a 250 or 500 metres minimum radius around the source depending on the amount of water taken.

Total catchment (SPZ3): This is the area around a supply source within which all the groundwater ends up at the abstraction point. This is the point from where the water is taken. This could extend some distance from the source point.

Zone of special interest (SPZ4): This zone is where local conditions require additional protection.

IN-SITU STRENGTH GEOTECHNICAL TESTING:

Windowless Sample and/or Cable Percussion and/or Rotary Boreholes provide samples of the ground for assessment but they do not give any engineering data. The standard penetration test (SPT) is an in-situ dynamic penetration test designed to provide information on the geotechnical engineering properties of soil. The test uses a thick-walled sample tube, with an outside diameter of 50mm and an inside diameter of 35mm, and a length of around 650mm. This is driven into the ground at the bottom of a borehole by blows from a slide hammer with a weight of 63.5kg falling through a distance of 760mm. The sample tube is driven 150mm into the ground and then the number of blows needed for the tube to penetrate each 75mm up to a depth of 450mm is recorded. The sum of the number of blows is termed the "standard penetration resistance" or the "N-value".

Dynamic Probing involves the driving of a metal cone into the ground via a series of steel rods. These rods are driven from the surface by a hammer system that lifts and drops a 63.5kg (SHDP) hammer onto the top of the rods through a set height, thus ensuring a consistent energy input. The number of hammer blows that are required to drive the cone down by each 100mm increment are recorded. These blow counts then provide a comparative assessment from which correlations have been published, based on dynamic energy, which permits engineering parameters to be generated. (The Dynamic Probe 'Super Heavy' (SHDP) Tests were conducted in accordance with BS 1377; 1990; Part 9, Clause 3.2).

APPENDIX C:
Soil Assessment Criteria

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Ground and Water Limited

Soil Guideline Values and Generic Assessment Criteria

The Contaminated Land Regime reflects the UK Government's stated objectives of achieving sustainable development through the 'suitable for use approach'. At preliminary risk assessment stage, risks are evaluated qualitatively. As the site investigation progresses to a generic or detailed quantitative risk assessment, data is collected and assessment criteria are utilised to evaluate whether the contaminants represent an unacceptable risk to the identified receptors.

1. Contaminated Land Exposure Assessment Model (CLEA)

Current United Kingdom risk assessment practice is based on the Contaminated Land Exposure Assessment Model (CLEA).

The CLEA Guidance comprises the following documents:

1) EA Science Report SC050021/SR2: Human health toxicological assessment of contaminants in soil.
2) EA Science Report SC050021/SR3: Updated technical background to the CLEA model.
3) EA CLEA Bulletin (2009).
4) CLEA software version 1.07 (2015)
5) Toxicological reports and SGV technical notes.

The CLEA guidance and tools:

- Do not cover other types of risk to humans, such as fire, suffocation or explosion, or short-term and acute exposures;
- Do not cover risks to the environment, such as groundwater, ecosystems or buildings;
- Do not provide a definitive test for telling when human health risks are significant; and
- Are not a legal requirement in assessing land contamination risks. They are not part of the legal regime for Part 2A of the Environmental Protection Act 1990.

The CLEA guidance derives soil concentrations of contaminants above which (in the opinion of the EA) there may be a concern that warrants further investigation. It does not provide a definitive test for establishing that the risk is significant.

1.1. Land-use Scenarios

The CLEA model uses a range of standard land-use scenarios to develop conceptual exposure models outlined in the following sections.

1.1.1. Residential (with home grown produce) (RwHP)

Generic scenario assumes a typical two-storey house built on a ground bearing slab with a private garden having a lawn, flowerbeds and a small fruit and vegetable patch.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil and indoor dust ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and indoor dust and inhalation of indoor and outdoor dust and vapours.
- Building type is a two-storey small-terraced house.

A sub-set of this land-use is residential apartments with communal landscaped gardens where the consumption of home grown vegetables will not occur. (Residential without homegrown produce (RwoHP)).

1.1.2. Allotments

Provision of open space (about 250sq.m) commonly made available to tenants by the local authority to grow fruit and vegetable for their own consumption. Typically, there are a number of plots to a site which may have a total area of up to 1 hectare. The tenants are assumed to be adults and that young children make occasional accompanied visits.

Although some allotment holders may choose to keep animals including rabbits, hens, and ducks, potential exposure to contaminated meat and eggs is not considered.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and inhalation of outdoor dust and vapours.
- There is no building.

1.1.3. Commercial/Industrial

The generic scenario assumes a typical commercial or light industrial property comprising a three-storey building at which employees spend most time indoors and are involved in office-based or relatively light physical work.

- Critical receptor is a working female adult (aged 16 to 65 years old).
- Exposure duration is a working lifetime of 49 years.
- Exposure pathways include direct soil and indoor dust ingestion, skin contact with soils and dusts and inhalation of dust and vapours.
- Building type is a three-storey office (pre 1970).

2. LQM/CIEH Suitable 4 Use Levels (S4UL)

For derivation of these S4UL reference must be made to:

Nathanial, P., McCaffrey, C., Gillet, A., Ogden, R., Nathanial, J., *The LQM/CIEH S4UL's for Human Health Risk Assessment*. **Land Quality Press**. 2015

2.1. S4UL Background

The Land Quality Management/Chartered Institute of Environmental Health (LQM/CIEH) S4UL for a given land use is the concentration of the contaminant in soil at which the predicted daily exposure,

as calculated by the CLEA software, equals the Health Criteria Value. The S4ULs have been derived for substances based on various generic land use and soil organic matter contents.

The final output for each contaminant represents a synthesis of new toxicological (and fate and transport) reviews published since the preparation of the 2nd edition LQM/CIEH GAC's (Nathanial et al., 2009).

In the derivation of LQM/CIEH S4UL's the principles of 'minimal' or 'tolerable' risk enshrined in SR2, which has not been withdrawn, has been maintained.

2.2. S4UL Land-use

S4UL's have been derived for the basic CLEA land-uses, as described in section 1.2, and for two new land uses:

- Public Open Spaces near Residential Housing (POSresi).
- Public Park (POSpark).

2.2.1. Public Open Spaces near Residential Housing (POSresi)

Includes the predominantly grassed areas adjacent to high density housing, the central green area on many 1930's – 1970's housing estates, and smaller areas commonly incorporated in newer developments as informal grassed areas or more formal landscaped areas with a mixture of open space and covered soils with planting. It is assumed that the close proximity to the place of residence will allow tracking back of soil to occur.

