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Environment Group

Vastint UK BV
Land on North side of Lamby Way
Rumney, Cardiff

Phase 2 Geo-Environmental Assessment

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Limitations

EXECUTIVE SUMMARY	
Site Address	Land on north side of Lamby Way, Waterside Business Park, Rumney, Cardiff, CF3 2EQ.
Site Setting and History	The site currently comprises a rectangular plot of rough scrubland, with an area of waterlogged ground in the north east of the site within a business park/small workshop setting. Semi-mature vegetation forms the northern boundary and a small electricity substation is located along the south eastern boundary. The Great Western Railway is located to the north of the site.
Published Geology, Hydrogeology and Hydrology	The west of the site is understood to be underlain by Tidal Flat Deposits (Secondary Undifferentiated Aquifer), overlying the bedrock geology of the Castell Formation (Secondary B Aquifer) and in the east, superficial deposit are noted to not be present, with the site directly underlain by the bedrock geology of the Cardiff Group (Secondary B Aquifer). BGS records do not indicate Made Ground to be present at the site. The closest surface water feature to the site is Rhosog Fach Reen, approximately 300m east of the site.
Scope of Investigation Works	The ground investigation was undertaken on 26th and 27th October 2016 and comprised the following: • Advancement of four dynamic sampler boreholes to a maximum depth of 5.45m bgl; • Advancement of eight trial pits to a maximum depth of 3.50m bgl; • Soil and groundwater chemical analysis; • Soil geotechnical analysis; and • Gas and groundwater monitoring.
Ground Conditions Encountered	Ground conditions comprised Made Ground (between ground level and 3.50m bgl) overlying Tidal Flat Deposits (maximum depth unproven to over 5.45m bgl) across the entire site. Neither the Castell Formation nor Cardiff Group were encountered as part of this investigation. Groundwater was encountered within the majority of exploratory holes between 0.80m bgl (water strike within Made Ground in TP06) and 5.00m bgl (water strike within Tidal Flat Deposits in DS03). No visual evidence of contamination was noted during the investigation. A faint hydrocarbon odour was noted between 1.30m and 1.60m bgl within DS02, with a volatile vapour concentration of 0.1ppm.
Geotechnical Appraisal	An assumption has been made that the proposed development will be lightly loaded and as such, a programme of ground improvement via excavation, proof rolling and re-engineering of Made Ground material is recommended in order to provide a suitable development platform for a raft foundation solution. It is recommended that that local thickening of the foundation may be required below walls, in mezzanine areas and below offices. Should detailed development plans with larger loadings become available, a piled foundation solution may be required. Design Sulphate Class DS-1 and ACEC Class AC-1 is required for concrete to resist attack from sulphate levels within soils and groundwater
Environmental Appraisal	Ground gas monitoring has identified elevated concentrations of methane and marginally elevated concentrations of carbon dioxide at the site. The results of soil chemical analysis have not identified significantly elevated contaminants when assessed in the context of the commercial development. Asbestos was identified within all Made Ground samples tested. Groundwater analysis identified marginally elevated concentrations of several heavy metals, cyanide, phenol and PAHs.

EXECUTIVE SUMMARY	
Waste Classification	Made Ground soils are expected to be classified as non-hazardous waste, but may require further testing prior to off-site disposal.
Recommendations	Ground gas protection measures achieving a score of 3.5 will be required at the site. Hardstanding and a layer of clean capping will be required to reduce the risk from asbestos to future site users. The risk to ground workers is likely mitigated through conventional working methods and hygiene practices. A Remediation Strategy should be completed detailing required mitigation measures.
This summary should be read in conjunction with BWB's full report (ref. LWC-BWB-00-XX-EN-RP-0002_PH2_P2) and reflects an assessment of the site based on information received by BWB at the time of production.	

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1 INTRODUCTION

Instruction

1.1 BWB Consulting (BWB) was instructed by Vastint UK BV (the Client) to carry out a Phase 2 Geo-Environmental Assessment of the Land on North side of Lamby Way, Rumney, Cardiff. Details of the project brief are included in BWB proposal reference KES/TJH/NTE2313/CL01/REV2 dated 12th October 2016.

1.2 The proposed development is anticipated to comprise the development of the site for a waste transfer station, comprising a number of processing and storage bays for waste sorting and associated offices. A proposed site plan is included within **Appendix 1**.

Previous Reports

1.3 BWB has previously completed the following geo-environmental report for the site, which should be read in conjunction with this report:

- '*Phase 1 Geo-Environmental Assessment: Land on North side of Lamby Way, Rumney, Cardiff*' by BWB Consulting for Vastint UK BV, reference LWC-BWB-00XX-EN-RP-0001_DS_P1, dated September 2016.

1.4 It is understood that the Client has reliance on the above report and therefore pertinent information has been included within this report, where appropriate.

Objectives

1.5 The objectives of the report are to assess:

- The prevailing ground and groundwater conditions across the site;
- The potential presence and extent of contamination in shallow soil and groundwater beneath the site;
- The significance and magnitude of the observed contamination through comparison of analytical data to appropriate published environmental screening criteria;
- The strength properties of the soil beneath the site to enable foundation design; and
- The ground gas regime beneath the site.

1.6 The above objectives will allow the Preliminary Conceptual Site Model presented in the Phase 1 report to be verified and updated. The report has been completed in accordance with BS10175:2011(+A1:2013) 'Investigation of Potentially Contaminated Sites, Code of Practice' and CLR11 'Model Procedures for the Management of Land Contamination'.

1.7 This report presents the information obtained from a desk study and the supplementary ground investigation. Sections 2 to 5 of the report, together with the associated Figures, Drawings and Appendices, provides a Ground Investigation Report (GIR), as defined in BS EN 1997-1:2004 and BS EN 1997-2:2007.

1.8 The report also includes information required to form a Geotechnical Design Report as defined in BS EN 1997-1:2004, and the salient information, assessments and recommendations are presented in Sections 6 to 14 of the report, together with the associated Figures, Drawings and Appendices.

Scope of Works

1.9 The scope of works was completed on 26th and 27th October 2016 and comprised the following:

- Non-intrusive survey of excavation locations for underground utilities;
- Eight machine excavated trial pits;
- Four dynamic sampler boreholes;
- Four gas and groundwater monitoring visits;
- Chemical analysis of soils and groundwater; and
- Geotechnical testing of soils.

2 THE SITE

Site Location

2.1 The site is located at Land on North side of Lamby Way, Rumney, Cardiff, at approximate National Grid reference 322019, 178619. The location of the site is shown in **Figure 1**.

Figure 1 Site Location Plan

Reproduced from the Ordnance Survey 1:25000 map with the permission of the controller of Her Majesty's Stationery Office Crown Copyright Reserved.

Site Description

2.2 A detailed description of the key features of the site and its surrounding is included within the Phase 1 Report.

2.3 The site forms a roughly rectangular plot of land, which is approximately 0.7 hectares in area. The site is generally flat and level, with cover comprising rough scrubland, with

some areas of waterlogged ground in the north-eastern part of the site. Semi-mature vegetation is found along the northern boundary and a small electricity substation is present along the south eastern boundary.

2.4 The site is bound by a mix of palisade and mesh fencing on all sides, with access to the site via a gated entrance off Lamby Way. The site is situated within an industrial park setting, with the northern boundary comprising the Great Western Railway.

2.5 The site has remained undeveloped throughout the mapped history, until 1994 when an electricity substation was constructed on the south eastern boundary.

3 GEO-ENVIRONMENTAL SETTING

Published Geology

3.1 Information published by the British Geological Survey (BGS) indicates that the site is directly underlain in the west by superficial Tidal Flat Deposits, overlying the bedrock geology of the Castell Formation. Superficial deposits are not noted to be present in the east of the site, with the site directly underlain by the bedrock geology of the Cardiff Group.

3.2 The BGS Lexicon database describes the Tidal Flat Deposits as a consolidated soft silty clay, with layers of sand, gravel and peat. The Castell Formation is described as sandstones, siltstones and subordinate mudstones, with the Cardiff Group described as interbedded mudstones and thin siltstones with subordinate thin sandstones and bioclastic limestones.

3.3 BGS records do not indicate Made Ground to be present on site, but the developed nature of the surrounding area suggests that deposits are likely to be present.

Hydrogeology

3.4 The underlying ground conditions have been classified by the Environment Agency (EA) as follows:

- Tidal Flat Deposits: Secondary Undifferentiated Aquifer;
- Castell Formation: Secondary B Aquifer; and
- Cardiff Group: Secondary B Aquifer.

3.5 Secondary Undifferentiated Aquifers are classified as layers that have previously been designated as both minor and non-aquifers in different locations due to the variable characteristics of the rock types. Secondary B Aquifers are described as lower permeability layers, which may store/yield limited amounts of groundwater due to localised features such as fissures, permeable horizons and weathering.

3.6 No groundwater abstraction licences or discharge consents issuing to groundwater are reported to be present within 500m of the site.

3.7 The site is not within or within close proximity to an EA groundwater Source Protection zone.

Hydrology

3.8 The closest mapped surface water features to the site are a primary river named Rhosog Fach Reen, approximately 300m east of the site; an unnamed tertiary river approximately 310m to the north-east; and a secondary river, noted to be a drain approximately 315m north-east of the site.

3.9 Information published by the EA indicated that much of the site is located within a Zone 2 Floodplain, with the annual probability of flooding to be between 1 in 1000 (0.1%)

and 1 in 100 (1%) from rivers and between 1 in 1000 (0.1%) and 1 in 200 (0.5%) from the sea.

3.10 No surface water or potable water abstraction licenses are noted to be within 500m of the site.

4 PRELIMINARY ENVIRONMENTAL RISK ASSESSMENT

Introduction

4.1 The risk posed by any contaminants in soil or groundwater will depend on the nature of the hazard, the probability of exposure, the pathway by which exposure occurs, and the likely effects on the receptors. A contaminant is defined as a substance that has the potential to cause harm, while a risk is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.

4.2 The following section discusses all the identified potential on and off site sources, pathways and receptors in the context of the proposed development and plausible pollutant linkages which may represent a risk to identified receptors such as human health and/or controlled waters from the data gained from the desk study. At this stage the assessment is qualitative and aimed to determine all pollutant linkages, irrespective of significance or allowing for uncertainty.

4.3 Three impact potentials exist for any given site, these are:

- The site impacting upon itself;
- The site impacting on its surroundings; and
- The surroundings impacting on the site.

4.4 All three impacts need to be considered in a risk assessment.

4.5 A Source, Pathway, Receptor analysis has been undertaken for the site based on the information provided in the preceding sections. This is presented as **Table 1.**

4.6 **Sources (S);** These are potential or known sources of contamination that may relate to a former land use or present site feature or process (e.g. fuel storage tanks).

4.7 **Pathways (P);** A pathway is defined as a mechanism or route by which a contaminant comes into contact with, or otherwise affects a receptor. Pathways by which the identified receptors may be impacted upon in the context of the proposed development.

4.8 **Receptors (R);** Receptors are defined as people, living organisms, ecological systems, controlled waters, atmosphere, structures and utilities that could be adversely affected by contaminant(s).

Table 1 Preliminary Conceptual Site Model

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
S1: On site: Made Ground – Potential contaminants may include heavy metals, benzo(a)pyrene and other PAH (Polycyclic Aromatic Hydrocarbon) compounds, sulphate, asbestos and hazardous ground gases (carbon dioxide/methane).	**P1:** Direct contact, incidental ingestion and inhalation of particulates.	**R1**: Construction/ services personnel	Mi	Lw	L	An intrusive ground investigation should be completed to characterise the Made Ground, asses the presence of contamination and characterise the ground gas regime. Exposure of contamination to construction workers can be mitigated by the adoption of suitable working methods and appropriated PPE. If significant asbestos is recorded the requirements of the Control of Asbestos Regulations, 2012 shall be complied with.
		R2: Future site users (commercial)	Mi	LW	L	
	P2: Vertical migration of contaminants in the soil leachate.	**R3:** Underlying Secondary B Aquifer	Mi	Lw	L	
	P3: Direct contact.	**R4:** Water utility pipes	Mi	Lw	L	Suitable water pipe materials should be agreed with the local utility provider.
		R5: Buried structures/ foundations.	Mi	Lw	L	The ground investigation should include analysis of pH and sulphates to assess the potential for aggressive ground conditions to be present. A suitable concrete mix shall be used for all buried concrete structures.
	P4: Migration and accumulation of ground gasses in enclosed spaces leading to asphyxiation (carbon dioxide) or explosion (methane).	**R1**: Construction/ services personnel	Md	Lw	M/L	A programme of gas monitoring should be completed to assess the potential for gas generation and ingress into any new buildings. Gas protection measures may be required in all new buildings consisting of a combination of floor slab, ventilation and gas impermeable membrane.
		R2: Future site users	Md	Lw	M/L	

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
S2: Carbon dioxide and methane generated from organic rich silts, clays and peat within the Tidal Flat Deposits.	**P4**: Migration and accumulation of ground gasses in enclosed spaces leading to asphyxiation (carbon dioxide).	**R1**: Construction/ services personnel	Md	Lw	M/L	A programme of gas monitoring should be completed to assess the potential for gas generation and ingress into any new buildings. Gas protection measures may be installed in all new buildings consisting of a combination of floor slab, ventilation and gas impermeable membrane.
		R2: Future site users	Md	Lw	M/L	

VH = Very High, H = High, M = Moderate, M/L = Moderate/Low, L = Low, VL = Very Low

KEY: Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor Hi = High, Li = Likely, Lw = Low Likelihood, Ul = Unlikely

5 PHASE II ENVIRONMENTAL AND GEOTECHNICAL GROUND INVESTIGATION

Scope of Works

5.1 Intrusive ground investigation works were undertaken on 26th and 27th October 2016 and comprised the following works:

- Clearance of investigation locations by a specialist buried services tracing company;
- Collection of coordinates and elevations of exploratory hole locations;
- The advancement of four boreholes (DS01 to DS04 inclusive) by dynamic sampling drilling techniques, to a maximum depth of 5.45m below ground level (bgl) with completion of SPTs and installations of gas and groundwater monitoring wells within three boreholes (DS01, DS02 and DS04);
- The advancement of eight machine excavated trial pits (TP01 to TP08 inclusive) to a maximum depth of 3.50m bgl;
- Collection of environmental soil and groundwater water samples for chemical analysis at a UKAS and MCERTS accredited laboratory;
- Collection of bulk and disturbed soil samples for geotechnical analysis at a UKAS accredited laboratory; and
- Four post investigation ground gas and groundwater level monitoring visits.

5.2 An exploratory hole location plan is presented as **Drawing 1**. BWB exploratory hole records are presented as **Appendix 2,** the SPT calibration certificate is presented in **Appendix 3**, and the post investigation gas and groundwater monitoring data is presented as **Appendix 4**.

5.3 The site investigation works were carried out in general accordance with BS5930:2015 'Code of Practice for Site Investigations' and BS10175:2011 'Investigation of Potentially Contaminated Sites'.

Chemical Sampling and Analytical Strategy

5.4 Exploratory holes were positioned across the whole site for general site coverage, with DS02 looking to cover the position of the proposed two storey office/welfare facility.

5.5 The response zones within DS01 and D02 were set within the Made Ground and within the superficial deposits in DS04, in order to obtain groundwater and ground gas data from both strata types encountered on site.

Soil Strategy

5.6 Soil samples were retrieved from a variety of depths and strata, where possible, to allow for a range of environmental laboratory testing.

5.7 Selected soil samples collected from exploratory hole locations were sent to i2 Analytical UK Ltd (UKAS and MCERTS accredited) for chemical analysis. The following chemical analytical testing was undertaken:

- Six soil samples tested for a soil suite (BWB Standard Suite) comprising arsenic, barium, beryllium, water soluble boron, cadmium, chromium, hexavalent chromium, copper, lead, mercury, nickel, selenium, vanadium, zinc, water soluble sulphate (2:1 extract), total phenols, total cyanide, free cyanide, complex cyanide, fraction of organic carbon, pH, Polycyclic Aromatic Hydrocarbons (PAHs) (United States Environment Protection Agency priority 16 compounds) and Total Petroleum Hydrocarbons (TPH) C6-C40;
- Two soil samples tested for TPH speciated to the UK Criteria Working Group (TPHCWG) aliphatic and aromatic compounds; and
- Four soil samples for asbestos screening.

5.8 The results of the soil chemical testing are presented as **Appendix 5**.

5.9 The above soil chemical testing was targeted based on the following rationale presented within **Table 2**.

Table 2 Analytical Strategy

Location	Depth (m bgl)	Stratum	Analysis	Reason
DS02	1.50	Made Ground	BWB Standard Suite, TPHCWG with BTEX	Hydrocarbon odour noted in arisings
DS03, TP01, TP06, TP08	1.60, 0.40, 0.30, 0.50	Made Ground	BWB Standard Suite, Asbestos Screen, TPHCWG with BTEX (DS03 @ 1.60m bgl)	General screen of Made Ground
DS02, DS03	4.50, 3.60	Tidal Flat Deposits	BWB Standard Suite	General screen of superficial deposits

Groundwater Strategy

5.10 Groundwater samples were obtained from all installed boreholes, prior to which they were purged using a bailer until the water failed to sufficiently recharge the monitoring wells. The groundwater samples were sent to i2 Analytical UK Ltd (UKAS and MCERTS accredited) for the following suite of groundwater chemical testing:

- Three water samples tested for arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium, zinc, conductivity, soluble sulphate, ammoniacal nitrogen, total phenols, total cyanide, pH, total organic carbon, PAHs (US EPA priority 16 compounds); and
- Three water samples tested for TPHCWG.

5.11 The results of the water chemical testing are presented as **Appendix 6**.

Geotechnical Strategy

5.12 Both the dynamic sampler boreholes and trial pits were positioned to assess ground conditions, strength properties and characteristics across the wider site, with DS02 positioned in the area of the proposed office/welfare facility on site.

5.13 In-situ soil strength testing comprising SPTs were undertaken within the dynamic sampler boreholes. SPT 'N' values are included on the exploratory hole logs presented as **Appendix 2**.

5.14 Selected disturbed and bulk samples were collected from all investigation locations and sent to the geotechnical project laboratory (i2 Analytical UK Ltd), which is UKAS accredited. The following geotechnical testing was undertaken:

- Six samples tested for moisture content;
- Three samples tested for Atterberg (liquid and plastic) limits; and
- Four samples tested for BRE Suite including aqueous sulphate and pH.

5.15 The results of the geotechnical testing are included as **Appendix 7**.

Limitations and Uncertainty

5.16 TP04 was terminated at shallow depths (2.10m bgl) due to instability within the Made Ground on site.

5.17 Groundwater recharge into the wells was not sufficient to allow for the wells to be purged of three times the well volume prior to collection of water samples. As such, all water samples obtained were grab samples.

5.18 No surface water sampling was completed as part of this ground investigation.

6 GROUND CONDITIONS ENCOUNTERED

Geological Summary

6.1 The ground conditions recorded as part of the ground investigation generally confirmed the published geology discussed in the Phase 1 report, comprising significant deposits of Made Ground overlying superficial deposits of Tidal Flat Deposits. Neither bedrock geologies – both the Castell Formation and the Cardiff Group – were encountered as part of this investigation.

6.2 The recorded ground conditions are summarised in **Table 3** below and **Drawing 2** presents a geological cross section through the site. Uncorrected SPT results collected from the borehole locations are presented on the exploratory hole records presented in **Appendix 2**.

Table 3 Summary of Ground Conditions

Strata	Top Depth (m)		Base Depth (m)		Thickness (m)		SPT N Value	
	Min	Max	Min	Max	Min	Max	Min	Max
Made Ground	0.00	0.00	1.90	3.50	1.90	3.50	6	18
Tidal Flat Deposits*	1.90	3.50	3.50	5.45	0.90	3.55	23	155

*Base depth and thickness of Tidal Flat Deposits unproven.

Geological Descriptions

Made Ground

6.3 Made Ground was encountered within all exploratory holes at the site with thicknesses raging between 1.90m and 3.50m. Inferred Made Ground thicknesses across the site are indicated on **Drawing 3**.

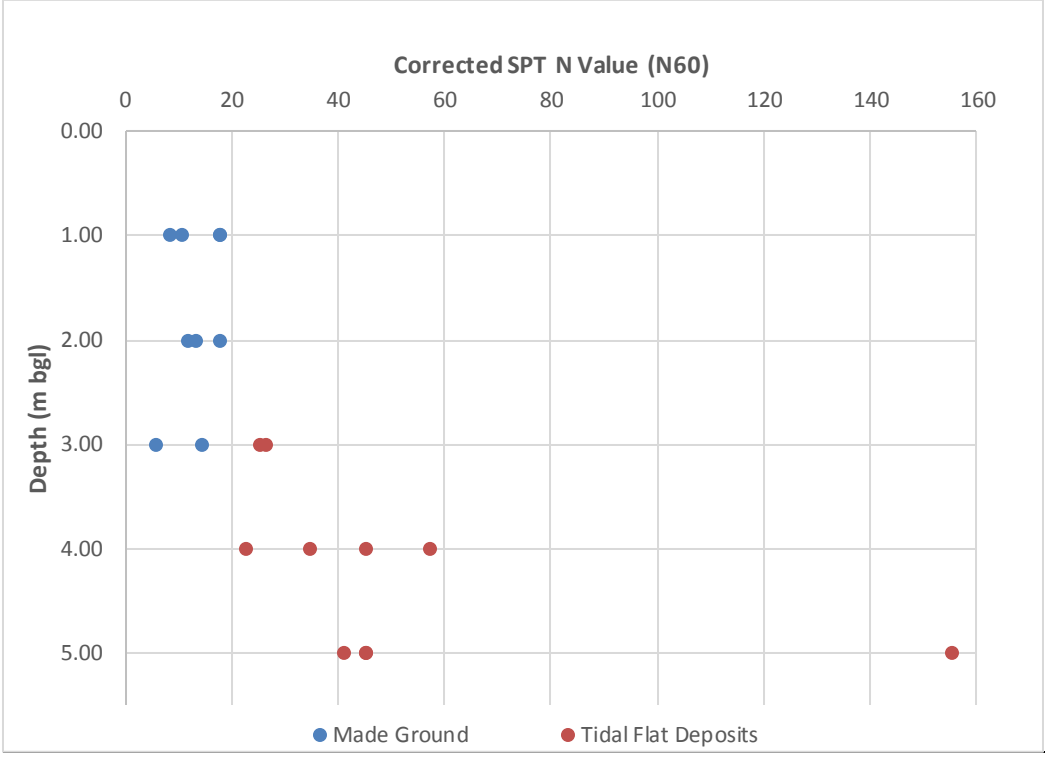
6.4 Made Ground deposits typically comprised a dark brownish black clayey sandy gravel of fine to coarse, angular to subrounded brick, concrete, metal, mudstone, sandstone, plastic, glass, organic material, ash, coal, clinker, slag, ceramic and tile. A moderate cobble content of angular to subangular brick and concrete and occasional boulders of concrete were recorded throughout the Made Ground.

6.5 A number of concrete and brick obstructions were found within the Made Ground across the site, within TP02 to TP06 inclusive.

6.6 Additionally, within several trial pits Made Ground deposits were encountered as a firm greyish orangish brown gravelly clay, with gravels of fine and medium, angular to subangular brick and mudstone.

6.7 SPT N_{60} values within the Made Ground were recorded in the range 6 and 18 blows. A plot of corrected SPT 'N_{60}' Value Vs Depth is presented as **Figure 2** below.

Figure 2 Corrected SPT 'N' Value (N_{60}) Versus Depth



6.8 Three samples of Made Ground from various depths and locations across the site were submitted for a range of geotechnical analysis including moisture content, plasticity limits and BRE suite testing.

6.9 Moisture content and plasticity limit testing was carried out on one sample of Made Ground from 3.00m bgl within TP01. Moisture content was reported at 24%, with a plasticity index of 22%, indicating intermediate plasticity.

6.10 Two samples of Made Ground were submitted for BRE suite testing from 0.50m bgl within TP02 and 2.70m bgl within TP03, which reported pH values of 8.1 and 7.1, respectively. Additionally, soil chemical testing reported values between 8 and 8.9.

Tidal Flat Deposits

6.11 Superficial deposits of Tidal Flat Deposits were encountered within six exploratory hole locations, including all dynamic sampler boreholes, from depths between 1.90m bgl and 3.50m bgl. The base of the Tidal Flat Deposits was unproven at all locations.

6.12 The Tidal Flat Deposits encountered within the boreholes typically comprised a soft to firm gravelly clay of either greenish grey or orangish red colour. The gravels were reported as angular to subangular, fine to coarse siltstone and mudstone. The stratum was noted to become a highly weathered siltstone from around 4.00m, with a colour change to red noted in locations where the clay was reported to be greenish grey.

6.13 The Deposits were encountered within two trial pit locations (TP07 and TP08) as a soft grey, oxidised orange very slightly gravelly, slightly sandy clay with gravels recorded as angular to subrounded, fine to coarse mudstone.

6.14 SPT N_{60} values within the Tidal Flat Deposits were recorded in the range 23 and 155 blows. A plot of corrected SPT 'N_{60}' Value Vs Depth is presented as **Figure 2** above.

6.15 Five samples obtained from various locations and depths within the Tidal Flat Deposits were submitted for a range of geotechnical analysis including moisture content, plasticity limits and BRE suite testing.

6.16 The geotechnical laboratory testing has indicated plasticity indices to be in the range 14% (at 4.00 – 4.45m bgl within DS03) and 21% (at 4.00 – 4.45m bgl within DS02) indicating low to intermediate plasticity, with associated moisture contents reported at 11% and 13%, respectively.

6.17 BRE suite testing reported pH values within the Tidal Flat Deposits to range between 8.1 (at 2.80m bgl within TP07) and 8.6 (at 4.00 – 5.00m bgl within DS01). Additionally, soil chemical testing reported values between 8.1 and 8.6.

Hydrogeology and Hydrology

6.18 Perched groundwater strikes were encountered within all exploratory hole positions, with the exception of four trial pits (TP03, TP05, TP07 and TP08). Groundwater strikes are noted on exploratory hole records presented in **Appendix 2**.

6.19 A summary of the water strikes is presented below in **Table 4**.

Table 4 Water Strikes

Location	Depth (m bgl)	Description	Stratum
DS01	1.80 2.75	Damp arisings Wet arisings	Made Ground Made Ground
DS02	1.30-1.60	Damp arisings	Made Ground
DS03	1.30 5.00	Damp arisings Water strike	Made Ground Tidal Flat Deposits
DS04	1.30 4.00	Damp arisings Water strike	Made Ground Tidal Flat Deposits
TP01	3.50	Seepage	Made Ground
TP02	1.40 1.50	Damp arisings Water strike	Made Ground Made Ground
TP04	1.50	Seepage	Made Ground
TP06	0.80	Water strike	Made Ground

6.20 Standing water levels were recorded within all boreholes during all monitoring visits. Groundwater levels were found to vary between 1.79m bgl (DS04 - 6.86m AOD) and 2.96m bgl (DS04 – 5.69m AOD). Groundwater elevations were noted to vary between 5.69m AOD (DS04) and 6.89m AOD (DS01).

6.21 A profile plot of groundwater elevation is presented as **Drawing 4**.

6.22 The results of groundwater elevation plots have not identified any discernible flow direction. Groundwater is considered to be perched, mainly residing within the Made Ground on site.

6.23 No surface water monitoring has been undertaken as part of this investigation.

Contamination Observations

6.24 During the ground investigation, no visual or olfactory evidence of contamination was identified within any exploratory hole positions, with the exception of DS02. Within DS02, a faint hydrocarbon odour was noted to be present between 1.30m to 1.60m bgl. Screening of volatile vapour concentrations at this depth, recorded using a Photo Ionisation Detector (PID) noted a reading of 0.1ppm.

7 GEOTECHNICAL ASSESSMENT

Introduction

7.1 It is understood that the proposed development is to comprise the development of the site for a waste transfer station comprising a number of processing and storage bays for waste sorting (between approximately 95m^2 and 235m^2) and associated offices (indicated to be two storey). A proposed site plan is included within **Appendix 1**.

7.2 As discussed in **Section 6**, encountered ground conditions typically comprised significant deposits of Made Ground to depths between 1.90m and 3.50m bgl, overlying superficial deposits of Tidal Flat Deposits, the base of which were unproven to depths greater than 5.45m bgl. The bedrock geology of the Castell Formation and the Cardiff Group were not encountered as part of this ground investigation. Ground water levels were recorded between 1.79m and 2.96m bgl.

Foundation Solution

7.3 At the time of writing, final development plans and loadings were unavailable. However, given the design plans and similar structures, assuming the wall height of the storage bays is no greater than 5m, a pressure of 100kPa could be expected. These loadings may be larger in office and mezzanine storage areas.

7.4 Given the assumed lightly loaded nature of the proposed structures, and an assumption that the development will not be particularly sensitive to settlement and the encountered ground conditions, a piled foundation is not considered as part of this assessment as it is likely economically unviable. However, should more detailed development plans be issued and larger loadings be finalised, a piled foundation solution may be required.

Simple Foundation

7.5 It is generally not recommended that foundations are constructed bearing into un-engineered Made Ground deposits, in order to avoid unpredictable and excessive total and differential settlements.

7.6 In order to reduce the risk of settlements within the Made Ground, it is recommended that the top metre of material is excavated, proof rolled and re-engineered in order to produce a suitable development platform prior to the forming of floor slabs.

7.7 Buried obstructions and boulders encountered within the Made Ground will likely require removal prior to the laying of re-engineered material.

7.8 Based on the assumed lightly loaded nature of the structure, a raft foundation, transferring loads onto the re-engineered Made Ground is considered viable.

7.9 A raft foundation set at 0.5m bgl could provide a bearing capacity of 75kPa, with the expected settlements to be less than 30mm. It may be prudent to locally increase the thickness of the raft underlying wall areas of storage bays, mezzanine area and offices in order to provide additional support.

7.10 Ground gas protection measures are required to be incorporated to the foundations for the proposed development, as detailed in **Section 8** of this report.

Roads and Pavements

7.11 No consideration to road or pavement design has been made as part of this investigation. However, a minimum CBR value of 3% within the granular Made Ground would be considered feasible and suitable for road design.

Groundwater and Drainage

7.12 During the ground investigation, groundwater was encountered within all boreholes and half of the trial pits between 0.80m (TP06) and 5.00m bgl (DS03), with standing water levels recorded in all boreholes between 1.79m (DS04) and 2.96m bgl (DS04).

7.13 Where excavations are required below the groundwater level, dewatering may be required. Groundwater flow into the excavation will depend upon the background water levels and on the permeability of the ground around and below the excavations.

7.14 A drainage assessment did not form part of the scope of this investigation. However, given the variable depth to groundwater, the construction of soakaways is likely to be unsuitable. Additionally, given the nature of the surrounding development, it is assumed that connections will be made to the existing drainage network, in order to accommodate the proposed development.

Excavations

Ease of Excavation

7.15 Excavations into the granular Made Ground and Tidal Flat Deposits are expected to be achievable using standard excavators.

Stability of Excavation

7.16 Excavations displayed generally poor stability within Made Ground deposits during the site investigation and excavations may become unstable if left open for any significant periods. Where personnel entry is required for inspection; excavations should be sufficiently enlarged and an assessment of safe temporary angles should be made. Alternatively, temporary shoring should be provided.

Legislation on Personnel Entry to Excavations

7.17 It is recommended that no excavations should be entered without appropriate support and a full risk assessment should be completed prior to entry. Mitigation measures to protect from accumulating ground gases should be implemented.

Chemical Attack on Buried Concrete

7.18 The results of soil chemical analysis has indicated the soils to have pH values ranging from 7.1 to 8.9, with water soluble sulphate concentrations between 30mg/l and 580mg/l and total sulphur concentrations ranged from 0.01% to 0.22%.

7.19 Sulphate concentrations in the groundwater ranged from 120mg/l to 290mg/l, with groundwater pH values ranging from 7.4 to 7.6.

7.20 In accordance with the recommendations of BRE Special Digest 1, 'Concrete in Aggressive Ground' 2005, the conditions of the soils at the site would therefore be classified as Design Sulphate Class DS-1 and ACEC Class AC-1 for soils and groundwater, when considering the most appropriate type of concrete to be used at the site in order to resist chemical attack from elevated sulphate present in the soils (assuming mobile groundwater in non pyritic soils).

Earthworks

7.21 Significant earthworks are unlikely to be undertaken as part of the proposed site redevelopment.

8 GROUND GAS ASSESSMENT

Introduction

8.1 Ground gas assessment has been undertaken to assess the risks associated with ground gases and volatile vapours to new buildings and their occupants. The results obtained have been assessed in line with relevant guidance (notably CIRIA C665).

8.2 CIRIA C665 guidance indicates that for a site with moderate/low gas generation potential (identified in the Desk Study, based on the presence of Made Ground and Tidal Flat Deposits) and a low sensitivity development (the proposed commercial land use), a typical monitoring programme may comprise four visits over a period of four weeks.

8.3 BWB have completed the prescribed monitoring programme as set out in CIRIA C665.

Methodology

8.4 Three boreholes were installed with ground gas monitoring wells with two response zones set within the Made Ground and one within the Tidal Flat Deposits. Exploratory hole records showing monitoring well constructions are presented in **Appendix 2**.

8.5 The assessment of potential ground gas generation is based on the observation of trends and changes in gas evolution by the direct measurement of ground gases from gas wells. The works included measurement of methane, carbon dioxide, oxygen, hydrogen sulphide, carbon monoxide, gas flows and barometric pressure. A PID survey was undertaken to measure volatile organic compounds within the borehole response zones.

Results

8.6 The minimum and maximum steady state concentrations recorded for borehole flow, oxygen, carbon dioxide and methane are summarised below in **Table 5**.

Table 5 Summary of Recorded Ground Gas Results

Borehole ID	Targeted Geology	Steady Flow (l/hr)		Carbon Dioxide (%v/v)		Methane (%v/v)	
		min.	max.	min.	max.	min.	max.
DS01	Made Ground	<0.1	<0.1	<0.1	4.1	12.4	17.0
DS02	Made Ground	<0.1	<0.1	0.2	0.8	<0.1	10.9
DS04	Tidal Flat Deposits	<0.1	0.6	1.1	3.5	<0.1	<0.1

Atmospheric Pressure and Flow

8.7 During the monitoring programme completed at the site the atmospheric pressure ranged between 998mb (recorded on 09/11/2016) and 1034mb (recorded on 30/11/2016).

