geotechnical and environmental consultants

ground&water

Contamination Assessment Report

Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

On behalf of Foreman Homes Limited

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EXECUTIVE SUMMARY	
PROPOSED DEVELOPMENT	At the time of reporting, October 2024, the proposed development was understood to comprise the re-development of the Former Dairy Crest site and adjacent Southern Co-Op owned land to the south. The development will comprise 74no. apartments spread across the northern and western parts of the site with car parking occupying much of the remainder. A communal amenity space is proposed in the south, while covered bicycle storage located in the centre. Ground floor flats will have private gardens.
GEOLOGY AND HYDROGEOLOGY	The British Geological Survey (BGS) maps and DEFRA online maps for the area suggest that the site was located on superficial Head Deposits within the western half, classified as a Secondary (Undifferentiated) Aquifer, no superficial deposits were recorded within the eastern half of the site. This was underlain by the Bognor Sand Member, classified as a Secondary (A) Aquifer, within the eastern half of the site and the London Clay Formation, classified as Unproductive Strata, within the western half of the site. The superficial and bedrock aquifers are considered to be in hydraulic continuity. Examination of the Environment Agency records showed that the site did fall within a Zone 1I – Subsurface Activity Groundwater Source Protection Zone (SPZ) as classified in the Policy and Practice for the Protection of Groundwater. From analysis of hydrogeological and topographical maps the groundwater table was anticipated to be encountered at shallow to moderate depth within the Head Deposits and Bognor Sand Member capping the impermeable London Clay Formation. Perched water

	was also likely to be found within the Made Ground, especially after periods of intense or prolonged rainfall. It was considered that the groundwater was flowing southwards, towards the Riders stream located on the southern boundary of the site in alignment with local topography. Riders Stream (main river status) was noted adjacent to the southern boundary of the site, ultimately discharging into an ecological asset named Langstone Harbour. No other surface water features were noted within a 250m radius of the site. Examination of the Environment Agency records showed that the vast majority of the site was noted to be classified as Flood Zone 1. A small portion of the site, directly adjacent to the Riders Stream, was noted to be classified as Flood Zone 3. The site was not protected by flood defences or benefiting from flood storage.
CONTAMINATION	Full details can be found within Section 5 of this report.
REMEDIATION	Full details can be found within Section 6. Soils The soil remediation has been split into private garden areas and communal soft landscaped areas. <u>Private Garden Areas</u> Based on the available information within this report it was proposed that the following remedial methodology should be undertaken within all private garden areas: Reduce dig of 600mm; Placement of 150mm anti-dig layer, overlaid by a geotextile marker membrane; Placement of 450mm clean capping of soil; 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. <u>Communal Soft Landscaped Areas</u> Based on the available information within this report it was proposed that the following remedial methodology should be undertaken within all communal soft landscaped areas: Reduce dig of 450mm; Placement of 150mm anti-dig layer, overlaid by a geotextile marker membrane; Placement of 300mm clean capping of soil; 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. Water Supply Pipes The Water Supply pipe risk assessment indicated that the use of PE pipes is appropriate at the site and no further measures are required.

	Groundwater The level 2 (groundwater) risk assessment has been undertaken and found a number of marginally elevated metals and inorganics within the groundwater on-site. A review of the soils assessment did not identify elevated cyanide within the Made Ground soils on-site. Similarly, other than lead, no metals were noted to be elevated within the Made Ground on-site. The groundwater results do not indicate that lead is elevated within the groundwater. Three other SVOCs were noted to be above the laboratory limit of detection. Research to find a GAC value did not identify a published threshold value within groundwater and therefore they are not considered to pose a vapour risk to the end users. Given the above the Made Ground soils on-site are not considered to be the source of the elevated determinands found within the groundwater. The understanding of the hydrogeological model indicates that the elevated determinands are likely caused by off-site sources within the nearby site environs, such as the bus depot, works, factory or garage noted within a 100m radius. Therefore, no further action is required. The findings of this risk assessment should be agreed with the Environment Agency. Ground Gas Based on risk assessment undertaken, the site warrants classification as Characteristic Situation CS2, where precautions to prevent the ingress of ground-gas are necessary. Type B buildings on CS2 classified sites require 3.5 points worth of protection, in accordance with BS8485:2015+A1:2019. Points must be made up through a structural barrier, ventilation, and/or membrane, where at least two methods are incorporated. Vapours No vapour protection measures are required on-site.

1. INTRODUCTION

1.1. General

Ground and Water Limited were instructed by Foreman Homes Limited on the 12th June 2024 to conduct a Contamination Assessment Report on the site at Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ. The scope of the investigation was detailed within the fee proposal QU-0264Rev3, dated the 20th May 2024.

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.

A geotechnical ground investigation report was issued in September 2024 and contains all of the geotechnical conclusions for the site. Report Ref. GWPR6068/GIR/September 2024 V1.01.

A contamination assessment was to be undertaken following chemical laboratory testing on soil samples recovered from the site to enable recommendations for the safe redevelopment of the site and the protection of site workers, end-users and the public from any potential contamination identified. The assessment comprises a Tier 2 Generic Quantitative Risk Assessment, under Land Contamination Risk Management (LCRM).

This Site Investigation Report must be read in conjunction with the following reports;

Desk Study Report produced by Ridge and Partners LLP issued in October 2018 referenced 5003415-RDG-XX-ST-DOC-C-0002.
Site Investigation Report produced by Ridge and Partners LLP issued in April 2020 referenced 5012199-RDG-XX-ST-DOC-C-00SIR01.
Site Investigation Report produced by Ridge and Partners LLP issued in July 2021 referenced 5012199-RDG-XX-ST-DOC-C-00SIR02.

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.

Reference has been made to a historical site investigation by another company. Ground and Water Limited cannot be held liable for any shortcomings.

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 ~4,500m^2 roughly rectangular shaped plot of land, situated on the south-eastern corner of the junction of Dunsbury Way to the west and Fulflood Road to the north. The site was located in the northern portion of Havant, a mainly residential town within south-east Hampshire.

The national grid reference for the centre of the site was approximately SU 71324 08235. A site location plan is given within Figure 1. A view of the site development area can be found within Figure 2, with an aerial view of the site visible within Figure 3.

2.2. Site Description

The northern part of the site comprises a single storey masonry former milk packaging and distribution depot building along the north-west boundary with covered bays and a yard in the north-east and east, a toilet block in the north-east corner and parking bays in the west of the site. The building contains predominantly office accommodation at the western end with warehouse, storage, refrigeration and loading areas in the centre and west. The covered bays in the north-east and east of the site, where milk distribution vehicles are believed to have been parked, were noted to be of steel frame construction with brick rear walls and suspected asbestos cement sheeting forming the roofs. The yard was predominantly covered by asphalt surfacing with a concrete slab along the western edge of the yard. No evidence of fuel or chemical storage was observed during the walkover survey and it is understood from planning records that repair, servicing or refuelling of vehicles was not permitted on site under the planning permission for the development of the depot.

The southern part of the site comprises a single storey brick funeral care facility with soft landscaping and parking fronting Dunsbury Way to the west of the building with a yard and garage to the rear (east) of the building. Adjacent to the south of the funeral care building is a residential bungalow, understood to have originally been constructed as the dwelling for the manager of the funeral care facility, with soft landscaping fronting Dunsbury Way and a rear garden to the east. No evidence of fuel or chemical storage was noted in relation to the funeral care facility or the bungalow. The southern boundary of the site is formed by a steep embankment down to the adjacent Riders Stream, approximately 2-3m below the general site level.

At the time of site works in July and August 2024 the site was in the process of being demolished. This was noted to be finished by September 2024.

2.3. Proposed Development

At the time of reporting, October 2024, the proposed development was understood to comprise the re-development of the Former Dairy Crest site and adjacent Southern Co-Op owned land to the south. The development will comprise 74no. apartments spread across the northern and western parts of the site with car parking occupying much of the remainder. A communal amenity space is proposed in the south, while covered bicycle storage located in the centre. Ground floor flats will have private gardens.

The proposed development fell within Geotechnical Design Category 2 in accordance with Eurocode 7. A proposed development plan is displayed within Figure 4.

2.4. Geology

The British Geological Survey (BGS) maps and DEFRA online maps for the area suggest that the site was located on superficial Head Deposits within the western half, classified as a Secondary (Undifferentiated) Aquifer, no superficial deposits were recorded within the eastern half of the site. This was underlain by the Bognor Sand Member, classified as a Secondary (A) Aquifer, within the eastern half of the site and the London Clay Formation, classified as Unproductive Strata, within the western half of the site. The superficial and bedrock aquifers are considered to be in hydraulic continuity.

A BGS borehole record in similar geology ~1km north of the site (ref.: SU70NW320) noted Topsoil to 0.30m bgl, followed by a silty fine sand with bands of very sandy clay to a depth of 5.60m bgl. This was followed by a very silty grey CLAY to the base of the borehole at a depth of 34.40m bgl. Numerous water levels recorded throughout the drilling, shallowest level recorded at 4.39m bgl.

2.5. Hydrogeology and Hydrology

Examination of the Environment Agency records showed that the site did fall within a Zone 1I – Subsurface Activity Groundwater Source Protection Zone (SPZ) as classified in the Policy and Practice for the Protection of Groundwater.

From analysis of hydrogeological and topographical maps the groundwater table was anticipated to be encountered at shallow to moderate depth within the Head Deposits and Bognor Sand Member capping the impermeable London Clay Formation. Perched water was also likely to be found within the Made Ground, especially after periods of intense or prolonged rainfall. It was considered that the groundwater was flowing southwards, towards the Riders stream located on the southern boundary of the site in alignment with local topography.

Riders Stream (main river status) was noted adjacent to the southern boundary of the site, ultimately discharging into an ecological asset named Langstone Harbour. No other surface water features were noted within a 250m radius of the site.

Examination of the Environment Agency records showed that the vast majority of the site was noted to be classified as Flood Zone 1. A small portion of the site, directly adjacent to the Riders Stream, was noted to be classified as Flood Zone 3. The site was not protected by flood defences or benefiting from flood storage.

2.6. Radon

A review of the freely available UK Health Security Agency radon database, UK Radon, indicated that the site was located within a 1km grid square, where the maximum radon potential of <1% was recorded. The neighbouring 1km grid square was noted to have a maximum radon potential of 5 – 10%. Basic radon protection measures are required in areas where more than 3% of houses are at or above the Action Level.

The site was in an area where a risk assessment was not required.

2.7. Internet Search (Site Setting)

2.7.1. Available Unexploded Ordnance (UXO) Map Review

A review of the data available on www.zeticauxo.com/ revealed the site was located within a low-risk area associated with unexploded ordnance (UXO), as indicated by having <15 bombs dropped per 1000 acres. No Strategic Targets or Other Points of Note were recorded within a 1km radius of the site.

2.7.2. Historical Landfill Tool Review

A review of the data available on www.groundsure.io/ revealed no areas of Historical or Authorised Landfills within a 250m radius of the site.

2.8. Preliminary Risk Assessment

The tabulated Conceptual Site Model developed as part of the Ridge and Partners LLP Desk Study (5003415-RDG-XX-ST-DOC-C-0002) 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: 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 (Residents/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 (Undifferentiated) Aquifer & Secondary A Aquifer Riders Stream	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
Ground gases generated by Made Ground and organic materials: Methane, Carbon Dioxide, Hydrogen Sulphide, and Carbon Monoxide.	Migration through anthropogenic & natural pathways Inhalation of Asphyxiating gases Explosion (methane only)	Human Health End Users (Residents/Future site visitors) Construction workers during development (especially in confined spaces) Site operatives during maintenance works in confined spaces Neighbours and public	Moderate
	Migration through anthropogenic & natural pathways Explosion (methane only)	Building Materials and Services Buildings Confined spaces Underground services	Moderate

Tabulated Conceptual Site Model – Pollutant Linkage Summary			(Off-Site Sources)
Potential Sources	Potential Absorption Pathways	Potential Receptors	Risk Classification
Made Ground from nearby construction and demolition works: 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 Direct ingestion of groundwater Inhalation of volatile vapour (indoors and outdoors)	Human Health End Users (Residents/Future site visitors) Construction workers during development Site operatives during maintenance works	Moderate
	Direct uptake of groundwater	Flora and Fauna Vegetation within soft landscaped areas	Moderate
Aggressive ground conditions associated with impacted groundwater; Sulphates, PAH/TPH.	Direct contact with aggressive ground conditions	Building Materials and Services Buried Concrete Underground services (water pipes)	Moderate
Ground gases generated by Made Ground: Methane, Carbon Dioxide, Hydrogen Sulphide, and Carbon Monoxide.	Migration through anthropogenic & natural pathways Inhalation of Asphyxiating gases Explosion (methane only)	Human Health End Users (Residents/Future site visitors) Construction workers during development (especially in confined spaces) Site operatives during maintenance works in confined spaces	Moderate
	Migration through anthropogenic & natural pathways Explosion (methane only)	Building Materials and Services Buildings Confined spaces Underground services	Moderate
Contaminants associated with off site depots, vehicle repair, service centre factory and works: Asbestos, PAHs, TPHs, VOCs, Sulphates, and	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 Direct ingestion of groundwater Inhalation of volatile vapour (indoors and outdoors)	Human Health End Users (Residents/Future site visitors) Construction workers during development Site operatives during maintenance works	Moderate
	Direct uptake of groundwater	Flora and Fauna Vegetation within soft landscaped areas	Moderate

Tabulated Conceptual Site Model – Pollutant Linkage Summary			(Off-Site Sources)
Potential Sources	Potential Absorption Pathways	Potential Receptors	Risk Classification
Metals.			

3. SITE WORKS

3.1. Scope of Works

Site works were undertaken between 16th – 18th July 2024 and comprised the drilling of the 2no. cable percussive boreholes (BH01 & BH02) to 20.00m with standard penetration tests at 1.00m intervals to a depth of 3.00m bgl, with SPTs and U100's alternating at 1.50m intervals thereafter to the base of the borehole. The installations of 2No. combined ground water and ground gas monitoring wells were installed within BH01 and BH02, the details of which can be found in the following table.

Combined Ground-gas and Groundwater Monitoring Well Construction					
Trial Hole	Depth of Installation (m bgl)	Thickness of slotted piping with gravel filter pack (m)	Depth of plain piping with bentonite seal (m bgl)	Response Zone (m bgl)	Piping internal diameter (mm)
BH01	5.00	3.00	2.00	2.00 – 5.00	50
BH02	8.00	3.00	5.00	5.00 – 8.00	50
WS105	4.50	3.40	1.10	1.10 – 4.50	50

A second phase of site works was undertaken on 7th August and comprised the drilling of 5No. Windowless Sampler Boreholes (WS101 – WS105) to depths between 4.60 – 5.45m bgl. SPTs were undertaken a 1.00m intervals to the base of the trial holes. A combined groundwater and ground gas monitoring well was installed to a depth of 4.50m bgl with a response zone noted between 1.10 – 4.50m bgl. Details have been provided in the following table.

The location of the trial hole locations can be seen within Figure 5.

Prior to commencing the ground investigation, a walkover survey was carried out to identify the presence of underground services and drainage. Where underground services/drainage were suspected and/or positively identified, the exploratory position was relocated away from these areas.

As a further precautionary measure, the borehole was hand excavated to 1.20m below the local ground level (bgl) and scanned with a Cable Avoidance Tool (CAT scanner) to minimise the risk to services.

Upon completion of the drilling works, the trial holes were backfilled and made good, in relation to the surrounding area.

3.2. Sampling Procedures

Small disturbed samples and environmental samples were recovered from the trial holes at the depths shown on the trial hole records. Soil samples were generally retrieved from each change of strata and/or at specific areas of concern. Samples were also taken at approximately 0.5m intervals during broad homogenous soil horizons.

A selection of samples were despatched to a laboratory for chemical testing purposes.

4. ENCOUNTERED GROUND CONDITIONS

4.1. Soil Conditions

The trial holes were logged by a Ground and Water Limited representative, generally in accordance with BS EN 14688 'Geotechnical Investigation and Testing – Identification and Classification of Soil'.

The ground conditions encountered within the trial holes constructed on the site did generally conform to that anticipated from examination of the geology map. A capping of Made Ground was noted to overlie the superficial Head Deposits and Bognor Sand Member deposits, underlain by the bedrock London Clay Formation.

The succession of conditions and description of soils encountered in the trial holes in descending order is tabulated below.

Summary of Strata Encountered (BH01 - BH02 & WS101 – WS105)			
Strata	Top Depth (m bgl)	Base Depth (m bgl)	Thickness (m)
MADE GROUND (BH1-BH02 & WS101 – WS105): Brown silty sandy gravelly CLAY. Sand is fine to medium. Gravel is angular to subrounded fine to coarse flint, brick, chalk, carbonaceous material and concrete.	GL – 0.90	1.10 – 3.00	1.10 – 2.10
MADE GROUND (BH02): Reddish brown gravelly fine to coarse SAND. Gravel is angular to sub-rounded fine to coarse brick.	GL	0.90	0.90
MADE GROUND (WS103): Brown silty slightly gravelly fine to coarse SAND. Gravel is fine to coarse subangular to rounded flint. Fragments of red brick.	0.80	2.60	1.80
HEAD DEPOSITS (BH02): Greyish brown silty sandy angular to sub-rounded fine to coarse GRAVEL comprised of flint. Sand is fine to coarse.	3.00	4.20	1.20
HEAD DEPOSITS (WS103): Grey and brown clayey fine to medium SAND.	2.60	>5.45	>2.85
HEAD DEPOSITS (WS105): Dark grey slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine sub-rounded flint.	1.10	2.80	1.70
BOGNOR SAND MEMBER (WS102 & WS105): Orangish brown slightly sandy (slightly gravelly) CLAY. Sand is fine to coarse. Gravel is fine to medium angular flint.	1.20 – 2.80	3.10 – 3.90	1.10 - 1.90
BOGNOR SAND MEMBER (BH01 & WS101 – WS102 & WS104): Orangish brown silty (slightly gravelly) fine to medium SAND. (Gravel is fine to coarse angular flint.)	1.10 – 3.10	3.70 - 4.30	0.80 – 2.60
LONDON CLAY FORMATION (BH01 - BH02 & WS101 – WS102 & WS104 – WS105): Dark grey brown to Blueish grey silty slightly sandy CLAY. Sand is fine.	3.55 - 4.30	>4.60 – >20.00	>1.05 - >15.80

For details of the composition of the soils encountered at particular points, reference must be made to the individual trial hole logs within Appendix C of this report. A trial hole location plan can also be viewed within Figure 5.

4.2. Roots Encountered

Fresh roots were proven to depths between 1.10 – 1.50m bgl across the site. The depths of root penetration can be seen tabulated below.

Summary of Root Penetration	
Trial Hole	Fresh Root Depth (m bgl)
BH01	None noted.
BH02	None noted.
WS101	1.10
WS102	1.50
WS103	1.10
WS104	1.10
WS105	None noted.

It should be noted that the accuracy of determining the depth of root penetration within narrow diameter boreholes is considered low. The site and its immediate environs were noted to contain a number of existing trees and vegetation. Therefore, it should be noted that roots may be found to greater depths at other locations on the site, particularly close to trees and/or trees that have been removed both within the site and its close environs.

4.3. Groundwater Conditions

Groundwater was encountered at shallow to intermediate depth within all of the boreholes undertaken on-site. A summary can be seen in the following table.

Summary of Groundwater Strikes		
Trial Hole	Depth of Strike (m bgl)	Depth after 20 minutes (m bgl)
BH01	2.60	2.40
BH02	3.30	2.90
WS101	2.00	-
WS102	2.35	-
WS103	2.30	-
WS104	2.10	-
WS105	3.50	-

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was undertaken in July – August 2024 when groundwater levels are likely to be approaching their annual minimum (lowest elevation). Exact groundwater levels may only be determined through long term measurements from monitoring wells installed on-site.

Groundwater monitoring was undertaken on six occasions. A summary can be seen in the following table.

Summary of Groundwater Observations			
Date	Trial Hole	Water Level	Final Well Depth
08/08/2024	BH01	2.10	5.20
	BH02	2.43	3.14
	WS105	2.20	4.33
20/09/2024	BH01	DRY	4.52
	BH02	3.30	8.00
	WS105	4.23	4.44
27/09/2024	BH01	1.35	5.52
	BH02	2.42	10.30
	WS105	-	-

Summary of Groundwater Observations			
Date	Trial Hole	Water Level	Final Well Depth
02/10/2024	BH01	1.24	5.52
	BH02	2.39	10.30
	WS105	-	-
04/01/2024	BH01	1.80	5.00
	BH02	2.90	10.30
	WS105	-	-
07/10/2024	BH01	2.10	5.30
	BH02	2.60	10.56
	WS105	-	-

4.4. Obstructions

No artificial or natural sub-surface obstructions were noted during construction of the trial holes.

5. CONTAMINATION RISK ASSESSMENT

5.1. Results of the Preliminary Risk Assessment

The tabulated Conceptual Site Model developed as part of the Ridge and Partners LLP Desk Study (5003415-RDG-XX-ST-DOC-C-0002) is reproduced in section 2.8. For the complete information please see the Desk Study report.

No additional source of contamination, pathway or receptor was identified between the desk study and the ground investigation and as such, it was not necessary to modify the CSM.

In the UK, the assessment of risk from contamination follows the source-pathway-receptor (SPR) approach. For a risk to be present there must be a source of contamination, a receptor or receptors, and a pathway for contaminants to migrate or be absorbed. If there is a linkage between any given source and receptor, then a quantitative risk assessment is used to assess the significance or impact of the pollutant linkage.

5.2. Sampling Locations

The synopsis for the trial hole locations and their final depth can be seen tabulated below. A trial hole location plan is provided within Figure 5. The table also indicates whether any locations targeted a source of contamination as well as the proposed end-use. The proposed development can be seen in Figure 4.

Trial Hole Location Synopsis		
Trial Hole/Final Depth	Sampling Strategy	Proposed End-Use
BH101/20.00m	Random	Footprint of Proposed Building
BH102/20.00m	Random	Footprint of Proposed Building
WS101/5.45m	Random	Footprint of Proposed Building
WS102/5.45m	Random	Hardstanding
WS103/5.45m	Random	Hardstanding
WS104/5.45m	Random	Footprint of Proposed Building
WS105/4.60m	Random	Hardstanding

The investigation area totals approximately 4,500m^2 and with seven sampling locations, given an unknown hotspot shape, the sampling density means that a hotspot with an area of approximately 965m^2 and a radius of approximately 17.50m would be encountered (CLR 4).

5.3. Soil Risk Assessment

Sampling depths were chosen to reflect the receptor of concern (e.g. human health, controlled waters and vegetation). The remaining samples were scheduled under a random strategy. The receptors relevant to the sampling depths are tabulated below.

