Stantec

Oxpens River Bridge, Oxford

Ground Investigation Report

Project reference: OXPEN-STN-GEN-ALL-RP-G-0602 P01

On behalf of **Oxford City Council**

OXFORD CITY COUNCIL

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Summary

This Ground Investigation Report presents an evaluation of all appropriate geotechnical and geoenvironmental information together with suggested characteristic values of geotechnical parameters for use in the design of the geotechnical elements for the proposed development of Oxpens River Bridge, Oxford.

SITE LOCATION The site is situated about 0.8 km south-west of Oxford City Centre. The land to the north and south of the River Thames comprises principally park land and riverbank. The River Thames bisects the Site flowing to the south-east. The Great Western Railway and a railway bridge are to the west of the Site.

Historically, the northern part of the Site was mostly vacant land with allotments and a small portion was formerly occupied by railway sidings. The southern part of the Site was vacant until the 1900 when the St Ebbe's Gas Works expanded into the Site. The land was raised by demolition materials sourced from the former gas works to the north of the River Thames. The gas works in the southern part of the Site included rail sidings, coal storage areas, wagon tipplers, coal elevators, a retort house, purifiers, benzole plant, a large oil tank, a compressor house, lagoons and gas holders. By mid 1960s the gasworks had ceased operation and the former gasworks structures were demolished (noting that some of the sub-surface structures may be left in place) and the land became part of Grandpont Nature Park. A historical landfill is recorded to the south and in the southern part of the Site.

GROUND CONDITIONS The natural ground conditions are recorded to comprise Alluvium underlain by the Northmoor Sand and Gravel Member and the Oxford Clay Formation at depth. Made Ground is also present principally associated with the former gas works to the south of the river. The Northmoor Sand and Gravel Member are designated as Secondary A Aquifer. The natural groundwater flow is anticipated to be towards the River Thames.

Summary of Existing Ground Conditions

Strata	Depth to Strata, m bgl (1)	Thickness, m	Typical Description
Topsoil	Ground Level	0.10 to 0.60	Soft dark grey brown slightly sandy slightly gravelly organic CLAY with roots and rootlets. Gravel is fine to medium subangular to subrounded of flint, quartzite, siltstone, and sandstone.
Made Ground - Northern Part	Ground Level to 0.10	0.30 to 3.50	Soft dark brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded brick, concrete, clinker, plastic and flint. Cobbles are of brick and concrete.
Made Ground – Southern Part	Ground Level to 0.10	0.30 to 6.00	Loose to medium dense dark brown and grey varying propositions of clayey sandy GRAVEL with cobbles. Gravel is fine to coarse angular to subrounded of brick, concrete, flint, clinker with fragments of plastic, metal, wood and ceramic. Cobbles of brick and concrete. Locally layers of firm to dark brown and grey sandy gravelly CLAY with frequent cobbles. Gravel is fine to coarse angular to subrounded of brick, concrete, flint, clinker with fragments of plastic, metal, wood and ceramic. Cobbles of brick and concrete. Locally with concrete slabs and brick sub-surface structures.
Alluvium	0.30 to 4.20	Typically – 0.30 to 1.80 Locally – >4.45	Very soft to soft grey and brown sandy silty CLAY.

Strata	Depth to Strata, m bgl (1)	Thickness, m	Typical Description
Northmoor Sand and Gravel Member	0.53 to 6.00	1.30 to 4.55	Medium dense dark orangish brown slightly clayey sandy GRAVEL. Gravel is subrounded to rounded of flint.
Oxford Clay Formation	1.83 to 8.80	>27.38	Stiff to very stiff grey fissured slightly sandy silty CLAY. Fissures are closely spaced, rough and undulating. Apertures are tight to open with frequent dark grey silt infill. Underlain by moderately weak grey MUDSTONE

Note 1) bgl denotes below ground level

Groundwater levels on the Site are typically close to ground level and allowance should be made for controlling inflows of groundwater from any excavation into the River Terrace Deposits, any water within disused drains encountered during the works and surface water inflows during periods of wet weather.

GEOENVIRONMENTAL CONDITIONS Measured concentrations of potential contaminants in the soils on the Site are mostly below the assessment values appropriate for a public open space - park land use. The exceptions relate to locally elevated concentrations of heavy metals and hydrocarbons within the Topsoil and Made Ground. The presence of asbestos containing materials associated with man-made materials in the Topsoil and Made Ground was encountered to the south of the river and locally to the north.

Measured concentrations of potential contaminants in the groundwaters on the Site identified slightly elevated concentrations of heavy metals and cyanide. It is expected that the elevated concentrations of potential contaminants reflect the background quality of the groundwater in the vicinity of the Site owing to the previous land uses of a Gas Works.

It is expected that any Made Ground to be disposed of off-site may, in general, be classified as hazardous waste although additional testing of the material may be required to confirm the actual classification of any material for off-site disposal. The natural soils on the Site are not likely to contain significant concentrations of contaminants and may be classified as inert, with exception of the Alluvium, which also can be classified as Hazardous Waste.

An assessment of the measured concentrations of ground gases indicates any gas source is unlikely to generate sufficient concentrations or gas volumes to represent a risk to Human Health or buildings.

GEOTECHNICAL CONSIDERATIONS The proposed development comprises the construction of a new footbridge across the River Thames. The principal geotechnical considerations will be the strength and compressibility of the founding soils and, hence, the foundation requirements for the proposed structure.

Pile Foundations For the ground conditions present at the Site, bored and cast-in-place piles formed using conventional rotary auger techniques or continuous flight auger techniques will be required to support the foundations loads of the proposed bridge. Preliminary estimates of the working capacity of 350, 450 and 600 mm uniform diameter bored piles are given in this report.

Pavement Design Pavements carried on suitable depth of capping/sub-base should prove adequate and a CBR value of 2.0 per cent for the near surface soils is recommended for pavement design.

Buried Concrete It is recommended that concrete in contact with the ground is designed for the mobile groundwater within the Alluvium and Northmoor Sand and Gravel Member the values correspond to Design Sulphate Class DS-1 and ACEC Class AC-1s. And for Oxford Clay Formation below 1.0m bgl, Design Sulphate Class DS-4 and ACEC Class AC-3s as defined by BRE (2005).

The summary contains an overview of the key findings and conclusions. However no reliance should be placed on any part of the summary until the whole of the report has been read.

1 Introduction

1.1 Preamble

1.1.1 Stantec UK Limited (Stantec) has been commissioned by Oxford City Council (the Client) to undertake a Ground Investigation Report to support the planning application and the design for a proposed footbridge over the River Thames known as Oxpens River Bridge, Oxford (the Site).

1.2 Background

1.2.1 Previously, a desk study review of readily available published information was carried out to assess the ground conditions on the Site and the potential for contamination to be present associated with previous and current uses of the Site and the surrounding areas. This work reviewed historical ground investigation data that covered parts of the Site to enable a qualitative contaminated land risk assessment on the geoenvironmental conditions at the Site. The findings of the study are presented in a separate Phase 1 Ground Condition Assessment prepared by Stantec (STN, 2023).

1.2.2 Subsequently, an intrusive ground investigation has been carried out to provide information on the ground conditions, including the concentrations of potential contaminants, present on the Site to inform the design of pavements, infrastructure and foundations for the scheme. The factual results of the investigation are presented in a separate report prepared by Endeavour Drilling Limited (EDL, 2022). The fieldwork and laboratory testing were carried out under the technical direction of Stantec.

1.2.3 Unless stated otherwise, information from the desk study and ground investigation report has not been included in this report and, where referenced, the reports presenting this information should be read in conjunction with this report.

1.3 Scope of Works

1.3.1 The scope of work performed by Stantec comprises the preparation of a Ground Investigation Report in general accordance with the requirements of BS EN 1997-2 (2007).

1.3.2 The Ground Investigation Report presents an assessment of the ground conditions, together with recommended characteristic values of geotechnical properties for use in the design of the geotechnical elements of the proposed development. The report also presents comments on the ground conditions in relation to the design and construction of the geotechnical elements of the proposed development.

1.3.3 The report also presents an assessment of the risks associated with any existing contamination in the ground to human health, the environment and the proposed structures. UK legislation on land contamination from historical activities is principally contained in Part 2A of the Environmental Protection Act, 1990 (which was inserted into the Act by Section 57 of the Environment Act 1995). The Regulations and Statutory Guidance that accompanied the Act, including the Contaminated Land (England) Regulations 2006, have been revised with the issue of the Contaminated Land (England) (Amendment) Regulations 2012 (SI 2012/263) and the Contaminated Land Statutory Guidance for England 2012.

1.3.4 Under the National Planning Policy Framework (2023), the broad approach, concepts and principles behind land contamination management advocated by the Part 2A regime are applied to the determination of planning applications. The Land Contamination: Risk Management (LC:RM) (EA, 2023) guidance which is based on the now superseded Model Procedures for the Management of Contaminated Land (CLR11) (EA, 2004) provides references to established technical and procedural practice.

1.3.5 The geoenvironmental assessment in this report follows the above reference guidance.

1.3.6 It should be noted that the scope of ground investigation works was designed by Stantec to cover a number of options for the proposed footbridge and associated work. Since the ground investigation works were carried out, the layout of the footbridge and associated works have been finalised. As a result, a number of exploratory holes are situated outside of the Red Line application boundary. Nevertheless, the information obtained is considered to be representative of the ground conditions on Site and suitable to support the planning application and the design of the proposed bridge and associated work.

1.4 Limitations

1.4.1 Guidance on the context of this report and any general limitations or constraints on its content and usage are given in a separate guidance note included after the text of this report.

2 The Site

2.1 Introduction

2.1.1 A summary of the characteristics the Site and overall site description including location, history, current use and geology are presented in the sections below. Further details of the history and present layout of the Site are given in the Phase 1 Ground Conditions Assessment prepared by Stantec (STN, 2023).

2.2 Site Location and Description

2.2.1 The site is situated about 0.8 km south-west of Oxford City Centre. The land comprises parkland with a number of footpaths crossing the Site to the north and south of the River Thames. The River Thames bisects the Site flowing to the south-east. The Great Western Railway and a railway bridge are to the west of the Site. The Site is approximately centred at National Grid Reference SP 507 056. A Site Location Plan is presented as **Figure 1**.

2.2.2 An Exploratory Hole Plan, showing the extent of the site is presented as **Figure 2**.

2.3 Site History

2.3.1 A summary of the history of the site is presented in the section below. Further details of the history including historical maps and plans and are given in the Phase 1 Ground Conditions Assessment prepared by Stantec (STN, 2023).

2.3.2 By 1850 the Oxford and Rugby Railway (now named Great Western Railway) was constructed with the railway and the rail bridge recorded at their current location to the west of the Site.

2.3.3 Historically, the northern part of the Site was mostly vacant parcel of floodplain land which became recreation ground. A small watercourse named St Ebbe's Bathing Place crossed the site connected the River Thames and Castle Mill Stream to the east. By the mid-1950s St Ebbe's Bathing Place was backfilled and the northern part of the Site has been used as a floodplain parkland.

2.3.4 The southern part of the Site was vacant until the 1900 when the St Ebbe's Gas Works expanded into the Site. The land was raised by demolition materials sourced from the former gasworks to the north of the River Thames. The main part of the gasworks was situated to the south of the Site with a section of the northern gas holders encroaching to the southern part of the Site.

2.3.5 By mid 1960s the gasworks had ceased operation and the former gasworks structures were demolished, with some of the sub-surface structures potentially left in place, and the land become part of Grandpont Nature Park.

2.3.6 By the mid-1980s the Oxford Ice Rink was constructed off site to the north-west of the of the northern part of the Site.

2.4 Geology

Published Geology

2.4.1 The 1:50,000 scale geological sheet (BGS, 1982) indicates that the Site is underlain by Superficial Deposits of Alluvium with the Solid Geology of the Oxford Clay Formation recorded at depth. The Northmoor Sand and Gravel Member (formerly denoted 1st Flood Plain Terrace

Deposits) is recorded in the vicinity of the Site and is likely to be present between the Oxford Clay Formation and the Alluvium.

2.4.2 Made Ground is denoted in the southern part of the Site and along the rail line to the west. It is expected that the Made Ground is associated with land rising at the former gasworks and the railway embankment. In addition, it is expected that Made Ground is locally present elsewhere associated with current and other historical developments on the Site.

2.5 Hydrogeology

2.5.1 The Environment Agency classifies the Alluvium as a Secondary B Aquifer whilst the Northmoor Sand and Gravel Member is classified as a Secondary A Aquifer. The Oxford Clay Formation is classified as an unproductive stratum.

2.5.2 The Site is not situated within a Source Protection Zones (SPZ) set out by the Environment Agency for the protection of groundwater abstractions.

2.6 Hydrology

2.6.1 The River Thames is classified by the Environment Agency as a Main River.

2.6.2 Bulstake Stream to the west and upstream of the Site and Castle Mill Stream to the east and downstream of the Site are also classified by the Environment Agency as a Main River.

2.6.3 The section of the River Thames between Evenlode to Thame is monitored by the Environment Agency and is classified as having a Moderate ecological status between 2013 and 2019, and a Good chemical status between 2013 and 2015 and fail between 2016 and 2019 for priority hazardous substances recorded including tributyltin, mercury, perfluorooctane sulphonate (PFOS), and polybrominated diphenyl ethers (PBDE).

2.6.4 Flood defences are recorded along the northern bank of the River Thames and both sides of the two tributaries. In addition, a sheet pile wall is present along the southern bank of the River Thames.

2.7 Proposed Development

2.7.1 The proposed footbridge is situated between Grandpont Nature Park, south of the river, and the meadows, north of the river. The bridge is to be designed as a dry route in times of flood to provide a continuous pedestrian route that would remain dry during a flood event.

2.7.2 The footbridge will require construction access from the south via Grandpont and via the floodplain in the north.

2.7.3 The proposed bridge and access ramps will be prefabricated off-site and installed on site. It is expected that the structure and the access ramps will be supported on pile foundations.

2.7.4 The footbridge will provide a greater capacity link from the city centre, station and proposed Oxpens development through to Grandpont and Osney Mead facilitating future redevelopment.

2.7.5 It is understood that it is proposed to reduce a portion of the site to the north of the river to 55.3m AOD for flood compensation works.

3 Ground Investigations

3.1 Historical BGS Borehole Locations

3.1.1 The British Geological Survey archives contain records of eleven boreholes sunk in 1969 to the south and north of the River Thames at and in the immediate vicinity of the Site as part of a ground investigation for the proposed Oxford Relief Road Scheme D47. The boreholes were sunk to between 13.7 and 20.1 m below ground level.

3.1.2 Copies of the borehole records have been obtained from the BGS archives and are reproduced in the Phase 1 Ground Conditions Assessment produced by Stantec UK (STN, 2023)**.** The locations of the boreholes are shown on the Exploratory Hole Plan presented as **Figure 2**.

3.2 Previous Ground Investigations

3.2.1 The ground conditions on the northern part of the Site have been investigated through two separate investigations in 2014 by Idom Merebrook Limited and in 2021 by Listers Geotechnical Consultants Limited.

2014 Idom Merebrook Investigation

3.2.2 The ground investigation was carried out to the north of the River Thames, west of the site boundary, in relation to a proposed residential development on the land off Oxpens Road.

3.2.3 The ground investigation comprised five window sample boreholes to 5.0 m below ground level and eight trial pits to 3.0 m below ground level. All of the exploratory holes are situated outside of the Site boundary.

3.2.4 The exploratory hole records are presented in the Geo-Environmental Assessment produced by Idom Merebrook (Idom, 2014). The location of the exploratory holes are shown on the Exploratory Hole Plan presented as **Figure 2**.

2021 Lister Geo Investigation

3.2.5 The ground investigation was carried out to the north of the River Thames including the northern part of the Site by Listers Geo on behalf of Oxford West End Development Limited in relation to the redevelopment of the land for residential uses (LG, 2021).

3.2.6 The ground investigation comprised six boreholes sunk by cable percussion techniques to 25.0 m depth, five trial pits to between 2.2 and 3.5 m depth and eleven window sample, boreholes to between 1.0 and 4.0 m depth. All of the exploratory holes are situated outside of the Site boundary.

3.2.7 The exploratory hole records are presented the Phase 2 Ground Investigation Reports produced by Listers Geo (LIS, 2021a and 2021b). The location of the exploratory holes are shown on the Exploratory Hole Plan presented as **Figure 2**.

3.3 Recent Ground Investigation

3.3.1 The ground conditions on Site have been investigated by an intrusive ground investigation to provide information for the development of the Site. The scope of the works is summarised in the following sections of the report. The factual results of the investigation are presented in a separate report prepared by Endeavour Drilling Ltd (EDL, 2022) which should be read in conjunction with this report.

Aim of the Investigation

3.3.2 The aim of the investigation was to confirm the ground conditions within the area of Site such that informed decisions on the proposed development of the Site can be made. The principal aims of the investigation were to determine:

i. The geotechnical characteristics of the ground principally for the design of the bridge proposed foundation, and the footpath upgrade.

ii. The presence and depth of any groundwater in the soils.

iii. The nature of any existing contamination of the ground, groundwater and surface water.

3.3.3 To satisfy the aims of the investigation, the proposed design of the ground investigation allowed for:

i. The sinking of 10 no. boreholes between 12.0 and 35.0 m below existing ground level with standard penetration testing and the recovery of soil samples.

ii. The sinking of 12 no. window sampling boreholes to a depth of 6.0 m below existing ground level with standard penetration testing and the recovery of soil samples.

iii. The excavation of 2 No. trial pits to a depth of 4.5 m below existing ground level to examine the near surface soils and the recovery of soil samples.

iv. The excavation of 2 No. trial trenches to a depth of 4.5 m below existing ground level to seek to examine the side walls of the former gas holders and the near surface soils including the recovery of soil samples.

v. The excavation of 6 No. observation pits to a depth of 1.5 m below existing ground level to examine the near surface soils and foundations to the existing railway bridge.

vi. Laboratory testing to determine geotechnical properties and concentrations of potential contaminants of the soils and waters.

3.3.4 The scope of the investigation was intended to provide information on the ground conditions to inform the design of the foundations, geotechnical elements of the proposed development, drainage strategy and to constitute an exploratory investigation for potential contaminants as outlined in BS 10175 (2017).

3.3.5 With regard to the investigation for potential contamination of the ground, a combined targeted and non-targeted investigation strategy was adopted for the Site. Adopting this strategy, exploratory holes were located within the constraints of access on the Site, with additional exploratory holes placed in the location of the former works, which may have elevated concentrations of potential contamination present.

3.3.6 The number of exploratory holes was selected from consideration of the recommendations given in BS 10175 (2013) for exploratory investigations for sites with a moderate potential for contamination to be present making allowance for the expected relatively homogenous conditions on Site. Sampling depths were selected so that representative material from various strata encountered were recovered for laboratory testing so that information on the distribution of potential contaminants in the soils in the Site could be determined.

Fieldwork

3.3.7 The fieldwork for the ground investigation was carried out between 17th January and 10th February 2022 and comprised the sinking of nine boreholes, sixteen windowless sampling boreholes, two trial trenches, one trial pit and six foundation inspection pits.

3.3.8 A number of exploratory holes were required to be repositioned and one borehole cancelled owing to the presence of possible badger sets to the north and south of the river. In addition, a number of exploratory holes were terminated at a shallow depth owing to the presence of obstructions in the southern part of the Site.

3.3.9 Four of the boreholes (Boreholes 101, 103, 104 and 105) were drilled using a combination of dynamic sampling and rotary coring techniques to a maximum depth of 34.95 m below ground level. Five boreholes (106, 107, 108, 109 and 110) were sunk using cable percussive techniques to a maximum depth of 25.9 m below ground level. Borehole BH102 situated in the southern bank was cancelled owing to the potential presence of a badger set in this part of the Site. The ground conditions were investigated by the recovery of open drive UT100 samples, prepared core subsamples, disturbed small and bulk samples and standard penetration tests carried out in each of the boreholes using a split spoon or solid cone.

3.3.10 Two falling head permeability tests were carried out in BH103 and BH105 at 7.0 m and 5.0 m, respectively. Two rising head permeability tests were carried out in BH107 and BH109 at 3.0 m bgl. A third rising head test was carried out in BH104; however, the rate of inflow was greater than then pump flow rate and therefore, the water column could not be drawn down sufficiently to be able to carry out the test at this location.

3.3.11 The windowless sample boreholes were sunk using a track mounted rig to a maximum depth of 6.45 m below ground level. The ground conditions were investigated by the recovery of disturbed small and bulk samples, and standard penetration tests carried out using a split spoon sampler or solid cone.

3.3.12 A number of window sample boreholes were terminated at a shallow depth on obstructions in the southern part of the Site. Window Sample WS101 terminated on a concrete slab at 0.66 m depth; the hole was relocated 9.5 m west and named WS101A which was terminated at 1.94 m on a layer of dense bitumen gravel. Window Sample WS103 terminated on a concrete slab between 0.7 m bgl; the hole was relocated 2.0 m and named WS013A. WS105 refused on encountering a concrete slab from 0.8 m bgl; the hole was relocated 1.0 m away and named WS105A. Window Sample WS107 terminated at 1.65 m bgl in gravel of concrete, brick, clinker, siltstone and flint. An addition window sampling borehole WS107A which was terminated at 3.05 m depth in very stiff to hard desiccated CLAY.

3.3.13 On completion a standpipe was constructed in selected boreholes to allow groundwater levels and concentrations of ground gases to be monitored and samples of groundwater recovered for chemical analysis. The boreholes were backfilled and sealed with bentonite pellets below the base of the installations.

3.3.14 The trial pit and trial trenches were excavated using a hydraulic excavator to depths between 1.70 m and 3.20 m below existing ground levels to obtain detailed information on the near-surface ground conditions and determine the extent of each of the gas holders along the southern bank.

3.3.15 The records of the exploratory holes are presented in Appendix B, C, D and E of the factual report (EDL, 2022) and their locations are shown on the Exploratory Hole Plan, **Figure 2**.

In-situ Soil Screening

3.3.16 Volatile Organic Compounds Screening for the presence of Volatile Organic Compounds (VOCs) was carried out using a photo-ionisation detector (PID) at each exploratory hole location. The screening was carried out on 1.0 m intervals in Made Ground and in the upper 1.0 m of the underlying natural soils.

3.3.17 The PID screening is a qualitative method. The numerical output of which cannot be directly compared to measured soil concentrations of contaminants of concern. Nevertheless, PID readings are a useful field tool for assessing the potential presence of elevated VOCs in the soil.

Laboratory Testing

3.3.18 A programme of geotechnical laboratory soils testing was carried out to verify the visual identification and classification, and to determine the physical properties of selected samples of the materials encountered. The testing was schedule by Stantec and carried out in accordance with BS 1377 (1990) by i2 analytical Ltd, who hold UKAS accreditation for geotechnical soils testing carried out. The results of the geotechnical testing are presented in the factual report (EDL, 2022).

3.3.19 A programme of geochemical laboratory testing was carried out on selected soil samples to determine the concentrations of a range of commonly occurring potential contaminants and the contaminants associated with former gasworks in the southern part of the Site (BS 18400, 2018 & DOE, 1995). Samples of soil for geochemical testing were taken from the exploratory holes and samples of water recovered from the installed standpipes. The geochemical analysis were scheduled by Stantec and carried out by i2 analytical Ltd. The geochemical analysis used methods that are accredited by MCERTS where available. The results of the geochemical analysis are presented in Appendix H of the factual report.

Monitoring

3.3.20 Each of the standpipes installed in the boreholes as part of the investigation have been purged by abstraction by at least three times the calculated standpipes volumes, with water samples taken on one occasion. The standpipes have also been monitored to determine the water level and concentrations of methane, carbon dioxide and oxygen together with gas flow rates and differential and atmospheric pressure.

3.3.21 In addition, an oil/water interface meter was used for the detection of potential floating light non-aqueous phase liquids (LNAPL) or sinking dense non-aqueous phase liquids (DNAPL).

3.3.22 The monitoring was carried out on three visits at nominal one-week intervals from 22 February and 9 March 2022. The monitoring results are presented in Appendix F and G of the factual report (EDL, 2022).

4 Ground Conditions

4.1 Stratigraphy

4.1.1 The ground conditions in the area of the Site, as revealed by the ground investigations, comprise Made Ground, overlying Alluvium, Northmoor Sand and Gravel Member, and the Oxford Clay Formation. These ground conditions are in agreement with the published geological information and known history of the Site.

4.1.2 Based on the information from previous and recent ground investigations, the ground conditions encountered are summarised in the following table

Table 4.1 Summary of Ground Conditions

Strata	Depth to Strata, m bgl (1)	Thickness, m	Typical Description
Topsoil	Ground Level	0.10 to 0.60	Soft dark grey brown slightly sandy slightly gravelly organic CLAY with roots and rootlets. Gravel is fine to medium subangular to subrounded of flint, quartzite, siltstone, and sandstone.
Made Ground - Northern Part	Ground Level to 0.10	0.30 to 3.5	Soft dark brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded brick, concrete, clinker, plastic and flint. Cobbles are of brick and concrete.
Made Ground – Southern Part	Ground Level to 0.10	0.30 to 6.00	Loose to medium dense dark brown and grey varying propositions of clayey sandy GRAVEL with cobbles. Gravel is fine to coarse angular to subrounded of brick, concrete, flint, clinker with fragments of plastic, metal, wood and ceramic. Cobbles of brick and concrete. Locally layers of firm to dark brown and grey sandy gravelly CLAY with frequent cobbles. Gravel is fine to coarse angular to subrounded of brick, concrete, flint, clinker with fragments of plastic, metal, wood and ceramic. Cobbles of brick and concrete. Locally with concrete slabs and brick sub-surface structures.
Alluvium	0.30 to 4.20	Typically – 0.3 to 1.8 Locally – >4.45	Very soft to soft grey and brown sandy silty CLAY.
Northmoor Sand and Gravel Member	0.53 to 6.00	1.30 to 4.55	Medium dense dark orangish brown slightly clayey sandy GRAVEL. Gravel is subrounded to rounded of flint.
Oxford Clay Formation	1.83 to 8.80	>27.38	Stiff to very stiff grey fissured slightly sandy silty CLAY. Fissures are closely spaced, rough and undulating. Apertures are tight to open with frequent dark grey silt infill. Underlain by moderately weak grey MUDSTONE

4.1.3 Details of the soils encountered are given in the following sections and are illustrated on Schematic Geological Sections included as **Figure 3** of this report. The line of section is shown on the Exploratory Hole Plan, **Figure 2**. The details of the strata encountered have been determined from the findings of the previous and recent investigations.

4.1.4 It should be noted that a number of exploratory hoes are situated outside of the site, however, these are considered to be generally representative of the ground conditions at the site and therefore are included and discussed in the report.

4.1.5 Comments and the nature and extent of each stratum are presented in the following sections of this report. Where characteristic values of parameters for geotechnical design are suggested in the discussion on ground conditions below, reference should be made to terminology and definitions given in the BS EN 1997-1 (2013) and BS EN 1997-2 (2007) as appropriate.

4.2 Made Ground

4.2.1 **Descriptions** Made Ground was encountered at 31 of the 34 locations investigated in the recent investigation to between 0.7 and 6.0 m below existing ground level. Made Ground was absent in three of the boreholes to the north of the River Thames where Topsoil overlies the superficial deposits directly. Made Ground was encountered within the historical boreholes within 27 of the 42 boreholes identified within the site boundary or in close vicinity.

4.2.2 **Northern Part** - The Made Ground was typically found to comprise soft dark brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded brick, concrete, clinker, plastic and flint. Cobbles are of brick and concrete. The Made Ground to the north of the River Thames was investigated between 0.3 and 3.5 m below ground level.

4.2.3 **Southern Part** - The Made Ground was typically found to comprise loose to medium dense dark brown and grey varying propositions of clayey sandy GRAVEL with cobbles. Gravel is fine to coarse angular to subrounded of brick, concrete, flint, clinker with fragments of plastic, metal, wood and ceramic. Cobbles were composed of brick and concrete. Local layers of firm to dark brown and grey sandy gravelly CLAY with frequent cobbles were recorded. The Made Ground was investigated between ground level and to a maximum depth of 6.0 m bgl.