8.8 One monitoring visit was undertaken when atmospheric pressure was recorded below 1000mB, representing a low pressure event and the worst case scenario for the site.

8.9 The pressure was recorded as static during two monitoring visits and falling during the remaining two monitoring visits.

8.10 On this basis, the monitoring is considered likely to have captured the worst case gassing scenario at the site as generally, ground gas emissions tend to increase when atmospheric pressure falls and particularly when the pressure drops below 1000mB.

8.11 During the monitoring period, steady flow rates ranged between 0l/hr (recorded on several occasions within multiple boreholes) and 0.6l/hr (recorded on 09/11/2016 within DS04).

Hazardous Ground Gas and Volatile Vapours

8.12 Steady carbon dioxide concentrations recorded ranged between <0.1% v/v (recorded in DS01 on 24/11/2016 and 30/11/2016) and 4.1% v/v (recorded in DS01 on 09/11/2016).

8.13 Steady methane concentrations ranged between <0.1% v/v (recorded in DS04 on all occasions and in DS02 on 30/11/2016) and 17.0% v/v (recorded in DS01 on 09/11/2016).

8.14 Hydrogen sulphide and carbon monoxide concentrations were not recorded above the limit of detection of the equipment (<1pmm) during the monitoring visits.

8.15 PID concentrations were recorded between <0.1ppm (the limit of detection of the equipment) and a maximum of 2.3ppm in DS02 on 30/11/2016.

8.16 Ground gas monitoring results are presented in **Appendix 4**.

Suitability of the Data

8.17 The response zone in DS04 has been partially flooded on all monitoring occasions since installation, in total, four discrete monitoring events (total number of discrete monitoring events = number of boreholes x number of monitoring visits) have been affected from the total twelve discrete monitoring events. Such flooding is likely to prevent the migration of ground gas into these boreholes and to affect measured gas flow rates and therefore recorded ground gas monitoring data may not be considered wholly representative of ground conditions.

8.18 Given the consistent partial flooding of the DS04, a sufficient amount of data may not be available to confirm the ground gas risk assessment within the Tidal Flat Deposits and further monitoring may be required prior to development.

Risk Assessment

8.19 CIRIA Report 665 'Assessing Risks Posed by Hazardous Ground Gases to Buildings' presents current best practice on the assessment of ground gases for commercial and residential buildings (with the exception of low rise traditional housing). The report

presents a risk based approach based on gas screening levels which depend on both the concentration and emission rate of gas from the ground. Gas screening levels are calculated as follows:

$$Gas\ screening\ value\ (l/hr) = \frac{gas\ concentration\ (\%)\ X\ measured\ borehole\ flow\ rate\ (l/h)}{100}$$

8.20 A maximum gas screening level of 0.102l/hr was recorded for methane using a gas concentration of 17.0% v/v and a maximum flow rate of 0.6l/hr, giving a classification of CS2, for which gas protection measures will be required.

Recommendations

8.21 Gas protection measures should be installed in accordance with BS848: 2015. Based on a Type B development and CS2 classification a gas protection score of 3.5 will need to be achieved. **Table 6** provides suggested combinations of floor slab, ventilation and membrane that can achieve a suitable level of protection.

Table 6 Gas Protection Matrix

Protection Measure Type	Protection Measure	Gas Protection Score
Floor and Substructure	Cast in situ ground bearing floor slab Reinforced cast in situ suspended floor slab with minimal penetrations	0.5 1 to1.5
Ventilation	Pressure relief pathway Passive sub floor dispersal layer Active dispersal layer Active positive pressurization	0.5 1.5 to 2.5 1.5 to 2.5 1.5 to 2.5
Gas Protection Membrane	Gas resistant membrane meeting the criteria within BS848: 2015, Table 7	2

8.22 The gas protection system, including membrane should be installed by a suitably qualified person(s) and independently inspected and validated in accordance with CIRIA Report C735 (2014). The overall aim is to ensure that a continuous seal is evident across the base of the building, in contact with the ground.

9 CONTAMINANT DISTRIBUTION AND HUMAN HEALTH RISK ASSESSMENT

Introduction

9.1 Contamination data have been compared to Generic Site Assessment Criteria (GSAC) for a commercial end use, developed by BWB using the CLEA model 1.07 and the updated CLEA framework (2009) for assessing risk from soil contamination to human health. The soil chemical laboratory results are presented as **Appendix 5** and details of the derivation of the GSACs are presented in **Appendix 8**. The criteria includes reference to the LQM/CIEH S4ULs for Human Health Risk Assessment Copyright Land Quality Management Limited reproduced with permission; publication number S4UL3271.

9.2 The GSACs have been developed with the following assumptions, which has been changed from the CLEA default parameter set. Soil type is a sandy loam with an organic matter content of 1%. This is considered to be more representative of Made Ground found on most brownfield sites than the CLEA default of 6% organic matter.

Potential Pathways

9.3 Contamination data have been compared to GSACs for a commercial end use (i.e. using all pathways for that end use) based on an organic matter content of 1%. The key receptor for such a site is considered to be an adult female worker and GSACs for a commercial industrial end use have been adopted.

9.4 Exposure pathways considered in this assessment are presented in **Table 7** below.

Table 7 Commercial Exposure Pathways

Source	Shallow Soils		Deep Soils
Pathway	**Commercial / Industrial with managed landscaped areas**	**Commercial / Industrial with Hard standing areas**	**Commercial / Industrial**
Ingestion of soil	✓	×	×
Ingestion of site derived household dust	✓	×	×
Ingestion of contaminated vegetables	×	×	×
Ingestion of soil attached to vegetables	×	×	×
Dermal contact with soil	✓	×	×

Source	Shallow Soils		Deep Soils
Dermal contact with site derived household dust	✓	×	×
Inhalation of fugitive soil dust	✓	×	×
Inhalation of fugitive site derived household dust	✓	×	×
Inhalation of vapours outside	✓	✓	✓
Inhalation of vapours inside	✓	✓	✓

Results and Contaminant Distribution

9.5 The results of the soil chemical laboratory results are provided within **Appendix 5** with a table summarising the results presented in **Appendix 9**.

9.6 The results of soil chemical analysis have identified generally low levels of heavy metals and PAHs within both the Made Ground and Tidal Flat Deposits. When the results are screened against the GSACs for a commercial development, all of the contaminants assessed were found to have concentrations below their respective screening criteria.

9.7 Additionally, all four samples subjected to an asbestos screen reported detections, as outlined in **Table 8** below.

Table 8 Summary of Asbestos Identification Results

Location	Depth (m bgl)	Stratum	Description
DS03	1.60	Made Ground	Chrysotile – Loose fibres
TP01	0.40	Made Ground	Chrysotile and Amosite – Loose fibres
TP06	0.30	Made Ground	Chrysotile – Insulation lagging
TP08	0.50	Made Ground	Chrysotile – Hard/cement type material

9.8 Identification of asbestos fibres within Made Ground deposits presents a risk to construction workers, ground workers and potentially to future site users, should Made Ground deposits not be removed during the development of the site. This is likely when considering the depths to which they were encountered.

9.9 It is considered that the risk to construction workers and ground workers can be mitigated by following guidance within the Control of Asbestos Regulations 2012, adopting appropriate PPE and maintaining good hygiene practices. The location of identified asbestos should also be marked on the Site Health and Safety File, which is to be retained on site following the development.

9.10 Additionally, the risk to future site users is considered to be low, as the majority of the site will be covered in hardstanding, therefore removing the exposure pathway. If areas of soft landscaping are present on site, a clean cover system will be required.

10 CONTROLLED WATERS RISK ASSESSMENT

Introduction

10.1 The results of groundwater sampling are presented as **Appendix 6**.

10.2 The controlled waters assessment considers the potential impact of on-site contamination to pertinent controlled waters receptors identified at the site including:

- Secondary B Aquifer beneath the site within the Castell Formation and Cardiff Group; and
- River Rhymney.

Pathways

10.3 A controlled waters risk assessment has been undertaken through assessment of leachable concentrations of contaminants in soil referring to exposure pathways considered and referencing **Table 9**.

Table 9 Controlled Water Exposure Pathways

Controlled Waters Exposure Pathway	Receptor
Leaching of soil contamination into recharge infiltration	✓
Vertical migration of impacted pore water through unsaturated zone into underlying aquifer	✓
Horizontal migration of groundwater through aquifer to off site receptors	✓

10.4 The site is underlain by Tidal Flat Deposits (Secondary Undifferentiated Aquifer) and the Castell Formation and Cardiff Group (both Secondary B Aquifers). Therefore, in the absence of a sensitive potable supply it is considered appropriate to adopt environmental quality standards (EQS) for freshwater when assessing groundwater quality. Where EQS are not available, World Health Organisation Standards (WHO) and UK Drinking Water Standards (DWS) have been adopted as the relevant screening criteria.

Groundwater

10.5 Grab samples of groundwater were collected from all boreholes and tested for a range of contaminants. A groundwater concentration screening sheet is presented as **Appendix 10** and below in **Table 10**.

Table 10 Summary of Groundwater Chemical Testing Results

Contaminant	Number of Samples	Range of Concentrations (µg/l)	Generic Screening Level (µg/l)	Number of Exceedances
Copper	3	2.50 – 8.80	1.00	3

Contaminant	Number of Samples	Range of Concentrations (µg/l)	Generic Screening Level (µg/l)	Number of Exceedances
Lead	3	0.20 – 1.30	1.20	1
Mercury	3	0.08 – 0.15	0.07	3
Nickel	3	0.50 – 15.00	4.00	2
Selenium	3	4.50 – 20.00	10.00	2
Cyanide	3	<10.00	1.00	3
Phenol	3	<10.00	7.70	3
Benzo(a)pyrene	2	<0.01	0.00017	2
Fluoranthene	2	<0.01	0.0063	2

10.6 Chemical analysis reported marginally elevated concentrations of a number of heavy metals including copper, lead, mercury, nickel and cyanide, which are not considered significant enough to pose a risk to human health and/or controlled waters.

10.7 Reported exceedances of cyanide, phenol, benzo(a)pyrene and fluoranthene are all at the limit of detection of the equipment used and as such they are not considered to pose a significant risk to human health or controlled waters and so will not be considered further within this assessment.

11 ENVIRONMENTAL RISK ASSESSMENT

11.1 An updated assessment of identified pollutant linkages has been made following completion of a ground investigation. The preliminary risk assessment presented in **Section 3** has been updated in the light of the findings of the ground investigation and the revised conceptual site model developed, as presented in **Table 11**.

Sources

- Elevated methane and marginally elevated carbon dioxide concentrations; and
- Asbestos in Made Ground across the site.

Pathway

- Accumulation and inhalation of ground gases within offices of new development; and
- Inhalation of asbestos fibres.

Receptor

- Future site users; and
- Ground workers.

Summary of Potentially Significant Pollutant Linkages

11.2 The potentially significant pollutant linkages are summarised below.

Potential accumulation of hazardous ground gas to future site users

11.3 There is a risk that methane and carbon dioxide concentrations could accumulate within enclosed spaces within the offices of the proposed development and present a risk to future site users through explosion or asphyxiation.

11.4 The recorded concentrations indicate that the site is categorised as a CS2 site whereby enhanced ground gas protection measures are required to mitigate against the risk.

Asbestos in Made Ground across the site

11.5 Where asbestos is exposed at the ground surface, airborne fibres may be generated which could affect human receptors through inhalation. Ground workers are most at risk during construction, particularly during installation of utilities, bulk earthworks or piling works that bring spoil to the surface.

11.6 Ground workers will need to be made aware of the potential for encountering asbestos and asbestos containing materials within the Made Ground and appropriate training, methods of working and PPE provided to mitigate the risks during the construction phase.

11.7 It is considered that the risk to ground workers can be mitigated by following guidance presented within the Control of Asbestos Regulations 2012, adopting damping down of soils, appropriate PPE and maintaining good hygiene practices. Additionally, visual

vigilance should be maintained throughout any groundworks. The locations should also be marked on the Site Health and Safety File, to be retained on site following development.

11.8 In the completed scheme, it is assumed that affected soils will be covered by hardstanding and should soft landscaping be present on site, a clean capping system will be in place.

Table 11 Revised Conceptual Site Model

Source	Pathway	Receptor	Con	Prob	Risk	Mitigation/Investigation
S1: Elev ated methane and carbon dioxide concentrations.	**P1:** Migration and accumulation of ground gasses in enclosed spaces leading to asphyxiation (carbon dioxide) or explosion (methane).	**R1**: Future site users (commercial)	Md	Lw	M/L	The recorded concentrations indicate that the site is categorised as a CS2, whereby enhanced ground gas protection measures are required to mitigate against the risk. Gas protection measures should be installed in accordance with BS848: 2015. Based on a Type B development and a CS2 classification, a gas protection score of 3.5 will need to be achiev ed.
S2: Asbestos found within Made Ground.	**P2**: Inhalation of contaminated soil particulates.	**R1**: Future site users (commercial)	Mi	Lw	L	In the context of the future use of the site, it is considered likely that hardstanding will be present on the majority of the site, thereby reducing the possibility for future site users to be impacted by contaminant sources. For areas of soft landscaping, a clean cover systems should be put in place to sever the pollutant linkage.
		R2: Ground workers	Md	Lw	M/L	Measures to mitigate the presence of asbestos on site may include appropriate assessment and off-site disposal of soils associated with potential foundation installation. The recommendations of the Control of Asbestos Regulations 2012, CIRIA Report C670 – 'Site Health Handbook' and CIRIA Report C741 – 'Environmental Good Practice on Site' should be considered during ground works at the site to ensure the appropriate PPE is worn, good hygiene practices and correct procedures are adopted.

VH = Very High, H = High, M = Moderate, M/L = Moderate/Low, L = Low, VL = Very Low

KEY: Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor Hi = High, Li = Likely, Lw = Low Likelihood, Ul = Unlikely

Pollutant Linkage Assessment Summary

The site is considered to represent a low to moderate risk to human health and a low risk to controlled waters. Risk to human health is likely to be mitigated through adoption of conventional mitigation measures comprising appropriate working methods and construction guidance.

12 ENVIRONMENTAL LIABILITY ASSESSMENT AND DEVELOPMENT CONSTRAINTS

Statutory Liability

12.1 Under statutory guidance for definition of contaminated land site may be classified into 4 categories. Categories 1 and 2 would meet the definition of contaminated land and categories 3 and 4 would not meet the definition.

12.2 It is considered that the site would fall within Category 3 based on the limited potential for significant contamination at the site.

12.3 The contaminated land regime has implications for those who cause or knowingly permit land to be contaminated, or who own or occupy land that is contaminated.

12.4 Contaminated land is defined in Section 78A(2) of Part IIA of the Environmental Protection Act 1990 as:

'*Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under land, that*:

a) *Significant harm is being caused or there is a significant possibility of such harm being caused; or*
b) *Pollution of controlled waters is being or is likely to be, caused*'.

12.5 Harm is defined in Section 78(4) of the Environmental Protection Act 1990 as:

'*Harm to the health of living organisms or other interference with ecological systems of which them form part and, in the case of man, includes harm to his property*'.

12.6 Once an area of land has been identified as contaminated land, appropriate persons will be identified as being responsible for the cost of cleaning up the land by the enforcing authority. The appropriate person will be liable for all or part of the remediation of the land. Two classes of appropriate person have been identified:

- Class A appropriate persons are those who cause or knowingly permit the pollutants to be in, on or under the land.
- Class B appropriate persons are the owners(s) or occupier(s) of the land.

12.7 Where no Class A appropriate persons can be identified, then Class B appropriate persons may become liable.

12.8 Based on the information available regarding the site, the potential for Statutory Authority action based on 'pollution of controlled waters' or 'significant harm' as defined by Part IIA of the Environmental Protection Act 1990 is considered to be **low**.

Third Party Liability

12.9 Based on the information contained in this report, it is the opinion of BWB that the potential for legal action by surrounding landowners, based on the potential for contamination to migrate off-site, is considered to be **low** when considering the nature of surrounding land use and limited potential for significant contamination on site.

Public Relations

12.10 The likelihood of public relations being tarnished due to contamination issues at the site are considered to be **low**.

Development Implications

12.11 Asbestos recorded across the site will need to be considered as part of any ground works. Ground works should comply with CAR 2012. Asbestos contaminated soils may be retained on site, provided they are buried and covered by hardstanding or a layer of clean cover.

12.12 Design Sulphate Class DS-1 and ACEC Class AC-1 is required for concrete to resist attack from sulphate levels within soils and groundwater.

12.13 Soil laboratory results should be sent to water utility providers in order to asses material requirements.

12.14 Ground gas protection measures are required to mitigate against elevated methane and marginally elevated carbon dioxide concentrations. Based on a Type B development and a CS2 classification, a gas protection score of 3.5 will need to be achieved.

12.15 A programme of ground improvement via excavation, proof rolling and re-engineering of Made Ground material is recommended in order to provide a suitable development platform for a raft foundation solution – based on an assumed light loading from the proposed development. Buried obstructions and boulders encountered within the Made Ground will likely require removal prior to the laying of re-engineered material.

13 WASTE MANAGEMENT

Waste Classification

13.1 Soil samples have been characterised against hazardous waste criteria using Hazwasteonline. The results of the waste classification are presented in **Appendix 11**. The assessment indicates that the Made Ground soils analysed are likely to be classified as potentially hazardous. However, should flash point testing be carried out, it is likely that these samples would be classified as non-hazardous. Samples obtained from the Tidal Flat Deposits are indicated to be classified as non-hazardous.

13.2 The waste classification assessment only applies to those soils that have been tested. If other soils are to be disposed of off-site then further analysis may be required.

13.3 Asbestos has been found at the site. The presence of visible asbestos containing materials in waste or at concentrations exceeding 0.1% by weight will classify the waste as mixed and require disposal as hazardous waste irrespective of the chemical properties of the waste.

13.4 Should any soils require disposal off site an assessment of waste classification of the soils for disposal should be made by a competent person. Further chemical analysis may be required to fully characterise waste soils for disposal to landfill or re-use off site. WAC analysis may be required for disposal of soils as inert or hazardous.

14 CONCLUSIONS AND RECOMMENDATIONS

14.1 Ground conditions were found to comprise up to 3.5m of Made Ground overlying the superficial Tidal Flat Deposits, to depths great than 5.45m bgl. Groundwater was encountered across the site, with standing levels recorded between 1.79m bgl and 2.96m bgl.

Environmental

14.2 Marginally elevated concentrations of carbon dioxide and elevated methane were recorded during the monitoring period and as such, the site is given a classification of CS2 and gas protection measures achieving a score of 3.5 will be required.

14.3 The results of soil chemical analysis identified generally low levels of heavy metals and PAHs within both Made Ground and natural strata. All concentrations were reported below their respective screening criteria and as such not considered to pose a risk to human health.

14.4 Asbestos fibres and Asbestos Containing Materials (ACM) were identified within all tested Made Ground samples, which generally comprised Chrysotile, with Amosite identified within one sample. Asbestos and ACM on site represent a risk to ground workers during the development of the site, who will need to be made aware of the potential for encountering asbestos and be provided with appropriate training, methods of working and PPE to mitigate the risk. The risk to future site users is likely to be removed through the use of hardstanding at the site and a clean capping system in areas of soft landscaping.

14.5 Groundwater analysis identified marginally elevated concentrations of a number of heavy metals and reported exceedances of cyanide, phenol, benzo(a)pyrene and fluoranthene, all at the limit of detection of the equipment. In the context of the proposed development and surrounding area, they were not considered to pose a significant risk to human health or controlled waters.

14.6 The results of waste classification indicated Made Ground soils to be potentially hazardous and further testing, including flash point analysis, may be required if soils require off-site disposal.

14.7 A Remediation Strategy should be completed detailing mitigation measures and validation expectations for gas protection and a topsoil cover system (if required) and include contingency arrangements should previously unforeseen contamination sources be identified.

Geotechnical

14.8 It is generally not recommended that foundation are constructed bearing into un-engineered Made Ground in order to avoid unpredictable and excessive total and differential settlements. However, in the context of the proposed development, it is not considered economically viable for the use of a piled foundation solution.

14.9 As such a programme of ground improvement via excavation, proof rolling and re-engineering of Made Ground material is recommended in order to provide a suitable development platform for a raft foundation solution – based on an assumed light loading from the proposed development.

14.10 A raft foundation founded at 0.5m bgl could provide a bearing capacity of 75kPa, with settlements less than 30mm. It is recommended the raft be increased in thickness below walls, mezzanine areas and offices to provide additional support.

14.11 Should more detailed development plans be issued and larger loadings be finalised, a piled foundation solution may be required for the site.

14.12 Design Sulphate Class DS-1 and ACEC Class AC-1 is required for concrete to resist attack from sulphate levels within soils and groundwater.

15 REFERENCES

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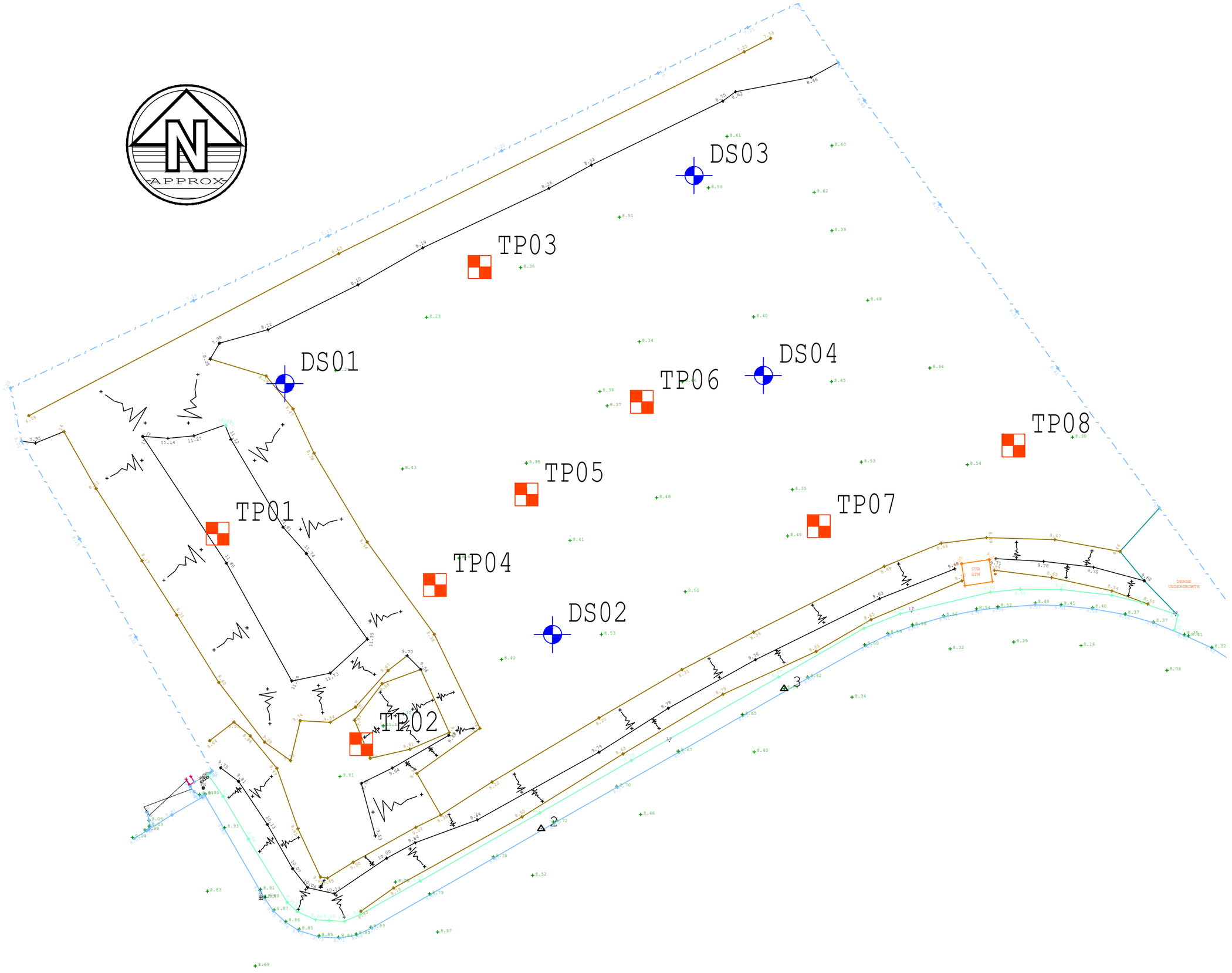
DRAWINGS

DRAWING 1

EXPLORATORY HOLE LOCATION PLAN



Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.

Key Plan

Legend

DS0* Dynamic Sampler Borehole Location

TP0* Trial Pit Location

Rev	Date	Details of issue / revision	Drw	Rev
P1	28.11.16	FINAL	IW	TH

Issues & Revisions

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Client

VASTINT UK BV

Project Title

LAMBY WAY, CARDIFF

Drawing Title

EXPLORATORY HOLE LOCATION PLAN

Drawn:	I. Wort		Reviewed:	T. Hull	
BWB Ref:	NTE2313	Date:	28.11.16	Scale@A3:	1:1

Drawing Status

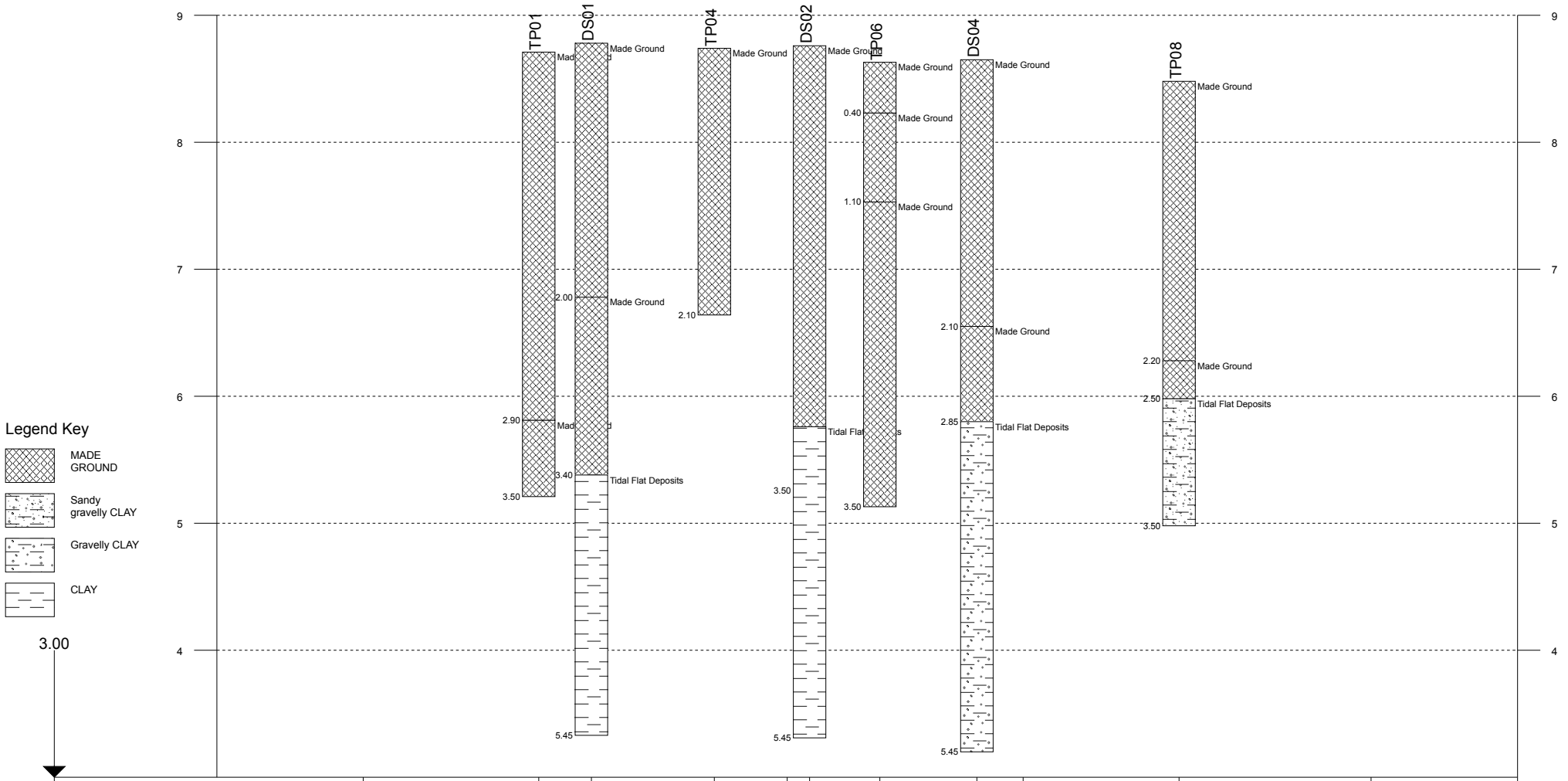
FINAL

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
LAM-BWB-00-XX-EN-DR-0001	P2	01

DRAWING 2

GEOLOGICAL CROSS SECTION

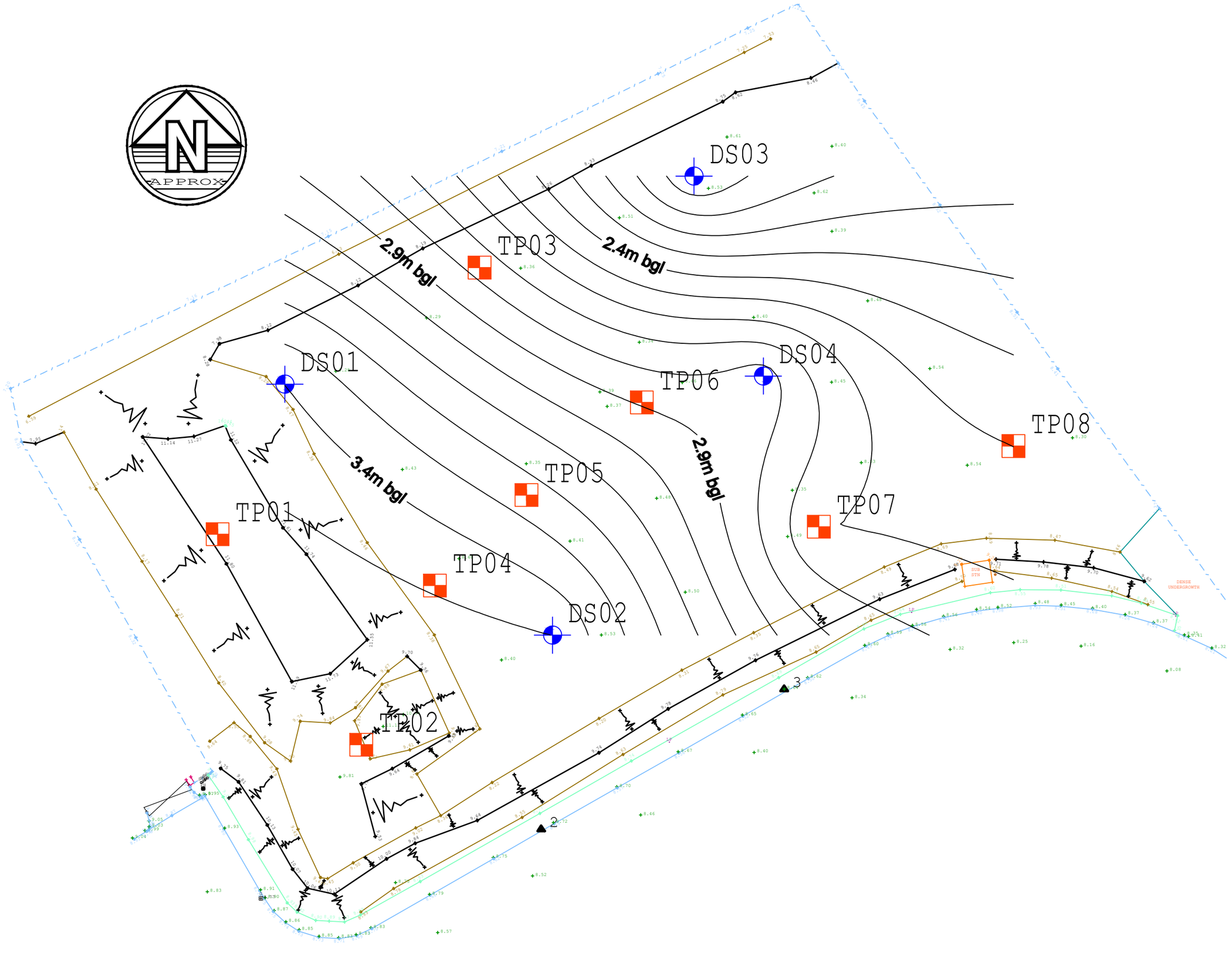
Project Id: NTE2313	Title: Section Line
Project Title: Lamby Way, Cardiff	Vertical Scale: 1:46
Location: CF3 3BN	Horizontal Scale: 1:796
Client: Vastint UK BV	Engineer:



Chainage (m)	0.00	23.93	31.11	47.87	57.81	60.86	70.44	83.67	89.98	111.23	137.41
Offset (m)		7.11	9.45	12.44	2.38	17.72	0.61	11.01	6.05	3.68	
Elevation (mAOD)		8.71	8.78	8.74	8.73	8.76	8.63	8.65	8.63	8.48	

DRAWING 3

MADE GROUND THICKNESSES



Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.