Summary of Receptors per Sample Depth	
Depth	Receptors
Shallow Samples (< 0.75m bgl)	End Users (Residents/Future site visitors) Construction workers during development Site operatives during maintenance works Neighbours and public Vegetation within soft landscaped areas (shallow rooted) Secondary (Undifferentiated) Aquifer – Head Deposits

	Secondary A Aquifer – Bognor Sand Member Buried Concrete Receiving landfill
Moderate Samples (0.75 – 1.50m bgl)	Construction workers during development Site operatives during maintenance works Vegetation within soft landscaped areas (deep rooted) Secondary (Undifferentiated) Aquifer – Head Deposits Secondary A Aquifer – Bognor Sand Member Buried Concrete Receiving landfill Underground services (water pipes)

Chemical laboratory testing, scheduled by Ground and Water Limited, and carried out by ALS Laboratories UK Limited, was undertaken on four samples of Made Ground. The samples were subjected to a combination of analysis that comprised:

Asbestos screen;
Semi-metals and heavy metals incl. Arsenic, Cadmium, Chromium (incl. Hexavalent Chromium), Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc;
Polycyclic Aromatic Hydrocarbons (PAH's) incl. Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(ghi)perylene;
Speciated TPH including full aliphatic/aromatic split;
BTEX compounds (Benzene, Toluene, Ethylbenzene, Xylene) and MTBE – used as marker compounds for Volatile Organic Compounds (VOCs);

A breakdown of the number of tests undertaken for each determinand is discussed in further sections. The chemical laboratory results are presented in Appendix D.

5.3.1. Soil Assessment Criteria and Results

At the time of reporting, August 2024, the proposed development was understood to comprise the re-development of the Former Dairy Crest site and adjacent Southern Co-Op owned land to the south. The development will comprise 74no. apartments spread across the northern and western parts of the site with car parking occupying much of the remainder. A communal amenity space is proposed in the south, while covered bicycle storage located in the centre. Ground floor flats will have private gardens.

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.

Where a contaminant of concern's GAC varies according to the Soil's Organic Matter (SOM), the SOM recorded for each uncontaminated soil type was used to derive the appropriate GAC for each soil type. A SOM value of 1%, the most conservative value, was utilised.

A summary of the analytical results and the comparison to the determinands adopted screening value are presented in the table below and overleaf.

Soil Contamination Test Results and Screening Values					
Determinand	Number of Samples	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Adopted Screening Value (mg/kg)	Was the adopted screening value exceeded for relevant land-use scenario?
INORGANICS					
Asbestos	4	ND	Detected	ND	Yes – WS101/1.00m
Cyanide (total)	4	< 1	< 1	24	No
Phenols	4	< 1	< 1	280	No
METALS					
Arsenic	4	8.5	11	37	No
Boron	4	0.5	1.5	290	No
Cadmium	4	< 0.2	<0.2	11	No
Chromium (III)	4	17	23	910	No
Chromium (Hexavalent)	4	< 1.8	< 1.8	6	No
Copper	4	14	21	2,400	No
Lead	4	61	280	200	Yes – BH1/0.80m
Mercury	4	< 0.3	< 0.3	1.2	No
Nickel	4	9.1	12	130	No
Selenium	4	< 1	< 1	250	No
Vanadium	4	29	39	410	No
Zinc	4	54	150	3,700	No
TOTAL PETROLEUM HYDROCARBONS (TPHs)					
Aliphatic >C5 - C6	1	< 0.020	< 0.020	42	No
Aliphatic >C6 - C8	1	< 0.020	< 0.020	100	No
Aliphatic >C8 - C10	1	< 0.050	< 0.050	27	No
Aliphatic >C10 - C12	1	< 1	< 1	130	No
Aliphatic >C12 - C16	1	< 2	< 2	1,100	No
Aliphatic >C16 - C21	1	< 8	< 8	65,000	No
Aliphatic >C21 - C35	1	< 8	< 8		
Aliphatic >C35 – C40	1	<10	<10	65,000	No
Aromatic >C5 - C7	1	< 0.010	< 0.010	70	No
Aromatic >C7 - C8	1	< 0.010	< 0.010	130	No
Aromatic >C8 - C10	1	< 0.050	< 0.050	34	No
Aromatic >C10 - C12	1	< 1	< 1	74	No
Aromatic >C12 - C16	1	< 2	< 2	140	No
Aromatic >C16 - C21	1	< 10	< 10	260	No
Aromatic >C21 - C35	1	< 10	< 10	1,100	No
Aromatic >C35 – C40	1	<10	< 10	1100	No
Benzene	1	< 5	< 5	0.087	No
Toluene	1	< 5	< 5	130	No
Ethylbenzene	1	< 5	< 5	47	No
m,p-Xylene	1	< 5	< 5	56	No
o-Xylene	1	< 5	< 5	60	No
POLYCYCLIC-AROMATIC HYDROCARBONS					

Acenapthene	4	< 0.05	0.15	210	No
Acenapthylene	4	< 0.05	< 0.05	170	No
Anthracene	4	< 0.05	0.49	2,400	No
Benzo(a)anthracene	4	< 0.05	1.4	7.2	No
Benzo(a)pyrene	4	0.19	1.3	2.2	No
Benzo(b)fluoranthene	4	0.17	1.50	2.6	No
Benzo(ghi)perylene	4	< 0.05	0.56	320	No
Benzo(k)fluoranthene	4	0.13	0.76	77	No
Chrysene	4	0.17	1.40	15	No
Dibenzo(a,h)anthracene	4	< 0.05	0.14	0.24	No
Fluoranthene	4	0.33	2.9	280	No
Fluorene	4	< 0.05	0.13	170	No
Indeno(1,2,3-cd)pyrene	4	< 0.05	0.51	27	No
Naphthalene	4	< 0.05	0.08	2.3	No
Phenanthrene	4	0.13	1.6	95	No
Pyrene	4	0.3	2.6	620	No
MARKER FOR VOLATILE ORGANIC COMPOUND					
Methyl tert-butyl ether (MTBE)	1	< 5	< 5	49	No
The derivation of the Soil Assessment Criteria used within this report can be seen within Appendix E. The soil concentrations were typically compared to the LQM/CIEH Suitable for Use Levels (S4UL) (2014), based upon the assumption of 1% soil organic matter. A screening value for Lead is based on the Category 4 Screening Levels (C4SLs). Where no S4UL or C4SL is available for Cyanide, a SoBRA acute GAC is assigned. Where no S4UL or C4SL is available for MTBE, a CL:AIRE 2010 GAC is assigned. Where exceedances are noted, the trial hole and depth of sample is recorded.					

The proposed development includes areas of soft-landscaping, where shallow rooted vegetation may be exposed to aggressive ground conditions. The previous table compares the results of the laboratory analysis to GAC that is protective of Human Health and therefore different GAC is required for vegetation.

Soil Contamination Test Results and Screening Value					
Determinand	Number of Samples	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Adopted Screening Value (mg/kg)	Was the adopted screening value exceeded for relevant land-use scenario?
Copper	4	14	21	100	No
Nickel	4	9.1	12	60	No
Zinc	4	54	150	200	No
The derivation of the Soil Assessment Criteria used within this report can be seen within Appendix E. The soil concentrations were compared to BS3882:2015 Specification for Topsoil and based on differing pH. For the purpose of conservatism, the pH of the soils have been assumed to be below 6 within this table. Where exceedances are noted, the trial hole and depth of sample is recorded.					

5.3.2. Soil Assessment

The comparison between the laboratory analysis and the assessment criteria indicates that there is an unacceptable risk to future receptors caused by exceedances of the following determinands: Lead; Asbestos. The remaining determinands were identified at below the adopted screening value and are

not considered to represent an unacceptable risk to future receptors. Where an unacceptable risk to future receptors remains, mitigation is required.

Lead was noted to be elevated within one sample (BH1/0.80m bgl) at 280mg/kg above the S4UL threshold of 200mg/kg for a 'Residential with Homegrown Produce' land-use scenario.

Due to the nature of the contamination encountered at the site, it is considered that there is an unacceptable risk to future receptors. Remediation, as outlined later within this report is required as part of any site development.

Asbestos

Asbestos was identified within one sample (WS101/1.00m) as amosite loose fibres. Quantification was ongoing at the time of reporting. Given the depth that the sample was recorded at and the location, beneath the building footprint there is only considered to be a short-term risk to development/construction workers and more specifically groundworkers from asbestos.

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.

Ridge and Partners Data – Soil Testing

Testing was undertaken on 9No. samples from across the site area. It should be noted that these were undertaken in areas of external hardstanding or soft landscaping and not within the footprint of the historical buildings on-site. The ground and water data is targeted to the footprint of the former buildings post demolition in order to improve site coverage in these areas.

Asbestos was detected in two of the nine samples tested. WS1-0.30m identified small bundles of chrysotile at <0.001% of the total sample volume. WS2-0.50m identified chrysotile and crocidolite present in microscopic loose fibrous debris <0.003% of the total sample by volume. Asbestos was identified in samples obtained from Made Ground soils only, asbestos was not detected in natural soils.

There were exceedances of the GAC for lead. Samples obtained from WS1-0.30m, WS3-0.70m and WS2-0.50m returned concentrations for lead of 384, 362 and 400mg/kg respectively, which exceeded the GAC of 200mg/kg. All samples exceeding the lead GAC were removed from Made Ground soils, there were no exceedances of natural soils. Following statistical analysis, those samples exceeding the lead GAC can be classified as significant outliers ($P<0.05$) when compared to the remainder of the Made Ground dataset. Therefore, lead results at WS1-0.30m, WS3-0.70m and WS2-0.50m are considered to represent isolated lead contamination 'hotspots'.

There were five exceedances of the PAH GAC, all returned from one sample WS1-0.30m. The sample was obtained from Made Ground comprising brick. There were no exceedances of natural soils. Following statistical analysis, all determinands exceeding PAH GAC in the sample obtained from WS1 at 0.30m can be classified as significant outliers ($P<0.05$) when compared to the remainder of the Made Ground dataset. Therefore, PAH results at WS1-0.30m are considered to represent an isolated PAH contamination 'hotspot'.

5.3.3. 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	< 5	No
Total VOCs	0.5	Marker compounds at lab LOD	No
Total SVOCs	2	Marker compounds at lab LOD	No
Phenols	2	< 1	No
TPH EC5 – EC10 (aliphatics and aromatics)	2	< 0.05	No
TPH EC10 – EC16 (aliphatics and aromatics)	10	< 4	No
TPH EC16 – EC40 (aliphatics and aromatics)	500	< 20	No
Naphthalene	5	< 0.05 – 0.08	No

The results indicate that no determinands were above the threshold for the use of a PE pipe at the site.

5.4. 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. In addition to the water environment receptors, contaminated groundwater has the potential to cause unacceptable risk to human health through vapours.

5.4.1. Background Information

The British Geological Survey (BGS) maps and DEFRA online maps for the area suggest that the site was located on superficial Head Deposits within the western half, classified as a Secondary (Undifferentiated) Aquifer, no superficial deposits were recorded within the eastern half of the site. This was underlain by the Bognor Sand Member, classified as a Secondary (A) Aquifer, within the eastern half of the site and the London Clay Formation, classified as Unproductive Strata, within the western half of the site. The superficial and bedrock aquifers are considered to be in hydraulic continuity.

Examination of the Environment Agency records showed that the site did fall within a Zone 1I – Subsurface Activity Groundwater Source Protection Zone (SPZ) as classified in the Policy and Practice for the Protection of Groundwater.

From analysis of hydrogeological and topographical maps the groundwater table was anticipated to be encountered at shallow to moderate depth within the Head Deposits and Bognor Sand Member capping the impermeable London Clay Formation. Perched water was also likely to be found within the Made Ground, especially after periods of intense or prolonged rainfall. It was considered that the groundwater was flowing southwards, towards the Riders stream located on the southern boundary of the site in alignment with local topography.

Riders Stream (main river status) was noted adjacent to the southern boundary of the site, ultimately discharging into an ecological asset named Langstone Harbour. No other surface water features were noted within a 250m radius of the site.

Examination of the Environment Agency records showed that the vast majority of the site was noted to be classified as Flood Zone 1. A small portion of the site, directly adjacent to the Riders Stream, was noted to be classified as Flood Zone 3. The site was not protected by flood defences or benefiting from flood storage.

During the site investigation, Made Ground was encountered to a maximum depth of 2.60m bgl, overlying granular and cohesive deposits of the superficial Head Deposits to depths between 2.80 - >5.45m bgl. This was underlain by cohesive and granular deposits of the Bognor Sand Member to depths between 3.10 – 4.30m bgl. This was underlain by cohesive deposits of the London Clay Formation to the base of the boreholes at depths between >4.60 - >20.00m bgl. Groundwater strikes were recorded between 2.60 – 3.30m bgl within BH101 & BH102 during site works.

Following the site investigation, 6No. return groundwater monitoring visits were undertaken. The groundwater levels can be seen can be seen below.

Summary of Groundwater Observations			
Date	Trial Hole	Water Level	Final Well Depth
08/08/2024	BH01	2.10	5.20
	BH02	2.43	3.14
	WS105	2.20	4.33
20/09/2024	BH01	DRY	4.52
	BH02	3.30	8.00
	WS105	4.23	4.44
27/09/2024	BH01	1.35	5.52
	BH02	2.42	10.30
	WS105	-	-
02/10/2024	BH01	1.24	5.52
	BH02	2.39	10.30
	WS105	-	-
04/01/2024	BH01	1.80	5.00
	BH02	2.90	10.30
	WS105	-	-
07/10/2024	BH01	2.10	5.30
	BH02	2.60	10.56
	WS105	-	-

During the monitoring round on the 16th August and 27th September 2024, samples were recovered from boreholes WS105 and BH101 respectively, following the removal of three times the borehole

volume. Samples were collected within a series of plastic and glass bottles, glass vials and bottles with preservatives to meet the requirements of BS5667 and as requested by the laboratory.

Ridge and Partners Data – Water Testing

Testing of the groundwater was undertaken on 3No. samples recovered during a round of monitoring.

There were no exceedances of the GAC, and the majority of results were below LOD.

Analytical results mirror observations made in the field, in that there was no visual/ olfactory evidence of contamination noted during groundwater sampling.

Groundwater was shown to rest at an average of 1.70mbgl. Soil exceedances were identified in soils at 0.30-0.70mbgl and therefore it is unlikely soil contamination has migrated to groundwater.

5.4.2. Level 2 (groundwater) Risk Assessment

As the site is located on a Secondary (Undifferentiated) Aquifer comprising the superficial Head Deposits and a Secondary A Aquifer comprising the bedrock Bognor Sand Member. It is considered that the aquifer may support base flow to rivers and surface water at a local level. It is therefore concluded that the most applicable screening values to be used is the Environmental Quality Standards (EQS), which are protective of ecology within the water. Where no EQS is available, other water quality standards have been noted within the table. A level 2 (groundwater) risk assessment compares the recorded concentration of a determinand to a pre-defined GAC (EQS, USEPA and UK drinking water standard).

The chemical laboratory results are presented in Appendix D and have been summarised within the table below and overleaf. Only determinands that have an appropriate screening value have been included within the table.

Groundwater Contamination Test Results and Screening Values				
Determinand	Minimum Concentration (µg/l)	Maximum Concentration (µg/l)	Adopted Screening Value (µg/l)	Was the adopted screening value exceeded?
INORGANICS				
pH	7	10	6.5 – 9.5[5]	Yes – BH101
Cyanide	< 1	2.7	1[1]	Yes – BH101
Phenols	< 1	< 1	7.7[1]	No
METALS				
Arsenic	1.09	3.26	50[1]	No
Boron	44	260	750[1]	No
Cadmium	< 0.02	0.05	0.08 – 0.25[1,2]	No
Chromium (III)	<0.2	17	4.7[1]	No
Chromium (Hexavalent)	< 5	15	3.4[1]	Yes – BH101
Copper	13	14	1[1,4]	Yes – BH101
Lead	<0.2	0.2	1.2[1]	No
Mercury	< 0.05	< 0.05	0.07[1]	No
Nickel	3.3	9.2	4[1]	Yes – BH101
Selenium	1.3	12	7.5[1]	Yes – BH101
Vanadium	0.5	18	86[6]	No

Zinc	0.9	5.7	10.9[1,4]	No
PETROLEUM HYDROCARBONS				
Aliphatic >C5 – C6	<1	<1	15,000[3]	No
Aliphatic >C6 – C8	<1	<1		No
Aliphatic >C8 – C10	<1	<1	300[3]	No
Aliphatic >C10 – C12	<10	<10		No
Aliphatic >C12 – C16	<10	<10		No
Aliphatic >C16 – C21	<10	<10	Not derived	No
Aliphatic >C21 – C35	<10	<10	Not derived	No
Aromatic >EC5 – EC7	<1	<1	10[3]	No
Aromatic >EC7 – EC8	<1	<1	700[3]	No
Aromatic >EC8 – EC10	<1	<1	300[3]	No
Aromatic >EC10 – EC12	<10	<10	90[3]	No
Aromatic >EC12 – EC16	<10	<10		No
Aromatic >EC16 – EC21	<10	<10	90[3]	No
Aromatic >EC21 – EC35	<10	<10		No
Total TPH	<10	<10	10[51]	No
Benzene	< 3	< 3	10[1]	No
Toluene	< 3	< 3	74[1]	No
Ethylbenzene	< 3	< 3	300[3]	No
Xylene	< 3	< 3	15.5-63.6[1]	No
POLYCYCLIC-AROMATIC HYDROCARBONS				
Anthracene	< 0.01	< 0.01	0.1[1]	No
Benzo(a)pyrene	< 0.01	< 0.01	0.00017[1]	No
Benzo(b)fluoranthene	< 0.01	< 0.01	[7]	No
Benzo(k)fluoranthene	< 0.01	< 0.01		No
Benzo(ghi)perylene	< 0.01	< 0.01	[7]	No
Dibenzo(a,h)anthracene	< 0.01	< 0.01	0.0025[6]	No
Fluoranthene	< 0.01	< 0.01	0.0063[1]	No
Fluorene	< 0.01	< 0.01	290[6]	No
Indeno(1,2,3-cd)pyrene	< 0.01	< 0.01	[7]	No
Naphthalene	< 0.01	< 0.01	2[1]	No
Total EPA-16 PAHs	<0.16	<0.16	0.1[5]	No
VOLATILE ORGANIC COMPOUNDs (VOCs)				
ALL BELOW LABORATORY LIMIT OF DETECTION	<3	<3	-	No
SEMI-VOLATILE ORGANIC COMPOUND (SVOCs) (WHERE ABOVE LOD)				
Dimethylphthalate	0.39	39	-	No
Diethyl phthalate	<0.05	0.45	Classed as inert by USEPA.	No
Dibutyl phthalate	<0.05	0.15	-	

[1]Environmental Quality Standards (EQS)
[2]Screening value changes as a result of calcium carbonate concentration of aquifer
[3]WHO Guidelines for drinking water quality, 2022
[4]Site specific threshold calculated based on the bio-availability per sample
[5]UK Drinking Water Standards
[6]United States Environmental Protection Agency
[7]For the group of priority substances for PAH, the AA EQS in water refer to the concentration of Benzo(a)pyrene on the toxicity of which they are based. Benzo(a)pyrene can be considered as a marker for other PAH's, hence only Benzo(a)pyrene must be monitored for comparison with the AA EQS.

The level 2 (groundwater) risk assessment has been undertaken and found a number of marginally elevated metals and inorganics within the groundwater on-site. A review of the soils assessment did not identify elevated cyanide within the Made Ground soils on-site. Similarly, other than lead, no metals were noted to be elevated within the Made Ground on-site. The groundwater results do not indicate that lead is elevated within the groundwater. Three other SVOCs were noted to be above the laboratory limit of detection. Research to find a GAC value did not identify a published threshold value within groundwater and therefore they are not considered to pose a vapour risk to the end users.

Given the above the Made Ground soils on-site are not considered to be the source of the elevated determinands found within the groundwater. The understanding of the hydrogeological model indicates that the elevated determinands are likely caused by off-site sources within the nearby site environs, such as the bus depot, works, factory or garage noted within a 100m radius. Therefore, no further action is required. The findings of this risk assessment should be agreed with the Environment Agency.

5.5. Ground Gas Risk Assessment

A review of the Phase I desk study, has identified a source of ground gas on-site or within influencing distance of the site that warrants investigation through ground gas monitoring.

The investigation undertaken to date have identified the main sources of ground gases to be associated with the degradation of putrescible material within Made Ground both on-site and off-site, where the off-site sources include the presence of a nearby garages, depots and works . Ground gases have the potential to migrate vertically through preferential pathways and build up within the proposed development, especially enclosed spaces on the ground floor. Based on the preceding information, ground gas monitoring was undertaken at the site.

5.5.1. Available Data

<u>Soils</u>

An alternative approach to ground gas risk assessment is presented within the CL:AIRE research bulletin RB17 and included within Annex D of BS8485:2015+A1:2019. 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, four samples were submitted to the laboratory for analysis, which identified TOC to vary between 0.5 and 0.9% in the Made Ground. The trial hole logs identified the gravels within the Made Ground to comprise; flint, brick, chalk, carbonaceous material and concrete. Made Ground was identified to a maximum depth between 1.10m and 2.60m bgl.

<u>Gas Monitoring</u>

In order to assess the ground-gas risk, three combined ground-gas/groundwater monitoring standpipes were installed to a maximum depth of 8.00m bgl. The construction of the wells has been tabulated below.

Monitoring Well Construction				
Trial Hole	Piping internal diameter (mm)	Depth of Installation (m bgl)	Response Zone (m bgl)	Response Zone Strata
BH101	50	5.00	2.00 – 5.00	Bognor Sand Member & London Clay Formation
BH102	50	8.00	5.00 – 8.00	London Clay Formation
WS105	50	4.50	1.10 – 4.50	Head Deposits & Bognor Sand Member

Ground-gas monitoring has been undertaken on six occasions by a representative of Ground and Water Limited using a GasData GFM436 landfill gas analyser, where monitoring was undertaken during a combination of atmospheric pressures and pressure trends. During monitoring the borehole flow, as well as concentrations of methane, carbon dioxide, carbon monoxide and hydrogen sulphide were recorded. In addition to the borehole readings, a reading was taken from the ambient air of the site to ensure that the gas analyser was functioning correctly.

The results of the ground-gas monitoring have been tabulated below and the full Ground and Water Limited monitoring results are provided within Appendix F. Where the reliability of the monitoring results will require consideration in line with CIRIA C665 and BS8485:2015+A1:2019, the table has been highlighted orange.

Ground-Gas Monitoring Results							
Trial Hole	Highest CH_4 (% v/v)	Highest CO_2 (% v/v)	Lowest O_2 (% v/v)	Highest H_2S (ppm)	Highest CO (ppm)	Highest Flow Rate (l/hr)	Shallowest Groundwater (m BGL)
Ambient Air	0.00	0.00	19.50[6]	0	0	n/a	n/a
BH101	0.00	2.90[2]	14.20[1]	0	0	0.00	1.24[4]
BH102	0.00	4.60[5]	14.80[1,5]	0	0	0.00	2.39[4]
WS105	0.00	12.00[1]	2.30[1]	0	0	0.00	2.20[1]
Notes: Number [1,2 etc.] indicates monitoring round when recorded.							

It should be noted that a number of the wells were recorded as flooded, and therefore the data within the table above has been highlighted orange when the readings occurred in flooded wells. No methane was encountered during the monitoring rounds. Carbon dioxide was encountered in all boreholes at a maximum concentration of 12.00%v/v, and was elevated during all the monitoring visits undertaken. No positive flow was encountered.