4.2.4 A number of subsurface structures were encountered in the Southern Part of the Site including concrete slabs, brick structures and the base of a former gas holder. The foundations of the rail bridges were investigated by a number of inspection pits excavated alongside of the rail bridges support. Further details including factual records, sketches and photographs are provided in the factual records provided in the Factual Report (EDL, 2022).

4.2.5 **Material Properties** Results of particle size distribution (PSD) analyses on recovered samples of Made Ground to the south of the River Thames are presented on **Figure 4**. The material tested comprised up to 25 per cent of cobbles, and between 34 and 46 per cent of gravel, 28 and 41 per cent of sand and 13 and 33 per cent of fines (i.e., silt and clay).

4.2.6 **Penetration Resistance** Test Values of normalised penetration resistance normalised for hammer efficiency SPT N_{60} value determined by standard penetration testing are presented as a plot against elevation on **Figure 5**. The N_{60} values are variable, typically between 0 and 30, and locally above 50, corresponding typically to very loose to medium dense for the granular soils and are indicative of the variable in-situ relative density of the Made Ground materials.

4.2.7 **Olfactory and Visual Signs of Contamination** In general, olfactory and visual signs of unusual solids and liquids associated with potential contamination were not noted during the investigation to the north of the river. However, hydrocarbon and burnt odours, blue crystals and materials suspected to contain asbestos were noted locally in the Made Ground to the south of the river. A summary of the olfactory and visual signs of contamination noted during the ground investigation is presented in the table below:

Table 4.2 Summary of olfactory and visual signs of Contamination

Location	Strata	Depth, m bgl[1]	Description
BH104	Made Ground	1.40 to 2.80	Weak burnt odour
WS101A	Made Ground	1.94	Strong Hydrocarbon odour
WS104	Made Ground	0.85	Suspected fragment of Asbestos
		1.60 to 2.45	Pockets of blue crystals
WS105A	Made Ground	3.10 to 3.15	Pockets of blue crystals
WS107A	Made Ground	1.80	Suspected Asbestos Containing Materials - pocket of fibrous orange pipe lagging
WS109	Made Ground	3.10 to 3.45	Pockets of blue crystals
TT101	Made Ground	1.80 to 2.40	Frequent cobble sized fragments of suspected asbestos roof sheeting.
TT102	Made Ground	1.10	Corrugated asbestos cement sheeting
		2.40 to 3.20	Strong hydrocarbon odour

Note (1) metres below ground level

4.2.8 **Characteristic Values** To allow for a mixture of materials within the Made Ground, an effective angle of internal friction of 27 degrees with drained cohesion of zero are recommended for use in design analysis. This value has been selected from consideration of visual description and data published in Stark et al. (2005). Bulk unit weight of this material may be taken to be 18.0 kN/m³.

4.3 Alluvium

4.3.1 **Description** Alluvium was encountered in 13 of the 34 exploratory holes completed during the recent ground investigation. Alluvium was encountered at 3 locations to the north of the River Thames at the surface and in 4 locations where the Made Ground was fully penetrated. All 5 locations to the south of the river that encountered Alluvium recorded it where the Made Ground was fully penetrated. Alluvium was also encountered either beneath the Topsoil or Made Ground at 34 of the 42 locations from the previous ground investigations and the BGS boreholes located on in the vicinity of the Site, one historical borehole within the site boundary recorded alluvium. It is expected that where the Alluvium is absent, it is a result of either being excavated or mixed with manmade materials during previous developments of the Site.

4.3.2 The Alluvium was investigated from surface to a maximum depth of 6.45 m below ground level, however, was not fully penetrated at this location. The Alluvium was typically described as brown slightly gravelly sandy silty CLAY. Locally granular horizons comprising fine to coarse angular to subangular flint GRAVEL were recorded within the Alluvium between 2.0 and 2.6 m bgl in WS103A, and 4.75 and 4.90 m bgl within WS105A.

4.3.3 Pockets of peat were recorded at two locations between 4.75 and 6.45 m bgl in WS103A, comprising pseudo fibrous peat. Pockets of peat were also recorded between 3.5 and 3.7m and 6.5 and 6.6m within BH105 comprising amorphous pseudofibrous peat.

4.3.4 **Classification** Results of classification testing are presented on an Atterberg Limits Chart on **Figure 6**, with measured values of liquid limit between about 100 and 120, and a plastic limit of 45, with corresponding values of plasticity index of 57 to 73. This indicates the material is typically of an extremely high plasticity silt. Measured values of moisture content are between about 17 and 79 per cent; these values reflect the variable nature and degree of saturation of the material.

4.3.5 **Material Properties** Results of particle size distribution analyses on recovered samples of Alluvium are presented on **Figure 4**. The cohesive material tested comprised up to 1 per cent gravel, between 3 and 34 per cent of sand, and 65 and 96 per cent fines (i.e. silt and clay). The silt fraction was recorded between 23 and 30 per cent and the clay fraction was recorded between 42 and 66 per cent. One sample of granular Alluvium was tested and comprised 51 per cent gravel, 30 per cent sand and 19 per cent fines (i.e., silt and clay). It should be noted that part of the fines fraction can be lost in the samples recovered using light cable percussive boring techniques hence the measured particle size distributions may not be fully representative of the in-situ conditions.

4.3.6 **Undrained Shear Strength** Visual examination of the material indicates the material is typically very soft or soft in consistency although locally the material was recorded to be firm in consistency. It is expected that the local variation noted in consistency reflects the variable nature and degree of saturation of the material. Measured values of undrained shear strength, as determined by in situ hand shear vane testing, are presented as a plot against reduced level on **Figure 7** together with values of undrained shear strength determined using an empirical correlation with SPT N values (Stroud, 1989). The measured and determined values are variable, typically being between 5 and 40 kPa, and locally up to 210 kPa.

4.3.7 **Characteristic Values** From consideration of the measured values, determined values and properties of the material, a uniform value of undrained shear strength of 25 kPa is considered appropriate. From consideration of the correlation with plasticity index (BS 8004, 2015) and visual description of the material, an effective angle of internal friction of 18 degrees is suggested for use in design analysis. For this material, effective cohesion may be taken to be zero in the design analysis.

4.3.8 A value of bulk unit weight of 17.0kN/m³ may be taken for this material based on BS 8004.

4.4 Northmoor Sand and Gravel Member

4.4.1 **Description** The Northmoor Sand and Gravel Member was encountered in 11 of the 12 exploratory holes completed as part of the recent ground investigation where the Made Ground and/or the Alluvium was fully penetrated.

4.4.2 **Material Properties** Results of particle size distribution analyses on recovered samples of Northmoor Sand and Gravel Member are presented on **Figure 4**. The material tested comprised up to 7 per cent of cobbles, and between 24 and 84 per cent of gravel, 12 and 56 per cent of sand and 2 and 21 per cent of fines (i.e., silt and clay). It should be noted that part of the fines fraction can be lost in the samples recovered using light cable percussive boring techniques hence the measured particle size distributions may not be fully representative of the in-situ conditions.

4.4.3 **Penetration Resistance** Values of penetration resistance determined by standard penetration testing and corrected for overburden pressure and hammer efficiency are presented as a plot against reduced level on **Figure 5**. The corrected SPT N values are typically in the range of between 10 to 40 indicating a typically medium dense or dense situ. Locally values were recorded below 10 and above 50 indicating a variable density within the stratum. The lower values were measured at the upper part of the stratum and may reflect disturbance of this material during the previous or current development of the Site.

4.4.4 **Characteristic Values** Peak and critical state values of effective angle of friction of 39 and 36 degrees are considered appropriate for use in design analysis. These values have been selected from consideration of the particle angularity, material grading, and values of penetration resistance using on the correlations in BS 8004 (2015).

4.4.5 Bulk unit weight of the Northmoor Sand and Gravel Member may be taken to be 20 kN/m³ based on BS 8004.

4.5 Oxford Clay Formation

4.5.1 **Description** The Oxford Clay Formation was encountered in boreholes where the Made Ground and Superficial Deposits were fully penetrated. The Oxford Clay Formation was investigated from 3.5 m below ground level to a maximum depth of 35.0 m below ground level.

4.5.2 The Oxford Clay Formation typically comprised fissured slightly sandy silty CLAY. Mudstone was encountered in one exploratory hole from 31.0 m below ground level, described as moderately weak grey MUDSTONE.

4.5.3 **Classification** Results of classification testing are presented on an Atterberg Limits Chart on **Figure 6**, with measures values of liquid and plastic limit between about 34 and 59, and between 24 and 25, respectively, with corresponding values of plasticity index of 17 to 34. This indicates the material is typically of an intermediate to high plasticity clay. Measured values of moisture content are between about 13 and 28 per cent.

4.5.4 **Material Properties** Results of particle size distribution analyses on recovered samples of Oxford Clay Formation are presented on **Figure 4**. The material tested comprised locally up to 1 per of gravel 2 and 5 per cent sand, and between 94 and 98 per cent fines (i.e., silt and clay). The silt fraction was recorded between 35 and 83 per cent and the clay fraction was recorded between 11 and 63 per cent.

4.5.5 **Undrained Shear Strength** Visual examination of the material indicates the clay is typically stiff or very stiff in consistency. Measured values of undrained shear strength, as determined by laboratory unconsolidated undrained triaxial testing of 100 mm diameter specimens, are presented as a plot against reduced level on **Figure 7** together with values of undrained shear strength determined using an empirical correlation with SPT N_{60} values (Stroud, 1989). Some of the values of undrained shear strength determined using SPT N_{60} correlation from the historical ground investigations is noted to be significantly elevated compared with derived and measured values from the current investigation, therefore these have been discounted. The adopted measured and derived values are typically being in the range of 100 kPa at 51 m OD increasing gradually to 400 kPa at 23 m OD.

4.5.6 **Characteristic Values** From consideration of the measured values and properties of the material, an undrained shear strength of 100 kPa at 51.0 m AOD increasing to 300 kPa at 23.0 m AOD, as drawn on **Figure 7**, is considered appropriate.

4.5.7 From consideration of correlation with plasticity index (BS 8004, 2005) and visual description of the material, an effective angle of internal friction of 23 degrees is suggested for use in design analysis. These values have been selected from the consideration of a characteristic plasticity of 35. For this material, effective cohesion may be taken to be zero in the design analysis.

4.5.8 A value of bulk unit weight of 19.0 kN/m³ may be taken for this material based on BS 8004.

4.6 Groundwater

4.6.1 **Groundwater Entries** During the previous ground investigations groundwater was encountered in Made Ground and Northmoor Sand and Gravel Member between 0.3 to 1.0 m and 0.9 to 4.6 m below ground level, respectively.

4.6.2 During the recent ground investigation (EDL, 2022), groundwater was encountered in the near surface soils between 1.1 and 6.0 m below ground level, typically in the Alluvium or Northmoor Sand and Gravel Member and rose to between 0.4 and 4.8 m bgl. Three groundwater entries were also recorded within the Made Ground between 0.9 and 1.4 m bgl and rose to between 0.5 and 1.35 m bgl. Further groundwater entries were noted in the boreholes within the Oxford Clay Formation at 9.6 and 4.1 m, rising to 1.16 and 0.1 m below ground level, respectively.

4.6.3 **Groundwater Levels** On completion of the previous ground investigations; groundwater levels were measured between 0.57 to 2.87 m below ground level (54.9 to 55.3 m AOD). The standpipes in the previous ground investigations were installed between 3.0 and 8.0 m below ground level Made Ground and Oxford Clay Formation.

4.6.4 On completion of the fieldwork for the recent ground investigation (EDL, 2022); groundwater levels between existing ground level and 4.78 m below ground level (55.06 and 54.80 m AOD) were measured in the standpipes installed in the natural stratum. Three standpipes were installed in the Made Ground down to a maximum of 4.00m below ground level, were recorded to be dry on all three monitoring visits.

4.6.5 **Permeability Testing** Rising and falling head permeability testing was carried out in the Northmoor Sand and Gravel Member in four selected boreholes. Two falling head permeability tests were carried out at 5.0 and 7.0 m below ground level and two rising head tests were carried out at 3.0 m below ground level. Results of the tests indicate the permeability rate within the Northmoor Sand and Gravel Member was between 1.7×10^{-4} and 5.9×10^{-6} m/sec.

4.6.6 **Characteristic Values** From consideration of the ground conditions and the geomorphological setting on the Site, it is recommended that a groundwater level of 55.3m AOD is assumed for the design analysis across the whole Site. It should be noted, however that locally higher water levels may be present following periods of prolonged rainfall or surface water flooding.

5 Geoenvironmental Conditions

5.1 Introduction

5.1.1 The Stantec Methodology for ground condition assessment is presented in **Appendix A**. This methodology has been prepared in general accordance with current technical guidance with specific reference to the latest guidance issued by the Environment Agency named Land Contamination: Risk Management (LC:RM) (EA, 2023).

5.1.2 In accordance with the Stantec methodology for assessing ground conditions site specific concentrations of potential soil and groundwater contaminants have been compared with published / generic criteria to screen the data. If the concentration is below the screening criterion for the specified end use the parameter is not deemed to be a hazard. Exceedance of the criterion indicates that the parameter is a possible hazard and either that further assessment or risk management is required.

5.1.3 A copy of Stantec rationale for selection of generic assessment criteria is also presented in **Appendix B**.

5.2 Contamination

Screening – Volatile Organic Compounds

5.2.1 Screening for the presence of Volatile Organic Compounds was carried out using a photo-ionisation detector (PID) at each exploratory hole location. The numerical output of PID cannot be directly compared to measured soil concentrations of contaminants of concern. Nevertheless, PID readings above 100 ppm are considered to be an indicative of potential presence of elevated Volatile Organic Compounds in the soil.

5.2.2 The PID readings were typically below 10 ppm. A single reading of 270 ppm reading was recorded on a sample taken from the Northmoor Sand and Gravel Member in BH105 within a sample taken at 5.0 m below ground level. The elevated volatile organic compounds did not correspond with any odours recorded at this location and depth.

Contamination Assessment Regime

5.2.3 **Soils** The results of the geochemical testing on the soil samples have been compared to the Category 4 Screening Levels (C4SL) for public open space – park land use prepared under the auspices of Defra (CL:AIRE, 2014 & 2021). Where a C4SL is not available the concentrations were compared against the Land Quality Management Ltd (LQM) Suitable 4 Use Levels (S4UL) for a public open space – park (CIEH, 2015).

5.2.4 The additive effect of the hydrocarbon fractions is considered by calculating a hazard quotient for each carbon banding which is the concentration divided by the fraction S4UL criterion for the selected land use. The hazard quotients are added together to give a Hazard Index for each sample assessed. A Hazard Index that exceeds unity can be indicative of a potentially significant human health hazard.

5.2.5 **Groundwaters** Under the EC Groundwater Daughter Directive the quality of groundwater is related to the potential to adversely impact the quality of surface waters and the potential for use as a water resource. On this basis the quality of groundwaters has been assessed in relation to the directions to the Environment Agency in regard to the implementation of the Water Framework Directive (WFD) (DEFRA, 2010) and the UK drinking water quality standards (DETR, 2000). However, given that the groundwaters in the southern part of the Site do not feed directly into surface waters owing to the presence of a sheet pile wall along the southern bank of the river and are not abstracted for drinking, the selected criteria are not strictly applicable, and in the context of this appraisal, solely provide a conservative framework for assessing the quality of the groundwater on the Site.

Geochemical Testing

5.2.6 Geochemical testing was carried out on a number of samples of soil for the majority of the contaminants identified in the Department of Environment Industry Profile for Gas Works, Coke Works and other Coal Carbonisation Works. For clarity the testing did not include a specific phenol suite noting that Semi Volatile Organic Compounds (SVOCs) with tentatively identified compounds (TICs) were scheduled, some metals (colbalt, iron, manganese, magnesium, molybdenum, vanadium), constituents of coal tar other than polyaromatic hydrocarbons (PAHs) and some inorganics (sulphides, carbonates and phosphate). A summary of the testing undertaken is provided below.

Table 5.1 The numbers of test per sample type

Parameter	Soil	Leaching	Groundwater	Surface water
Arsenic	32	6	5	2
Cadmium	32	6	5	2
Calcium	32	6	5	2
Chromium (hexavalent)	32	6	5	2
Copper	32	6	5	2
Lead	32	6	5	2
Mercury	32	6	5	2
Nickel	32	6	5	2
Selenium	32	6	5	2
Zinc	32	6	5	2
Ammonium (as NH4+)	-	-	5	2
Cyanide (Total Free and Complex)	7	6	-	-
Chloride	-	-	5	2
Sulphate (Water Soluble)	-	-	5	2
Total Sulphate	47	-	-	-
Phenol	-	-	5	2
TPH - CWG (C5-35) Aliphatic/Aromatic Split	32	-	5	2
TPH Total (C6-40)				
BTEX	32	-	5	2
Speciated PAH (USEPA 16 compounds) by GCMS	34	-	5	2
Soil Organic Matter	-	-	-	-
Asbestos screen	32	-	-	-
pH	58	-	5	2
Dissolved Organic Carbon	-	-	-	2
Semi Volatile Organic Compounds SVOC + TICs	11	-	-	-
VOCs inc. BTEX, MTBE & Vinyl Chloride (VC) + TICs	11	-	5	2

5.2.7 The results of the analysis carried out on the soil samples are summarised on **Table 1 and 2 in Appendix C**. Full results of the chemical analysis are presented in the factual report of the ground investigation (EDL, 2022).

5.2.8 The results of the analysis carried out on the 5 samples of groundwater, 2 samples of surface water and 6 leachate samples are summarised on **Table 1** in **Appendix D**. Full results of the chemical analysis are presented in the factual report on the ground investigation (EDL, 2022).

5.2.9 In addition, 10 samples of the near surface Made Ground were scheduled for Waste Acceptance Criteria (WAC) full suite to allow a preliminary determination of the waste classification of any material to be disposed of off-site as part of the proposed redevelopment. Results of the WAC test analysis are summarised below. Full results of the chemical analysis are presented in the factual report of the ground investigation (EDL, 2022).

6 Assessment of Contamination

6.1 Introduction

6.1.1 This section of the report discusses the measured concentrations of contaminants recorded during the ground investigation and assesses the geoenvironmental conditions on the site with respect to the proposed development and the environment from potential hazards posed by these conditions.

6.1.2 **Human Health (end-user)** - The measured concentrations of potential contaminants in the soil samples tested have been compared against the screening criteria for public open space – park land use, and are summarised in **Appendix C**. These criteria are considered suitably protective for this receptor, noting that the nearest residential property is 60m east of the Site boundaries. The Tier 2 GAC routinely adopted by Stantec for assessing the potential for harm to human health via ingestion of waters are taken from Water Supply (Water Quality) Regulations 2016 (S.I. 2016/614), as amended by the 2018 Amendment Regulations (S.I 2018/706) unless otherwise indicated. The Tier 2 GAC adopted by Stantec for assessing the potential for chronic human health risk from the inhalation of vapours from volatile contaminants in groundwater are taken from a report published by the Society of Brownfield Risk Assessment (SoBRA, 2017).

6.1.3 **Human Health (construction workers and neighbours)** - The measured concentrations of potential contaminants in the soil samples tested have been compared against the screening criteria presented in the Society of Brownfield Risk Assessment (SoBRA) report entitled "Development of Acute Generic Assessment Criteria (AGAC) for Assessing Risks to Human Health from Contaminants in Soil". Because chronic risks often occur at lower doses than acute risks, they are often the key risk drivers but there are situations where this is not adequately protectionary for acute dose exposure.

6.1.4 **Potential to Harm Property – Animal and Crop (Landscaping)** - The results of the laboratory analysis undertaken on the recovered soil samples have been compared to the criteria for phytotoxic contaminants presented in BS 3882:2015 (Specification for topsoil and requirements for use) and in ICRCL 70/90.

6.1.5 **Surface Water** - The results of the liquid tests have been compared to the Environmental Quality Standards (EQS) for freshwaters or the Site-specific EQS calculated using the M-BAT tool (see below).

Metals Bioavailability

6.1.6 Bioavailable EQS have been developed for UK Specific Pollutants Copper, Zinc and Manganese and the EU priority substances Lead and Nickel.

6.1.7 The bioavailability of a metal depends on a number of physico-chemical factors which govern both metal behaviour and the interactions of the toxic forms of the metals with a biological receptor.

6.1.8 The bioavailable EQS corresponds to the bioavailable fraction (BioF) of dissolved metal in a sample, as determined by the physico-chemical characteristics of the water and can be calculated using a biotic ligand model (BLM) or other calculation method. To assess compliance, the bioavailable fraction of dissolved metal can be compared to the EQS bioavailable. However, bioavailable metal is not the same metric as dissolved metal as only a fraction of the dissolved metal will usually be bioavailable.

6.1.9 It is very difficult to measure the bioavailable concentration of a metal directly. Biotic Ligand Models (BLMs) are a predictive tool that can take account of water quality parameters such as pH, and calcium to determine the amount of bioavailable metal present. However, the complexity of the models, the runtime per sample, input data requirements and level of operator skill needed to interpret the model outputs mean that few regulatory organisations have adopted the full BLMs. The UK has developed simplified Metal Bioavailability Assessment Tool (M-BAT) for copper, zinc, nickel, and manganese.

6.1.10 Predicted No Effect Concentrations (PNEC) i.e., Site-specific EQS have been calculated using the M-BAT tool (**Appendix E**). The PNEC for each of Copper, Zinc and Nickel were calculated using the Upstream and Downstream samples' recorded pH, Calcium and Dissolved Organic Carbon (DOC) concentrations.

6.1.11 The minimum, maximum and median PNEC are presented in the table below.

Table 6.1 Calculated PNEC

Determinand	Upstream PNEC (µg/l)	Downstream PNEC (µg/l)	Bioavailable Fraction
Copper	17.57	19.70	0.06/0.05
Zinc	33.13	39.16	0.33/0.28
Nickel	10.83	11.38	0.37/0.35
Lead	7.31	9.38	0.16/0.13

Surrogate Marker Approach

6.1.12 In accordance with our guide in order to justify the use of a surrogate marker assessment criterion (C4SL for benzo(a)pyrene and S4UL coal tar) the LQM PAH Profiling Tool is used by Stantec to assess the similarity of the PAH profile in a soil sample to that of the toxicity study.

6.1.13 The tool calculates the relative proportions of the eight genotoxic PAHs and plots them on two charts relative to composition of the two coal mixtures used by Culp et al. The plots identify which samples, if any, deviate significantly from coal tar using a plus/minus an order of magnitude limits suggested by HPA.

6.1.14 The PAH profiling tool output provided in **Appendix F** demonstrates that Benzo(a)Pyrene is a suitable surrogate marker as the majority of the samples are within either ±2.5x the mean of the Culp data or between 2.5x and 10x the mean of the Culp data. None of the samples plotted as greater than 10x the mean of the Culp data. Stantec has therefore used the C4SL for benzo(a)pyrene as a surrogate marker for the carcinogenic PAHs, i.e., benzo(a)pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(ah)anthracene, indeno(123-cd) pyrene and benzo(ghi) perylene.

6.2 Review of Soils – Potential to Harm Human Health

6.2.1 The measured concentrations of potential contaminants, as summarised on Table 1 in **Appendix C**, are mostly below the selected assessment values appropriate for public open space – park land use. The exceptions comprise slightly elevated levels of some metals and polyaromatic hydrocarbons (PAHs), together with asbestos detected in a number of samples across the site, which are discussed in the following text.

Metals

6.2.2 A review of the metal concentrations indicated that in general the measured concentrations of metals are below the corresponding screening values appropriate for protection of human health in a public open space park land use.

6.2.3 The exceptions comprise elevated concentrations of the following within the southern part of the Site:

- Arsenic – Concentrations of Arsenic above the screening value were detected in 2 of 33 samples tested. Both samples were recovered from BH105, which is situated within the red line boundary One exceedance was recorded in the Northmoor Sand and Gravel Member at 4.2 m bgl and the one was recorded in the Made Ground at 0.3 m bgl. The exceedances were 210 and 320 mg/kg compared with the assessment criteria of 170 mg/kg.

- Lead – Concentrations of Lead slightly above the screening value were detected in 1 of the 33 samples. The slight exceedance was recorded within WS106, outside the red line boundary, within the Made Ground at 0.3 m bgl. The exceedance was 1400 mg/kg compared with the assessment criteria of 1300 mg/kg.

6.2.4 The results of the recent the investigations align with the results from the 2014 and 2021 investigations were elevated concentrations of Arsenic and Lead were detected in samples of Made Ground and Alluvium to the west of the northern section of the Site.

6.2.5 Metals (arsenic and lead) are taken forward as a potential hazard for human receptors and are discussed further in **Section 8**.

Cyanide

6.2.6 None of the seven samples tested for the Cyanide suite recorded Free Cyanide above the LOD of 1 mg/kg. Two of these samples were of the soils where blue crystals were observed.

Polynuclear Aromatic Hydrocarbons (PAHs)

Double Ratio Plots

6.2.7 In accordance with our guide, the LQM PAH Double Ratio Plot Tool has been used to assist in understanding the possible / likely source(s) of the PAH contamination.

6.2.8 PAH mixtures can be associated with a diverse range of contaminative sources, including petrogenic (e.g., oil spills and coal storage), pyrolytic (e.g., ash, clinker, soot and atmospheric deposition of smoke, coal tars, etc) and phytogenic (e.g., plant-derived peat, etc). Due to the prevailing chemical processes, the profile of PAH mixtures generated at high temperatures (i.e., pyrolytic sources) differ from those formed at more moderate temperatures (i.e., petrogenic sources).

6.2.9 Concentration ratios of certain of PAH congeners can be used to infer the possible source of PAH mixtures. By plotting each sample in terms of two such ratios, it is possible to tease apart mixtures with different PAH profiles and tentatively assign a possible source based on where these samples cluster within the plot. A range of possible ratios can be used and collectively these methods are referred to as "double ratio plots".

6.2.10 The plots provided in **Appendix G** indicate that the majority of samples with positive detections of PAHs plot within the "*grass/wood/coal combustion and coal tar and creosote signatures*" region of the plot, and also commonly within the "*Carbonisation and Coke Oven Tar*" region. This is consistent with the known land use history of the Site in the southern section of the Site.

6.2.11 Review of the Polycyclic Aromatic Hydrocarbons analysis (PAHs), as summarised in **Table 1** in **Appendix C**, indicate in general the measured concentrations of PAHs are below the corresponding screening values appropriate for public open space park land use.

6.2.12 The exceptions comprise elevated concentrations of the following:

- Benzo(a)pyrene – Concentrations of benzo(a)pyrene above the screening value were detected in 7of 33 samples, of which 4 are located within the Site boundary from samples recovered from BH104 and BH105. All exceedances were detected in the Made Ground between 0.05 and 2.10 m bgl to the south of the River Thames. The exceedances were between 13 and 36 mg/kg compared with the assessment criteria of 11 mg/kg.

- Benzo(b)fluoranthene – Concentrations of benzo(b)fluoranthene above the screening value were detected in 6 of the 33 samples, of which 3 are located within the Site boundary within BH104 and BH105. The majority of the exceedances were recorded within the Made Ground and a single sample of Topsoil, all sampled from south of the River Thames. The exceedances were between 15 and 42 mg/kg compared with the assessment criteria of 13 mg/kg.

- Dibenzo(a,h)anthracene – Concentrations of dibenzo(a,h)anthracene above the screening value were detected in 10 of the 33 samples, of which 6 are located within the Site boundary, 5 in the south and 1 in the north of the Site. The exceedances were recorded within the Made ground and 1 was recorded in a sample of Topsoil, most of which were to the south of the river, however, 2 exceedances were recorded to the north in BH108 and BH110. The exceedances were between 1.3 and 6.9 mg/kg compared with the assessment criteria of 1.1 mg/kg

6.2.13 Where present the PAH exceedances are found at various depths in the Made Ground and Topsoil, typically in the south of the Site, with 1 exceedance in the north of the Site. The elevated concentrations of individual PAHs are taken forward as a potential hazard for human receptors and are discussed in **Section 8**.

6.2.14 Review of the Coal Tar (BaP as Surrogate) identified 12 exceedances out for 43 samples for public open space park. The measured concentrations were between 4.6 and 36 mg/kg compared to the assessment criteria of 4.4 mg/kg. This is consistent with the known land use history of the Site.