Key Plan

Legend

DS0* Dynamic Sampler Borehole Location

TP0* Trial Pit Location

Rev	Date	Details of issue / revision	Drw	Rev
P1	28.11.16	FINAL	IW	TH

Issues & Revisions

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Nottingham | 0115 924 1100
www.bwbconsulting.com

Client

VASTINT UK BV

Project Title

LAMBY WAY, CARDIFF

Drawing Title

MADE GROUND PROVEN THICKNESSES

Drawn:	I. Wort	Reviewed:	T. Hull		
BWB Ref:	NTE2313	Date:	28.11.16	Scale@A3:	1:1

Drawing Status

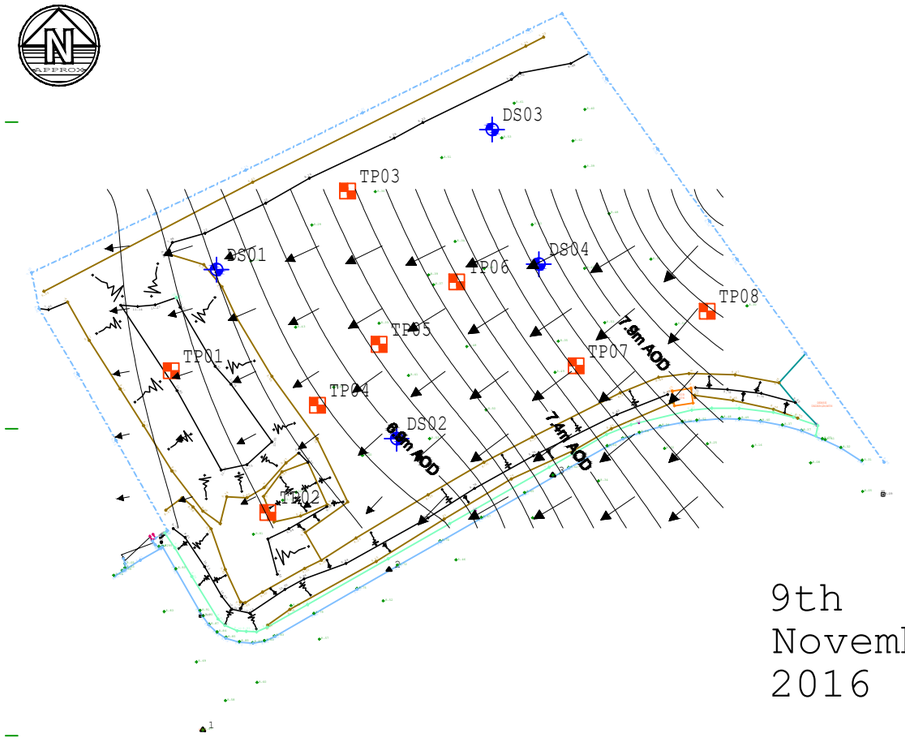
FINAL

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
LAM-BWB-00-XX-EN-DR-0002	P1	01

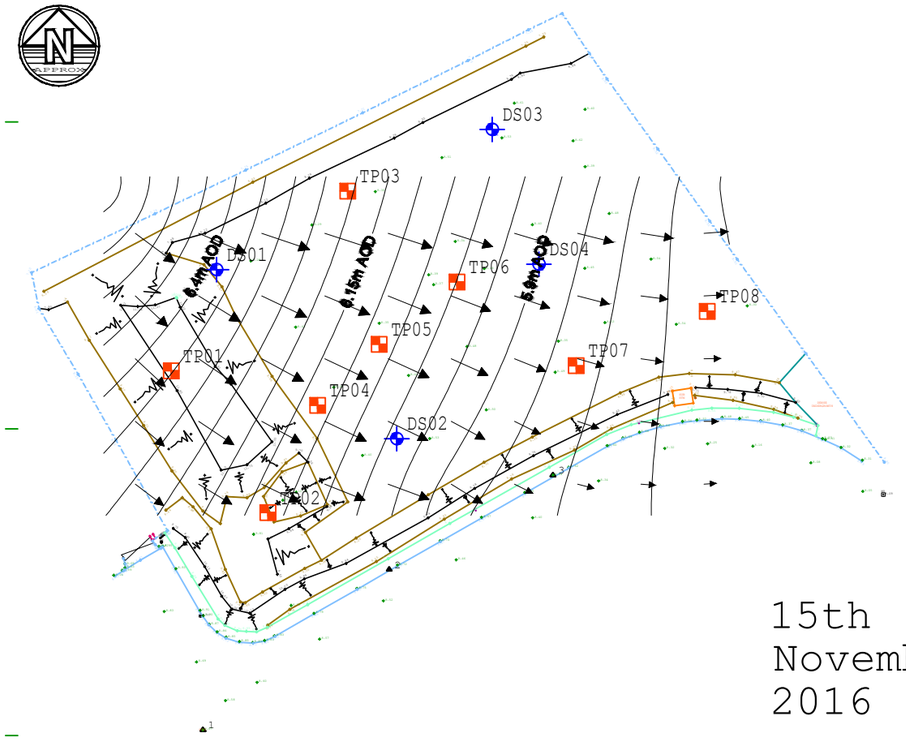
Y:\NTE\NTE2313_Lamby Way, Cardiff\02. Project Delivery\01. WIP\Drawings\LAM-BWB-00-XX-EN-DR-0002-P1_Proven Made Ground Thicknesses.dwg

DRAWING 4

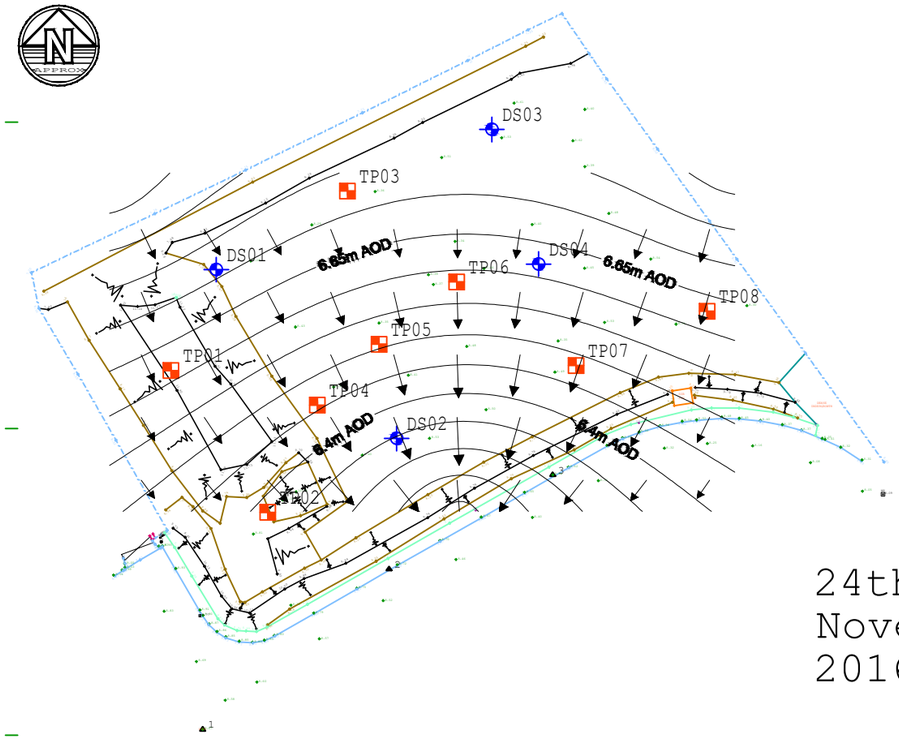
INFERRED GROUNDWATER PROFILE



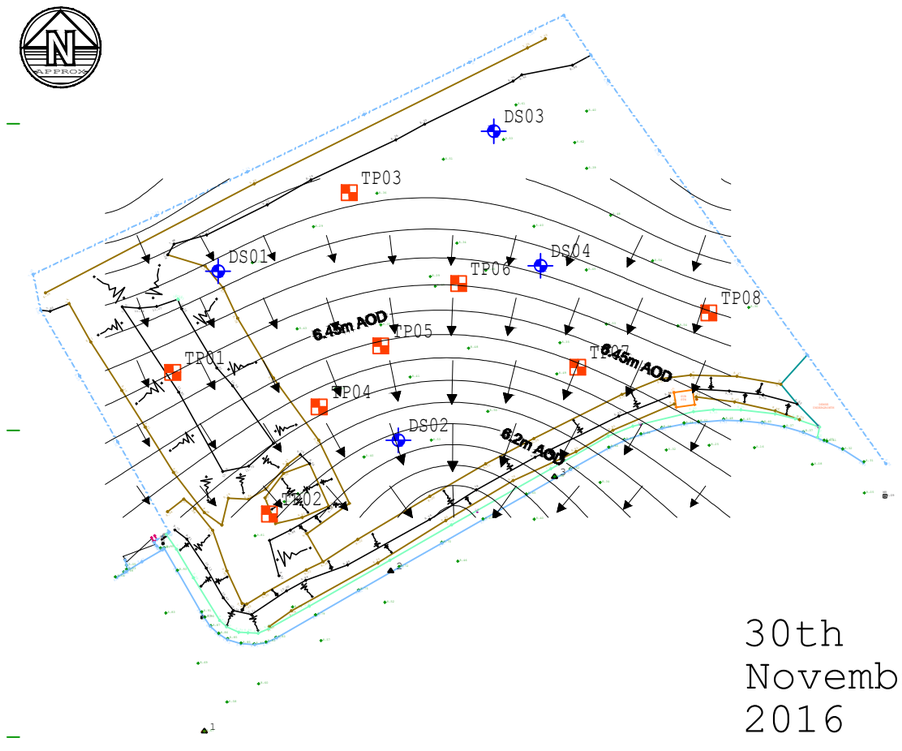
9th November 2016



15th November 2016



24th November 2016



30th November 2016

Notes

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2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.

Key Plan

Legend

DS0* Dynamic Sampler Borehole Location

TP0* Trial Pit Location

Rev	Date	Details of issue / revision	Drw	Rev
P1	01.12.16	FINAL	IW	TH

Issues & Revisions

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Client
VASTINT UK BV

Project Title
LAMBY WAY, CARDIFF

Drawing Title
INFERRED GROUNDWATER PROFILE

Drawn:	I. Wort		Reviewed:	T. Hull	
BWB Ref:	NTE2313	Date:	01.12.16	Scale@A3:	1:1

Drawing Status
FINAL

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
LAM-BWB-00-XX-EN-DR-0003	**P1**	**01**

Y:\NTE\NTE2313_Lamby Way, Cardiff\02. Project Delivery\01. WIP\Drawings\LAM-BWB-00-XX-EN-DR-0003-P1_Groundwater flows.dwg

APPENDICES

APPENDIX 1

PROPOSED SITE PLAN

TYPICAL IBC SPACING

DO NOT SCALE FROM THIS DRAWING

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER HBL DRAWINGS ISSUED FOR THIS PROJECT

LEGEND

- CONCRETE SURFACE
- TARMAC SURFACE
- BUILDING FOOTPRINT
- PERSONNEL ACCESS / WALKWAY
- MEZZANINE LEVEL (HATCHED)
- ARMCO BARRIER
- PALISADE FENCE LINE
- LC — LIGHTING COLUMN
- CCTV — CCTV COLUMN

REV.	DATE	DRAWN	DESCRIPTION	CHKD	APPRD
P1	OCT'17	HM	SURFACE MATERIAL CHANGED TO CONCRETE	ALS	ALS
P0	AUG'17	HM	PRELIMINARY ISSUE	ALS	ALS

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Facsimile: 0161 432 7979
Email : consultants@hblassociates.co.uk

Biffa

STATUS: PRELIMINARY

CLIENT: BIFFA WASTE SERVICES LTD	DRAWN: H.MAMAGANI
PROJECT: BIFFA RELOCATION	CHECKED: A.L.SMITH
LOCATION: LAMBY WAY, CARDIFF	APPROVED: A.L.SMITH
DRAWING TITLE: PROPOSED SITE PLAN	DATE: AUGUST 2017
	SCALE(S): 1:200 — A1
DRAWING No.: 102	HBL REF.: 6042
	REVISION: P1

FILE REF: R:\JOBS CURRENT\

APPENDIX 2

EXPLORATORY HOLE LOGS

BOREHOLE LOG

Scale 1:50 Sheet 1 of 1

LOCATION ID					
DS01	**Project Name:** Lamby Way, Cardiff			**Ground Level (m AOD):** 8.78	
	Project Number: NTE2313			**Eastings:** 321984.40	
	Client: Vastint UK BV			**Northings:** 178625.94	
Hole Type: WLS	**Rig:** Premier	**Start & End Date:** 27/10/2016		**Engineer:** IW	**Checker:** TH

Groundwater			Strata			Samples			In-Situ Tests			
Strike	Strike Details	Well	Level (m AOD) & [Thickness (m)]	Description	Legend	Depth (m bgl)	Type (Ublows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)
			[2.00]	Soft dark brown sandy gravelly CLAY. Sand is medium and coarse. Gravel is angular to subrounded fine to coarse brick, concrete, plastic, ash, coal, slag, mudstone, limestone, glass, tile and quartzite. (Made Ground)			ES	0.30	0.30		0.30	0ppm	
							ES	0.70	0.70		0.70	0ppm	
							D	1.00	1.45	S	1.00	N=9 (2,2/2,2,2,3)	
							ES	1.40	1.40		1.40	0ppm	
▼	1.8m bgl 1.80m bgl after 20mins		6.78 [1.40]	Brownish grey sandy clayey angular to subangular fine to coarse brick, concrete, coal and ash GRAVEL. Sand is medium and coarse. Wet from 2.75m. (Made Ground)		2.00	D	2.00	2.45	S	2.00	N=11 (2,2/4,3,2,2)	
▼	2.75m bgl 1.80m bgl after 20mins						ES	2.90	2.90		2.90	0ppm	
							D	3.00	3.45	S	3.00	N=5 (1,1/1,1,1,2)	
			5.38 [2.05]	Soft grey CLAY. Becoming orangish grey from 3.90m. Becoming a red highly weathered siltstone from 4.30m. (Tidal Flat Deposits)		3.40	ES	3.80	3.80		3.80	0ppm	
							B	4.00	4.45	S	4.00	N=29 (3,4/6,7,7,9)	
							D	4.00	5.00				
							D	5.00	5.45	S	5.00	N=34 (2,4/7,9,9,9)	
			3.33	Hole Terminated at 5.450m bgl.		5.45							

Chiseling		
From (m bgl)	To (m bgl)	Time (hh:mm)

Water Added		
From (m bgl)	To (m bgl)	Volume (l)

Remarks

Reason for Termination:

Borehole terminated at target depth.

Groundwater Remarks:

Damp arisings from 1.80m. Wet arisings from 2.75m.

Other Remarks:

1. Borehole installed with 50mm HDPE pipe, rubber bung, gas tap and flush cover. 2. No visual or olfactory evidence of contamination. 3. Borehole cased to 4.00m during the drilling period.

Legend

Sample Type:
B - Bulk
C - Core
D - Disturbed
ES - Environmental Sample
U - Undisturbed

Groundwater:
Groundwater Strike
Resting Groundwater
NR = Not Recorded

In-Situ Tests
C - Cone Penetration Test
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detection Screen
S - Standard Penetration Test

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BOREHOLE LOG

Scale 1:50 Sheet 1 of 1

LOCATION ID					
DS02	**Project Name:** Lamby Way, Cardiff			**Ground Level (m AOD):**	8.76
	Project Number: NTE2313			**Eastings:**	322013.80
	Client: Vastint UK BV			**Northings:**	178598.39
Hole Type: WLS	**Rig:** Premier	**Start & End Date:**	27/10/2016	**Engineer:** IW	**Checker:** TH

Groundwater			Strata				Samples			In-Situ Tests			
Strike	Strike Details	Well	Level (m AOD) & [Thickness (m)]	Description	Legend	Depth (m bgl)	Type (Ublows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)
			[3.50]	Soft dark brownish black sandy gravelly CLAY with low cobble content. Sand is medium and coarse. Gravel is angular to subangular fine to coarse brick, concrete, ash, coal, slag, wood, organic material, ceramic, tile and limestone. Cobbles are subangular mudstone. Black and damp with faint hydrocarbon odour from 1.30-1.60m. Becoming very soft and reddish brown from 2.00m. (Made Ground)			ES	0.50	0.50	PID	0.50	0ppm	
							ES	0.90	0.90	PID	0.90	0.1ppm	
							D	1.00	1.45	S	1.00	N=15 (4,4/3,3,5,4)	
▼	1.3m bgl 1.30m bgl after 20mins						ES	1.50	0.90	PID	1.50	0.1ppm	
							D	2.00	2.45	S	2.00	N=10 (1,2/4,2,2,2)	
							ES	2.20	2.20	PID	2.20	0ppm	
							D	3.00	3.45	S	3.00	N=12 (1,1/2,3,3,4)	
							ES	3.30	3.30	PID	3.30	0ppm	
			5.26 [1.95]	Soft greenish grey mottled orange very slightly gravelly CLAY. Gravel is angular to subangular fine and medium siltstone and mudstone. Becoming a reddish grey highly weathered siltstone from 4.40m. (Tidal Flat Deposits)		3.50							
							D	4.00	4.45	S	4.00	N=17 (4,2/2,3,5,7)	
							ES	4.50	4.50	PID	4.50	0ppm	
							D	5.00	5.45	S	5.00	N=34 (5,5/6,7,9,12)	
			3.31	Hole Terminated at 5.450m bgl.		5.45							

Chiseling		
From (m bgl)	To (m bgl)	Time (hh:mm)

Water Added		
From (m bgl)	To (m bgl)	Volume (l)

Remarks

Reason for Termination:

Borehole terminated at target depth.

Groundwater Remarks:

Damp arisings between 1.30-1.60m.

Other Remarks:

1. Borehole installed with 50mm HDPE pipe, rubber bung, gas tap and flush cover. 2. Faint hydrocarbon odour between 1.30-1.60m. No visual evidence of contamination. 3. Borehole cased to 4.00m during the drilling period.

Legend

Sample Type:
B - Bulk
C - Core
D - Disturbed
ES - Environmental Sample
U - Undisturbed

Groundwater:
▽ Groundwater Strike
▼ Resting Groundwater
NR = Not Recorded

In-Situ Tests
C - Cone Penetration Test
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detection Screen
S - Standard Penetration Test

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BOREHOLE LOG

Scale 1:50 Sheet 1 of 1

LOCATION ID	Project Name:	Lamby Way, Cardiff	Ground Level (m AOD):	8.68
DS03	Project Number:	NTE2313	Eastings:	322029.35
	Client:	Vastint UK BV	Northings:	178648.78
Hole Type: WLS	Rig:	Premier	Start & End Date: 27/10/2016	Engineer: IW / Checker: TH

Groundwater			Strata			Samples			In-Situ Tests			
Strike	Strike Details	Well	Level (m AOD) & [Thickness (m)]	Description	Depth (m bgl)	Type (Ublows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)
			[0.80]	Soft dark brownish black gravelly sandy CLAY. Gravel is angular to subangular fine to coarse concrete, brick, glass, metal, plastic, ash and tile. Sand is medium and coarse. (Made Ground)		ES	0.40	0.40	PID	0.40	0ppm	
			7.88		0.80							
			[0.20]	Soft orange CLAY. (Made Ground)	1.00	ES	0.90	0.90	PID	0.90	0ppm	
			7.68			D	1.00	1.45	S	1.00	N=15 (14,9/5,4,3,3)	
▼	1.3m bgl 1.30m bgl after 20mins		[0.20]	Weak concrete. (Made Ground)	1.20							
			7.48									
			[0.70]	Very soft dark greyish brown gravelly sandy CLAY. Gravel is angular to subrounded fine to coarse brick, concrete, ash, plastic, metal, siltstone, mudstone and quartzite. Sand is fine and medium. Damp from 1.30m. (Made Ground)		ES	1.60	1.60	PID	1.60	0ppm	
			6.78		1.90							
			[0.20]		2.10	D	2.00	2.45	S	2.00	N=8 (1,2/2,1,2,3)	
			6.58									
			[3.35]	Soft grey mottled green CLAY. (Tidal Flat Deposits)		ES	2.40	2.40	PID	2.40	0ppm	
				Firm orangish red gravelly CLAY. Gravel is angular to subangular fine and medium siltstone and mudstone. Becoming a highly weathered siltstone from 2.70m. (Tidal Flat Deposits)		D	3.00	3.45	S	3.00	N=20 (2,3/4,5,5,6)	
						ES	3.60	3.60	PID	3.60	0ppm	
						D	4.00	4.45	S	4.00	N=43 (5,11/16,9,10,8)	
▼	5m bgl 1.30m bgl after 20mins					D	5.00	5.45	S	5.00	N=31 (7,5/8,8,8,7)	
			3.23	Hole Terminated at 5.450m bgl.	5.45							

Chiseling		
From (m bgl)	To (m bgl)	Time (hh:mm)

Water Added		
From (m bgl)	To (m bgl)	Volume (l)

Remarks

Reason for Termination:

Borehole terminated at target depth.

Groundwater Remarks:

Other Remarks:

1. Borehole backfilled with arisings. 2. No visual or olfactory evidence of contamination. 3. Borehole cased to 4.00m during the drilling period.

Legend

Sample Type:
B - Bulk
C - Core
D - Disturbed
ES - Environmental Sample
U - Undisturbed

Groundwater:
Groundwater Strike
Resting Groundwater
NR = Not Recorded

In-Situ Tests
C - Cone Penetration Test
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detection Screen
S - Standard Penetration Test

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BOREHOLE LOG

Scale 1:50 Sheet 1 of 1

LOCATION ID					
DS04	**Project Name:** Lamby Way, Cardiff			**Ground Level (m AOD):** 8.65	
	Project Number: NTE2313			**Eastings:** 322036.97	
	Client: Vastint UK BV			**Northings:** 178626.83	
Hole Type: WLS	**Rig:** Premier	**Start & End Date:** 27/10/2016		**Engineer:** IW	**Checker:** TH

Groundwater			Strata			Samples			In-Situ Tests			
Strike	Strike Details	Well	Level (m AOD) & [Thickness (m)]	Description	Legend	Depth (m bgl)	Type (Ublows)	From (m)	To (m)	Type	Depth (m)	Result	Casing Depth & (Water Level)
			[2.10]	Soft dark brownish black sandy gravelly CLAY. Sand is fine and medium. Gravel is angular to subangular fine to coarse brick, concrete, siltstone, limestone, ash, coal and organic material. Patch of yellow sand at 0.75m. Damp from 1.30m. (Made Ground)			ES	0.30	0.30	PID	0.30	0ppm	
							ES	0.80	0.80	PID	0.80	0ppm	
							D	1.00	1.45	S	1.00	N=7 (2,1/1,2,2,2)	
▼	1.3m bgl 1.30m bgl after 20mins						ES	1.50	1.50	PID	1.50	0ppm	
										S	2.00	N=15 (10,6/4,4,3,4)	
			6.55 [0.75]	Grey sandy subangular to rounded fine to coarse quartzite and concrete GRAVEL with moderate cobble content of subangular concrete. Sand is coarse. (Made Ground)		2.10							
			5.80 [2.60]	Firm orangish red gravelly CLAY. Gravel is subangular coarse siltstone. Becoming multicoloured from 3.00-4.00m. (Tidal Flat Deposits)		2.85	D	3.00	3.45	S	3.00	N=19 (3,3/4,5,4,6)	
							ES	3.50	3.50	PID	3.50	0ppm	
▼	4m bgl 1.30m bgl after 20mins						D	4.00	4.45	S	4.00	N=34 (3,5/9,9,9,7)	
							ES	4.50	4.50	PID	4.50	0ppm	
							D	5.00	5.45	S	5.00	117 (8,18/117 for 245mm)	
			3.20	Hole Terminated at 5.450m bgl.		5.45							

Chiseling		
From (m bgl)	To (m bgl)	Time (hh:mm)

Water Added		
From (m bgl)	To (m bgl)	Volume (l)

Remarks

Reason for Termination:

Borehole terminated at target depth.

Groundwater Remarks:

Other Remarks:

1. Borehole installed with 50mm HDPE pipe, rubber bung, gas tap and flush cover. 2. No visual or olfactory evidence of contamination. 3. Borehole cased to 4.00m during the drilling period.

Legend

Sample Type:
B - Bulk
C - Core
D - Disturbed
ES - Environmental Sample
U - Undisturbed

Groundwater:
Groundwater Strike
Resting Groundwater
NR = Not Recorded

In-Situ Tests
C - Cone Penetration Test
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detection Screen
S - Standard Penetration Test

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TRIAL PIT LOG

Scale: 1:50 Sheet 1 of 1

LOCATION ID:	**Project Name:** Lamby Way, Cardiff		2.10
TP01	**Project Number:** NTE2313		0.60 Pit Dimensions (m) 10 Degrees
	Client: Vastint UK BV		
Hole Type: TP	**Plant:** JCB 3CX	**Start & End Date:** 26/10/2016	Stability: Poor stability within Made Ground.
Ground Level (m AOD): 8.71		**Eastings & Northings:** 321977E 178609N	Engineer: IW / Checker: TH

Groundwater		Strata					Samples			In-Situ Tests		
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend / Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
			5.81	2.90m	Dark brownish black clayey sandy fine to coarse angular to subrounded brick, concrete, metal, mudstone, sandstone, plastic, organic material and glass GRAVEL with moderate cobble content. Sand is fine to coarse. Cobbles are angular to subangular brick and concrete. Occasional boulders of concrete. Roots, rootlets and wood present throughout. Pocket of clay at 2.50m. (Made Ground)	2.90	B D ES	0.40 0.40 0.40	0.40 0.40 0.40	PID	0.40	0.0ppm
							B D ES	0.90 0.90 0.90	0.90 0.90 0.90	PID	0.90	0.1ppm
							B D ES	1.90 1.90 1.90	1.90 1.90 1.90	PID	1.90	0.0ppm
			5.21	0.60m	Firm greyish organish brown gravelly CLAY. Gravel is angular to subangular fine and medium brick and mudstone. Reworked natural material. (Made Ground)	3.50	B D ES	3.00 3.00 3.00	3.00 3.00 3.00	PID	3.00	0.0ppm
▼	3.50 3.50m bgl after 20mins				Hole terminated at 3.500m bgl.							

Remarks

Reason for Termination:

Trial pit terminated at target depth.

Groundwater Notes:

Groundwater seepage at 3.50m.

Other Remarks:

1. Trial pit backfilled with arisings. 2. No visual or olfactory evidence of contamination.

Legend

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detector Test

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TRIAL PIT LOG

Scale: 1:50 Sheet 1 of 1

LOCATION ID:	**Project Name:** Lamby Way, Cardiff		2.10
TP02	**Project Number:** NTE2313		0.60 Pit Dimensions (m) 45 Degrees
	Client: Vastint UK BV		
Hole Type: TP	**Plant:** JCB 3CX	**Start & End Date:** 26/10/2016	Stability: Poor stability within Made Ground.
Ground Level (m AOD): 8.79		**Eastings & Northings:** 321993E 178586N	Engineer: IW / Checker: TH

Groundwater		Strata					Samples			In-Situ Tests		
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend / Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
					Dark brownish black clayey sandy fine to coarse angular to subrounded brick, concrete, metal, mudstone, sandstone, plastic, organic material and glass GRAVEL with moderate cobble content. Sand is fine to coarse. Cobbles are angular to subangular brick and concrete. Occasional boulders of concrete at 0.10m. Roots, rootlets and wood present throughout. Becoming very clayey from 1.00m. Concrete obstruction in south face of trial pit at 0.50m-3.10m. Part of brick wall in north face of trial pit at 1.00m. (Made Ground)		B	0.50	0.50	PID	0.50	0.0ppm
							D	0.50	0.50			
							ES	0.50	0.50			
							B	0.90	0.90	PID	0.90	0.0ppm
							D	0.90	0.90			
▼	1.40 1.40m bgl after 20mins 1.50 1.40m bgl after 20mins			3.10m			ES	0.90	0.90			
							B	1.40	1.40	PID	1.40	0.0ppm
							D	1.40	1.40			
							ES	1.40	1.40			
							B	2.70	2.70	PID	2.70	0.1ppm
							D	2.70	2.70			
			5.69			3.10	ES	2.70	2.70			
				0.40m	Firm greyish organish brown gravelly CLAY. Gravel is angular to subangular fine and medium brick and mudstone. Reworked natural material. (Made Ground)		B	3.20	3.20	PID	3.20	0.1ppm
							D	3.20	3.20			
			5.29			3.50	ES	3.20	3.20			
					Hole terminated at 3.500m bgl.							

Remarks

Reason for Termination:

Trial pit terminated at target depth.

Groundwater Notes:

Damp arisings from 1.40m. Groundwater stike from 1.50m.

Other Remarks:

1. Trial pit backfilled with arisings. 2. No visual or olfactory evidence of contamination.

Legend

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detector Test

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TRIAL PIT LOG

Scale: 1:50 Sheet 1 of 1

LOCATION ID:	**Project Name:** Lamby Way, Cardiff		2.10
TP03	**Project Number:** NTE2313		0.60 Pit Dimensions (m) 30 Degrees
	Client: Vastint UK BV		
Hole Type: TP	**Plant:** JCB 3CX	**Start & End Date:** 26/10/2016	Stability: Poor stability within Made Ground.
Ground Level (m AOD): 8.73		**Eastings & Northings:** 322006E 178639N	Engineer: IW / Checker: TH

Groundwater		Strata					Samples			In-Situ Tests		
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend / Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
					Dark reddish brown clayey sandy fine to coarse angular to subrounded brick, concrete, metal, mudstone, sandstone, plastic, coal ash, organic material and glass GRAVEL with moderate cobble content. Sand is fine to coarse. Cobbles are angular to subangular brick and concrete. Occasional boulders of concrete throughout. Roots, rootlets and wood present throughout. Concrete obstruction in north face of trial pit at 1.90m. (Made Ground)		B	0.30	0.30	PID	0.30	0.0ppm
							D	0.30	0.30			
							ES	0.30	0.30			
							B	0.90	0.90	PID	0.90	0.0ppm
							D	0.90	0.90			
▼	0.00						ES	0.90	0.90			
				3.50m			B	1.60	1.60	PID	1.60	0.0ppm
							D	1.60	1.60			
							ES	1.60	1.60			
							B	2.70	2.70	PID	2.70	0.0ppm
							D	2.70	2.70			
							ES	2.70	2.70			
			5.23			3.50						
					Hole terminated at 3.500m bgl.							

Remarks

Reason for Termination:

Trial pit terminated at target depth.

Groundwater Notes:

Groundwater was not encountered during the excavation period.

Other Remarks:

1. Trial pit backfilled with arisings. 2. No visual or olfactory evidence of contamination.

Legend

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detector Test

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TRIAL PIT LOG

Scale: 1:50 Sheet 1 of 1

LOCATION ID: TP04	**Project Name:** Lamby Way, Cardiff		2.10 / 0.60 Pit Dimensions (m) / 0 Degrees
	Project Number: NTE2313		
	Client: Vastint UK BV		
Hole Type: TP	**Plant:** JCB 3CX	**Start & End Date:** 26/10/2016	Stability: Poor stability within Made Ground.
Ground Level (m AOD): 8.74		**Eastings & Northings:** 322001E 178604N	Engineer: IW / Checker: TH

Groundwater		Strata					Samples			In-Situ Tests		
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend / Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
				2.10m	Dark brownish black clayey sandy fine to coarse angular to subrounded brick, concrete, reinforced concrete, metal, mudstone, sandstone, plastic, coal, ash, clinker, organic material and glass GRAVEL with moderate cobble content. Sand is fine to coarse. Cobbles are angular to subangular brick and concrete. Occasional boulders of concrete at 1.50m. Roots, rootlets and wood present throughout. Becoming very clayey from 1.00m. Concrete obstruction in south face of trial pit at 0.50m-3.10m. Part of brick wall in north face of trial pit at 1.00m. (Made Ground)		B D ES	0.50 0.50 0.50	0.50 0.50 0.50	PID	0.50	0.0ppm
▼	1.50 1.50m bgl after 20mins		6.64				B D ES	1.50 1.50 1.50	1.50 1.50 1.50	PID	1.50	0.0ppm
					Hole terminated at 2.100m bgl.	2.10	B D ES	2.00 2.00 2.00	2.00 2.00 2.00	PID	2.00	0.0ppm

Remarks

Reason for Termination:

Trial pit terminated at 2.10m due to instability within Made Ground.

Groundwater Notes:

Groundwater seepage at 1.50m.

Other Remarks:

1. Trial pit backfilled with arisings. 2. No visual or olfactory evidence of contamination.

Legend

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detector Test

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TRIAL PIT LOG

Scale: 1:50 Sheet 1 of 1

LOCATION ID:	**Project Name:** Lamby Way, Cardiff		2.10
TP05	**Project Number:** NTE2313		0.60 Pit Dimensions (m) 80 Degrees
	Client: Vastint UK BV		
Hole Type: TP	**Plant:** JCB 3CX	**Start & End Date:** 26/10/2016	Stability: Fair.
Ground Level (m AOD): 8.73		**Eastings & Northings:** 322011E 178614N	Engineer: IW / Checker: TH

Groundwater		Strata						Samples			In-Situ Tests		
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend	Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
			6.93	1.80m	Dark brownish black clayey sandy fine to coarse angular to subrounded brick, concrete, metal, mudstone, sandstone, plastic, ceramic, tile, ash, slag, organic material and glass GRAVEL with moderate cobble content. Sand is fine to coarse. Cobbles are angular to subangular brick and concrete. Occasional boulders of concrete. Roots, rootlets and wood present throughout. Concrete obstruction in eastern face of trial pit at 1.60m. (Made Ground)			B D ES B D ES	0.40 0.40 0.40 0.80 0.80 0.80	0.40 0.40 0.40 0.80 0.80 0.80	PID	0.40 0.80	0.0ppm 0.1ppm
▼	0.00												
			6.33	0.60m	Orangish brown soft gravelly CLAY. Gravel is subangular to subrounded sandstone, brick and mudstone. (Made Ground)		1.80	B D ES	1.90 1.90 1.90	1.90 1.90 1.90	PID	1.90	0.1ppm
			5.23	1.10m	Grey mottled orange very slightly gravelly CLAY. Gravel is angular to subangular fine and medium brick and mudstone. Reworked natural material. (Made Ground)		2.40	B D ES	2.80 2.80 2.80	2.80 2.80 2.80	PID	2.80	0.0ppm
					Hole terminated at 3.500m bgl.		3.50						

Remarks

Reason for Termination:

Trial pit terminated at target depth.

Groundwater Notes:

Groundwater was not encountered during the excavation period.