5.5.2. 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

Review of Data Quality			
Geological and hydro-geological conditions	The CSM identified the site to be located on Made Ground toa depth of 2.60m bgl, overlying both permeable and impermeable strata of the Head Deposits and Bognor Sand Member. Groundwater has been encountered at shallow depth during drilling and monitoring.	CIRA C665 & C659, Wilson and Card (1999) and BS 8485 recommend that geology and hydrogeology be fully understood.	The geological and hydrogeological model is 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 4No. samples have identified a range of TOC concentrations between 0.5% and 0.9%.	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 < 4%.	The TOC concentrations are below the limit of 4% in order to use the soil derived approach for the risk assessment. No further action required.
Monitoring period	The monitoring has been undertaken on a total of six occasions to date. Monitoring has been undertaken during a variety of atmospheric conditions including periods of falling, steady and rising pressure.	CIRIA C665 and BS 8576 recommends monitoring over a range of weather conditions. Concentrations of ground gas are likely to be highest during falling pressures, with sharp falls providing the worst-case results. In line with CIRIA C665 / BS8576 a minimum of 6No. monitoring visits are required.	Monitoring should be undertaken over a 2 month period with between weekly and fortnightly readings. Monitoring has been undertaken during atmospheric pressures of between 986.3 and 1016.5 mbar No further action required.
Gas data sets	Carbon dioxide concentrations were recorded up to 12.00%. No methane, hydrogen sulphide or carbon monoxide has been detected during monitoring. No positive flow rates were recorded.	Borehole flow velocity and borehole gas volume (methane and carbon dioxide) are required for ground gas flux categorisation. Modified Wilson and Card classification, CIRIA C665 (2007), BS8485:2015+A1:2019.	6No. suitable gas datasets are available for the risk assessment. No further action required.

5.5.3. Risk Assessment

<u>Soil Derived Method</u>

The intrusive investigation has revealed a maximum thickness of Made Ground of 2.60m overlying both granular and cohesive Head Deposits and Bognor Sand Member. These deposits were underlain by cohesive deposits of the London Clay Formation. Site has undergone a previous phase of construction 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.

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 4No. samples with the analytical results ranging between 0.5 and 0.9%. Furthermore, it is considered that a thickness of 1.10 - 2.60m would not generate sufficient ground gas to pose an unacceptable risk.

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.

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.

Gas Monitoring Data

The ground gas monitoring undertaken to date has been reviewed and following any omissions caused by contradiction of the UK guidance (e.g. flooded wells), is deemed suitable for use in the risk assessment. The monitoring undertaken recorded carbon dioxide concentrations of up to 12.00%v/v and no positive flow was recorded.

Based on the documentation presented in BS 8485:2015+A1:2019 "Code of practice for the characterisation and remediation from ground gas in affected developments", the hazardous gas flow rate (Q_{hg}) should be calculated for each borehole using the equation below.

$$Q_{hg}=(C_{hg}/100) * q$$

Where: Q_{hg} is the measured hazardous gas concentration (in percentage volume-by-volume);
q is the flow rate (in litres per hour) of combined gases found by direct measurement.

The hazardous gas flow rate has been calculated for each borehole, referred to as the Gas Screening Value (GSV) using the worst-case steady-state concentration and flow, from all monitoring to date. The results are presented within the table below. Following the generation of the GSV, a ground gas characteristic situation can be assigned to the borehole. This has also been included within the table below.

Hazardous Gas Flow Rate Assessment							
Trial Hole	CH_4 (%v/v)	CO_2 (%v/v)	Flow Rate (l/hr)	CH_4 GSV (l/hr)	Characteristic Situation	CO_2 GSV (l/hr)	Characteristic Situation
BH101	0.0	2.90	0.0	0.0000	CS1	0.0029	CS1
BH102	0.0	4.60	0.0	0.0000	CS1	0.0046	CS1
WS105	0.0	12.00	0.0	0.0000	CS1	0.0120	CS1

[1]Where a value of 0.0 %v/v is detected the detection error is to be used of 0.2%v/v for methane.
[2]Where a value of 0.0 %v/v is detected the detection error is to be used of 0.1%v/v for carbon dioxide.
[3]Where a value of 0.0 l/hr is detected the detection error is to be used of 0.1 l/hr for flow.

[4]CS1 typically when <1% methane and <5% carbon dioxide otherwise consider an increase to CS2.

Based upon the available ground gas monitoring to date, the risk from ground gas is considered to be very low (CS1), in accordance with BS8485:2015+A1:2019. Carbon monoxide and hydrogen sulphide was not detected at a concentration to warrant further assessment.

Consideration is required to any GSV that falls into the CS1 category, however the methane concentration is greater than 1% and/or the carbon dioxide concentration is greater than 5%. These locations are typical of sites where the hazardous gas concentration is significant, however marginal flow has been recorded during monitoring. It should be noted that consideration does not indicate that an increase is required. The monitoring results indicate due to the elevated Carbon Dioxide results, consideration for an increase is required.

Assessing the sufficiency of the data is a requirement of BS 8576:2013, to determine whether further monitoring is required and the impact that this may have on the risk assessment. The current worst-case scenario is within WS105, which has identified a carbon dioxide GSV of 0.0120 l/hr. A GSV of 0.07 l/hr or above would result in an increase to Characteristic Situation CS2. Should the flow rate remain (0.1l/hr), a carbon dioxide concentration of 70% would be required to increase the classification to CS2. The understanding of the CSM indicates that this is unlikely to occur, however a slight increase may be plausible. Should the concentration of carbon dioxide remain constant (12.00%), a borehole flow rate of 0.583l/hr would be required to increase the classification to CS2. This increase in flow is possible within the understanding of the CSM. A worst-case falling pressure has been noted during monitoring.

Ridge and Partners Data – Gas Monitoring

Gas Monitoring was undertaken on 5No. rounds by Ridge and Partners on 3No. wells installed across the site area. A snippet of the Monitoring Results summary has been included below.

Results from the monitoring programme are summarised in the table below. Atmospheric pressure was noted to be decreasing during monitoring rounds 2 and 5. Monitoring sheets can be viewed in Appendix 3.

	WS1	WS7	WS8	Worst Case
Max. Flow Rate (L/hr)	0	0.30	0.10	0.30
Peak CH_4 (%)	0.20	59.70	0.20	59.70
Peak CO_2 (%)	9.60	1.10	6.80	9.60
Min. O_2 (%)	0.90	0.60	7	0.60
Max. H2S (ppm)	0	0	0	0
Max. CO (ppm)	84	0	2	84
VOCs (ppm)	0.40	0.26	0.39	0.40

Flow was recorded at a maximum of 0.30L/hr. Methane was consistently high in WS7, with a maximum of 59.70% recorded, although it is likely equilibrium levels are closer to 10.70% which was recorded during the last monitoring round. Methane was less than 1% across the remainder of the monitoring wells. Carbon dioxide was recorded above 5% within two of the three monitoring wells with a maximum of 9.60% recorded at WS1 during monitoring round 4. Carbon monoxide was generally

below 10ppm, other than that recorded at WS1 during monitoring round 3, where 84ppm was recorded. This reduced to 6ppm after 30 seconds, and to <1ppm thereafter. PID results were all below 1ppm across the monitoring programme. The results find a classification of the site as CS2.

5.5.4. Ground Gas Risk Assessment Summary

Two methods of ground gas risk assessment have been applied to the site following site investigation, comprising a review of organic content of soils and ground gas monitoring.

A soil derived approach identified soils of the Made Ground was not considered to pose an unacceptable ground gas risk at the site and warrant classification of Characteristic Situation CS1.

The ground gas monitoring and the derived GSVs have indicated that there is a very low risk from ground gases, equating to Characteristic Situation CS1 across the site, however a small increase in borehole flow rate during the final monitoring rounds may result in a Characteristic Situation CS2 classification, as a result of the high CO2 concentration.

Therefore, based on the evidence available to date, the risk assessment for the site indicates that the site should be classified as Characteristic Situation CS2. All plots on-site require gas protection measures.

Boreholes can act as preferential pathways for ground gas and therefore prior to construction, all boreholes should be suitably decommissioned in line with Environment Agency guidance. This usually comprises pumping liquid grout down a tremie pipe to the base of the borehole, raising as the borehole fills.

The gas protection methods are outlined in BS8485:2015+A1:2019 and should be installed in line with CIRIA C735. The protection measures required are summarised within Section 5.8.

5.6. Vapour Risk Assessment

The CSM identified a source of contamination that may pose an unacceptable risk to receptors through vapours. Best practice is to assess a multiple lines of evidence to identify any vapours that may be present.

5.6.1. 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 D). The testing suites included contaminants that may be present in the vapour phrase (Mercury, Napthalene, TPHs and volatile Organic Compounds (VOCs)) taken within Made Ground samples.

All samples scheduled (4No.) identified VOCs at concentrations lower than the laboratory limit of detection. Two samples of naphthalene were noted to be marginally elevated above the laboratory limit of detection but well below the relevant GAC.

5.6.2. Human Health Risk Assessment from Dissolved Contaminants

In order to assess potential risk to site users, dissolved concentrations of potential contaminants have been compared to generic assessment criteria (GAC_{gwvap}) for assessing vapour risk to human health for volatile contaminants in groundwater for a residential end-use, published by the Society for

Brownfield Risk Assessment (SoBRA). The table below and overleaf summarises the results of the laboratory analysis. Potential contaminants have been split into the groups presented in the SoBRA Report. Only determinands of concern that were detected in at least one sample over the monitoring period above the LOD where a SoBRA GAC_{gwvap} is published have been included. The results are included as Appendix D.

Groundwater Contamination Test Results			
Determinand	SoBRA GAC_{gwvap} (µg/l)	Laboratory Analysis Range (µg/l)	Was the GAC Exceeded?
ORGANIC AND INORGANIC			
Mercury	1.1/95	<0.05	No
Methyl tert-butyl ether (MTBE)	83,000/7,800,000	< 3	No
PETROLEUM HYDROCARBONS			
ALL BELOW LABORATORY LIMIT OF DETECTION	1,900/190,000	<10	No
POLYCYCLIC-AROMATIC HYDROCARBONS			
ALL BELOW LABORATORY LIMIT OF DETECTION	170,000/15,000,000	<0.01	No
VOLATILE ORGANIC COMPOUNDs (VOCs)			
ALL BELOW LABORATORY LIMIT OF DETECTION	240/22,000	<3	No
SEMI-VOLATILE ORGANIC COMPOUNDs (VOCs) (WHERE ABOVE LOD)			
Dimethylphthalate	-	0.39 – 39	No
Diethyl phthalate	-	<0.05 – 0.45	No
Dibutyl phthalate	-	<0.05 – 0.15	No

The assessment of risk to human health from vapours associated with dissolved contaminants in groundwater summarised in the table above indicates that the majority of the determinands are significantly below the GACgwvap adopted.

The assessment of risk to human health from dissolved contamination in groundwater indicates that the concentrations measured do not represent an unacceptable risk to human health from vapour generation. Therefore no vapour protection measures are required on-site. Similarly, no remediation to the groundwater is considered necessary on-site.

5.6.3. Borehole Monitoring

During the monitoring of the boreholes installed, an oil-water interface probe and Photoionization Detector (PID) was utilised. The interface probe did not identify any dense or light non-aqueous phase liquids (DNAPL / LNAPL) during any of the monitoring visits. PID monitoring was undertaken on 6 rounds, on the first monitoring round peak PID readings were noted between 19.1 – 78.2ppm before dropping off after ~30 seconds. On the remaining monitoring rounds peak PID readings were recorded between 0.0 – 6.7ppm. Given the dataset the average peak PID reading fell well below the 10ppm threshold for further works. The conceptual site model indicates that sources of vapours are from off-site and would therefore have to be dissolved within the groundwater on-site as the Made Ground identified was primarily cohesive to a depth of 1.10m bgl. Direct testing for VOCs and SVOCs within the groundwater identified all determinands other than 3No. to be below the laboratory limit of detection. Therefore no unacceptable risk is considered to be present and no vapour protection measures are required on-site.

5.7. Updated Conceptual Site Model

Following completion of the Phase 2 Site Investigation, the CSM, inclusive of associated risk, within Section 2.8 of this report was re-evaluated.

For ease of reference and understanding, the risks have been re-assigned within this risk assessment against three possible levels / categories, summarised in the table below.

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.
Moderate Risk	Regarding this potential SPR linkage, the site is suitable for the proposed end-use however remediation and/or further investigation is required.
High Risk	Regarding this potential SPR linkage, the site is not suitable for proposed end-use and there is an unacceptable risk to receptors. 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: Asbestos, PAHs, TPHs, VOCs, - Low risk 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 (Residents/Future site visitors) Construction workers during development Site operatives during maintenance works Neighbours and public	Moderate – Engineered Capping System within Private Gardens and Soft Landscaped Areas On-site
	Direct uptake of groundwater Direct uptake of determinands in the soil	Flora and Fauna Vegetation within soft landscaped areas	Moderate – Suitable growing medium required.
	Anthropogenic (man-made) pathways Vertical and lateral migration in permeable strata Surface water runoff	Controlled Waters Secondary (Undifferentiated) Aquifer & Secondary A Aquifer Riders Stream	Low
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)	Low
Ground gases generated by Made Ground and organic materials: Methane, Carbon Dioxide, Hydrogen Sulphide, and Carbon Monoxide.	Migration through anthropogenic & natural pathways Inhalation of Asphyxiating gases Explosion (methane only)	Human Health End Users (Residents/Future site visitors) Construction workers during development (especially in confined spaces) Site operatives during maintenance works in confined spaces Neighbours and public	Moderate – Site Classified as CS2
	Migration through anthropogenic & natural pathways Explosion (methane only)	Building Materials and Services Buildings Confined spaces Underground services	Moderate – Site Classified as CS2

Tabulated Conceptual Site Model – Pollutant Linkage Summary			(Off-Site Sources)
Potential Sources	Potential Absorption Pathways	Potential Receptors	Risk Classification
Made Ground from nearby construction and demolition works: 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 Direct ingestion of groundwater Inhalation of volatile vapour (indoors and outdoors)	Human Health End Users (Residents/Future site visitors) Construction workers during development Site operatives during maintenance works	Low
	Direct uptake of groundwater	Flora and Fauna Vegetation within soft landscaped areas	Low
Aggressive ground conditions associated with impacted groundwater; Sulphates, PAH/TPH.	Direct contact with aggressive ground conditions	Building Materials and Services Buried Concrete Underground services (water pipes)	Low
Ground gases generated by Made Ground: Methane, Carbon Dioxide, Hydrogen Sulphide, and Carbon Monoxide.	Migration through anthropogenic & natural pathways Inhalation of Asphyxiating gases Explosion (methane only)	Human Health End Users (Residents/Future site visitors) Construction workers during development (especially in confined spaces) Site operatives during maintenance works in confined spaces	Moderate – Site Classified as CS2
	Migration through anthropogenic & natural pathways Explosion (methane only)	Building Materials and Services Buildings Confined spaces Underground services	Moderate – Site Classified as CS2
Contaminants associated with off site depots, vehicle repair, service centre factory and works: 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 Direct ingestion of groundwater Inhalation of volatile vapour (indoors and outdoors)	Human Health End Users (Residents/Future site visitors) Construction workers during development Site operatives during maintenance works	Low
	Direct uptake of groundwater	Flora and Fauna Vegetation within soft landscaped areas	Low

6. CONTAMINATION RECOMMENDATIONS AND REMEDIATION STRATEGY

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

Three contaminants (lead, PAHs & asbestos) have been found at an unacceptable concentrations within the soils across the site.

Gas protection measures are required in line with the requirements of Characteristic Situation CS2.

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.

6.1. Soils

The soil remediation has been split into private garden areas and communal soft landscaped areas.

<u>Private Garden Areas</u>

The highest exceedance of contaminants has been identified as PAHs at ~7 times the assessment criteria. Since the exceedances is considered to be significant (more than 5-6 times the assessment criteria), the BRE "Cover Systems for Land Generation" is not appropriate. An engineered capping system should be considered applicable within all soft landscaped areas.

Based on the available information within this report it was proposed that the following remedial methodology should be undertaken within all private garden areas:

Reduce dig of 600mm;

Placement of 150mm anti-dig layer, overlaid by a geotextile marker membrane;

Placement of 450mm clean capping of soil;

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.

6.1.1. 600mm Reduce Dig

Made Ground should be removed from the locations to a minimum depth of 0.60m bgl to allow for the placement of the engineered capping system. On sites where levels are raised, the imported materials should be clean and validated, and can therefore enable a reduction in the reduce level dig. Should site levels be lowered, or natural soils encountered, samples of the natural soils should be sent to the laboratory for testing. If the soils are deemed suitable for use, the risk assessment should be revisited and a new remediation strategy agreed with the regulators.

Materials 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 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.

6.1.2. 150mm Anti-dig layer and Marker Membrane

Following the excavation of the 600mm reduce dig, the void should be infilled with 150mm thick anti-dig layer comprising gap graded certified clean material (e.g. recycled crushed concrete), free from rebar and debris.

Following placement of the anti-dig layer a geotextile marker membrane should be placed to act as a barrier between the clean soils above and the anti-dig layer and contaminated soils below.

6.1.3. 450mm Clean Capping of Soil

The capping system should be at least 450mm in thickness within all garden areas and soft landscaping. It is recommended that 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 4.8.

<u>Communal Soft Landscaped Areas</u>

The highest exceedance of contaminants has been identified as PAHs at ~7 times the assessment criteria. Since the exceedances is considered to be significant (more than 5-6 times the assessment criteria), the BRE "Cover Systems for Land Generation" is not appropriate. An engineered capping system should be considered applicable within all soft landscaped areas.

Based on the available information within this report it was proposed that the following remedial methodology should be undertaken within all communal soft landscaped areas:

- Reduce dig of 450mm;
- Placement of 150mm anti-dig layer, overlaid by a geotextile marker membrane;
- Placement of 300mm clean capping of soil;
- 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.

6.1.4. 450mm Reduce Dig

Made Ground should be removed from the locations to a minimum depth of 0.45m bgl to allow for the placement of the engineered capping system. On sites where levels are raised, the imported materials should be clean and validated, and can therefore enable a reduction in the reduce level dig. Should site levels be lowered, or natural soils encountered, samples of the natural soils should be sent to the laboratory for testing. If the soils are deemed suitable for use, the risk assessment should be revisited and a new remediation strategy agreed with the regulators.

Materials 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 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.

6.1.5. 150mm Anti-dig layer and Marker Membrane

Following the excavation of the 450mm reduce dig, the void should be infilled with 150mm thick anti-dig layer comprising gap graded certified clean material (e.g. recycled crushed concrete), free from rebar and debris.

Following placement of the anti-dig layer a geotextile marker membrane should be placed to act as a barrier between the clean soils above and the anti-dig layer and contaminated soils below.

6.1.6. 300mm Clean Capping of Soil

The capping system should be at least 300mm in thickness within all garden areas and soft landscaping. It is recommended that 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 4.8.

6.1.7. 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 and photographed by a suitably trained Ground and Water Limited Engineer following the 750mm reduce dig, placement of the no dig layer (prior to placement of the geotextile membrane) and after placement of the clean soils.

Validation holes should prove the depth of the clean cover to the marker membrane to ensure that it is present and enable the sampling of soils. Due to the design of the proposed development, validation should be undertaken at a rate of 1 validation trial hole per area of soft-landscaping and a sample taken equating to 1 sample per 50m^3 imported.

6.1.8. Water Supply Pipes

The Water Supply pipe risk assessment indicated that the use of PE pipes is appropriate at the site and no further measures are required.

6.2. Groundwater

The level 2 (groundwater) risk assessment has been undertaken and found a number of marginally elevated metals and inorganics within the groundwater on-site. A review of the soils assessment did not identify elevated cyanide within the Made Ground soils on-site. Similarly, other than lead, no metals were noted to be elevated within the Made Ground on-site. The groundwater results do not

indicate that lead is elevated within the groundwater. Three other SVOCs were noted to be above the laboratory limit of detection. Research to find a GAC value did not identify a published threshold value within groundwater and therefore they are not considered to pose a vapour risk to the end users.

Given the above the Made Ground soils on-site are not considered to be the source of the elevated determinands found within the groundwater. The understanding of the hydrogeological model indicates that the elevated determinands are likely caused by off-site sources within the nearby site environs, such as the bus depot, works, factory or garage noted within a 100m radius. Therefore, no further action is required. The findings of this risk assessment should be agreed with the Environment Agency.

6.3. Ground Gas and Vapours

Based on risk assessment undertaken, the site warrants classification as Characteristic Situation CS2, where precautions to prevent the ingress of ground-gas are necessary. Type B buildings on CS2 classified sites require 3.5 points worth of protection, in accordance with BS8485:2015+A1:2019. Points must be made up through a structural barrier, ventilation, and/or membrane, where at least two methods are incorporated.

An example of the gas protection measures that could be adopted are:

Passive sub-floor dispersal layer, typically no fine gravel or polystyrene (1.5 points):
In accordance with BS8485: The volume flow-through rate is governed by the size and number of side vents; for small to medium width buildings (up to 15 m wide – considered to be present onsite), the minimum area of side ventilation should be 1500mm^2/m run of wall on at least two opposite sides. Where there are multiple internal obstructions to air flow (caused by beams), there should be four or five times the area of the side vents provided in the internal obstructions.

Gas Resistant Membrane (Visqueen gas barrier or similar) meeting the criteria below (2 points):

- Sufficiently impervious to the gases (methane and carbon dioxide);
- Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions;
- Sufficiently strong to withstand in-service stresses (e.g. settlement if placed below a floor slab);
- Sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc);
- Capable, after installation, of providing a complete barrier to the entry of the relevant gas;
- Verified by a suitably trained Ground and Water Limited Engineer in accordance with CIRIA C735.

Please note any deviation from the above should meet the points criteria, as outlined within BS8485:2015+A1:2019. Gas protection measures should be suitably designed by a qualified professional following confirmation of the construction design.

6.3.1. Prior to Construction

Prior to construction of the buildings, the following should be undertaken:

The decommissioning of all boreholes beneath the footprint of the building, in line with the EA guidance.

Suitable design of ground gas protection measures.

6.3.2. During Construction

During construction of the structure, the following should be undertaken within each plot:

Following the excavation and construction of foundations, a passive subfloor dispersal layer should be installed, complete with ventilation bricks.

The subfloor dispersal layer should be verified by an appropriately trained Ground and Water Limited Engineer, and photographs obtained.

Following installation of ventilation system, a gas resistant membrane (Visqueen Gas barrier or similar) should be installed by a suitably qualified groundworker prior to pouring of the floor slab.

The gas resistant membrane must be visually verified in accordance with CIRIA C735, by an appropriately trained Ground and Water Limited Engineer, and photographs obtained of all components (overlaps, service entries, corners, repairs). This is required prior to pouring of the floor slab.

The floor slab should be poured to prevent any damage or loss of integrity to the installed ground gas precautions.

6.3.3. Verification

Following completion of all the verification works, outlined above, a report should be submitted to the local authority for approval. This should include as a minimum, verification photographs of the visual checks.

<u>Vapours</u>

No vapour protection measures are required on-site.

6.4. 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). Such occurrences may be discovered during the construction phases for the redevelopment of the site.