6.2.15 PAHs are taken forward as a potential hazard for human receptors and are discussed further in **Section 8**.

Asbestos

6.2.16 Asbestos containing materials were identified in 8 of the 34 exploratory holes as part of the recent fieldwork, these are highlighted in **Table 4.2**. These locations limited to the southern section of the Site, outside the red line boundary.

6.2.17 The laboratory screening for asbestos identified asbestos fibres in 11 of the 33 samples tested within the Topsoil or Made Ground between 0.05 and 5.00 m below ground level. These locations were typically limited to the south of the Site boundary, with exception to 1 sample recovered from BH106 recovered from north of the River Thames within the Site boundary.

6.2.18 The samples screened contained a mixture of loose fibres, cement, bitumen, and sheeting. The asbestos identified comprised principally chrysotile and amosite with two samples also testing positive for crocidolite.

6.2.19 Concentrations of asbestos were recorded between < 0.001 per cent (laboratory reporting limit of detection) and up to 0.608 per cent by weight.

6.2.20 Asbestos in the Topsoil and Made Ground is taken forward as a potential hazard for human receptors and are discussed further in **Section 8**.

Previous Ground Investigations

6.2.21 **Metals** The results of the recent the investigations align with the results from the 2014 and 2021 investigations were elevated concentrations of Arsenic and Lead were detected in samples of Made Ground and Alluvium.

6.2.22 **PAHs** The results of previous ground investigations align with the results from the recent ground investigation with elevated levels of PAHs identified above in samples of Made Ground and Alluvium.

6.2.23 **Asbestos** Asbestos was not detected in the samples screened as part of the 2014 Idom Investigation or the 2021 Listers Geo investigations to the north of the River Thames.

6.3 Review of Soils – Potential to Harm Animal and Crop

6.3.1 Review of the metal concentrations indicated that in general the measured concentrations of metals are below the corresponding screening values as presented on **Table 2 in Appendix C**, the exceptions comprise the following:

- Copper – Concentrations of copper are above the screening value in 1 of the 33 samples tested, of which is outside the Site boundary to the south. The exceedance relates to a sample of Made Ground at 1.60 m bgl in WS104, recording a value of 330 mg/kg compared to the assessment criteria of 200 mg/kg.

- Zinc – Concentrations of zinc are above the screening value in 4 of the 33 samples tested, of which only 1 is located in the southern part of the Site, the remaining exceedances are located to the south of the Site. The exceedances relates to the Made Ground between 0.05 and 1.60 m. The exceedances were recorded between 340 and 650 mg/kg compared with the assessment criteria of 300 mg/kg.

6.4 Review of Liquids – Potential to Harm Surface Water Ecology

6.4.1 The measured concentrations of potential contaminants, as summarised on Table 1 in **Appendix D,** are mostly below the selected assessment values appropriate for Freshwater. The following exceedances within the liquid samples (surface water, groundwater and eluates from leaching tests) are recorded as following:

- Cadmium - Concentrations of cadmium above the screening value were detected in all six samples tested for leachability, of which, all are located to the south of the river and 2 located on Site. All exceedances were detected in the Made Ground between 0.3 and 4.7 m bgl. The exceedances were between 0.14 and 0.72 µg/l compared with the assessment criteria of 0.08 µg/l mg/kg. All the surface water and groundwater samples tested were all below the assessment criteria.

- Chromium – Concentrations of Chromium (Total) have been compared with the assessment criteria of Chromium Hexavalent for freshwater. Using with criteria, concentrations of chromium were recorded in two out of six samples tested for leachability. Both exceedances were recorded in the Made Ground between 1.6 and 3.2 m bgl, in boreholes off site, to the south of the Site boundary. The exceedances were 4.2 and 6.4 µg/l compared to the assessment criteria of 3.4 µg/l. All the surface water and groundwater samples tested were all below the assessment criteria.

- Lead – Concentrations of lead above the screening value were detected in one out of six samples tested for leachability. The sample was recorded in the Made Ground at 3.2 m bgl in WS109 to the south of the Site boundary. The exceedance was recorded at 8.2 µg/l compared to the assessment criteria of 7.31 µg/l. All the surface water and groundwater samples tested were all below the assessment criteria.

- Ammoniacal Nitrogen as NH_4 – Concentration were detected above the screening value in a single sample of groundwater, located off site. Both surface water samples were below the assessment criteria. The sample from BH103 measured 2300 µg/l compared to the assessment criteria of 260 µg/l.

- Ammoniacal Nitrogen as NH_3 – Concentrations were detected above the screening value in two samples of groundwater to the south of the river. Both surface water samples were below the assessment criteria. The samples from BH103 (offsite) and BH105 (onsite) measured 2172 µg/l and 227, respectively, compared to the assessment criteria of 200 µg/l.

6.5 Review of Liquids – Potential to Harm a Water Abstraction Resource (Actual or Future)

6.5.1 The measured concentrations of potential contaminants within groundwater samples tested, as summarised on Table 1 in **Appendix D**, have been compared against the selected assessment values appropriate for human consumption. The following exceedances are recorded:

- Water Soluble Sulphate – Concentrations of Water-Soluble Sulphates exceeded the screening criteria in two of the five samples of groundwater. Both samples were taken from south of the river, with BH105 located on-site and WS103 located offsite. One sample was taken from a standpipe within the Alluvium, the other in the installation within the Alluvium and Northmoor Sand and Gravel Member. The result within WS103 recorded the highest exceedance at 1010 mg/l, approximately 4 times the assessment criterion.

- Arsenic – Concentrations of Arsenic above the screening value were detected in one out of six soil samples tested for leachability, located in the southern part of the Site. The sample was recorded in the Made Ground at 0.3 m bgl. The exceedance was recorded at 13 µg/l compared to the assessment criteria of 10 µg/l. All the surface water and groundwater samples tested were all below the assessment criteria.

- Ammoniacal Nitrogen as NH_4 – Concentrations were detected above the screening value in a single sample of groundwater, located offsite, to the south of the site boundary. The sample from BH103 measured 2300 µg/l compared to the assessment criteria of 500 µg/l. Both surface water samples were below the assessment criteria.

- Cyanide – Concentrations of Cyanide above the screening value were detected in all six soil samples tested for leachability. The samples were recorded in the Made Ground between 0.3 and 4.7 m bgl. The exceedances were recorded between 92 and 290 µg/l compared to the assessment criteria of 50 µg/l.

Previous Ground Investigations

6.5.2 **Metals** The results of the recent the investigations align with the results from the 2014 and 2021 investigations were elevated concentrations of Copper, Nickel and Zinc detected in samples groundwater. Elevated levels of Arsenic and Boron were also reported in the 2021 investigation.

6.6 Ground Gas and Petroleum Hydrocarbon Vapours

Ground Gases

6.6.1 The range of concentrations of ground gases measured during the post fieldwork monitoring in the standpipes installed as part of the recent ground investigation (EDL, 2022) in the Made Ground and Northmoor Sands and Gravels Member is summarised in the table below.

Table 6.2 Measured Concentrations of Ground Gases

Gas	Made Ground	Northmoor Sands and Gravels Member
Methane, %v/v	0.0 to 0.2	0.0 to 0.2
Carbon Dioxide, %v/v	2.0 to 5.7	0.0 to 5.9
Oxygen, %v/v	16.1 to 19.2	12.9 to 21.4
Hydrogen Sulfide (ppm)	0	0
Carbon Monoxide (ppm)	0.0 to 2.0	1.0 to 8.0
Gas Flow, l/hr	0.0 to 0.1	-9.8 to 0.1

6.6.2 Ground gas monitoring was carried out on three occasions between 22 February and 09 March 2022.

6.6.3 Only the ground gas data from the shallow wells installed in the Made Ground (WS102, WS105A and WS109) where the groundwater table is below the response zone are considered for the assessment for the gassing regime at the Site. In accordance with the guidance given in BS8485 (2015) any boreholes where the response zone (slotted section) is completely below the groundwater is not considered to be representative of the gas conditions in the vadose zone (unsaturated ground above the water table), and that data has not been used to assess the ground gas regime.

6.6.4 The measured concentrations of ground gases in the shallow wells with response zones in the Made Ground indicate variably elevated concentrations of carbon dioxide and corresponding slightly depleted oxygen concentrations. The source of the elevated carbon dioxide concentrations is likely to be related to biodegradation of hydrocarbons and organic matter within the Made Ground and the Alluvium below.

6.6.5 Negligible steady-state gas flow rates were recorded, with a maximum detected flow rate of 0.1 l/hr recorded across the monitoring period.

6.6.6 As advised in current guidance (BS8485, 2019) as the maximum carbon dioxide concentration exceeds 5%v/v consideration has been given to whether the gas regime CS should be increase. The data has been plotted onto a Ternary Plot using the LQM Ternary Plot Tool, presented in **Appendix H**, to identity the composition of the ground gases encountered during the monitoring to help further characterise the ground gas regime.

6.6.7 The Ternary Plot shows that all the data is plotting within the bottom left corner which is indicative of microbial respiration of organic materials. The gas source is unlikely to generate sufficient concentrations or volumes to represent a risk to Human Health or buildings.

Petroleum Hydrocarbon Vapours

6.6.8 The presence of Petroleum Hydrocarbon Vapours were measured during each of the monitoring rounds using a photo-ionisation detector (PID). The results across the installation ranged from 0.0 to 1.0 ppm. There was one notable recording during the fieldwork of in the Northmoor Sand and Gravel Member. Given the potential for petroleum hydrocarbon vapours to be present from residues generated by the former Gas Works, adaptive working methods are required for in-ground works including:

- Use of toolbox talks prior to any excavation with specific coverage of hydrocarbon vapours, so site workers are aware of potential vapours, triggers and the measures to be implemented.
- Use of a dynamic risk assessment during any excavations works.

- Use of a watching brief by an independent technical specialist during the higher risk's activities or in specific areas of the site where there may be offsite receptors, including potential boundary monitoring.

- Have an agreed protocol in case of hydrocarbon vapours being detected during the works which may affect site workers, neighbours or the environment.

7 Preliminary Classification for Off Site Disposal

7.1 Introduction

7.1.1 A preliminary waste classification assessment has been carried out to inform the potential costs and constraints posed by the off-site disposal of waste soil generated through the proposed development.

7.1.2 To enable classification, the soil laboratory data has been assessed in general accordance with the European Waste Framework Directive (2008/98/EC) using the methodology outlined within WM3 v1.2 (EA, 2021). Identification of whether a waste is non-hazardous or hazardous is an iterative process. Firstly, it is determined if the material is indeed a waste. Secondly, it is assigned a list of waste (LoW) code and then a determination is made of whether the waste is hazardous, non-hazardous, or is a mirror entry and therefore requires further assessment.

7.1.3 In addition to the hazardous classification, the results of WAC testing are also required by the waste receiver under environmental permitting regulations.

7.2 Waste Streams

7.2.1 It is assumed that any excavated soils will not have a defined use once excavated. Therefore, under the guidance provided in WM3 v1.2, it will be considered to be surplus and a waste requiring off-site disposal or treatment. If these circumstances alter and the re-use of excavated soil is required this should be undertaken following an appropriate regulatory framework, such as a Waste Exemption, or by following the procedures laid out in the ‘Definition of Waste: Development Industry Code of Practice Guidance’ (CL:AIRE, 2011). Any re-use of materials should be subject to strict compliance with an approved materials management plan.

7.2.2 Based upon the encountered ground conditions (as summarised in Table 4.1) the anticipated soil waste streams are as follows.

Table 7.1 Anticipated Soil Waste Streams

Soil Waste Streams
Topsoil
Made Ground (Northern Part)
Made Ground (Southern Part)
Alluvium
Northmoor Sand and Gravel Member

7.2.1 It should be noted that during the fieldwork, bulk fragments of suspected ACM were encountered within 3 of the 34 of the exploratory hole location. Laboratory testing identified 11 of the 34 exploratory holes contain asbestos fibres, with 10 of the 11 all in the southern part of the site, the exception was BH106. Without any segregation prior to disposal then a mixed LoW code would be applicable to these soils.

7.2.2 Construction and demolition wastes are classified under Chapter 17 of WM3 v1.1. Given the composition of the anticipated waste streams to be generated through the development earthworks the following LoW codes could apply:

- 17-05-03* (soils and stones containing hazardous substances),
- 17-05-04 (soils and stones other than those mentioned in 17-05-03*), and

- 17-06-05* (construction materials containing asbestos) (for segregated asbestos board).

7.2.3 These codes are classified as mirror entries and additional classification of their chemical properties is required to confirm the appropriate LoW code is attributed.

7.3 Preliminary Classifications

7.3.1 The preliminary classification has been carried out using a web-based software programme, HazWasteOnline™. The software is maintained, updated, and operated by One Touch Data Limited, and utilises the recorded total concentrations of various contaminants to carry out the assessment. The software is compliant with WM3 v1.2 and 2008/98/EC. Copies of the HazWasteOnline™ classification reports[1] are presented in **Appendix I.**

7.3.2 A summary of indicative LoW codes that could be applied to the identified soil waste streams are provided in Table 7.2, below.

Table 7.2 Indicative LoW codes

Soil Waste Stream	Indicative LoW Code(s)	Classification
Topsoil	17-05-04	Non-hazardous waste
Made Ground (Northern Part)	17-05-04	Non-hazardous waste
Made Ground (Southern Part)	17-05-03*, 17-05-04, 17-06-05*	Mixed hazardous and non-hazardous waste
Alluvium	17-05-04	Non-hazardous waste
Northmoor Sand and Gravel Member	17-05-04	Non-hazardous waste

7.3.3 Segregation of the individual waste streams and between the different materials within each stream that have differing LoW codes will be required, otherwise a mixed code will need to be assumed thereby limiting disposal opportunities, noting that the segregation of the ACM will not address the metal concentrations in some samples that were above the Hazardous threshold.

7.3.4 Segregation to separate the soils from ACM could either be carried out by hand or mechanically. Any adopted segregation method will need to be compliant with any relevant health and safety requirements including the requirements of the Control of Asbestos Regulations 2012 and potentially undertaken under an Environmental Permit.

7.4 Waste Acceptance Criteria (WAC)

7.4.1 Ten samples were subject to the WAC testing suite, spread across the following soil waste streams.

Table 7.3 WAC Testing Locations

Soil Waste Stream	No. of WAC Tests
Topsoil	2
Made Ground (Southern Part)	7
Alluvium	1

[1] References SFSJG-TDTH0-VW15Z, QHRBV-NUYXL-EECJ1, ZM0MK-X0HGL-ON7DB, 977BY-TY33F-5BP0T, P30YF-VEWJY-M24WU

7.4.2 The concentrations of the determinands tested are generally below the limiting values for classification as inert waste outlined within the waste acceptance procedures (DEFRA, 2005).

7.4.3 The exceptions comprise the following

- Loss on Ignition – Values for Loss on Ignition were recorded above the assessment criteria for Hazardous Waste on 2 of the 10 samples tested. The samples were of Topsoil and Alluvium, recorded as 16 and 11 per cent, respectively, compared with the limiting criteria of 10 per cent.

- Total Organic Carbon (TOC) – Values of TOC were recorded above the assessment criteria for Inert in 1 sample, Non-Hazardous in 1 sample and Hazardous in 1 sample. The sample above the criteria for Inert was a sample of Made Ground at 3.3 % compared to 3 %; the Non-Hazardous was a sample of Topsoil at 5.5 % compared to 5 %; and hazardous sample of Topsoil at 7 % compared to 6 %.

- Speciated PAH – Values of Speciated PAHs were recorded above the assessment criteria for Inert Waste in 2 of the 10 samples. The samples were of Topsoil and Alluvium, recorded as 143 and 109 mg/kg, respectively, compared with the limiting criteria of 100 mg/kg.

- Arsenic – Values of Arsenic were recorded above the assessment criteria for inert waste in 1 of the 10 samples. The sample of Topsoil was recorded at 0.85 mg/kg compared with the limiting criteria of 0.5 mg/kg.

- Total Sulphate – Values of Total Sulphate were recorded above the assessment criteria for inert waste in 1 of the 10 samples. The sample of Made Ground was recorded at 1700 mg/kg compared with the limiting criteria of 1000 mg/kg.

7.4.4 A summary of the WAC assessment is presented in Table 7.4, below.

Table 7.4 Summary of WAC Assessments

Soil Waste Stream	Acceptable as:
Topsoil	Stable non-reactive hazardous waste in non-hazardous landfill; or; Hazardous waste landfill
Made Ground (Southern Part)	Inert waste landfill; or; Stable non-reactive hazardous waste in non-hazardous landfill; or; Hazardous waste landfill
Alluvium	Hazardous waste landfill

7.4.5 It is possible that some form of treatment and re-testing of the identified soil waste streams may be appropriate following excavation prior to off-site disposal. This is contingent on there being sufficient room to stockpile and segregate the different waste streams whilst treating. Waste acceptance is ultimately the decision of the waste receiver, and confirmatory analysis may be required at the receiver's discretion, based on all of the test results and any specific permit requirements.

7.5 Data Gaps and Limitations

7.5.1 The assessment detailed in the above sections is purely preliminary and should be used as indicative of the final waste classifications that will need to be produced for any waste soils being disposed of from the site. It has been assumed that any excavated soils will be classified as a waste and no assessment for the suitability for re-use has been carried out.

7.5.2 It should be noted that loose asbestos fibres were recorded within the soils of the Topsoil material stream. The recorded concentration of fibres within the samples analysed was below the hazardous waste limit. However due to the non-homogenous nature of asbestos fibres dispersed within soil, it is recommended that further testing and analysis of the Topsoil is undertaken prior to disposal to ensure a correct classification. Given the presence of fibres there is also a potential to encounter bulk ACM within this waste stream. If ACM is present, then a mixed LoW code will need to be applied to this waste stream. Alternatively, segregation of the bulk ACM should be carried out and treated as a separate waste stream with the LoW code 17-06-05*.

7.5.3 No assessment on the potential classification or WAC testing of the Oxford Clay Formation has been carried out. Should this material become a surplus material waste stream then further sampling, analysis, and classification of these soils will be required.

7.5.4 No samples of the Made Ground in the northern part of the Site or of the Northmoor Sand and Gravel Member were subject to WAC testing, and further testing of these waste streams will be required prior to disposal.

7.5.5 The preliminary assessment has been carried out using the data that was collected as part of the Tier 2 Environmental Risk Assessment, and as such testing and assessment of additional determinands may be required in the future. The northern part of the site was noted to have been formerly occupied by allotments and railway sidings, and the southern part of the site formerly occupied a gasworks and a historical landfill (STN, 2021). As such the following minimum suites should be carried out across the northern and southern parts of the site to inform a full waste soil classification assessment.

Table 7.5 Minimum Soil Laboratory Testing Suites for a Full Waste Soil Classification Assessment

Determinand	Northern Part	Southern Part
Metals (As, Ba, Be, Ca, Cd, Cr [III and VI], Hg, Mn, Mg, Ni, Pb, Se, V, Zn)	✓	✓
Polycyclic Aromatic Hydrocarbons (PAHs) [USEPA-16 and coronene]	✓	✓
Petroleum hydrocarbons (TPH), BTEX[2], and MTBE[3]	✓	✓
Ammonia	-	✓
Asbestos	✓	✓
Herbicides / Pesticides[4]	✓	-
Sulphate	✓	✓
Cyanide (Free, complex, and thiocyanate)	-	✓
Chlorinated solvents	-	✓
Volatile Organic Compounds (VOCs) and Semi- Volatile Organic Compounds (SVOCs)	✓	✓

[2] Benzene, Toluene, Ethylbenzene, and Xylene (m-, o-, p- isomers)

[3] Methyl tert butyl ether

[4] Confirmation of the specific herbicides and pesticides that were used on-site should be sought, otherwise the worst-case scenario of herbicides or pesticides that are classified as persistent organic pollutants (POPs) should be assumed.

7.6 Commentary on the Preliminary Waste Classification

7.6.1 It should be noted that the above conclusions relate to the specific samples tested during this investigation, and therefore, material excavated during construction will not necessarily have the same classification. It is therefore recommended that testing from individual stockpiles is carried out prior to transport off the site.

7.6.2 The Landfill Regulations require landfill operators to ensure that all waste (apart from inert waste) accepted at their sites has been pre-treated where feasible. In this case suitable treatment is expected to comprise separation of the waste.

7.6.3 Where off-site disposal is required, it is recommended that excavated spoil is disposed of at regular intervals during the works to limit surface water run-off from stockpiled materials.

7.6.4 Stockpiled material must be well managed and kept on an area of hardstanding located down gradient of surface water drainage that may potentially discharge to a watercourse. It is recommended that any stockpiled material is covered to prevent rainfall infiltration, run off, and leachate and dust generation. Stockpiles should be secured when not in use to prevent third party access.

7.6.5 Landfills and waste treatment/ recovery facilities will require full details of all laboratory data, confirmatory testing and compliance with WM3 for waste classification including WAC analysis and may request further testing prior to disposal/ acceptance confirmation.

8 Tier 2 Generic Quantitative Risk Assessment

8.1 Introduction

8.1.1 To assess the potential risk from the proposed development in relation to the quality of the ground and groundwater, a qualitative risk assessment has been carried out utilising a Conceptual Model and 'source-pathway-receptor' to identify significant pollutant linkages. The assessment has been carried out by considering both historical information and the findings of the ground investigation including a review of site-specific data against applicable screening criteria.

8.1.2 The hazard identification and Conceptual Model (CM) presented in this section is based on the environmental settings, historical and current land use and the data review in **Section 7** undertaken in accordance with BS 10175:2011+A2:2017 Investigation of Potentially Contaminated Sites - Code of Practice. For clarity BS 10176 2020. Taking soil samples for determination of volatile organic compounds was not followed and potential limitations in the VOC data is acknowledged.

8.1.3 The Tier 2 Generic Risk Assessment (GQRA) presented in this Section has been prepared in accordance with the Environment Agency’s Land Contamination: Risk Management (EA, 2021), which has replaced the previous guidance CLR11 Model Procedures for the Management of Contaminated Land.

8.1.4 For the purposes of this study the potential for a significant source, pathway or receptor being present has been assessed in terms of their probability and magnitude as being very low, low, moderate, high or very high. The geoenvironmental risk is determined by the interrelationship between the potential for a source of contamination to be present, the potential for migration along a given pathway, and the significance of potential receptors for any plausible source-pathway-receptor linkage. This approach allows the probability and magnitude of the possible consequences that may arise as a result of a hazard to be assessed and possible unacceptable risks to be identified.

8.1.5 The methodology developed and adopted by Stantec for the assessment of risks and hazards associated with existing contamination in the ground is presented in **Appendix A** of this report.

8.2 Hazard Identification

8.2.1 Based on the ground investigations the following potential hazards have been considered and taken forward to the risk assessment.

Human Health Hazards

8.2.2 The ground investigation identified that concentrations of potential contaminants in the majority of the soil tested across the Site are below the screening criteria for park open space park development land use. The exceptions are related to a couple of metals, some individual PAHs, potentially Cyanide and Asbestos present in the Topsoil and Made Ground within the southern area of the Site that are taken forward as potential hazards to human health.

8.2.3 It should be noted that the majority of the exceedances recorded were taken from exploratory holes situated outside of the Site itself, however, bearing in mind the nature of the Made Ground in the southern part associated with the former gasworks these are considered to be representative of the Made Ground in the southern part of the Site.

Hazards to Controlled Waters

8.2.4 The results of the groundwater analysis undertaken show that the majority of the measured concentrations of potential groundwater contaminants are below the adopted screening criteria with the exception of elevated levels of arsenic, cadmium, chromium, lead, cyanide and ammoniacal nitrogen as NH_3 and NH_4.

8.2.5 Therefore, metals, cyanide and ammoniacal nitrogen are considered a hazard and are carried forward as potential hazard to controlled waters.

Pathways

8.2.6 Potential environmental hazards need a pathway connecting the source (if present) to potential receptors in order to be able to impact upon the receptors. These pathways are capable of conveying the contaminants. Pathways may be anthropogenic (artificial) or natural.

8.2.7 Anthropogenic pathways are artificial routes capable of conveying contaminants and include such routes as surface water drains, high permeability backfill materials, poorly consolidated Made Ground, foundations, and persons disturbing contamination sources in such a way as to liberate contaminants.

8.2.8 In the case of persons working with contaminated ground (e.g., to lay foundations or install services) direct contact with the source becomes possible, and pathways such as dermal contact, inhalation or ingestion require consideration.

8.2.9 The majority of the Site is currently soft landscaping with limited hard standing and is proposed to remain the same, so the potential pathways relevant to future site users would be potential of ingestion, inhalation and dermal absorption across the majority of the Site.

8.2.10 The Site is locally underlain by a layer of cohesive Alluvium. Downward and lateral migration of contaminants within the Alluvium is limited owing to the relatively low permeability cohesive nature of the Alluvium. Whilst it is possible that the installation of piled foundations as part of the proposed development could form a potential pathway for groundwater migration there are appropriate types of piling techniques that can be adopted to avoid causing a significant pathway.

8.2.11 The groundwater flow in the Northmoor Sand and Gravel Member is expected to be flowing in the direction towards the River Thames bisecting the Site. However, the presence of the sheet pile wall along the southern bank of the River Thames is expected to halt direct continuity between the Made Ground, the Alluvium and the River Thames in the southern part of the Site. Nevertheless, groundwater flow is taken a potential pathway for migration of potential contaminants to the River Thames albeit the layer of Alluvium will act as barrier between any perched shallow groundwater in the Made Ground (if present) and the aquifer in the Northmoor Sand and Gravel Member.

Receptor Identification

8.2.12 It is expected that the proposed development comprises the construction of a new bridge and associated footways.

8.2.13 The Northmoor Sand and Gravel Member Aquifer, the River Thames and human receptors are considered to be sensitive.

8.2.14 Details of the potential receptors considered and whether or not the receptors are plausible is summarised in the table below:

Table 8.1 Summary of Potential Receptors

Receptor Type	Plausible Receptor (Y/N)	Sensitivity / Value
Human Health – Current	Leisure and pedestrians	High / 4
Human Health – Future	Leisure and pedestrians	High / 4
Human Health – Neighbours	Leisure, pedestrians and neighbouring residents	Very High / 5
Human Health – Construction / Maintenance Workers	Construction workers and future maintenance works	High / 4
Groundwater	Secondary Aquifers	Low / 2
Surface Water	The River Thames with Moderate Ecological Status and Good/Fail Chemical Status	Moderate / 3
Property (Buildings) / Heritage	Possible heritage within the Site	Very Low / 1
Property – Animal or Crop Effect	Agricultural fields in the vicinity of the Site	Low / 2
Ecological Systems	Green belt and local park land	Low / 2

8.2.15 Table 2 in the Stantec methodology describes possible pathways for each receptor type. Each of these possible pathways is then considered when assessing the possible pollutant linkages (see below).

8.2.16 Potential pollutant linkages have been identified using the information on potential sources (contaminant types), receptors and exposure pathways. **Appendix F** identifies which pollutant linkages are considered to potentially exist.

8.3 Risk Estimation

8.3.1 Further to the findings of the ground investigation, the conceptual Site Model presented in the Phase 1 Ground Conditions Assessment (STN, 2023) has been reviewed and revised. A risk estimation has been carried out for the Northern Part of the Site with a separate risk estimation for the Southern Part of the Site.

8.3.2 Risk estimation involves predicting the likely consequence (what degree of harm might result) and the probability that the consequences will arise (how likely the outcome is). The table in **Appendix J** summarises the estimated risks for the identified pollutant linkages.