Other Remarks:

1. Trial pit backfilled with arisings. 2. No visual or olfactory evidence of contamination.

Legend

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detector Test

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TRIAL PIT LOG

Scale: 1:50 Sheet 1 of 1

LOCATION ID: TP06	**Project Name:** Lamby Way, Cardiff		2.10
	Project Number: NTE2313		0.60 Pit Dimensions (m) 45 Degrees
	Client: Vastint UK BV		
Hole Type: TP	**Plant:** JCB 3CX	**Start & End Date:** 26/10/2016	Stability: Poor stability within Made Ground.
Ground Level (m AOD): 8.63		**Eastings & Northings:** 322024E 178617N	Engineer: IW / Checker: TH

Groundwater		Strata					Samples			In-Situ Tests		
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend / Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
			8.23	0.40m	Dark brownish black clayey sandy fine to coarse angular to subrounded brick, concrete, metal, mudstone, sandstone, plastic, organic material and glass GRAVEL with moderate cobble content. Sand is fine to coarse. Cobbles are angular to subangular brick and concrete. Occasional boulders of concrete at 0.10m. Roots, rootlets and wood present throughout. Becoming very clayey from 1.00m. Concrete obstruction in south face of trial pit at 0.50m-3.10m. Part of brick wall in north face of trial pit at 1.00m. (Made Ground)	0.40	B D ES	0.30 0.30 0.30	0.30 0.30 0.30	PID	0.30	0.0ppm
▼	0.80 0.80m bgl after 20mins		7.53	0.70m	Greyish brown slightly sandy subangular medium and coarse roadstone GRAVEL with moderate cobble content of subangular roadstone from 1.00m. Sand is medium and coarse. (Made Ground)	1.10	B D ES	1.90 1.90 1.90	1.90 1.90 1.90	PID	1.90	0.0ppm
			5.13	2.40m	Firm greyish brown gravelly CLAY. Gravel is angular to subangular fine and medium brick and mudstone. Reworked natural material. Part of brick wall at 1.60m. Concrete obstruction in eastern face of trial pit at 1.80m. (Made Ground)	3.50	B D ES	3.40 3.40 3.40	3.40 3.40 3.40	PID	3.40	0.1ppm
					Hole terminated at 3.500m bgl.							

Remarks

Reason for Termination:
Trial pit terminated at target depth.

Groundwater Notes:
Groundwater stike from 0.80m.

Other Remarks:
1. Trial pit backfilled with arisings. 2. No visual or olfactory evidence of contamination.

Legend

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detector Test

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TRIAL PIT LOG

Scale: 1:50 Sheet 1 of 1

LOCATION ID:	**Project Name:** Lamby Way, Cardiff		2.10
TP07	**Project Number:** NTE2313		0.60 Pit Dimensions (m) 60 Degrees
	Client: Vastint UK BV		
Hole Type: TP	**Plant:** JCB 3CX	**Start & End Date:** 26/10/2016	Stability: Poor stability within Made Ground.
Ground Level (m AOD): 8.63		**Eastings & Northings:** 322043E 178610N	Engineer: IW / Checker: TH

Groundwater		Strata					Samples			In-Situ Tests		
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend / Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
					Dark brownish black clayey sandy fine to coarse angular to subrounded brick, concrete, metal, mudstone, sandstone, plastic, organic material and glass GRAVEL with moderate cobble content. Sand is fine to coarse. Cobbles are angular to subangular brick and concrete. Lenses of orangish brown clay throughout. Occasional boulders of concrete. Roots, rootlets and wood present throughout. (Made Ground)		B	0.20	0.20	PID	0.20	0.0ppm
							D	0.20	0.20			
							ES	0.20	0.20			
▼	0.00						B	0.80	0.80	PID	0.80	0.0ppm
							D	0.80	0.80			
							ES	0.80	0.80			
				2.60m								
							B	1.70	1.70	PID	1.70	0.0ppm
							D	1.70	1.70			
							ES	1.70	1.70			
			6.03			2.60						
					Soft grey oxidised orange very slightly gravelly slightly sandy CLAY. Gravel is angular to subrounded fine to coarse mudstone. Sand is fine and medium. (Tidal Flat Deposits)		B	2.80	2.80	PID	2.80	0.0ppm
							D	2.80	2.80			
				0.90m			ES	2.80	2.80			
			5.13			3.50						
					Hole terminated at 3.500m bgl.							

Remarks

Reason for Termination:
Trial pit terminated at target depth.

Groundwater Notes:
Groundwater was not encountered during the excavation period.

Other Remarks:
1. Trial pit backfilled with arisings. 2. No visual or olfactory evidence of contamination.

Legend

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detector Test

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TRIAL PIT LOG

Scale: 1:50 Sheet 1 of 1

LOCATION ID: TP08	**Project Name:** Lamby Way, Cardiff		2.10 / 0.60 / Pit Dimensions (m) / 270 Degrees
	Project Number: NTE2313		
	Client: Vastint UK BV		
Hole Type: TP	**Plant:** JCB 3CX	**Start & End Date:** 26/10/2016	Stability: Poor stability within Made Ground.
Ground Level (m AOD): 8.48		**Eastings & Northings:** 322064E 178619N	Engineer: IW / Checker: TH

Groundwater		Strata					Samples			In-Situ Tests		
Strike	Strike Details	Backfill	Level (m AOD)	Thickness	Description	Legend / Depth (m bgl)	Type	From (m)	To (m)	Type	Depth (m)	Result
▼	0.00		6.28	2.20m	Dark brownish black clayey sandy fine to coarse angular to subrounded brick, concrete, metal, mudstone, sandstone, plastic, tile, ceramic organic material and glass GRAVEL with high cobble content. Sand is fine to coarse. Cobbles are angular to subangular brick, sandstone, quartzite and concrete. Roots, rootlets and wood present throughout. (Made Ground)		B D ES	0.50 0.50 0.50	0.50 0.50 0.50	PID	0.50	0.0ppm
			5.98	0.30m	Firm greenish grey gravelly CLAY. Gravel is angular to subangular fine and medium brick and mudstone. Reworked natural material. (Made Ground)	2.20	B D ES	1.85 1.85 1.85	1.85 1.85 1.85	PID	1.85	0.1ppm
			4.98	1.00m	Soft grey oxidised orange very slightly gravelly slightly sandy CLAY. Gravel is angular to subrounded fine to coarse mudstone. Sand is fine and medium. (Tidal Flat Deposits)	2.50	B D ES	2.70 2.70 2.70	2.70 2.70 2.70	PID	2.70	0.0ppm
					Hole terminated at 3.500m bgl.	3.50						

Remarks

Reason for Termination:

Trial pit terminated at target depth.

Groundwater Notes:

Groundwater was not encountered during the excavation period.

Other Remarks:

1. Trial pit backfilled with arisings. 2. No visual or olfactory evidence of contamination.

Legend

Samples:
B - Bulk
D - Disturbed
ES - Environmental Sample

Groundwater Strikes:
Groundwater Strike Resting
Groundwater Level

In-Situ Tests:
HSV - Hand Shear Vane Test
PID - Photo Ionisation Detector Test

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APPENDIX 3

TRIP HAMMER CALIBRATION CERTIFICATE

SPT Calibration Report

EQUIPE GROUP
www.equipegroup.com

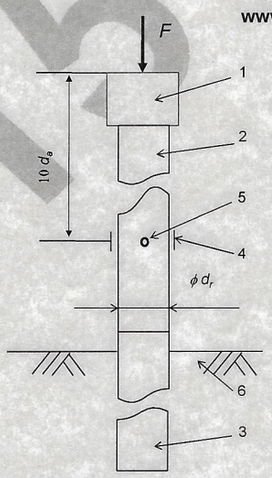
Hammer Energy Measurement Report

Type of Hammer	DART
Client	JACKSON DRILLING
Test No	EQU1397
Test Depth (m)	7.90
Date of Test	23 December 2015
Valid until	22 December 2016
Hammer ID	JD9

Mass of the hammer	m =	63.5kg
Falling height	h =	0.76m
E_{theor} =	$m \times g \times h$ =	473J

Characteristics of the instrumented rod

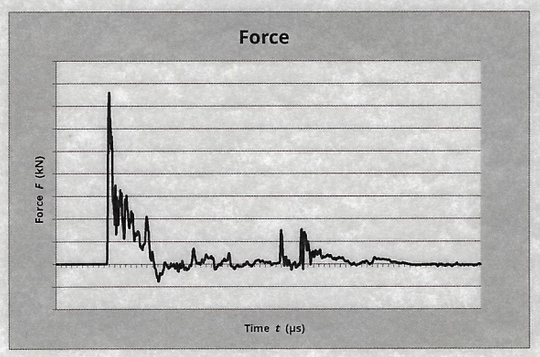
Diameter	d_r =	0.052 m
Length of the instrumented rod		0.558 m
Area	A =	11.61 cm^2
Modulus	E_a =	206843 MPa

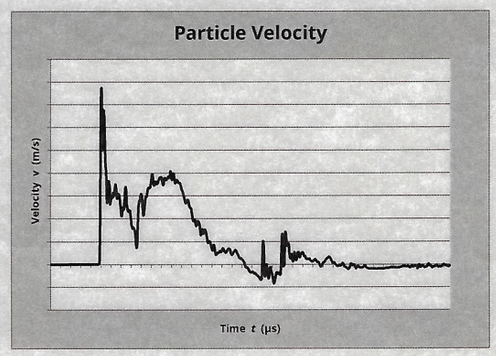


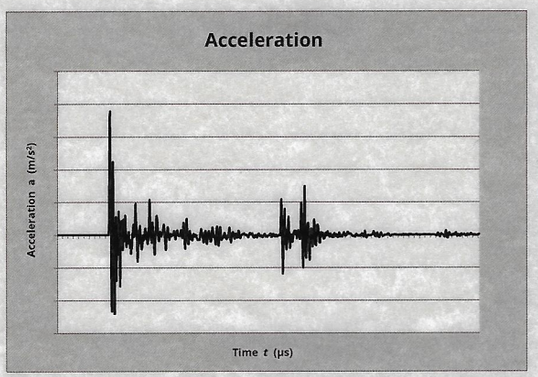
Key
1 Anvil
2 Part of instrumented rod
3 Drive Rod
4 Strain Gauge
5 Accelerometer
6 Ground

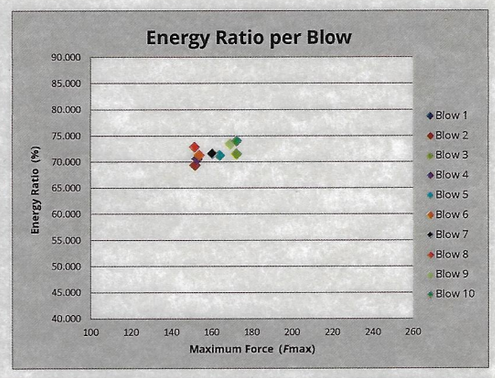
F Force
d_r Diameter of rod

Fig. B.1 and B.2 BS EN ISO 22476-3 : 2005 + A1 : 2011









Observations:
1.

E_{meas} =	**0.340**	kN-m
E_{theor} =	**0.473**	kN-m

Energy Ratio (E_r) $= \frac{E_{meas}}{E_{theor}}$: **71.79%**

Equipe SPT Analyzer Operators: MH

Prepared by: [signature] **Checked by:** [signature] **Date** 15/01/2016

Equipe Group, The Paddocks, Home Farm Offices, The Upton Estate, Banbury, Oxfordshire, OX15 6HU
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APPENDIX 4

GAS AND GROUNDWATER MONITORING RESULTS

BWB GAS AND GROUNDWATER MONITORING

Site:		Lamby Way, Cardiff
Client:		Vastint UK BV
Job No.:		NTE2313
Date:		09 November 2016
Start / End Time:		8.30AM - 9.30AM
Engineer:		IW
Monitoring Equipment:	**Gas Meter ID**	**BWB00994**
	PID ID	**BWB00998**
	Dip Tape	**BWB00979**
	Other	

NR = Not Recorded
Dry = No Groundwater

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Weather Conditions	Start	End
(Dry / Raining)	DRY	DRY
Cloud Cover (Oktas)	6/8	6/8
Wind Strength (m/s)	6.7	6.7
Wind Direction (from)	NW	NW
Temperature (°C)	9.0	9.0
Barometric Pressure (mb)	998	998
(Rising/ Falling)		STEADY
PID - Air	0	0
PID - Calibration Gas		

Location Reference	Relative Pressure (mbar)	Flow (l/hr)		Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	PID (ppm)	Depth to water (m)	Base of Response Zone (m)	Free-Phase Product Level Top (m)	Groundwater Elevation (m AOD)	Notes
		Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady								
Ambient Air Start (Calibration)	998		0.0				0.3		20.1								
Ambient Air Finish (Calibration)	998		0.0				0.3		20.1								
DS01	997.0000		<0.1		17.0		4.1		0.3	<1	<1	<0.1	2.32	3.11		6.46	Very high LEL concentrations
DS02	998.0000		<0.1		10.9		0.5		<0.1	<1	<1	0.3	1.97	3.59		6.79	Very high LEL concentrations
DS04	998.0000	5.8	0.6	1.6	<0.1		1.8	7.2	9.0	<1	<1	<0.1	2.87	4.94		5.78	Silt on dip tape

BWB GAS AND GROUNDWATER MONITORING

Site:		Lamby Way, Cardiff
Client:		Vastint UK BV
Job No.:		NTE2313
Date:		15/11/2016
Start / End Time:		2.30 PM - 3.30 PM
Engineer:		LM
Monitoring Equipment:	**Gas Meter ID**	**BWB00994**
	PID ID	**BWB00998**
	Dip Tape	**BWB00979**
	Other	

NR = Not Recorded
Dry = No Groundwater

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Weather Conditions	Start	End
(Dry / Raining)	DRY	DRY
Cloud Cover (Oktas)	7/8	7/8
Wind Strength (m/s)	6.7	6.7
Wind Direction (from)	WNW	WNW
Temperature (°C)	12.0	12.0
Barometric Pressure (mb)	1027	1027
(Rising/ Falling)	STEADY	STEADY
PID - Air	0	0
PID - Calibration Gas		

Location Reference	Relative Pressure (mbar)	Flow (l/hr)		Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	PID (ppm)	Depth to water (m)	Base of Response Zone (m)	Free-Phase Product Level Top (m)	Groundwater Elevation (m AOD)	Notes
		Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady								
Ambient Air Start (Calibration)																	
Ambient Air Finish (Calibration)											<1						
DS01		<0.1	<0.1		15.2		4.0		<0.1	<1	<1	<0.1	2.15	3.11		6.63	Water surrounding bung
DS02		10.0	<0.1		2.0		0.8		<0.1	<1	<1	0.1	2.90	3.61		5.86	Water surrounding bung. High LEL concentrations (46.6%)
DS04		86..2	<0.1	0.4	<0.1		3.5		13.6	<1	<1	0.2	2.96	4.90		5.69	Water surrounding bung

BWB GAS AND GROUNDWATER MONITORING

Site:		Lamby Way, Cardiff
Client:		Vastint UK BV
Job No.:		NTE2313
Date:		24/11/2016
Start / End Time:		11:00 - 11:45
Engineer:		HC
Monitoring Equipment:	**Gas Meter ID**	**BWB00995**
	PID ID	**BWB00911**
	Dip Tape	**-**
	Other	

NR = Not Recorded
Dry = No Groundwater

BWB
CONSULTANCY | ENVIRONMENT
INFRASTRUCTURE | BUILDINGS

Weather Conditions	Start	End
(Dry / Raining)	Dry	Dry
Cloud Cover (Oktas)	8/9	8/9
Wind Strength (m/s)	8.0	8.0
Wind Direction (from)	ENE	ENE
Temperature (°C)	8.0	8.0
Barometric Pressure (mb)	1021	1019
(Rising/ Falling)	Falling	Falling
PID - Air	0	0
PID - Calibration Gas		

Location Reference	Relative Pressure (mbar)	Flow (l/hr)		Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	PID (ppm)	Depth to water (m)	Base of Response Zone (m)	Free-Phase Product Level Top (m)	Groundwater Elevation (m AOD)	Notes
		Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady								
Ambient Air Start (Calibration)																	
Ambient Air Finish (Calibration)											<1						
DS01	1019	<0.1	<0.1	15.6	15.6	0.3	<0.1	3.6	3.6	<1	<1	<0.1	1.89	2.99		6.89	
DS02	1021	1.7	<0.1	9.3	5.0	0.3	0.2	3.5	11.4	<1	<1	<0.1	2.58	3.50		6.18	
DS04	1019	6.0	0.4	<0.1	<0.1	2.4	2.4	8.8	8.8	<1	<1	<0.1	1.82	4.83		6.83	Flooded

BWB GAS AND GROUNDWATER MONITORING

Site:		Lamby Way, Cardiff
Client:		Vastint UK BV
Job No.:		NTE2313
Date:		30/11/2016
Start / End Time:		11:00/12:00
Engineer:		HC
Monitoring Equipment:	**Gas Meter ID**	**BWB00995**
	PID ID	**BWB00911**
	Dip Tape	**-**
	Other	

NR = Not Recorded
Dry = No Groundwater

BWB
CONSULTANCY | ENVIRONMENT
INFRASTRUCTURE | BUILDINGS

Weather Conditions	Start	End
(Dry / Raining)	Dry	Dry
Cloud Cover (Oktas)	0/1	1
Wind Strength (m/s)	8.0	8.0
Wind Direction (from)	NW	NW
Temperature (°C)	6.0	6.0
Barometric Pressure (mb)	1034	1032
(Rising/ Falling)		FALLING
PID - Air		
PID - Calibration Gas		

Location Reference	Relative Pressure (mbar)	Flow (l/hr)		Methane (%v/v)		Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	PID (ppm)	Depth to water (m)	Base of Response Zone (m)	Free-Phase Product Level Top (m)	Groundwater Elevation (m AOD)	Notes
		Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady								
Ambient Air Start (Calibration)																	
Ambient Air Finish (Calibration)											<1						
DS01	**1033**	<0.1	<0.1	12.4	12.4	<0.1	<0.1	3.6	3.6	<1	<1	<0.1	1.94	2.99		6.84	
DS02	**1034**	<0.1	<0.1	1.9	<0.1	0.4	0.4	18.9	19.2	<1	<1	2.3	2.79	3.61		5.97	
DS04	**1032**	25.4	0.3	<0.1	<0.1	1.1	1.1	11.0	13.7	<1	<1	<0.1	1.79	4.83		6.86	

APPENDIX 5

SOIL CHEMICAL ANALYSIS RESULTS

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Analytical Report Number : 16-31661

Project / Site name:	Lamby Way, Cardiff	**Samples received on:**	31/10/2016
Your job number:	NTE2313	**Samples instructed on:**	01/11/2016
Your order number:	POR007395	**Analysis completed by:**	10/11/2016
Report Issue Number:	1	**Report issued on:**	10/11/2016
Samples Analysed:	7 soil samples		

Signed:

Rexona Rahman
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Signed:

Dr Irma Doyle
Senior Account Manager
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.

Analytical Report Number: 16-31661

Project / Site name: Lamby Way, Cardiff
Your Order No: POR007395

Lab Sample Number				652351	652352	652353	652354	652355
Sample Reference				DS02	DS02	DS03	DS03	TP01
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.50	4.50	1.60	3.60	0.40
Date Sampled				27/10/2016	27/10/2016	27/10/2016	27/10/2016	26/10/2016
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	17	12	15	13	9.6
Total mass of sample received	kg	0.001	NONE	1.2	1.0	1.3	0.93	0.40
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	Chrysotile- Loose fibres	-	Chrysotile, Amosite- Loose fibres
Asbestos in Soil	Type	N/A	ISO 17025	-	-	Detected	-	Detected
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.9	8.3	8.0	8.1	8.1
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Complex Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Free Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.58	0.074	0.10	0.030	0.12
Total Sulphur	mg/kg	50	MCERTS	2200	160	560	82	1000
Fraction Organic Carbon (FOC)	N/A	0.001	NONE	0.0089	0.0029	0.015	< 0.0010	0.012
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	1.3	< 0.05	0.17	< 0.05	0.30
Acenaphthylene	mg/kg	0.1	MCERTS	0.52	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	mg/kg	0.1	MCERTS	1.2	< 0.10	0.90	< 0.10	< 0.10
Fluorene	mg/kg	0.1	MCERTS	1.6	< 0.10	1.2	< 0.10	0.14
Phenanthrene	mg/kg	0.1	MCERTS	11	< 0.10	3.5	< 0.10	0.93
Anthracene	mg/kg	0.1	MCERTS	2.6	< 0.10	0.85	< 0.10	0.16
Fluoranthene	mg/kg	0.1	MCERTS	14	< 0.10	4.5	< 0.10	1.2
Pyrene	mg/kg	0.1	MCERTS	10	< 0.10	3.3	< 0.10	0.97
Benzo(a)anthracene	mg/kg	0.1	MCERTS	7.6	< 0.10	2.3	< 0.10	0.87
Chrysene	mg/kg	0.05	MCERTS	6.6	< 0.05	2.3	< 0.05	0.89
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	6.9	< 0.10	2.3	< 0.10	0.93
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	2.9	< 0.10	1.5	< 0.10	0.64
Benzo(a)pyrene	mg/kg	0.1	MCERTS	4.7	< 0.10	1.7	< 0.10	0.68
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	2.6	< 0.10	1.0	< 0.10	0.31
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	1.0	< 0.10	0.41	< 0.10	< 0.10
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.9	< 0.05	1.2	< 0.05	0.52
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	77.1	< 1.60	27.2	< 1.60	8.58
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	14	1.6	11	5.0	13
Barium (aqua regia extractable)	mg/kg	1	MCERTS	370	320	540	270	320
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.31	0.75	0.64	1.3	0.86
Boron (water soluble)	mg/kg	0.2	MCERTS	5.4	0.6	2.3	0.5	1.6
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.4	< 0.2	0.7	< 0.2	0.8
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	19	22	28	18	30
Copper (aqua regia extractable)	mg/kg	1	MCERTS	38	8.3	33	7.1	68
Lead (aqua regia extractable)	mg/kg	1	MCERTS	210	7.2	67	6.2	130
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	0.6	< 0.3	0.4
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	15	32	20	32	30
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	1.8	< 1.0	< 1.0	< 1.0	3.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	22	23	32	23	25
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	180	52	120	41	230

Analytical Report Number: 16-31661

Project / Site name: Lamby Way, Cardiff
Your Order No: POR007395

Lab Sample Number				652351	652352	652353	652354	652355
Sample Reference				DS02	DS02	DS03	DS03	TP01
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.50	4.50	1.60	3.60	0.40
Date Sampled				27/10/2016	27/10/2016	27/10/2016	27/10/2016	26/10/2016
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	ug/kg	1	MCERTS	< 1.0	-	< 1.0	-	-
Toluene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	-
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	-
p & m-xylene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	-
o-xylene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	-
Petroleum Hydrocarbons								
TPH C10 - C40	mg/kg	10	MCERTS	460	< 10	200	< 10	82
TPH2 (C6 - C10)	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	7.3	-	3.8	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	19	-	16	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	48	-	46	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	75	-	66	-	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	1.5	-	< 1.0	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	20	-	6.5	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	100	-	34	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	210	-	98	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	340	-	140	-	-

Analytical Report Number: 16-31661

Project / Site name: Lamby Way, Cardiff
Your Order No: POR007395

Lab Sample Number				652356	652357			
Sample Reference				TP06	TP08			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.30	0.50			
Date Sampled				26/10/2016	26/10/2016			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	-	< 0.1			
Moisture Content	%	N/A	NONE	-	9.8			
Total mass of sample received	kg	0.001	NONE	-	1.1			
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Chrysotile-Insulation lagging	Chrysotile- Hard/ Cement type material			
Asbestos in Soil	Type	N/A	ISO 17025	Detected	Detected			
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	8.2			
Total Cyanide	mg/kg	1	MCERTS	-	< 1			
Complex Cyanide	mg/kg	1	MCERTS	-	< 1			
Free Cyanide	mg/kg	1	MCERTS	-	< 1			
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.18			
Total Sulphur	mg/kg	50	MCERTS	-	740			
Fraction Organic Carbon (FOC)	N/A	0.001	NONE	-	0.0061			
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	< 1.0			
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	-	1.6			
Acenaphthylene	mg/kg	0.1	MCERTS	-	0.29			
Acenaphthene	mg/kg	0.1	MCERTS	-	1.0			
Fluorene	mg/kg	0.1	MCERTS	-	1.1			
Phenanthrene	mg/kg	0.1	MCERTS	-	9.5			
Anthracene	mg/kg	0.1	MCERTS	-	3.0			
Fluoranthene	mg/kg	0.1	MCERTS	-	16			
Pyrene	mg/kg	0.1	MCERTS	-	12			
Benzo(a)anthracene	mg/kg	0.1	MCERTS	-	9.8			
Chrysene	mg/kg	0.05	MCERTS	-	8.6			
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	-	11			
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	-	6.1			
Benzo(a)pyrene	mg/kg	0.1	MCERTS	-	8.0			
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	-	4.1			
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	-	1.3			
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	4.4			
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	-	98.0			
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	15			
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	490			
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	0.68			
Boron (water soluble)	mg/kg	0.2	MCERTS	-	1.8			
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	0.7			
Chromium (hexavalent)	mg/kg	4	MCERTS	-	< 4.0			
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	21			
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	61			
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	120			
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	0.4			
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	17			
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	< 1.0			
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	25			
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	140			

Analytical Report Number: 16-31661

Project / Site name: Lamby Way, Cardiff
Your Order No: POR007395

Lab Sample Number				652356	652357			
Sample Reference				TP06	TP08			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.30	0.50			
Date Sampled				26/10/2016	26/10/2016			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	ug/kg	1	MCERTS	-	-			
Toluene	µg/kg	1	MCERTS	-	-			
Ethylbenzene	µg/kg	1	MCERTS	-	-			
p & m-xylene	µg/kg	1	MCERTS	-	-			
o-xylene	µg/kg	1	MCERTS	-	-			
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-			
Petroleum Hydrocarbons								
TPH C10 - C40	mg/kg	10	MCERTS	-	320			
TPH2 (C6 - C10)	mg/kg	0.1	NONE	-	< 0.1			
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	-	-			
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	-	-			
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	-	-			
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-			
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-			
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-			
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-			
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-			
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	-	-			
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	-	-			
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	-	-			
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-			
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-			
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-			
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-			
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-			

Analytical Report Number : 16-31661

Project / Site name: Lamby Way, Cardiff

* 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 *
652351	DS02	None Supplied	1.50	Brown loam and clay with gravel.
652352	DS02	None Supplied	4.50	Light brown clay and sand with gravel.
652353	DS03	None Supplied	1.60	Brown loam and clay with gravel.
652354	DS03	None Supplied	3.60	Light brown clay.
652355	TP01	None Supplied	0.40	Brown clay and loam with vegetation.
652356	TP06	None Supplied	0.30	-
652357	TP08	None Supplied	0.50	Brown loam and clay with gravel.

Analytical Report Number : 16-31661

Project / Site name: Lamby Way, Cardiff

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

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 disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
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	L038-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Complex Cyanide in soil	Determination of complex cyanide by calculation.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Fraction of Organic Carbon in soil	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	NONE
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
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.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
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 (skalar)	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
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.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	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 (Skalar)	L080-PL	W	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding.	L076-PL	W	MCERTS

Analytical Report Number : 16-31661

Project / Site name: Lamby Way, Cardiff

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
TPH2 (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L076-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' 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.

APPENDIX 6

GROUNDWATER CHEMICAL ANALYSIS RESULTS

Imogen Wort
BWB Consulting Limited
5th Floor
Waterfront House
Nottingham
NG2 3DQ

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i2 Analytical Ltd.
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Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 16-32657

Project / Site name:	Lamby Way	**Samples received on:**	11/11/2016
Your job number:	NTE2313	**Samples instructed on:**	11/11/2016
Your order number:	POR007589	**Analysis completed by:**	21/11/2016
Report Issue Number:	1	**Report issued on:**	21/11/2016
Samples Analysed:	3 water samples		

Signed:

Rexona Rahman
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Signed:

Emma Winter
Assistant Reporting Manager
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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Analytical Report Number: 16-32657

Project / Site name: Lamby Way

Your Order No: POR007589

Lab Sample Number				657545	657546	657547		
Sample Reference				DS01	DS02	DS04		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				None Supplied	None Supplied	None Supplied		
Date Sampled				09/11/2016	09/11/2016	09/11/2016		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
General Inorganics								
pH	pH Units	N/A	ISO 17025	7.6	7.5	7.4		
Electrical Conductivity	µS/cm	10	NONE	1600	1500	1600		
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10		
Sulphate as SO_4	µg/l	45	ISO 17025	217000	289000	119000		
Sulphate as SO_4	mg/l	0.045	ISO 17025	220	290	120		
Ammoniacal Nitrogen as N	µg/l	15	ISO 17025	-	3000	100		
Total Phenols								
Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10	< 10		
Speciated PAHs								
Naphthalene	µg/l	0.01	ISO 17025	-	< 0.01	< 0.01		
Acenaphthylene	µg/l	0.01	ISO 17025	-	< 0.01	< 0.01		
Acenaphthene	µg/l	0.01	ISO 17025	-	< 0.01	< 0.01		
Fluorene	µg/l	0.01	ISO 17025	-	< 0.01	< 0.01		
Phenanthrene	µg/l	0.01	ISO 17025	-	< 0.01	< 0.01		
Anthracene	µg/l	0.01	ISO 17025	-	< 0.01	< 0.01		
Fluoranthene	µg/l	0.01	ISO 17025	-	< 0.01	< 0.01		
Pyrene	µg/l	0.01	ISO 17025	-	< 0.01	< 0.01		
Benzo(a)anthracene	µg/l	0.01	ISO 17025	-	< 0.01	< 0.01		
Chrysene	µg/l	0.01	ISO 17025	-	< 0.01	< 0.01		
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	-	< 0.01	< 0.01		
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	-	< 0.01	< 0.01		
Benzo(a)pyrene	µg/l	0.01	ISO 17025	-	< 0.01	< 0.01		
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	-	< 0.01	< 0.01		
Dibenz(a,h)anthracene	µg/l	0.01	NONE	-	< 0.01	< 0.01		
Benzo(ghi)perylene	µg/l	0.01	NONE	-	< 0.01	< 0.01		
Total PAH								
Total EPA-16 PAHs	µg/l	0.16	NONE	-	< 0.16	< 0.16		
Heavy Metals / Metalloids								
Arsenic (dissolved)	µg/l	0.15	ISO 17025	0.24	4.78	1.12		
Barium (dissolved)	µg/l	0.06	ISO 17025	21	87	87		
Beryllium (dissolved)	µg/l	0.1	ISO 17025	< 0.1	< 0.1	< 0.1		
Boron (dissolved)	µg/l	10	ISO 17025	250	180	140		
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.02	0.05	0.02		
Chromium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	0.9	0.3		
Copper (dissolved)	µg/l	0.5	ISO 17025	4.0	8.8	2.5		
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2	0.7	1.3		
Mercury (dissolved)	µg/l	0.05	ISO 17025	0.08	0.13	0.15		
Nickel (dissolved)	µg/l	0.5	ISO 17025	< 0.5	15	7.7		
Selenium (dissolved)	µg/l	0.6	ISO 17025	14	20	4.5		
Vanadium (dissolved)	µg/l	0.2	ISO 17025	0.2	4.5	0.9		
Zinc (dissolved)	µg/l	0.5	ISO 17025	0.8	7.0	4.1		

Analytical Report Number: 16-32657

Project / Site name: Lamby Way

Your Order No: POR007589

Lab Sample Number				657545	657546	657547		
Sample Reference				DS01	DS02	DS04		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				None Supplied	None Supplied	None Supplied		
Date Sampled				09/11/2016	09/11/2016	09/11/2016		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0		
Toluene	µg/l	1	ISO 17025	-	< 1.0	< 1.0		
Ethylbenzene	µg/l	1	ISO 17025	-	< 1.0	< 1.0		
p & m-xylene	µg/l	1	ISO 17025	-	< 1.0	< 1.0		
o-xylene	µg/l	1	ISO 17025	-	< 1.0	< 1.0		
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	-	< 1.0	< 1.0		
Petroleum Hydrocarbons								
TPH1 (C10 - C40)	µg/l	10	NONE	-	< 10	< 10		
TPH2 (C6 - C10)	µg/l	10	NONE	< 10	< 10	< 10		
TPH-CWG - Aliphatic >C5 - C6	µg/l	10	NONE	-	< 10	< 10		
TPH-CWG - Aliphatic >C6 - C8	µg/l	10	NONE	-	< 10	< 10		
TPH-CWG - Aliphatic >C8 - C10	µg/l	10	NONE	-	< 10	< 10		
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	-	< 10	< 10		
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	-	< 10	< 10		
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	-	< 10	< 10		
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	-	< 10	< 10		
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	-	< 10	< 10		
TPH-CWG - Aromatic >C5 - C7	µg/l	10	NONE	-	< 10	< 10		
TPH-CWG - Aromatic >C7 - C8	µg/l	10	NONE	-	< 10	< 10		
TPH-CWG - Aromatic >C8 - C10	µg/l	10	NONE	-	< 10	< 10		
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	-	< 10	< 10		
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	-	< 10	< 10		
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	-	< 10	< 10		
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	-	< 10	< 10		
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	-	< 10	< 10		

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 16-32657

Project / Site name: Lamby Way

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Ammoniacal Nitrogen as N in water	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the discrete analyser (colorimetric) salicylate/nitroprusside method. Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
Boron in water	Determination of boron in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW	In-house method based on MEWAM	L039-PL	W	ISO 17025
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Electrical conductivity at 20oC of water	Determination of electrical conductivity in water by electrometric measurement.	In-house method	L031-PL	W	NONE
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.	L012-PL	W	ISO 17025
Monohydric phenols 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 (skalar)	L080-PL	W	ISO 17025
pH at 20oC in water (automated)	Determination of pH in water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	W	ISO 17025
Speciated EPA-16 PAHs in water	Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW	In-house method based on USEPA 8270	L0102B-PL	W	NONE
Sulphate in water	Determination of sulphate in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Sulphate in water	Determination of sulphate in water by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Total cyanide 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 (Skalar)	L080-PL	W	ISO 17025
TPH1 (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS.	In-house method	L070-PL	W	NONE
TPH2 (Waters)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	NONE
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' 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.