Groundworkers should 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 and then the Local Authority will need to be informed.

6.5. Imported Material

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 E of this report.

6.6. 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 the investigation, 4No. 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, three soil samples (WS102/0.80m bgl, BH101/0.80m bgl & BH102/0.40m bgl) of Made Ground encountered on-site were NON-HAZARDOUS. Sample WS101/1.00m bgl was found to be HAZARDOUS due to the pH and was flagged for being corrosive. The results of the assessment are given within Appendix G.

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 was scheduled to undergo Waste Acceptance Criteria (WAC) testing with single batch leachate. The results indicate that 1No. samples conformed to the Inert Waste Classification.

Where contaminated soils are to be removed, they should be placed on an impermeable membrane (visqueen or similar) to ensure that no cross-contamination of soils occurs.

6.7. Duty of Care

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.

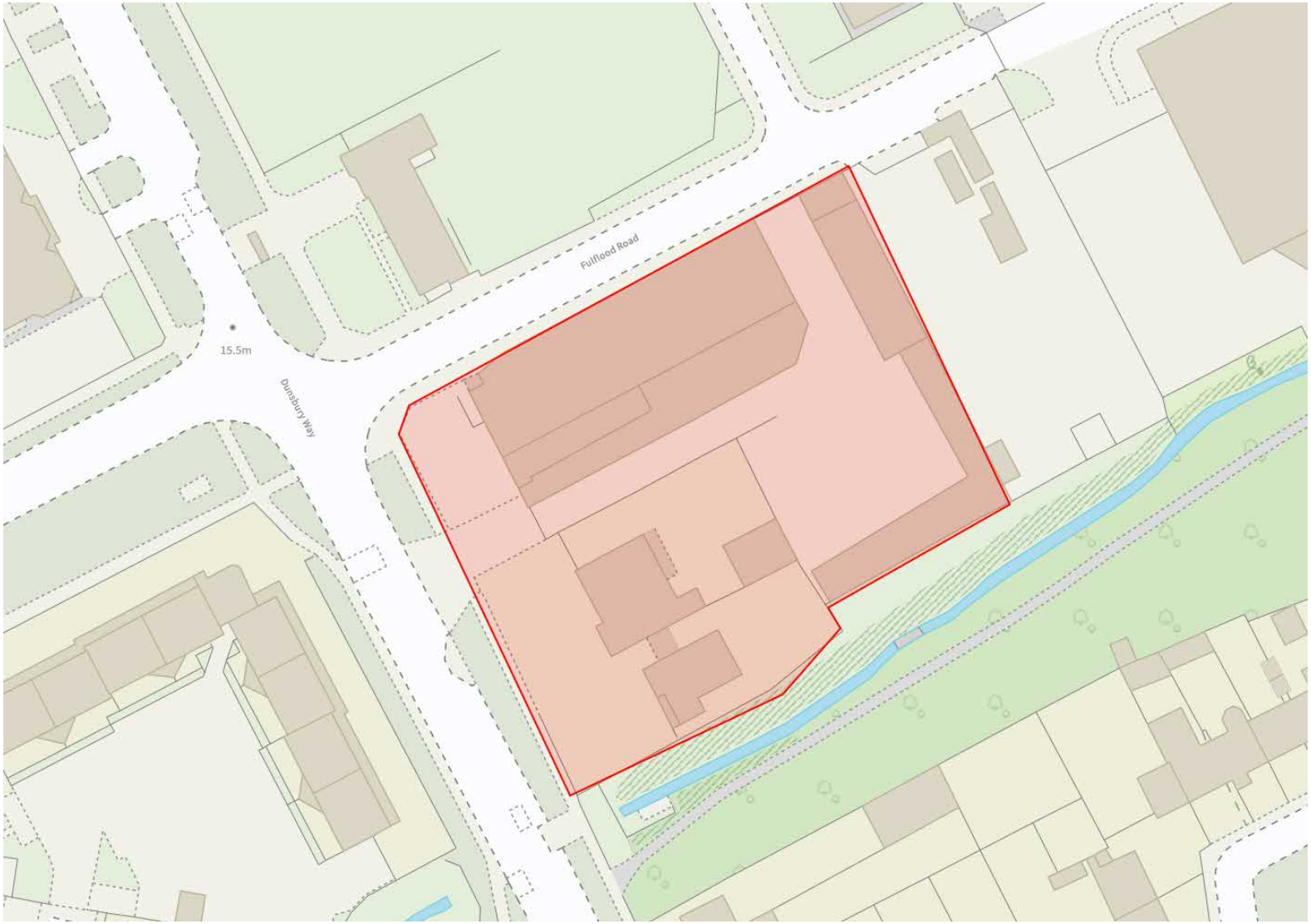
FIGURES

Site Location

NTS

Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ	
Foreman Homes Limited	October 2024
Figure 1 – Site Location Plan	GWPR6068

ground&water



Site Boundary

NTS

Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Foreman Homes Limited	October 2024
Figure 2 – Site Development Area	GWPR6068

ground&water

NTS

Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ	
Foreman Homes Limited	October 2024
Figure 3 – Aerial Photograph	GWPR6068

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NTS

Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Foreman Homes Limited	October 2024
Figure 4 – Proposed development plan -Site plan	GWPR6068

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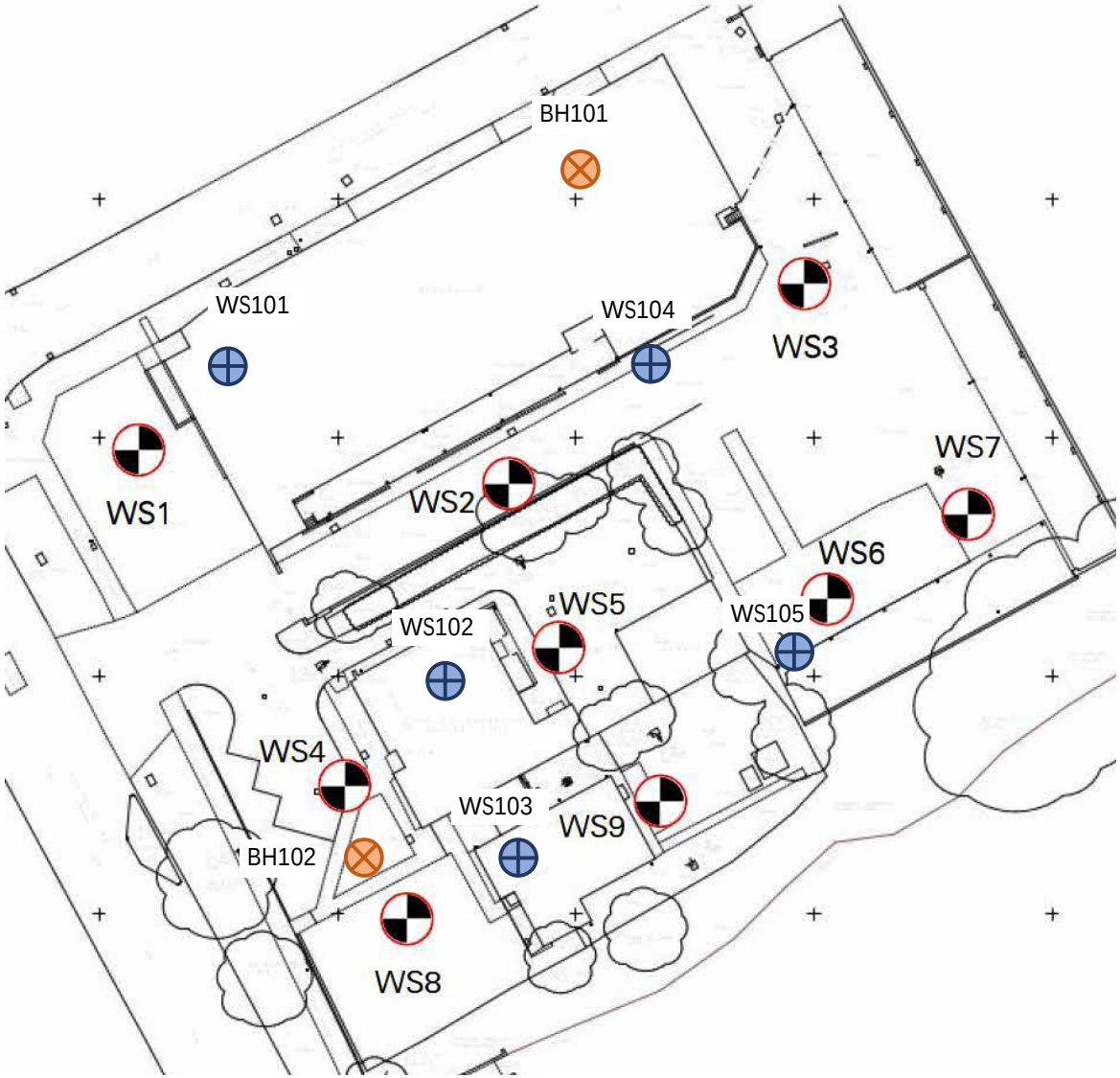

Site boundary

Cable Percussion Borehole

Windowless Sampler Borehole

Ridge Boreholes

NOT TO SCALE

Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ	
Foreman Homes Limited	October 2024
Figure 5 – Trial Hole Location Plan	GWPR6068

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APPENDIX A: Conditions and Limitations

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 Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ.

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

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

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 (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: Trial Hole Logs

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

Well

Well

Well

Well

Well

Well

Well

Well

Well

APPENDIX D: Chemical Laboratory Testing

2 The Long Barn, Norton Farm, Selborne Road, Alton, Hampshire GU34 3NB
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e: reception@i2analytical.com

Analytical Report Number : 24-032141

Replaces Analytical Report Number: 24-032141, issue no. 1
Client references/information amended.
Site name amended at clients request

Project / Site name:	Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ	**Samples received on:**	23/07/2024
Your job number:	GWPR6068	**Samples instructed on/ Analysis started on:**	23/07/2024
Your order number:	GWPR6068	**Analysis completed by:**	29/07/2024
Report Issue Number:	2	**Report issued on:**	30/07/2024
Samples Analysed:	2 soil samples - 1 leachate sample		

[redacted]

Signed:

Adam Fenwick
Key Account Executive
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 24-032141
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ
Your Order No: GWPR6068

Lab Sample Number				265002	265003
Sample Reference				BH1	BH2
Sample Number				None Supplied	None Supplied
Depth (m)				0.80-0.80	0.40-0.40
Date Sampled				16/07/2024	18/07/2024
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	14	16
Total mass of sample received	kg	0.1	NONE	1.1	1.1

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	MWI	MWI

General Inorganics

pH (L005B)	pH Units	N/A	MCERTS	-	7.5
pH (L099)	pH Units	N/A	MCERTS	10.5	8.5
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	1900	250
Water Soluble SO_4 16hr extraction (2:1)	mg/l	1.25	MCERTS	973	125
Organic Matter (automated)	%	0.1	MCERTS	1.1	1.5
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	0.7	0.9
Loss on Ignition @ 450°C	%	0.2	MCERTS	-	2.8
Acid Neutralisation Capacity	+/- mmol/kg	-9999	NONE	-	4.6

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.06	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.1	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.08	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	1.6	0.13
Anthracene	mg/kg	0.05	MCERTS	0.32	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	2.4	0.33
Pyrene	mg/kg	0.05	MCERTS	1.9	0.3
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1	0.16
Chrysene	mg/kg	0.05	MCERTS	1.1	0.17
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	1.3	0.17
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.48	0.13
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.98	0.19
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.51	0.12
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.14	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.56	< 0.05
Coronene	mg/kg	0.05	NONE	-	0.08

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	12.5	1.7
Total WAC-17 PAHs	mg/kg	0.85	NONE	-	1.77

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	11	8.8
Boron (water soluble)	mg/kg	0.2	MCERTS	0.6	0.5
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8

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Analytical Report Number: 24-032141
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ
Your Order No: GWPR6068

Lab Sample Number				265002	265003
Sample Reference				BH1	BH2
Sample Number				None Supplied	None Supplied
Depth (m)				0.80-0.80	0.40-0.40
Date Sampled				16/07/2024	18/07/2024
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status		
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	17	23
Copper (aqua regia extractable)	mg/kg	1	MCERTS	21	14
Lead (aqua regia extractable)	mg/kg	1	MCERTS	280	66
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	9.9	12
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	30	38
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	150	54

Petroleum Hydrocarbons

TPHCWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.01	MCERTS	-	< 0.020
TPHCWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.01	MCERTS	-	< 0.020
TPHCWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.01	MCERTS	-	< 0.050
TPHCWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL	mg/kg	1	MCERTS	-	< 1.0
TPHCWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	MCERTS	-	< 2.0
TPHCWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	MCERTS	-	< 8.0
TPHCWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	MCERTS	-	< 8.0
TPHCWG - Aliphatic >EC35 - EC40 EH_CU_1D_AL	mg/kg	10	NONE	-	< 10
TPHCWG - Aliphatic >EC5 - EC35 EH_CU+HS_1D_AL	mg/kg	10	NONE	-	< 10
TPHCWG - Aliphatic >EC5 - EC40 EH_CU+HS_1D_AL	mg/kg	10	NONE	-	< 10

TPHCWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.01	MCERTS	-	< 0.010
TPHCWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.01	MCERTS	-	< 0.010
TPHCWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.02	MCERTS	-	< 0.050
TPHCWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	MCERTS	-	< 1.0
TPHCWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	-	< 2.0
TPHCWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	-	< 10
TPHCWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	-	< 10
TPHCWG - Aromatic >EC35 - EC40 EH_CU_1D_AR	mg/kg	10	NONE	-	< 10
TPHCWG - Aromatic >EC5 - EC35 EH_CU+HS_1D_AR	mg/kg	10	NONE	-	< 10
TPHCWG - Aromatic >EC5 - EC40 EH_CU+HS_1D_AR	mg/kg	10	NONE	-	< 10

TPH Total >EC5 - EC40 EH_CU+HS_1D_TOTAL	mg/kg	10	NONE	-	< 10

Mineral Oil (EC10 - EC40) EH_CU_1D_AL	mg/kg	10	NONE	-	< 10

VOCs

MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	< 5.0
Benzene	µg/kg	5	MCERTS	-	< 5.0
Toluene	µg/kg	5	MCERTS	-	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	-	< 5.0
p & m-Xylene	µg/kg	5	MCERTS	-	< 5.0
o-Xylene	µg/kg	5	MCERTS	-	< 5.0

Total BTEX	µg/kg	5	MCERTS	-	< 5.0

PCBs by GC-MS

PCB Congener 28	mg/kg	0.001	MCERTS	-	< 0.001
PCB Congener 52	mg/kg	0.001	MCERTS	-	< 0.001
PCB Congener 101	mg/kg	0.001	MCERTS	-	< 0.001
PCB Congener 118	mg/kg	0.001	MCERTS	-	< 0.001
PCB Congener 138	mg/kg	0.001	MCERTS	-	< 0.001

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The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 24-032141
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ
Your Order No: GWPR6068

Lab Sample Number				265002	265003
Sample Reference				BH1	BH2
Sample Number				None Supplied	None Supplied
Depth (m)				0.80-0.80	0.40-0.40
Date Sampled				16/07/2024	18/07/2024
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status		
PCB Congener 153	mg/kg	0.001	MCERTS	-	< 0.001
PCB Congener 180	mg/kg	0.001	MCERTS	-	< 0.001
Total PCBs	mg/kg	0.007	MCERTS	-	< 0.007

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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The results included within the report relate only to the sample(s) submitted for testing.

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Waste Acceptance Criteria Analytical Results

Report No:	24-032141						
					Client: GANDW		
Location	Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ						
Lab Reference (Sample Number)	265003				Landfill Waste Acceptance Criteria Limits		
Sampling Date	18/07/2024				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	BH2						
Depth (m)	0.40-0.40						
Solid Waste Analysis							
TOC (%)**	0.9				3%	5%	6%
Loss on Ignition (%) **	2.8				--	--	10%
BTEX (µg/kg) **	< 5.0				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	1.77				100	--	--
pH (units)**	7.5				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	4.6				--	To be evaluated	To be evaluated
Eluate Analysis (BS EN 12457 - 2 preparation utilising end over end leaching procedure)	10:1			10:1	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
	mg/l			mg/kg			
Arsenic *	< 0.00100			< 0.0100	0.5	2	25
Barium *	0.0234			0.234	20	100	300
Cadmium *	< 0.000100			< 0.00100	0.04	1	5
Chromium *	0.0030			0.030	0.5	10	70
Copper *	0.017			0.17	2	50	100
Mercury *	< 0.000500			< 0.00500	0.01	0.2	2
Molybdenum *	0.00213			0.0213	0.5	10	30
Nickel *	0.0021			0.021	0.4	10	40
Lead *	0.0041			0.041	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.016			0.16	4	50	200
Chloride *	0.75			7.5	800	15000	25000
Fluoride*	0.33			3.3	10	150	500
Sulphate *	16			160	1000	20000	50000
TDS*	66			660	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	7.51			75.1	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	1.1						
Dry Matter (%)	84						
Moisture (%)	16						

Results are expressed on a dry weight basis, after correction for moisture content where applicable.

Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation

* = UKAS accredited (liquid eluate analysis only)

** = MCERTS accredited

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number : 24-032141
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
265002	BH1	None Supplied	0.80-0.80	Brown clay with gravel
265003	BH2	None Supplied	0.40-0.40	Brown clay with gravel

Analytical Report Number : 24-032141
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
pH at 20°C in soil	Determination of pH in soil by addition of water followed by electrometric measurement	In-house method	L005B	W	MCERTS
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
PCB's By GC-MS in soil	Determination of PCB by extraction with hexane followed by GC-MS	In-house method based on USEPA 8082	L027B	D	MCERTS
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by electrometric measurement	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L031B	W	ISO 17025
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination	L033B	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved organic carbon in leachate by TOC/DOC NDIR Analyser	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L038B	D	MCERTS
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES	In-house method based on Second Site Properties version 3	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Sample Preparation		In-house method	L043B	W	NONE
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe	In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance	L046B	W	NONE

Analytical Report Number : 24-032141
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Loss on ignition of soil @ 450°C	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	In-house method	L047	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L076B/L088	D/W	MCERTS
Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS	In-house method	L076B/L088	D/W	NONE
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method	L080	W	MCERTS
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	ISO 17025
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	MCERTS
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser	In-house based on MEWAM Method ISBN 0117516260	L082B	W	ISO 17025
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099	D	MCERTS

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))

Analytical Report Number : 24-032141
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
CU	Clean-up - e.g. by Florisil®, silica gel				
1D	GC - Single coil/column gas chromatography				
2D	GC-GC - Double coil/column gas chromatography				
Total	Aliphatics & Aromatics				
AL	Aliphatics				
AR	Aromatics				
#1	EH_2D_Total but with humics mathematically subtracted				
#2	EH_2D_Total but with fatty acids mathematically subtracted				
_	Operator - underscore to separate acronyms (exception for +)				
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total				

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

Sample Deviation Report

Analytical Report Number : 24-032141
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis.Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
BH1	N/A	S	265002	c	Total cyanide in soil	L080	c

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Analytical Report Number : 24-037309

Project / Site name:	Former Dairy Crest Depot, Dunsbury Way	**Samples received on:**	13/08/2024
Your job number:	GWPR6068	**Samples instructed on/ Analysis started on:**	20/08/2024
Your order number:	GWPR6068	**Analysis completed by:**	23/08/2024
Report Issue Number:	1	**Report issued on:**	23/08/2024
Samples Analysed:	2 soil samples		

Signed: [redacted]

Joanna Wawrzeczko
Senior Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 24-037309
Project / Site name: Former Dairy Crest Depot, Dunsbury Way
Your Order No: GWPR6068

Lab Sample Number				291569	291570
Sample Reference				WS101	WS102
Sample Number				None Supplied	None Supplied
Depth (m)				1.00	0.80
Date Sampled				07/08/2024	07/08/2024
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status		
Stone Content	%	0.1	NONE	65.4	< 0.1
Moisture Content	%	0.01	NONE	4.9	11
Total mass of sample received	kg	0.1	NONE	0.8	0.8

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	PKU	PKU
Actinolite detected	Type	N/A	ISO 17025	Not-detected	-
Amosite detected	Type	N/A	ISO 17025	Detected	-
Anthophyllite detected	Type	N/A	ISO 17025	Not-detected	-
Chrysotile detected	Type	N/A	ISO 17025	Not-detected	-
Crocidolite detected	Type	N/A	ISO 17025	Not-detected	-
Tremolite detected	Type	N/A	ISO 17025	Not-detected	-

Asbestos Containing Material Types Detected (ACM)	Type	N/A	ISO 17025	Loose Fibres	-

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	11.5	8
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	310	450
Water Soluble SO_4 16hr extraction (2:1)	mg/l	1.25	MCERTS	156	224
Organic Matter (automated)	%	0.1	MCERTS	0.9	1.6
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	0.5	0.9

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	0.08
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	0.15
Fluorene	mg/kg	0.05	MCERTS	< 0.05	0.13
Phenanthrene	mg/kg	0.05	MCERTS	0.23	1.6
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.49
Fluoranthene	mg/kg	0.05	MCERTS	0.46	2.9
Pyrene	mg/kg	0.05	MCERTS	0.41	2.6
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	1.4
Chrysene	mg/kg	0.05	MCERTS	0.25	1.4
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.27	1.5
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.15	0.76
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.25	1.3
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.49
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.14	0.53

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	2.15	15.4

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Analytical Report Number: 24-037309
Project / Site name: Former Dairy Crest Depot, Dunsbury Way
Your Order No: GWPR6068

Lab Sample Number				291569	291570
Sample Reference				WS101	WS102
Sample Number				None Supplied	None Supplied
Depth (m)				1.00	0.80
Date Sampled				07/08/2024	07/08/2024
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status		
Heavy Metals / Metalloids					
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	8.5	9.6
Boron (water soluble)	mg/kg	0.2	MCERTS	1.5	1.2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	17	22
Copper (aqua regia extractable)	mg/kg	1	MCERTS	20	14
Lead (aqua regia extractable)	mg/kg	1	MCERTS	91	61
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	9.1	11
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	29	39
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	84	79

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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Analytical Report Number : 24-037309
Project / Site name: Former Dairy Crest Depot, Dunsbury Way

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
291569	WS101	None Supplied	1	Brown sand with gravel and stones
291570	WS102	None Supplied	0.8	Brown clay and sand with gravel and vegetation

Analytical Report Number : 24-037309
Project / Site name: Former Dairy Crest Depot, Dunsbury Way

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L038B	D	MCERTS
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES	In-house method based on Second Site Properties version 3	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method	L080	W	MCERTS
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	MCERTS

Analytical Report Number : 24-037309
Project / Site name: Former Dairy Crest Depot, Dunsbury Way

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099	D	MCERTS

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

Sample Deviation Report

Analytical Report Number : 24-037309
Project / Site name: Former Dairy Crest Depot, Dunsbury Way

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis.Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
WS101	N/A	S	291569	c	Total cyanide in soil	L080	c
WS102	N/A	S	291570	c	Total cyanide in soil	L080	c

UKAS TESTING
4041

Environmental Science

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Analytical Report Number : 24-035877

Project / Site name:	Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ	**Samples received on:**	09/08/2024
Your job number:	GWPR6068	**Samples instructed on/ Analysis started on:**	13/08/2024
Your order number:	GWPR6068	**Analysis completed by:**	16/08/2024
Report Issue Number:	1	**Report issued on:**	16/08/2024
Samples Analysed:	1 water sample		

Signed: [redacted]

Rafał Szczepańczyk
Technical Reviewer
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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The results included within the report are representative of the samples submitted for analysis.