2.2.2. Public Park (POSpark)

An area of open space, usually owned and maintained by the local authority, provided for recreational uses including family visists and picnics, children's play area, informal sporting activities (not a dedicated sports pitch), and dog walking. It is assumed that tracking back of soils into places of residence will be negligible.

The following LQM/CIEH S4Uls (Copyright Land Quality Management Limited) have been reproduced with permission, to the publication number S4UL3072.

3. Category 4 Screening Levels (C4SLs)

In the case of Lead, no SGV or GAC has been published to date. This is likely to be due to the toxicity review that is currently being undertaken by the Environment Agency. In the absence of updated toxicity information the SGV derived using CLEA 1.07 methodology and related toxicity will be used.

The overall objective of the C4SLs research project was to assist the provision of technical guidance in support of Defra's revised Statutory Guidance (SG) for Part 2A of the Environmental Protection Act 1990 (Part 2A) (Defra, 2012a). Specifically, the project aimed to deliver:

- A methodology for deriving C4SLs for four generic land-uses comprising residential, commercial, allotments and public open space; and
- A demonstration of the methodology, via the derivation of C4SLs for six substances – arsenic, benzene, benzo(a)pyrene, cadmium, chromium (VI) and lead.

To help achieve a more targeted approach to identifying and managing contaminated land in relation to the risk (or possibility) of harm to human health, the revised SG presented a new four category

system for considering land under Part 2A, ranging from Category 4, where there is no risk that land poses a significant possibility of significant harm (SPOSH), or the level of risk is low, to Category 1, where the risk that land poses a significant possibility of significant harm (SPOSH) is unacceptably high. More specific guidance on what type of land should be considered as Category 4 (Human Health) is provided in Paragraphs 4.21 and 4.22 of the revised SG, as follows:

> *"4.21 The local authority should consider that the following types of land should be placed into Category 4: Human Health:*
> *(a) Land where no relevant contaminant linkage has been established.*
> *(b) Land where there are only normal levels of contaminants in soil, as explained in Section 3 of this Guidance.*
> *(c) Land that has been excluded from the need for further inspection and assessment because contaminant levels do not exceed relevant generic assessment criteria in accordance with Section 3 of this Guidance, or relevant technical tools or advice that may be developed in accordance with paragraph 3.30 of this Guidance.*
> *(d) Land where estimated levels of exposure to contaminants in soil are likely to form only a small proportion of what a receptor might be exposed to anyway through other sources of environmental exposure (e.g. in relation to average estimated national levels of exposure to substances commonly found in the environment, to which receptors are likely to be exposed in the normal course of their lives).*
>
> *4.22 The local authority may consider that land other than the types described in paragraph 4.21 should be placed into Category 4: Human Health if following a detailed quantitative risk assessment it is satisfied that the level of risk posed is sufficiently low."*

The C4SLs are intended as "relevant technical tools" (in relation to Paragraph 4.21(c)) to help local authorities and others when deciding to stop further assessment of a site, on the grounds that it falls within Category 4 (Human Health).

The Impact Assessment (IA), which accompanied the revised SG (Defra, 2012b) provides further information on the nature and potential role of the C4SLs. Paragraph 47(h) of the IA states that:

> *"The new statutory guidance will bring about a situation where the current SGVs/GACs are replaced with more pragmatic (but still strongly precautionary) Category 4 screening levels (C4SLs) which will provide a higher simple test for deciding that land is suitable for use and definitely not contaminated land."*

A key distinction between the Soil Guideline Values (SGVs) and the C4SLs is the level of risk that they describe. As described by the Environment Agency (2009a):

> *"SGVs are guidelines on the level of long-term human exposure to individual chemicals in soil that, unless stated otherwise, are tolerable or pose a minimal risk to human health."*

The implication of Paragraph 47(h) of the IA is that minimal risk is well within Category 4 and that the C4SLs should describe a higher level of risk which, whilst not minimal, can still be considered low enough to allow a judgement to be made that land containing substances at, or below, the C4SLs would typically fall within Category 4. This reflects Paragraph 4.20 of the revised SG, which states:

> *"4.20 The local authority should not assume that land poses a significant possibility of significant harm if it considers that there is no risk or that the level of risk posed is low. For the purposes of this Guidance, such land is referred to as a "Category 4: Human Health" case. The authority may decide that the land is a Category 4: Human Health case as soon as it considers it has evidence to this effect, and this may happen at any stage during risk assessment including the early stages."*

C4SLs, therefore, should not be viewed as "SPOSH levels" and they should not be used as a legal trigger for the determination of land under Part 2A.

The generic screening values referred to before usually take the form of risk-based Soil Guideline Values (SGVs) or other Generic Assessment Criteria (GACs) that are most typically derived using the Environment Agency's Contaminated Land Exposure Assessment (CLEA) model, as described in the Environment Agency's SR2, SR3 and SR7 reports (EA, 2009b & c; EA, 2008). It is anticipated that C4SLs will be used in a similar manner; as generic screening criteria that can be used within a GQRA, albeit describing a higher level of risk than the SGVs.

The suggested approach to the development of C4SLs consists of the retention and use of the CLEA framework, modified according to considerations of the underlying science within the context of Defra's policy objectives relating to the revised SG. Within this context, it is suggested that the development of C4SLs may be achieved in one of three ways, namely:

- By modifying the toxicological parameters used within CLEA (while maintaining current exposure parameters);
- By modifying the exposure parameters embedded within CLEA (while maintaining current toxicological "minimal risk" interpretations); and
- By modifying both toxicological and exposure parameters.

There is also a suggested check on "other considerations" (e.g., background levels, epidemiological data, sources of uncertainty) within the approach, applicable to all three options.

It is suggested that a new term is defined for the toxicological guidance values associated with the derivation of C4SLs – a Low Level of Toxicological Concern (LLTC). A LLTC should represent an intake of low concern that remains suitably protective of health, and definitely does not approach an intake level that could be defined as SPOSH.

4. CL:AIRE Generic Assessment Criteria (GAC)

For derivation of the CL:AIRE Generic Assessment Criteria (GAC) reference should be made to the following report:

> CL:AIRE, *The Soil Generic Assessment Criteria for Human Health Risk Assessment.* **Contaminated Land: Applications in the Real Environment**. 2009.

Within this report, Contaminated Land: Applications in Real Environments (CL:AIRE) provided Generic Assessment Criteria (GAC) in accordance with the CLEA software and the principles outlined previously for a further 35 contaminants sometimes encountered on land affected by contamination.