Sample ID	Other_ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
DS01		W	16-32657	657545	c	Electrical conductivity at 20oC of water	L031-PL	c
DS01		W	16-32657	657545	c	pH at 20oC in water (automated)	L099-PL	c
DS02		W	16-32657	657546	c	Ammoniacal Nitrogen as N in water	L082-PL	c
DS02		W	16-32657	657546	c	Electrical conductivity at 20oC of water	L031-PL	c
DS02		W	16-32657	657546	c	pH at 20oC in water (automated)	L099-PL	c
DS04		W	16-32657	657547	c	Ammoniacal Nitrogen as N in water	L082-PL	c
DS04		W	16-32657	657547	c	Electrical conductivity at 20oC of water	L031-PL	c
DS04		W	16-32657	657547	c	pH at 20oC in water (automated)	L099-PL	c

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

APPENDIX 7

GEOTECHNICAL LABORAOTY TESTING RESULTS

Imogen Wort
BWB Consulting Limited
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WD18 8YS

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e: reception@i2analytical.com

Analytical Report Number : 16-31677

Project / Site name:	Lamby Way, Cardiff	**Samples received on:**	31/10/2016
Your job number:	NTE2313	**Samples instructed on:**	01/11/2016
Your order number:	POR007390	**Analysis completed by:**	10/11/2016
Report Issue Number:	1	**Report issued on:**	10/11/2016
Samples Analysed:	4 soil samples		

Signed:

Rexona Rahman
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Signed:

Dr Irma Doyle
Senior Account Manager
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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Analytical Report Number: 16-31677

Project / Site name: Lamby Way, Cardiff
Your Order No: POR007390

Lab Sample Number				652439	652440	652441	652442	
Sample Reference				TP02	TP03	TP07	DS01	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				0.50	2.70	2.80	4.00-5.00	
Date Sampled				26/10/2016	26/10/2016	26/10/2016	27/10/2016	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Moisture Content	%	N/A	NONE	16	19	18	13	
Total mass of sample received	kg	0.001	NONE	0.75	0.68	0.42	0.40	
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.1	7.1	8.1	8.6	
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.057	0.033	0.041	0.088	

Analytical Report Number : 16-31677

Project / Site name: Lamby Way, Cardiff

* 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 *
652439	TP02	None Supplied	0.50	Brown loam and clay with gravel and vegetation.
652440	TP03	None Supplied	2.70	Brown clay and loam with gravel and vegetation.
652441	TP07	None Supplied	2.80	Light brown clay and sand.
652442	DS01	None Supplied	4.00-5.00	Brown clay.

Analytical Report Number : 16-31677

Project / Site name: Lamby Way, Cardiff

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
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.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' 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.

TEST CERTIFICATE

Determination of Moisture Content

Tested in Accordance with BS 1377-2:1990: Clause 3.2

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

UKAS TESTING 4041

Client:	BWB Consulting Limited	Client Reference:	NTE2313
Client Address:	5th Floor Waterfront House Nottingham NG2 3DQ	Job Number:	16-31676
		Date Sampled:	27/10/2016
		Date Received:	31/10/2016
Contact:	Imogen Wort	Date Tested:	08/11/2016
Site Name:	Lamby Way, Cardiff	Sampled By:	Not Given
Site Address:	Not Given		

Test results

Laboratory Reference	Sample Reference	Location	Depth Top [m]	Depth Base [m]	Sample Type	Description	Moisture Content [%]
652433	Not Given	TP01	3	Not Given	B	Grey sandy CLAY	24
652434	Not Given	TP07	2.8	Not Given	B	Yellowish brown CLAY	25
652435	Not Given	TP08	2.7	Not Given	B	Yellowish brown CLAY	28
652436	Not Given	DS01	4	5	D	Brown slightly gravelly CLAY	21
652437	Not Given	DS02	4	4.45	D	Yellowish brown slightly gravelly sandy CLAY	13
652438	Not Given	DS03	4	4.45	D	Yellowish brown gravelly very sandy CLAY. Gravel is siltstone	11

Remarks

Approved:

Mirosława Pytlik
PL Head of
Geotechnical Section

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

Date Reported: 14/11/2016

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

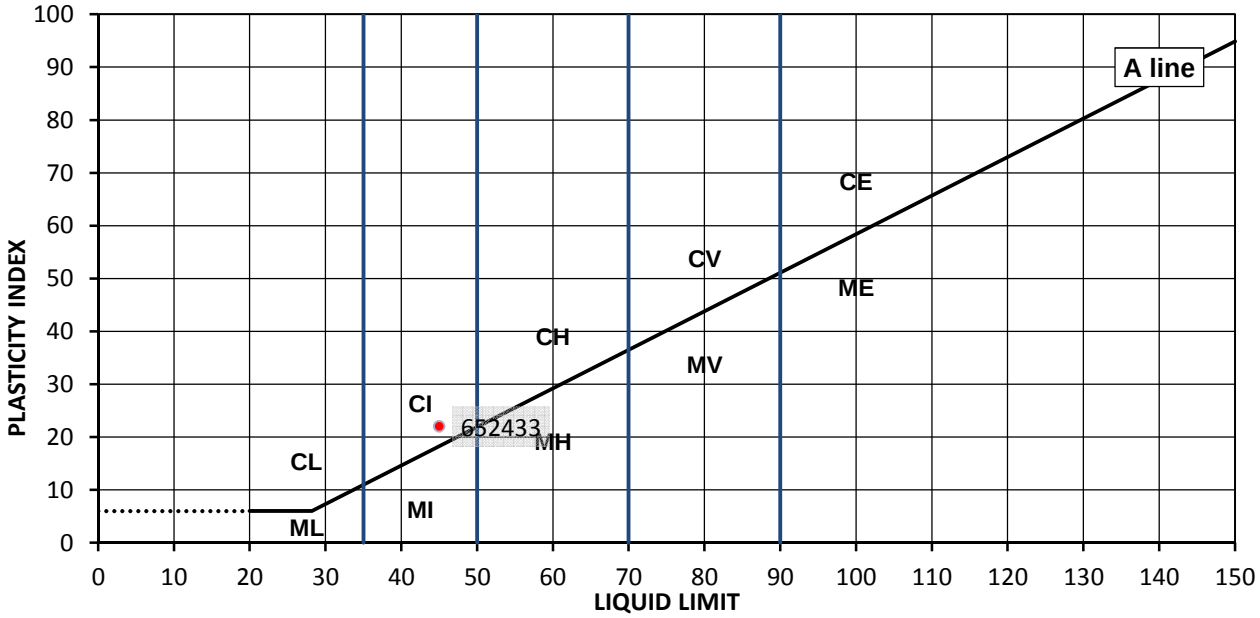
Client:	BWB Consulting Limited	Client Reference:	NTE2313
Client Address:	5th Floor Waterfront House Nottingham NG2 3DQ	Job Number:	16-31676
		Date Sampled:	26/10/2016
		Date Received:	31/10/2016
Contact:	Imogen Wort	Date Tested:	08/11/2016
Site Name:	Lamby Way, Cardiff	Sampled By:	Not Given
Site Address:	Not Given		

TEST RESULTS

Laboratory Reference: 652433
Sample Reference: Not Given

Description:	Grey sandy CLAY	Sample Type:	B
Location:	TP01	Depth Top [m]:	3
Sample Preparation:	Tested in natural condition	Depth Base [m]:	Not Given

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
24	45	23	22	100



Legend, based on BS 5930:1999 +A2: 2010 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks

Approved:

Mirosława Pytlik
PL Head of
Geotechnical Section

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

Date Reported: 14/11/2016

for and on behalf of i2 Analytical Ltd

GF 105.9

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

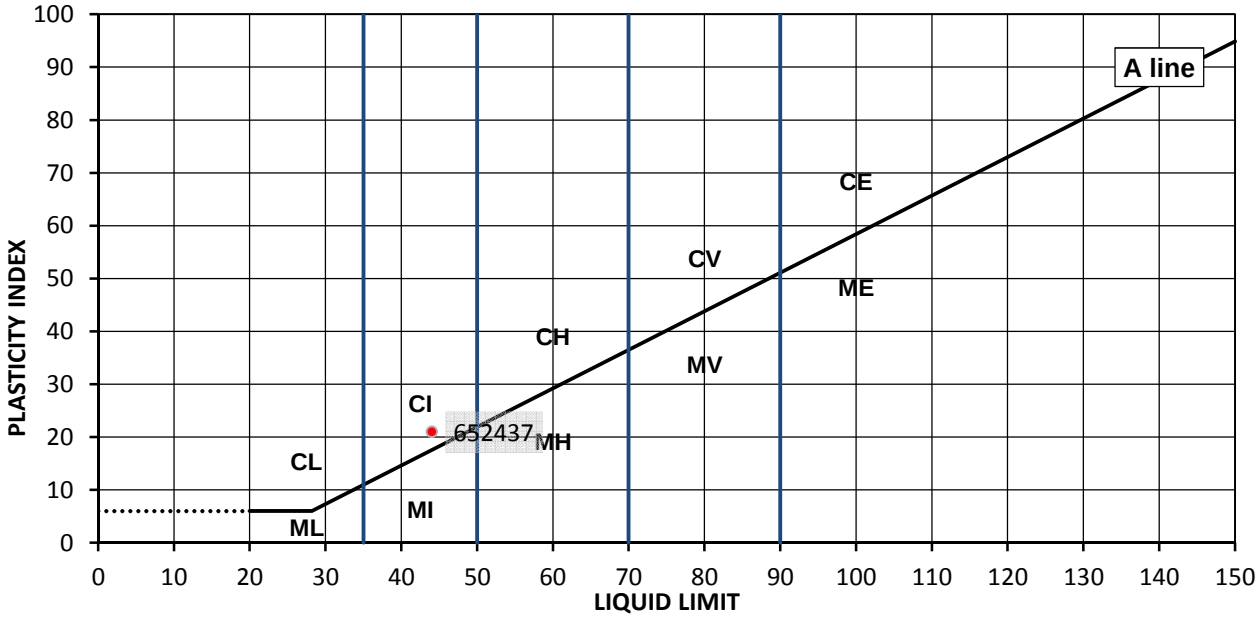
Client:	BWB Consulting Limited	Client Reference:	NTE2313
Client Address:	5th Floor Waterfront House Nottingham NG2 3DQ	Job Number:	16-31676
		Date Sampled:	27/10/2016
		Date Received:	31/10/2016
Contact:	Imogen Wort	Date Tested:	08/11/2016
Site Name:	Lamby Way, Cardiff	Sampled By:	Not Given
Site Address:	Not Given		

TEST RESULTS

Laboratory Reference: 652437
Sample Reference: Not Given

Description:	Yellowish brown slightly gravelly sandy CLAY	Sample Type:	D
Location:	DS02	Depth Top [m]:	4
Sample Preparation:	Tested after >425um removed by hand	Depth Base [m]:	4.45

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
13	44	23	21	98



Legend, based on BS 5930:1999 +A2: 2010 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks

Approved:

Mirosława Pytlik
PL Head of
Geotechnical Section

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

Date Reported: 14/11/2016

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Determination of Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

UKAS TESTING 4041

Tested in Accordance with BS1377-2: 1990: Clause 4.4 & 5: One Point Method

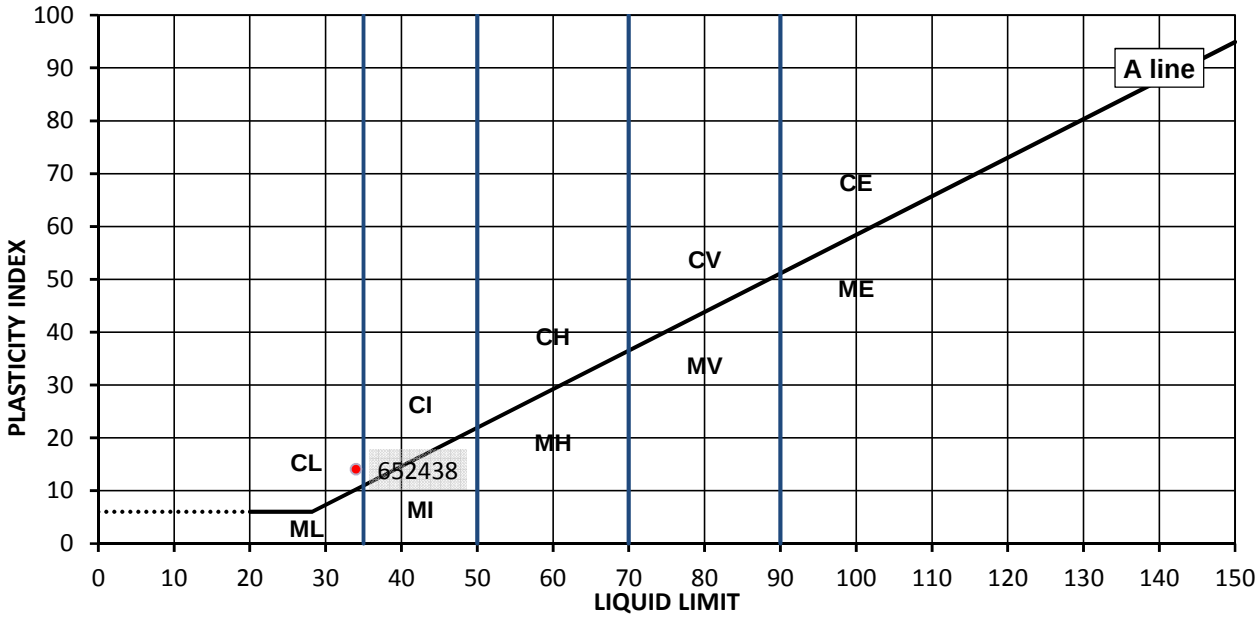
Client:	BWB Consulting Limited	Client Reference:	NTE2313
Client Address:	5th Floor Waterfront House Nottingham NG2 3DQ	Job Number:	16-31676
		Date Sampled:	27/10/2016
		Date Received:	31/10/2016
Contact:	Imogen Wort	Date Tested:	08/11/2016
Site Name:	Lamby Way, Cardiff	Sampled By:	Not Given
Site Address:	Not Given		

TEST RESULTS

Laboratory Reference: 652438
Sample Reference: Not Given

Description:	Yellowish brown gravelly very sandy CLAY. Gravel is siltstone	Sample Type:	D
Location:	DS03	Depth Top [m]:	4
Sample Preparation:	Tested after washing to remove >425um	Depth Base [m]:	4.45

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
11	34	20	14	51



Legend, based on BS 5930:1999 +A2: 2010 Code of practice for site investigations

		Plasticity		Liquid Limit
C	Clay	L	Low	below 35
M	Silt	I	Medium	35 to 50
		H	High	50 to 70
		V	Very high	70 to 90
		E	Extremely high	exceeding 90
	Organic	O	append to classification for organic material (eg CHO)	

Remarks

Approved:

Mirosława Pytlik
PL Head of
Geotechnical Section

Signed:

Sushil Sharda
Technical Manager
(Geotechnical Division)

Date Reported: 14/11/2016

for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Summary of Classification Test Results

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS

Client: BWB Consulting Limited
Client Address: 5th Floor
Waterfront House
Nottingham
NG2 3DQ
Contact: Imogen Wort
Site Name: Lamby Way, Cardiff
Site Address: Not Given

Client Reference: NTE2313
Job Number: 16-31676
Date Sampled: 27/10/2016
Date Received: 31/10/2016
Date Tested: 08/11/2016
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Soil Description	Density		M/C	Attenberg				PD
		Reference	Top depth [m]	Base depth [m]	Type		bulk Mg/m3	dry Mg/m3	%	% Passing 425um %	LL %	PL %	PI %	Mg/m3
652433	TP01	Not Given	3.00	Not Given	B	Grey sandy CLAY			24	100	45	23	22	
652437	DS02	Not Given	4.00	4.45	D	Yellowish brown slightly gravelly sandy CLAY			13	98	44	23	21	
652438	DS03	Not Given	4.00	4.45	D	Yellowish brown gravelly very sandy CLAY. Gravel is siltstone			11	51	34	20	14	

Comments:

Approved:

Mirosława Pytlik
PL Head of Geotechnical Section

Signed:

Sushil Sharda
Technical Manager (Geotechnical Division)

Date Reported: 14/11/2016

for and on behalf of i2 Analytical Ltd

APPENDIX 8

DERIVATION OF BWB GSAC

BWB HUMAN HEALTH GENERIC QUANTITATIVE RISK ASSESSMENT (GQRA)

Human Health Generic Screening Criteria

The Environment Agency published the revised CLEA framework for assessing the risk to human health from soil contamination in January 2009. The framework comprises a technical background document (EA, 2009a), toxicological assessment EA 2009b and CLEA spreadsheet model (EA 2009c). The new framework supersedes the 2002 CLEA model and subsequent briefing notes. The 2002 CLEA software and CLEA 2005 have also been withdrawn and all previously published Soil Guideline Values (SGV) have been withdrawn. The EA have issued revised SGVs for the following substances.

- Arsenic
- cadmium
- nickel
- selenium
- benzene
- toluene
- ethylbenzene
- xylene
- dioxins and dioxin like PCBS
- Phenol
- Mercury

In the absence of an SGV for a particular contaminant Generic assessment criteria have been generated by BWB using the CLEA framework. This is a similar approach to Generic screening criteria published by LQM/CIEH and CLAIRE/EIC.

The Statutory Guidance on Part IIa of the Environment Act was revised in 2012 and introduced the concept of characterising Land into 4 categories. Categories 1 and 2 were classed as "Contaminated Land" and Categories 3 and 4 as "not Contaminated Land". DEFRA commissioned a research project to develop Category 4 Screening Levels (C4SLs) which would be used to rapidly screen sites as not contaminated land. These values would be less conservative than SGVs or equivalent GSACs but still be strongly precautionary. In 2014 DEFRA published the framework for deriving C4SLs and C4SLs for six substances:

Arsenic
Cadmium
Chromium VI
Lead
Benzo(a)pyrene
Benzene

The framework recommended changes to exposure parameters as well as introducing a new Health Criteria Value known as a "Low level of Toxicological Concern" (LLTC) This would be less conservative than the minimal risk approach used to derive TDIs and IDs under the 2009b CLEA framework.

In response LQM/CIEH published their third edition of Generic screening criteria for human health in January 2015. These were known and "Suitable for Use Levels" (S4ULs) and adopted the changes to exposure parameters that were developed under the Category 4 Screening Level methodology.

The report also reviewed toxicity information but adopted the minimal risk approach as set out in EA 2009b. This report presented revised data for some substances for which an SGV had been developed, therefore some of the existing SGVs have been superseded.

BWB have updated their GSACs to take into account the LQM/CIEH S4ULs and DEFRA C4SLs but have retained the CLEA exposure assumptions, the BWB GSACs represent the most conservative minimal risk approach.

The screening approach comprises tiered assessment of contaminant data against BWB GSACs in the first instance, then S4ULs and finally C4SLs if available.

Conceptual Site Model

The standard exposure pathways and Conceptual Models for human exposure to contaminants for different site uses are set out in the updated technical background to the CLEA model (Environment Agency 2009a).

Descriptive Conceptual Models (From Environment Agency 2009a)

Residential This generic scenario assumes a typical residential property consisting of a two-storey house built on a ground bearing slab with a private garden consisting of lawn, flower beds and a small fruit and vegetable patch. The occupants are assumed to be parents with young children, who make regular use of the garden area. The key assumptions for BWB GSACs are Critical receptor is a young female child (aged zero to six years old) Exposure duration is six years Exposure pathways include direct soil and indoor dust ingestion, consumption of homegrown produce, consumption of soil attached to home grown produce, skin contact with soils and indoor dusts, and inhalation of indoor and outdoor dust and vapours. Soil type is a Sandy Loam with 1% organic matter Building type is a two storey small terraced house
Commercial/industrial There are many different kinds of workplace and work-related activities. This generic scenario assumes a typical commercial or light industrial property consisting of a three storey building at which employees spend most time indoors and are involved in office based or relatively light physical work. The key assumptions for BWB GSACs are Critical receptor is a working female adult (aged 16 to 65 years) 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.

Soil type is a Sandy Loam with 1% organic matter

Building type is a three storey office (post 1970) (Representative of new buildings)

The 2009a report identifies 10 potential exposure pathways by which contaminated soils may impact human health and also sets out which pathways are applicable for four standard land uses. The pathways for the residential and commercial end uses are shown below.

Screening Criteria Modelling

The CLEA model version 1.06 has been used to calculate BWB GSACs. BWB have used the model to calculate Individual criteria for each relevant pathway so, for example, in a residential with vegetable uptake scenario we would need six individual criteria:-

- Ingestion of soil and dust
- Ingestion of contaminated vegetables and soil attached to vegetables
- Dermal contact indoors and outdoors
- Particulate dust inhalation indoors and outdoors
- Vapour inhalation indoors
- Vapour inhalation outdoors

The final overall assessment criteria is calculated by adding together the reciprocal of the individual criteria for each pathway, therefore if several of the individual criteria are of similar magnitude the final criteria may be substantially lower than the lowest individual criteria so that total exposure is below the respective health threshold.

$1/GSAC = \sum 1/ASC_{ingestion} + 1/ASC_{inhalation} + 1/ASC_{dermal}$

By adopting this methodology BWB are able to provide a more flexible site specific approach to generic human health risk assessment.

Pathway Selection - Generic Site Assessment Criteria

Pathway	Residential	Commercial / Industrial
Ingestion of Soil	Yes	Yes
Ingestion of site derived household dust	Yes	Yes
Ingestion of contaminated homegrown produce	Optional	No
Ingestion of soil attached to homegrown produce	Optional	No
Dermal contact with Soil	Yes	Yes
Dermal contact with site derived household dust	Yes	Yes
Inhalation of fugitive soil dust	Yes	Yes
Inhalation of fugitive site derived household dust	Yes	Yes
Inhalation of vapours outside	Yes	Yes
Inhalation of vapours inside	Yes	Yes

Health Criteria Values

The general hierarchy for selecting health criteria values is as follows:

1. EA / DEFRA TOX report
2. Other UK authoritative body e.g. Committee on toxicity, Food Standards Agency
3. EU authoritative body
4. Other EU body e.g. RIVM
5. Other US/International Body

In the absence of updated TOX reports which take into account the recommendations of EA report (2009b) TOX reports produced under the old regime have been used and GSACs will be updated accordingly as further authoritative information is issued.

REFERENCES

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EIC/AGS/CL:AIRE (2010), Soil Generic Assessment Criteria for Human Health Risk Assessment. Environment Industries Commission (EIC), Association of Geotechnical and Geoenvironmental Specialists (AGS), Contaminated Land: Applications in Real Environments (CL:AIRE). Published by CL:AIRE. ISBN: 978-1-905046-20-1.

Nathanail, C.P., McCaffrey,C., Ashmore,M.H., Cheng, Y.Y., Gillett, A., Ogden,R. & Scott,D. (2009). The LQM/CIEH Generic Assessment Criteria for

Human Health Risk Assessment (2nd Edition). Land Quality Press, Nottingham. ISBN: 0-9547474-7-X.

Nathanail, C.P.; McCaffrey,C.; Gillett, A.G.; Ogden, R.C. & Nathanail, J.F. (2015). The LQM/CIEH Suitable 4 Use Levels. Land Quality Press, Nottingham. ISBN: 978-0-9931084-0-2.

Residential Pathway Specific Assessment Sub Criteria derived May 2015 1% Organic Matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	mg/kg	mg/kg
Arsenic	NR	NR	3.50E+01	4.29E+02	8.50E+01	3.24E+01	N/A
Barium	NR	NR	1.35E+03		4.25E+05	1.34E+03	N/A
Beryllium	NR	NR	1.56E+02	2.96E+03	1.21E+00	1.21E+00	N/A
Boron	NR	NR	1.08E+04	3.00E+02	3.65E+06	2.91E+02	N/A
Cadmium	NR	NR	1.21E+02	1.24E+01	1.27E+02	1.03E+01	N/A
Chromium III	NR	NR	1.98E+04	1.25E+06	6.37E+02	6.17E+02	N/A
Chromium VI	NR	NR	7.05E+01	1.22E+01	4.25E+00	4.25E+00	N/A
Copper	NR	NR	1.08E+04	3.54E+03	9.89E+03	2.10E+03	N/A
Lead						2.00E+02	N/A
Inorganic Mercury	NR	NR	5.71E+01	1.40E+02	2.55E+03	3.99E+01	N/A
Nickel	NR	NR	7.89E+02	1.64E+03	1.27E+02	1.27E+02	N/A
Selenium	NR	NR	4.31E+02	6.15E+02	1.36E+05	2.53E+02	N/A
Vanadium	NR	NR	1.17E+03	6.21E+02	1.03E+03	2.91E+02	N/A
Zinc	NR	NR	4.05E+04	4.13E+03	2.55E+07	3.74E+03	N/A
Cyanide (free)						4.30E+01	N/A
Cyanide (Complex)						2.13E+02	N/A
Phenol	3.43E+02	***4.21E+05***	6.56E+02	1.55E+02	3.22E+05	9.18E+01	4.16E+04
Benzene	2.69E-01	***5.63E+03***	2.58E+01	1.13E-01	5.95E+04	7.93E-02	1.22E+03
Toluene	6.38E+02	***8.78E+06***	1.98E+04	1.48E+02	5.92E+07	1.19E+02	8.69E+02
Ethylbenzene	5.86E+01	***6.17E+05***	8.88E+03	1.07E+02	3.11E+06	3.77E+01	5.18E+02
Total Xylene	5.57E+01	***5.15E+05***	1.60E+04	1.87E+02	2.28E+06	4.28E+01	4.78E+02
TPH (EC5-6) aliphatic	2.88E+01	***2.41E+06***	2.23E+05	***4.90E+03***	1.06E+08	2.86E+01	3.04E+02
TPH (>EC6-8) aliphatic	7.02E+01	***3.76E+06***	2.23E+05	***1.53E+04***	1.06E+08	6.99E+01	1.44E+02
TPH (>EC8-10) aliphatic	1.82E+01	***4.61E+05***	4.45E+03	***2.17E+03***	6.16E+06	1.80E+01	7.77E+01
TPH (>EC10-12) aliphatic	***9.02E+01***	***1.03E+06***	4.45E+03	***1.67E+04***	6.16E+06	***8.79E+01***	4.75E+01

Residential Pathway Specific Assessment Sub Criteria derived May 2015 1% Organic Matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
TPH (>EC12-16) aliphatic	7.55E+02	2.97E+06	4.45E+03	2.32E+05	6.16E+06	6.43E+02	2.37E+01
TPH (>EC16-35) aliphatic	8.91E+04	8.47E+07	8.91E+04	1.15E+07	4.25E+07	4.43E+04	8.48E+00
TPH (>EC35-44) aliphatic	8.91E+04	8.47E+07	8.91E+04	1.15E+07	4.25E+07	4.43E+04	8.48E+00
TPH (>EC6-7) aromatic (benzene)	2.69E-01	5.63E+03	2.58E+01	1.13E-01	5.95E+04	7.93E-02	1.22E+03
TPH (>EC7-8) aromatic (toluene)	6.26E+02	8.62E+06	1.98E+04	1.48E+02	5.81E+07	1.19E+02	8.69E+02
TPH (>EC8-10) aromatic	3.22E+01	2.79E+05	1.78E+03	5.73E+01	1.28E+06	2.04E+01	6.13E+02
TPH (>EC10-12) aromatic	1.75E+02	6.50E+05	1.78E+03	8.34E+01	1.28E+06	5.47E+01	3.64E+02
TPH (>EC12-16) aromatic	1.94E+03	2.15E+06	1.78E+03	1.52E+02	1.28E+06	1.31E+02	2.37E+01
TPH (>EC16-21) aromatic	3.54E+04	5.95E+06	1.34E+03	3.06E+02	6.38E+05	2.47E+02	5.37E+01
TPH (>EC21-35) aromatic	3.99E+06	2.67E+07	1.34E+03	2.66E+03	6.38E+05	8.90E+02	4.83E+00
TPH (>EC35-44) aromatic	3.99E+06	2.67E+07	1.34E+03	2.66E+03	6.38E+05	8.90E+02	4.83E+00
Naphthalene	1.64E+00	3.17E+04	1.58E+03	2.72E+01	2.93E+04	1.55E+00	7.64E+01
Acenaphthylene	3.27E+03	1.26E+07	4.85E+03	1.84E+02	2.55E+06	1.68E+02	8.61E+01
Acenaphthene	3.47E+03	1.32E+07	4.85E+03	2.28E+02	2.55E+06	2.05E+02	5.70E+01
Fluorene	4.37E+03	1.17E+07	3.23E+03	1.79E+02	1.70E+06	1.63E+02	3.09E+01
Phenanthrene	5.09E+03	6.29E+06	1.00E+03	1.03E+02	5.30E+05	9.17E+01	3.60E+01
Anthracene	1.09E+05	1.48E+08	2.43E+04	2.55E+03	1.27E+07	2.26E+03	1.17E+00
Fluoranthene	2.84E+04	1.26E+07	1.01E+03	3.49E+02	5.31E+05	2.57E+02	1.89E+01
Pyrene	6.50E+04	2.87E+07	2.42E+03	7.43E+02	1.27E+06	5.63E+02	2.20E+00
Benzo(a)anthracene	2.40E+01	3.37E+03	1.25E+01	2.11E+01	6.37E+01	5.41E+00	1.71E+00
Chrysene	2.53E+02	5.87E+03	2.51E+01	2.90E+01	1.27E+02	1.16E+01	4.40E-01
Benzo(b)fluoranthene	9.32E+01	1.05E+03	3.15E+00	7.43E+00	1.61E+01	1.90E+00	1.22E+00
Benzo(k)fluoranthene	4.04E+03	3.28E+04	8.33E+01	2.85E+02	4.25E+02	5.51E+01	6.87E-01
Benzo(a)pyrene	1.04E+02	9.12E+02	2.51E+00	7.36E+00	1.27E+01	1.60E+00	9.11E-01
Indeno(123-cd)pyrene	8.78E+02	1.10E+04	3.58E+01	6.93E+01	1.83E+02	2.04E+01	6.14E-02
Dibenzo(ah)anthracene	5.23E+00	1.13E+02	2.51E-01	1.11E+00	1.27E+00	1.70E-01	3.93E-03

Residential Pathway Specific Assessment Sub Criteria derived May 2015 1% Organic Matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
Benzo(g,h,i)perylene	***2.34E+04***	***1.83E+05***	2.78E+02	***2.77E+03***	1.40E+03	***2.12E+02***	1.54E-02
Tetrachloroethene (PCE)	1.26E-01	***2.48E+04***	4.92E+02	4.36E+00	2.34E+05	1.22E-01	4.24E+02
Trichloroethene (TCE)	1.21E-02	***2.44E+03***	4.45E+01	2.74E-01	2.42E+04	1.15E-02	1.54E+03
***cis*-1,2-Dichloroethene**	1.20E-01	***2.33E+04***	4.82E+02	1.75E+00	2.30E+05	1.12E-01	3.94E+03
Vinyl Chloride (VC)	5.43E-04	3.59E+02	1.25E+00	3.70E-03	1.27E+04	4.73E-04	1.36E+03
1,1,2,2-Tetrachloroethane (PCA)	2.76E+00	***1.17E+05***	5.07E+02	2.72E+00	2.41E+05	1.37E+00	2.67E+03
1,1,1-Trichloroethane (TCA)	6.33E+00	***1.79E+06***	5.34E+04	3.22E+02	2.46E+07	6.21E+00	1.43E+03
1,2-Dichloroethane	6.46E-03	8.09E+02	1.07E+01	3.07E-02	5.10E+03	5.33E-03	3.41E+03
Carbon Tetrachloride	1.81E-02	***5.07E+03***	5.38E+02	3.00E+00	6.93E+04	1.80E-02	1.52E+03
Carbon disulphide	1.01E-01	***3.42E+04***	3.55E+02	3.20E+01	6.08E+05	1.01E-01	2.11E+03

ASC exceeds soil saturation limit

Residential Pathway Specific Assessment Sub Criteria derived May 2015 2.5% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	mg/kg	mg/kg
Arsenic	NR	NR	3.50E+01	4.29E+02	8.50E+01	3.24E+01	N/A
Barium	NR	NR	1.35E+03		4.25E+05	1.34E+03	N/A
Beryllium	NR	NR	1.56E+02	2.96E+03	1.21E+00	1.21E+00	N/A
Boron	NR	NR	1.08E+04	3.00E+02	3.65E+06	2.91E+02	N/A
Cadmium	NR	NR	1.21E+02	1.24E+01	1.27E+02	1.03E+01	N/A
Chromium III	NR	NR	1.98E+04	1.25E+06	6.37E+02	6.17E+02	N/A
Chromium VI	NR	NR	7.05E+01	1.22E+01	4.25E+00	4.25E+00	N/A
Copper	NR	NR	1.08E+04	3.54E+03	9.89E+03	2.10E+03	N/A
Lead						2.00E+02	N/A
Inorganic Mercury	NR	NR	5.71E+01	1.40E+02	2.55E+03	3.99E+01	N/A
Nickel	NR	NR	7.89E+02	1.64E+03	1.27E+02	1.27E+02	N/A
Selenium	NR	NR	4.31E+02	6.15E+02	1.36E+05	2.53E+02	N/A
Vanadium	NR	NR	1.17E+03	6.21E+02	1.03E+03	2.91E+02	N/A
Zinc	NR	NR	4.05E+04	4.13E+03	2.55E+07	3.74E+03	N/A
Cyanide (free)						4.30E+01	N/A
Cyanide (Complex)						2.13E+02	N/A
Phenol	5.39E+02	***5.28E+05***	6.56E+02	2.88E+02	3.22E+05	1.46E+02	8.15E+04
Benzene	4.99E-01	***7.68E+03***	2.58E+01	2.30E-01	5.95E+04	1.57E-01	2.26E+03
Toluene	1.41E+03	***1.30E+07***	1.98E+04	3.41E+02	5.92E+07	2.71E+02	1.92E+03
Ethylbenzene	1.37E+02	***9.44E+05***	8.88E+03	2.58E+02	3.11E+06	8.88E+01	1.22E+03
Total Xylene	1.31E+02	***7.89E+05***	1.60E+04	4.50E+02	2.28E+06	1.01E+02	1.12E+03
TPH (EC5-6) aliphatic	5.28E+01	***3.26E+06***	2.23E+05	***1.14E+04***	1.06E+08	5.25E+01	5.58E+02
TPH (>EC6-8) aliphatic	1.57E+02	***5.62E+06***	2.23E+05	***3.75E+04***	1.06E+08	1.56E+02	3.22E+02
TPH (>EC8-10) aliphatic	4.44E+01	***7.20E+05***	4.45E+03	***5.38E+03***	6.16E+06	4.36E+01	1.90E+02