8.3.3 Based on the information available, the estimated risk from the proposed development have been designated with further comments are given in the table below:

Table 8.2 Summary of Risk Estimates

Receptor	Northern Part of the Site	Southern Part of the Site
Human Health – Current	Low	High
Human Health – Future	Low	High
Human Health – Neighbours	Low	High
Human Health – Construction / Maintenance Workers	Low	High
Groundwater	Moderate	Moderate
Surface Water	Low	Low

Receptor	Northern Part of the Site	Southern Part of the Site
Property (Buildings) / Heritage	Very Low	Very Low
Property – Animal or Crop Effect	Low	Low
Ecological Systems	Low	Low

Human Health – Construction Works

8.3.4 The risk to construction workers relates to the risk of ingestion, inhalation or skin contact of contaminated materials on the Site and inhalation of any potentially hazardous ground gases. Considering the expected variable and locally potentially significant concentrations of potential contaminants within the soils present on the Site, the potential risk to site workers is expected to be **High** for the Southern Section of the Site and **Low** for the Northern Part of the Site

8.3.5 In accordance with the current health and safety legislation, the contractor will be required to adopt measures to mitigate the risk to site workers and off-site 'neighbours'. Such measures will include:

- Informing site workers through site induction and 'toolbox talks' of the possibility that unexpected contamination will be encountered in the ground and the potential health effects from exposure.
- The provision of appropriate protective clothing and equipment to be worn when appropriate by site workers;
- The provision by the contractor of a suitably experienced geoenvironmental engineer either on-call or with a watching brief for visual and olfactory assessment of the material, and sampling and testing for verification purposes, to adopt measures to manage any unidentified sources of contamination;
- The adoption of good standards of hygiene to prevent prolonged skin contact, inhalation, and ingestion of soils during construction;
- The selection of appropriate methods of working to limit disturbance of contaminated soil or water, where possible; and,
- The provision of a dust suppression system during excavation works to reduce the risk of releasing of asbestos fibres into the air.

8.3.6 An agreed protocol should be implemented during the works to deal with asbestos should it be encountered during excavation works at the Site. The removal, temporary storage and disposal of materials containing asbestos is required to be carried out in accordance with the relevant legislation and guidance including the Control of Asbestos Regulations (CAR) 2012.

8.3.7 Given the adoption of appropriate measures, the risks associated with the potential for skin contact, inhalation and ingestion of the near-surface soils to construction workers involved in earthworks or groundworks is expected to be Low in the Southern Part of the Site and Very Low for the Northern Part of the Site.

8.3.8 In the context of this report for a **Low** Risk, further consideration of mitigation or remedial measures are required and highlighted in **Section 9**.

Human Health – Site Maintenance Workers

8.3.9 Service trenches will be backfilled with clean imported materials, and so the potential for future maintenance workers to come into contact with potentially contaminated soils will be reduced.

Human Health – Future Users

8.3.10 The effect on future site users relates to the risk of ingestion, inhalation or prolonged skin contact of contaminated material on the site. In the absence of any structures, it is expected that any potentially hazardous ground gases if present will dissipate into the atmosphere and therefore any mitigation/remediation in relation to ground gasses is not required.

8.3.11 In the areas of the hard surfaces of the proposed development, the potential risk to future site users associated with contaminated material is assessed to be Very Low owing to the very low potential for skin contact, inhalation and ingestion of any potential contaminants.

8.3.12 In areas of proposed landscaping, it is expected that the installation of a clean cover system between the Made Ground and future site users in areas of soft landscaping will be sufficient to limit any risk of movement of contaminated material to the surface. The segregation layer expected to comprise a marker layer of geotextile at the base of a layer of clean imported soil cover. A greater depth of soil cover will be required in landscaped areas where trees or deep rooting shrubs are to be planted.

8.3.13 Given the adoption of appropriate measures, the risks to future site users associated with the potential for skin contact, inhalation and ingestion of the near-surface soils, and ground gases is expected to be **Low** in the Southern part and **Very Low** in the northern part of the Site.

8.3.14 In the context of this report a **Low** Risk, further consideration of mitigation or remedial measures are required and highlighted in **Section 9**.

Controlled Waters

8.3.15 If dewatering of excavations during the works is required, permission to discharge to surface water, ground, or foul drainage must be confirmed prior to works, together with any requirement to treat the abstracted water.

8.3.16 All results of any testing associated with the extracted waters should be supplied to waste disposal facility or wastewater treatment works prior to removal / discharge from site to confirm suitability and any required permitting.

8.3.17 Laboratory analysis results will need to be provided as part of the discharge consent application and potentially additional information may be required.

8.3.18 The installation of piled foundations might create a pathway through the Alluvium (where present) for migration of potential contaminants from the Made Ground to the Northmoor Sand and Gravel Member Aquifer. It is recommended that in order to minimise the potential for groundwater contamination any piles installed as part of the proposed scheme will be designed and installed in accordance with the Environment Agency guidance for piling in potentially contaminated sites (EA, 2001 and 2002).

8.3.19 Given the adoption of appropriate measures for the installations of piles for the Scheme, the risk to controlled waters associated with the potential for migration of contamination, if present from the near-surface soils to the aquifer is expected to be **Very Low**.

Built Environment

8.3.20 The appropriate design of concrete and in ground materials in accordance with **Section 10** will be sufficient to mitigate the risks of chemical attack on buried concrete during the lifetime of the completed development.

8.3.21 On this basis, the risks to the structures associated with the potential for migration of contamination and ground gases, from the near-surface soils is **Very Low**. In this context **Very Low** risk means at such a level as to be considered acceptable and not a constraint to redevelopment.

8.4 Risk Evaluation

8.4.1 Possible pollutant linkages are determined using professional judgement. If a linkage is considered possible, it is considered that this represents a potentially 'unacceptable risk' and therefore requires further consideration. This may be through remediation or mitigation or through further tiers of assessment.

8.4.2 Based on the findings of this investigation it is considered that further tiers of assessment are NOT required to support the redevelopment of Oxpens River Bridge. Furthermore, on the basis of the Tier 2 Risk Assessment, remediation of the ground is unlikely to be required. Mitigation measures principally required for the protection of construction workers, future site users, and for the installation of piles are detailed further in **Section 9** below.

8.4.3 According to Oxford City Council, the former gas works has been identified for inspection under the Council's Land Quality Strategy as a Category 3 site, which is considered by the Council to be suitable for its present use. According to the Council contaminants are probably or certainly present in the ground but these are unlikely to have an unacceptable risk on key receptors. *'Assessment action is unlikely to be needed whilst the site remains in its present use or otherwise remains undisturbed'*. Based on the findings of the ground investigation, the Tier 2 Risk Assessment with the implementation of the proposed mitigation measures as outlined above and further detailed in **Section 9** it is considered unlikely that the local planning authority will designate the site as Contaminated Land under Part 2a of the Environmental Protection Act 1990.

9 Outline Remediation and Mitigation Strategy

9.1 Health & Safety legislation

9.1.1 The Principal Contractor (PC) for the proposed works will have responsibility for ensuring legislative compliance and obtaining all permits/licenses as required. The following are highlighted but should not be considered the only aspects to be addressed.

9.1.2 The Construction (Design & Management) Regulations (CDM 2015) are the main regulations for managing the health, safety and welfare on construction projects and will apply to the proposed development. A Principal Designer (PD) and Principal Contractor will be appointed by the client to plan, manage, monitor and coordinate health and safety during the pre-construction and construction phases respectively. The PD role includes identifying, eliminating or controlling foreseeable risks. All persons engaged in groundworks and construction will be made aware of the findings of the intrusive ground investigation and the potential for residual contamination to be present. A Site-specific health and safety plan will be produced in accordance with CDM 2015 Regulations.

9.1.3 It will be the responsibility of the Principal Contractor, in accordance with CDM 2015 Regulations, to ensure that a safe working system is in place including measures to manage the presence of asbestos identified on Site. The Control of Asbestos Regulations (CAR), 2012 require that where there is a potential for asbestos containing materials (ACMs) including soils to be disturbed, an assessment of risk is required. The person undertaking the Risk Assessment must be competent to do so in line with Regulation 10. The Principal Contractor will be responsible for the provision of an appropriate risk assessment, in line with Regulation 6, which must include the following:

- Description of work including type and duration;
- Type, quantity and condition of ACMs;
- Steps to reduce exposure to the lowest level reasonably practicable including detail of how stockpiles will be conditioned/ managed to prohibit dust migration during periods of high wind;
- The reasons for the chosen work methods; Steps taken to control the release of asbestos into the environment;
- Details of expected exposure and number of people affected;
- Details on the type and use of Respiratory Protective Equipment (RPE) and Personal Protective Equipment (PPE);
- Details of decontamination procedures;
- Procedures for waste removal;
- How to deal with emergencies; and
- Other info relating to safe working.

9.2 Construction Environmental Management Plan

9.2.1 The purpose of a Construction Environmental Management Plan (CEMP) is to outline how a construction project will avoid, minimise or mitigate effects on the environment and surrounding area. The findings of the ground investigations undertaken to date will be incorporated into the CEMP to ensure that an appropriate level of mitigation is provided. The CEMP will present:

- Environmental requirements and controls to cover policy and planning, environmental impacts, risks and mitigation, procedures for monitoring construction processes against environmental objectives, pollution control measures, environmental risk register.

- Consents, commitments and permissions considering all appropriate environmental legislation, planning conditions and any other consents or licensing.

- Management plans such as; noise and vibration, and pollution.

9.2.2 The CEMP will contain measures to minimise the potential for generating contamination during construction phase likely to include, but not limited to, the following:

- The provision of spill kits and appropriate training of all Site personnel.
- The specification of dust minimisation measures to be implemented.
- The siting of chemicals, fuel and oil stores on impervious hardstanding and within bunded areas.
- A requirement for standing machinery to have drip trays placed underneath to prevent oil or fuel leaks causing pollution.
- A requirement for the refuelling of vehicles and machinery to be carried out in one designated area with spill kits located close by in the event of a spill on an impermeable surface a suitable distance away from surface water bodies.
- Protocol for tank removal including measures to facilitate decommissioning of tanks and pipework validation that residual contamination is not present.
- Protocol for management of potential and actual surplus soils and liquids (soil re-use, soils off-site disposal and dewatering).
- Discovery Strategy including a requirement for a geoenvironmental watching brief for contamination during in-ground works.

9.3 Protection of Site Workers

9.3.1 During the construction phase, measures to limit risk to Site workers from any potential contaminants in the ground will be implemented. Specification of appropriate measures will be the responsibility of the Principal Contractor but are likely to include the following as a minimum:

- Informing the Site workers of potential contamination on the Site and the potential health effects from exposure through Site induction and ‘toolbox talks’ to provide advice on contamination, with particular emphasis on the management of asbestos.
- Methods of dust control and selection of appropriate methods of working to limit the potential for air-borne dust to arise associated with the excavation and disturbance of the soils present on the Site.
- Operational good practice (PPE, hygiene facilities, safe methods of work).
- The provision by the contractor of a suitably experienced geoenvironmental engineer either on-call or with a watching brief for visual and olfactory assessment of the material, and sampling and testing for verification purposes, to adopt measures to manage any unidentified sources of contamination;
- The adoption of good standards of hygiene to prevent prolonged skin contact, inhalation, and ingestion of soils during construction;
- The selection of appropriate methods of working to limit disturbance of contaminated soil or water, where possible;

9.4 Service Trenches

9.4.1 To mitigate the hazard to future maintenance / service workers associated with the inhalation of asbestos in the Made Ground the following should be followed. It is noted that where Made Ground is not present within service trenches then mitigation will not be required.

- Remove all Made Ground from within the trenches and replace with “clean” imported material.

- Incorporate a marker membrane within all service trenches to identify the presence of potentially asbestos contaminated Made Ground below.

9.4.2 Any imported soil for any purpose will conform to an importation criteria specification.

9.5 Landscaped Areas

9.5.1 To mitigate the hazard to end-users associated with the inhalation of asbestos in the Made Ground the following should be adopted. It is noted that where Made Ground is not present beneath areas of soft landscaping then mitigation will not be required.

9.5.2 Cap all soft landscaped areas with a “clean cover” system comprising either 600mm thickness of “clean” imported Topsoil and subsoil with an orange marker membrane at the base of the clean cover system. It is considered that a 600mm thickness will provide sufficient mitigation against the disturbance through regular landscaping activities, (e.g., shrub planting etc.) of the underlying Made Ground.

9.5.3 Any imported soil for any purpose will conform to an importation criteria specification.

9.6 Discovery Strategy (Unexpected Ground Conditions)

9.6.1 A discovery strategy will be written that defines how any unusual materials (solids, liquids or gases/odours) will be managed if encountered during the construction works. The strategy awareness establishes protocols to be implemented (and by whom) and will include the following:

- All personnel working on site will undergo a site induction and toolbox talks which will include references to potential environmental hazards such as contamination.

- Training and Maintaining Awareness Programme – mechanisms such as posters or monthly repeat inductions to reinforce the procedure and highlighting the key steps to be followed should contamination be identified.

- Watching Brief – including competent person definition

- Communication protocol.

- Specialist Contamination Advisor.

9.7 Soil Excavation, Re-Use and Disposal Protocol

9.7.1 The Contractor will prepare a procedure for identifying where waste will be generated, any additional testing to confirm the classification and measures to be adopted to address the requirements of the European Waste Directive that all waste needs to be pre-treated prior to disposal.

9.7.2 If material is proposed to be removed or re-used off-Site or reused on-Site as part of the works, it will require appropriate classification and / or sorting to demonstrate suitability. The actual material to be excavated should be analysed and assessed as suitable for reuse by assessing potential risk to human and controlled water receptors.

9.7.3 There should also be a clear requirement for reuse in the scheme design and may require consideration as part of a materials management plan or U1 exemption. It is the Contractor's responsibility to appropriately classify material excavated and ensure adequate testing is completed.

9.7.4 If it is intended to re-use spoil arisings then the PC will need to undertake an assessment regarding suitability and demonstrate that the material is not a waste using the Definition of Waste: Development Industry Code of Practice (CL:AIRE, 2011). The Code of Practice sets out good practice for the development industry to use when assessing whether excavated materials are classified as waste or not. It also allows the determination, on a Site-specific basis, when treated excavated waste can cease to be waste for a particular use. Further it describes an auditable system to demonstrate that this Code of Practice has been adhered to.

9.7.5 Off-Site disposal requires an accurate written description of the waste and must include:

- The waste classification code, also referred to as LoW (List of Waste) or EWC (European Waste Catalogue) code - classification codes for common types of waste are in the relevant parts of this guidance.
- Whether it's hazardous or Persistent organic pollutant (POPs) waste.
- The type of premises or business where the waste was produced.
- The name of the substance or substances.
- The process that produced the waste.
- A chemical and physical analysis of the waste and its components.
- Any special problems, requirements or knowledge related to the waste.

9.7.6 For controlled waste that is classified as 'non-hazardous' this will be a waste transfer note and for waste classified as 'hazardous' this will be a consignment note. In both cases the record will require a waste code and classification.

9.7.7 Failure to comply with the duty of care requirements is a criminal offence and could lead to prosecution.

Dewatering of Excavations

9.7.8 If dewatering is required, abstraction and discharge licences will be sought from the Environment Agency under the terms of the Environmental Permitting Regulations 2010.

9.7.9 Discharge to sewer may be possible subject to the utility provider approval. It should be noted that if free product is present then separation prior to discharge to sewer might be necessary. Alternatively, it might be necessary to contain all arisings and tanker the liquid(s) for off-Site disposal.

9.7.10 All results of any testing associated with the extracted waters should be supplied to waste disposal facility or wastewater treatment works prior to removal / discharge from site to confirm suitability and any required permitting

9.7.11 Laboratory analysis results will need to be provided as part of the discharge consent application and potentially additional information is required.

9.7.12 If groundwater is to be removed into a storage vessel for off-site disposal, laboratory analysis results must be forwarded to the waste disposal site for confirmation of acceptance prior to works commencing.

10 Geotechnical Assessment

10.1 Geotechnical Considerations

10.1.1 For the proposed development, the principle geotechnical consideration will be strength and compressibility of the founding soils and hence, the foundation requirements for the proposed structure. This section of the report presents comments on the ground conditions in relation to design and construction of the geotechnical elements of the proposed structures.

10.1.2 Recommended characteristic values of parameters for geotechnical design as determined from consideration of the results of geotechnical testing carried out on samples of soils recovered during the recent ground investigation and consideration of published data correlations with index properties are discuss in **Section 4** of this report and are summarised in the following table.

Table 10.1 Summary of Geotechnical Parameters

Strata	Base of Stratum (m bgl)	Bulk Unit Weight, kN/m^3	Undrained Shear Strength (2) kPa	Effective Cohesive, kPa	Effective angle of shearing resistance, degrees
Made Ground	2.0	18.0	-	0	27
Alluvium	3.0	17.0	25	0	18
Northmoor Sand and Gravel Member	6.0	20.0	-	0	36 (39)
Oxford Clay Formation	>34.7	19.0	100 kPa at 51.0 m AOD increasing to 300 kPa at 23.0 m	0	23

Notes – Value in brackets denotes the peak angle of shearing resistance

10.1.3 It is recommended that a groundwater level of 55.3m above ordnance datum is assumed for design analysis.

10.2 Site Preparation

10.2.1 It is expected that the proposed development will largely be constructed at grade on the existing ground profile. The bridge will be founded on pile foundations with approach embankments leading up to the bridge. Local regrading of the existing ground levels will be required to accommodate the footpath in the southern part of the Site. Furthermore, localised excavation of trenches and ditches will be required associated with the construction of the site infrastructure.

Excavation Works

10.2.2 The near-surface soils typically comprise clays with varying proportions of gravel. These materials should be readily excavated using conventional plant and equipment. Excavation of the surface pavements and any existing foundations and below ground structures, however, will require pre-treatment by use of hydraulic breakers to fracture the material. Once fractured, it should be possible to excavate these materials using conventional tracked excavators. Any remains of walls, foundations et cetera within 1.0 m of formation level should be removed to prevent any development of concentrations of stress in foundations and pavements.

10.2.3 Significant difficulties were experienced in advancing the exploratory holes through the Made Ground owing to the presence of artificial obstructions. On this basis, the presence of obstructions to excavations during the construction works cannot at this time be discounted.

10.2.4 Particular care will be required in excavating material to identify and wherever practicable to segregate any potentially contaminated materials to ensure they do not adversely affect the classification of other excavated materials.

10.2.5 It is essential that contractors carefully inspect and check the exposed formation for evidence of localised weak areas and possible voids, such as old wells or trenches, and take appropriate measures to ensure the adequacy of the exposed formation.

Groundwater Control

10.2.6 As discussed in **Section 6.4**, groundwater levels are expected to be close to ground level across the Site. The expected permeability of the near surface soils on the Site is expected to vary depending on the material composition. Allowance should be made for controlling inflows of any groundwater from any excavation into the Northmoor Sand and Gravel member, any water within disused drains encountered during works and surface water inflows during periods of wet weather.

10.2.7 Based on the visual examination of the materials encountered, control of groundwater inflows by the construction of drainage ditches and pumping from sumps within any excavations into the Northmoor Sand and Gravel Member may not be practicable. As an alternative, some form of cut off wall, for example sheet pilling, may be required to control groundwater entries into any excavations into the Northmoor Sand and Gravel Member.

Stability of Excavations

10.2.8 Although the sides of trenches and areas of open cut may stand with near-vertical side slopes in the short term, these may need to be either battered back to a safe slope angle or restrained by full-face support to ensure stability in the short to medium term. The temporary safe slope angle will depend on the nature and strength of the material around the excavation, and it is expected that the temporary safe slope angles to excavations will typically be between about 30 and 35 degrees to the horizontal (CIRIA, 1992).

10.2.9 Particular care will be required in excavating around the perimeter of the Site to ensure the works do not compromise the stability of the footpaths and infrastructure outside of the site boundary.

Backfill to Excavations

10.2.10 Where the excavation of existing foundations and below ground structures is below the formation level for the proposed development, the excavations will need to be filled to the required formation level. The resulting voids should be backfilled with an engineered fill having the same characteristics and strength as the surrounding material.

10.2.11 Given the limited volume of material to be excavated and the potential for presence of contaminates in the near surface soils, it is expected that treatment and processing of the excavated material to allow for its re-use will not be feasible nor economical and hence that all excavated material will need to be removed for disposal off-site.

10.3 Foundations

10.3.1 Based upon the ground conditions encountered on Site, piled foundations are likely to be appropriate for the proposed footbridge.

Piled Foundations

10.3.2 **Pile Construction** It is expected that bored and cast-in-place concrete piles are the most efficient means of carrying foundation loads of the proposed bridge. Such piles formed using conventional rotary auger techniques or continuous flight auger techniques should be appropriate although the presence of any existing foundations, below ground structures or mudstone strata within the Oxford Clay Formation may form obstructions to piling works. If continuous flight auger techniques are used, instability of the pile bore in the Northmoor Sand and Gravel Member sands may be experienced. Similarly, if the use of conventional rotary auger techniques is required, it is likely that temporary casing will be needed to the base of the Northmoor Sand and Gravel Member, to support the pile bore and to exclude groundwater.

10.3.3 **Axial Resistance** The axial resistance of the piles may be determined from the characteristic values recommended in **Section 4** using the static design procedures and the partial and model factors given in the BS EN 1997-1 (2013). In these procedures the axial capacity of the pile is taken to be the sum of the adhesion on the pile shaft and the end bearing resistance on the pile base.

10.3.4 Given the nature of the Northmoor Sand and Gravel Member, it is expected that any excess groundwater pressure will dissipate rapidly and, hence, it is recommended that the resistance on the pile shaft in this stratum is determined using effective stress strength parameters. On this basis, the resistance on the pile shaft is related to the effective overburden pressure using an earth pressure coefficient and an angle of friction between the pile shaft and the founding soil. The value of earth pressure coefficient depends on the pile construction techniques used and for bored cast-in-place concrete piles may be taken as 0.85 times the at-rest earth pressure coefficient. The angle of friction between the pile shaft and the founding soils depends on the material forming the pile shaft and for cast-in-place concrete piles is typically taken to be equal to the angle of internal friction of the founding soil.

10.3.5 For the Alluvium, the adhesion on the pile shaft is related to the undrained shear strength of the founding clay by an adhesion factor. The adhesion factor depends on the degree of softening and stress relief in the clay around the pile during boring and prior to concreting. Given that significant quantities of groundwater may enter the pile bore it is expected that softening of the clay may take place. For such conditions, an adhesion factor of 0.5 is considered appropriate for the Alluvium (BS 8004, 2015).

10.3.6 An adhesion factor of 0.5 is considered appropriate for the Oxford Clay Formation (BS 8004, 2016).

10.3.7 For the Oxford Clay Formation, the end bearing on the pile toe may be taken as nine times the undrained shear strength of the clay immediately below the toe (BS 8004, 2015). Appropriate techniques will need to be adopted to clean the pile bore sufficiently to ensure that full end bearing can be realised.

10.3.8 The axial pile resistance should be determined using appropriate partial factors on soil properties, actions and resistances to determine the adequacy of the pile design (BS EN 1997-1, 2013).

10.3.9 Preliminary estimates of the axial resistance for the COM2 limit state of 350, 450 and 600 mm uniform diameter piles have been made using the static design procedures and the partial and model factors given in the BS EN 1997-1 (2013). For piles with a pile head level of 1.0m below ground level, the preliminary estimates are presented in the table below.

Table 10.1 Summary of Pile Axial Resistance

Pile Toe Depth, m bgl	Axial Resistance, KN (1)		
	350 mm	450 mm	600 mm
15.0	370	500	700
20.0	600(2)	800	1110
25.0(3)	880(2)	1150(2)	1590

Notes:
1) Axial resistances calculated assuming no explicit verification of serviceability limit state and without verification of ultimate limit state by maintained load test.
2) Pile length exceeds 50 times pile diameter (LDSA, 2009)
3) CFA piling rigs often have a maximum pile length of 23 m hence discussions with piling contractors will be required if longer piles are proposed to ensure they can be constructed.

10.3.10 The preliminary estimates of axial resistance presented above are appropriate for single isolated piles assuming that no bending or horizontal loads are applied to the pile.

10.3.11 The actual resistance of a pile will be dependent on the method of installation and technique used. The actual pile capacity should therefore be established with reference to specialist piling contractors during detailed design. Pile integrity testing should be carried out to confirm the design and workmanship. Consideration may be given to carrying out pile loading tests to verify the design and hence allow lower partial factors to be adopted.

10.3.12 The preliminary estimates of axial resistance presented above are given to inform the conceptual design of the proposed structure only. Design of the piles will need to be carried out by the appointed Geotechnical Designer taking into account the partial factors on soil properties, actions and resistances in accordance with the requirements of BS EN 1997-1 (2013).

10.4 Pavement Design

10.4.1 Pavements carried on a suitable depth of capping/sub-base should prove adequate provided the exposed deposits are compacted by a heavy smooth wheeled roller and any soft degradable material removed and replace with compacted granular fill. Similarly, any remains of walls, foundations or exposed pieces of demolitions materials would need to be removed to prevent any development or concentrations of stress in the pavement.

10.4.2 It is noted that CBR values determined from in-situ or laboratory tests may not be representative of the long-term equilibrium conditions present below the completed pavement. Estimated values of long term CBR can also be determined through correlation with plasticity index in accordance with the values given in IAN 73/06 (HE, 2009). On this basis, it is recommended that a design CBR value of 2 per cent be selected from consideration of the values proposed by HE (2009).

10.4.3 All formations will likely deteriorate rapidly in inclement weather conditions and appropriate construction practice should be adopted with all formations exposed only for the minimum time period. The suggested CBR value is likely to be achieved for the materials on site provided that the materials are handled carefully and protected from adverse weather. It is recommended that a geotechnical engineer inspects all exposed sub-grade formations to confirm that the recommended CBR values can be achieved. It is expected that additional in situ CBR testing will be carried to confirm the CBR value at the time of construction.

10.5 Surface Water Drainage

10.5.1 Based on the composition of the soils on site, and the shallow groundwater level it is considered that deep infiltration is not suitable for the disposal of surface water runoff. Runoff could be infiltrated shallow, thereby behaving similar to existing precipitation infiltration. Locally surface water runoff may be overspill on the surrounding Topsoil.

10.6 Aggressiveness of the Ground

10.6.1 The measured pH values and concentration of water-soluble sulphate measured on samples of soils and groundwaters recovered as part of the recent investigation are presented in the factual report on the investigation (EDL, 2022) and are summarised on the following table.

Table 10.2 Summary of Sulphate testing results

Strata	Number of Tests	pH Value	Water Soluble Sulphate (g/l)	Total Sulphate as SO4 (mg/kg)	Total Sulphur (mg/kg)
Made Ground	7	7.6 – 10.0	0.41 – 2.10	890 – 4700	690- 17000
Alluvium	2	7.4 – 7.6	-	1800 – 2700	-
Northmoor Sand and Gravel Member	5	8.0 – 8.6	0.028	650 – 890	-
Oxford Clay Formation	6	7.6 – 8.7	0.37 – 0.70	1200 - 1500	6900 - 15000

10.6.2 For the mobile groundwater within the Alluvium and Northmoor Sand and Gravel Member the values correspond to Design Sulphate Class DS-1 and ACEC Class AC-1s as defined by BRE (2017).

10.6.3 The values in the Oxford Clay Formation below 1.0 m depth correspond to Design Sulphate Class DS-4 and ACEC Class AC-3s as defined by BRE (2005). It is noted, however, that the conditions in the Oxford Clay relate to the high potential sulphate content of the Oxford Clay at depth, owing to the pyrite minerals likely to be present but as yet not having oxidised to produce soluble sulphate minerals, whereas the measured concentrations of soluble sulphates indicate a less onerous design condition.

10.6.4 In line with the recommendations in BRE (2005), concrete in ground containing pyrite minerals does not have to be designed to withstand high potential sulphate concentrations where the measured concentrations of soluble sulphate are low, unless the concrete is exposed to ground which has been disturbed to the extent that the pyrite might oxidise and the resultant sulphate ions come into contact with the concrete. Such conditions are considered not to apply for bored and cast in-place piles for which Design Sulphate Class DS-2 and ACEC Class AC-1s may be used for concrete in contact with the ground as defined by BRE in areas where the Oxford Clay at depth is not exposed by regrading works (2005).

10.6.5 The recommendations of BRE (2005) should be followed in the design of mixes for buried concrete for the classifications given.

References

BGS (1982) Geological Map Sheet 236 Witney, Solid and Drift 1: 50,000 published by the British Geological Survey (BGS), Keyworth.

BRE (2005) Concrete in aggressive ground. Specialist Digest 1, Building Research Establishment, Garston, Herts.