5. SoBRA Acute GAC

The Society of Brownfield Risk Assessment (SoBRA) identified that most human health risk assessments focus on the chronic risks arising from long-term exposure to specific substances. As chronic risks often occur at lower doses than acute risks, they are often the key drivers, however, in some instances the acute dose may also be an important consideration within risk assessments.

The methodology for deriving the acute GAC were related to two distinct receptor groups:

- Members of the public, where the 'critical' receptor for this group will typically be a female child, which is consistent with CLEA residential and Public Open Space/allotments land-uses;
- Workers involved with excavations. The critical receptor for this group is assumed to be a female working adult, without the use of PPE.

The acute GACs relate to short term exposure of high concentrations of a substance that lead to acute effects. They are not considered to be average exposures across a specific / defined area. As a result, the GACs should be normally be compared with the maximum likely concentration that the individual may be exposed to, and not the average concentration within a specific area.

The SoBRA acute GAC will primarily be used for contaminants that do not currently have any GAC, most notably Cyanide.

6. Detailed Quantitative Risk Assessments (DQRA)

Where the adoption of a GAC is not appropriate, for instance when the intended land-use is at variance the CLEA standard land-uses, then a DQRA may be undertaken to develop site specific values for relevant soil contaminants.

- Establishing the plausibility that generic exposure pathways exist in practice by measurement and observation.
- Developing more accurate parameters using site data.

7. Phytotoxicity

CLEA guidance only addresses human health toxicity; assessment of plant toxicity (phytotoxicity) is based on threshold trigger values obtained from the following source:

- BS3882:2015 – *Specification for Topsoil*

The trigger values are relevant only to those contaminants, where present in excess, have the potential to inhibit plant growth, or kill plants (Cu, Ni and Zn). The criteria have been based on a wide range of planting that are common within a multi-purpose topsoil.

8. Statistical Tests

DEFRA R&D Publication CLR 7 (DOE 1994) addressed the statistical treatment of test results and their comparison to Soil Guideline Values.

Consideration must be given to the appropriate area of land to be considered termed the critical averaging area.

For a communal open space or commercial land-use, the critical averaging area will depend on the proposed layout. For a residential use with private gardens the averaging area is the individual plot.

It may be appropriate to compare the upper 95th percentile concentration with the Soil Guideline Value, subject to applying a statistical test to establish that the range of concentrations are reasonably consistent and belonging to the same underlying distribution of data.

CL:AIRE published guidance in 2020, *Guidance in comparing soil contamination data with a critical concentration,* superseding the CL:AIRE/CIEH 2008 report of the same name. The guidance provides ways to assist land contamination stakeholders to apply statistical methods to their data to enable decisions under the legislative framework; either planning system or Part 2A of the Environmental Protection Act 1990.

The use of the statistical tests should only be applied if the following statements are valid for the datasets:

- Averaging areas, as well as the smallest area of concern have been identified on the basis of the CSM, including the desk study and/or the site walkover;
- The sample locations were chosen using a simple random, stratified random or stratified systematic (square, herringbone or triangular grid) sampling pattern, rather than being targeted to locations suspected of being contaminated;
- The sample locations are relatively evenly spread across the area and are not clustered, to avoid giving undue weight to some parts of the site over others in the calculated statistics;
- The analyses do not suggest a hotspot or outlier of contamination that should be treated as a separate zone. This has been established by a histogram and/or a names statistical test;
- The sample locations are all taken from one population (i.e. the same material);
- Where an averaging zone encompasses several averaging areas, analyses do not show a spatial trend or other spatial pattern across that zone; and
- The number of samples has been shown to be sufficient for a statistical analysis.

Any included statistical spreadsheet is based on an in-house method of statistical analysis, in line with those outlined within the CL:AIRE guidance (2020).

Treatment of Hot-Spots

- A statistical test is applied to establish whether the data is a part of a single set, or whether data outliers are present.
- Provided that the data is based on random sampling and no distinct contamination source was present at the sampling location, the hot-spot(s) may be excluded and the mean of the remaining data assessed.

9. Ground and Water Limited Soil Assessment Criteria

The Soil Assessment Criteria used in the preparation of the Generic Quantitative Risk Assessment are tabulated in the following pages, where the source of each has been outlined in the previous sections.

9.1. Inorganics

SoBRA – Acute Generic Assessment Criteria						
Determinand	**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Cyanide	24	24	24	1400	24	24

9.2. Metals

C4SL Low Level of Toxicological Concern						
Determinand	**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Lead	< 200	< 310	< 80	< 2300	< 630	< 1300

LQM/CIEH Suitable 4 Use Levels – Metals and Semi-metals						
Determinand	**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Arsenic	37	40	43	640	79	170
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11000	45	240000	21000	46000
Cadmium	11	85	1.9	190	120	532
Chromium (III)	910	910	18000	8600	1500	33000
Chromium (VI)	6	6	1.8	33	7.7	220
Copper	2400	7100	520	68000	12000	44000
Elemental Mercury	1.2	1.2	21	58	16	30
Inorganic Mercury	40	56	19	1100	120	240
Methylmercury	11	15	6	320	40	68
Nickel	130	180	53	980	230	800
Selenium	250	430	88	12000	1100	1800
Vanadium	410	1200	91	9000	2000	5000
Zinc	3700	40000	620	730000	81000	170000

Phytotoxicity (Harmful to Plants) Threshold Trigger Values			
Determinand	**Soil pH < 6.0 (mg/kg)**	**Soil pH 6.0 – 7.0 (mg/kg)**	**Soil pH > 7.0 (mg/kg)**
Copper	100	135	200
Nickel	60	75	110
Zinc	200	200	300
Notes: BS3882:2015 – *Specification for Topsoil*. Based on a wide range of common plants that will be exposed to multi-purpose topsoil. Toxicity of contaminant may also be impacted by pH of soils. Site observation of plant vitality may give additional guidance.			