UKAS TESTING
4041

Analytical Environmental Science

Analytical Report Number: 24-035877
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Your Order No: GWPR6068

Lab Sample Number	284243
Sample Reference	WS105
Sample Number	None Supplied
Depth (m)	3.00
Date Sampled	16/08/2024
Time Taken	None Supplied

Analytical Parameter (Water Analysis)	Units	Test Limit of detection	Test Accreditation Status	
General Inorganics				
pH (L099)	pH Units	N/A	ISO 17025	7
Total Cyanide (Low Level 1 µg/l)	µg/l	1	NONE	< 1.0
Sulphate as SO_4	mg/l	0.045	ISO 17025	9.33
Total Phenols				
Total Phenols (Monohydric) Low Level	µg/l	1	NONE	< 1.0
Speciated PAHs				
Naphthalene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01
Total PAH				
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16
Heavy Metals / Metalloids				
Arsenic (dissolved)	µg/l	0.15	ISO 17025	1.09
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.05
Chromium (dissolved)	µg/l	0.2	ISO 17025	< 0.2
Copper (dissolved)	µg/l	0.5	ISO 17025	14
Lead (dissolved)	µg/l	0.2	ISO 17025	0.2
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	9.2
Selenium (dissolved)	µg/l	0.6	ISO 17025	1.3
Vanadium (dissolved)	µg/l	0.2	ISO 17025	0.5
Zinc (dissolved)	µg/l	0.5	ISO 17025	5.7
Boron (dissolved)	µg/l	10	ISO 17025	44
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0

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The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 24-035877
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Your Order No: GWPR6068

Lab Sample Number				284243
Sample Reference				WS105
Sample Number				None Supplied
Depth (m)				3.00
Date Sampled				16/08/2024
Time Taken				None Supplied
Analytical Parameter (Water Analysis)	Units	Test Limit of detection	Test Accreditation Status	

Petroleum Hydrocarbons

TPH - Aliphatic >EC5 - EC6 HS_1D_AL	µg/l	1	ISO 17025	< 1.0
TPH - Aliphatic >EC6 - EC8 HS_1D_AL	µg/l	1	ISO 17025	< 1.0
TPH - Aliphatic >EC8 - EC10 HS_1D_AL	µg/l	1	ISO 17025	< 1.0
TPH - Aliphatic >EC10 - EC12 EH_1D_AL_MS	µg/l	10	NONE	< 10
TPH - Aliphatic >EC12 - EC16 EH_1D_AL_MS	µg/l	10	NONE	< 10
TPH - Aliphatic >EC16 - EC21 EH_1D_AL_MS	µg/l	10	NONE	< 10
TPH - Aliphatic >EC21 - EC35 EH_1D_AL_MS	µg/l	10	NONE	< 10
TPH - Aliphatic >EC5 - EC35 HS+EH_1D_AL_MS	µg/l	10	NONE	< 10
TPH - Aliphatic >EC35 - EC40 EH_1D_AL_MS	µg/l	10	NONE	< 10
TPH - Aliphatic >EC5 - EC40 HS+EH_1D_AL_MS	µg/l	10	NONE	< 10

TPH - Aromatic >EC5 - EC7 HS_1D_AR	µg/l	1	ISO 17025	< 1.0
TPH - Aromatic >EC7 - EC8 HS_1D_AR	µg/l	1	ISO 17025	< 1.0
TPH - Aromatic >EC8 - EC10 HS_1D_AR	µg/l	1	ISO 17025	< 1.0
TPH - Aromatic >EC10 - EC12 EH_1D_AR_MS	µg/l	10	NONE	< 10
TPH - Aromatic >EC12 - EC16 EH_1D_AR_MS	µg/l	10	NONE	< 10
TPH - Aromatic >EC16 - EC21 EH_1D_AR_MS	µg/l	10	NONE	< 10
TPH - Aromatic >EC21 - EC35 EH_1D_AR_MS	µg/l	10	NONE	< 10
TPH - Aromatic >EC5 - EC35 HS+EH_1D_AR_MS	µg/l	10	NONE	< 10
TPH - Aromatic >EC35 - EC40 EH_1D_AR_MS	µg/l	10	NONE	< 10
TPH - Aromatic >EC5 - EC40 HS+EH_1D_AR_MS	µg/l	10	NONE	< 10

TPH Total (>EC5 - EC40) HS+EH_1D_TOTAL_MS	µg/l	10	NONE	< 10

VOCs

Chloromethane	µg/l	3	ISO 17025	< 3.0
Chloroethane	µg/l	3	ISO 17025	< 3.0
Bromomethane	µg/l	3	ISO 17025	< 3.0
Vinyl Chloride	µg/l	3	NONE	< 3.0
Trichlorofluoromethane	µg/l	3	NONE	< 3.0
1,1-Dichloroethene	µg/l	3	ISO 17025	< 3.0
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	3	ISO 17025	< 3.0
Trans 1,2-dichloroethylene	µg/l	3	ISO 17025	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0
1,1-Dichloroethane	µg/l	3	ISO 17025	< 3.0
2,2-Dichloropropane	µg/l	3	NONE	< 3.0
Chloroform	µg/l	3	ISO 17025	< 3.0
1,1,1-Trichloroethane	µg/l	3	ISO 17025	< 3.0
1,2-Dichloroethane	µg/l	3	ISO 17025	< 3.0
1,1-Dichloropropene	µg/l	3	ISO 17025	< 3.0
Cis-1,2-dichloroethene	µg/l	3	ISO 17025	< 3.0
Benzene	µg/l	3	ISO 17025	< 3.0
Carbontetrachloride	µg/l	3	ISO 17025	< 3.0
1,2-Dichloropropane	µg/l	3	ISO 17025	< 3.0
Trichloroethene	µg/l	3	ISO 17025	< 3.0
Dibromomethane	µg/l	3	ISO 17025	< 3.0
Bromodichloromethane	µg/l	3	ISO 17025	< 3.0
Cis-1,3-dichloropropene	µg/l	3	ISO 17025	< 3.0
Trans-1,3-dichloropropene	µg/l	3	ISO 17025	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0
1,1,2-Trichloroethane	µg/l	3	ISO 17025	< 3.0

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Analytical Report Number: 24-035877
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Your Order No: GWPR6068

Lab Sample Number				284243
Sample Reference				WS105
Sample Number				None Supplied
Depth (m)				3.00
Date Sampled				16/08/2024
Time Taken				None Supplied
Analytical Parameter (Water Analysis)	Units	Test Limit of detection	Test Accreditation Status	
1,3-Dichloropropane	µg/l	3	ISO 17025	< 3.0
Dibromochloromethane	µg/l	3	ISO 17025	< 3.0
Tetrachloroethene	µg/l	3	ISO 17025	< 3.0
1,2-Dibromoethane	µg/l	3	ISO 17025	< 3.0
Chlorobenzene	µg/l	3	ISO 17025	< 3.0
1,1,1,2-Tetrachloroethane	µg/l	3	ISO 17025	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0
p & m-xylene	µg/l	3	ISO 17025	< 3.0
Styrene	µg/l	3	ISO 17025	< 3.0
Bromoform	µg/l	3	ISO 17025	< 3.0
o-xylene	µg/l	3	ISO 17025	< 3.0
Isopropylbenzene	µg/l	3	ISO 17025	< 3.0
1,1,2,2-Tetrachloroethane	µg/l	3	NONE	< 3.0
Bromobenzene	µg/l	3	ISO 17025	< 3.0
n-Propylbenzene	µg/l	3	ISO 17025	< 3.0
2-Chlorotoluene	µg/l	3	ISO 17025	< 3.0
4-Chlorotoluene	µg/l	3	ISO 17025	< 3.0
1,3,5-Trimethylbenzene	µg/l	3	ISO 17025	< 3.0
tert-Butylbenzene	µg/l	3	ISO 17025	< 3.0
1,2,4-Trimethylbenzene	µg/l	3	ISO 17025	< 3.0
sec-Butylbenzene	µg/l	3	ISO 17025	< 3.0
1,3-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0
p-Isopropyltoluene	µg/l	3	ISO 17025	< 3.0
1,4-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0
1,2-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0
Butylbenzene	µg/l	3	ISO 17025	< 3.0
1,2-Dibromo-3-chloropropane	µg/l	3	ISO 17025	< 3.0
1,2,4-Trichlorobenzene	µg/l	3	ISO 17025	< 3.0
Hexachlorobutadiene	µg/l	3	ISO 17025	< 3.0
1,2,3-Trichlorobenzene	µg/l	3	ISO 17025	< 3.0

SVOCs

Aniline	µg/l	0.05	NONE	< 0.05
Phenol	µg/l	0.05	NONE	< 0.05
2-Chlorophenol	µg/l	0.05	NONE	< 0.05
Bis(2-chloroethyl)ether	µg/l	0.05	NONE	< 0.05
1,3-Dichlorobenzene	µg/l	0.05	NONE	< 0.05
1,2-Dichlorobenzene	µg/l	0.05	NONE	< 0.05
1,4-Dichlorobenzene	µg/l	0.05	NONE	< 0.05
Bis(2-chloroisopropyl)ether	µg/l	0.05	NONE	< 0.05
2-Methylphenol	µg/l	0.05	NONE	< 0.05
Hexachloroethane	µg/l	0.05	NONE	< 0.05
Nitrobenzene	µg/l	0.05	NONE	< 0.05
4-Methylphenol	µg/l	0.05	NONE	< 0.05
Isophorone	µg/l	0.05	NONE	< 0.05
2-Nitrophenol	µg/l	0.05	NONE	< 0.05
2,4-Dimethylphenol	µg/l	0.05	NONE	< 0.05
Bis(2-chloroethoxy)methane	µg/l	0.05	NONE	< 0.05
1,2,4-Trichlorobenzene	µg/l	0.05	NONE	< 0.05
2,4-Dichlorophenol	µg/l	0.05	NONE	< 0.05
4-Chloroaniline	µg/l	0.05	NONE	< 0.05
Hexachlorobutadiene	µg/l	0.05	NONE	< 0.05

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Analytical Report Number: 24-035877
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Your Order No: GWPR6068

Lab Sample Number				284243
Sample Reference				WS105
Sample Number				None Supplied
Depth (m)				3.00
Date Sampled				16/08/2024
Time Taken				None Supplied
Analytical Parameter (Water Analysis)	Units	Test Limit of detection	Test Accreditation Status	
4-Chloro-3-methylphenol	µg/l	0.05	NONE	< 0.05
2,4,6-Trichlorophenol	µg/l	0.05	NONE	< 0.05
2,4,5-Trichlorophenol	µg/l	0.05	NONE	< 0.05
2-Methylnaphthalene	µg/l	0.05	NONE	< 0.05
2-Chloronaphthalene	µg/l	0.05	NONE	< 0.05
Dimethylphthalate	µg/l	0.05	NONE	39
2,6-Dinitrotoluene	µg/l	0.05	NONE	< 0.05
2,4-Dinitrotoluene	µg/l	0.05	NONE	< 0.05
Dibenzofuran	µg/l	0.05	NONE	< 0.05
4-Chlorophenyl phenyl ether	µg/l	0.05	NONE	< 0.05
Diethyl phthalate	µg/l	0.05	NONE	0.45
4-Nitroaniline	µg/l	0.05	NONE	< 0.05
Azobenzene	µg/l	0.05	NONE	< 0.05
Bromophenyl phenyl ether	µg/l	0.05	NONE	< 0.05
Hexachlorobenzene	µg/l	0.05	NONE	< 0.05
Carbazole	µg/l	0.05	NONE	< 0.05
Dibutyl phthalate	µg/l	0.05	NONE	< 0.05
Anthraquinone	µg/l	0.05	NONE	< 0.05
Butyl benzyl phthalate	µg/l	0.05	NONE	< 0.05

3+4-Methylphenol	µg/l	0.1	NONE	< 0.10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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Analytical Report Number : 24-035877
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW	In-house method based on USEPA Method 6020 & 200.8 for the determination of trace elements in water by ICP-MS	L012B	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices: SW, GW, PW, PrW (Al, Cu, Fe,Zn)	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Total petroleum hydrocarbons with carbon banding by GC-MS in water	Determination of total petroleum hydrocarbons in water by GC-MS/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L070B	W	NONE
BTEX and/or Volatile organic compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA 8260	L073B	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method by continuous flow analyser. Accredited Matrices SW, GW, PW	L080	W	ISO 17025
Monohydric phenols (low level) in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	NONE
Total cyanide (low level) in water	Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	NONE
Total petroleum hydrocarbons by GC-MS HS in water	Determination of total petroleum hydrocarbons in water by GC-MS HS	In-house method	L088B	W	ISO 17025
pH at 20°C in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In-house method	L099	W	ISO 17025
Speciated PAHs and/or Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds (including PAH) in leachate by extraction in dichloromethane followed by GC-MS	In-house method based on USEPA 8270	L102B	W	ISO 17025
Phenols in water by GC-MS	Determination of phenols in water by GC-MS	In-house method	L102B	W	NONE

Analytical Report Number : 24-035877
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW, LL	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

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Analytical Report Number : 24-044930

Project / Site name:	Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ	**Samples received on:**	27/09/2024
Your job number:	GWPR6068	**Samples instructed on/ Analysis started on:**	27/09/2024
Your order number:	GWPR6068	**Analysis completed by:**	07/10/2024
Report Issue Number:	1	**Report issued on:**	07/10/2024
Samples Analysed:	1 water sample		

Signed [redacted]

Dominika Liana
Junior Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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The results included within the report are representative of the samples submitted for analysis.

UKAS TESTING
4041

Analytical Environmental Science

Analytical Report Number: 24-044930
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Your Order No: GWPR6068

Lab Sample Number	332821
Sample Reference	BH101
Sample Number	None Supplied
Depth (m)	2.00
Date Sampled	27/09/2024
Time Taken	None Supplied

Analytical Parameter (Water Analysis)	Units	Test Limit of detection	Test Accreditation Status	
General Inorganics				
pH (L099)	pH Units	N/A	ISO 17025	10
Total Cyanide (Low Level 1 µg/l)	µg/l	1	NONE	2.7
Sulphate as SO_4	mg/l	0.045	ISO 17025	1580
Total Phenols				
Total Phenols (Monohydric) Low Level	µg/l	1	NONE	< 1.0
Speciated PAHs				
Naphthalene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01
Total PAH				
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16
Heavy Metals / Metalloids				
Arsenic (dissolved)	µg/l	0.15	ISO 17025	3.26
Cadmium (dissolved)	µg/l	0.02	ISO 17025	< 0.02
Chromium (dissolved)	µg/l	0.2	ISO 17025	17
Copper (dissolved)	µg/l	0.5	ISO 17025	13
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	3.3
Selenium (dissolved)	µg/l	0.6	ISO 17025	12
Vanadium (dissolved)	µg/l	0.2	ISO 17025	18
Zinc (dissolved)	µg/l	0.5	ISO 17025	0.9
Boron (dissolved)	µg/l	10	ISO 17025	260
Chromium (hexavalent)	µg/l	5	ISO 17025	15

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The results included within the report relate only to the sample(s) submitted for testing.

UKAS TESTING 4041

Analytical Environmental Science

Analytical Report Number: 24-044930
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Your Order No: GWPR6068

Lab Sample Number				332821
Sample Reference				BH101
Sample Number				None Supplied
Depth (m)				2.00
Date Sampled				27/09/2024
Time Taken				None Supplied
Analytical Parameter (Water Analysis)	Units	Test Limit of detection	Test Accreditation Status	
Petroleum Hydrocarbons				
TPH - Aliphatic >EC5 - EC6 HS_1D_AL	µg/l	1	ISO 17025	< 1.0
TPH - Aliphatic >EC6 - EC8 HS_1D_AL	µg/l	1	ISO 17025	< 1.0
TPH - Aliphatic >EC8 - EC10 HS_1D_AL	µg/l	1	ISO 17025	< 1.0
TPH - Aliphatic >EC10 - EC12 EH_1D_AL_MS	µg/l	10	NONE	< 10
TPH - Aliphatic >EC12 - EC16 EH_1D_AL_MS	µg/l	10	NONE	< 10
TPH - Aliphatic >EC16 - EC21 EH_1D_AL_MS	µg/l	10	NONE	< 10
TPH - Aliphatic >EC21 - EC35 EH_1D_AL_MS	µg/l	10	NONE	< 10
TPH - Aliphatic >EC5 - EC35 HS+EH_1D_AL_MS	µg/l	10	NONE	< 10
TPH - Aliphatic >EC35 - EC40 EH_1D_AL_MS	µg/l	10	NONE	< 10
TPH - Aliphatic >EC5 - EC40 HS+EH_1D_AL_MS	µg/l	10	NONE	< 10
TPH - Aromatic >EC5 - EC7 HS_1D_AR	µg/l	1	ISO 17025	< 1.0
TPH - Aromatic >EC7 - EC8 HS_1D_AR	µg/l	1	ISO 17025	< 1.0
TPH - Aromatic >EC8 - EC10 HS_1D_AR	µg/l	1	ISO 17025	< 1.0
TPH - Aromatic >EC10 - EC12 EH_1D_AR_MS	µg/l	10	NONE	< 10
TPH - Aromatic >EC12 - EC16 EH_1D_AR_MS	µg/l	10	NONE	< 10
TPH - Aromatic >EC16 - EC21 EH_1D_AR_MS	µg/l	10	NONE	< 10
TPH - Aromatic >EC21 - EC35 EH_1D_AR_MS	µg/l	10	NONE	< 10
TPH - Aromatic >EC5 - EC35 HS+EH_1D_AR_MS	µg/l	10	NONE	< 10
TPH - Aromatic >EC35 - EC40 EH_1D_AR_MS	µg/l	10	NONE	< 10
TPH - Aromatic >EC5 - EC40 HS+EH_1D_AR_MS	µg/l	10	NONE	< 10
TPH Total (>EC5 - EC40) HS+EH_1D_TOTAL_MS	µg/l	10	NONE	< 10
VOCs				
Chloromethane	µg/l	3	ISO 17025	< 3.0
Chloroethane	µg/l	3	ISO 17025	< 3.0
Bromomethane	µg/l	3	ISO 17025	< 3.0
Vinyl Chloride	µg/l	3	NONE	< 3.0
Trichlorofluoromethane	µg/l	3	NONE	< 3.0
1,1-Dichloroethene	µg/l	3	ISO 17025	< 3.0
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	3	ISO 17025	< 3.0
Trans 1,2-dichloroethylene	µg/l	3	ISO 17025	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0
1,1-Dichloroethane	µg/l	3	ISO 17025	< 3.0
2,2-Dichloropropane	µg/l	3	NONE	< 3.0
Chloroform	µg/l	3	ISO 17025	< 3.0
1,1,1-Trichloroethane	µg/l	3	ISO 17025	< 3.0
1,2-Dichloroethane	µg/l	3	ISO 17025	< 3.0
1,1-Dichloropropene	µg/l	3	ISO 17025	< 3.0
Cis-1,2-dichloroethene	µg/l	3	ISO 17025	< 3.0
Benzene	µg/l	3	ISO 17025	< 3.0
Carbontetrachloride	µg/l	3	ISO 17025	< 3.0
1,2-Dichloropropane	µg/l	3	ISO 17025	< 3.0
Trichloroethene	µg/l	3	ISO 17025	< 3.0
Dibromomethane	µg/l	3	ISO 17025	< 3.0
Bromodichloromethane	µg/l	3	ISO 17025	< 3.0
Cis-1,3-dichloropropene	µg/l	3	ISO 17025	< 3.0
Trans-1,3-dichloropropene	µg/l	3	ISO 17025	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0
1,1,2-Trichloroethane	µg/l	3	ISO 17025	< 3.0
1,3-Dichloropropane	µg/l	3	ISO 17025	< 3.0

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4041

Analytical Report Number: 24-044930
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Your Order No: GWPR6068

Lab Sample Number				332821
Sample Reference				BH101
Sample Number				None Supplied
Depth (m)				2.00
Date Sampled				27/09/2024
Time Taken				None Supplied
Analytical Parameter (Water Analysis)	Units	Test Limit of detection	Test Accreditation Status	
Dibromochloromethane	µg/l	3	ISO 17025	< 3.0
Tetrachloroethene	µg/l	3	ISO 17025	< 3.0
1,2-Dibromoethane	µg/l	3	ISO 17025	< 3.0
Chlorobenzene	µg/l	3	ISO 17025	< 3.0
1,1,1,2-Tetrachloroethane	µg/l	3	ISO 17025	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0
p & m-xylene	µg/l	3	ISO 17025	< 3.0
Styrene	µg/l	3	ISO 17025	< 3.0
Bromoform	µg/l	3	ISO 17025	< 3.0
o-xylene	µg/l	3	ISO 17025	< 3.0
Isopropylbenzene	µg/l	3	ISO 17025	< 3.0
1,1,2,2-Tetrachloroethane	µg/l	3	NONE	< 3.0
Bromobenzene	µg/l	3	ISO 17025	< 3.0
n-Propylbenzene	µg/l	3	ISO 17025	< 3.0
2-Chlorotoluene	µg/l	3	ISO 17025	< 3.0
4-Chlorotoluene	µg/l	3	ISO 17025	< 3.0
1,3,5-Trimethylbenzene	µg/l	3	ISO 17025	< 3.0
tert-Butylbenzene	µg/l	3	ISO 17025	< 3.0
1,2,4-Trimethylbenzene	µg/l	3	ISO 17025	< 3.0
sec-Butylbenzene	µg/l	3	ISO 17025	< 3.0
1,3-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0
p-Isopropyltoluene	µg/l	3	ISO 17025	< 3.0
1,4-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0
1,2-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0
Butylbenzene	µg/l	3	ISO 17025	< 3.0
1,2-Dibromo-3-chloropropane	µg/l	3	ISO 17025	< 3.0
1,2,4-Trichlorobenzene	µg/l	3	ISO 17025	< 3.0
Hexachlorobutadiene	µg/l	3	ISO 17025	< 3.0
1,2,3-Trichlorobenzene	µg/l	3	ISO 17025	< 3.0