BRE (2007) Soakaway Design. Digest 365, Building Research Establishment, Garston, Herts.

BS 10175 (2017) Investigation of potentially contaminated sites – Code of practice. British Standards Institution, London.

BS 1377 (1990) Methods of test for soils for soils civil engineering purposes. British Standards Institute, London.

BS 8004 (2015) Code of Practice for Foundations. British Standards Institution, London.

BS 8103 (1995) Structural Design of Low-Rise Buildings. Part 1: Code of practice for stability, site investigations, foundations and ground floor slabs for housing. British Standards Institute, London.

BS 8485 (2015) Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings. British Standards Institution, London.

BS EN 1997-1 (2013) Eurocode 7 – Geotechnical Design – Part 1: General Rules. British Standards Institution, London.

BS EN 1997-2 (2007) Eurocode 7 – Geotechnical Design – Part 2: Ground Investigation and testing. British Standards Institution, London.

BS ISO 19400 (2018) Soil quality — Sampling, Part 202: Preliminary investigations. British Standards Institution, London.

CDE (2007) Phase 2 Site Investigation, Pippen Fort, Camberwick Green. Report 51002, Calderedge Drilling Enterprises, Chigley, Trumptonshire.

Chandler R J and Skempton A W (1974) The design of permanent cutting slopes in stiff fissured clays. Géotechnique, Vol 24, No 4, pp 457-466.

CIEH (2008) Guidance on Comparing Soil Contamination Data with a Critical Concentration. The Chartered Institute of Environmental Health, Nottingham.

CIEH (2015) The LQM/CIEH S4ULs for Human Health Risk Assessment. The Chartered Institute of Environmental Health, Nottingham.

CIRIA (1983) Settlement of structures on clay soils. Special Publication 27, Construction Industry Research and Information Association, London.

CIRIA (1992) Trenching Practice. Report 97, Construction Industry Research and Information Association, London.

CIRIA (2004) Engineering in the Lambeth Group. Report C583, Construction Industry Research and Information Association, London.

CL:AIRE (2011) Contaminated Land: Applications in Real environments, The Definition of Waste: Development Industry Code of Practice. Version 2 CL:AIRE, London

CL:AIRE (2014 & 2021) Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. Final Project Report SP1010 (Rev 2), Contaminated Land: Applications in Real Environments, London.

CL:AIRE (2014) Gasworks Profiles. Contaminated Land: Applications in Real Environments.

DOE (1995) Industry Profiles – Gas works, coke works, and other coal carbonisation plants. Department of the Environment.

DEFRA (2005) The Landfill (England and Wales) (Amendment) Regulations 2005. Statutory Instrument 2005 No 1640. Department of the Environment, Food and Rural Affairs, London.

EA (2004) CLR 11 Model procedures for the management of contaminated land. Department of the Environment Contaminated Land Report. Environment Agency.

EA (2023) Land Contamination: Risk Management, LCRM. Environment Agency.

EA (2021) Technical Guidance WM3 v1.2: Waste Classification – Guidance on Classification and Assessment of Waste

EDL (2022 Ground Investigation Report (Factual), Oxpens Footbridge, Osney, Oxford, Oxfordshire. Report Ref: END22-019. Endeavour Drillin Limited.

HE (2009) Design Guidance for Road Pavement Foundations (Draft HD25). Interim Advice Note 73/06 Rev 1, Highways England, Birmingham.

LDSA (2009) Guidance Notes for the Design of Straight Shafted Bored Piles in London Clay. Guidance Note 01, London District Surveyors Association, London.

NHBC (2014) NHBC Standards. National House Building Council, Amersham, Buckinghamshire.

STA (2023) Phase 1 Ground Condition Assessment, Oxpens River Bridge & Osney Path Works, Oxford. Report 330610555-STN-ZZ-XX-RP-S-3501-S2-P01, Stantec UK, Reading, Berkshire.

Stroud M A (1989) The standard penetration test its application and interpretation. ICE Conference on Penetration Testing in the UK, Birmingham, pp 29-50.

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OXPENS RIVER BRIDGE,
OXFORD

Title
SITE LOCATION PLAN

Prepared:	Checked:	Date:	Revision:	Figure
davco	AZ	2022.08.19	0	1

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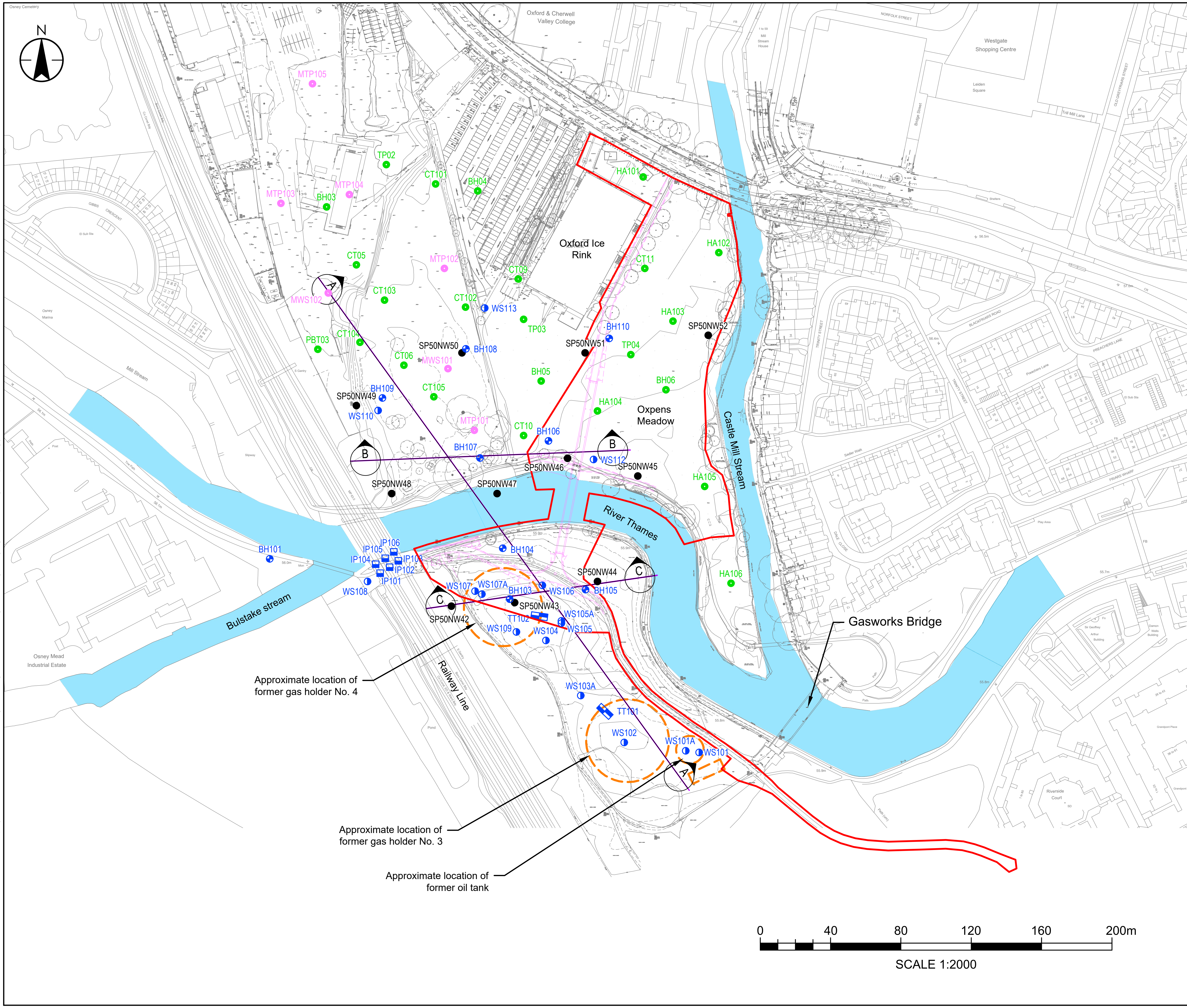

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Legend

- Borehole Location
- Window Sample Location
- Trial Pit Location
- Observation Pit Location
- Trial Trench Location

Historical Ground Investigations

- Idom Merebrook (2014)
- LISTERS GEO (2021)
- BGS Borehole Locations

- Cross Sections Alignments (Refer To Figure 3)
- Proposed Layout

Client/Project:
OXFORD CITY COUNCIL

OXPENS RIVER BRIDGE, OXFORD

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davco	AZ	2023.10.11

Title
EXPLORATORY HOLE LOCATION PLAN

Revision:	Figure
0	2

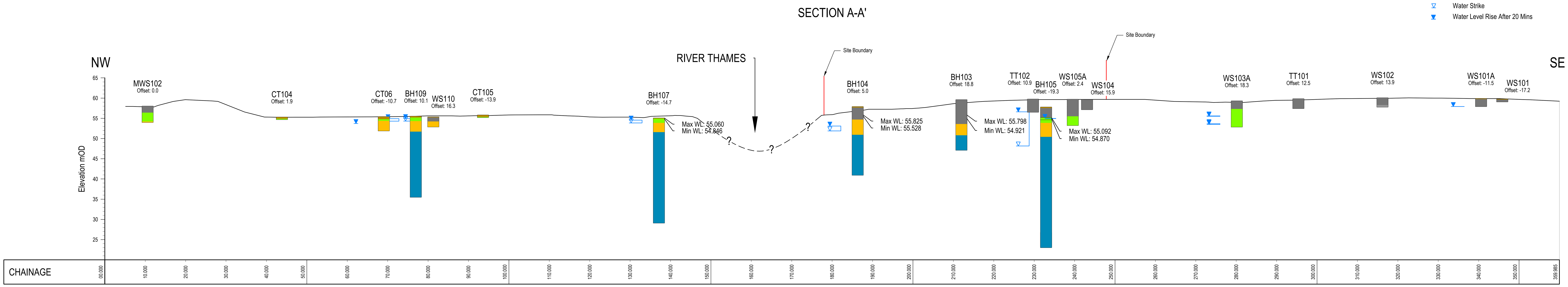
Plotted: 12.10.2023 2023.10.12 10:12:37 AM By: Cotton, David
ORIGINAL SHEET - ISOA3
\\cbh-vfil-001\cbh\projects\332610335 oxpens river bridge\3500 - geotechnical\03 - figures & dwgs\dwgs\gi\330610555 figure 2 (asbuilt gi)_rev 1

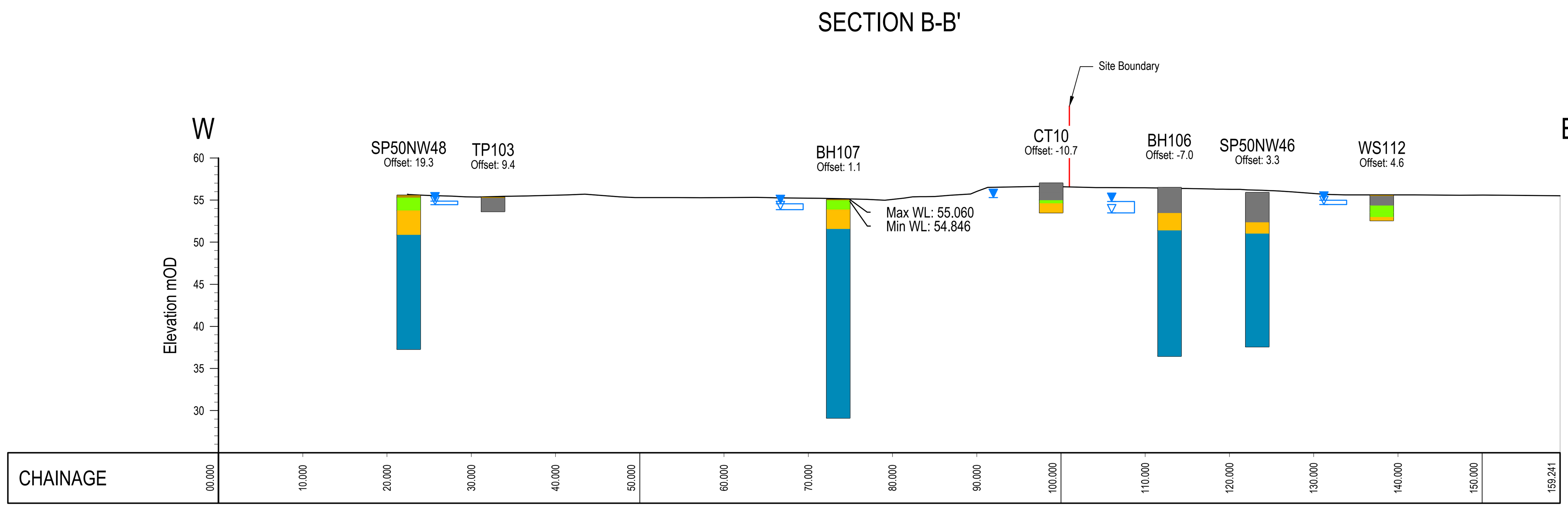
Notes

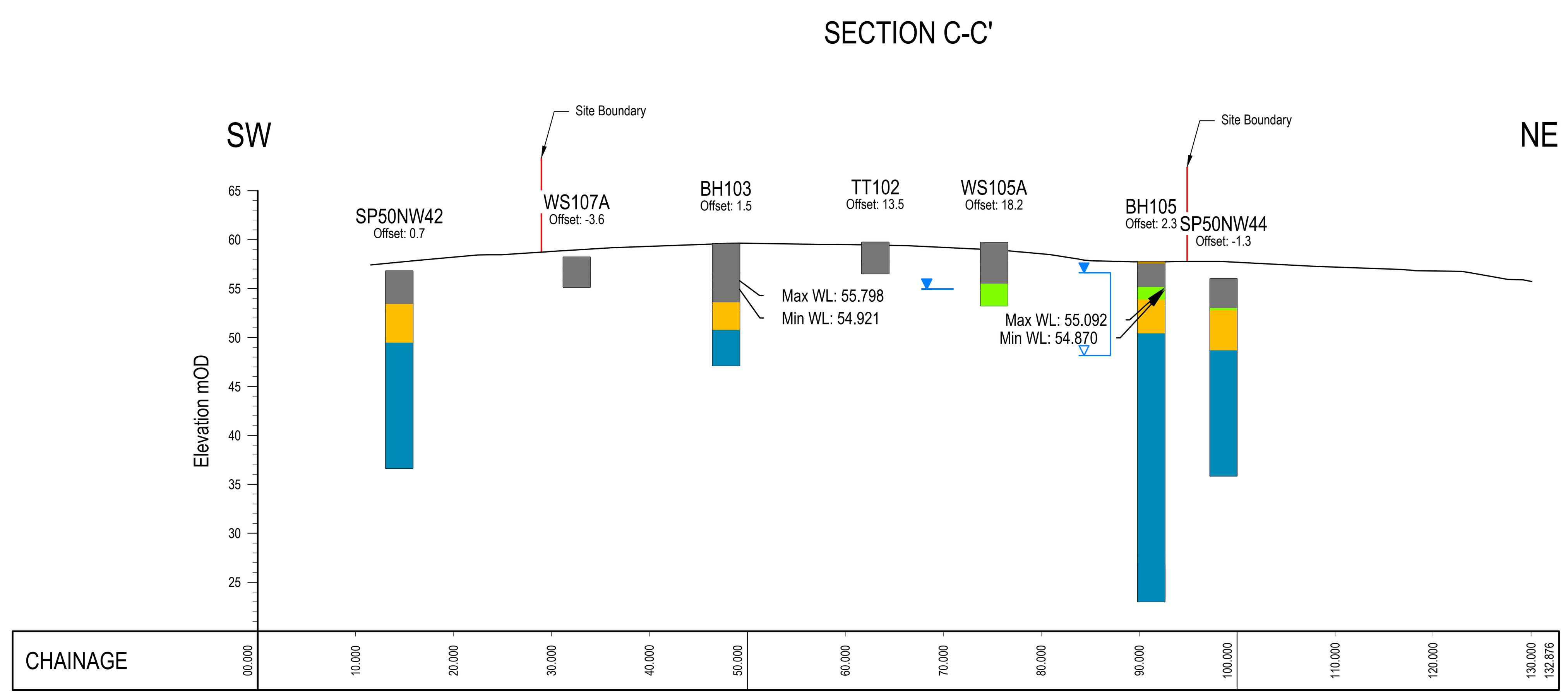
Cross Section Alignments are shown on Figure 2

Legend

- Topsoil
- Made Ground
- Alluvium
- Northmoor Sand and Gravel Member
- Oxford Clay Formation
- Water Strike
- Water Level Rise After 20 Mins







Offset measured in meters from the cross section alignments as shown in Figure 2

Positive values denote South East of the section line
Negative values denote North West of the section line

Notes:

UTILITIES NOTE: The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty to this is expressed or implied. Other such plant or apparatus may also be present but not shown. The Contractor is therefore advised to undertake their own investigation where the presence of any existing sewers, services, plant or apparatus may affect their operations.

Issue Status

Report Figure

This document is suitable only for the purpose noted above. Use of this document for any other purpose is not permitted.

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OXPENS RIVER BRIDGE, OXFORD

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Title

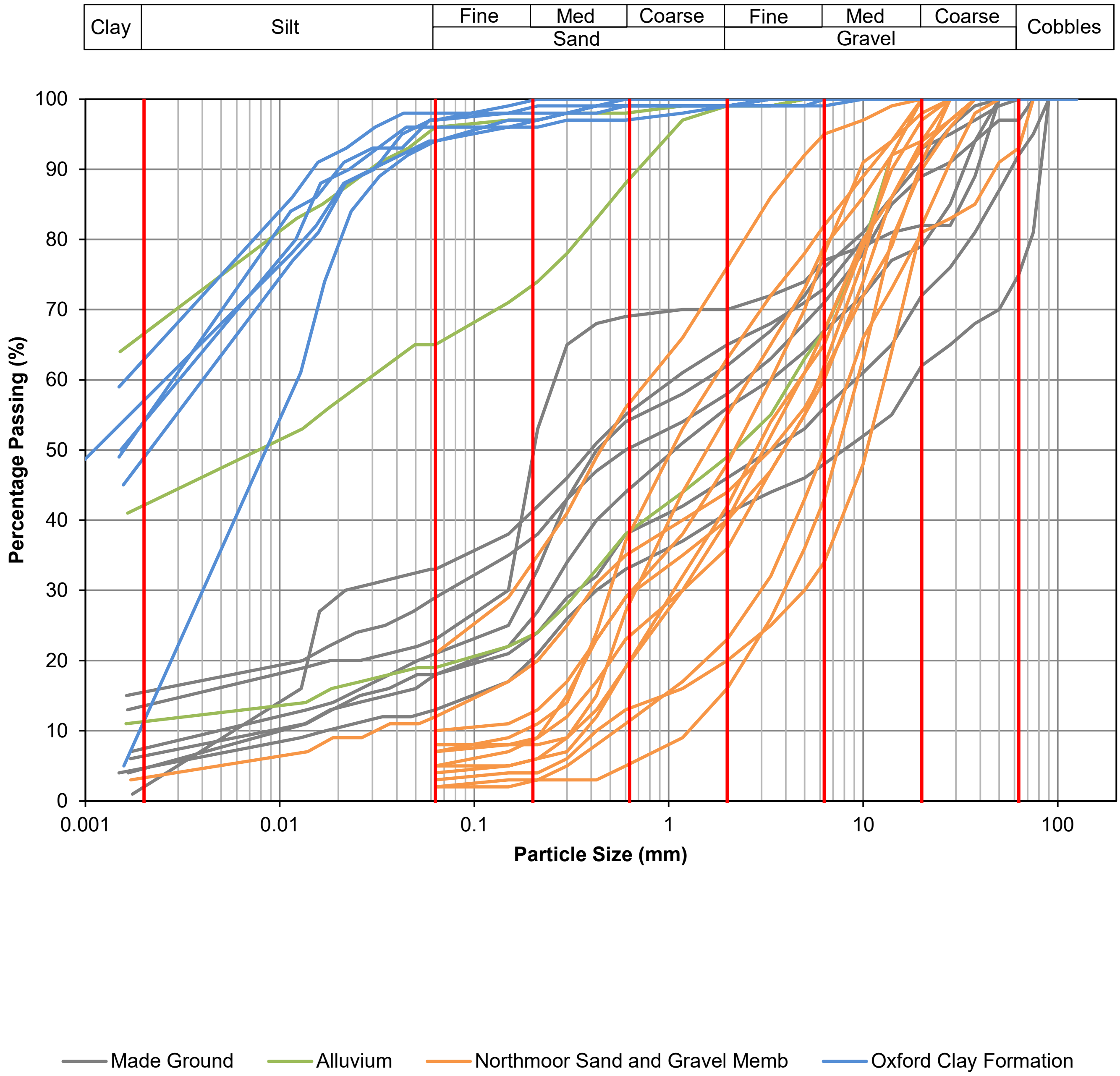
GEOLOGICAL CROSS SECTIONS

Project No. 330610555

Scale 1:500

Revision 0

Drawing No. **Figure 3**



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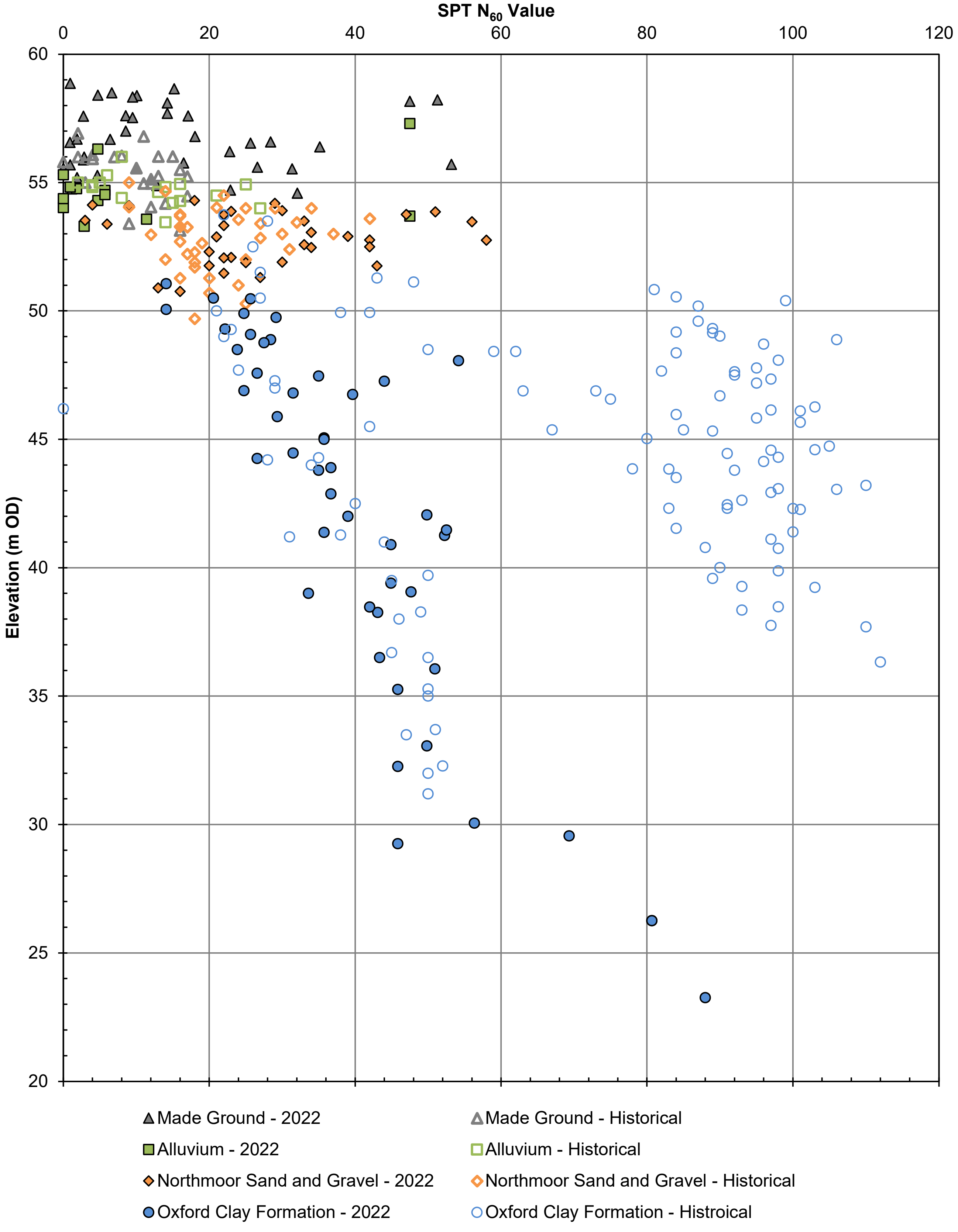
[Printed: 10/08/2022 09:06 By: Taplin, Thomas]

Stantec Stantec UK Limited READING Caversham Bridge House, Waterman Place, Reading, RG1 8DN +44 118 950 0761 www.stantec.com/uk	Client/Project **Oxford City Council** **Oxpens River Bridge, Oxford** Prepared: TT Checked: AZ Date: Aug-22	Title **Particle Size Distribution** **Summary** Revision: 00 Figure 4

ORIGINAL SHEET - ISOA4 FORMAT



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Oxford City Council

Oxpens River Bridge & Osney Path Works, Oxford

Prepared:	Checked:	Date:
TT	AZ	Aug 2022

Title

SPT N_{60} Value v Depth

ALL DATA

Revision: 00 Figure 5

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[Printed: 10/08/2022 16:23 By: Taplin, Thomas]

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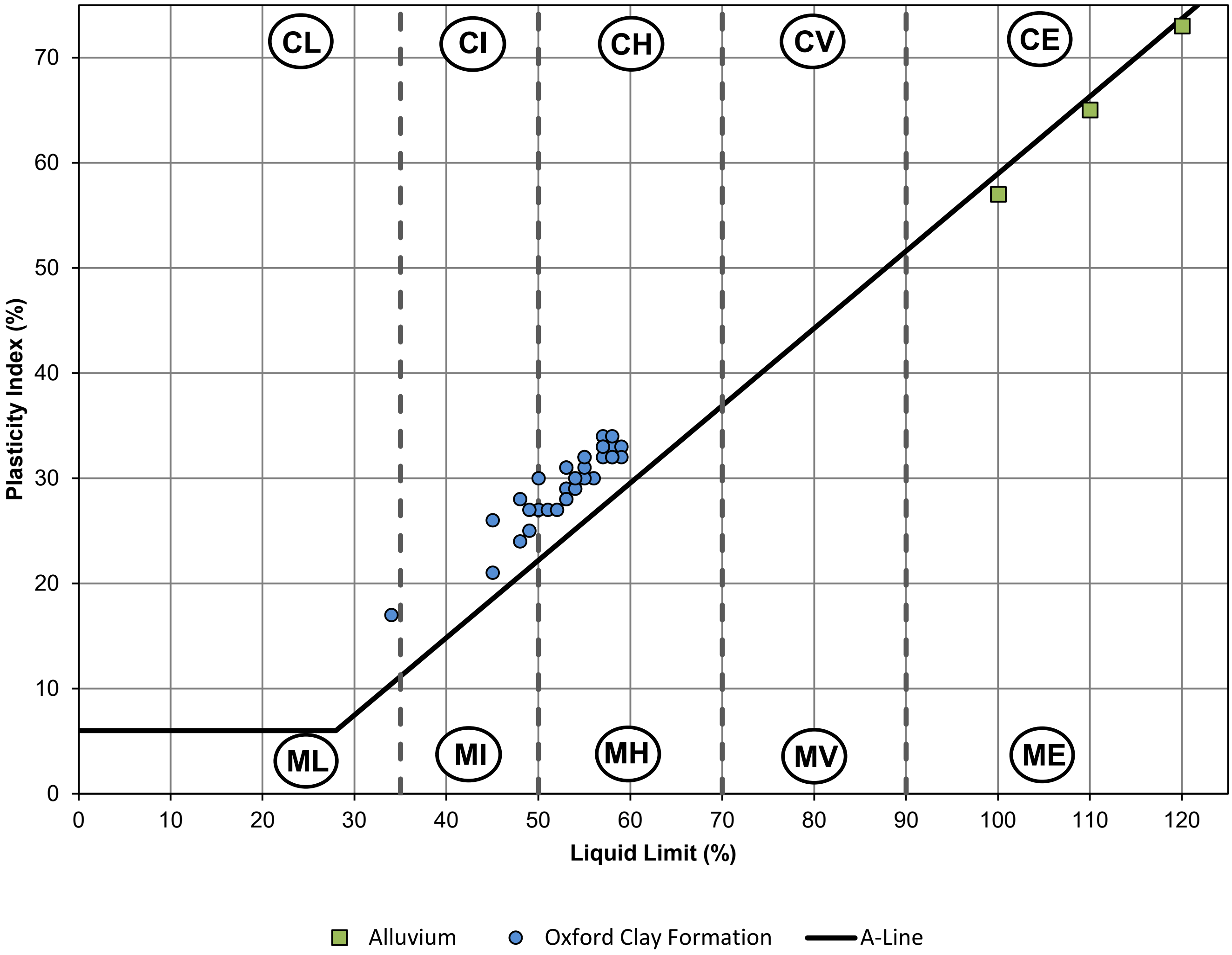