Residential Pathway Specific Assessment Sub Criteria derived May 2015 2.5% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
TPH (>EC10-12) aliphatic	2.24E+02	1.62E+06	4.45E+03	4.00E+04	6.16E+06	2.12E+02	1.18E+02
TPH (>EC12-16) aliphatic	1.89E+03	4.69E+06	4.45E+03	3.64E+05	6.16E+06	1.32E+03	5.91E+01
TPH (>EC16-35) aliphatic	2.23E+05	1.34E+08	8.91E+04	1.16E+07	4.25E+07	6.32E+04	2.12E+01
TPH (>EC35-44) aliphatic	2.23E+05	1.34E+08	8.91E+04	1.16E+07	4.25E+07	6.32E+04	2.12E+01
TPH (>EC6-7) aromatic (benzene)	4.99E-01	7.68E+03	2.58E+01	2.30E-01	5.95E+04	1.56E-01	2.26E+03
TPH (>EC7-8) aromatic (toluene)	1.38E+03	1.28E+07	1.98E+04	3.41E+02	5.81E+07	2.70E+02	1.92E+03
TPH (>EC8-10) aromatic	7.88E+01	4.36E+05	1.78E+03	1.42E+02	1.28E+06	4.93E+01	1.50E+03
TPH (>EC10-12) aromatic	4.34E+02	1.02E+06	1.78E+03	2.07E+02	1.28E+06	1.30E+02	8.99E+02
TPH (>EC12-16) aromatic	4.83E+03	3.39E+06	1.78E+03	3.79E+02	1.28E+06	2.93E+02	5.91E+01
TPH (>EC16-21) aromatic	8.83E+04	9.40E+06	1.34E+03	7.61E+02	6.38E+05	4.82E+02	1.34E+02
TPH (>EC21-35) aromatic	9.98E+06	4.23E+07	1.34E+03	6.50E+03	6.38E+05	1.11E+03	1.21E+01
TPH (>EC35-44) aromatic	9.98E+06	4.23E+07	1.34E+03	6.50E+03	6.38E+05	1.11E+03	1.21E+01
Naphthalene	3.93E+00	4.91E+04	1.58E+03	6.63E+01	2.93E+04	3.70E+00	1.83E+02
Acenaphthylene	8.06E+03	1.97E+07	4.85E+03	4.56E+02	2.55E+06	3.96E+02	2.12E+02
Acenaphthene	8.57E+03	2.07E+07	4.85E+03	5.67E+02	2.55E+06	4.79E+02	1.41E+02
Fluorene	1.08E+04	1.84E+07	3.23E+03	4.45E+02	1.70E+06	3.77E+02	7.65E+01
Phenanthrene	1.27E+04	9.91E+06	1.00E+03	2.57E+02	5.30E+05	2.01E+02	8.96E+01
Anthracene	2.70E+05	2.33E+08	2.43E+04	6.34E+03	1.27E+07	4.93E+03	2.91E+00
Fluoranthene	7.08E+04	2.00E+07	1.01E+03	8.68E+02	5.31E+05	4.63E+02	4.73E+01
Pyrene	1.62E+05	4.54E+07	2.42E+03	1.85E+03	1.27E+06	1.04E+03	5.49E+00
Benzo(a)anthracene	6.00E+01	5.32E+03	1.25E+01	5.18E+01	6.37E+01	7.60E+00	4.28E+00
Chrysene	6.32E+02	9.28E+03	2.51E+01	7.15E+01	1.27E+02	1.58E+01	1.10E+00
Benzo(b)fluoranthene	2.33E+02	1.66E+03	3.15E+00	1.81E+01	1.61E+01	2.28E+00	3.04E+00
Benzo(k)fluoranthene	1.01E+04	5.19E+04	8.33E+01	6.87E+02	4.25E+02	6.27E+01	1.72E+00
Benzo(a)pyrene	2.61E+02	1.44E+03	2.51E+00	1.78E+01	1.27E+01	1.86E+00	2.28E+00
Indeno(123-cd)pyrene	2.20E+03	1.74E+04	3.58E+01	1.70E+02	1.83E+02	2.51E+01	5.30E-01

Residential Pathway Specific Assessment Sub Criteria derived May 2015 2.5% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
Dibenzo(ah)anthracene	***1.31E+01***	***1.79E+02***	2.51E-01	***2.65E+00***	1.27E+00	***1.91E-01***	9.82E-03
Benzo(g,h,i)perylene	***5.85E+04***	***2.89E+05***	2.78E+02	***6.27E+03***	1.40E+03	***2.23E+02***	3.85E-02
Tetrachloroethene (PCE)	2.82E-01	***3.71E+04***	4.92E+02	1.02E+01	2.34E+05	2.74E-01	9.51E+02
Trichloroethene (TCE)	2.52E-02	***3.53E+03***	4.45E+01	6.09E-01	2.42E+04	2.42E-02	3.22E+03
***cis*-1,2-Dichloroethene**	2.02E-01	***3.02E+04***	4.82E+02	3.35E+00	2.30E+05	1.90E-01	6.61E+03
Vinyl Chloride (VC)	7.02E-04	4.08E+02	1.25E+00	6.67E-03	1.27E+04	6.35E-04	1.76E+03
1,1,2,2-Tetrachloroethane (PCA)	5.65E+00	***1.68E+05***	5.07E+02	5.92E+00	2.41E+05	2.87E+00	5.46E+03
1,1,1-Trichloroethane (TCA)	1.29E+01	***2.55E+06***	5.34E+04	7.06E+02	2.46E+07	1.27E+01	2.92E+03
1,2-Dichloroethane	9.32E-03	9.72E+02	1.07E+01	5.56E-02	5.10E+03	7.98E-03	4.91E+03
Carbon Tetrachloride	3.97E-02	***7.50E+03***	5.38E+02	6.95E+00	6.93E+04	3.95E-02	3.32E+03
Carbon disulphide	2.02E-01	***4.83E+04***	3.55E+02	6.84E+01	6.08E+05	2.01E-01	4.21E+03

ASC exceeds soil saturation limit

Residential Pathway Specific Assessment Sub Criteria derived May 2015 6% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	mg/kg	mg/kg
Arsenic	NR	NR	3.50E+01	4.29E+02	8.50E+01	3.24E+01	N/A
Barium	NR	NR	1.35E+03		4.25E+05	1.34E+03	N/A
Beryllium	NR	NR	1.56E+02	2.96E+03	1.21E+00	1.21E+00	N/A
Boron	NR	NR	1.08E+04	3.00E+02	3.65E+06	2.91E+02	N/A
Cadmium	NR	NR	1.21E+02	1.24E+01	1.27E+02	1.03E+01	N/A
Chromium III	NR	NR	1.98E+04	1.25E+06	6.37E+02	6.17E+02	N/A
Chromium VI	NR	NR	7.05E+01	1.22E+01	4.25E+00	4.25E+00	N/A
Copper	NR	NR	1.08E+04	3.54E+03	9.89E+03	2.10E+03	N/A
Lead						2.00E+02	N/A
Inorganic Mercury	NR	NR	5.71E+01	1.40E+02	2.55E+03	3.99E+01	N/A
Nickel	NR	NR	7.89E+02	1.64E+03	1.27E+02	1.27E+02	N/A
Selenium	NR	NR	4.31E+02	6.15E+02	1.36E+05	2.53E+02	N/A
Vanadium	NR	NR	1.17E+03	6.21E+02	1.03E+03	2.91E+02	N/A
Zinc	NR	NR	4.05E+04	4.13E+03	2.55E+07	3.74E+03	N/A
Cyanide (free)						4.30E+01	N/A
Cyanide (Complex)						2.13E+02	N/A
Phenol	9.95E+02	*7.17E+05*	6.56E+02	5.72E+02	3.22E+05	2.34E+02	1.74E+05
Benzene	1.04E+00	*1.11E+04*	2.58E+01	4.98E-01	5.95E+04	3.32E-01	4.71E+03
Toluene	3.20E+03	*1.97E+07*	1.98E+04	7.89E+02	5.92E+07	6.13E+02	4.36E+03
Ethylbenzene	3.22E+02	*1.44E+06*	8.88E+03	6.09E+02	3.11E+06	2.06E+02	2.84E+03
Total Xylene	3.06E+02	*1.21E+06*	1.60E+04	1.06E+03	2.28E+06	2.34E+02	2.62E+03
TPH (EC5-6) aliphatic	1.09E+02	*4.68E+06*	2.23E+05	*2.62E+04*	1.06E+08	1.08E+02	1.15E+03
TPH (>EC6-8) aliphatic	3.59E+02	*8.49E+06*	2.23E+05	*8.91E+04*	1.06E+08	3.57E+02	7.36E+02
TPH (>EC8-10) aliphatic	1.06E+02	*1.11E+06*	4.45E+03	*1.27E+04*	6.16E+06	1.03E+02	4.51E+02

Residential Pathway Specific Assessment Sub Criteria derived May 2015 6% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
TPH (>EC10-12) aliphatic	5.38E+02	2.51E+06	4.45E+03	8.76E+04	6.16E+06	4.77E+02	2.83E+02
TPH (>EC12-16) aliphatic	4.53E+03	7.27E+06	4.45E+03	4.67E+05	6.16E+06	2.23E+03	1.42E+02
TPH (>EC16-35) aliphatic	5.34E+05	2.07E+08	8.91E+04	1.17E+07	4.25E+07	7.57E+04	5.09E+01
TPH (>EC35-44) aliphatic	5.34E+05	2.07E+08	8.91E+04	1.17E+07	4.25E+07	7.57E+04	5.09E+01
TPH (>EC6-7) aromatic (benzene)	1.04E+00	1.11E+04	2.58E+01	4.98E-01	5.95E+04	3.32E-01	4.71E+03
TPH (>EC7-8) aromatic (toluene)	3.14E+03	1.93E+07	1.98E+04	7.89E+02	5.81E+07	6.11E+02	4.36E+03
TPH (>EC8-10) aromatic	1.88E+02	6.73E+05	1.78E+03	3.38E+02	1.28E+06	1.13E+02	3.58E+03
TPH (>EC10-12) aromatic	1.04E+03	1.58E+06	1.78E+03	4.95E+02	1.28E+06	2.82E+02	2.15E+03
TPH (>EC12-16) aromatic	1.16E+04	5.25E+06	1.78E+03	9.07E+02	1.28E+06	5.71E+02	1.42E+02
TPH (>EC16-21) aromatic	2.12E+05	1.46E+07	1.34E+03	1.81E+03	6.38E+05	7.66E+02	3.21E+02
TPH (>EC21-35) aromatic	2.39E+07	6.54E+07	1.34E+03	1.48E+04	6.38E+05	1.23E+03	2.90E+01
TPH (>EC35-44) aromatic	2.39E+07	6.54E+07	1.34E+03	1.48E+04	6.38E+05	1.23E+03	2.90E+01
Naphthalene	9.28E+00	7.55E+04	1.58E+03	1.57E+02	2.93E+04	8.71E+00	4.32E+02
Acenaphthylene	1.92E+04	3.05E+07	4.85E+03	1.09E+03	2.55E+06	8.50E+02	5.06E+02
Acenaphthene	2.05E+04	3.20E+07	4.85E+03	1.36E+03	2.55E+06	1.01E+03	3.36E+02
Fluorene	2.58E+04	2.85E+07	3.23E+03	1.06E+03	1.70E+06	7.74E+02	1.83E+02
Phenanthrene	3.03E+04	1.53E+07	1.00E+03	6.14E+02	5.30E+05	3.75E+02	2.14E+02
Anthracene	6.48E+05	3.60E+08	2.43E+04	1.52E+04	1.27E+07	9.21E+03	6.96E+00
Fluoranthene	1.70E+05	3.09E+07	1.01E+03	2.07E+03	5.31E+05	6.75E+02	1.12E+02
Pyrene	3.89E+05	7.03E+07	2.42E+03	4.40E+03	1.27E+06	1.55E+03	1.32E+01
Benzo(a)anthracene	1.44E+02	8.24E+03	1.25E+01	1.20E+02	6.37E+01	9.01E+00	1.03E+01
Chrysene	1.52E+03	1.44E+04	2.51E+01	1.67E+02	1.27E+02	1.84E+01	2.64E+00
Benzo(b)fluoranthene	5.59E+02	2.57E+03	3.15E+00	4.12E+01	1.61E+01	2.47E+00	7.29E+00
Benzo(k)fluoranthene	2.43E+04	8.03E+04	8.33E+01	1.53E+03	4.25E+02	6.63E+01	4.12E+00
Benzo(a)pyrene	6.27E+02	2.23E+03	2.51E+00	4.01E+01	1.27E+01	1.98E+00	5.46E+00
Indeno(123-cd)pyrene	5.27E+03	2.69E+04	3.58E+01	3.90E+02	1.83E+02	2.76E+01	3.68E-01

Residential Pathway Specific Assessment Sub Criteria derived May 2015 6% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & dermal contact	Ingestion of Contaminated Vegetables and soil attached to vegetables	Particulate Dust Inhalation	Residential GSAC	Soil Saturation Limit
Dibenzo(ah)anthracene	***3.14E+01***	***2.78E+02***	2.51E-01	***5.77E+00***	1.27E+00	***2.01E-01***	2.36E-02
Benzo(g,h,i)perylene	***1.41E+05***	***4.48E+05***	2.78E+02	***1.24E+04***	1.40E+03	***2.27E+02***	9.23E-02
Tetrachloroethene (PCE)	6.47E-01	***5.61E+04***	4.92E+02	2.38E+01	2.34E+05	6.29E-01	2.18E+03
Trichloroethene (TCE)	5.60E-02	5.25E+03	4.45E+01	1.39E+00	2.42E+04	5.38E-02	7.14E+03
***cis*-1,2-Dichloroethene**	3.93E-01	***4.22E+04***	4.82E+02	6.91E+00	2.30E+05	3.72E-01	1.29E+04
Vinyl Chloride (VC)	1.07E-03	5.05E+02	1.25E+00	1.22E-02	1.27E+04	9.83E-04	2.69E+03
1,1,2,2-Tetrachloroethane (PCA)	1.24E+01	***2.49E+05***	5.07E+02	1.33E+01	2.41E+05	6.34E+00	1.20E+04
1,1,1-Trichloroethane (TCA)	2.84E+01	***3.78E+06***	5.34E+04	1.59E+03	2.46E+07	2.79E+01	6.39E+03
1,2-Dichloroethane	1.60E-02	1.27E+03	1.07E+01	1.06E-01	5.10E+03	1.39E-02	8.43E+03
Carbon Tetrachloride	8.99E-02	***1.13E+04***	5.38E+02	1.61E+01	6.93E+04	8.94E-02	7.54E+03
Carbon disulphide	4.37E-01	***7.10E+04***	3.55E+02	1.52E+02	6.08E+05	4.35E-01	9.11E+03

ASC exceeds soil saturation limit

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 1% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	mg/kg
Arsenic	NR	NR	6.35E+02	6.95E+02	6.40E+02	N/A
Barium	NR	NR	2.22E+04	3.48E+06	2.21E+04	N/A
Beryllium	NR	NR	3.97E+03	1.24E+01	1.24E+01	N/A
Boron	NR	NR	2.38E+05	2.99E+07	2.36E+05	N/A
Cadmium	NR	NR	3.99E+02	2.43E+02	2.30E+02	N/A
Chromium III	NR	NR	3.31E+05	9.09E+03	8.84E+03	N/A
Chromium VI	NR	NR	1.79E+03	3.48E+01	3.48E+01	N/A
Copper	NR	NR	1.89E+05	9.50E+04	6.33E+04	N/A
Lead					2.33E+03	N/A
Inorganic Mercury	NR	NR	1.18E+03	2.09E+04	3.60E+03	N/A
Nickel	NR	NR	2.22E+04	1.04E+03	1.04E+03	N/A
Selenium	NR	NR	1.23E+04	1.93E+06	1.30E+04	N/A
Vanadium	NR	NR	2.15E+04	9.58E+03	6.63E+03	N/A
Zinc	NR	NR	7.35E+05	2.09E+08	7.33E+05	N/A
Cyanide (free)					4.30E+01	N/A
Cyanide (Complex)					2.13E+02	N/A
Phenol	*8.34E+04*	*1.09E+06*	4.07E+04	3.28E+06	2.65E+04	4.16E+04
Benzene	2.97E+01	*1.17E+04*	5.53E+02	4.87E+05	2.81E+01	1.22E+03
Toluene	*6.91E+04*	*1.83E+07*	4.25E+05	4.86E+08	*5.92E+04*	8.69E+02
Ethylbenzene	*6.28E+03*	*1.30E+06*	1.91E+05	2.57E+07	*6.05E+03*	5.18E+02
Total Xylene	*6.43E+03*	*1.17E+06*	3.43E+05	2.03E+07	*6.28E+03*	4.78E+02
TPH (EC5-6) aliphatic	*3.31E+03*	*5.01E+06*	4.77E+06	8.69E+08	*3.31E+03*	3.04E+02
TPH (>EC6-8) aliphatic	*8.06E+03*	*7.82E+06*	4.77E+06	8.69E+08	*8.04E+03*	1.44E+02
TPH (>EC8-10) aliphatic	*2.09E+03*	*9.59E+05*	9.53E+04	5.04E+07	*2.04E+03*	7.77E+01
TPH (>EC10-12) aliphatic	*1.04E+04*	*2.13E+06*	9.53E+04	5.04E+07	*9.33E+03*	4.75E+01

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 1% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
TPH (>EC12-16) aliphatic	8.68E+04	6.18E+06	9.53E+04	5.04E+07	4.51E+04	2.37E+01
TPH (>EC16-35) aliphatic	1.02E+07	1.76E+08	1.91E+06	3.48E+08	1.59E+06	8.48E+00
TPH (>EC35-44) aliphatic	1.02E+07	1.76E+08	1.91E+06	3.48E+08	1.59E+06	8.48E+00
TPH (>EC6-7) aromatic (benzene)	4.75E+01	1.17E+04	5.53E+02	4.87E+05	4.36E+01	1.22E+03
TPH (>EC7-8) aromatic (toluene)	6.88E+04	1.83E+07	4.25E+05	4.84E+08	5.90E+04	8.69E+02
TPH (>EC8-10) aromatic	3.70E+03	5.80E+05	3.81E+04	1.04E+07	3.35E+03	6.13E+02
TPH (>EC10-12) aromatic	2.02E+04	1.35E+06	3.81E+04	1.04E+07	1.31E+04	3.64E+02
TPH (>EC12-16) aromatic	2.25E+05	4.48E+06	3.81E+04	1.04E+07	3.22E+04	2.37E+01
TPH (>EC16-21) aromatic	4.59E+06	1.24E+07	2.86E+04	5.22E+06	2.82E+04	5.37E+01
TPH (>EC21-35) aromatic	7.57E+08	5.56E+07	2.86E+04	5.22E+06	2.84E+04	4.83E+00
TPH (>EC35-44) aromatic	7.57E+08	5.56E+07	2.86E+04	5.22E+06	2.84E+04	4.83E+00
Naphthalene	2.06E+02	7.85E+04	3.64E+04	2.85E+05	2.04E+02	7.64E+01
Acenaphthylene	3.76E+05	2.62E+07	1.10E+05	2.09E+07	8.45E+04	8.61E+01
Acenaphthene	3.87E+05	2.74E+07	1.10E+05	2.09E+07	8.50E+04	5.70E+01
Fluorene	5.10E+05	2.44E+07	7.31E+04	1.39E+07	6.35E+04	3.09E+01
Phenanthrene	6.87E+05	1.31E+07	2.28E+04	4.34E+06	2.19E+04	3.60E+01
Anthracene	1.41E+07	3.07E+08	5.49E+05	1.04E+08	5.25E+05	1.17E+00
Fluoranthene	4.36E+06	2.63E+07	2.29E+04	4.34E+06	2.26E+04	1.89E+01
Pyrene	1.02E+07	5.98E+07	5.49E+04	1.04E+07	5.43E+04	2.20E+00
Benzo(a)anthracene	4.04E+03	7.01E+03	2.84E+02	5.21E+02	1.71E+02	1.71E+00
Chrysene	5.01E+04	1.22E+04	5.67E+02	1.04E+03	3.54E+02	4.40E-01
Benzo(b)fluoranthene	1.86E+04	2.18E+03	7.13E+01	1.32E+02	4.52E+01	1.22E+00
Benzo(k)fluoranthene	8.14E+05	6.83E+04	1.88E+03	3.48E+03	1.20E+03	6.87E-01
Benzo(a)pyrene	2.10E+04	1.90E+03	5.67E+01	1.04E+02	3.60E+01	9.11E-01
Indeno(123-cd)pyrene	1.75E+05	2.29E+04	8.10E+02	1.49E+03	5.12E+02	6.14E-02
Dibenzo(ah)anthracene	1.01E+03	2.36E+02	5.67E+00	1.04E+01	3.60E+00	3.93E-03
Benzo(g,h,i)perylene	4.64E+06	3.81E+05	6.29E+03	1.15E+04	4.02E+03	1.54E-02

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 1% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
Tetrachloroethene (PCE)	1.98E+01	***7.63E+04***	1.12E+04	2.83E+06	1.97E+01	4.24E+02
Trichloroethene (TCE)	1.31E+00	***5.07E+03***	9.53E+02	1.98E+05	1.30E+00	1.54E+03
***cis*-1,2-Dichloroethene**	1.45E+01	***5.26E+04***	1.12E+04	2.04E+06	1.45E+01	3.94E+03
Vinyl Chloride (VC)	6.31E-02	7.47E+02	2.67E+01	1.04E+05	6.29E-02	1.36E+03
1,1,2,2-Tetrachloroethane (PCA)	2.98E+02	***2.49E+05***	1.10E+04	2.01E+06	2.90E+02	2.67E+03
1,1,1-Trichloroethane (TCA)	7.01E+02	***3.81E+06***	1.14E+06	2.07E+08	7.00E+02	1.43E+03
1,2-Dichloroethane	7.14E-01	1.68E+03	2.29E+02	4.17E+04	7.11E-01	3.41E+03
Carbon Tetrachloride	3.04E+00	***1.65E+04***	7.62E+03	8.85E+05	3.04E+00	1.52E+03
Carbon disulphide	1.16E+01	***7.12E+04***	9.53E+04	4.97E+06	1.16E+01	2.11E+03

ASC exceeds soil saturation limit

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 2.5% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	mg/kg
Arsenic	NR	NR	6.35E+02	6.95E+02	6.40E+02	N/A
Barium	NR	NR	2.22E+04	3.48E+06	2.21E+04	N/A
Beryllium	NR	NR	3.97E+03	1.24E+01	1.24E+01	N/A
Boron	NR	NR	2.38E+05	2.99E+07	2.36E+05	N/A
Cadmium	NR	NR	3.99E+02	2.43E+02	2.30E+02	N/A
Chromium III	NR	NR	3.31E+05	9.09E+03	8.84E+03	N/A
Chromium VI	NR	NR	1.79E+03	3.48E+01	3.48E+01	N/A
Copper	NR	NR	1.89E+05	9.50E+04	6.33E+04	N/A
Lead					2.33E+03	N/A
Inorganic Mercury	NR	NR	1.18E+03	2.09E+04	3.60E+03	N/A
Nickel	NR	NR	2.22E+04	1.04E+03	1.04E+03	N/A
Selenium	NR	NR	1.23E+04	1.93E+06	1.30E+04	N/A
Vanadium	NR	NR	2.15E+04	9.58E+03	6.63E+03	N/A
Zinc	NR	NR	7.35E+05	2.09E+08	7.33E+05	N/A
Cyanide (free)					4.30E+01	N/A
Cyanide (Complex)					2.13E+02	N/A
Phenol	*1.31E+05*	*1.37E+06*	4.07E+04	3.28E+06	3.01E+04	8.15E+04
Benzene	5.53E+01	*1.60E+04*	5.53E+02	4.87E+05	5.01E+01	2.26E+03
Toluene	*1.52E+05*	*2.72E+07*	4.25E+05	4.86E+08	*1.12E+05*	1.92E+03
Ethylbenzene	*1.47E+04*	*1.99E+06*	1.91E+05	2.57E+07	*1.36E+04*	1.22E+03
Total Xylene	*1.51E+04*	*1.79E+06*	3.43E+05	2.03E+07	*1.43E+04*	1.12E+03
TPH (EC5-6) aliphatic	*6.07E+03*	*6.79E+06*	4.77E+06	8.69E+08	*6.06E+03*	5.58E+02
TPH (>EC6-8) aliphatic	*1.80E+04*	*1.17E+07*	4.77E+06	8.69E+08	*1.79E+04*	3.22E+02
TPH (>EC8-10) aliphatic	*5.11E+03*	*1.50E+06*	9.53E+04	5.04E+07	*4.83E+03*	1.90E+02
TPH (>EC10-12) aliphatic	*2.58E+04*	*3.37E+06*	9.53E+04	5.04E+07	*2.02E+04*	1.18E+02

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 2.5% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
TPH (>EC12-16) aliphatic	2.17E+05	9.77E+06	9.53E+04	5.04E+07	6.57E+04	5.91E+01
TPH (>EC16-35) aliphatic	2.56E+07	2.79E+08	1.91E+06	3.48E+08	1.76E+06	2.12E+01
TPH (>EC35-44) aliphatic	2.56E+07	2.79E+08	1.91E+06	3.48E+08	1.76E+06	2.12E+01
TPH (>EC6-7) aromatic (benzene)	5.53E+01	1.60E+04	5.53E+02	4.87E+05	5.01E+01	2.26E+03
TPH (>EC7-8) aromatic (toluene)	1.52E+05	2.71E+07	4.25E+05	4.84E+08	1.11E+05	1.92E+03
TPH (>EC8-10) aromatic	9.06E+03	9.08E+05	3.81E+04	1.04E+07	7.26E+03	1.50E+03
TPH (>EC10-12) aromatic	4.99E+04	2.13E+06	3.81E+04	1.04E+07	2.13E+04	8.99E+02
TPH (>EC12-16) aromatic	5.59E+05	7.06E+06	3.81E+04	1.04E+07	3.54E+04	5.91E+01
TPH (>EC16-21) aromatic	1.15E+07	1.96E+07	2.86E+04	5.22E+06	2.83E+04	1.34E+02
TPH (>EC21-35) aromatic	1.89E+09	8.79E+07	2.86E+04	5.22E+06	2.84E+04	1.21E+01
TPH (>EC35-44) aromatic	1.89E+09	8.79E+07	2.86E+04	5.22E+06	2.84E+04	1.21E+01
Naphthalene	4.93E+02	1.21E+05	3.64E+04	2.85E+05	4.84E+02	1.83E+02
Acenaphthylene	9.26E+05	4.11E+07	1.10E+05	2.09E+07	9.76E+04	2.12E+02
Acenaphthene	9.56E+05	4.31E+07	1.10E+05	2.09E+07	9.80E+04	1.41E+02
Fluorene	1.26E+06	3.84E+07	7.31E+04	1.39E+07	6.86E+04	7.65E+01
Phenanthrene	1.71E+06	2.07E+07	2.28E+04	4.34E+06	2.24E+04	8.96E+01
Anthracene	3.51E+07	4.84E+08	5.49E+05	1.04E+08	5.37E+05	2.91E+00
Fluoranthene	1.09E+07	4.16E+07	2.29E+04	4.34E+06	2.27E+04	4.73E+01
Pyrene	2.54E+07	9.45E+07	5.49E+04	1.04E+07	5.45E+04	5.49E+00
Benzo(a)anthracene	1.01E+04	1.11E+04	2.84E+02	5.21E+02	1.77E+02	4.28E+00
Chrysene	1.25E+05	1.93E+04	5.67E+02	1.04E+03	3.59E+02	1.10E+00
Benzo(b)fluoranthene	4.66E+04	3.45E+03	7.13E+01	1.32E+02	4.57E+01	3.04E+00
Benzo(k)fluoranthene	2.03E+06	1.08E+05	1.88E+03	3.48E+03	1.21E+03	1.72E+00
Benzo(a)pyrene	5.26E+04	3.00E+03	5.67E+01	1.04E+02	3.63E+01	2.28E+00
Indeno(123-cd)pyrene	4.38E+05	3.62E+04	8.10E+02	1.49E+03	5.17E+02	5.30E-01
Dibenzo(ah)anthracene	2.53E+03	3.73E+02	5.67E+00	1.04E+01	3.63E+00	9.82E-03
Benzo(g,h,i)perylene	1.16E+07	6.02E+05	6.29E+03	1.15E+04	4.03E+03	3.85E-02

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 2.5% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
Tetrachloroethene (PCE)	4.43E+01	***1.14E+05***	1.12E+04	2.83E+06	4.41E+01	9.51E+02
Trichloroethene (TCE)	2.74E+00	***7.34E+03***	9.53E+02	1.98E+05	2.73E+00	3.22E+03
***cis*-1,2-Dichloroethene**	2.43E+01	***6.81E+04***	1.12E+04	2.04E+06	2.42E+01	6.61E+03
Vinyl Chloride (VC)	8.16E-02	8.50E+02	2.67E+01	1.04E+05	8.13E-02	1.76E+03
1,1,2,2-Tetrachloroethane (PCA)	6.11E+02	***3.56E+05***	1.10E+04	2.01E+06	5.78E+02	5.46E+03
1,1,1-Trichloroethane (TCA)	1.43E+03	***5.46E+06***	1.14E+06	2.07E+08	1.43E+03	2.92E+03
1,2-Dichloroethane	1.03E+00	2.02E+03	2.29E+02	4.17E+04	1.02E+00	4.91E+03
Carbon Tetrachloride	6.67E+00	***2.44E+04***	7.62E+03	8.85E+05	6.66E+00	3.32E+03
Carbon disulphide	2.32E+01	***1.00E+05***	9.53E+04	4.97E+06	2.32E+01	4.21E+03

ASC exceeds soil saturation limit

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 6% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	mg/kg
Arsenic	NR	NR	6.35E+02	6.95E+02	6.40E+02	N/A
Barium	NR	NR	2.22E+04	3.48E+06	2.21E+04	N/A
Beryllium	NR	NR	3.97E+03	1.24E+01	1.24E+01	N/A
Boron	NR	NR	2.38E+05	2.99E+07	2.36E+05	N/A
Cadmium	NR	NR	3.99E+02	2.43E+02	2.30E+02	N/A
Chromium III	NR	NR	3.31E+05	9.09E+03	8.84E+03	N/A
Chromium VI	NR	NR	1.79E+03	3.48E+01	3.48E+01	N/A
Copper	NR	NR	1.89E+05	9.50E+04	6.33E+04	N/A
Lead					2.33E+03	N/A
Inorganic Mercury	NR	NR	1.18E+03	2.09E+04	3.60E+03	N/A
Nickel	NR	NR	2.22E+04	1.04E+03	1.04E+03	N/A
Selenium	NR	NR	1.23E+04	1.93E+06	1.30E+04	N/A
Vanadium	NR	NR	2.15E+04	9.58E+03	6.63E+03	N/A
Zinc	NR	NR	7.35E+05	2.09E+08	7.33E+05	N/A
Cyanide (free)					4.30E+01	N/A
Cyanide (Complex)					2.13E+02	N/A
Phenol	*2.42E+05*	*1.86E+06*	4.07E+04	3.28E+06	3.39E+04	1.74E+05
Benzene	1.15E+02	*2.30E+04*	5.53E+02	4.87E+05	9.47E+01	4.71E+03
Toluene	*3.46E+05*	*4.11E+07*	4.25E+05	4.86E+08	*1.90E+05*	4.36E+03
Ethylbenzene	*3.45E+04*	*3.04E+06*	1.91E+05	2.57E+07	*2.89E+04*	2.84E+03
Total Xylene	*3.53E+04*	*2.74E+06*	3.43E+05	2.03E+07	*3.16E+04*	2.62E+03
TPH (EC5-6) aliphatic	*1.25E+04*	*9.74E+06*	4.77E+06	8.69E+08	*1.25E+04*	1.15E+03
TPH (>EC6-8) aliphatic	*4.12E+04*	*1.77E+07*	4.77E+06	8.69E+08	*4.08E+04*	7.36E+02
TPH (>EC8-10) aliphatic	*1.21E+04*	*2.31E+06*	9.53E+04	5.04E+07	*1.07E+04*	4.51E+02
TPH (>EC10-12) aliphatic	*6.18E+04*	*5.22E+06*	9.53E+04	5.04E+07	*3.72E+04*	2.83E+02