CL:AIRE Soil Generic Assessment Criteria				
Determinand	**Residential (mg/kg)**	**Residential without plant uptake (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**
Antimony	ND	550	ND	7500
Barium	ND	1300	ND	22000
Molybdenum	ND	670	ND	17000
ND – Not derived				

9.3. Total Petroleum Hydrocarbons (TPHs)

9.3.1. BTEX Compounds

LQM/CIEH Suitable 4 Use Levels – BTEX Compounds							
Determinand	**Soil Organic Matter**	**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Benzene	1.0% SOM	0.087	0.38	0.017	27	72	90
	2.5% SOM	0.170	0.70	0.034	47	72	100
	6.0% SOM	0.370	1.40	0.075	90	73	110
Toluene	1.0% SOM	130	880	22	56000	56000	87000
	2.5% SOM	290	1900	51	110000	56000	95000
	6.0% SOM	660	3900	120	180000	56000	100000
Ethylbenzene	1.0% SOM	47	83	16	5700	24000	17000
	2.5% SOM	110	190	39	13000	24000	22000
	6.0% SOM	260	440	91	27000	25000	27000
o-Xylene	1.0% SOM	60	88	28	6600	41000	17000
	2.5% SOM	140	210	67	15000	42000	24000
	6.0% SOM	330	480	160	33000	43000	33000
m-Xylene	1.0% SOM	59	82	31	6200	41000	17000
	2.5% SOM	140	190	74	14000	42000	24000
	6.0% SOM	320	450	170	31000	43000	33000
p-Xylene	1.0% SOM	56	79	29	5900	41000	17000
	2.5% SOM	130	180	69	14000	42000	23000
	6.0% SOM	310	430	160	30000	43000	31000
SOM = Soil Organic Matter Content (%)							

9.3.2. Total Petroleum Hydrocarbons – Aliphatic

LQM/CIEH Suitable 4 Use Levels For TPH							
Aliphatic		**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
EC 5-6	1.0% SOM	42	42	730	3,200 (304) [sol]	570,000 (304) [sol]	95,000 (304) [sol]
	2.5% SOM	78	78	1,700	5,900 (558) [sol]	590,000	130,000 (558) [sol]
	6.0% SOM	160	160	3,900	12,000 (1150) [sol]	600,000 (1150)[sol]	180,000 (1150) [sol]
EC >6-8	1.0% SOM	100	100	2,300	7,800 (144) [sol]	600,000	150,000 (144) [sol]
	2.5% SOM	230	230	5,600	17,000 (322) [sol]	610,000	220,000 (322) [sol]
	6.0% SOM	530	530	13,000	40,000 (736) [sol]	620,000	320,000 (736) [sol]
EC >8-10	1.0% SOM	27	27	320	2,000 (78) [sol]	13,000	14,000 (78) [sol]
	2.5% SOM	65	65	770	4,800 (118) [vap]	13,000	18,000 (118) [vap]
	6.0% SOM	150	150	1,700	11,000 (451) [vap]	13,000	21,000 (451) [vap]
EC >10-12	1.0% SOM	130 (48) [vap]	130 (48) [vap]	2,200	9,700 (48) [sol]	13,000	21,000 (48) [sol]
	2.5% SOM	330 (118) [vap]	330 (118) [vap]	4,400	23,000 (118) [vap]	13,000	23,000 (118) [vap]
	6.0% SOM	760 (283) [vap]	760 (283) [vap]	7,300	47,000 (283) [vap]	13,000	24,000 (283) [vap]
EC >12-16	1.0% SOM	1,100 (24) [sol]	1,100 (24) [sol]	11,000	59,000 (24) [sol]	13,000	25,000 (24) [sol]
	2.5% SOM	2,400 (59) [sol]	2,400 (59) [sol]	13,000	82,000 (59) [sol]	13,000	25,000 (59) [sol]
	6.0% SOM	4,300 (142) [sol]	4,400 (142) [sol]	13,000	90,000 (142) [sol]	13,000	26,000 (142) [sol]
EC >16-35	1.0% SOM	65,000 (8.48) [sol]	65,000 (8.48) [sol]	260,000	1,600,000	250,000	450,000
	2.5% SOM	92,000 (21) [sol]	92,000 (21) [sol]	270,000	1,700,000	250,000	480,000
	6.0% SOM	110,000	110,000	270,000	1,800,000	250,000	490,000
EC >35-44	1.0% SOM	65,000 (8.48) [sol]	65,000 (8.48) [sol]	260,000	1,600,000	250,000	450,000
	2.5% SOM	92,000 (21) [sol]	92,000 (21) [sol]	270,000	1,700,000	250,000	480,000
	6.0% SOM	110,000	110,000	270,000	1,800,000	250,000	490,000

SOM = Soil Organic Matter Content (%)

[vap] – GAC presented exceeds the vapour saturation limit, which is presented in brackets.

[sol] – GAC presented exceeds the soil saturation limit, which is presented in brackets.

9.3.3. Total Petroleum Hydrocarbons – Aromatic

LQM/CIEH Suitable 4 Use Levels For TPH							
Aromatic		**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
EC 5-7 (Benzene)	1.0% SOM	70	370	13	26,000 (1220) [sol]	56,000	76,000 (1220 [sol]
	2.5% SOM	140	690	27	46,000 (2260) [sol]	56,000	84,000 (2260) [sol]
	6.0% SOM	300	1,400	57	86,000 (4710) [sol]	56,000	92,000 (4710) [sol]
EC >7-8 (Toluene)	1.0% SOM	130	860	22	56,000 (869) [vap]	56,000	87,000 (869) [sol]
	2.5% SOM	290	1,800	51	110,000 (1920) [sol]	56,000	95,000 (1920) [sol]
	6.0% SOM	660	3,900	120	180,000 (4360) [vap]	56,000	100,000 (4360) [vap]
EC >8-10	1.0% SOM	34	47	8.6	3,500 (613) [vap]	5,000	7,200 (613) [vap]
	2.5% SOM	83	110	21	8,100 (1500) [vap]	5,000	8,500 (1500) [vap]
	6.0% SOM	190	270	51	17,000 (3850) [vap]	5,000	9,300 (3580) [vap]
EC >10-12	1.0% SOM	74	250	13	16,000 (364) [sol]	5,000	9,200 (364) [sol]
	2.5% SOM	180	590	31	28,000 (899) [sol]	5,000	9,700 (889) [sol]
	6.0% SOM	380	1,200	74	34,000 (2150) [sol]	5,000	10,000
EC >12-16	1.0% SOM	140	1,800	23	36,000 (169) [sol]	5,100	10,000
	2.5% SOM	330	2,300 (419) [sol]	57	37,000	5,100	10,000
	6.0% SOM	660	2,500	130	38,000	5,000	10,000
EC >16-21	1.0% SOM	260	1,900	46	28,000	3,800	7,600
	2.5% SOM	540	1,900	110	28,000	3,800	7,700
	6.0% SOM	930	1,900	260	28,000	3,800	7,800
EC >21-35	1.0% SOM	1,100	1,900	370	28,000	3,800	7,800
	2.5% SOM	1,500	1,900	820	28,000	3,800	7,800
	6.0% SOM	1,700	1,900	1,600	28,000	3,800	7,900
EC >35-44	1.0% SOM	1,100	1,900	370	28,000	3,800	7,800
	2.5% SOM	1,500	1,900	820	28,000	3,800	7,800
	6.0% SOM	1,700	1,900	1,600	28,000	3,800	7,900
EC >44-70	1.0% SOM	1,600	1,900	1,200	28,000	3,800	7,800
	2.5% SOM	1,800	1,900	2,100	28,000	3,800	7,800
	6.0% SOM	1,900	1,900	3,000	28,000	3,800	7,900

SOM = Soil Organic Matter Content (%)

[vap] – GAC presented exceeds the vapour saturation limit, which is presented in brackets.