J:\330610555\3500 - Geotechnical\04 Data\Eng+Calcs\[STN Atterberg Limits.xlsm]Summary
[Printed: 10/08/2022 09:21 By: Taplin, Thomas]

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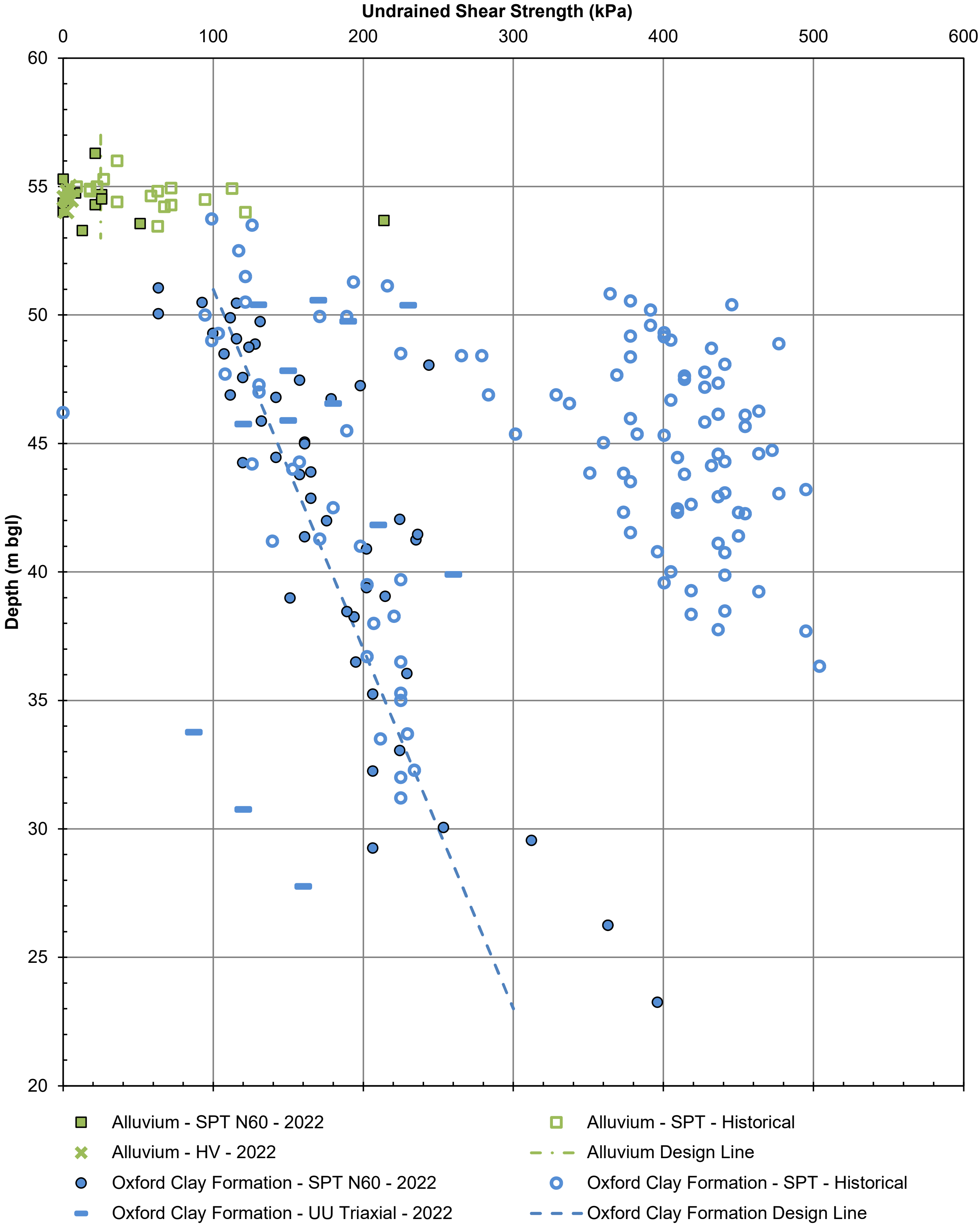
ORIGINAL SHEET - ISOA4 FORMAT



After Stroud (1975) where $c_u = f_1 \times N_{60}$ where $f_1 = 4.5$

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TT	AZ	Aug 2022

Title

Undrained Shear Strength v Elevation

ALL DATA

Revision: 00 Figure 7

ORIGINAL SHEET - ISOA4 FORMAT

Appendix A Stantec Methodology for the Assessment of Contaminated Land

1 INTRODUCTION

This document defines the approach adopted by Stantec in relation to the assessment of land contamination in England. The aim is for the approach to (i) be systematic and objective, (ii) provide for the assessment of uncertainty and (iii) provide a rational, consistent, transparent framework.

When preparing our methodology, we have made reference to various technical guidance documents and legislation referenced in Section 7 of which the principal documents are (I) Contaminated Land Statutory Guidance (Defra 2012), (ii) online guidance Land Contamination: Risk Management (LC:RM) accessed from GOV.UK which is expected to replace Contaminated Land Research (CLR) Report 11: Model Procedures for the Management of Contamination (EA 2004). It should be noted that LCRM is currently due to be revised following consultation and CLR 11 is archived, (iii) Contaminated land risk assessment: A guide to good practice (C552) (CIRIA 2001) (iv) National Planning Policy Framework (NPPF, 2019) (v) BS 10175 Investigation of potentially contaminated sites - Code of Practice (BSI 2017) and (vi) The series of British Standards on Soil Quality BS 18400.

2 DEALING WITH LAND CONTAMINATION

Government policy on land contamination aims to prevent new contaminated land from being created and promotes a risk-based approach to addressing historical contamination. For historical contamination, regulatory intervention is held in reserve for land that meets the legal definition and cannot be dealt with through any other means, including through planning. Land is only considered to be "*contaminated land*" in the legal sense if it poses an unacceptable risk.

UK legislation on contaminated land is principally contained in Part 2A of the Environmental Protection Act, 1990 (which was inserted into the 1990 Act by section 57 of the Environment Act 1995). Part 2A was introduced in England on 1 April 2000 and provides a risk-based approach to the identification and remediation of land where contamination poses an unacceptable risk to human health or the environment.

The Model Procedures for the Management of Land Contamination (CLR 11), were developed to provide the technical framework for applying a risk management process when dealing with land affected by contamination. The process involves identifying, making decisions on, and taking appropriate action to deal with land contamination in a way that is consistent with government policies and legislation within the UK. The approach, concepts and principles for land contamination management promoted by LC:RM (and its predecessor CLR 11) are applied to the determination of planning applications. The guidance given in LC:RM follows the same principles.

Other legislative regimes may also provide a means of dealing with land contamination issues, such as the regimes for waste, water, environmental permitting, and environmental damage. Further, the law of statutory nuisance may result in contaminants being unacceptable to third parties whilst not attracting action under Part 2A or other environmental legislation.

2.1 Part 2A

The Regulations and Statutory Guidance that accompanied the Act, including the Contaminated Land (England) Regulations 2006, has been revised with the issue of The Contaminated Land (England) (Amendment) Regulations 2012 (SI 2012/263) and the Contaminated Land Statutory Guidance for England 2012.

Part 2A defines contaminated land as "*land which appears to the Local Authority in whose area it is situated to be in such a condition that, by reason of substances in, on or under the land that significant harm is being caused, or there is a significant possibility that such significant harm (SPOSH) could be caused, or significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution (SPOSP) being caused*".

Harm is defined as "*harm to the health of living organisms or other interference with the ecological systems of which they form part, and in the case of man, includes harm to his property*".

Part 2A provides a means of dealing with unacceptable risks posed by land contamination to human health and the environment, and under the guidance enforcing authorities should seek to find and deal with such land. It states that "*under Part 2A the starting point should be that land is not contaminated land unless there is reason to consider otherwise. Only land where unacceptable risks are clearly identified, after a risk assessment has been undertaken in accordance with the Guidance, should be considered as meeting the Part 2A definition of contaminated land*". Further, the guidance makes it clear that *"regulatory decisions should be based on what is reasonably likely, not what is hypothetically possible".*

The overarching objectives of the Government's policy on contaminated land and the Part 2A regime are:

"(a) To identify and remove unacceptable risks to human health and the environment.

(a) To seek to ensure that contaminated land is made suitable for its current use.

(b) To ensure that the burdens faced by individuals, companies and society as a whole are proportionate, manageable and compatible with the principles of

sustainable development".

The enforcing authority may need to decide whether and how to act in situations where decisions are not straight forward, and where there is uncertainty. "*In so doing, the authority should use its judgement to strike a reasonable balance between: (a) dealing with risks raised by contaminants in land and the benefits of remediating land to remove or reduce those risks; and (b) the potential impacts of regulatory intervention including financial costs to whoever will pay for remediation, health and environmental impacts of taking action, property blight, and burdens on affected people".*

The authority is required to "*take a precautionary approach to the risks raised by contamination, whilst avoiding a disproportionate approach given the circumstances of each case".* The aim is "*that the regime produces net benefits, taking account of local circumstances*".

The guidance recognises that *"normal levels of contaminants in soils should not be considered to cause land to qualify as contaminated land, unless there is a particular reason to consider otherwise".* Normal levels are quoted as:

"a) *natural presence of contaminants'* such as from underlying geology *'that have not been shown to pose an unacceptable risk to health and the environment*

b) *…low level diffuse pollution, and common human activity…"*

Similarly the guidance states that significant pollution or significant possibility of significant pollution of controlled waters is required for land to be considered contaminated and the "*fact that substances are merely entering water"* or "*where discharge from land is not discernible at a location immediately downstream"* does not constitute contaminated land.

To help achieve a more targeted approach to identifying and managing contaminated land in relation to the risk (or possibility) of harm to human health, the revised Statutory Guidance presented a new four category system for considering land under Part 2A, ranging from Category 4, where there is no risk that land poses a significant possibility of significant harm (SPOSH), or the level of risk is low, to Category 1, where the risk that land poses a significant possibility of significant harm (SPOSH) is unacceptably high.

For land that cannot be readily placed into Categories 1 or 4 further assessment is required. If there is sufficient concern that the risks could cause significant harm or have the significant possibility of significant harm the land is to be placed into Category 2. If the concern is not met land is considered Category 3.

The technical guidance clearly states that the currently published Soil Guidance Values (SGV's) and Generic Assessment Criteria (GAC's) represent *"cautious estimates of level of contaminants in soils"* which should be considered *"no risk to health or, at most, a minimal risk"*. These values do not represent the boundary between categories 3 and 4 and "*should be considered to be comfortably within Category 4".*

At the end of 2013 technical guidance in support of Defra's revised Statutory Guidance (SG) was published and then revised in 2014 (CL: AIRE 2014) which provided:

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

For controlled waters, the revised Statutory Guidance states that the following types of pollution should be considered to constitute significant pollution of controlled waters:

"(a) Pollution equivalent to "environmental damage" to surface water or groundwater as defined by The Environmental Damage (Prevention and Remediation) Regulations 2009, but which cannot be dealt with under those Regulations.

(b) Inputs resulting in deterioration of the quality of water abstracted, or intended to be used in the future, for human consumption such that additional treatment would be required to enable that use.

(c) A breach of a statutory surface water Environment Quality Standard, either directly or via a groundwater pathway.

(d) Input of a substance into groundwater resulting in a significant and sustained upward trend in concentration of contaminants (as defined in Article 2(3) of the Groundwater Daughter Directive (2006/118/EC)".

The guidance also states that, in some circumstances, significant concentrations at a compliance point (in groundwater or surface water) may constitute pollution of controlled waters.

As with SPOSH for human health, the revised Statutory Guidance presents a four-category system for Significant Pollution of controlled waters. Category 1 covers land where there is a strong and compelling case for SPOSP, for example where significant pollution would almost certainly occur if no action was taken to avoid it. Category 4 covers land where there is no risk or the risk is low, for example, where the land contamination is having no discernible impact on groundwater or surface water quality. Category 2 is for land where the risks posed to controlled waters are not high enough to consider the land as Category 1 but nonetheless are of sufficient concern to constitute SPOSP, Category 3 is for land where the risks posed to controlled waters are higher than low but not of sufficient concern to constitute SPOSP.

2.2 Planning

The Local Planning Authority (LPA) is responsible for the control of development, and in doing so it has a duty to take account of all material considerations, including contamination.

The principal planning objective is to ensure that any unacceptable risks to human health, buildings and other property and the natural and historical environment from the contaminated condition of the land are identified so that appropriate action can be considered and taken to address those risks.

The National Planning Policy Framework (NPPF, 2021), includes the following.

Paragraph 120 states that planning policies and decisions should "*(c) give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land*."

Paragraph 184 states "*Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner*".

Paragraph 174 states "*planning policies and decisions should contribute to and enhance the natural and local environment by:*

(e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; *and*

(f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

Paragraph 183 describes the policy considerations the Government expects LPA's to have in regard to land affected by contamination when preparing policies for development plans and in taking decisions on applications.

Paragraph 183 states "*planning policies and decisions should ensure that:*

(a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);

(b) after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and

c) adequate site investigation information, prepared by a competent person, is available to inform these assessments."

Paragraph 187 states "*The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.*"

The Glossary in Annex 2 provides the following:

Brownfield land registers*: Registers of previously developed land that local planning authorities consider to be appropriate for residential development, having regard to criteria in the Town and Country Planning (Brownfield Land Registers) Regulations 2017. Local planning authorities will be able to trigger a grant of permission in principle for residential development on suitable sites in their registers where they follow the required procedures.*

Competent person (to prepare site investigation information)*: A person with a recognised relevant qualification, sufficient experience in dealing with the type(s) of pollution or land instability, and membership of a relevant professional organisation.*

Previously developed land*: Land which is or was occupied by a permanent structure, including the curtilage of the developed land (although it should not be assumed that the whole of the curtilage should be developed) and any associated fixed surface infrastructure. This excludes: land that is or was last occupied by agricultural or forestry buildings; land that has been developed for minerals extraction or waste disposal by landfill, where provision for restoration has been made through development management procedures; land in built-up areas such as residential gardens, parks, recreation grounds and allotments; and land that was previously developed but where the* *remains of the permanent structure or fixed surface structure have blended into the landscape.*

***Site investigation information**: Includes a risk assessment of land potentially affected by contamination, or ground stability and slope stability reports, as appropriate. All investigations of land potentially affected by contamination should be carried out in accordance with established procedures (such as BS10175 Investigation of Potentially Contaminated Sites – Code of Practice).*

Stantec adopt the principle that a Preliminary Investigation (Desk Study and Site Reconnaissance) and Preliminary Risk Assessment (see below) is the minimum assessment requirement to support a planning application.

The level at which contamination is deemed to be unacceptable, or, gives rise to adverse effects under a planning context has not been identified but is envisaged to be more precautionary than the level required to determine land as contaminated under Part 2A.

2.3 Building Control

The building control department of the local authority or private sector approved inspectors are responsible for the operation and enforcement of the Building Regulations (DCLG 2010) to protect the health, safety and welfare of people in and around buildings. Approved Document C requires the protection of buildings and associated land from the effects of contamination, to be applied (non-exclusively) in all changes of use from commercial or industrial premises, to residential property.

3 APPROACH

As with CLR11 the guidance given in LC:RM presents three stages of land contamination management: -

(a) Stage 1 - Risk Assessment;

(b) Stage 2 - Options Appraisal; and

(c) Stage 3 - Remediation.

Each stage has three tiers. The three tiers of Stage 1 Risk Assessment are: -

- Tier 1 - Preliminary Risk Assessment (PRA) - first tier of RA that develops the outline conceptual model (CM) and establishes whether there are any potentially unacceptable risks.
- Tier 2 - Generic Quantitative Risk Assessment (GQRA) - carried out using generic assessment criteria and assumptions to estimate risk.
- Tier 3 - Detailed Quantitative Risk Assessment (DQRA) - carried out using detailed site-specific information to generate Site Specific Assessment Criteria (SSAC) as risk evaluation criteria.

For each tier of a Stage 1 - Risk Assessment you must:

1. Identify the hazard - establish contaminant sources.
2. Assess the hazard - use a source-pathway-receptor (S-P-R) pollutant linkage approach to find out if there is the potential for unacceptable risk.
3. Estimate the risk - predict what degree of harm or pollution might result and how likely it is to occur.
4. Evaluate the risk - decide whether a risk is unacceptable.

A Stantec Preliminary Investigation report normally comprises a desk study, walkover site reconnaissance and preliminary risk assessment (PRA). The project specific proposal defines the actual scope of work which might include review of ground investigation data in which case the report includes a GQRA.

Risk estimation involves identifying the magnitude of the potential consequence (taking into account both the potential severity of the hazard and the sensitivity of the receptor) and the magnitude of the likelihood i.e. the probability (taking into account the presence of the hazard and the receptor and the integrity of the pathway). This approach is promoted in current guidance such as R&D 66 (NHBC 2008).

For a PRA, Stantec's approach is that if a pollution linkage is identified then it represents a potentially unacceptable risk which either (1) remediation / direct risk management or (2) progression to further tiers of risk assessment (GQRA and GQRA) requiring additional data collection and enabling refinement of the CM using the site specific data.

4 IDENTIFICATION OF POLLUTANT LINKAGES AND DEVELOPMENT OF A CONCEPTUAL MODEL (CM)

For all Tiers of a Stage 1 Risk Assessment, the underlying principle to ground condition assessment is the identification of *pollutant linkages* in order to evaluate whether the presence of a source of contamination could potentially lead to harmful consequences. A pollutant linkage consists of the following three elements: -

- A source/hazard – a substance or situation which has the potential to cause harm or pollution;
- A pathway – a means by which the hazard moves along / generates exposure; and
- A receptor/target – an entity which is vulnerable to the potential adverse effects of the hazard.

The *Conceptual Model* identifies the types and locations of potential contaminant sources/hazards and potential receptors and potential migration/transportation pathway(s). The CM is refined through progression to further tiers of risk assessment (GQRA and GQRA) requiring additional data collection.

4.1 Hazard Identification

A hazard is a substance or situation that has the potential to cause harm. Hazards may be chemical, biological or physical.

In a PRA the potential for hazards to be present is determined from consideration of the previous or ongoing activities on or near to the site in accordance with the criteria presented in the **Table 1**.

Based on the land use information Contaminants of Potential Concern (COPC) are identified. The COPC direct the scope of the collection of site-specific data and the analytical testing selected for subsequent Tiers.

At Tier 2 the site-specific data is evaluated using appropriate published assessment criteria (refer to Stantec document entitled Rationale for the Selection of Evaluation Criteria for a Generic Quantitative Risk Assessment (GQRA)). In general, published criteria have been developed using highly conservative assumptions and therefore if the screening criterion is not exceeded (and if enough samples from appropriate locations have been analysed) then the COPC is eliminated as a potential Hazard. It should be noted that exceedance does not necessarily indicate that a site is contaminated and/or unsuitable for use only that the COPC is retained as a potential Hazard. Published criteria are generated using models based on numerous and complex assumptions. Whether or not these assumptions are appropriate or sufficiently protective requires confirmation on a project by project basis. Manipulation of the default assumptions would normally form part of a Tier 3 Detailed Quantitative Risk Assessment (DQRA).

When reviewing or assessing site specific data Stantec utilise published guidance on comparing contamination data with a critical concentration (CL:AIRE/CIEH 2008) which presents a structured process for employing statistical techniques for data assessment purposes.

4.2 Receptor and Pathway Identification

For all Tiers the potential receptors (for both on site and adjoining land) that will be considered are:

- Human Health – including current and future occupiers, construction and future maintenance workers, and neighbouring properties/third parties;
- Ecological Systems; [1]
- Controlled Waters [2] – Under section 78A(9) of Part 2A the term "pollution of controlled waters" means the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter. The term "controlled waters" in relation to England has the same meaning as in Part 3 of the Water Resources Act 1991, except that "ground waters" does not include waters contained in underground strata but above the saturation zone.
- Property - Animal or Crop (including timber; produce grown domestically, or on allotments, for consumption; livestock; other owned or domesticated animals; wild animals which are the subject of shooting or fishing rights); and
- Property - Buildings (any structure or erection, and any part of a building including any part below ground level, but does not include plant or machinery comprised in a building, or buried services such as sewers, water pipes or electricity cables including archaeological sites and ancient monuments).

If a receptor is taken forward for further assessment it will be classified in terms of its sensitivity, the criteria for which are presented in **Table 2**. Table 2 has been generated using descriptions of environmental receptor importance/value given in various guidance documents including R&D 66 (NHBC 2008), EA 2017 and Transport Analysis Guidance (based on DETR 2000). Human health and buildings classifications have been generated by Stantec using the attribute description for each class. Surface water sensitivity is classified using the Water Framework Directive (WFD) status for the River Basin obtained from: https://environment.data.gov.uk/catchment-planning/

[1] International or nationally designated sites (as defined in the statutory guidance (Defra Circular 04/12)) "*in the local area*" will be identified as potential ecological receptors. A search radius of 1, 2 or 5km will be utilised depending on the site-specific circumstances (see also pathway identification). The Environment Agency has published an ecological risk assessment framework (EA 2008) which promotes (as opposed to statutorily enforces) consideration of additional receptors to include locally protected sites and protected or notable species. These additional potential receptors will only be considered if a Phase 1 habitat survey, undertaken in accordance with guidance (JNCC 1993), is commissioned and the data provided to Stantec. It should be noted that without such a survey a Land Contamination risk assessment may conclude that the identification of potential ecological receptors is inconclusive (refer to Stantec Specification for a Preliminary Investigation (Desk Study and Site Reconnaissance).

[2] The definition of "pollution of controlled water" was amended by the introduction of Section 86 of the Water Act 2003. For the purposes of Part 2A groundwater does not include waters above the saturated zone and our assessment does not therefore address perched water other than where development causes a pathway to develop.

The exposure pathway and modes of transport that will be considered are presented in **Table 3**.

4.3 Note regarding Ecological Systems

The Environment Agency (EA) has developed an ecological risk assessment framework which aims to provide a structured approach for assessing the risks to ecology from chemical contaminants in soils (EA 2008). In circumstances where contaminants in water represent a potential risk to aquatic ecosystems then risk assessors will need to consider this separately.

The framework consists of a three-tiered process: -

- Tier 1 is a screening step where the site soils chemical data is compared to a soil screening value (SSV)
- Tier 2 uses various tools (including surveys and biological testing) to gather evidence for any harm to the ecological receptors
- Tier 3 seeks to attribute the harm to the chemical contamination

Tier 1 is preceded by a desk study to collate information about the site and the nature of the contamination to assess whether pollutant linkages are feasible. The framework presents ten steps for ecological desk studies and development of a conceptual model as follows.

1. Establish Regulatory Context
2. Collate and Assess Documentary Information
3. Summarise Documentary Information
4. Identify Contaminants of Potential Concern
5. Identify Likely Fate Transport of Contaminants
6. Identify Potential Receptors of Concern
7. Identify Potential Pathways of Concern
8. Create a Conceptual Model
9. Identify Assessment and Measurement Endpoints
10. Identify Gaps and Uncertainties

The information in a standard PRA report covers Steps 1 to 4 inclusive. Step 5 considers fate and transport of contaminants and it should be noted that our standard report adopts a simplified approach considering only transport mechanisms. A simplified approach has also been adopted in respect of Steps 6 and 7 receptors (a detailed review of the ecological attributes has not been undertaken) and pathways (a food chain assessment has not been undertaken). Step 9 is outside the scope of our standard PRA report.

It should be noted that the PRA report will present an assessment for ecological systems (where identified as a receptor for a land contamination assessment) considering the viability of the mode of transport given the site-specific circumstances and not specific pathways. The PRA may conclude that the risk to potential ecological receptors is inconclusive.

4.4 Note regarding controlled waters

Controlled waters are rivers, estuaries, coastal waters, lakes and groundwaters, but not perched waters.

The EU Water Framework Directive (WFD) 2000/60/EC provides for the protection of sub-surface, surface, coastal and territorial waters through a framework of river basin management. The EU Updated Water Framework Standards Directive 2014/101/EU amended the EU WFD to update the international standards therein; it entered into force on 20 November 2014 with the requirements for its provisions to be transposed in Member State law by 20 May 2016. Other EU Directives in the European water management framework include:

- the EU Priority Substances Directive 2013/39/EU;
- EU Groundwater Pollutants Threshold Values Directive 2014/80/EU amending the EU Groundwater Directive 2006/118/EC; and
- EU Biological Monitoring Directive 2014/101/EU.

The Ground Water Daughter Directive (GWDD) was enacted by the Groundwater Regulations (2009), which were subsumed by the Environmental Permitting Regulations (2010) which provide essential clarification including on the four objectives specifically for groundwater quality in the WFD: -

Achieve ‘Good’ groundwater chemical status by 2015, commonly referred to as ‘status objective’;
Achieve Drinking Water Protected Area Objectives;
Implement measures to reverse any significant and sustained upward trend in groundwater quality, referred to as ‘trend objective’; and

Prevent or limit the inputs of pollutants into groundwater, commonly referred to as ‘prevent or limit’ objectives

The Water Act 2003 (Commencement No.11) Order 2012 amends the test for 'contaminated land' which relates to water pollution so that pollution of controlled waters must now be "significant" to meet the definition of contaminated land.

The Water Framework Directive (WFD) requires the preparation, implementation and review of River Basin Management Plans (RBMP) on a six-year cycle. River basins are made up of lakes, rivers, groundwaters, estuaries and coastal waters, together with the land they drain. River Basin Districts (RBD) and the WFD Waterbodies that they comprise are important spatial management units, regularly used in catchment management studies. River Basin Management Plans (RBMP) have been developed for the 11 River Basin Districts in England and Wales.

These were released by Defra in 2009 (Defra 2009) and updated in 2015.

These RBMP's establish the current status of waters within the catchments of the respective Districts and the current status of adjoining waters identified. As part of a Tier 2 risk assessment water quality data is screened against the WFD assessment criteria. Comparison with the RBMP's current status of waters for the catchment under consideration would form part of a Tier 3 assessment.

5 RISK ESTIMATION

Risk estimation classifies what degree of harm might result to a receptor (defined as consequence) and how likely it is that such harm might arise (probability).
At Tier 1 the consequence classification is generated by multiplying the hazard classification score and the receptor sensitivity score. This approach follows that presented in the republished R&D 66 (NHBC 2008).

The criteria for classifying probability are set out in **Table 4** and have been taken directly from Table 6.4 CIRIA C552 (CIRIA 2001). Probability considers the integrity of the exposure pathway.

The consequence classifications detailed in **Table 5** have been adapted from Table 6.3 presented in C552 and R&D 66 (Annex 4 Table A4.3).

The Tier 1 risk classification is estimated for each pollutant linkage using the matrix given in **Table 6** which is taken directly from C552 (Table 6.5).

Subsequent Tiers refine the CM through retention or elimination of potential hazards and pollutant linkages.