SVOCs

Aniline	µg/l	0.05	NONE	< 0.05
Phenol	µg/l	0.05	NONE	< 0.05
2-Chlorophenol	µg/l	0.05	NONE	< 0.05
Bis(2-chloroethyl)ether	µg/l	0.05	NONE	< 0.05
1,3-Dichlorobenzene	µg/l	0.05	NONE	< 0.05
1,2-Dichlorobenzene	µg/l	0.05	NONE	< 0.05
1,4-Dichlorobenzene	µg/l	0.05	NONE	< 0.05
Bis(2-chloroisopropyl)ether	µg/l	0.05	NONE	< 0.05
2-Methylphenol	µg/l	0.05	NONE	< 0.05
Hexachloroethane	µg/l	0.05	NONE	< 0.05
Nitrobenzene	µg/l	0.05	NONE	< 0.05
4-Methylphenol	µg/l	0.05	NONE	< 0.05
Isophorone	µg/l	0.05	NONE	< 0.05
2-Nitrophenol	µg/l	0.05	NONE	< 0.05
2,4-Dimethylphenol	µg/l	0.05	NONE	< 0.05
Bis(2-chloroethoxy)methane	µg/l	0.05	NONE	< 0.05
1,2,4-Trichlorobenzene	µg/l	0.05	NONE	< 0.05
2,4-Dichlorophenol	µg/l	0.05	NONE	< 0.05
4-Chloroaniline	µg/l	0.05	NONE	< 0.05
Hexachlorobutadiene	µg/l	0.05	NONE	< 0.05
4-Chloro-3-methylphenol	µg/l	0.05	NONE	< 0.05
2,4,6-Trichlorophenol	µg/l	0.05	NONE	< 0.05

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4041

Analytical Report Number: 24-044930
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Your Order No: GWPR6068

Lab Sample Number				332821
Sample Reference				BH101
Sample Number				None Supplied
Depth (m)				2.00
Date Sampled				27/09/2024
Time Taken				None Supplied
Analytical Parameter (Water Analysis)	Units	Test Limit of detection	Test Accreditation Status	
2,4,5-Trichlorophenol	µg/l	0.05	NONE	< 0.05
2-Methylnaphthalene	µg/l	0.05	NONE	< 0.05
2-Chloronaphthalene	µg/l	0.05	NONE	< 0.05
Dimethylphthalate	µg/l	0.05	NONE	0.39
2,6-Dinitrotoluene	µg/l	0.05	NONE	< 0.05
2,4-Dinitrotoluene	µg/l	0.05	NONE	< 0.05
Dibenzofuran	µg/l	0.05	NONE	< 0.05
4-Chlorophenyl phenyl ether	µg/l	0.05	NONE	< 0.05
Diethyl phthalate	µg/l	0.05	NONE	< 0.05
4-Nitroaniline	µg/l	0.05	NONE	< 0.05
Azobenzene	µg/l	0.05	NONE	< 0.05
Bromophenyl phenyl ether	µg/l	0.05	NONE	< 0.05
Hexachlorobenzene	µg/l	0.05	NONE	< 0.05
Carbazole	µg/l	0.05	NONE	< 0.05
Dibutyl phthalate	µg/l	0.05	NONE	0.15
Anthraquinone	µg/l	0.05	NONE	< 0.05
Butyl benzyl phthalate	µg/l	0.05	NONE	< 0.05

3+4-Methylphenol	µg/l	0.1	NONE	< 0.10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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4041

Analytical Report Number : 24-044930
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW	In-house method based on USEPA Method 6020 & 200.8 for the determination of trace elements in water by ICP-MS	L012B	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices: SW, GW, PW, PrW (Al, Cu, Fe,Zn)	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Total petroleum hydrocarbons with carbon banding by GC-MS in water	Determination of total petroleum hydrocarbons in water by GC-MS/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L070B	W	NONE
BTEX and/or Volatile organic compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA 8260	L073B	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method by continuous flow analyser. Accredited Matrices SW, GW, PW	L080-PL	W	ISO 17025
Monohydric phenols (low level) in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	NONE
Total cyanide (low level) in water	Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	NONE
Total petroleum hydrocarbons by GC-MS HS in water	Determination of total petroleum hydrocarbons in water by GC-MS HS	In-house method	L088-PL	W	ISO 17025
pH at 20°C in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In-house method	L099-PL	W	ISO 17025
Speciated PAHs and/or Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds (including PAH) in leachate by extraction in dichloromethane followed by GC-MS	In-house method based on USEPA 8270	L102B	W	ISO 17025
Phenols in water by GC-MS	Determination of phenols in water by GC-MS	In-house method	L102B	W	NONE

Analytical Report Number : 24-044930
Project / Site name: Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW, LL	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

APPENDIX E: Soil Assessment Criteria

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

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. 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).

Land contamination can harm a number of receptors, most notably: human health; drinking water; groundwater; surface water; soils; ecosystems; and buildings/structures. The UK Government's stated objectives of LCRM are to enhance the health and wellbeing of all, whilst adding the economic, ecological and amenity value of the area through dealing with land contamination.

The risk assessment is an iterative process. 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.

Based on the identified receptor, there are numerous assessment criteria that can be used, which have been outlined in the subsequent sections.

1. Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015

1.1. Background

Within England and Wales, an appropriate agency must classify the ecological and chemical status of a body of surface water. The agency must also classify the chemical and quantitative status of a body of groundwater. The appropriate agency must review and update the classifications at least every 6 years as and when new data is collected through monitoring programmes. In addition to the classification and as part of the WFD, pollution of surface waters must be controlled by limiting the discharge of priority substances and other substances into surface water.

1.2. Surface Water

In order to aid with the classification, a series of environmental quality standards (EQS) for specific pollutants have been generated. The EQS refer to the dissolved fraction of metals within a water sample, therefore the sample collected must pass through a 0.45µm filter at the time of sampling. A number of metals have a bioavailable threshold and therefore a site specific meta bioavailability assessment should be undertaken.

Where the calculated mean value of a measurement is less than the limit of quantification and the limit of quantification is above the EQS, the result must not be used for determining a failed classification.

For the majority of substances, two values will be included for review; AA and MAC. The Annual Average (AA) is the arithmetic mean of the concentrations measured at different times during the year for each representative point within the water body. When using the Max Allowable Concentration (MAC) values, a statistical analysis may be undertaken to ensure an acceptable level of confidence for determining compliance with the MAC.

1.3. Groundwater

The appropriate agency must apply the threshold values for groundwater (in Table 1, Schedule 5) and, if any value is exceeded, undertake an appropriate investigation to determine whether or not the

applicable conditions for good groundwater chemical status are met. The criteria outlined are designed to be averaged across an aquifer rather than a site specific investigations.

2. The Water Supply (Water Quality) Regulations 2016

The water supply regulations apply in relation to the supply of water to premises for domestic purposes (including for cooking, drinking, food preparation and washing) or for food production purposes, both of which include the intended use for human consumption.

The point of compliance for the water supply is principally the consumers' taps, however, where stated the compliance point is the reservoir or treatment works.

3. World Health Organisation, Petroleum Products in Drinking Water, 2008

The World Health Organisation produced a background document for the development of WHO Guidelines for Drinking-water Quality, specifically relating to petroleum products (WHO/SDE/WSH/05.08/123). Petroleum products are used widely in a range of industrial applications, with the largest quantities used for gasoline, diesel and heating oil.

The difference in chemical and physical properties of each hydrocarbon means that they will behave differently within the environment, where their persistence is dictated by their volatilisation, biodegradation and dissolution within water. As a result of these, the heavier hydrocarbons typically have more persistence. Exposure to human health from petroleum hydrocarbons within drinking water can occur from a short to long-term, however the incident that leads to high concentrations within the drinking water will typically occur in the short term.

Petroleum products are a complicated mix of hundreds of compounds and therefore assessment can be difficult. The TPH-CWG method, developed in the USA, groups the TPH into a series of fractions based on the number of carbon atoms, coupled with the overall structure of the compound. This process enables the TPHs to be split into two distinct groups, aliphatics and aromatics.

4. SoBRA GAC_{gwvap}

Prior to the development of the SoBRA GAC_{gwvap}, there were no formally published UK GAC for the assessment of vapour risk arising from volatile contaminants in groundwater in the UK. The SoBRA groundwater vapour GAC (GAC_{gwvap}) is intended as a conservative screening tool that assessors may choose to use to help assess the long-term (chronic) risks to human health from inhalation of vapours arising from groundwater. They are intended for comparison with measured groundwater concentrations and represent the estimated concentration in groundwater below which the long-term risks to human health from vapour migration and inhalation can be considered low/tolerable, i.e. unlikely to be of concern (for the land use scenarios considered). When used as part of a Generic Quantitative Risk Assessment (GQRA) (which includes consideration of uncertainties) comparison of the GAC_{gwvap} with measured concentrations in groundwater can be used to screen out contaminants as being unlikely to represent an unacceptable risk to humans living or working above the groundwater plume.

The GAC have been derived for two land use scenarios for which the vapour intrusion pathway is likely to require assessment: residential and commercial. Generic assumptions have been made for each land use. These include assumptions about the depth to groundwater, soil type in the unsaturated zone, building dimension and foundation type, and receptor behaviour. The parameter values have been chosen to ensure that the GAC are precautionary for the vast majority of commercial and

residential properties in the UK. However, there may be particular situations where the GAC are not protective, for example where non aqueous phase liquid (NAPL) is present or preferential pathways exist.

5. 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 groundwater contaminants. As part of the EA Remedial Targets Methodology (RTM), a level 3 risk assessment will consider the effect of attenuation between the site and a downgradient receptor or compliance point. For a level 4 risk assessment the appropriateness of assessing dilution in a receiving watercourse or a pumping abstraction borehole will need to be considered.

The RTM also recommends that sensitivity/uncertainty analysis is incorporated into each stage of the assessment.

6. Ground and Water Limited Waters Assessment Criteria

The Waters 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.

6.1. Inorganics

Specific Pollutants				
Determinand	Long Term Fresh water (µg/l)	Short Term Fresh water (µg/l)	Long Term Salt water (µg/l)	Short Term Salt water (µg/l)
Cyanide	1	5	1	5
Phenol	7.7	46	7.7	46

Drinking Water Standards	
Determinand	Maximum allowable Concentration at compliance point (µg/l)
Cyanide	50
pH	6.5 – 9.5

6.2. Metals

Specific Pollutants				
Determinand	Long Term Fresh water (µg/l)	Short Term Fresh water (µg/l)	Long Term Salt water (µg/l)	Short Term Salt water (µg/l)
Arsenic	50	-	25	-
Chromium (III)	4.7	32	-	-
Chromium (VI)	3.4	-	0.6	32
Copper	1*	-	3.76	34
Iron	1000	-	1000	-
Manganese	123*	-	-	-
Zinc	10.9*	-	6.8	-

*Site specific bioavailability calculation should be undertaken.

EQS for Priority Substances and other substances

Determinand		AA-EQS Inland surface water (µg/l)	MAC-EQS Inland surface water (µg/l)	AA-EQS Other Surface waters (µg/l)	MAC-EQS Other Surface waters (µg/l)
Cadmium	<40mg/l CaCO3 40 – <50mg/l 50 – <100mg/l 100 – <200mg/l >200mg/l	<0.08 0.08 0.09 0.15 0.25	<0.45 0.45 0.6 0.9 1.5	0.2	-
Lead		1.2	14	1.3	14
Mercury		-	0.07	-	0.07
Nickel		4	34	8.6	34

Threshold Values for Groundwater			
Determinand	Groundwater Impact on Surface Water (µg/l)	Drinking water Protected Area (µg/l)	General Quality of Groundwater Body (µg/l)
Aluminum	-	150	150
Arsenic	25.8 – 106	7.5	7.5
Boron	-	750	-
Cadmium	0.054 – 0.53	3.75	-
Copper	0.516 – 2.12	1500	1500
Lead	0.619 – 2.54	7.5	7.5
Mercury	0.026 – 0.106	0.75	-
Nickel	2.06 – 8.48	15	15
Selenium	-	7.5	-
Zinc	5.62 – 23.1	-	-

Drinking Water Standards	
Determinand	Maximum allowable Concentration at compliance point (µg/l)
Arsenic	10
Cadmium	5
Chromium	50
Copper	2
Lead	10
Mercury	1
Nickel	20

6.3. Total Petroleum Hydrocarbons (TPHs)

6.3.1. BTEX Compounds

Specific Pollutants				
Determinand	Long Term Fresh water (µg/l)	Short Term Fresh water (µg/l)	Long Term Salt water (µg/l)	Short Term Salt water (µg/l)
Toluene	74	380	74	370

EQS for Priority Substances and other substances				
Determinand	AA-EQS Inland surface water (µg/l)	MAC-EQS Inland surface water (µg/l)	AA-EQS Other Surface waters (µg/l)	MAC-EQS Other Surface waters (µg/l)
Benzene	10	50	8	50

Threshold Values for Groundwater			
Determinand	Groundwater Impact on Surface Water (µg/l)	Drinking water Protected Area (µg/l)	General Quality of Groundwater Body (µg/l)
Benzene	5.16 – 21.2	0.75	0.75
Toluene	38.2 – 157	-	-
Xylene (o+p+m)	15.5 – 63.6	-	-

6.3.2. Total Petroleum Hydrocarbons – Aliphatic

World Health Organisation	
Determinand	Drinking Water Standard (µg/l)
>C5 – C6	15,000
>C6 – C8	
>C8 – C10	300
>C10 – C12	
>C12 – C16	
>C16 – C21	Not Derived
>C21 – C35	Not Derived

6.3.3. Total Petroleum Hydrocarbons – Aromatic

World Health Organisation	
Determinand	Drinking Water Standard (µg/l)
>EC5 – EC7	10
>EC7 – EC8	700
>EC8 – EC10	300
>EC10 – EC12	90
>EC12 – EC16	
>EC16 – EC21	90
>EC21 – EC35	

6.4. Polycyclic Aromatic Hydrocarbons (PAHs)

EQS for Priority Substances and other substances				
Determinand	AA-EQS Inland surface water (µg/l)	MAC-EQS Inland surface water (µg/l)	AA-EQS Other Surface waters (µg/l)	MAC-EQS Other Surface waters (µg/l)
Anthracene	0.1	0.1	0.1	0.1
Fluoranthene	0.0063	0.12	0.0063	0.12
Naphthalene	2	130	2	130
Benzo(a)pyrene	0.00017	0.27	0.00017	0.027
Benzo(b)fluoranthene	*	0.017	*	0.017
Benzo(k)fluoranthene	*	0.017	*	0.017
Benzo(ghi)perylene	*	0.0082	*	0.00082
Indeno(123-cd)pyrene	*	-	*	-

*For the group of priority substances of polyaromatic hydrocarbons, the AA-EQS in water refer to the concentration of benzo(a)pyrene. Benzo(a)pyrene can be considered as a marker for the other PAHs, hence only benzo(a)pyrene must be monitored for comparison with the corresponding AA-EQS.

Threshold Values for Groundwater			
Determinand	Groundwater Impact on Surface Water (µg/l)	Drinking water Protected Area (µg/l)	General Quality of Groundwater Body (µg/l)
Anthracene	0.052 – 0.193	-	-
Benzo(a)pyrene	0.000089 – 0.000328	0.0075	-
Benzo(b)fluoranthene	0.016 – 0.058	0.075	-
Fluoranthene	0.0033 – 0.0122	-	0.075
Naphthalene	1.03 – 4.24	-	0.075

Drinking Water Standards	
Determinand	Maximum allowable Concentration at compliance point (µg/l)
Benzo(a)pyrene	0.010
Benzo(b) fluoranthene	0.10
Benzo(k)fluoranthene	
Benzo(ghi)perylene	
Indeno(1,2,3-cd)pyrene	

6.5. Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS)

EQS for Priority Substances and other substances				
Determinand	AA-EQS Inland surface water (µg/l)	MAC-EQS Inland surface water (µg/l)	AA-EQS Other Surface waters (µg/l)	MAC-EQS Other Surface waters (µg/l)
Perfluorooctane sulfonic acid (PFOS)	0.00065	36	0.00013	7.2

6.6. Volatile and Semi-volatile Organic Compounds

SoBRA GAC_{gwvap} for Petroleum Hydrocarbons			
Determinand	GAC_{gwvap} (µg/l)[1,2]		Aqueous Solubility (µg/l)
	Residential	Commercial	
1,2,4-Trimethylbenzene	24	2,200	559,000
Benzene[3]	210	20,000	1,780,000
Ethylbenzene[3]	10,000	960,000 (sol)	180,000
Isopropylbenzene	850	86,000 (sol)	56,000
Propylbenzene	2,700	240,000 (sol)	54,100
Styrene	8,800	810,000 (sol)	290,000
Toluene[3]	230,000	21,000,000 (sol)	590,000
TPH Aliphatic EC5-EC6[3]	1,900	190,000 (sol)	35,900
TPH Aliphatic >EC6-EC8[3]	1,500	150,000 (sol)	5,370
TPH Aliphatic >EC8-EC10[3]	57	5,700 (sol)	427
TPH Aliphatic >EC10-EC12[3]	37	3,600 (sol)	34
TPH Aromatic >EC5-EC7[3]	210,000	20,000,000 (sol)	1,780,000
TPH Aromatic >EC7-EC8[3]	220,000	21,000,000 (sol)	590,000
TPH Aromatic >EC8-EC10[3]	1,900	190,000 (sol)	64,600
TPH Aromatic >EC10-EC12[3]	6,800	660,000 (sol)	24,500
TPH Aromatic >EC12-EC16[3]	39,000	3,700,000 (sol)	5,750
m-Xylene[3,5]	9,500	940,000 (sol)	200,000
o-Xylene[3,5]	12,000	1,100,000 (sol)	173,000
p-Xylene[2,]	9,900	980,000 (sol)	200,000
Notes			

1. GAC in italics with (sol) exceed aqueous solubility.
2. GAC rounded to two significant figures.
3. The GAC for these petroleum hydrocarbon contaminants have been calculated using a sub-surface soil to indoor air correction factor of 10 in line with the physical-chemical data sources.
4. The GAC for TPH fractions do not account for genotoxic mutagenic effects. Concentrations of TPH Aromatic >EC5-EC7 should therefore also be compared with the GAC for benzene to ensure that such effects are also assessed.
5. The Health Criteria Value used for each xylene isomer was for total xylene. If site specific additivity assessments are not completed, as a conservative measure the sum of isomer concentrations should be compared to the lowest xylene GAC (as is the case for soil GAC).

SoBRA GAC_{gwvap} for Polycyclic Aromatic Hydrocarbons			
Determinand	GAC_{gwvap} (µg/l) [1,2]		Aqueous Solubility (µg/l)
	Residential	Commercial	
Acenaphthene	170,000 (sol)	15,000,000 (sol)	4,110
Acenaphthylene	220,000 (sol)	20,000,000 (sol)	7,950
Fluorene	210,000 (sol)	18,000,000 (sol)	1,860
Naphthalene	220	23,000 (sol)	19,000

Notes
1. GAC in italics with (sol) exceed aqueous solubility.
2. GAC rounded to two significant figures.

SoBRA GAC_{gwvap} for Pesticides			
Determinand	GAC_{gwvap} (µg/l) [1,2]		Aqueous Solubility (µg/l)
	Residential	Commercial	
Aldrin	47 (sol)	3,700 (sol)	20
alpha-Endosulfan	7,400 (sol)	590,000 (sol)	530
beta-Endosulfan	7,500 (sol)	600,000 (sol)	280

Notes
1. GAC in italics with (sol) exceed aqueous solubility.
2. GAC rounded to two significant figures.

SoBRA GAC_{gwvap} for Halogenated Organics			
Determinand	GAC_{gwvap} (µg/l) [1,2]		Aqueous Solubility (µg/l)
	Residential	Commercial	
1,1,1,2-Tetrachloroethane	240	22,000	1,110,000
1,1,1-Trichloroethane	3,000	290,000	1,300,000
1,1,2,2-Tetrachloroethane	1,600	150,000	2,930,000
1,1,2-Trichloroethane	520	49,000	4,491,000
1,1-Dichloroethane	2,700	260,000	3,666,000
1,1-Dichloroethene	160	16,000	3,100,000
1,2,3,4-Tetrachlorobenzene	240	31,000 (sol)	7,800
1,2,3,5-Tetrachlorobenzene	7.0	600	3,500
1,2,3-Trichlorobenzene	35	3,100	21,000
1,2,4,5-Tetrachlorobenzene	8.1	700 (sol)	600
1,2,4-Trichlorobenzene	68	7,200	41,400
1,2-Dichlorobenzene	2,000	220,000 (sol)	133,000
1,2-Dichloroethane	8.9	850	8,680,000
1,2-Dichloropropane	22	2,600	2,050,000

1,3,5-Trichlorobenzene	7.4	660	6,000
1,3-Dichlorobenzene	31	2,800	103,000
1,4-Dichlorobenzene	5,000	460,000 (sol)	51,200
Bromobenzene	220	20,000	388,040
Bromodichloromethane	17	1,600	3,000,000
Bromoform (Tribromomethane)	3,100	400,000	3,000,000
Chlorobenzene	98	15,000	387,000
Chloroethane	10,000	1,000,000	5,742,000
Chloroethene (Vinyl Chloride)	0.62	63	2,760,000
Chloromethane	14	1,400	5,350,000
cis-1,2-Dichloroethene	130	13,000	7,550,000
Dichloromethane	3,300	370,000	20,080,000
Hexachlorobenzene	16 (sol)	1,400 (sol)	10
Hexachlorobutadiene	1.7	230	4,800
Hexachloroethane	8.5	740	49,900
Pentachlorobenzene	140	12,000 (sol)	500
Tetrachloroethene	34	4,600	225,000
Tetrachloromethane (Carbon Tetrachloride)	5.3	770	846,000
trans-1,2-Dichloroethene	160	16,000	5,250,000
Trichloroethene	5.7	530	1,370,000
Trichloromethane (Chloroform)	790	85,000	8,950,000

Notes
1. GAC in italics with (sol) exceed aqueous solubility.
2. GAC rounded to two significant figures.

SoBRA GAC_{gwvap} for Others (organic and inorganic)			
Determinand	GAC_{gwvap} (µg/l) [1,2]		Aqueous Solubility (µg/l)
	Residential	Commercial	
2-Chloronaphthalene	160	14,000 (sol)	11,700
Biphenyl (Lemonene)	15,000 (sol)	1,300,000 (sol)	4,060
Carbon disulphide	56	5,600	2,100,000
Mercury, elemental	1.1	95 (sol)	56
Methyl tertiary butyl ether (MTBE)	83,000	7,800,000	48,000,000

Notes
1. GAC in italics with (sol) exceed aqueous solubility.
2. GAC rounded to two significant figures.

7. Climate Change

Review of the publication by SoBRA referenced: Guidance on Assessing Risk to Controlled Waters from UK Land Contamination Under Conditions of Future Climate Change, August 2022, addresses the consideration of climate change as part of groundwater risk assessments. Following the development of a preliminary Conceptual Site Model (CSM), climate change should be included by re-evaluating the potential Source-Pathway-Receptor (SPR) linkage assessment to account for the potential effects of climate change based on projections for the region of the site. It is recommended where practicable to use at least two contrasting future climate change scenarios, incorporating information for the periods of 2020s, 2050s and 2080s dependent on the relevant timeframe to the specific assessment. A qualitative assessment of the impact of climate change on the SPRs and resultant impacts on the contaminants linkages within the CSM. Quantitative data can be used to re-address the generic quantitative risk assessment for medium to long term climate change effects. For short-term extreme weather events the of "what if" scenarios should be considered. Consideration also needs to be given to the shortcomings of available simulation models in the UK where they are not equipped to model

temporal changes to parameter values and where mitigation measures may be appropriate to address this.