[sol] – GAC presented exceeds the soil saturation limit, which is presented in brackets.

9.4. Polycyclic Aromatic Hydrocarbons (PAHs)

LQM/CIEH Suitable 4 Use Levels For Polycyclic Aromatic Hydrocarbons (PAHs)							
Determinands		**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Acenapthene	1.0% SOM	210	3,000 (57.0) [sol]	34	84,000(57.0) [sol]	15,000	29,000
	2.5% SOM	510	4,700(141) [sol]	85	97,000(141) [sol]	15,000	30,000
	6.0% SOM	1100	6,000(336) [sol]	200	100,000	15,000	30,000
Acenapthylene	1.0% SOM	170	2,900(86.1) [sol]	28	83,000(86.1) [sol]	15,000	29,000
	2.5% SOM	420	4,600(212) [sol]	69	97,000(212) [sol]	15,000	30,000
	6.0% SOM	920	6,000(506) [sol]	160	100,000	15,000	30,000
Anthracene	1.0% SOM	2,400	31,000(1.17) [vap]	380	520,000	74,000	150,000
	2.5% SOM	5,400	35,000	950	540,000	74,000	150,000
	6.0% SOM	11,000	37,000	2,200	540,000	74,000	150,000
Benzo(a)anthracene	1.0% SOM	7.20	11	2.90	170	29	49
	2.5% SOM	11	14	6.50	170	29	56
	6.0% SOM	13	15	13	180	29	62
Benzo(a)pyrene	1.0% SOM	2.20	3.20	0.97	35	5.70	11
	2.5% SOM	2.70	3.20	2.00	35	5.70	12
	6.0% SOM	3.00	3.20	3.50	36	5.70	13
Benzo(b)flouranthene	1.0% SOM	2.60	3.90	0.99	44	7.10	13
	2.5% SOM	3.30	4.00	2.10	44	7.20	15
	6.0% SOM	3.70	4.00	3.90	45	7.20	16
Benzo(ghi)perylene	1.0% SOM	320	360	290	3,900	640	1,400
	2.5% SOM	340	360	470	4,000	640	1,500
	6.0% SOM	350	360	640	4,000	640	1,600
Benzo(k)flouranthene	1.0% SOM	77	110	37	1,200	190	370
	2.5% SOM	93	110	75	1,200	190	410
	6.0% SOM	100	110	130	1,200	190	440
Chrysene	1.0% SOM	15	30	4.10	350	57	93
	2.5% SOM	22	31	9.40	350	57	110
	6.0% SOM	27	32	19	350	57	120
Dibenzo(ah)anthracene	1.0% SOM	0.24	0.31	0.14	3.50	0.57	1.10
	2.5% SOM	0.28	0.32	0.27	3.50	0.57	1.30
	6.0% SOM	0.30	0.32	0.43	3.60	0.58	1.40
Flouranthene	1.0% SOM	280	1,500	52	23,000	3,100	6,300
	2.5% SOM	560	1,600	130	23,000	3,100	6,300
	6.0% SOM	890	1,600	290	23,000	3,100	6,300
Flourene	1.0% SOM	170	2,800 (30.9) [sol]	27	63,000(30.9) [sol]	9,900	20,000
	2.5% SOM	400	3,800(76.5) [sol]	67	68,000	9,900	20,000
	6.0% SOM	860	4,500(183) [sol]	160	71,000	9,900	20,000
Indeno(123-cd)pyrene	1.0% SOM	27	45	9.50	500	82	150
	2.5% SOM	36	46	21	510	82	170
	6.0% SOM	41	46	39	510	82	180
Napthalene	1.0% SOM	15	36	65	1,600	11,000	800
	2.5% SOM	36	36	130	3,700	15,000	1,200
	6.0% SOM	85	85	200	8,400	17,000	1,900
Phenanthrene	1.0% SOM	95	1,300(183) [sol]	15	22,000	3,100	6,200
	2.5% SOM	220	1,500	38	22,000	3,100	6,200
	6.0% SOM	440	1,500	90	23,000	3,100	6,300
Pyrene	1.0% SOM	620	3,700	110	54,000	7,400	15,000
	2.5% SOM	1200	3,800	270	54,000	7,400	15,000
	6.0% SOM	2000	3,800	620	54,000	7,400	15,000
Coal Tar (Benzo(a)pyrene used as marker compound)	1.0% SOM	0.79	1.2	0.32	15	2.20	4.40
	2.5% SOM	0.98	1.2	0.67	15	2.20	4.70
	6.0% SOM	1.10	1.2	1.20	15	2.20	4.80

SOM = Soil Organic Matter Content (%)

[vap] – GAC presented exceeds the vapour saturation limit, which is presented in brackets.

[sol] – GAC presented exceeds the soil saturation limit, which is presented in brackets.