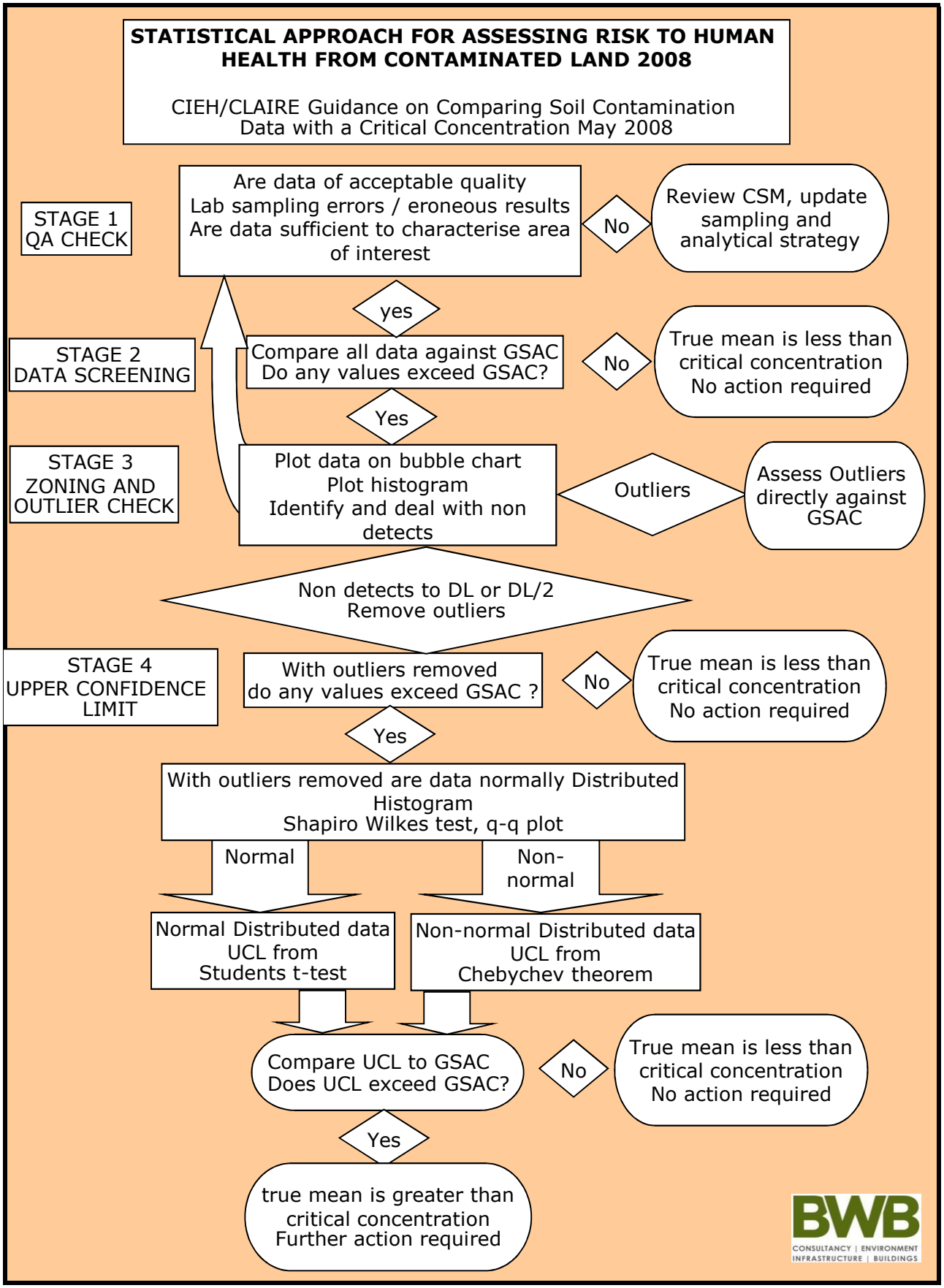
Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 6% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
TPH (>EC12-16) aliphatic	5.20E+05	1.51E+07	9.53E+04	5.04E+07	8.00E+04	1.42E+02
TPH (>EC16-35) aliphatic	6.14E+07	4.32E+08	1.91E+06	3.48E+08	1.83E+06	5.09E+01
TPH (>EC35-44) aliphatic	6.14E+07	4.32E+08	1.91E+06	3.48E+08	1.83E+06	5.09E+01
TPH (>EC6-7) aromatic (benzene)	1.15E+02	2.30E+04	5.53E+02	4.87E+05	9.48E+01	4.71E+03
TPH (>EC7-8) aromatic (toluene)	3.45E+05	4.09E+07	4.25E+05	4.84E+08	1.89E+05	4.36E+03
TPH (>EC8-10) aromatic	2.16E+04	1.40E+06	3.81E+04	1.04E+07	1.36E+04	3.58E+03
TPH (>EC10-12) aromatic	1.19E+05	3.29E+06	3.81E+04	1.04E+07	2.85E+04	2.15E+03
TPH (>EC12-16) aromatic	1.34E+06	1.09E+07	3.81E+04	1.04E+07	3.68E+04	1.42E+02
TPH (>EC16-21) aromatic	2.75E+07	3.03E+07	2.86E+04	5.22E+06	2.84E+04	3.21E+02
TPH (>EC21-35) aromatic	4.54E+09	1.36E+08	2.86E+04	5.22E+06	2.84E+04	2.90E+01
TPH (>EC35-44) aromatic	4.54E+09	1.36E+08	2.86E+04	5.22E+06	2.84E+04	2.90E+01
Naphthalene	1.16E+03	1.87E+05	3.64E+04	2.85E+05	1.11E+03	4.32E+02
Acenaphthylene	2.21E+06	6.35E+07	1.10E+05	2.09E+07	1.04E+05	5.06E+02
Acenaphthene	2.28E+06	6.67E+07	1.10E+05	2.09E+07	1.04E+05	3.36E+02
Fluorene	3.02E+06	5.94E+07	7.31E+04	1.39E+07	7.09E+04	1.83E+02
Phenanthrene	4.09E+06	3.20E+07	2.28E+04	4.34E+06	2.25E+04	2.14E+02
Anthracene	8.41E+07	7.50E+08	5.49E+05	1.04E+08	5.42E+05	6.96E+00
Fluoranthene	2.61E+07	6.44E+07	2.29E+04	4.34E+06	2.28E+04	1.12E+02
Pyrene	6.09E+07	1.46E+08	5.49E+04	1.04E+07	5.45E+04	1.32E+01
Benzo(a)anthracene	2.42E+04	1.72E+04	2.84E+02	5.21E+02	1.80E+02	1.03E+01
Chrysene	3.00E+05	2.99E+04	5.67E+02	1.04E+03	3.62E+02	2.64E+00
Benzo(b)fluoranthene	1.12E+05	5.34E+03	7.13E+01	1.32E+02	4.59E+01	7.29E+00
Benzo(k)fluoranthene	4.88E+06	1.67E+05	1.88E+03	3.48E+03	1.21E+03	4.12E+00
Benzo(a)pyrene	1.26E+05	4.65E+03	5.67E+01	1.04E+02	3.64E+01	5.46E+00
Indeno(123-cd)pyrene	1.05E+06	5.60E+04	8.10E+02	1.49E+03	5.20E+02	3.68E-01
Dibenzo(ah)anthracene	6.07E+03	5.78E+02	5.67E+00	1.04E+01	3.65E+00	2.36E-02
Benzo(g,h,i)perylene	2.78E+07	9.33E+05	6.29E+03	1.15E+04	4.04E+03	9.23E-02

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015 6% Organic matter	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
Tetrachloroethene (PCE)	1.02E+02	***1.73E+05***	1.12E+04	2.83E+06	1.01E+02	2.18E+03
Trichloroethene (TCE)	6.07E+00	***1.09E+04***	9.53E+02	1.98E+05	6.03E+00	7.14E+03
***cis*-1,2-Dichloroethene**	4.73E+01	***9.50E+04***	1.12E+04	2.04E+06	4.71E+01	1.29E+04
Vinyl Chloride (VC)	1.25E-01	1.05E+03	2.67E+01	1.04E+05	1.24E-01	2.69E+03
1,1,2,2-Tetrachloroethane (PCA)	1.34E+03	***5.27E+05***	1.10E+04	2.01E+06	1.19E+03	1.20E+04
1,1,1-Trichloroethane (TCA)	3.14E+03	***8.08E+06***	1.14E+06	2.07E+08	3.13E+03	6.39E+03
1,2-Dichloroethane	1.77E+00	2.65E+03	2.29E+02	4.17E+04	1.76E+00	8.43E+03
Carbon Tetrachloride	1.51E+01	***3.67E+04***	7.62E+03	8.85E+05	1.51E+01	7.54E+03
Carbon disulphide	5.01E+01	***1.48E+05***	9.53E+04	4.97E+06	5.01E+01	9.11E+03

ASC exceeds soil saturation limit

APPENDIX 9

SOIL CHEMICAL RESULTS SUMMARY


STATISTICAL APPROACH FOR ASSESSING RISK TO HUMAN HEALTH FROM CONTAMINATED LAND 2008
CIEH/CLAIRE Guidance on Comparing Soil Contamination Data with a Critical Concentration May 2008
STAGE 1 QA CHECK
Are data of acceptable quality
Lab sampling errors / eroneous results
Are data sufficient to characterise area of interest
No
Review CSM, update sampling and analytical strategy
yes
STAGE 2 DATA SCREENING
Compare all data against GSAC
Do any values exceed GSAC?
No
True mean is less than critical concentration
No action required
Yes
STAGE 3 ZONING AND OUTLIER CHECK
Plot data on bubble chart
Plot histogram
Identify and deal with non detects
Outliers
Assess Outliers directly against GSAC
Non detects to DL or DL/2
Remove outliers
STAGE 4 UPPER CONFIDENCE LIMIT
With outliers removed
do any values exceed GSAC ?
No
True mean is less than critical concentration
No action required
Yes
With outliers removed are data normally Distributed
Histogram
Shapiro Wilkes test, q-q plot
Normal
Non-normal
Normal Distributed data
UCL from
Students t-test
Non-normal Distributed data
UCL from
Chebychev theorem
Compare UCL to GSAC
Does UCL exceed GSAC?
No
True mean is less than critical concentration
No action required
Yes
true mean is greater than critical concentration
Further action required
BWB
CONSULTANCY | ENVIRONMENT
INFRASTRUCTURE | BUILDINGS

Human Health Generic QRA Worksheet

Lamby Way, Cardiff	NTE2313
Site assessed as one averaging area.	

GSAC Type	**BWB_GSAC**
Key Receptor/CSM (Residential/Commercial/POS)	**Commercial**
Organic Matter % (If unknown use 1%)	**1**

Exposure Pathway Selection	
(Residential/Commercial scenarios only)	
Soil Ingestion, dermal contact, particulate inhalation	**TRUE**
Ingestion of site grown vegetables and soil attached to vegetables	**FALSE**
Inhalation of vapours Indoors	**TRUE**
Inhalation of vapours Outdoors	**TRUE**

Default pathways	
Residential	**Commercial**
TRUE	**TRUE**
Optional	**FALSE**
TRUE	**TRUE**
TRUE	**TRUE**

Generic Assessment Criteria Lamby Way, Cardiff NTE2313	Commercial mg/kg	Source
Arsenic	640.00	BWB_GSAC
Barium	22075.98	BWB_GSAC
Beryllium	12.36	BWB_GSAC
Boron	236162.71	BWB_GSAC
Cadmium	230.00	BWB_GSAC
Chromium III	8844.34	BWB_GSAC
Chromium VI	34.76	BWB_GSAC
Copper	63257.96	BWB_GSAC
Lead	2330.00	DEFRA_C4SL
Inorganic Mercury	3600.00	BWB_GSAC
Nickel	1042.26	BWB_GSAC
Selenium	13000.00	BWB_GSAC
Vanadium	6625.16	BWB_GSAC
Zinc	732811.46	BWB_GSAC
Cyanide (Free)	43.00	BWB_GSAC
Cyanide (Complex)	213.00	BWB_GSAC
Phenols (Total)	26470.70	BWB_GSAC
Benzene	28.13	BWB_GSAC
Toluene	59239.76	BWB_GSAC
Ethyl benzene	6048.35	BWB_GSAC
Total Xylene	6276.89	BWB_GSAC
TPH (EC5-6) aliphatic	3305.51	BWB_GSAC
TPH (>EC6-8) aliphatic	8038.06	BWB_GSAC
TPH (>EC8-10) aliphatic	2040.71	BWB_GSAC
TPH (>EC10-12) aliphatic	9333.90	BWB_GSAC
TPH (>EC12-16) aliphatic	45054.03	BWB_GSAC
TPH (>EC16-35) aliphatic	1586911.64	BWB_GSAC
TPH (>EC35-44) aliphatic	1586911.64	BWB_GSAC
TPH (>EC6-7) aromatic (benzene)	43.58	BWB_GSAC
TPH (>EC7-8) aromatic (toluene)	59016.08	BWB_GSAC
TPH (>EC8-10) aromatic	3351.91	BWB_GSAC
TPH (>EC10-12) aromatic	13056.78	BWB_GSAC
TPH (>EC12-16) aromatic	32247.11	BWB_GSAC
TPH (>EC16-21) aromatic	28204.67	BWB_GSAC
TPH (>EC21-35) aromatic	28428.54	BWB_GSAC
TPH (>EC35-44) aromatic	28428.54	BWB_GSAC
Naphthalene	204.16	BWB_GSAC
Acenaphthylene	84484.45	BWB_GSAC
Acenaphthene	85039.57	BWB_GSAC
Fluorene	63477.55	BWB_GSAC
Phenanthrene	21919.25	BWB_GSAC
Anthracene	524854.95	BWB_GSAC
Fluoranthene	22641.89	BWB_GSAC
Pyrene	54271.58	BWB_GSAC
Benzo(a)anthracene	171.36	BWB_GSAC
Chrysene	354.05	BWB_GSAC
Benzo(b)fluoranthene	45.25	BWB_GSAC
Benzo(k)fluoranthene	1198.49	BWB_GSAC
Benzo(a)pyrene	35.97	BWB_GSAC
Indeno(1,2,3-c,d)pyrene	512.12	BWB_GSAC
Dibenzo(a,h)anthracene	3.60	BWB_GSAC
Benzo(g,hi)perylene	4016.76	BWB_GSAC

Generic Assessment Criteria Lamby Way, Cardiff NTE2313	Commercial mg/kg	Source
Tetrachloroethene (PCE)	19.73	BWB_GSAC
Trichloroethene (TCE)	1.30	BWB_GSAC
***cis*-1,2-Dichloroethene**	14.48	BWB_GSAC
Vinyl Chloride (VC)	0.06	BWB_GSAC
1,1,2,2-Tetrachloroethane (PCA)	289.76	BWB_GSAC
1,1,1-Trichloroethane (TCA)	700.44	BWB_GSAC
1,2-Dichloroethane	0.71	BWB_GSAC
Carbon Tetrachloride	3.04	BWB_GSAC
Carbon disulphide	11.60	BWB_GSAC

Location	Sample depth	Easting	Northing	Strata Type	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium III	Chromium VI	Copper	Lead	Inorganic Mercury	Nickel	Selenium	Vanadium	Zinc	Cyanide (Free)	Cyanide (Complex)	Phenols (Total)
Detection Limit					0.2	1.5	0.2	0.2	0.1	0.15	1	0.2	0.3	0.03	0.2	0.5	0.8	1	0.1	0.1	0.3
GSAC					640.00	22075.98	12.36	236162.71	230.00	8844.34	34.76	63257.96	2330.00	3600.00	1042.26	13000.00	6625.16	732811.46	43.00	213.00	26470.70
DS02	1.50	322014	178598	Made Ground	14	370	0.31	5.4	0.4	19	4	38	210	0.3	15	1.8	22	180	1	1	1
DS02	4.50	322014	178598	Tidal Flat Deposits	1.6	320	0.75	0.6	0.2	22	4	8.3	7.2	0.3	32	1	23	52	1	1	1
DS03	1.60	322029	178649	Made Ground	11	540	0.64	2.3	0.7	28	4	33	67	0.6	20	1	32	120	1	1	1
DS03	3.60	322029	178649	Tidal Flat Deposits	5	270	1.3	0.5	0.2	18	4	7.1	6.2	0.3	32	1	23	41	1	1	1
TP01	0.40	321977	178609	Made Ground	13	320	0.86	1.6	0.8	30	4	68	130	0.4	30	3	25	230	1	1	1
TP06	0.30	322024	178617	Made Ground																	
TP08	0.50	322064	178619	Made Ground	15	490	0.68	1.8	0.7	21	4	61	120	0.4	17	1	25	140	1	1	1

Location	Sample depth	Benzene	Toluene	Ethyl benzene	Total Xylene	TPH (EC5-6) aliphatic	TPH (>EC6-8) aliphatic	TPH (>EC8-10) aliphatic	TPH (>EC10-12) aliphatic	TPH (>EC12-16) aliphatic	TPH (>EC16-35) aliphatic	TPH (>EC35-44) aliphatic	TPH (>EC6-7) aromatic (benzene)	TPH (>EC7-8) aromatic (toluene)	TPH (>EC8-10) aromatic	TPH (>EC10-12) aromatic	TPH (>EC12-16) aromatic	TPH (>EC16-21) aromatic	TPH (>EC21-35) aromatic	TPH (>EC35-44) aromatic
Detection Limit		0.01	0.01	0.01	0.01	0.01	0.01	0.01	1.5	1.2	1.5	3.4	0.01	0.01	0.01	0.9	0.5	0.6	1.4	1.4
GSAC		28.13	59239.76	6048.35	6276.89	3305.51	8038.06	2040.71	9333.90	45054.03	1586911.64	1586911.64	43.58	59016.08	3351.91	13056.78	32247.11	28204.67	28428.54	28428.54
DS02	1.50	0.001	0.001	0.001	0.002	0.1	0.1	0.1	1	7.3	67		0.1	0.1	0.1	1.5	20	100	210	
DS02	4.50																			
DS03	1.60	0.001	0.001	0.001	0.002	0.1	0.1	0.1	1	3.8	62		0.1	0.1	0.1	1	6.5	34	98	
DS03	3.60																			
TP01	0.40																			
TP06	0.30																			
TP08	0.50																			

Location	Sample depth	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-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,hi)perylene
Detection Limit		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
GSAC		204.16	84484.45	85039.57	63477.55	21919.25	524854.95	22641.89	54271.58	171.36	354.05	45.25	1198.49	35.97	512.12	3.60	4016.76
DS02	1.50	1.3	0.52	1.2	1.6	11	2.6	14	10	7.6	6.6	6.9	2.9	4.7	2.6	1	2.9
DS02	4.50	0.05	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.1	0.1	0.1	0.1	0.1	0.05
DS03	1.60	0.17	0.1	0.9	1.2	3.5	0.85	4.5	3.3	2.3	2.3	2.3	1.5	1.7	1	0.41	1.2
DS03	3.60	0.05	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.1	0.1	0.1	0.1	0.1	0.05
TP01	0.40	0.3	0.1	0.1	0.14	0.93	0.16	1.2	0.97	0.87	0.89	0.93	0.64	0.68	0.31	0.1	0.52
TP06	0.30																
TP08	0.50	1.6	0.29	1	1.1	9.5	3	16	12	9.8	8.6	11	6.1	8	4.1	1.3	4.4

Determinand	Number of tests	Range (mg/kg)	Commercial GSAC (mg/kg)	Detection Limit (mg/kg)	Min	Max	No. of Exceedances	No. Non detects	< or not
Arsenic	6	1.6 to 15	6.40E+02	0.2	1.6	15	0	0	
Barium	6	270 to 540	2.21E+04	1.5	270	540	0	0	
Beryllium	6	0.31 to 1.3	1.24E+01	0.2	0.31	1.3	0	0	
Boron	6	0.5 to 5.4	2.36E+05	0.2	0.5	5.4	0	0	
Cadmium	6	0.2 to 0.8	2.30E+02	0.1	0.2	0.8	0	0	
Chromium III	6	18 to 30	8.84E+03	0.15	18	30	0	0	
Chromium VI	6	4 to 4	3.48E+01	1	4	4	0	0	
Copper	6	7.1 to 68	6.33E+04	0.2	7.1	68	0	0	
Lead	6	6.2 to 210	2.33E+03	0.3	6.2	210	0	0	
Inorganic Mercury	6	0.3 to 0.6	3.60E+03	0.03	0.3	0.6	0	0	
Nickel	6	15 to 32	1.04E+03	0.2	15	32	0	0	
Selenium	6	1 to 3	1.30E+04	0.5	1	3	0	0	
Vanadium	6	22 to 32	6.63E+03	0.8	22	32	0	0	
Zinc	6	41 to 230	7.33E+05	1	41	230	0	0	
Cyanide (Free)	6	1 to 1	4.30E+01	0.1	1	1	0	0	
Cyanide (Complex)	6	1 to 1	2.13E+02	0.1	1	1	0	0	
Phenols (Total)	6	1 to 1	2.65E+04	0.3	1	1	0	0	
Benzene	2	0.001 to 0.001	2.81E+01	0.01	0.001	0.001	0	0	
Toluene	2	0.001 to 0.001	5.92E+04	0.01	0.001	0.001	0	0	
Ethyl benzene	2	0.001 to 0.001	6.05E+03	0.01	0.001	0.001	0	0	
Total Xylene	2	0.002 to 0.002	6.28E+03	0.01	0.002	0.002	0	0	
TPH (EC5-6) aliphatic	2	0.1 to 0.1	3.31E+03	0.01	0.1	0.1	0	0	
TPH (>EC6-8) aliphatic	2	0.1 to 0.1	8.04E+03	0.01	0.1	0.1	0	0	
TPH (>EC8-10) aliphatic	2	0.1 to 0.1	2.04E+03	0.01	0.1	0.1	0	0	
TPH (>EC10-12) aliphatic	2	1 to 1	9.33E+03	1.5	1	1	0	0	
TPH (>EC12-16) aliphatic	2	3.8 to 7.3	4.51E+04	1.2	3.8	7.3	0	0	
TPH (>EC16-35) aliphatic	2	62 to 67	1.59E+06	1.5	62	67	0	0	
TPH (>EC35-44) aliphatic	0	0 to 0	1.59E+06	3.4	0	0	0	0	
TPH (>EC6-7) aromatic (benzene)	2	0.1 to 0.1	4.36E+01	0.01	0.1	0.1	0	0	
TPH (>EC7-8) aromatic (toluene)	2	0.1 to 0.1	5.90E+04	0.01	0.1	0.1	0	0	
TPH (>EC8-10) aromatic	2	0.1 to 0.1	3.35E+03	0.01	0.1	0.1	0	0	
TPH (>EC10-12) aromatic	2	1 to 1.5	1.31E+04	0.9	1	1.5	0	0	
TPH (>EC12-16) aromatic	2	6.5 to 20	3.22E+04	0.5	6.5	20	0	0	
TPH (>EC16-21) aromatic	2	34 to 100	2.82E+04	0.6	34	100	0	0	
TPH (>EC21-35) aromatic	2	98 to 210	2.84E+04	1.4	98	210	0	0	
TPH (>EC35-44) aromatic	0	0 to 0	2.84E+04	1.4	0	0	0	0	
Naphthalene	6	0.05 to 1.6	2.04E+02	0.1	0.05	1.6	0	0	
Acenaphthylene	6	<0.1 to 0.52	8.45E+04	0.1	0.1	0.52	0	4	<
Acenaphthene	6	<0.1 to 1.2	8.50E+04	0.1	0.1	1.2	0	3	<
Fluorene	6	<0.1 to 1.6	6.35E+04	0.1	0.1	1.6	0	2	<
Phenanthrene	6	<0.1 to 11	2.19E+04	0.1	0.1	11	0	2	<
Anthracene	6	<0.1 to 3	5.25E+05	0.1	0.1	3	0	2	<
Fluoranthene	6	<0.1 to 16	2.26E+04	0.1	0.1	16	0	2	<
Pyrene	6	<0.1 to 12	5.43E+04	0.1	0.1	12	0	2	<
Benzo(a)anthracene	6	<0.1 to 9.8	1.71E+02	0.1	0.1	9.8	0	2	<
Chrysene	6	0.05 to 8.6	3.54E+02	0.1	0.05	8.6	0	0	
Benzo(b)fluoranthene	6	<0.1 to 11	4.52E+01	0.1	0.1	11	0	2	<
Benzo(k)fluoranthene	6	<0.1 to 6.1	1.20E+03	0.1	0.1	6.1	0	2	<
Benzo(a)pyrene	6	<0.1 to 8	3.60E+01	0.1	0.1	8	0	2	<
Indeno(1,2,3-c,d)pyrene	6	<0.1 to 4.1	5.12E+02	0.1	0.1	4.1	0	2	<
Dibenzo(a,h)anthracene	6	<0.1 to 1.3	3.60E+00	0.1	0.1	1.3	0	3	<
Benzo(g,hi)perylene	6	0.05 to 4.4	4.02E+03	0.1	0.05	4.4	0	0	
Tetrachloroethene (PCE)	0	0 to 0	1.97E+01	0.001	0	0	0	0	
Trichloroethene (TCE)	0	0 to 0	1.30E+00	0.001	0	0	0	0	
cis-1,2-Dichloroethene	0	0 to 0	1.45E+01	0.001	0	0	0	0	
Vinyl Chloride (VC)	0	0 to 0	6.29E-02	0.001	0	0	0	0	
1,1,2,2-Tetrachloroethane (PCA)	0	0 to 0	2.90E+02	0.001	0	0	0	0	
1,1,1-Trichloroethane (TCA)	0	0 to 0	7.00E+02	0.001	0	0	0	0	
1,2-Dichloroethane	0	0 to 0	7.11E-01	0.001	0	0	0	0	
Carbon Tetrachloride	0	0 to 0	3.04E+00	0.001	0	0	0	0	
Carbon disulphide	0	0 to 0	1.16E+01	0.001	0	0	0	0	

Commercial/Industrial Pathway Specific Assessment Sub Criteria derived May 2015	Vapour Inhalation (Indoors)	Vapour Inhalation (Outdoors)	Soil Ingestion & Dermal Contact	Particulate Dust Inhalation	Commercial GSAC	Soil Saturation Limit
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	mg/kg
Arsenic	NR	NR	6.35E+02	6.95E+02	6.40E+02	N/A
Barium	NR	NR	2.22E+04	3.48E+06	2.21E+04	N/A
Beryllium	NR	NR	3.97E+03	1.24E+01	1.24E+01	N/A
Boron	NR	NR	2.38E+05	2.99E+07	2.36E+05	N/A
Cadmium	NR	NR	3.99E+02	2.43E+02	2.30E+02	N/A
Chromium III	NR	NR	3.31E+05	9.09E+03	8.84E+03	N/A
Chromium VI	NR	NR	1.79E+03	3.48E+01	3.48E+01	N/A
Copper	NR	NR	1.89E+05	9.50E+04	6.33E+04	N/A
Lead					2.33E+03	N/A
Inorganic Mercury	NR	NR	1.18E+03	2.09E+04	3.60E+03	N/A
Nickel	NR	NR	2.22E+04	1.04E+03	1.04E+03	N/A
Selenium	NR	NR	1.23E+04	1.93E+06	1.30E+04	N/A
Vanadium	NR	NR	2.15E+04	9.58E+03	6.63E+03	N/A
Zinc	NR	NR	7.35E+05	2.09E+08	7.33E+05	N/A
Cyanide (free)					4.30E+01	N/A
Cyanide (Complex)					2.13E+02	N/A
Phenol	*8.34E+04*	*1.09E+06*	4.07E+04	3.28E+06	2.65E+04	4.16E+04
Benzene	2.97E+01	*1.17E+04*	5.53E+02	4.87E+05	2.81E+01	1.22E+03
Toluene	*6.91E+04*	*1.83E+07*	4.25E+05	4.86E+08	*5.92E+04*	8.69E+02
Ethylbenzene	*6.28E+03*	*1.30E+06*	1.91E+05	2.57E+07	*6.05E+03*	5.18E+02
Total Xylene	*6.43E+03*	*1.17E+06*	3.43E+05	2.03E+07	*6.28E+03*	4.78E+02
TPH (EC5-6) aliphatic	*3.31E+03*	*5.01E+06*	4.77E+06	8.69E+08	*3.31E+03*	3.04E+02
TPH (>EC6-8) aliphatic	*8.06E+03*	*7.82E+06*	4.77E+06	8.69E+08	*8.04E+03*	1.44E+02
TPH (>EC8-10) aliphatic	*2.09E+03*	*9.59E+05*	9.53E+04	5.04E+07	*2.04E+03*	7.77E+01
TPH (>EC10-12) aliphatic	*1.04E+04*	*2.13E+06*	9.53E+04	5.04E+07	*9.33E+03*	4.75E+01
TPH (>EC12-16) aliphatic	*8.68E+04*	*6.18E+06*	9.53E+04	5.04E+07	*4.51E+04*	2.37E+01
TPH (>EC16-35) aliphatic	*1.02E+07*	*1.76E+08*	1.91E+06	3.48E+08	*1.59E+06*	8.48E+00
TPH (>EC35-44) aliphatic	*1.02E+07*	*1.76E+08*	1.91E+06	3.48E+08	*1.59E+06*	8.48E+00
TPH (>EC6-7) aromatic (benzene)	4.75E+01	*1.17E+04*	5.53E+02	4.87E+05	4.36E+01	1.22E+03
TPH (>EC7-8) aromatic (toluene)	*6.88E+04*	*1.83E+07*	4.25E+05	4.84E+08	*5.90E+04*	8.69E+02
TPH (>EC8-10) aromatic	*3.70E+03*	*5.80E+05*	3.81E+04	1.04E+07	*3.35E+03*	6.13E+02
TPH (>EC10-12) aromatic	*2.02E+04*	*1.35E+06*	3.81E+04	1.04E+07	*1.31E+04*	3.64E+02
TPH (>EC12-16) aromatic	*2.25E+05*	*4.48E+06*	3.81E+04	1.04E+07	*3.22E+04*	2.37E+01
TPH (>EC16-21) aromatic	*4.59E+06*	*1.24E+07*	2.86E+04	5.22E+06	*2.82E+04*	5.37E+01
TPH (>EC21-35) aromatic	*7.57E+08*	*5.56E+07*	2.86E+04	5.22E+06	*2.84E+04*	4.83E+00
TPH (>EC35-44) aromatic	*7.57E+08*	*5.56E+07*	2.86E+04	5.22E+06	*2.84E+04*	4.83E+00
Naphthalene	*2.06E+02*	*7.85E+04*	3.64E+04	2.85E+05	*2.04E+02*	7.64E+01
Acenaphthylene	*3.76E+05*	*2.62E+07*	1.10E+05	2.09E+07	*8.45E+04*	8.61E+01
Acenaphthene	*3.87E+05*	*2.74E+07*	1.10E+05	2.09E+07	*8.50E+04*	5.70E+01
Fluorene	*5.10E+05*	*2.44E+07*	7.31E+04	1.39E+07	*6.35E+04*	3.09E+01
Phenanthrene	*6.87E+05*	*1.31E+07*	2.28E+04	4.34E+06	*2.19E+04*	3.60E+01
Anthracene	*1.41E+07*	*3.07E+08*	5.49E+05	1.04E+08	*5.25E+05*	1.17E+00
Fluoranthene	*4.36E+06*	*2.63E+07*	2.29E+04	4.34E+06	*2.26E+04*	1.89E+01
Pyrene	*1.02E+07*	*5.98E+07*	5.49E+04	1.04E+07	*5.43E+04*	2.20E+00
Benzo(a)anthracene	*4.04E+03*	*7.01E+03*	2.84E+02	5.21E+02	*1.71E+02*	1.71E+00
Chrysene	*5.01E+04*	*1.22E+04*	5.67E+02	1.04E+03	*3.54E+02*	4.40E-01
Benzo(b)fluoranthene	*1.86E+04*	*2.18E+03*	7.13E+01	1.32E+02	*4.52E+01*	1.22E+00
Benzo(k)fluoranthene	*8.14E+05*	*6.83E+04*	1.88E+03	3.48E+03	*1.20E+03*	6.87E-01
Benzo(a)pyrene	*2.10E+04*	*1.90E+03*	5.67E+01	1.04E+02	*3.60E+01*	9.11E-01
Indeno(123-cd)pyrene	*1.75E+05*	*2.29E+04*	8.10E+02	1.49E+03	*5.12E+02*	6.14E-02
Dibenzo(ah)anthracene	*1.01E+03*	*2.36E+02*	5.67E+00	1.04E+01	*3.60E+00*	3.93E-03
Benzo(g,h,i)perylene	*4.64E+06*	*3.81E+05*	6.29E+03	1.15E+04	*4.02E+03*	1.54E-02
Tetrachloroethene (PCE)	1.98E+01	*7.63E+04*	1.12E+04	2.83E+06	1.97E+01	4.24E+02
Trichloroethene (TCE)	1.31E+00	*5.07E+03*	9.53E+02	1.98E+05	1.30E+00	1.54E+03
***cis*-1,2-Dichloroethene**	1.45E+01	*5.26E+04*	1.12E+04	2.04E+06	1.45E+01	3.94E+03
Vinyl Chloride (VC)	6.31E-02	7.47E+02	2.67E+01	1.04E+05	6.29E-02	1.36E+03
1,1,2,2-Tetrachloroethane (PCA)	2.98E+02	*2.49E+05*	1.10E+04	2.01E+06	2.90E+02	2.67E+03
1,1,1-Trichloroethane (TCA)	7.01E+02	*3.81E+06*	1.14E+06	2.07E+08	7.00E+02	1.43E+03
1,2-Dichloroethane	7.14E-01	1.68E+03	2.29E+02	4.17E+04	7.11E-01	3.41E+03
Carbon Tetrachloride	3.04E+00	*1.65E+04*	7.62E+03	8.85E+05	3.04E+00	1.52E+03
Carbon disulphide	1.16E+01	*7.12E+04*	9.53E+04	4.97E+06	1.16E+01	2.11E+03
		ASC exceeds soil saturation limit				

APPENDIX 10

GROUNDWATER CHEMICAL LABORATORY RESULTS SUMMARY

*EQS Standard: Phenol and Benzene annual average of 300µg/l; Toluene 500µg/l for Freshwater, 400µg/l for Saltwater; 1,1,1-TCA 1,000µg/l.