6 RISK EVALUATION

Evaluation criteria are the parameters used to judge whether harm or pollution needs further assessment or is unacceptable. The evaluation criteria used will depend on:

- the reasons for doing the RA and the regulatory context such as Part 2A or planning;
- the CM and pollutant linkages present;
- any criteria set by regulators;
- any advisory requirements such as from Public Health England;
- the degree of confidence and precaution required;
- the level of confidence required to judge whether a risk is unacceptable;
- how you've used or developed more detailed assessment criteria in the later tiers of RA;
- the availability of robust scientific data;
- how much is known - for example, about the pathway mechanism and how the contaminants affect receptors; and
- any practical reasons such as being able to measure or predict against the criteria.

In order to put the Tier 1 risk classification into context the likely actions are described in **Table 7** which is taken directly from Table 6.6 of C552 (CIRIA 2001).

REFERENCES

BSI 2017 BS 10175:2011+A2:2017 Investigation of potentially contaminated sites - Code of Practice

BSI 2019 BS 8485:2015+A1:2019 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings

CIRIA 2001: Contaminated land risk assessment – a guide to good practice C552.

CIRIA 2008: Assessing risks posed by hazardous ground gases to buildings C655

CL: AIRE/CIEH 2008 Guidance on Comparing Soil Contamination Data with a Critical Concentration. Published by Contaminated Land: Applications in Real Environments (CL: AIRE) and the Chartered Institute of Environmental Health (CIEH)

CL: AIRE 2013 SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. Final Project Report published by Contaminated Land: Applications in Real Environments (CL: AIRE) 20th December 2013

DCLG 2010 Building Regulations 2010 Approved Document C Site preparation and resistance to contaminants and moisture.

DETR 2000 Methodology for Multi Modal Studies. Volume 2 Section 4. The Environmental Objective.

DEFRA 2012 Environmental Protection Act 1990: Part 2A. Contaminated Land Statutory Guidance. Department for Environment, Food and Rural Affairs

DEFRA, 2006 The Contaminated Land (England) Regulations 2006.

DEFRA, 2012 The Contaminated Land (England) (Amendment) Regulations 2012 (SI2012/263).

DEFRA, 2012 Environmental Protection Act 1990: Part 2A. Contaminated Land Statuary Guidance. April 2012.

DEFRA, 2013 Environmental Damage (Prevention and Remediation) Regulations 2009: Guidance for England and Wales

Defra '2009 Water for Life and Livelihoods. River Basin Management Plan. (11 Districts: Anglia, Dee, Humber, Northumbria, Northwest, Severn, Solway and Tweed, Southeast, Thames, Western Wales) December 2009

EA 2004: Contaminated Land Research (CLR) Report 11: The Model Procedures for the Management of Land Contamination CRL 11 by the Environment Agency (EA).

EA 2008 Ecological Risk Assessment Science Report Series SC070009 published by the Environment Agency (EA).

EA 2017 New groundwater vulnerability mapping methodology in England and Wales Report – SC040016/R Environment Agency (EA) September 2017

JNCC 1993 Handbook for Phase 1 Habitat Survey – A Technical for Environmental Audit prepared by the Joint Nature Conservancy Council (JNCC)

NHBC/EA/CIEH 2008: R&D Publication 66 Guidance for the safe development of housing on land affected by contamination.

National Planning Policy Framework (February 2019 revised), published by the Ministry of Housing, Communities and Local Government (MHCLG) at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf

Stantec Methodology for Assessment of Land Contamination (England)

Table 1: Criteria for Classifying Hazards / Potential for Generating Contamination

Classification/Score	Potential for generating contamination/gas based on land use
Very Low 1	Land Use: Residential, retail or office use, agriculture Contamination: Limited. Gas generation potential: Soils with low organic content
Low 2	Land Use: Recent small scale industrial and light industry Contamination: locally slightly elevated concentrations. Gas generation potential: Soils with high organic content (limited thickness)
Moderate 3	Land Use: Railway yards, collieries, scrap yards, engineering works. Contamination: Possible widespread slightly elevated concentrations and locally elevated concentrations. Gas generation potential: Dock silt and substantial thickness of organic alluvium/peat
High 4	Land Use: Heavy industry, non-hazardous landfills. Contamination: Possible widespread elevated concentrations. Gas generation potential: Shallow mine workings Pre 1960s landfill
Very High 5	Land Use: Hazardous waste landfills, gas works, chemical works, Contamination: Likely widespread elevated concentrations. Gas generation potential: Landfill post 1960

"Greenfield" is land which has not been developed and there has been no use of agrochemicals

Table 2: Criteria for Classifying Receptor Sensitivity/Value

Classification	Definition
Very Low 1	Receptor of limited importance • Groundwater: Unproductive strata (Strata with negligible significance for water supply or river baseflow) (previously Non-aquifer), Secondary B (water-bearing parts of non-aquifers), Secondary undifferentiated (previously minor or non-aquifer, but information insufficient to classify as secondary A or B) • Surface water: WFD Surface Water status Bad • Ecology: No local designation • Buildings: Replaceable • Human health: Unoccupied/limited access
Low 2	Receptor of local or county importance with potential for replacement • Groundwater: Secondary A aquifer • Surface water: WFD Surface Water status Poor • Ecology: local habitat resources • Buildings: Local value • Human health: Minimum score 4 where human health identified as potential receptor
Moderate 3	Receptor of local or county importance with potential for replacement • Groundwater: Principal aquifer • Surface water: WFD Surface Water status Moderate • Ecology: County wildlife sites, Areas of Outstanding Natural Beauty (AONB) • Buildings: Area of Historic Character • Human health: Minimum score 4 where human health identified as potential receptor
High 4	Receptor of county or regional importance with limited potential for replacement • Groundwater: Source Protection Zone 2 or 3 • Surface water: WFD Surface Water status Good • Ecology: SSSI, National or Marine Nature Reserve (NNR or MNR) • Buildings: Conservation Area • Human health: Minimum score 4 where human health identified as potential receptor
Very High 5	Receptor of national or international importance • Groundwater: Source Protection Zone (SPZ) 1 • Surface water: WFD Surface Water status High • Ecology: Special Areas of Conservation (SAC and candidates), Special Protection Areas (SPA and potentials) or wetlands of international importance (RAMSAR) • Buildings: World Heritage site • Human health: Residential, open spaces and uses where children are present

Table 3: Exposure Pathway and Modes of Transport

Receptor	Pathway	Mode of transport
Human health	Ingestion	Fruit or vegetable leaf or roots
		Contaminated water
		Soil/dust indoors
		Soil/dust outdoors
	Inhalation	Particles (dust / soil) – outdoor
		Particles (dust / soil) - indoor
		Vapours – outdoor - migration via natural or anthropogenic pathways
		Vapours - indoor - migration via natural or anthropogenic pathways
	Dermal absorption	Direct contact with soil
		Direct contact with waters (swimming / showering)
		Irradiation
Groundwater	Leaching	Gravity / permeation
	Migration	Natural – groundwater as pathway Anthropogenic (e.g. boreholes, culverts, pipelines etc.)
Surface Water	Direct	Runoff or discharges from pipes
	Indirect	Recharge from groundwater
	Indirect	Deposition of windblown dust
Buildings	Direct contact	Sulphate attack on concrete, hydrocarbon corrosion of plastics
	Gas ingress	Migration via natural or anthropogenic paths
Ecological systems	See Notes	Runoff/discharge to surface water body
	See Notes	Windblown dust
	See Notes	Groundwater migration
	See Notes	At point of contaminant source
Animal and crop	Direct	Windblown or flood deposited particles / dust / sediments
	Indirect	Plants via root up take or irrigation. Animals through watering
	Inhalation	By livestock / fish - gas / vapour / particulates / dust
	Ingestion	Consumption of vegetation / water / soil by animals

Table 4: Classification of Probability

Classification	Definition
High likelihood	There is a pollution linkage and an event either appears very likely in the short-term and almost inevitable over the long-term, or there is already evidence at the receptor of harm / pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter-term.
Unlikely	There is a pollution linkage, but circumstances are such that it is improbable that an event would occur even in the very long-term.

Table 5: Classification of Consequence (score = magnitude of hazard and sensitivity of receptor)

Classification / Score	Examples
Severe **17-25** **(3 out of 25 outcomes)**	Human health effect - exposure likely to result in "significant harm" as defined in the Defra (2012) Part 2A Statutory Guidance [1.] Controlled water effect - short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. Equivalent to EA Category 1 incident (persistent and/or extensive effects on water quality leading to closure of potable abstraction point or loss of amenity, agriculture or commercial value. Major fish kill. Ecological effect - short-term exposure likely to result in a substantial adverse effect. Catastrophic damage to crops, buildings or property
Medium **10-16** **(7 out of 25 outcomes)**	Human health effect - exposure could result in "significant harm" [1]. Controlled water effect - equivalent to EA Category 2 incident requiring notification of abstractor Ecological effect - short-term exposure may result in a substantial adverse effect. Damage to crops, buildings or property
Mild **5-9** **(7 out of 25 outcomes)**	Human health effect - exposure may result in "significant harm" [1]. Controlled water effect - equivalent to EA Category 3 incident (short lived and/or minimal effects on water quality). Ecological effect - unlikely to result in a substantial adverse effect. Minor damage to crops, buildings or property. Damage to building rendering it unsafe to occupy (for example foundation damage resulting in instability).
Minor **1-4** **(8 out of 25 outcomes)**	No measurable effect on humans. Protective equipment is not required during site works. Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems. Repairable effects to crops, buildings or property. The loss of plants in a landscaping scheme. Discolouration of concrete.

[1] Significant harm includes death, disease, serious injury, genetic mutation, birth defects or impairment of reproductive function. The local authority may also consider other health effects to constitute significant harm such as physical injury; gastrointestinal disturbances; respiratory tract effects; cardio-vascular effects; central nervous system effects; skin ailments; effects on organs such as the liver or kidneys; or a wide range of other health impacts. Whether or not these would constitute significant harm would depend on the seriousness of harm including impact on health, quality of life and scale of impact.

Table 6: Classification of Risk (Combination of Consequence Table 5 and Probability Table 4)

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

Table 7: Description of Risks and Likely Action Required

Risk Classification	**Description**
Very high risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation is likely to be required in the short term.
High risk	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short-term and are likely over the longer-term.
Moderate risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer-term.
Low risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very low risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

Appendix B Stantec Assessment Criteria of Contaminated Land

1 INTRODUCTION

The aim of this document is to present an explanation for the selection of the evaluation criteria routinely used by Stantec UK Ltd when undertaking a land contamination Tier 2 Generic Quantitative Risk Assessment (GQRA).

A GQRA uses published criteria to screen the site-specific contamination testing data and identify potential hazards to specific receptors. Generic criteria are typically conservative in derivation and exceedance does not indicate that a site is statutorily contaminated and/or unsuitable for use in the planning context. These criteria are used to identify situations where further assessment and/or action may be required. This document is divided into general introductory text and sections on soils, waters and gases.

2 GENERAL NOTES

This document should be read in conjunction with another entitled "Stantec Methodology for Assessment of Land Contamination" which summarises the legislative regime and our approach to ground contamination and risk assessment.

Any Stantec interpretation of contamination test results is based on a scientific and engineering appraisal. The perceptions of, for example, banks, insurers, lay people etc are not taken into account.

Any tables included in this document are produced for ease of reference to the criteria, they do not in any way replace the documents of origin (which are fully referenced) and which should be read to ensure appropriate use and interpretation of the data.

Generic criteria provide an aid to decision-making, but they do not replace the need for sound professional judgement in risk assessment (EA, 2006). The criteria are based on numerous and complex assumptions. The appropriateness of these assumptions in a site-specific context requires confirmation on a project by project basis. Our interpretative report will comment on the appropriateness of the routine criteria for project objectives or ground conditions. In some cases the published criteria whilst typically conservative may in some circumstances not be suitable for the site being assessed, either because they do not address the identified pollutant linkages or because they may not be sufficiently precautionary in the context of the site. Under these circumstances it may be necessary to recommend deriving site-specific assessment criteria. Any deviation from the routine criteria and/or selection of criteria for parameters not covered in this document will be described in the report text.

3 CRITERIA FOR EVALUATING SOIL RESULTS

3.1 Potential Harm to Human Health

The criteria used by Stantec UK Ltd to assess the potential for harm to human health are:-

- Category 4 Screening Levels (C4SLs) (Phase 1 substances DEFRA, 2014 and Phase 2 substances CLAIRE, 2021).
- Suitable 4 Use Levels (S4ULs) (Nathanail *et al*, 2015).
- CL:AIRE/EIC/AGS Generic Assessment Criteria (GAC) (CL:AIRE, 2010).
- Soil Guideline Values (SGVs) (EA, 2009a).

These criteria have been generated using the Contaminated Land Exposure Assessment model (CLEA) and supporting technical guidance (EA, 2009b, 2009c, 2009d, 2009e). The CLEA model uses generic assumptions about the fate and transport of chemicals in the environment and a generic conceptual model for site conditions and human behaviour to estimate child and adult exposures to soil contaminants for those potentially living, working, and/or playing on contaminated sites over long time periods (EA, 2009c).

The S4ULs, SGVs and GACs are all based on use of minimal/tolerable risk Health Criteria Values (HCVs) as the toxicological benchmark whereas the C4SL are based on use of a "low level of toxicological concern" (LLTC) as the toxicological benchmark. The LLTC represents a slightly higher level of risk than the HCV.

An update to the software (1.071) was published on 04/09/2015 (the handbook (EA 2009f) referring to version 1.05 is still valid). The update includes the library data sets from the DEFRA research project SP1010 (Development of Category 4 Screening Levels for assessment of land affected by contamination).

The CLEA model uses ten exposure pathways (Ingestion (outdoor soil, indoor dust, homegrown vegetables and soil attached to homegrown vegetables), Dermal Contact (outdoor soil and indoor dust) and Inhalation (outdoor dust, indoor dust, outdoor vapours and indoor vapours)). There are exposure pathways not included in the CLEA model such as the permeation of organics into plastic water supply pipes.

The presence and/or significance of each of the potential exposure pathways is dependent on the land use being considered. The model uses standard land use scenarios as follows:-

Residential – habitation of a dwelling up to two storeys high with various default material and design parameters, access to either private or nearby community open space with soil track back to form indoor dust. Assumes ingestion of homegrown produce.

Allotments – the model has default parameters for use and consumption of vegetables but not animals or their products (eggs).

Industrial/Commercial – assumes office or light physical work in a permanent three storey structure with breaks taken outside and that the site is NOT covered in hardstanding.

Public Open Space – two public open space (POS) scenarios are considered: POS_{resi} is shared communal space within a residential development where tracking back of soil into the home is assumed to occur. POS_{park} is intended for a public park sufficiently distant from housing (i.e. not adjacent to housing) such that tracking back of soil into the home is negligible. Note that the POS assessment criteria may not be appropriate for assessing sports fields.

The assessment criteria generated using CLEA can be used as a conservative starting point for evaluating long-term risks to human health from chemicals in soil.

It is important to note that the model does not assess all the potential exposure scenarios, for example risk to workers in excavations (short term exposure) or diffusion of contaminants through drinking water pipes.

Recent guidance (DEFRA 2012) introduces a four stage classification system where Category 1 sites are clearly contaminated land and Category 4 sites are definitely not contaminated land as defined by EPA 1990. Outside of these categories further specific risk assessment is required to determine if the site should fall into Category 2 (contaminated land) or Category 3 (not contaminated land). Category 4 screening values are considered to be more pragmatic than the current published SGV/GAC criteria but still strongly precautionary with the aim of allowing rapid identification of sites where the risk is above minimal but still low/acceptable.

Category 4 Screening Levels (C4SLs)

At the end of 2013, technical guidance in support of DEFRA's revised Statutory Guidance (SG) was published and then revised in 2014 (CL:AIRE 2014) which provided:

- A methodology for deriving C4SLs for the standard land-uses and two new public open space scenarios using the updated assumptions relating to the modelling of human exposure to soil contaminants; and
- A demonstration of the methodology, via the derivation of C4SLs for six substances – arsenic, benzene, benzo(a)pyrene, cadmium, chromium (VI) and lead.

Following issue of an Erratum in December 2014, a Policy Companion Document was published (DEFRA 2014).

A letter from Lord de Mauley dated 3rd September 2014 provides more explicit direction to local authorities on the use of the C4SL in a planning context. The letter identifies four key points:

1) that the screening values were developed expressly with the planning regime in mind

2) their use is recommended in DCLG's planning guidance

3) soil concentrations below a C4SL limit are considered to be 'definitely not contaminated' under Part IIA of the 1990 Environmental Protection Act and pose at most a 'low level of toxicological concern' and,

4) exceedance of a C4SL screening value does not mean that land is definitely contaminated land, just that further investigation may be warranted.

Stantec use the C4SLs as the Tier 2 soil screening criteria protective of human health for substances with C4SL available. Table 1 summarises the C4SL for each of the published substances.

Note that, with the exception of benzene, the DEFRA published C4SL are not dependent on soil organic matter content (SOM) ("*Given that BaP is non volatile and that empirical soil to plant concentration factors have been used, soil organic matter content has a negligible influence on the C4SLs for this chemical"*). The DEFRA published C4SL for benzene is based on an SOM of 6%. Stantec has used the CLEA model (v1.071) to derive C4SL for benzene for 1% and 2.5% SOM which are also shown in Table 1.

Note that an industry led project to derive C4SL for a further 20 substances has commenced (CL:AIRE, 2018). The project is being project managed by CL:AIRE and is funded by the Soil and Groundwater Technology Association (SAGTA), the Society of Brownfield Briefing (SoBRA) and others. A dedicated steering group, made up of representatives from SAGTA, DEFRA, Welsh Government, Public Health England, Environment Agency, Natural Resources Wales, Food Standards Agency, Homes England and further Land Forum representatives, has been set up to oversee the project. The new C4SL will be added to this document as they are published.

Suitable 4 Use Levels (S4ULs)

In July 2009, Generic Assessment Criteria (GACs) for 82 substances were published (LQM and CIEH, 2009) using the then current version of the CLEA software v1.04 and replaced those generated in 2006 using the original version of the model CLEA UK *beta*. In 2015 S4ULs were published by LQM/CIEH (Nathanail *et al*, 2015) to replace the second edition GACs. Table 2 summarises the S4ULs which are reproduced with permission; Publication Number S4UL3202.

Soil Guideline Values (SGVs) and Generic Assessment Criteria (GAC)

In 2009, Soil Guideline Values (SGVs) were published by the Environment Agency for arsenic, cadmium, mercury, nickel, selenium, benzene, toluene, ethyl benzene, xylenes, phenol and dioxins, furans and dioxin-like PCBs. These were derived using the CLEA model for residential, allotments and commercial land-uses.

These SGVs have now largely been superseded by the C4SLs and the S4ULs, with the exception of the SGVs for dioxins, furans and dioxin-like PCBs which are shown in Table 3.

In January 2010, Generic Assessment Criteria (GAC) derived using CLEA were published by CL:AIRE for 35 substances. These GAC are listed in Table 4.

Note that the SGVs for dioxins, furans and dioxin like PCBs and CL:AIRE GAC were derived using an older version of CLEA (v1.06) than used to derive the S4UL and C4SL (v1.07). This older version used slightly more conservative values for some exposure parameters and therefore the derived SGVs/GAC are still considered suitably precautionary for use as screening criteria.

Note on Mercury, Chromium and Arsenic

The analytical testing routinely undertaken by Stantec determines total concentration, however, the toxicity depends on the form of the contaminant.

If a source of Mercury, Chromium or Arsenic is identified or the total concentration exceeds the relevant worst case speciated criteria it will be desirable/necessary to undertake additional speciated testing and further assessment.

Note on Polycyclic Aromatic Hydrocarbons

Polycyclic Aromatic Hydrocarbons (PAHs) are a family of hundreds of different congeners whose chemical structures contain two or more fused aromatic rings. Whilst it is recognised that there is an ongoing debate on the most appropriate method to assess health effects of PAH mixtures, in 2010 the Health Protection Agency recommended the use of benzo[a]pyrene (BaP) as a surrogate marker approach in the assessment of carcinogenic risks posed by PAHs in soils (HPA, 2010).

In most cases, BaP is chosen as the surrogate marker (SM) due to its ubiquitous nature and the vast amount of data available and has been used by various authoritative bodies to assess the carcinogenic risk of PAHs in food. The SM approach estimates the carcinogenic toxicity of a mixture of PAHs in an environmental matrix by using toxicity data for a PAH mixture for which the composition is known.

Exposure to the SM is assumed to represent exposure to all PAHs in that matrix therefore the toxicity of the SM represents the toxicity of the mixture. The SM approach relies on a number of assumptions (HPA, 2010).

- The SM (BaP) must be present in all the samples.
- The profile of the different PAH relative to BaP should be similar in all samples.
- The PAH profile in the soil samples should be sufficiently similar to that used in the pivotal toxicity study on which HBGV was based i.e. the Culp study (Culp et al. (1998)).

In order to justify the use of a surrogate marker assessment criterion (C4SL for benzo(a)pyrene and S4UL coal tar) the LQM PAH Profiling Tool is used by Stantec to assess the similarity of the PAH profile in a soil sample to that of the toxicity study. The spreadsheet calculates the relative proportions of the genotoxic PAHs and plots them relative to the composition of the two coal mixtures used by Culp et al. Provided that the relative proportions are within an order of magnitude of those from the Culp Study (as suggested by HPA) Stantec will use the C4SL for benzo(a)pyrene as a surrogate marker for the carcinogenic PAHs, i.e. benzo(a)pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(ah)anthracene, indeno(123-cd)pyrene and benzo(ghi)perylene. For projects where this approach is appropriate the results will be assessed using the Coal Tar criterion (BAP C4SL) and the criteria for non-carcinogenic PAHs (S4ULs), i.e. naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene and pyrene.

Note on Total Petroleum Hydrocarbons

The S4UL for Total Petroleum Hydrocarbon (TPH) fractions are based on ‘threshold’ health effects. In accordance with Environment Agency guidance (EA, 2005) and the S4UL report (Nathanail *et al*, 2015) the potential for additivity of toxicological effects between fractions should be considered. Practically, to address this issue the hazard quotient (HQ) for each fraction should be calculated by dividing the measured concentration of the fraction by the GAC. The HQs are then added to form a hazard index (HI) for that sample. An HI greater than 1 indicates an exceedance.

Note on Dioxins, Furans and Dioxin-like PCBs

The SGVs for dioxins, furans and dioxin-like PCBs are based on an assumed congener profile for urban soils. The total measured concentration of dioxin, furan and dioxin-like PCB congeners listed in the SGV report (EA, 2009a) should be compared with the SGVs to make an initial assessment of risk. A more accurate assessment can be made using the Environment Agency's site specific worksheet for dioxins, furans and dioxin like PCBs available from https://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/77-risk-assessment-info-ra/199-dioxins-site-specific-worksheets.

Note on Asbestos

Asbestos in soil and made ground is currently under review by a number of bodies. There are no current published guidance values for asbestos in soil other than the waste classification values given in the EA's Technical Guidance WM3, Hazardous Waste – Interpretation of the definition and classification of hazard waste (EA, 2015). This guidance is only appropriate for soils that are being discarded as waste.

Testing for asbestos will be carried out on selected samples of made ground encountered during investigation, initially samples will be subjected to an asbestos screen and, if asbestos is found to be present, subjected to quantification depending on the project specific requirements. The reader is directed to the report text for guidance on the approach adopted in respect to any asbestos found to be present.

Further guidance is also available in publication C733, Asbestos in soil and made ground: a guide to understanding and managing risks (CIRIA 2014).

Note on Soil Saturation Concentration

The soil saturation concentration is the concentration of an organic constituent in soil at which either the pore water or soil vapour has theoretically become saturated with the substance, i.e. the substance concentration has reached its maximum aqueous solubility or vapour pressure. The soil saturation concentration is related to the properties of the substance as well as the properties of the soil (including soil organic matter content).

The soil saturation concentrations are shown in Table 2 in brackets where exceeded by the assessment criteria and in Table 4 for all substances. Measured concentrations in excess of the soil saturation concentration have various potential implications as discussed below.

Firstly, where measured concentrations exceed the soil saturation concentration, the risk from vapour inhalation and/or consumption of produce may be limited. The CLEA model calculates the soil saturation concentration but it does not limit exposure where this concentration is exceeded. This adds an additional level of conservatism for CLEA derived assessment criteria where these exceed the calculated soil saturation concentration. Secondly, the soil saturation concentration is sometimes used to flag the potential presence of non-aqueous phase liquid (NAPL, a.k.a. free phase) in soil. The presence of NAPL is an important consideration in the Tier 2 assessment because, where present, the risks from NAPL may need to be considered separately. Theoretically, where a measured concentration exceeds the soil saturation concentration NAPL could be present. However, using theoretical saturation values is not always reliable for the following reasons: The soil saturation concentration is based on the aqueous solubility and vapour pressure of a pure substance and not a mixture, of which NAPLs are often comprised; and

The soil saturation concentration does not account for the sorption capacity of the soil. As a result, exceedance of the soil saturation concentration does not necessarily imply that NAPL is present. This is particularly the case for longer chain hydrocarbons such as PAHs which have low solubility and vapour pressure and hence a low soil saturation concentration but that are strongly sorbed to soil.

The measured concentrations will be compared to the soil saturation concentrations shown in Tables 2 and 4. Where exceeded Stantec will use additional lines of evidence (such as visual evidence and concentration of total TPH) to determine whether or not NAPL is likely to be present. If the presence of NAPL is deemed plausible the implications will be considered in the risk assessment.

3.2 Potential Harm to the Built Environment

Land contamination can pose risks to buildings, building materials and services (BBM&S) in a number of ways. Volatile contaminants and gases can accumulate and cause explosion or fire. Foundations and buried services can be damaged by corrosive substances and contaminants such as steel slags can create unstable ground conditions through expansion causing structural damage.

Stantec use the following primary guidance to assess the significance of soil chemistry with respect to its potential to harm the built environment.

i) Approved Document C - Site Preparation and Resistance to Contaminants and Moisture. (DCLG, 2013);
ii) Concrete in aggressive ground SD1 (BRE 2005);
iii) Guidance for the selection of water supply pipes to be used in brownfield sites (UK WIR 2011);

iv) Protocols published by agreement between Water UK and the Home Builders Federation providing supplementary guidance which includes the Risk Assessment for Water Pipes (the 'RA') (Water UK 2014).
v) Performance of Building Materials in Contaminated Land report BR255 (BRE 1994).
vi) Risks of Contaminated Land to Buildings, Building Materials and Services. A Literature Review - Technical Report P331 (EA, 2000).
vii) Guidance on assessing and managing risks to buildings from land contamination - Technical Report P5 035/TR/01 (EA, 2001).

3.3 Potential to Harm Ecosystems, Animals, Crops etc

The criteria routinely used by Stantec as Tier 2 screening values to assess the potential of soil chemistry to harm ecosystems are taken from the following guidance and are summarised in Table 5.

i) Derivation and Use of Soil Screening Values for assessing ecological risks (EA, 2017a);
ii) The Restoration and Aftercare of Metalliferous Mining Sites for Pasture and Grazing (ICRCL 70/90, 1990);
iii) Sewage sludge on farmland: code of practice for England, Wales and Northern Ireland (DEFRA, 2018); and
iv) BS 3882:2015 Specification for topsoil and requirements for use (BSI, 2015).

Unless stated in the report the assessment is solely for phytotoxic parameters and additional assessment is required to determine suitability as a growing medium.

4 CRITERIA FOR EVALUATING LIQUID RESULTS

4.1 Potential Harm to Human Health via Ingestion

The Tier 2 water screening values routinely adopted by Stantec for assessing the potential for harm to human health via ingestion (presented as Table 6) are taken from The Water Supply (Water Quality) Regulations (S.I. 2018/647) unless otherwise indicated.

It should be noted that some of the prescribed concentrations listed in the Water Supply Regulations have been set for reasons other than their potential to cause harm to human health. The concentrations of iron and manganese are controlled because they may taint potable water with an undesirable taste, odour or colour or may potentially deposit precipitates in water supply pipes.

4.2 Potential Harm to Human Health via Inhalation of Vapours

The Tier 2 water screening values adopted by Stantec for assessing the potential for chronic human health risk from the inhalation of vapours from volatile contaminants in groundwater are presented in Table 7. These generic assessment criteria have been taken from a report published by the Society of Brownfield Risk Assessment (SoBRA) (SoBRA, 2017). The methodology adopted in their generation is considered compatible with the UK approach to deriving GAC and adopts a precautionary approach. As with all published GAC the suitability for use on the site being assessed has to be decided by the assessor based on a thorough understanding of the methodology and assumptions used in their derivation. Note, that the SoBRA groundwater vapour GAC are not intended for assessing risks to ground workers from short-term exposure.