9.5. Volatile and Semi-volatile Organic Compounds

LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds							
Determinands		**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Chloroalkanes & alkenes							
1,2 Dichloroethane	1.0% SOM	0.0071	0.0092	0.0046	0.67	29	21
	2.5% SOM	0.011	0.013	0.0083	0.97	29	24
	6.0% SOM	0.019	0.023	0.016	1.70	29	28
1,1,2,2 Tetrachloroethane	1.0% SOM	1.60	3.90	0.41	270	1,400	1,800
	2.5% SOM	3.40	8.00	0.89	550	1,400	2,100
	6.0% SOM	7.50	17	2.00	1,100	1,400	2,300
1,1,1,2 Tetrachloroethane	1.0% SOM	1.20	1.50	0.79	110	1,400	1,500
	2.5% SOM	2.80	3.50	1.90	250	1,400	1,800
	6.0% SOM	6.40	8.20	4.40	560	1,400	2,100
Tetrachloroethene	1.0% SOM	0.18	0.18	0.65	19	1,400	810 [sol](424)
	2.5% SOM	0.39	0.40	1.50	42	1,400	1,100 [sol](951)
	6.0% SOM	0.90	0.92	3.60	95	1,400	1,500
1,1,1 Trichloroethane	1.0% SOM	8.80	9.00	48	660	140,000	57,000 [vap](1425)
	2.5% SOM	18	18	110	1,300	140,000	76,000 [vap](2915)
	6.0% SOM	39	40	240	3,000	140,000	100,000 [vap] (6392)
Tetrachloromethene	1.0% SOM	0.026	0.026	0.45	2.90	890	190
	2.5% SOM	0.056	0.056	1.00	6.30	920	270
	6.0% SOM	0.130	0.130	2.40	14	950	400
Trichloroethene	1.0% SOM	0.016	0.017	0.041	1.20	120	70
	2.5% SOM	0.034	0.036	0.091	2.60	120	91
	6.0% SOM	0.075	0.080	0.210	5.70	120	120
Trichloromethane	1.0% SOM	0.91	1.20	0.42	99	2,500	2,600
	2.5% SOM	1.70	2.10	0.83	170	2,500	2,800
	6.0% SOM	3.40	4.20	1.70	350	2,500	3,100
Vinyl Chloride	1.0% SOM	0.00064	0.00077	0.00055	0.059	3.50	4.80
	2.5% SOM	0.00087	0.00100	0.00100	0.077	3.50	5.00
	6.0% SOM	0.00014	0.00150	0.00180	0.120	3.50	5.40
Explosives							
2,4,6 Trinitrotoluene	1.0% SOM	1.60	65	0.24	1,000	130	260
	2.5% SOM	3.70	66	0.58	1,000	130	270
	6.0% SOM	8.10	66	1.40	1,000	130	270
RDX (Hexogen/Cyclonite/1,3,5-trinitro-1,3,5-triazacyclohexane)	1.0% SOM	120	13,000	17	210,000	26,000	49,000(18.7)[sol]
	2.5% SOM	250	13,000	38	210,000	26,000	51,000
	6.0% SOM	540	13,000	85	210,000	27,000	53,000
HMX (Octogen/1,3,5,7-tetrenitro-1,3,5,7-tetrazacyclo-octane)	1.0% SOM	5.70	67,00	0.86	110,000	13,000	23,000(0.35)[vap]
	2.5% SOM	13	67,00	1.90	110,000	13,000	23,000(0.39)[vap]
	6.0% SOM	26	67,00	3.90	110,000	13,000	24,000(0.48)[vap]
Atrazine	1.0% SOM	3.30	610	0.50	9,300	1,200	2,300
	2.5% SOM	7.60	620	1.20	9,400	1,200	2,400
	6.0% SOM	17.40	620	2.70	9,400	1,200	2,400
[vap] – GAC presented exceeds the vapour saturation limit, which is presented in brackets.							
[sol] – GAC presented exceeds the soil saturation limit, which is presented in brackets.							

VOC and SVOC table continued overleaf

VOC and SVOC table continued from previous page

LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds							
Determinands		**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Pesticides							
Aldrin	1.0% SOM	5.70	7.30	3.20	170	18	30
	2.5% SOM	6.60	7.40	6.10	170	18	31
	6.0% SOM	7.10	7.50	9.60	170	18	31
Dieldrin	1.0% SOM	0.97	7.00	0.17	170	18	30
	2.5% SOM	2.00	7.30	0.41	170	18	30
	6.0% SOM	3.50	7.40	0.96	170	18	31
Dichlorvos	1.0% SOM	0.032	6.40	0.0049	140	16	26
	2.5% SOM	0.066	6.50	0.0100	140	16	26
	6.0% SOM	0.140	6.60	0.0220	140	16	27
Alpha - Endosulfan	1.0% SOM	7.40	160(0.003)[vap]	1.20	5,600(0.003)[vap]	1,200	2,400
	2.5% SOM	18	280(0.007)[vap]	2.90	7,400(0.007)[vap]	1,200	2,400
	6.0% SOM	41	410(0.016)[vap]	6.80	8,400(0.016)[vap]	1,200	2,400
Beta - Endosulfan	1.0% SOM	7.00	190(0.00007)[vap]	1.10	6,300(0.00007)[vap]	1,200	2,400
	2.5% SOM	17	320(0.0002)[vap]	2.70	7,800(0.0002)[vap]	1,200	2,400
	6.0% SOM	39	440(0.0004)[vap]	6.40	8700	1,200	2,500
Alpha - Hexachlorocyclohexanes	1.0% SOM	0.23	6.90	0.035	170	24	47
	2.5% SOM	0.55	9.20	0.087	180	24	48
	6.0% SOM	1.20	11	0.210	180	24	48
Beta - Hexachlorocyclohexanes	1.0% SOM	0.085	3.70	0.013	65	8.10	15
	2.5% SOM	0.200	3.80	0.032	65	8.10	15
	6.0% SOM	0.460	3.80	0.077	65	8.10	16
Gamma - Hexachlorocyclohexanes	1.0% SOM	0.06	2.90	0.0092	67	8.2	14
	2.5% SOM	0.14	3.30	0.0230	69	8.2	15
	6.0% SOM	0.33	3.50	0.0540	70	8.2	15
Chlorobenzenes							
Chlorobenzene	1.0% SOM	0.46	0.46	5.90	56	11,000	1,300(675)[sol]
	2.5% SOM	1.00	1.00	14	130	13,000	2,000(1520)[sol]
	6.0% SOM	2.40	2.40	32	290	14,000	2,900
1,2-Dichlorobenzene	1.0% SOM	23	24	94	2,000 (571) [sol]	90,000	24,000(571)[sol]
	2.5% SOM	55	57	230	4,800 (1370) [sol]	95,000	36,000(1370)[sol]
	6.0% SOM	130	130	540	11,000 (3240) [sol]	98,000	51,000(3240)[sol]
1,3-Dichlorobenzene	1.0% SOM	0.40	0.44	0.25	30	300	390
	2.5% SOM	1.00	1.10	0.60	73	300	440
	6.0% SOM	2.30	2.50	1.50	170	300	470
1,4-Dichlorobenzene	1.0% SOM	61	61	15	4,400 (224)[vap]	17,000[g]	36,000 (224)[vap]
	2.5% SOM	150	150	37	10,000 (540)[vap]	17,000[g]	36,000 (540)[vap]
	6.0% SOM	350	350	88[g]	25,000 (1280)[vap]	17,000[g]	36,000 (1280)[vap]
1,2,3,-Trichlorobenzene	1.0% SOM	1.50	1.50	4.70	102	1,800	770(134[vap]
	2.5% SOM	3.60	3.70	12	250	1,800	1,100(330)[vap]
	6.0% SOM	8.60	8.80	28	590	1,800	1,600(789)[vap]
1,2,4,-Trichlorobenzene	1.0% SOM	2.60	2.60	55	220	15,000	1,700(318)[vap]
	2.5% SOM	6.40	6.40	140	530	17,000	2,600(786)[vap]
	6.0% SOM	15	15	320	1,300	19,000	4,000(1880)[vap]
1,3,5,-Trichlorobenzene	1.0% SOM	0.33	0.33	4.70	23	1,700	380(36.7)[vap]
	2.5% SOM	0.81	0.81	12	55	1,700	590(90.8)[vap]
	6.0% SOM	1.90	1.90	140	130	1,800	860(217)[vap]