APPENDIX F: Ground Gas Monitoring Results

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

Job No:	GWPR6068
Site name:	Former Dairy
Operator:	MF

Date:		08/08/2024	
Time:	11:30	to	12:40
Visit No:	1	of	6

Ground Gas Analyser:	GFM-436
Last Calibration:	Mar-24

ground&water

Monitoring Point	GAS CONCENTRATIONS								VOLATILES		FLOW DATA			WELL AND WATER DATA		Additional Remarks
	Methane (%v/v)		Carbon dioxide (%v/v)		Carbon monoxide (ppm)	Hydrogen sulphide (ppm)	Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Water level (m bgl)	Depth of well (m bgl)	
	Peak	Steady	Peak	Steady	Peak	Peak	Min	Steady			Peak	Steady				
Ambient air	0.00	0.00	0.20	0.00	0	0	20.30	20.30	/	/	n/a	n/a	n/a	n/a	n/a	
Bh101	0.00	0.00	0.10	0.10	0	0	14.20	14.20	19.1	/	0.0	0.0	0.00	2.10	5.20	No product. Flooded.
Bh102	0.00	0.00	2.80	2.80	0	0	14.80	14.80	78.2	/	0.0	0.0	0.00	2.43	3.14	No product. Flooded.
WS105	0.00	0.00	12.00	12.00	0	0	2.30	2.30	41.0	/	0.0	0.0	0.00	2.20	4.33	No product.
Max	0.00	0.00	12.00	12.00	0	0	20.30	20.30	78.2	0	0.00	0.00	0.00	2.43		
Min	0.00	0.00	0.10	0.00	0	0	2.30	2.30	19.1	0	0.00	0.00	0.00	2.1		

SITE INFORMATION:

State of ground:	X	Dry		Wet		Snow		Frozen		Hardstanding
Wind:	X	Calm		Moderate		Strong				
Cloud cover:		None	X	Cloudy		Overcast				
Preciptation:		None	X	Moderate		Heavy				

METEOROLOGICAL INFORMATION:

Official Barometric Pressure (mbar): 1010.5 3hr Before 1009.2 End of Monitoring (taken from wow.metoffice.gov.uk station Draig)

Official Pressure Tendency:

(Change in atmospheric pressure for the preceding 3 hours of monitoring)

	Falling (decreasing change >1.6 mbar)
X	Steady (change of 0.1 - 1.5 mbar)
	Rising (increasing change >1.6 mbar)

Job No:	GWPR6068
Site name:	Former Dairy
Operator:	AA

Date:		20/09/2024	
Time:	12:30	to	13:00
Visit No:	2	of	6

Ground Gas Analyser:	GFM-436
Last Calibration:	Mar-24

ground&water

Monitoring Point	GAS CONCENTRATIONS								VOLATILES		FLOW DATA			WELL AND WATER DATA		Additional Remarks
	Methane (%v/v)		Carbon dioxide (%v/v)		Carbon monoxide (ppm)	Hydrogen sulphide (ppm)	Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Water level (m bgl)	Depth of well (m bgl)	
	Peak	Steady	Peak	Steady	Peak	Peak	Min	Steady			Peak	Steady				
Ambient air	0.00	0.00	0.00	0.00	0	0	20.30	20.30	/	/	n/a	n/a	n/a	n/a	n/a	
BH101	0.00	0.00	2.90	2.90	0	0	15.00	15.10	6.7	/	0.0	0.0	0.00	Dry	4.52	No product.
BH102	0.00	0.00	1.10	1.10	0	0	18.50	18.60	1.2	/	0.0	0.0	0.00	3.30	8.00	No product. Flooded.
WS105	0.00	0.00	0.40	0.40	0	0	18.00	18.00	0.9	/	0.0	0.0	0.00	4.23	4.44	No product.
Max	0.00	0.00	2.90	2.90	0	0	20.30	20.30	6.7	0	0.00	0.00	0.00	4.23		
Min	0.00	0.00	0.00	0.00	0	0	15.00	15.10	0.9	0	0.00	0.00	0.00	3.3		

SITE INFORMATION:

State of ground:	X	Dry		Wet		Snow		Frozen		Hardstanding
Wind:	X	Calm		Moderate		Strong				
Cloud cover:		None	X	Cloudy		Overcast				
Preciptation:		None	X	Moderate		Heavy				

METEOROLOGICAL INFORMATION:

Official Barometric Pressure (mbar):	1014.8	3hr Before	1013.7	End of Monitoring	(taken from wow.metoffice.gov.uk station Draig)

Official Pressure Tendency:

(Change in atmospheric pressure for the preceding 3 hours of monitoring)

	Falling (decreasing change >1.6 mbar)
X	Steady (change of 0.1 - 1.5 mbar)
	Rising (increasing change >1.6 mbar)

Job No:	GWPR6068
Site name:	Former Dairy
Operator:	AA

Date:		27/09/2024	
Time:	07:20	to	09:00
Visit No:	3	of	6

Ground Gas Analyser:	GFM-436
Last Calibration:	Mar-24

Monitoring Point	GAS CONCENTRATIONS								VOLATILES		FLOW DATA			WELL AND WATER DATA		Additional Remarks
	Methane (%v/v)		Carbon dioxide (%v/v)		Carbon monoxide (ppm)	Hydrogen sulphide (ppm)	Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Water level (m bgl)	Depth of well (m bgl)	
	Peak	Steady	Peak	Steady	Peak	Peak	Min	Steady			Peak	Steady				
Ambient air	0.00	0.00	0.00	0.00	0	0	20.40	20.40	/	/	n/a	n/a	n/a	n/a	n/a	
BH101	0.00	0.00	0.40	0.40	0	0	18.70	18.70	0.6	/	0.0	0.0	0.00	1.35	5.52	No product. Flooded.
BH102	0.00	0.00	2.40	2.40	0	0	16.20	16.40	5.2	/	0.0	0.0	0.00	2.42	10.30	No product. Flooded.
WS105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	COULD NOT LOCATE WELL
Max	0.00	0.00	2.40	2.40	0	0	20.40	20.40	5.2	0	0.00	0.00	0.00	2.42		
Min	0.00	0.00	0.00	0.00	0	0	16.20	16.40	0.6	0	0.00	0.00	0.00	1.35		

SITE INFORMATION:

State of ground:		Dry	X	Wet		Snow		Frozen		Hardstanding
Wind:		Calm	X	Moderate		Strong				
Cloud cover:		None	X	Cloudy		Overcast				
Preciptation:		None	X	Moderate		Heavy				

METEOROLOGICAL INFORMATION:

Official Barometric Pressure (mbar): 986.3 3hr Before 992.5 End of Monitoring (taken from wow.metoffice.gov.uk station Draig)

Official Pressure Tendency:

(Change in atmospheric pressure for the preceding 3 hours of monitoring)

	Falling (decreasing change >1.6 mbar)
	Steady (change of 0.1 - 1.5 mbar)
X	Rising (increasing change >1.6 mbar)

Job No:	GWPR6068
Site name:	Former Dairy
Operator:	AA

Date:		02/10/2024	
Time:	07:40	to	08:10
Visit No:	4	of	6

Ground Gas Analyser:	GFM-436
Last Calibration:	Mar-24

Monitoring Point	GAS CONCENTRATIONS								VOLATILES		FLOW DATA			WELL AND WATER DATA		Additional Remarks
	Methane (%v/v)		Carbon dioxide (%v/v)		Carbon monoxide (ppm)	Hydrogen sulphide (ppm)	Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Water level (m bgl)	Depth of well (m bgl)	
	Peak	Steady	Peak	Steady	Peak	Peak	Min	Steady			Peak	Steady				
Ambient air	-	-	-	-	-	-	-	-	/	/	n/a	n/a	n/a	n/a	n/a	
BH101	-	-	-	-	-	-	-	-	0.8	/	-	-	-	1.24	5.52	No product. Flooded.
BH102	-	-	-	-	-	-	-	-	5.9	/	-	-	-	2.39	10.30	No product. Flooded.
WS105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	COULD NOT LOCATE WELL
Max	0.00	0.00	0.00	0.00	0	0	0.00	0.00	5.9	0	0.00	0.00	0.00	2.39		
Min	0.00	0.00	0.00	0.00	0	0	0.00	0.00	0.8	0	0.00	0.00	0.00	1.24		

SITE INFORMATION:

State of ground:	X	Dry		Wet		Snow		Frozen		Hardstanding
Wind:	X	Calm		Moderate		Strong				
Cloud cover:	X	None		Cloudy		Overcast				
Preciptation:	X	None		Moderate		Heavy				

METEOROLOGICAL INFORMATION:

Official Barometric Pressure (mbar): 1004.5 3hr Before 1006.5 End of Monitoring (taken from wow.metoffice.gov.uk station Draig)

Official Pressure Tendency:

(Change in atmospheric pressure for the preceding 3 hours of monitoring)

	Falling (decreasing change >1.6 mbar)
	Steady (change of 0.1 - 1.5 mbar)
X	Rising (increasing change >1.6 mbar)

Job No:	GWPR6068
Site name:	Former Dairy
Operator:	AA

Date:		04/10/2024	
Time:	13:45	to	14:20
Visit No:	5	of	6

Ground Gas Analyser:	GFM-436
Last Calibration:	Mar-24

Monitoring Point	GAS CONCENTRATIONS								VOLATILES		FLOW DATA			WELL AND WATER DATA		Additional Remarks
	Methane (%v/v)		Carbon dioxide (%v/v)		Carbon monoxide (ppm)	Hydrogen sulphide (ppm)	Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Water level (m bgl)	Depth of well (m bgl)	
	Peak	Steady	Peak	Steady	Peak	Peak	Min	Steady			Peak	Steady				
Ambient air	0.00	0.00	0.00	0.00	0	0	20.40	20.40	/	/	n/a	n/a	n/a	n/a	n/a	
BH101	0.00	0.00	0.10	0.10	0	0	18.30	18.30	0.2	/	0.0	0.0	0.00	1.80	5.00	No product. Flooded.
BH102	0.00	0.00	4.60	4.60	0	0	14.80	14.80	0.2	/	0.0	0.0	0.00	2.90	10.30	No product. Flooded.
WS105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	COULD NOT LOCATE WELL
Max	0.00	0.00	4.60	4.60	0	0	20.40	20.40	0.2	0	0.00	0.00	0.00	2.9		
Min	0.00	0.00	0.00	0.00	0	0	14.80	14.80	0.2	0	0.00	0.00	0.00	1.8		

SITE INFORMATION:

State of ground:	X	Dry		Wet		Snow		Frozen		Hardstanding
Wind:	X	Calm		Moderate		Strong				
Cloud cover:		None	X	Cloudy		Overcast				
Preciptation:	X	None		Moderate		Heavy				

METEOROLOGICAL INFORMATION:

Official Barometric Pressure (mbar):	1016.5	3hr Before	1015.2	End of Monitoring	(taken from wow.metoffice.gov.uk station Draig)

Official Pressure Tendency:

(Change in atmospheric pressure for the preceding 3 hours of monitoring)

	Falling (decreasing change >1.6 mbar)
X	Steady (change of 0.1 - 1.5 mbar)
	Rising (increasing change >1.6 mbar)

Job No:	GWPR6068
Site name:	Former Dairy
Operator:	OD

Date:		07/10/2024	
Time:	14:45	to	15:30
Visit No:	6	of	6

Ground Gas Analyser:	GFM-436
Last Calibration:	Mar-24

Monitoring Point	GAS CONCENTRATIONS								VOLATILES		FLOW DATA			WELL AND WATER DATA		Additional Remarks
	Methane (%v/v)		Carbon dioxide (%v/v)		Carbon monoxide (ppm)	Hydrogen sulphide (ppm)	Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Water level (m bgl)	Depth of well (m bgl)	
	Peak	Steady	Peak	Steady	Peak	Peak	Min	Steady			Peak	Steady				
Ambient air	0.00	0.00	0.00	0.00	0	0	19.50	19.50	/	/	n/a	n/a	n/a	n/a	n/a	
BH101	-0.10	-0.10	0.20	0.20	0	0	20.30	20.30	0.0	/	0.0	0.0	0.00	2.10	5.30	No product. Flooded.
BH102	0.00	0.00	0.20	0.20	0	0	20.10	20.10	0.0	/	0.0	0.0	0.00	2.60	10.56	No product. Flooded.
WS105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	COULD NOT LOCATE WELL
Max	0.00	0.00	0.20	0.20	0	0	20.30	20.30	0.0	0	0.00	0.00	0.00	2.6		
Min	-0.10	-0.10	0.00	0.00	0	0	19.50	19.50	0.0	0	0.00	0.00	0.00	2.1		

SITE INFORMATION:

State of ground:	X	Dry		Wet		Snow		Frozen		Hardstanding
Wind:	X	Calm		Moderate		Strong				
Cloud cover:	X	None		Cloudy		Overcast				
Preciptation:	X	None		Moderate		Heavy				

METEOROLOGICAL INFORMATION:

Official Barometric Pressure (mbar): 993.7 3hr Before 991.7 End of Monitoring (taken from wow.metoffice.gov.uk station Draig)

Official Pressure Tendency:

(Change in atmospheric pressure for the preceding 3 hours of monitoring)

X	Falling (decreasing change >1.6 mbar)
	Steady (change of 0.1 - 1.5 mbar)
	Rising (increasing change >1.6 mbar)

APPENDIX G: Waste Hazard Assessment

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

HazWasteOnline™

Waste Classification Report

HazWasteOnline™ classifies waste as either **hazardous** or **non-hazardous** based on its chemical composition, related legislation and the rules and data defined in the current UK or EU technical guidance (Appendix C) (note that HP 9 Infectious is not assessed). It is the responsibility of the classifier named below to:

a) understand the origin of the waste
b) select the correct List of Waste code(s)
c) confirm that the list of determinands, results and sampling plan are fit for purpose
d) select and justify the chosen metal species (Appendix B)
e) correctly apply moisture correction and other available corrections
f) add the meta data for their user-defined substances (Appendix A)
g) check that the classification engine is suitable with respect to the national destination of the waste (Appendix C)

To aid the reviewer, the laboratory results, assumptions and justifications managed by the classifier are highlighted in pale yellow.

23SML-JCE01-3VIYG

Job name

24-032141-2_HWOL

Description/Comments

Project

GWPR6068

Site

Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Classified by

Name:
Myles Finnerty
Date:
11 Oct 2024 10:02 GMT
Telephone:

Company:
Ground and Water
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Alton
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HazWasteOnline™ provides a two day, hazardous waste classification course that covers the use of the software and both basic and advanced waste classification techniques. Certification has to be renewed every 3 years.

HazWasteOnline™ Certification:	-
Course	**Date**
Hazardous Waste Classification	-

Purpose of classification

2 - Material Characterisation

Address of the waste

Former Dairy Crest Depot, Dunsbury Way, Havant **Post Code** PO9 5BQ

SIC for the process giving rise to the waste

Description of industry/producer giving rise to the waste

Redevelopment of site

Description of the specific process, sub-process and/or activity that created the waste

Foundation preparation

Description of the waste

Made Ground

Job summary

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
1	BH1--16072024-0.80		Non Hazardous		3
2	BH2--18072024-0.40		Non Hazardous		5

Related documents

#	Name	Description
1	24-032141-2_HWOL.hwol	i2 Analytical .hwol file used to populate the Job

Report

Created by: Myles Finnerty

Created date: 11 Oct 2024 10:02 GMT

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Appendix B: Rationale for selection of metal species	9
Appendix C: Version	10

Classification of sample: BH1--16072024-0.80

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
BH1--16072024-0.80
Moisture content:
14%
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 14% Wet Weight Moisture Correction applied (MC)

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1		chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<1.8	mg/kg	1.923	<3.462	mg/kg	<0.000346 %		**<LOD**
2		monohydric phenols			P1186		<1	mg/kg		<1	mg/kg	<0.0001 %		**<LOD**
3		cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				<1	mg/kg	1.884	<1.884	mg/kg	<0.000188 %		**<LOD**
4		pH			PH		10.5	pH		10.5	pH	10.5 pH		
5		boron { boron tribromide }	005-003-00-0	233-657-9	10294-33-4		0.6	mg/kg	23.173	11.957	mg/kg	0.0012 %	✓	
6		arsenic { arsenic }	033-001-00-X	231-148-6	7440-38-2		11	mg/kg		9.46	mg/kg	0.000946 %	✓	
7		cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	<0.2	mg/kg	1.285	<0.257	mg/kg	<0.00002 %		**<LOD**
8		copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		21	mg/kg	1.126	20.334	mg/kg	0.00203 %	✓	
9		mercury { mercury }	080-001-00-0	231-106-7	7439-97-6		<0.3	mg/kg		<0.3	mg/kg	<0.00003 %		**<LOD**
10		nickel { nickel dihydroxide }	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]		9.9	mg/kg	1.579	13.448	mg/kg	0.00134 %	✓	
11		lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	280	mg/kg	1.56	375.603	mg/kg	0.0241 %	✓	
12		selenium { selenium }	034-001-00-2	231-957-4	7782-49-2		<1	mg/kg		<1	mg/kg	<0.0001 %		**<LOD**
13		vanadium { divanadium pentaoxide; vanadium pentoxide }	023-001-00-8	215-239-8	1314-62-1		30	mg/kg	1.785	46.058	mg/kg	0.00461 %	✓	
14		zinc { zinc sulphate }	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]		150	mg/kg	2.469	318.539	mg/kg	0.0319 %	✓	

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
15	•	acenaphthylene		205-917-1	208-96-8		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		**<LOD**
16	•	acenaphthene		201-469-6	83-32-9		0.1	mg/kg		0.086	mg/kg	0.0000086 %	✓	
17	•	anthracene		204-371-1	120-12-7		0.32	mg/kg		0.275	mg/kg	0.0000275 %	✓	
18		benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		1	mg/kg		0.86	mg/kg	0.000086 %	✓	
19		benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		0.98	mg/kg		0.843	mg/kg	0.0000843 %	✓	
20		benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		1.3	mg/kg		1.118	mg/kg	0.000112 %	✓	
21		benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		0.48	mg/kg		0.413	mg/kg	0.0000413 %	✓	
22	•	benzo[ghi]perylene		205-883-8	191-24-2		0.56	mg/kg		0.482	mg/kg	0.0000482 %	✓	
23		chrysene	601-048-00-0	205-923-4	218-01-9		1.1	mg/kg		0.946	mg/kg	0.0000946 %	✓	
24		dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		0.14	mg/kg		0.12	mg/kg	0.000012 %	✓	
25	•	fluoranthene		205-912-4	206-44-0		2.4	mg/kg		2.064	mg/kg	0.000206 %	✓	
26	•	fluorene		201-695-5	86-73-7		0.08	mg/kg		0.0688	mg/kg	0.00000688 %	✓	
27	•	indeno[123-cd]pyrene		205-893-2	193-39-5		0.51	mg/kg		0.439	mg/kg	0.0000439 %	✓	
28		naphthalene	601-052-00-2	202-049-5	91-20-3		0.06	mg/kg		0.0516	mg/kg	0.00000516 %	✓	
29	•	phenanthrene		201-581-5	85-01-8		1.6	mg/kg		1.376	mg/kg	0.000138 %	✓	
30	•	pyrene		204-927-3	129-00-0		1.9	mg/kg		1.634	mg/kg	0.000163 %	✓	
31		chromium in chromium(III) compounds { • chromium(III) oxide }		215-160-9	1308-38-9		17	mg/kg	1.462	24.846	mg/kg	0.00248 %		
											Total:	0.0704 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: BH2--18072024-0.40

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
BH2--18072024-0.40
Moisture content:
16%
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 16% Wet Weight Moisture Correction applied (MC)

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1		chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<1.8	mg/kg	1.923	<3.462	mg/kg	<0.000346 %		**<LOD**
2		monohydric phenols			P1186		<1	mg/kg		<1	mg/kg	<0.0001 %		**<LOD**
3		cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				<1	mg/kg	1.884	<1.884	mg/kg	<0.000188 %		**<LOD**
4		pH			PH		8.5	pH		8.5	pH	8.5 pH		
5		boron { boron tribromide }	005-003-00-0	233-657-9	10294-33-4		0.5	mg/kg	23.173	9.733	mg/kg	0.000973 %	✓	
6		arsenic { arsenic }	033-001-00-X	231-148-6	7440-38-2		8.8	mg/kg		7.392	mg/kg	0.000739 %	✓	
7		cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	<0.2	mg/kg	1.285	<0.257	mg/kg	<0.00002 %		**<LOD**
8		copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		14	mg/kg	1.126	13.24	mg/kg	0.00132 %	✓	
9		mercury { mercury }	080-001-00-0	231-106-7	7439-97-6		<0.3	mg/kg		<0.3	mg/kg	<0.00003 %		**<LOD**
10		nickel { nickel dihydroxide }	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]		12	mg/kg	1.579	15.921	mg/kg	0.00159 %	✓	
11		lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	66	mg/kg	1.56	86.476	mg/kg	0.00554 %	✓	
12		selenium { selenium }	034-001-00-2	231-957-4	7782-49-2		<1	mg/kg		<1	mg/kg	<0.0001 %		**<LOD**
13		vanadium { divanadium pentaoxide; vanadium pentoxide }	023-001-00-8	215-239-8	1314-62-1		38	mg/kg	1.785	56.983	mg/kg	0.0057 %	✓	
14		zinc { zinc sulphate }	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]		54	mg/kg	2.469	112.007	mg/kg	0.0112 %	✓	

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
15		acenaphthylene		205-917-1	208-96-8		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
16		acenaphthene		201-469-6	83-32-9		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
17		anthracene		204-371-1	120-12-7		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
18		benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		0.16	mg/kg		0.134	mg/kg	0.0000134 %	✓	
19		benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		0.19	mg/kg		0.16	mg/kg	0.000016 %	✓	
20		benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		0.17	mg/kg		0.143	mg/kg	0.0000143 %	✓	
21		benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		0.13	mg/kg		0.109	mg/kg	0.0000109 %	✓	
22		benzo[ghi]perylene		205-883-8	191-24-2		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
23		chrysene	601-048-00-0	205-923-4	218-01-9		0.17	mg/kg		0.143	mg/kg	0.0000143 %	✓	
24		dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
25		fluoranthene		205-912-4	206-44-0		0.33	mg/kg		0.277	mg/kg	0.0000277 %	✓	
26		fluorene		201-695-5	86-73-7		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
27		indeno[123-cd]pyrene		205-893-2	193-39-5		0.12	mg/kg		0.101	mg/kg	0.0000101 %	✓	
28		naphthalene	601-052-00-2	202-049-5	91-20-3		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
29		phenanthrene		201-581-5	85-01-8		0.13	mg/kg		0.109	mg/kg	0.0000109 %	✓	
30		pyrene		204-927-3	129-00-0		0.3	mg/kg		0.252	mg/kg	0.0000252 %	✓	
31		benzene	601-020-00-8	200-753-7	71-43-2		<5	µg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
32		ethylbenzene	601-023-00-4	202-849-4	100-41-4		<5	µg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
33		tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane	603-181-00-X	216-653-1	1634-04-4		<5	µg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
34		o-xylene; [1] p-xylene; [2] m-xylene; [3] xylene [4]	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]		<5	µg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
35		toluene	601-021-00-3	203-625-9	108-88-3		<5	µg/kg		<0.005	mg/kg	<0.0000005 %		<LOD
36		polychlorobiphenyls; PCB	602-039-00-4	215-648-1	1336-36-3		<0.007	mg/kg		<0.007	mg/kg	<0.0000007 %		<LOD
37		coronene		205-881-7	191-07-1		0.08	mg/kg		0.0672	mg/kg	0.00000672 %	✓	
38		TPH (C6 to C40) petroleum group			TPH		<10	mg/kg		<10	mg/kg	<0.001 %		<LOD
39		chromium in chromium(III) compounds { chromium(III) oxide }		215-160-9	1308-38-9		23	mg/kg	1.462	33.616	mg/kg	0.00336 %		
											Total:	0.0324 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Appendix A: Classifier defined and non GB MCL determinands

- **monohydric phenols** (CAS Number: P1186)

Description/Comments: Combined hazards statements from harmonised entries in CLP for phenol, cresols and xylenols (604-001-00-2, 604-004-00-9, 604-006-00-X)
Data source: CLP combined data
Data source date: 26 Mar 2019
Hazard Statements: Muta. 2; H341 , Acute Tox. 3; H331 , Acute Tox. 3; H311 , Acute Tox. 3; H301 , STOT RE 2; H373 , Skin Corr. 1B; H314 , Skin Corr. 1B; H314 >= 3 % , Skin Irrit. 2; H315 1 <= conc. < 3 % , Eye Irrit. 2; H319 1 <= conc. < 3 % , Aquatic Chronic 2; H411

- **salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex**

GB MCL index number: 006-007-00-5
Description/Comments: Conversion factor based on a worst case compound: sodium cyanide
Additional Hazard Statement(s): EUH032 >= 0.2 %
Reason for additional Hazards Statement(s):
20 Nov 2021 - EUH032 >= 0.2 % hazard statement sourced from: WM3, Table C12.2

- **pH** (CAS Number: PH)

Description/Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: None.