Project Name:	Lamby Way, Cardiff
Project Number:	NTE2313
Assessment for:	Water Assessment
Laboratory:	I2
Receptor:	Freshwater
Receptor Water Hardness:	<40 (No Data)

100 = Assessment Criteria

50 = M-BAT Bioavailabilit

	Contaminant	Units	Detection Limit	Guideline Concentration	Source	Number of Samples	Min	Max	No of Exceedences	DS01	DS02	DS04
Heavy Metals	Arsenic	µg/l	0.15	50	EQS Freshwater	3	0.24	4.78	0	0.24	4.78	1.12
	Barium	mg/l	0.06	700	UK DWS	3	0.02	0.09	0	0.02	0.09	0.09
	Beryllium	µg/l	0.1	None Available		3	0.10	0.10	0	0.10	0.10	0.10
	Cadmium	µg/l	0.02	0.08	EQS Freshwater	3	0.02	0.05	0	0.02	0.05	0.02
	Chromium III	µg/l	0.2	4.7	EQS Freshwater	3	0.20	0.90	0	0.20	0.90	0.30
	Chromium VI	µg/l		3.4	EQS Freshwater	0	0.00	0.00	0			
	Copper	µg/l	0.5	1	EQS Freshwater	3	2.50	8.80	**3**	**4.00**	**8.80**	**2.50**
	Lead	µg/l	0.2	1.2	EQS Freshwater	3	0.20	1.30	1	0.20	0.70	**1.30**
	Mercury	µg/l	0.05	0.07	EQS Freshwater	3	0.08	0.15	3	**0.08**	**0.13**	**0.15**
	Nickel	µg/l	0.5	4	EQS Freshwater	3	0.50	15.00	**2**	0.50	**15.00**	**7.70**
	Selenium	µg/l	0.6	10	UK DWS	3	4.50	20.00	2	**14.00**	**20.00**	4.50
	Vanadium	µg/l	0.2	None Available		3	0.20	4.50	0	0.20	4.50	0.90
	Zinc	µg/l	0.5	10.9	EQS Freshwater	3	0.80	7.00	0	0.80	7.00	4.10
	Sulphate	mg/l	45	400	EQS Freshwater	3	119.00	289.00	0	217.00	289.00	119.00
	Boron	mg/l	10	2000	EQS Freshwater	3	0.14	0.25	0	0.25	0.18	0.14
	pH	µg/l	0.00			0	0.00	0.00	0	7.6	7.5	7.4
Inorganics	Cyanide (total)	µg/l	10	1	EQS Freshwater	3	10.00	10.00	3	**10.00**	**10.00**	**10.00**
	Phenol*	µg/l	10	7.7	EQS Freshwater	3	10.00	10.00	3	**10.00**	**10.00**	**10.00**
BTEX	Benzene*	µg/l	1	10	EQS Freshwater	2	1.00	1.00	0		1.00	1.00
	Ethylbenzene	µg/l	1	300	UK DWS	2	1.00	1.00	0		1.00	1.00
	Toluene*	µg/l	1	74	EQS Freshwater	2	1.00	1.00	0		1.00	1.00
	Xylene	µg/l		30	EQS Freshwater	2	2.00	2.00	0		2.00	2.00
Total Petroleum Hydrocarbons	Aliphatic C5-C6	µg/l	10	10	UK DWS	2	10.00	10.00	0		10.00	10.00
	Aliphatic C6-C8	µg/l	10	10	UK DWS	2	10.00	10.00	0		10.00	10.00
	Aliphatic C8-C10	µg/l	10	10	UK DWS	2	10.00	10.00	0		10.00	10.00
	Aliphatic C10-C12	µg/l	10	10	UK DWS	2	10.00	10.00	0		10.00	10.00
	Aliphatic C12-C16	µg/l	10	10	UK DWS	2	10.00	10.00	0		10.00	10.00
	Aliphatic C16-C21	µg/l	10	10	UK DWS	2	10.00	10.00	0		10.00	10.00
	Aliphatic C21-C35	µg/l	10	10	UK DWS	2	10.00	10.00	0		10.00	10.00
	Aromatic EC5-EC7	µg/l	10	10	EQS Freshwater	2	10.00	10.00	0		10.00	10.00
	Aromatic EC7-EC8	µg/l	10	74	EQS Freshwater	2	10.00	10.00	0		10.00	10.00
	Aromatic EC8-EC10	µg/l	10	10	UK DWS	2	10.00	10.00	0		10.00	10.00
	Aromatic EC10-EC12	µg/l	10	10	UK DWS	2	10.00	10.00	0		10.00	10.00
	Aromatic EC12-EC16	µg/l	10	10	UK DWS	2	10.00	10.00	0		10.00	10.00
	Aromatic EC16-EC21	µg/l	10	10	UK DWS	2	10.00	10.00	0		10.00	10.00
	Aromatic EC21-EC35	µg/l	10	10	UK DWS	2	10.00	10.00	0		10.00	10.00
	Total TPH (EC5-EC35)	µg/l		10	EQS Freshwater	0	0.00	0.00	0			
Polycyclic Aromatic Hydrocarbons	Acenaphthene	µg/l	0.01	None Available		2	0.01	0.01	0		0.01	0.01
	Acenaphthylene	µg/l	0.01	None Available		2	0.01	0.01	0		0.01	0.01
	Anthracene	µg/l	0.01	0.1	EQS Freshwater	2	0.01	0.01	0		0.01	0.01
	Benzo(a)anthracene	µg/l	0.01	None Available		2	0.01	0.01	0		0.01	0.01
	Benzo(a)pyrene	µg/l	0.01	0.00017	EQS Freshwater	2	0.01	0.01	2		**0.01**	**0.01**
	Benzo(b)fluoranthene	µg/l	0.01	None Available		2	0.01	0.01	0		0.01	0.01
	Benzo(k)fluoranthene	µg/l	0.01	None Available		2	0.01	0.01	0		0.01	0.01
	Benzo(g,h,i)perylene	µg/l	0.01	None Available		2	0.01	0.01	0		0.01	0.01
	Chrysene	µg/l	0.01	None Available		2	0.01	0.01	0		0.01	0.01
	Dibenzo(a,h)anthracene	µg/l	0.01	None Available		2	0.01	0.01	0		0.01	0.01
	Fluoranthene	µg/l	0.01	0.0063	EQS Freshwater	2	0.01	0.01	2		**0.01**	**0.01**
	Fluorene	µg/l	0.01	None Available		2	0.01	0.01	0		0.01	0.01
	Indeno(1,2,3-c,d)pyrene	µg/l	0.01	None Available		2	0.01	0.01	0		0.01	0.01
	Naphthalene	µg/l	0.01	2	EQS Freshwater	2	0.01	0.01	0		0.01	0.01
	Phenanthrene	µg/l	0.01	None Available		2	0.01	0.01	0		0.01	0.01
	Pyrene	µg/l	0.01	None Available		2	0.01	0.01	0		0.01	0.01
	Total PAH	µg/l	0.16	0.1	WHO (Health)	0	0.00	0.00	0			

APPENDIX 11

HAZWASTEONLINE CLASSIFICATION REPORT

Waste Classification Report

2GG8U-HRT28-Y4K6R

Job name

NTE2313 Lamby Way, Cardiff

Description/Comments

Project

NTE2313

Site

Lamby Way, Cardiff

Waste Stream Template

BWB Contaminated Land Suite WM3

Classified by

Name:
Richard Robinson
Date:
20/12/2016 15:11:37 UTC
Telephone:
0115 924 1100

Company:
BWB Consulting Ltd
5th Floor
Waterfront House, Station Street
Nottingham
NG2 3DQ

Report

Created by: Richard Robinson
Created date: 20/12/2016 15:11 UTC

Job summary

#	Sample Name	Depth [m]	Classification Result	Hazard properties	Page
1	DS02	1.5	Potentially Hazardous	HP 3(i)	2
2	DS02[1]	4.5	Non Hazardous		5
3	DS03	1.6	Potentially Hazardous	HP 3(i)	7
4	DS03[1]	3.6	Non Hazardous		10
5	TP01	0.4	Potentially Hazardous	HP 3(i)	12
6	TP08	0.5	Potentially Hazardous	HP 3(i)	14

Classification of sample: DS02

Potentially Hazardous Waste
Classified as **17 05 04** or **17 05 03 ***
in the List of Waste

Sample details

Sample Name:
DS02
Sample Depth:
1.5 m
Moisture content:
17%
(no correction)

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

Hazard properties (substances considered hazardous until shown otherwise)

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.046%)

Determinands

Moisture content: 17% No Moisture Correction applied (MC)

#	Determinand	CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	confirm TPH has NOT arisen from diesel or petrol					☑					
2	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		14 mg/kg	1.32	18.485 mg/kg	0.00185 %		
3	beryllium { beryllium oxide }	004-003-00-8	215-133-1	1304-56-9		0.31 mg/kg	2.78	0.86 mg/kg	0.000086 %		
4	boron { boron tribromide/trichloride/trifluoride (combined) }			10294-33-4, 10294-34-5, 7637-07-2		5.4 mg/kg	13.43	72.522 mg/kg	0.00725 %		
5	cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	0.4 mg/kg	1.29	0.514 mg/kg	0.00004 %		
6	chromium { chromium(III) oxide }		215-160-9	1308-38-9		19 mg/kg	1.46	27.77 mg/kg	0.00278 %		
7	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		38 mg/kg	1.13	42.784 mg/kg	0.00428 %		
8	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	210 mg/kg	1.56	327.561 mg/kg	0.021 %		
9	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		<0.3 mg/kg	1.35	<0.406 mg/kg	<0.000041 %		<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]		15 mg/kg	1.58	23.692 mg/kg	0.00237 %		

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number									
11		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				1.8	mg/kg	2.55	4.596	mg/kg	0.00046 %		
		034-002-00-8											
12		zinc { zinc chromate }				180	mg/kg	2.77	499.346	mg/kg	0.0499 %		
		024-007-00-3											
13		pH				8.9	pH		8.9	pH	8.9 pH		
				PH									
14		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 }				<1	mg/kg	1.88	<1.884	mg/kg	<0.000188 %		**<LOD**
		006-007-00-5											
15		TPH (C6 to C40) petroleum group				460	mg/kg		460	mg/kg	0.046 %		
				TPH									
16		benzene				<1	mg/kg		<1	mg/kg	<0.0001 %		**<LOD**
		601-020-00-8	200-753-7	71-43-2									
17		ethylbenzene				<1	mg/kg		<1	mg/kg	<0.0001 %		**<LOD**
		601-023-00-4	202-849-4	100-41-4									
18		toluene				<1	mg/kg		<1	mg/kg	<0.0001 %		**<LOD**
		601-021-00-3	203-625-9	108-88-3									
19		xylene				<1	mg/kg		<1	mg/kg	<0.0001 %		**<LOD**
		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]									
20		acenaphthene				1.2	mg/kg		1.2	mg/kg	0.00012 %		
			201-469-6	83-32-9									
21		acenaphthylene				0.52	mg/kg		0.52	mg/kg	0.000052 %		
			205-917-1	208-96-8									
22		anthracene				2.6	mg/kg		2.6	mg/kg	0.00026 %		
			204-371-1	120-12-7									
23		benzo[a]anthracene				7.6	mg/kg		7.6	mg/kg	0.00076 %		
		601-033-00-9	200-280-6	56-55-3									
24		benzo[a]pyrene; benzo[def]chrysene				4.7	mg/kg		4.7	mg/kg	0.00047 %		
		601-032-00-3	200-028-5	50-32-8									
25		benzo[b]fluoranthene				6.9	mg/kg		6.9	mg/kg	0.00069 %		
		601-034-00-4	205-911-9	205-99-2									
26		benzo[ghi]perylene				2.9	mg/kg		2.9	mg/kg	0.00029 %		
			205-883-8	191-24-2									
27		benzo[k]fluoranthene				2.9	mg/kg		2.9	mg/kg	0.00029 %		
		601-036-00-5	205-916-6	207-08-9									
28		chrysene				6.6	mg/kg		6.6	mg/kg	0.00066 %		
		601-048-00-0	205-923-4	218-01-9									
29		dibenz[a,h]anthracene				1	mg/kg		1	mg/kg	0.0001 %		
		601-041-00-2	200-181-8	53-70-3									
30		fluoranthene				14	mg/kg		14	mg/kg	0.0014 %		
			205-912-4	206-44-0									
31		fluorene				1.6	mg/kg		1.6	mg/kg	0.00016 %		
			201-695-5	86-73-7									
32		indeno[123-cd]pyrene				2.6	mg/kg		2.6	mg/kg	0.00026 %		
			205-893-2	193-39-5									
33		naphthalene				1.3	mg/kg		1.3	mg/kg	0.00013 %		
		601-052-00-2	202-049-5	91-20-3									
34		phenanthrene				11	mg/kg		11	mg/kg	0.0011 %		
			201-581-5	85-01-8									
35		pyrene				10	mg/kg		10	mg/kg	0.001 %		
			204-927-3	129-00-0									
36		phenol				<1	mg/kg		<1	mg/kg	<0.0001 %		**<LOD**
		604-001-00-2	203-632-7	108-95-2									
										Total:	0.145 %		

Key	
	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Potentially 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: DS02[1]

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

Sample details

Sample Name:
DS02[1]
Sample Depth:
4.5 m
Moisture content:
12%
(no 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: 12% No Moisture Correction applied (MC)

#	Determinand	CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	confirm TPH has NOT arisen from diesel or petrol					☑					
2	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		1.6 mg/kg	1.32	2.113 mg/kg	0.000211 %		
3	beryllium { beryllium oxide }	004-003-00-8	215-133-1	1304-56-9		0.75 mg/kg	2.78	2.082 mg/kg	0.000208 %		
4	boron { boron tribromide/trichloride/trifluoride (combined) }			10294-33-4, 10294-34-5, 7637-07-2		0.6 mg/kg	13.43	8.058 mg/kg	0.000806 %		
5	cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	<0.2 mg/kg	1.29	<0.257 mg/kg	<0.00002 %		<**LOD**
6	chromium { chromium(III) oxide }		215-160-9	1308-38-9		22 mg/kg	1.46	32.154 mg/kg	0.00322 %		
7	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		8.3 mg/kg	1.13	9.345 mg/kg	0.000934 %		
8	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	7.2 mg/kg	1.56	11.231 mg/kg	0.00072 %		
9	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		<0.3 mg/kg	1.35	<0.406 mg/kg	<0.000041 %		<**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]		32 mg/kg	1.58	50.544 mg/kg	0.00505 %		
11	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8				<1 mg/kg	2.55	<2.554 mg/kg	<0.000255 %		<**LOD**
12	zinc { zinc chromate }	024-007-00-3				52 mg/kg	2.77	144.256 mg/kg	0.0144 %		
13	pH			PH		8.3 pH		8.3 pH	8.3 pH		

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number									
14		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 }				<1	mg/kg	1.88	<1.884	mg/kg	<0.000188 %		<**LOD**
		006-007-00-5											
15		TPH (C6 to C40) petroleum group				<10	mg/kg		<10	mg/kg	<0.001 %		<**LOD**
				TPH									
16		acenaphthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
			201-469-6	83-32-9									
17		acenaphthylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
			205-917-1	208-96-8									
18		anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
			204-371-1	120-12-7									
19		benzo[a]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
		601-033-00-9	200-280-6	56-55-3									
20		benzo[a]pyrene; benzo[def]chrysene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
		601-032-00-3	200-028-5	50-32-8									
21		benzo[b]fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
		601-034-00-4	205-911-9	205-99-2									
22		benzo[ghi]perylene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
			205-883-8	191-24-2									
23		benzo[k]fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
		601-036-00-5	205-916-6	207-08-9									
24		chrysene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
		601-048-00-0	205-923-4	218-01-9									
25		dibenz[a,h]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
		601-041-00-2	200-181-8	53-70-3									
26		fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
			205-912-4	206-44-0									
27		fluorene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
			201-695-5	86-73-7									
28		indeno[123-cd]pyrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
			205-893-2	193-39-5									
29		naphthalene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
		601-052-00-2	202-049-5	91-20-3									
30		phenanthrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
			201-581-5	85-01-8									
31		pyrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
			204-927-3	129-00-0									
32		phenol				<1	mg/kg		<1	mg/kg	<0.0001 %		<**LOD**
		604-001-00-2	203-632-7	108-95-2									
										Total:	0.0273 %		

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: DS03

Potentially Hazardous Waste
Classified as **17 05 04** or **17 05 03 ***
in the List of Waste

Sample details

Sample Name:
DS03
Sample Depth:
1.6 m
Moisture content:
15%
(no correction)

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

Hazard properties (substances considered hazardous until shown otherwise)

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.02%)

Determinands

Moisture content: 15% No Moisture Correction applied (MC)

#	Determinand	CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	confirm TPH has NOT arisen from diesel or petrol					☑					
2	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		11 mg/kg	1.32	14.524 mg/kg	0.00145 %		
3	beryllium { beryllium oxide }	004-003-00-8	215-133-1	1304-56-9		0.64 mg/kg	2.78	1.776 mg/kg	0.000178 %		
4	boron { boron tribromide/trichloride/trifluoride (combined) }			10294-33-4, 10294-34-5, 7637-07-2		2.3 mg/kg	13.43	30.889 mg/kg	0.00309 %		
5	cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	0.7 mg/kg	1.29	0.9 mg/kg	0.00007 %		
6	chromium { chromium(III) oxide }		215-160-9	1308-38-9		28 mg/kg	1.46	40.924 mg/kg	0.00409 %		
7	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		33 mg/kg	1.13	37.154 mg/kg	0.00372 %		
8	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	67 mg/kg	1.56	104.508 mg/kg	0.0067 %		
9	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		0.6 mg/kg	1.35	0.812 mg/kg	0.000081 %		
10	nickel { nickel dihydroxide }	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]		20 mg/kg	1.58	31.59 mg/kg	0.00316 %		

#	Determinand	CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
11	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8				<1	mg/kg	2.55	<2.554	mg/kg	<0.000255 %		<LOD
12	zinc { zinc chromate }	024-007-00-3				120	mg/kg	2.77	332.898	mg/kg	0.0333 %		
13	pH			PH		8	pH		8	pH	8pH		
14	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	1.88	<1.884	mg/kg	<0.000188 %		<LOD
15	TPH (C6 to C40) petroleum group			TPH		200	mg/kg		200	mg/kg	0.02 %		
16	benzene	601-020-00-8	200-753-7	71-43-2		<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
17	ethylbenzene	601-023-00-4	202-849-4	100-41-4		<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
18	toluene	601-021-00-3	203-625-9	108-88-3		<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
19	xylene	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]		<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
20	acenaphthene		201-469-6	83-32-9		0.9	mg/kg		0.9	mg/kg	0.00009 %		
21	acenaphthylene		205-917-1	208-96-8		<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
22	anthracene		204-371-1	120-12-7		0.85	mg/kg		0.85	mg/kg	0.000085 %		
23	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		2.3	mg/kg		2.3	mg/kg	0.00023 %		
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		1.7	mg/kg		1.7	mg/kg	0.00017 %		
25	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		2.3	mg/kg		2.3	mg/kg	0.00023 %		
26	benzo[ghi]perylene		205-883-8	191-24-2		1.2	mg/kg		1.2	mg/kg	0.00012 %		
27	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		1.5	mg/kg		1.5	mg/kg	0.00015 %		
28	chrysene	601-048-00-0	205-923-4	218-01-9		2.3	mg/kg		2.3	mg/kg	0.00023 %		
29	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		0.41	mg/kg		0.41	mg/kg	0.000041 %		
30	fluoranthene		205-912-4	206-44-0		4.5	mg/kg		4.5	mg/kg	0.00045 %		
31	fluorene		201-695-5	86-73-7		1.2	mg/kg		1.2	mg/kg	0.00012 %		
32	indeno[123-cd]pyrene		205-893-2	193-39-5		1	mg/kg		1	mg/kg	0.0001 %		
33	naphthalene	601-052-00-2	202-049-5	91-20-3		0.17	mg/kg		0.17	mg/kg	0.000017 %		
34	phenanthrene		201-581-5	85-01-8		3.5	mg/kg		3.5	mg/kg	0.00035 %		
35	pyrene		204-927-3	129-00-0		3.3	mg/kg		3.3	mg/kg	0.00033 %		
36	phenol	604-001-00-2	203-632-7	108-95-2		<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
										Total:	0.0795 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Potentially 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: DS03[1]

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

Sample details

Sample Name:
DS03[1]
Sample Depth:
3.6 m
Moisture content:
13%
(no 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: 13% No Moisture Correction applied (MC)

#	Determinand	CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	confirm TPH has NOT arisen from diesel or petrol					☑					
2	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		5 mg/kg	1.32	6.602 mg/kg	0.00066 %		
3	beryllium { beryllium oxide }	004-003-00-8	215-133-1	1304-56-9		1.3 mg/kg	2.78	3.608 mg/kg	0.000361 %		
4	boron { boron tribromide/trichloride/trifluoride (combined) }			10294-33-4, 10294-34-5, 7637-07-2		0.5 mg/kg	13.43	6.715 mg/kg	0.000672 %		
5	cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	<0.2 mg/kg	1.29	<0.257 mg/kg	<0.00002 %		<LOD
6	chromium { chromium(III) oxide }		215-160-9	1308-38-9		18 mg/kg	1.46	26.308 mg/kg	0.00263 %		
7	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		7.1 mg/kg	1.13	7.994 mg/kg	0.000799 %		
8	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	6.2 mg/kg	1.56	9.671 mg/kg	0.00062 %		
9	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		<0.3 mg/kg	1.35	<0.406 mg/kg	<0.000041 %		<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]		32 mg/kg	1.58	50.544 mg/kg	0.00505 %		
11	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8				<1 mg/kg	2.55	<2.554 mg/kg	<0.000255 %		<LOD
12	zinc { zinc chromate }	024-007-00-3				41 mg/kg	2.77	113.74 mg/kg	0.0114 %		
13	pH			PH		8.1 pH		8.1 pH	8.1 pH		

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number									
14		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 }				<1	mg/kg	1.88	<1.884	mg/kg	<0.000188 %		<**LOD**
		006-007-00-5											
15		TPH (C6 to C40) petroleum group				<10	mg/kg		<10	mg/kg	<0.001 %		<**LOD**
				TPH									
16		acenaphthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
			201-469-6	83-32-9									
17		acenaphthylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
			205-917-1	208-96-8									
18		anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
			204-371-1	120-12-7									
19		benzo[a]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
		601-033-00-9	200-280-6	56-55-3									
20		benzo[a]pyrene; benzo[def]chrysene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
		601-032-00-3	200-028-5	50-32-8									
21		benzo[b]fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
		601-034-00-4	205-911-9	205-99-2									
22		benzo[ghi]perylene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
			205-883-8	191-24-2									
23		benzo[k]fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
		601-036-00-5	205-916-6	207-08-9									
24		chrysene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
		601-048-00-0	205-923-4	218-01-9									
25		dibenz[a,h]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
		601-041-00-2	200-181-8	53-70-3									
26		fluoranthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
			205-912-4	206-44-0									
27		fluorene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
			201-695-5	86-73-7									
28		indeno[123-cd]pyrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
			205-893-2	193-39-5									
29		naphthalene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<**LOD**
		601-052-00-2	202-049-5	91-20-3									
30		phenanthrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
			201-581-5	85-01-8									
31		pyrene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
			204-927-3	129-00-0									
32		phenol				<1	mg/kg		<1	mg/kg	<0.0001 %		<**LOD**
		604-001-00-2	203-632-7	108-95-2									
										Total:	0.0239 %		

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: TP01

Potentially Hazardous Waste
Classified as **17 05 04** or **17 05 03 ***
in the List of Waste

Sample details

Sample Name:
TP01
Sample Depth:
0.4 m
Moisture content:
9.6%
(no correction)

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

Hazard properties (substances considered hazardous until shown otherwise)

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0082%)

Determinands

Moisture content: 9.6% No Moisture Correction applied (MC)

#	Determinand	CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1	confirm TPH has NOT arisen from diesel or petrol					☑							
2	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		13	mg/kg	1.32	17.164	mg/kg	0.00172 %		
3	beryllium { beryllium oxide }	004-003-00-8	215-133-1	1304-56-9		0.86	mg/kg	2.78	2.387	mg/kg	0.000239 %		
4	boron { boron tribromide/trichloride/trifluoride (combined) }			10294-33-4, 10294-34-5, 7637-07-2		1.6	mg/kg	13.43	21.488	mg/kg	0.00215 %		
5	cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	0.8	mg/kg	1.29	1.028	mg/kg	0.00008 %		
6	chromium { chromium(III) oxide }		215-160-9	1308-38-9		30	mg/kg	1.46	43.847	mg/kg	0.00438 %		
7	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		68	mg/kg	1.13	76.56	mg/kg	0.00766 %		
8	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	130	mg/kg	1.56	202.776	mg/kg	0.013 %		
9	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		0.4	mg/kg	1.35	0.541	mg/kg	0.000054 %		
10	nickel { nickel dihydroxide }	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]		30	mg/kg	1.58	47.385	mg/kg	0.00474 %		

#		Determinand	CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
11		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8				3	mg/kg	2.55	7.661	mg/kg	0.000766 %		
12		zinc { zinc chromate }	024-007-00-3				230	mg/kg	2.77	638.054	mg/kg	0.0638 %		
13		pH			PH		8.1	pH		8.1	pH	8.1 pH		
14		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	1.88	<1.884	mg/kg	<0.000188 %		**<LOD**
15		TPH (C6 to C40) petroleum group			TPH		82	mg/kg		82	mg/kg	0.0082 %		
16		acenaphthene		201-469-6	83-32-9		<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		**<LOD**
17		acenaphthylene		205-917-1	208-96-8		<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		**<LOD**
18		anthracene		204-371-1	120-12-7		0.16	mg/kg		0.16	mg/kg	0.000016 %		
19		benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		0.87	mg/kg		0.87	mg/kg	0.000087 %		
20		benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		0.68	mg/kg		0.68	mg/kg	0.000068 %		
21		benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		0.93	mg/kg		0.93	mg/kg	0.000093 %		
22		benzo[ghi]perylene		205-883-8	191-24-2		0.52	mg/kg		0.52	mg/kg	0.000052 %		
23		benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		0.64	mg/kg		0.64	mg/kg	0.000064 %		
24		chrysene	601-048-00-0	205-923-4	218-01-9		0.89	mg/kg		0.89	mg/kg	0.000089 %		
25		dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		**<LOD**
26		fluoranthene		205-912-4	206-44-0		1.2	mg/kg		1.2	mg/kg	0.00012 %		
27		fluorene		201-695-5	86-73-7		0.14	mg/kg		0.14	mg/kg	0.000014 %		
28		indeno[123-cd]pyrene		205-893-2	193-39-5		0.31	mg/kg		0.31	mg/kg	0.000031 %		
29		naphthalene	601-052-00-2	202-049-5	91-20-3		0.3	mg/kg		0.3	mg/kg	0.00003 %		
30		phenanthrene		201-581-5	85-01-8		0.93	mg/kg		0.93	mg/kg	0.000093 %		
31		pyrene		204-927-3	129-00-0		0.97	mg/kg		0.97	mg/kg	0.000097 %		
32		phenol	604-001-00-2	203-632-7	108-95-2		<1	mg/kg		<1	mg/kg	<0.0001 %		**<LOD**
											Total:	0.108 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Potentially 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: TP08

Potentially Hazardous Waste
Classified as **17 05 04** or **17 05 03 ***
in the List of Waste

Sample details

Sample Name:
TP08
Sample Depth:
0.5 m
Moisture content:
9.8%
(no correction)

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

Hazard properties (substances considered hazardous until shown otherwise)

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.032%)

Determinands

Moisture content: 9.8% No Moisture Correction applied (MC)

#	Determinand	CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	confirm TPH has NOT arisen from diesel or petrol					☑					
2	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		15 mg/kg	1.32	19.805 mg/kg	0.00198 %		
3	beryllium { beryllium oxide }	004-003-00-8	215-133-1	1304-56-9		0.68 mg/kg	2.78	1.887 mg/kg	0.000189 %		
4	boron { boron tribromide/trichloride/trifluoride (combined) }			10294-33-4, 10294-34-5, 7637-07-2		1.8 mg/kg	13.43	24.174 mg/kg	0.00242 %		
5	cadmium { cadmium sulfide }	048-010-00-4	215-147-8	1306-23-6	1	0.7 mg/kg	1.29	0.9 mg/kg	0.00007 %		
6	chromium { chromium(III) oxide }		215-160-9	1308-38-9		21 mg/kg	1.46	30.693 mg/kg	0.00307 %		
7	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		61 mg/kg	1.13	68.679 mg/kg	0.00687 %		
8	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	120 mg/kg	1.56	187.178 mg/kg	0.012 %		
9	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		0.4 mg/kg	1.35	0.541 mg/kg	0.000054 %		
10	nickel { nickel dihydroxide }	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]		17 mg/kg	1.58	26.851 mg/kg	0.00269 %		

#		Determinand	CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
11		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8				<1	mg/kg	2.55	<2.554	mg/kg	<0.000255 %		<**LOD**
12		zinc { zinc chromate }	024-007-00-3				140	mg/kg	2.77	388.381	mg/kg	0.0388 %		
13		pH			PH		8.2	pH		8.2	pH	8.2 pH		
14		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	1.88	<1.884	mg/kg	<0.000188 %		<**LOD**
15		TPH (C6 to C40) petroleum group			TPH		320	mg/kg		320	mg/kg	0.032 %		
16		acenaphthene		201-469-6	83-32-9		1	mg/kg		1	mg/kg	0.0001 %		
17		acenaphthylene		205-917-1	208-96-8		0.29	mg/kg		0.29	mg/kg	0.000029 %		
18		anthracene		204-371-1	120-12-7		3	mg/kg		3	mg/kg	0.0003 %		
19		benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		9.8	mg/kg		9.8	mg/kg	0.00098 %		
20		benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		8	mg/kg		8	mg/kg	0.0008 %		
21		benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		11	mg/kg		11	mg/kg	0.0011 %		
22		benzo[ghi]perylene		205-883-8	191-24-2		4.4	mg/kg		4.4	mg/kg	0.00044 %		
23		benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		6.1	mg/kg		6.1	mg/kg	0.00061 %		
24		chrysene	601-048-00-0	205-923-4	218-01-9		8.6	mg/kg		8.6	mg/kg	0.00086 %		
25		dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		1.3	mg/kg		1.3	mg/kg	0.00013 %		
26		fluoranthene		205-912-4	206-44-0		16	mg/kg		16	mg/kg	0.0016 %		
27		fluorene		201-695-5	86-73-7		1.1	mg/kg		1.1	mg/kg	0.00011 %		
28		indeno[123-cd]pyrene		205-893-2	193-39-5		4.1	mg/kg		4.1	mg/kg	0.00041 %		
29		naphthalene	601-052-00-2	202-049-5	91-20-3		1.6	mg/kg		1.6	mg/kg	0.00016 %		
30		phenanthrene		201-581-5	85-01-8		9.5	mg/kg		9.5	mg/kg	0.00095 %		
31		pyrene		204-927-3	129-00-0		12	mg/kg		12	mg/kg	0.0012 %		
32		phenol	604-001-00-2	203-632-7	108-95-2		<1	mg/kg		<1	mg/kg	<0.0001 %		<**LOD**
											Total:	0.11 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Potentially 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

Appendix A: Classifier defined and non CLP determinands

confirm TPH has NOT arisen from diesel or petrol

Description/Comments: Chapter 3, section 4b requires a positive confirmation for benzo[a]pyrene to be used as a marker in evaluating Carc. 1B; H350 (HP 7) and Muta. 1B; H340 (HP 11)
Data source: WM3 1st Edition 2015
Data source date: 25/05/2015
Risk Phrases: None.
Hazard Statements: None.

boron tribromide/trichloride/trifluoride (combined) (CAS Number: 10294-33-4, 10294-34-5, 7637-07-2)

Conversion factor: 13.43
Description/Comments: Combines the hazard statements and the average of the conversion factors for boron tribromide, boron trichloride and boron trifluoride
Data source: N/A
Data source date: 06/08/2015
Risk Phrases: R14 , T+ R26/28 , C R34 , C R35
Hazard Statements: EUH014 , Acute Tox. 2 H330 , Acute Tox. 2 H300 , Skin Corr. 1A H314 , Skin Corr. 1B H314

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

Conversion factor: 1.462
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: 17/07/2015
Risk Phrases: R20 , R22 , R36 , R37 , R38 , R42 , R43 , R50/53 , R60 , R61
Hazard Statements: Acute Tox. 4 H332 , Acute Tox. 4 H302 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315 , Resp. Sens. 1 H334 , Skin Sens. 1 H317 , Repr. 1B H360FD , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

dicopper oxide; copper (I) oxide (EC Number: 215-270-7, CAS Number: 1317-39-1)

CLP index number: 029-002-00-X
Data source: Regulation (EU) 2016/1179 of 19 July 2016 (ATP9)
Additional Risk Phrases: N R50/53 , N R50/53 >= 0.25 %
Additional Hazard Statement(s): None.
Reason for additional Hazards Statement(s)/Risk Phrase(s):
10/10/2016 - N R50/53 risk phrase sourced from: WM3 v1 still uses ecotoxic risk phrases
10/10/2016 - N R50/53 >= 0.25 % risk phrase sourced from: WM3 v1 still uses ecotoxic risk phrases

pH (CAS Number: PH)

Description/Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25/05/2015
Risk Phrases: None.
Hazard Statements: None.

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

CLP index number: 006-007-00-5
Data source: Commission Regulation (EC) No 790/2009 - 1st Adaptation to Technical Progress for Regulation (EC) No 1272/2008. (ATP1)
Additional Risk Phrases: None.
Additional Hazard Statement(s): EUH032 >= 0.2 %
Reason for additional Hazards Statement(s)/Risk Phrase(s):
14/12/2015 - EUH032 >= 0.2 % hazard statement sourced from: WM3, Table C12.2

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: 25/05/2015
Risk Phrases: R10 , R45 , R46 , R51/53 , R63 , R65
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

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

CLP index number: 601-023-00-4
Data source: Commission Regulation (EU) No 605/2014 – 6th Adaptation to Technical Progress for Regulation (EC) No 1272/2008. (ATP6)
Additional Risk Phrases: None.
Additional Hazard Statement(s): Carc. 2 H351
Reason for additional Hazards Statement(s)/Risk Phrase(s):
03/06/2015 - Carc. 2 H351 hazard statement sourced from: IARC Group 2B (77) 2000

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: 17/07/2015
Risk Phrases: R36 , R37 , R38 , N R50/53 , N R51/53
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

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: 17/07/2015
Risk Phrases: R22 , R26 , R27 , R36 , R37 , R38
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

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: 17/07/2015
Risk Phrases: R36 , R37 , R38 , R43 , N R50/53
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: 23/07/2015
Risk Phrases: N R50/53
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: 21/08/2015
Risk Phrases: Xn R22 , N R50/53
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: 06/08/2015
Risk Phrases: N R50/53
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: 06/08/2015
Risk Phrases: R40
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: 06/08/2015
Risk Phrases: R22 , R36 , R37 , R38 , R40 , R43 , N R50/53
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: 21/08/2015
Risk Phrases: Xi R36/37/38 , N R50/53
Hazard Statements: Skin Irrit. 2 H315 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Worst case species based on risk phrases

beryllium {beryllium oxide}

Worst case species based on risk phrases

boron {boron tribromide/trichloride/trifluoride (combined)}

Worst case species based on risk phrases

cadmium {cadmium sulfide}

Worst case species based on risk phrases

chromium {chromium(III) oxide}

testing for Cr VI confirmed concentrations <4mg/kg.

copper {dicopper oxide; copper (I) oxide}

Most likely common species

lead {lead chromate}

Worst case species based on risk phrases

mercury {mercury dichloride}

Worst case species based on risk phrases

nickel {nickel dihydroxide}

Worst case species based on risk phrases

selenium {selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex}

Worst case species based on risk phrases

zinc {zinc chromate}

Worst case species based on risk phrases

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}

Worst case species

Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition, May 2015
HazWasteOnline Classification Engine Version: 2016.317.3166.6295 (12 Nov 2016)
HazWasteOnline Database: 2016.315.3165.6292 (10 Nov 2016)

This classification utilises the following guidance and legislation:
WM3 - Waste Classification - May 2015
CLP Regulation - Regulation 1272/2008/EC of 16 December 2008
1st ATP - Regulation 790/2009/EC of 10 August 2009
2nd ATP - Regulation 286/2011/EC of 10 March 2011
3rd ATP - Regulation 618/2012/EU of 10 July 2012
4th ATP - Regulation 487/2013/EU of 8 May 2013
Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013
5th ATP - Regulation 944/2013/EU of 2 October 2013
6th ATP - Regulation 605/2014/EU of 5 June 2014
WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014
Revised List of Wastes 2014 - Decision 2014/955/EU of 18 December 2014
7th ATP - Regulation 2015/1221/EU of 24 July 2015
8th ATP - Regulation (EU) 2016/918 of 19 May 2016
9th ATP - Regulation (EU) 2016/1179 of 19 July 2016
POPs Regulation 2004 - Regulation 850/2004/EC of 29 April 2004
1st ATP to POPs Regulation - Regulation 756/2010/EU of 24 August 2010
2nd ATP to POPs Regulation - Regulation 757/2010/EU of 24 August 2010

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