[vap] – GAC presented exceeds the vapour saturation limit, which is presented in brackets.
[sol] – GAC presented exceeds the soil saturation limit, which is presented in brackets.

VOC and SVOC table continued overleaf

VOC and SVOC table continued from previous page

LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds							
Determinands		**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Chlorobenzenes (cont.)							
1,2,3,4,-Tetrachlorobenzene	1.0% SOM	15	24	4.40	1,700(122)^{vap}	830	1,500(122)^{vap}
	2.5% SOM	36	56	11	3,080(304)^{vap}	830	1,600
	6.0% SOM	78	120	26	4,400(728)^{vap}	830	1,600
1,2,3,5,-Tetrachlobenzene	1.0% SOM	0.66	0.75	0.38	49(39.4)^{vap}	78	110(39)^{vap}
	2.5% SOM	1.60	1.90	0.90	120(98.1)^{vap}	79	120
	6.0% SOM	3.70	4.30	2.20	240(235)^{vap}	79	130
1,2,4, 5,-Tetrachlobenzene	1.0% SOM	0.33	0.73	0.06	42(19.7)^{sol}	13	25
	2.5% SOM	0.77	1.70	0.16	72(49.1)^{sol}	13	26
	6.0% SOM	1.60	3.50	0.37	96	13	26
Pentachlrobenzene	1.0% SOM	5.80	19	1.20	640(43.0)^{sol}	100	190
	2.5% SOM	12	30	3.10	770(107)^{sol}	100	190
	6.0% SOM	22	38	7.00	830	100	190
Hexachlorobenzene	1.0% SOM	1.80(0.20)^{vap}	4.10 (0.20)^{vap}	0.47	110(0.20)^{vap}	16	30
	2.5% SOM	3.30(0.50)^{vap}	5.70 (0.50)^{vap}	1.10	120	16	30
	6.0% SOM	4.90	6.70 (1.2)^{vap}	2.50	120	16	30
Phenols & Chlorophenols							
BTEX	1.0% SOM	280	750	66	760^{dir}(31,000)	760^{dir}(11,000)	760^{dir}(8,600)
	2.5% SOM	550	1,300	140	1,500^{dir}(35,000)	1,500^{dir}(11,000)	1,500^{dir}(9,700)
	6.0% SOM	1100	2,300	280	3,200^{dir}(37,000)	3,200^{dir}(11,000)	3,200^{dir}(11,000)
Chlorophenols (4 Congeners)	1.0% SOM	0.87	94	0.13	3,500	620	1,100
	2.5% SOM	2.00	150	0.30	4,000	620	1,100
	6.0% SOM	4.50	210	0.70	4,300	620	1,100
Pentachlorophenols	1.0% SOM	0.22	27(16.4)^{vap}	0.03	400	60	110
	2.5% SOM	0.52	29	0.08	400	60	120
	6.0% SOM	1.20	31	0.19	400	60	120
Others							
Carbon Disulphide	1.0% SOM	0.14	0.14	4.80	11	11,000	1,300
	2.5% SOM	0.29	0.29	10	22	11,000	1,900
	6.0% SOM	0.62	0.62	23	47	12,000	2,700
Hexachloro-1,3-Butadiene	1.0% SOM	0.29	0.32	0.25	31	25	48
	2.5% SOM	0.70	0.78	0.61	68	25	50
	6.0% SOM	1.60	1.80	1.40	120	25	51

^{vap} – GAC presented exceeds the vapour saturation limit, which is presented in brackets.
^{sol} – GAC presented exceeds the soil saturation limit, which is presented in brackets.

VOC and SVOC table continued overleaf

VOC and SVOC table continued from previous page

CL:AIRE General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds					
Determinands		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)
1,1,2 Trichloroethane	1.0% SOM	0.60	0.88	0.28	94
	2.5% SOM	1.20	1.8	0.61	190
	6.0% SOM	2.70	3.9	1.40	400
1,1-Dichloroethane	1.0% SOM	2.40	2.50	9.20	280
	2.5% SOM	3.90	4.10	17	450
	6.0% SOM	7.40	7.70	35	850
1,1-Dichloroethene	1.0% SOM	0.23	0.23	2.80	26
	2.5% SOM	0.40	0.41	5.60	46
	6.0% SOM	0.82	0.82	12	92
1,2,4-Trimethylbenzene	1.0% SOM	0.35	0.41	0.38	42
	2.5% SOM	0.85	0.99	0.93	99
	6.0% SOM	2.00	2.30	2.20	220
1,2-Dichloropropane	1.0% SOM	0.024	0.024	0.62	3.3
	2.5% SOM	0.042	0.042	1.20	5.9
	6.0% SOM	0.084	0.085	2.60	12
2,4-Dimethylphenol	1.0% SOM	19	210	3.10	16000*
	2.5% SOM	43	410	7.20	24000*
	6.0% SOM	97	730	17	30000*
2,4-Dinitrotoluene	1.0% SOM	1.50	170*	0.22	3700*
	2.5% SOM	3.20	170	0.49	3700*
	6.0% SOM	7.20	170	1.10	3800*
2,6-Dinitrotoluene	1.0% SOM	0.78	78	0.12	1900*
	2.5% SOM	1.70	84	0.27	1900*
	6.0% SOM	3.90	87	0.61	1900*
2-Chloronapthalene	1.0% SOM	3.70	3.80	40	390*
	2.5% SOM	9.20	9.30	98	960*
	6.0% SOM	22	22	230	2200*
Biphenyl	1.0% SOM	66*	220*	14	18000*
	2.5% SOM	160	500*	35	33000*
	6.0% SOM	360	980*	83	48000*
Bis (2-ethylhexyl) phthalate	1.0% SOM	280*	2700*	47*	85000*
	2.5% SOM	610*	2800*	120*	86000*
	6.0% SOM	1100*	2800*	280*	86000*
Bromobenzene	1.0% SOM	0.87	0.91	3.2	97
	2.5% SOM	2.0	2.1	7.6	220
	6.0% SOM	4.7	4.9	18	520
Bromodichloromethane	1.0% SOM	0.016	0.019	0.016	2.1
	2.5% SOM	0.030	0.034	0.032	3.7
	6.0% SOM	0.061	0.070	0.068	7.6
Bromoform	1.0% SOM	2.8	5.2	0.95	760
	2.5% SOM	5.9	11	2.1	1500
	6.0% SOM	13	23	4.6	3100
Butyl benzyl phthalate	1.0% SOM	1400*	42000*	220*	940000*
	2.5% SOM	3300*	44000*	550*	940000*
	6.0% SOM	7200*	44000*	1300*	950000*