- **arsenic** (EC Number: 231-148-6, CAS Number: 7440-38-2)

GB MCL index number: 033-001-00-X
Description/Comments: Worst Case: IARC considers arsenic Group 1; Carcinogenic to humans
Additional Hazard Statement(s): Carc. 1A; H350
Reason for additional Hazards Statement(s):
20 Nov 2021 - Carc. 1A; H350 hazard statement sourced from: IARC Group 1 (23, Sup 7, 100C) 2012

- **acenaphthylene** (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H302 , Acute Tox. 1; H330 , Acute Tox. 1; H310 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315

- **acenaphthene** (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Aquatic Chronic 2; H411

- **anthracene** (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 23 Jul 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **fluoranthene** (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **fluorene** (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **indeno[123-cd]pyrene** (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Carc. 2; H351

- **phenanthrene** (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Carc. 2; H351 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Skin Irrit. 2; H315

- **pyrene** (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Skin Irrit. 2; H315 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **chromium(III) oxide** (EC Number: 215-160-9, CAS Number: 1308-38-9)

Description/Comments: Data from ECHA's C&L inventory database
Data source: https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/33806
Data source date: 30 Apr 2020
Hazard Statements: Acute Tox. 4; H302 , Skin Sens. 1; H317 , Eye Irrit. 2; H319

- **ethylbenzene** (EC Number: 202-849-4, CAS Number: 100-41-4)

GB MCL index number: 601-023-00-4
Description/Comments:
Additional Hazard Statement(s): Carc. 2; H351
Reason for additional Hazards Statement(s):
20 Nov 2021 - Carc. 2; H351 hazard statement sourced from: IARC Group 2B (77) 2000

- **polychlorobiphenyls; PCB** (EC Number: 215-648-1, CAS Number: 1336-36-3)

GB MCL index number: 602-039-00-4
Description/Comments: Worst Case: IARC considers PCB Group 1; Carcinogenic to humans;

POP specific threshold from ATP1 (Regulation 756/2010/EU) to POPs Regulation (Regulation 850/2004/EC). Where applicable, the calculation method laid down in European standards EN 12766-1 and EN 12766-2 shall be applied.
Additional Hazard Statement(s): Carc. 1A; H350
Reason for additional Hazards Statement(s):
20 Nov 2021 - Carc. 1A; H350 hazard statement sourced from: IARC Group 1 (23, Sup 7, 100C) 2012

- **coronene** (EC Number: 205-881-7, CAS Number: 191-07-1)

Description/Comments: Data from C&L Inventory Database; no entries in Registered Substances or Pesticides Properties databases; SDS: Sigma Aldrich, 1907/2006 compliant, dated 2012 - no entries; IARC – Group 3, not carcinogenic.
Data source: http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=17010&HarmOnly=no?fc=true&lang=en
Data source date: 16 Jun 2014
Hazard Statements: STOT SE 2; H371

- **TPH (C6 to C40) petroleum group** (CAS Number: TPH)

Description/Comments: Hazard statements taken from WM3 1st Edition 2015; Risk phrases: WM2 3rd Edition 2013
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: Flam. Liq. 3; H226 , Asp. Tox. 1; H304 , STOT RE 2; H373 , Muta. 1B; H340 , Carc. 1B; H350 , Repr. 2; H361d , Aquatic Chronic 2; H411

Appendix B: Rationale for selection of metal species

chromium in chromium(VI) compounds {chromium(VI) oxide}

Most likely worst case.

cyanides {salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex}

Most likely worst case.

boron {boron tribromide}

Most likely worst case.

arsenic {arsenic}

Most likely worst case.

cadmium {cadmium sulfide}

Most likely worst case.

copper {dicopper oxide; copper (I) oxide}

Most likely worst case.

mercury {mercury}

Most likely worst case.

nickel {nickel dihydroxide}

Most likely worst case.

lead {lead chromate}

Most likely worst case.

selenium {selenium}

Most likely worst case.

vanadium {divanadium pentaoxide; vanadium pentoxide}

Most likely worst case.

zinc {zinc sulphate}

Most likely worst case.

chromium in chromium(III) compounds {chromium(III) oxide}

Most likely worst case.

Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition v1.2.GB - Oct 2021
HazWasteOnline Classification Engine Version: 2024.281.6280.11501 (07 Oct 2024)
HazWasteOnline Database: 2024.281.6280.11501 (07 Oct 2024)

This classification utilises the following guidance and legislation:
WM3 v1.2.GB - Waste Classification - 1stEditionv1.2.GB-Oct2021
CLP Regulation - Regulation1272/2008/ECof16December2008
1st ATP - Regulation790/2009/ECof10August2009
2nd ATP - Regulation286/2011/ECof10March2011
3rd ATP - Regulation618/2012/EUof10July2012
4th ATP - Regulation487/2013/EUof8May2013
Correction to 1st ATP - Regulation758/2013/EUof7August2013
5th ATP - Regulation944/2013/EUof2October2013
6th ATP - Regulation605/2014/EUof5June2014
WFD Annex III replacement - Regulation1357/2014/EUof18December2014
Revised List of Waste 2014 - Decision2014/955/EUof18December2014
7th ATP - Regulation2015/1221/EUof24July2015
8th ATP - Regulation(EU)2016/918of19May2016
9th ATP - Regulation(EU)2016/1179of19July2016
10th ATP - Regulation(EU)2017/776of4May2017
HP14 amendment - Regulation(EU)2017/997of8June2017
13th ATP - Regulation(EU)2018/1480of4October2018
14th ATP - Regulation(EU)2020/217of4October2019
15th ATP - Regulation(EU)2020/1182of19May2020
The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use)(Amendment etc.) (EU Exit) Regulations 2020 - UK:2020No.1567of16thDecember2020
The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1540 of 16th December 2020
GB MCL List - version1.1of09June2021
GB MCL List v2.0 - version2.0of20thOctober2023
GB MCL List v3.0 - version3.0of11thJanuary2024
GB MCL List v4.0 - version4.0of2ndMarch2024
GB MCL List v5.0 - version5.0of26thJune2024

HazWasteOnline™

Waste Classification Report

HazWasteOnline™ classifies waste as either **hazardous** or **non-hazardous** based on its chemical composition, related legislation and the rules and data defined in the current UK or EU technical guidance (Appendix C) (note that HP 9 Infectious is not assessed). It is the responsibility of the classifier named below to:

a) understand the origin of the waste
b) select the correct List of Waste code(s)
c) confirm that the list of determinands, results and sampling plan are fit for purpose
d) select and justify the chosen metal species (Appendix B)
e) correctly apply moisture correction and other available corrections
f) add the meta data for their user-defined substances (Appendix A)
g) check that the classification engine is suitable with respect to the national destination of the waste (Appendix C)

To aid the reviewer, the laboratory results, assumptions and justifications managed by the classifier are highlighted in pale yellow.

BNNLD-EFJZ6-IOTV0

Job name

24-037309_HWOL

Description/Comments

Project

GWPR6068

Site

Former Dairy Crest Depot, Dunsbury Way, Havant PO9 5BQ

Classified by

Name:
Myles Finnerty
Date:
11 Oct 2024 10:03 GMT
Telephone:

Company:
Ground and Water
2 The Long Barn, Norton Farm, Selborne Road
Alton
CU34 3NB

HazWasteOnline™ provides a two day, hazardous waste classification course that covers the use of the software and both basic and advanced waste classification techniques. Certification has to be renewed every 3 years.

HazWasteOnline™ Certification:	-
Course	**Date**
Hazardous Waste Classification	-

Purpose of classification

2 - Material Characterisation

Address of the waste

Former Dairy Crest Depot, Dunsbury Way, Havant **Post Code** PO9 5BQ

SIC for the process giving rise to the waste

Description of industry/producer giving rise to the waste

Redevelopment of the site

Description of the specific process, sub-process and/or activity that created the waste

Foundation preparation

Description of the waste

Made Ground

Job summary

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
1	WS101--07082024-1.00		Hazardous	HP 8	3
2	WS102--07082024-0.80		Non Hazardous		5

Related documents

#	Name	Description
1	24-037309_HWOL.hwol	i2 Analytical .hwol file used to populate the Job

Report

Created by: Myles Finnerty

Created date: 11 Oct 2024 10:03 GMT

Appendices	Page
Appendix A: Classifier defined and non GB MCL determinands	7
Appendix B: Rationale for selection of metal species	8
Appendix C: Version	9

Classification of sample: WS101--07082024-1.00

Hazardous Waste
Classified as **17 05 03 ***
in the List of Waste

Sample details

Sample name:
WS101--07082024-1.00
Moisture content:
4.9%
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 03 * (Soil and stones containing hazardous substances)

Hazard properties

HP 8: Corrosive "waste which on application can cause skin corrosion"

pH; pH "Assumed to be irritant/corrosive because of pH value"

Because of determinand:

pH: (conc.: 11.5 pH)

Determinands

Moisture content: 4.9% Wet Weight Moisture Correction applied (MC)

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1		chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<1.8	mg/kg	1.923	<3.462	mg/kg	<0.000346 %		**<LOD**
2		monohydric phenols			P1186		<1	mg/kg		<1	mg/kg	<0.0001 %		**<LOD**
3		cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				<1	mg/kg	1.884	<1.884	mg/kg	<0.000188 %		**<LOD**
4		pH			PH		11.5	pH		11.5	pH	11.5 pH		
5		boron { boron tribromide }	005-003-00-0	233-657-9	10294-33-4		1.5	mg/kg	23.173	33.056	mg/kg	0.00331 %	✓	
6		arsenic { arsenic }	033-001-00-X	231-148-6	7440-38-2		8.5	mg/kg		8.083	mg/kg	0.000808 %	✓	
7		cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	<0.2	mg/kg	1.285	<0.257	mg/kg	<0.00002 %		**<LOD**
8		copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		20	mg/kg	1.126	21.414	mg/kg	0.00214 %	✓	
9		mercury { mercury }	080-001-00-0	231-106-7	7439-97-6		<0.3	mg/kg		<0.3	mg/kg	<0.00003 %		**<LOD**
10		nickel { nickel dihydroxide }	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]		9.1	mg/kg	1.579	13.669	mg/kg	0.00137 %	✓	
11		lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	91	mg/kg	1.56	134.988	mg/kg	0.00865 %	✓	
12		selenium { selenium }	034-001-00-2	231-957-4	7782-49-2		<1	mg/kg		<1	mg/kg	<0.0001 %		**<LOD**

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
13		vanadium { divanadium pentaoxide; vanadium pentoxide }	023-001-00-8	215-239-8	1314-62-1		29	mg/kg	1.785	49.234	mg/kg	0.00492 %	✓	
14		zinc { zinc sulphate }	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]		84	mg/kg	2.469	197.257	mg/kg	0.0197 %	✓	
15		acenaphthylene		205-917-1	208-96-8		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		**<LOD**
16		acenaphthene		201-469-6	83-32-9		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		**<LOD**
17		anthracene		204-371-1	120-12-7		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		**<LOD**
18		benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		**<LOD**
19		benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		0.25	mg/kg		0.238	mg/kg	0.0000238 %	✓	
20		benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		0.27	mg/kg		0.257	mg/kg	0.0000257 %	✓	
21		benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		0.15	mg/kg		0.143	mg/kg	0.0000143 %	✓	
22		benzo[ghi]perylene		205-883-8	191-24-2		0.14	mg/kg		0.133	mg/kg	0.0000133 %	✓	
23		chrysene	601-048-00-0	205-923-4	218-01-9		0.25	mg/kg		0.238	mg/kg	0.0000238 %	✓	
24		dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		**<LOD**
25		fluoranthene		205-912-4	206-44-0		0.46	mg/kg		0.437	mg/kg	0.0000437 %	✓	
26		fluorene		201-695-5	86-73-7		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		**<LOD**
27		indeno[123-cd]pyrene		205-893-2	193-39-5		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		**<LOD**
28		naphthalene	601-052-00-2	202-049-5	91-20-3		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		**<LOD**
29		phenanthrene		201-581-5	85-01-8		0.23	mg/kg		0.219	mg/kg	0.0000219 %	✓	
30		pyrene		204-927-3	129-00-0		0.41	mg/kg		0.39	mg/kg	0.000039 %	✓	
31		chromium in chromium(III) compounds { chromium(III) oxide }		215-160-9	1308-38-9		17	mg/kg	1.462	24.846	mg/kg	0.00248 %		
											Total:	0.0444 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Hazardous result
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: WS102--07082024-0.80

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
WS102--07082024-0.80
Moisture content:
11%
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 11% Wet Weight Moisture Correction applied (MC)

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1		chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<1.8	mg/kg	1.923	<3.462	mg/kg	<0.000346 %		**<LOD**
2		monohydric phenols			P1186		<1	mg/kg		<1	mg/kg	<0.0001 %		**<LOD**
3		cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				<1	mg/kg	1.884	<1.884	mg/kg	<0.000188 %		**<LOD**
4		pH			PH		8	pH		8	pH	8pH		
5		boron { boron tribromide }	005-003-00-0	233-657-9	10294-33-4		1.2	mg/kg	23.173	24.749	mg/kg	0.00247 %	✓	
6		arsenic { arsenic }	033-001-00-X	231-148-6	7440-38-2		9.6	mg/kg		8.544	mg/kg	0.000854 %	✓	
7		cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	<0.2	mg/kg	1.285	<0.257	mg/kg	<0.00002 %		**<LOD**
8		copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		14	mg/kg	1.126	14.029	mg/kg	0.0014 %	✓	
9		mercury { mercury }	080-001-00-0	231-106-7	7439-97-6		<0.3	mg/kg		<0.3	mg/kg	<0.00003 %		**<LOD**
10		nickel { nickel dihydroxide }	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]		11	mg/kg	1.579	15.463	mg/kg	0.00155 %	✓	
11		lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	61	mg/kg	1.56	84.682	mg/kg	0.00543 %	✓	
12		selenium { selenium }	034-001-00-2	231-957-4	7782-49-2		<1	mg/kg		<1	mg/kg	<0.0001 %		**<LOD**
13		vanadium { divanadium pentaoxide; vanadium pentoxide }	023-001-00-8	215-239-8	1314-62-1		39	mg/kg	1.785	61.964	mg/kg	0.0062 %	✓	
14		zinc { zinc sulphate }	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]		79	mg/kg	2.469	173.616	mg/kg	0.0174 %	✓	

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
15	•	acenaphthylene		205-917-1	208-96-8		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		**<LOD**
16	•	acenaphthene		201-469-6	83-32-9		0.15	mg/kg		0.134	mg/kg	0.0000134 %	✓	
17	•	anthracene		204-371-1	120-12-7		0.49	mg/kg		0.436	mg/kg	0.0000436 %	✓	
18		benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		1.4	mg/kg		1.246	mg/kg	0.000125 %	✓	
19		benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		1.3	mg/kg		1.157	mg/kg	0.000116 %	✓	
20		benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		1.5	mg/kg		1.335	mg/kg	0.000133 %	✓	
21		benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		0.76	mg/kg		0.676	mg/kg	0.0000676 %	✓	
22	•	benzo[ghi]perylene		205-883-8	191-24-2		0.53	mg/kg		0.472	mg/kg	0.0000472 %	✓	
23		chrysene	601-048-00-0	205-923-4	218-01-9		1.4	mg/kg		1.246	mg/kg	0.000125 %	✓	
24		dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		**<LOD**
25	•	fluoranthene		205-912-4	206-44-0		2.9	mg/kg		2.581	mg/kg	0.000258 %	✓	
26	•	fluorene		201-695-5	86-73-7		0.13	mg/kg		0.116	mg/kg	0.0000116 %	✓	
27	•	indeno[123-cd]pyrene		205-893-2	193-39-5		0.49	mg/kg		0.436	mg/kg	0.0000436 %	✓	
28		naphthalene	601-052-00-2	202-049-5	91-20-3		0.08	mg/kg		0.0712	mg/kg	0.00000712 %	✓	
29	•	phenanthrene		201-581-5	85-01-8		1.6	mg/kg		1.424	mg/kg	0.000142 %	✓	
30	•	pyrene		204-927-3	129-00-0		2.6	mg/kg		2.314	mg/kg	0.000231 %	✓	
31		chromium in chromium(III) compounds { • chromium(III) oxide }		215-160-9	1308-38-9		22	mg/kg	1.462	32.154	mg/kg	0.00322 %		
											Total:	0.0406 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Appendix A: Classifier defined and non GB MCL determinands

monohydric phenols (CAS Number: P1186)

Description/Comments: Combined hazards statements from harmonised entries in CLP for phenol, cresols and xylenols (604-001-00-2, 604-004-00-9, 604-006-00-X)
Data source: CLP combined data
Data source date: 26 Mar 2019
Hazard Statements: Muta. 2; H341 , Acute Tox. 3; H331 , Acute Tox. 3; H311 , Acute Tox. 3; H301 , STOT RE 2; H373 , Skin Corr. 1B; H314 , Skin Corr. 1B; H314 >= 3 % , Skin Irrit. 2; H315 1 <= conc. < 3 % , Eye Irrit. 2; H319 1 <= conc. < 3 % , Aquatic Chronic 2; H411

salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex

GB MCL index number: 006-007-00-5
Description/Comments: Conversion factor based on a worst case compound: sodium cyanide
Additional Hazard Statement(s): EUH032 >= 0.2 %
Reason for additional Hazards Statement(s):
20 Nov 2021 - EUH032 >= 0.2 % hazard statement sourced from: WM3, Table C12.2

pH (CAS Number: PH)

Description/Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: None.

arsenic (EC Number: 231-148-6, CAS Number: 7440-38-2)

GB MCL index number: 033-001-00-X
Description/Comments: Worst Case: IARC considers arsenic Group 1; Carcinogenic to humans
Additional Hazard Statement(s): Carc. 1A; H350
Reason for additional Hazards Statement(s):
20 Nov 2021 - Carc. 1A; H350 hazard statement sourced from: IARC Group 1 (23, Sup 7, 100C) 2012

acenaphthylene (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H302 , Acute Tox. 1; H330 , Acute Tox. 1; H310 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315

acenaphthene (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Aquatic Chronic 2; H411

anthracene (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

benzo[ghi]perylene (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 23 Jul 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

fluoranthene (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

fluorene (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **indeno[123-cd]pyrene** (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Carc. 2; H351

- **phenanthrene** (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Carc. 2; H351 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Skin Irrit. 2; H315

- **pyrene** (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Skin Irrit. 2; H315 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **chromium(III) oxide** (EC Number: 215-160-9, CAS Number: 1308-38-9)

Description/Comments: Data from ECHA's C&L inventory database
Data source: https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/33806
Data source date: 30 Apr 2020
Hazard Statements: Acute Tox. 4; H302 , Skin Sens. 1; H317 , Eye Irrit. 2; H319

Appendix B: Rationale for selection of metal species

chromium in chromium(VI) compounds {chromium(VI) oxide}

Most likely worst case.

cyanides {salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex}

Most likely worst case.

boron {boron tribromide}

Most likely worst case.

arsenic {arsenic}

Most likely worst case.

cadmium {cadmium sulfide}

Most likely worst case.

copper {dicopper oxide; copper (I) oxide}

Most likely worst case.

mercury {mercury}

Most likely worst case.

nickel {nickel dihydroxide}

Most likely worst case.

lead {lead chromate}

Most likely worst case.

selenium {selenium}

Most likely worst case.

vanadium {divanadium pentaoxide; vanadium pentoxide}

Most likely worst case.

zinc {zinc sulphate}

Most likely worst case.

chromium in chromium(III) compounds {chromium(III) oxide}

Most likely worst case.

Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition v1.2.GB - Oct 2021
HazWasteOnline Classification Engine Version: 2024.281.6280.11501 (07 Oct 2024)
HazWasteOnline Database: 2024.281.6280.11501 (07 Oct 2024)

This classification utilises the following guidance and legislation:
WM3 v1.2.GB - Waste Classification - 1stEditionv1.2.GB-Oct2021
CLP Regulation - Regulation1272/2008/ECof16December2008
1st ATP - Regulation790/2009/ECof10August2009
2nd ATP - Regulation286/2011/ECof10March2011
3rd ATP - Regulation618/2012/EUof10July2012
4th ATP - Regulation487/2013/EUof8May2013
Correction to 1st ATP - Regulation758/2013/EUof7August2013
5th ATP - Regulation944/2013/EUof2October2013
6th ATP - Regulation605/2014/EUof5June2014
WFD Annex III replacement - Regulation1357/2014/EUof18December2014
Revised List of Waste 2014 - Decision2014/955/EUof18December2014
7th ATP - Regulation2015/1221/EUof24July2015
8th ATP - Regulation(EU)2016/918of19May2016
9th ATP - Regulation(EU)2016/1179of19July2016
10th ATP - Regulation(EU)2017/776of4May2017
HP14 amendment - Regulation(EU)2017/997of8June2017
13th ATP - Regulation(EU)2018/1480of4October2018
14th ATP - Regulation(EU)2020/217of4October2019
15th ATP - Regulation(EU)2020/1182of19May2020
The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use)(Amendment etc.) (EU Exit) Regulations 2020 - UK:2020No.1567of16thDecember2020
The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1540 of 16th December 2020
GB MCL List - version1.1of09June2021
GB MCL List v2.0 - version2.0of20thOctober2023
GB MCL List v3.0 - version3.0of11thJanuary2024
GB MCL List v4.0 - version4.0of2ndMarch2024
GB MCL List v5.0 - version5.0of26thJune2024