*soil concentration above saturation limit

VOC and SVOC table continued overleaf

VOC and SVOC table continued from previous page

CL:AIRE General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds					
Determinands		**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**
Chloroethane	1.0% SOM	8.3	8.4	110	960
	2.5% SOM	11	11	200	1300
	6.0% SOM	18	18	380	2100
Chloromethane	1.0% SOM	0.0083	0.0085	0.066	1.0
	2.5% SOM	0.0098	0.0099	0.13	1.2
	6.0% SOM	0.013	0.013	0.23	1.6
***Cis* 1,2 Dichloroethene**	1.0% SOM	0.11	0.12	0.26	14
	2.5% SOM	0.19	0.20	0.50	24
	6.0% SOM	0.37	0.39	1.0	47
Dichloromethane	1.0% SOM	0.58	2.10	0.10	270
	2.5% SOM	0.98	2.80	0.19	360
	6.0% SOM	1.70	4.50	0.34	560
Diethyl Phthalate	1.0% SOM	120*	1800*	19*	150000*
	2.5% SOM	260*	3500*	41*	220000*
	6.0% SOM	570*	6300*	94*	290000*
Di-*n*-butyl phthalate	1.0% SOM	13*	450*	2.00	15000*
	2.5% SOM	31*	450*	5.00	15000*
	6.0% SOM	67*	450*	12	15000*
Di-*n*-octyl phthalate	1.0% SOM	2300*	3400*	940*	89000*
	2.5% SOM	2800*	3400*	2100*	89000*
	6.0% SOM	3100*	3400*	3900*	89000*
Hexachloroethane	1.0% SOM	0.20	0.22	0.27	22*
	2.5% SOM	0.48	0.54	0.67	53*
	6.0% SOM	1.10	1.30	1.60	120*
Isopropylbenzene	1.0% SOM	11	12	32	1400*
	2.5% SOM	27	28	79	3300*
	6.0% SOM	64	67	190	7700*
Methyl *tert*-butyl ether (MTBE)	1.0% SOM	49	73	23	7900
	2.5% SOM	84	120	44	13000
	6.0% SOM	160	220	90	24000
Propylbenzene	1.0% SOM	34	40	34	4100*
	2.5% SOM	82	97	83	9700*
	6.0% SOM	190	230	200	21000*
Styrene	1.0% SOM	8.10	35	1.60	3300*
	2.5% SOM	19	78	3.70	6500*
	6.0% SOM	43	170	8.70	11000*
Total Cresols (2-, 3-, and 4-methylphenol)	1.0% SOM	80	3700	12	160000
	2.5% SOM	180	5400	27	180000*
	6.0% SOM	400	6900	63	180000*
***Trans* 1,2 Dichloroethene**	1.0% SOM	0.19	0.19	0.93	22
	2.5% SOM	0.34	0.35	1.90	40
	6.0% SOM	0.70	0.71	0.24	81
Tributyl tin oxide	1.0% SOM	0.25	1.40	0.042	130*
	2.5% SOM	0.59	3.10	0.100	180*
	6.0% SOM	1.30	5.70	0.240	200*

*soil concentration above saturation limit

C4SL Low Level of Toxicological Concern							
Determinands		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
1,2-Dichloroethane (Ethylene Dichloride)	1.0% SOM	0.11	0.16	0.054	12	300	300
	2.5% SOM	0.18	0.24	0.10	17	310	330
	6.0% SOM	0.31	0.41	0.19	29	310	380
Cis-1,2-Dichloroethene	1.0% SOM	0.46	0.50	0.89	38	3,800	2,000
	2.5% SOM	0.78	0.84	1.7	64	3,800	2,400
	6.0% SOM	1.5	1.6	3.6	120	3,900	3,100
Tetrachloroethene (PCE)	1.0% SOM	0.31	0.32	2	24	3,200	1,400
	2.5% SOM	0.70	0.71	4.8	55	3,300	1,900
	6.0% SOM	1.60	1.60	11	130	3,400	2,500
Trans-1,2-Dichloroethene	1.0% SOM	0.90	0.93	3.70	69	13,000	5,600
	2.5% SOM	1.60	1.70	7.50	120	13,000	7,000
	6.0% SOM	3.30	3.40	16	260	13,000	9,100
Trichloroethene (TCE)	1.0% SOM	0.0093	0.0097	0.032	0.73	76	41
	2.5% SOM	0.020	0.020	0.072	1.5	78	54
	6.0% SOM	0.043	0.045	0.16	3.4	79	69
Vinyl Chloride (Chloroethene)	1.0% SOM	0.0064	0.015	0.0017	1.1	7.8	18
	2.5% SOM	0.010	0.019	0.0031	1.4	7.8	19
	6.0% SOM	0.017	0.029	0.0058	2.2	7.8	19

9.6. Per- and Polyfluoroalkyl Substances (PFAS)

Interim C4SLs for PFOA, PFNA, PFHxS and PFOS						
Determinand	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
PFOA	0.076	0.041	0.0014	0.60	0.079	0.17
PFOS	0.013	0.041	0.0027	0.60	0.079	0.17
PFHxS	0.0081	0.041	0.0015	0.60	0.079	0.17
PFNA	0.0073	0.041	0.0013	0.60	0.079	0.17

9.7. Asbestos

No asbestos or asbestos containing materials (ACM's) are considered acceptable on-site from a human health perspective. Therefore the GAC for asbestos & ACM's within any imported material should be none detected (ND).