Note that Table 7 shows the theoretical maximum aqueous solubility for each contaminant and indicates the GAC that exceed solubility. Measured concentrations in excess of solubility may be an indication that NAPL is present. As for the assessment of soils, if the presence of NAPL is deemed plausible the implications will be considered in the risk assessment.

4.3 Potential to Harm Controlled Waters

When assessing ground condition data and the potential to harm Controlled Waters Stantec uses the approach presented in the groundwater protection position statements published 14.03.17 (EA, 2017b) which describe the Environment Agency's approach to managing and protecting groundwater. They update and replace Groundwater Protection: principles and practice (GP3). Controlled Waters are rivers, estuaries, coastal waters, lakes and groundwaters. Water in the unsaturated zone is not groundwater but does come within the scope of the term "ground waters" as used and defined in the Water Resources Act 1991. It will continue to be a technical decision for the Environment Agency to determine what is groundwater in certain circumstances for the purposes of the Regulations. As discussed in our Methodology for Assessment of Land Contamination perched water is not considered a receptor in Stantec assessments.

The EU Water Framework Directive (WFD) 2000/60/EC provides for the protection of sub-surface, surface, coastal and territorial waters through a framework of river basin management.

The EU Updated Water Framework Standards Directive 2014/101/EU amended the EU WFD to update the international standards therein; it entered into force on 20 November 2014 with the requirement for its provisions to be transposed in Member State law by 20 May 2016.

Member States are required under the EU WFD to update their river basin management plans every six years. The first river basin management plans for England and Wales, Scotland and Northern Ireland were published in December 2009, and these were updated in 2015.

Other EU Directives in the European water management framework include:

- the EU Priority Substances Directive 2013/39/EU;
- EU Groundwater Pollutants Threshold Values Directive 2014/80/EU amending the EU Groundwater Daughter Directive (GWDD) 2006/118/EC; and
- the EU Biological Monitoring Directive 2014/101/EU.

The Priority Substances Directive set environmental quality standards (EQS) for the substances in surface waters (river, lake, transitional and coastal) and confirmed their designation as priority or priority hazardous substances (PS), the latter being a subset of particular concern. Environmental Quality Standards for PS are determined at the European level and apply to all Member States. Member States identify and develop standards for 'Specific Pollutants'. Specific Pollutants (SP) are defined as substances that can have a harmful effect on biological quality.

The Water Framework Directive (Standards and Classification) Directions (England and Wales) (DEFRA, 2015) were issued to the Environment Agency as an associated document of the Water Environment (WFD) (England and Wales) Regulations 2015 (S.I. 2015/1623) and provide directions for the classification of surface water and groundwater bodies. Schedule 3 parts 2 and 3 relate to surface water standards for specific pollutants in fresh or salt water bodies and priority substances in inland (rivers, lakes and related modified/artificial bodies) or other surface waters respectively. Although Schedule 5 presents threshold values for groundwater the Direction specifically excludes their use as part of site-specific investigations.

Table 6 presents the criteria routinely used by Stantec as Tier 2 screening values. This table only presents a selection of the more commonly analysed parameters and the source documents should be consulted for other chemicals. For screening groundwater the criteria selected are the standards for surface water and/or human consumption as appropriate together with the following:-

For a **hazardous substance** Stantec adopts the approach that, if the concentration in a discharge to groundwater is less than the Minimum Reporting Value (MRV), the input is regarded as automatically meeting the Article 2 (b) 'de-minimus' requirement of exemption 6 (3) (b) of the GWDD. Stantec has selected hazardous substances from the latest list published by the Joint Agencies Groundwater Directive Advisory Group (JAGDAG, 2018). MRV is the lowest concentration of a substance that can be routinely determined with a known degree of confidence, and may not be equivalent to limit of detection. MRVs have been identified from DEFRA's guidance on Hazardous Substances to Groundwater: Minimum Reporting Values (DEFRA, 2017), and are shown in Table 6.

Note that for land contamination assessments, where hazardous substances have already entered groundwater, remediation targets would typically be based on achieving appropriate water quality standards (e.g. drinking water standard or EQS) at a compliance point rather than an MRV. For this reason, when assessing measured groundwater or soil leachate concentrations, the values for human consumption, fresh water and salt water shown in Table 6 (whichever is appropriate for the context of the site) will be used as the Tier 2 assessment criteria rather than MRV. For hazardous substances with no water quality standard the laboratory method detection limit will be used as the assessment criteria.

For **non-hazardous substances** the GWDD requires that inputs be limited to avoid deterioration. UKTAG guidance equates deterioration with pollution. Non-hazardous substances are all substances not classified as hazardous. For Stantec assessments the values for human consumption, fresh water and salt water shown in Table 6 (whichever is appropriate for the context of the site) are used as the assessment criteria for non-hazardous substances.

Note on Copper, Lead, Manganese, Nickel and Zinc

$EQS_{bioavailable}$ have been developed for UK Specific Pollutants copper, zinc and manganese and the EU priority substances lead and nickel. An EQS is the concentration of a chemical in the environment below which there is not expected to be an adverse effect on the specific endpoint being considered, e.g. the protection of aquatic life.

It is very difficult to measure the bioavailable concentration of a metal directly. The UK has developed simplified Metal Bioavailability Assessment Tool (M-BAT) for copper, zinc, nickel and manganese which uses local water chemistry data, specifically pH, dissolved organic carbon (DOC) (mg/L) and Calcium (Ca) (mg/L).

Where the recorded total dissolved concentration exceeds the screening criteria for these parameters ($EQS_{bioavailable}$) further assessment will be undertaken using the tools downloaded from http://www.wfduk.org/resources/rivers-lakes-metal-bioavailability-assessment-tool-m-bat

The models calculate a risk characterisation ratio

(RCR) and where this is greater than 1 this indicates the bioavailable concentration is above the EQS and the parameter is then identified as a potential hazard. The report will discuss this identified hazard noting that the pH, calcium and, in particular, the dissolved organic carbon (DOC) in groundwater may be quite different to the receiving water (e.g. due to the presence to leaf litter or organic sediments dissolving in the water).

5 CRITERIA FOR EVALUATING GAS RESULTS

Stantec use the following primary guidance on gas monitoring methods and investigation, the assessment of risk posed by soil gases (including Volatile Organic Compounds (VOCs)) and mitigation measures/risk reduction during site development.

i) BS 8576:2013 – Guidance on Ground Gas Investigations: Permanent gases and Volatile Organic Compounds (VOCs) (BSI, 2013);
ii) TB18 Continuous Ground-Gas Monitoring and the Lines of Evidence Approach to Risk Assessment CL:AIRE Technical Bulletin TB18 (CL:AIRE 2019)
iii) RB17 A pragmatic approach to Ground Gas Risk Assessment. CL:AIRE Research Bulletin RB17 (Card et al, 2012);
iv) The VOCs Handbook. C682 (CIRIA, 2009).
v) Assessing risks posed by hazardous gases to buildings C665 (CIRIA, 2007);
vi) Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present. (NHBC, 2007); and
vii) BS 8485:2015+A1:2019- Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (BSI, 2019).

Gas and borehole flow data are used to obtain the gas screening value (GSV) for methane and carbon dioxide. The GSV is used to establish the characteristic situation and to make recommendations for gas protection measures for buildings if required.

Radon

Stantec use the following primary guidance to assess the significance of the radon content of soil gas.

i) Radon: guidance on protective measures for new dwellings. Report BR211 (BRE, 2015); and
ii) Indicative Atlas of Radon in England and Wales (HPA & BGS, 2007).

6 REFERENCES

BRE (1994) Performance of Building Materials in Contaminated Land (BR255) Building Research Establishment (BRE).

BRE (2005) Concrete in aggressive ground. Special Digest 1, Building Research Establishment (BRE), Garston, Herts.

BRE (2015) BR211-2015 : Radon: Guidance on protective measures for new buildings (2015 edition) Building Research Establishment (BRE), Garston, Herts.

BSI (2011) BS10175:2011 +A1:2013 Investigation of contaminated sites – code of practice. British Standards Institute, London.

BSI (2013) BS 8576:2013 – Guidance on Ground Gas Investigations : Permanent gases and Volatile Organic Compounds (VOCs). British Standards Institute, London.

BSI (2015) BS 3882:2015 - Specification for topsoil

BSI (2019) BS 8485:2015+A1:2019 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings. British Standards Institute, London.

Card G, Wilson S, Mortimer S. (2012). A Pragmatic Approach to Ground Gas Risk Assessment. CL:AIRE Research Bulletin RB17. CL:AIRE, London, UK. ISSN 2047- 6450 (Online)

CL:AIRE (2019) TB18 Continuous Ground-Gas Monitoring and the Lines of Evidence Approach to Risk Assessment CL:AIRE Technical Bulletin TB18

CIRIA (2007) C665 Assessing risks posed by hazardous gases to buildings. Construction Industry Research and Information Association (CIRIA), London.

CIRIA (2009) C682 The VOCs Handbook. C682 Construction Industry Research and Information Association (CIRIA), London.

CIRIA (2014) C733, Asbestos in soil and made ground: a guide to understanding and managing risks. Construction Industry Research and Information Association (CIRIA), London.

CL:AIRE (2010) Soil Generic Assessment Criteria for Human Health Risk Assessment. Published in January 2010 by Contaminated Land: Applications in Real Environments, London. ISBN 978-1-905046-20-1.

CL:AIRE (2014) SP1010 – Development of Category 4 Screening Levels for Assessment of

Land Affected by Contamination. Final Project Report published by Contaminated Land: Applications in Real Environments (CL:AIRE) 24th September 2014

CL:AIRE (2021) Web page on Category 4 Screening Levels and the Phase 2 project https://www.claire.co.uk/projects-and-initiatives/category-4-screening-levels

Culp, S.J, Gaylor, D.W., Sheldon, W.G., Goldstein, L.W. and Beland, F.A. (1998) A comparison of the tumors induced by coal tar and benzo(a)pyrene in a 2-year bioassay. Carcinogenesis, 19, pp 117-124.

DCLG (2013) Approved Document C - Site preparation and resistance to contaminates and moisture (2004 Edition incorporating 2010 and 2013 amendments).

DEFRA (2012) Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance. Department for Environment, Food and Rural Affairs (DEFRA).

DEFRA (2014) SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document. Department for Environment, Food and Rural Affairs December 2014

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

DEFRA (2017) Hazardous substances to groundwater: minimum reporting values. Updated 13 January 2017 https://www.gov.uk/government/publications/values-for-groundwater-risk-assessments/hazardous-substances-to-groundwater-minimum-reporting-values

DEFRA (2018) Sewage sludge in agriculture: code of practice for England, Wales and Northern Ireland https://www.gov.uk/government/publications/sewage-sludge-in-agriculture-code-of-practice/sewage-sludge-in-agriculture-code-of-practice-for-england-wales-and-northern-ireland

EA (2000) Risks of Contaminated Land to Buildings, Building Materials and Services. A Literature Review - Technical Report P331

EA (2001) Guidance on assessing and managing risks to buildings from land contamination - Technical Report P5 035/TR/01

EA (2006) CLEA update No. 4. Environment Agency, Bristol.

EA (2008) Ecological Risk Assessment (ERA). Science Report Series SC070009, Environment Agency, Bristol.

EA (2009a) Soil Guideline Values for contaminants in soil. Science Reports SC050021/various.

EA (2009b) Using Soil Guideline Values. Science Report SC050021/SGV Introduction. Environment Agency, Bristol.

EA (2009c) Updated Technical Background to the CLEA model. Science Report SC050021/SR3 Introduction. Environment Agency, Bristol.

EA (2009d) Human health toxicological assessment of contaminants in soil. Science Report SC050021/SR2. Environment Agency, Bristol.

EA (2009e) Compilation data for priority organic contaminants for derivation of soil guideline values Science Report SC50021/SR7

EA (2009f) CLEA Software (Version 1.05) Handbook Science Report SC050021/SR4

EA (2015) Guidance on the classification and assessment of waste (3rd edition 2015) - Technical Guidance WM3

EA (2017a) Derivation and use of soil screening values for assessing ecological risks. Report – ShARE id26

EA (2017b) Groundwater Protection Position Statements - https://www.gov.uk/government/publications/groundwater-protection-position-statements

HPA (2010) Risk assessment approaches for polycyclic aromatic hydrocarbons. HPA contaminated land information sheet. Health Protection Agency (HPA)

HPA & BGS (2007). Indicative Atlas of Radon in England and Wales. HPA-RPD-033. Health Protection Agency and British Geological Survey

ICRCL (1990) The Restoration and Aftercare of Metalliferous Mining Sites for Pasture and Grazing 70/90. Interdepartmental Committee on the Redevelopment of Contaminated Land, London.

JAGDAG (2018). Substances confirmed as hazardous or non-hazardous pollutants following public consultation. Last updated 31 January 2018. Joint Agencies Groundwater Directive Advisory Group http://wfduk.org/sites/default/files/Media/JAGDAG/2018%2001%2031%20Confirmed%20hazardous%20substances%20list_0.pdf

Nathanail, C.P., McCaffrey, C., Gillett, A.G., Ogden, R.C. and Nathanail, J.F. (2015) The LQM/CIEH

S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham.

NHBC (2007) Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present. National House Building Council.

S.I. (2018/647). Statutory Instrument 2018 No 614 The Water Supply (Water Quality) Regulations, 2016.

S.I. (2017/407). Statutory Instrument 2017 No 407 Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

S.I. (2015/1623). Statutory Instrument 2015 No 1623 The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations 2015.

SoBRA (2017) Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health from Volatile Contaminants in Groundwater Version 1.0 February 2017. Society of Brownfield Risk Assessment (SoBRA)

UKWIR (2011) Guidance for the selection of Water Pipes to be used in Brownfield Sites. UK Water Industry Research (UKWIR)

Water UK (2014) Contaminated Land Assessment Guidance

Table 1: Category 4 Screening Levels (C4SL)

	Allotments	Residential (with home-grown produce)	Residential (without home-grown produce)	Commercial	Public Open Space 1	Public Open Space 2
Arsenic	49	37	40	640	79	170
Benzene - 1% SOM* - 2.5% SOM* - 6% SOM	 0.039 0.081 0.18	 0.20 0.41 0.87	 0.89 1.6 3.3	 27 50 98	 140 140 140	 190 210 230
Benzo(a)pyrene (as a surrogate marker for carcinogenic PAHs)	5.7	5.0	5.3	77	10	21
Cadmium	3.9	22	150	410	220	880
Chromium VI	170	21	21	49	21	250
Lead	80	200	310	2300	630	1300
Vinyl Chloride/ Chloroethene/ Chloroethylene, (CAS No. 75-01-4)	 0.0017 0.0031 0.0058	 0.0064 0.010 0.017	 0.015 0.019 0.029	 1.1 1.4 2.2	 7.8 7.8 7.8	 18 19 19
Trichloroethene / Trichloroethylene/ TCE or 'Trike' (CAS No. 79-01-06)	 0.032 0.072 0.16	 0.0093 0.020 0.043	 0.0097 0.020 0.045	 0.73 1.5 3.4	 76 78 79	 41 54 69
Tetrachloroethene/ Tetrachloroethylene/ Perchloroethylene, PCE or 'perc', (CAS No. 127-18-4)	 2.0 4.8 11.0	 0.31 0.70 1.60	 0.32 0.71 1.60	 24 55 130	 3,200 3,300 3,400	 1,400 1,900 2,500

Units mg/kg dry weight

Values taken from SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document (Department for Environment, Food and Rural Affairs December 2014), unless stated otherwise
Public Open Space 1 – for grassed area adjacent to residential housing
Public Open Space 2 - Park Type Public Open Space Scenario
Based on a sandy loam as defined in SR3 (Environment Agency, 2009b)
Note that, with the exception of benzene, these C4SL are not SOM dependent
* - Stantec derived C4SL using CLEA v1.071

Table 2: Suitable 4 Use Levels (S4UL)

Determinand	Allotment	R_WHP	R_{WO}HP	Commercial/ Industrial	POSresi	POSpark
Metals						
Arsenic (**Inorganic**)[a, b, c]	43	37	40	640	79	170
Beryllium [a, b, d, e]	35	1.7	1.7	12	2.2	63
Boron [a, b, d]	45	290	11000	240000	21000	46000
Cadmium (**pH6-8**) [a, b, d, f]	1.9	11	85	190	120	560
Chromium (trivalent) [a, b, d, g]	18000	910	910	8600	1500	33000
Chromium (hexavalent) [a, b, c]	1.8[h]	6[i]	6[i]	33[i]	7.7[i]	220[i]
Copper [a, b, c]	520	2400	7100	68000	12000	44000
Mercury (elemental) [a, b, c, j]	21	1.2	1.2	58[vap] (25.8)	16	30[vap] (25.8)
Mercury (inorganic) [a, b, c]	19	40	56	1100	120	240
Methylmercury [a, b, c]	6	11	15	320	40	68
Nickel [a, b, c]	53[k]	130[e]	180[e]	980[e]	230[e]	800[k]
Selenium [a, b, c]	88	250	430	12000	1100	1800
Vanadium [a, b, c, i, j]	91	410	1200	9000	2000	5000
Zinc [a, b, c]	620	3700	40000	730000	81000	170000
BTEX Compounds (SOM 1%/ 2.5%/ 6%)						
Benzene [a, b, l, m]	0.017/0.034/ 0.075	0.087/0.17/ 0.37	0.38/0.7/1.4	27 / 47 / 90	72 / 72 / 73	90 / 100 / 110
Toluene [a, b, l, m]	22 / 51 / 120	130 / 290 / 660	880[vap] (869) /1900/3900	56000[vap] (869) / 110000[vap] (1920)/ 180000[vap] (4360)	56000 / 56000 / 56000	87000[vap](869)/ 95000[vap](1920)/ 100000[vap](4360)
Ethylbenzene [a, b, l, m]	16 / 39 / 91	47 / 110 / 260	83 / 190 / 440	5700[vap] (518) / 13000[vap] (1220) / 27000[vap] (2840)	24000 / 24000 / 25000	17000[vap] (518) / 22000[vap](1220) / 27000[vap] (2840)
O – Xylene [a, b, l, m, n]	28 / 67 / 160	60 / 140 / 330	88 / 210 / 480	6600[sol] (478) / 15000[sol] (1120) / 33000[sol] (2620)	41000 / 42000 / 43000	17000[sol] (478) / 24000[sol] (1120) / 33000[sol] (2620)
M – Xylene [a, b, l, m, n]	31 / 74 / 170	59 / 140 / 320	82 / 190 / 450	6200[vap] (625) / 14000[vap] (1470) / 31000[vap] (3460)	41000 / 42000 / 43000	17000[vap] (625) / 24000[vap](1470) / 32000[vap] (3460)
P – Xylene [a, b, l, m, n]	29 / 69 / 160	56 / 130 / 310	79 / 180 / 430	5900[sol] (576) / 14000[sol] (1350) / 30000[sol] (3170)	41000 / 42000 / 43000	17000[sol] (576) / 23000[sol] (1350) / 31000[sol] (3170)

Determinand	Allotment	R_{W}HP	R_{WO}HP	Commercial/ Industrial	POSresi	POSpark
Total xylenes [t]	28 / 67 / 160	56 / 130 / 310	79 / 180 / 430	5900[sol] (576) / 14000[sol] (1350) / 30000[sol] (3170)	41000 / 42000 / 43000	17000[sol] (576) / 23000[sol] (1350) / 31000[sol] (3170)
Polycyclic Aromatic Hydrocarbons (SOM 1%/ 2.5%/ 6%) [a, b, l, p]						
Acenaphthene	34 / 85 / 200	210 / 510 / 1100	3000[sol](57.0)/ 4700[sol] (141)/ 6000[sol] (336)	84000[sol] (57.0)/ 97000[sol] (141)/ 100000	15000 / 15000 / 15000	29000/ 30000/ 30000
Acenaphthylene	28 / 69 / 160	170 / 420 / 920	2900[sol](86.1)/ 4600[sol] (212)/ 6000[sol] (506)	83000[sol] (86.1)/ 97000[sol] (212)/ 100000	15000 / 15000 / 15000	29000 / 30000 / 30000
Anthracene	380 / 950 / 2200	2400 / 5400 / 11000	31000[sol](1.17) /35000/ 37000	520000/ 540000/ 540000	74000 / 74000 / 74000	150000 / 150000 / 150000
Benzo(a)anthracene	2.9 / 6.5 / 13	7.2 / 11 / 13	11 / 14 / 15	170 / 170 / 180	29 / 29 / 29	49 / 56 / 62
Benzo(a)pyrene (Bap) [u]	0.97 / 2.0 / 3.5	2.2 / 2.7 / 3.0	3.2 / 3.2 / 3.2	35 / 35 / 36	5.7 / 5.7 / 5.7	11 / 12 / 13
Benzo(b)fluoranthene	0.99 / 2.1 / 3.9	2.6 / 3.3 / 3.7	3.9 / 4.0 / 4.0	44 / 44 / 45	7.1 / 7.2 / 7.2	13 / 15 / 16
Benzo(g,h,i)perylene	290 / 470 / 640	320 / 340 / 350	360 / 360 / 360	3900 / 4000 / 4000	640 / 640 / 640	1400 / 1500 / 1600
Benzo(k)fluoranthene	37 / 75 / 130	77 / 93 / 100	110 / 110 / 110	1200 / 1200 /1200	190 / 190 / 190	370 / 410 / 440
Chrysene	4.1 / 9.4 / 19	15 / 22 / 27	30 / 31 / 32	350 / 350 / 350	57 / 57 / 57	93 / 110 / 120
Dibenzo(ah)anthracene	0.14 / 0.27 / 0.43	0.24 / 0.28 / 0.3	0.31 / 0.32 / 0.32	3.5 / 3.6 / 3.6	0.57 / 0.57 / 0.58	1.1 / 1.3 / 1.4
Fluoranthene	52 / 130 / 290	280 / 560 / 890	1500 / 1600 / 1600	23000 / 23000 / 23000	3100 / 3100 / 3100	6300 / 6300 / 6400
Fluorene	27 / 67 / 160	170 / 400 / 860	2800[sol] (30.9) /3800[sol] (76.5) /4500[sol] (183)	63000[sol] (30.9) / 68000 / 71000	9900 / 9900 / 9900	20000 / 20000 / 20000
Indeno(1,2,3-cd)pyrene	9.5 / 21 / 39	27 / 36 / 41	45 / 46 / 46	500 / 510 / 510	82 / 82 / 82	150 / 170 / 180
Naphthalene [q]	4.1 / 10 / 24	2.3 / 5.6 / 13	2.3 / 5.6 / 13	190[sol] (76.4) / 460[sol] (183) / 1100[sol] (432)	4900/ 4900/ 4900	1200[sol] (76.4) / 1900[sol] (183) / 3000
Phenanthrene	15 / 38 / 90	95 / 220 / 440	1300[sol](36.0) / 1500 / 1500	22000 / 22000 / 23000	3100 / 3100 / 3100	6200 / 6200 / 6300
Pyrene	110 / 270 / 620	620 / 1200 / 2000	3700 / 3800 / 3800	54000 / 54000 / 54000	7400 / 7400 / 7400	15000 / 15000 / 15000
Coal Tar (Bap as surrogate marker) [u]	0.32 / 0.67 / 1.2	0.79 / 0.98 / 1.1	1.2 / 1.2 / 1.2	15 / 15 / 15	2.2 / 2.2 / 2.2	4.4 / 4.7 / 4.8
Explosives [a, b, l, p]						
2, 4, 6 Trinitrotoluene	0.24 / 0.58 / 1.40	1.6 / 3.7 / 8.0	65 / 66 / 66	1000 / 1000 / 1000	130 / 130 / 130	260 / 270 / 270
RDX (Royal Demolition Explosive $C_3H_6N_6O_6$)	17 / 38 / 85	120 / 250 / 540	13000 / 13000 / 13000	210000 / 210000 / 210000	26000 / 26000 / 27000	49000[sol] (18.7) / 51000 / 53000
HMX (High Melting Explosive $C_4H_8N_8O_8$)	0.86 / 1.9 / 3.9	5.7 / 13 / 26	6700 / 6700 / 6700	110000 / 110000 / 110000	13000 / 13000 / 13000	23000[vap] (0.35) /23000[vap] (0.39) /24000[vap] (0.48)
Petroleum Hydrocarbons (SOM 1%/ 2.5%/ 6%) [a, b, l, m]						
Aliphatic EC 5-6	730 / 1700 / 3900	42 / 78 / 160	42 / 78 / 160	3200[sol] (304) / 5900[sol] (558) / 12000[sol] (1150)	570000[sol](304) 590000 / 600000	95000[sol] (304) / 130000[sol] (558)/ 180000[sol](1150)
Aliphatic EC >6-8	2300 / 5600 / 13000	100 / 230 / 530	100 / 230 / 530	7800[sol] (144) / 17000[sol] (322) / 40000[sol] (736)	600000 / 610000 / 620000	150000[sol] (144) 220000[sol] (322)/ 320000[sol] (736)
Aliphatic EC >8-10	320 / 770 / 1700	27 / 65 / 150	27 / 65 / 150	2000[sol] (78) / 4800[vap] (190) / 11000[vap] (451)	13000 / 13000 / 13000	14000[sol] (78) / 18000[vap] (190) / 21000[vap] (451)
Aliphatic EC >10-12	2200 / 4400 / 7300	130v[ap] (48) / 330[vap] (118) / 760[vap] (283)	130v[ap] (48) / 330[vap] (118) / 770[vap] (283)	9700[sol] (48) / 23000[vap] (118) / 47000[vap] (283)	13000 / 13000 / 13000	21000[sol] (48) / 23000[vap] (118) / 24000[vap] (283)
Aliphatic EC >12-16	11000 / 13000 / 13000	1100[sol] (24) / 2400[sol] (59) / 4300[sol] (142)	1100[sol] (24) / 2400[sol] (59) / 4400[sol] (142)	59000[sol] (24) / 82000[sol] (59) / 90000[sol] (142)	13000 / 13000 / 13000	25000[sol] (24) / 25000[sol] (59) / 26000[sol] (142)
Aliphatic EC >16-35 [o]	260000 / 270000 / 270000	65000[sol](8.48 92000[sol] (21) 110000	65000[sol](8.48 92000[sol] (21) 110000	1600000 / 1700000 / 1800000	250000 / 250000 / 250000	450000 / 480000 / 490000
Aliphatic EC >35-44 [o]	260000 / 270000 / 270000	65000[sol](8.48 92000[sol] (21) / 110000	65000[sol](8.48 92000[sol] (21) 110000	1600000 / 1700000 / 1800000	250000 / 250000 / 250000	450000 / 480000 / 490000
Aromatic EC 5-7 (benzene)	13 / 27 / 57	70 / 140 / 300	370 / 690 / 1400	26000[sol] (1220) / 46000[sol] (2260) / 86000[sol] (4710)	56000 / 56000 / 56000	76000[sol] (1220) /84000[sol](2260)/ 92000[sol] (4710)
Aromatic EC >7-8 (toluene)	22 / 51 / 120	130 / 290 / 660	860 / 1800 / 3900	56000[vap] (869)/ 110000[sol] (1920)/ 180000[vap] (4360)	56000 / 56000 / 56000	87000[vap](869) / 95000[sol] (1920)/ 100000[vap](4360)
Aromatic EC >8-10	8.6 / 21 / 51	34 / 83 / 190	47 / 110 / 270	3500[vap] (613) / 8100[vap] (1500) / 17000[vap] (3580)	5000 / 5000 / 5000	7200[vap](613) / 8500[vap] (1500) / 9300[vap] (3580)

Determinand	Allotment	RWHP	RWOHP	Commercial/ Industrial	POSresi	POSpark
Aromatic EC >10-12	13 / 31 / 74	74 / 180 / 380	250 / 590 / 1200	16000[sol] (364) / 28000[sol] (899) / 34000[sol] (2150)	5000 / 5000 / 5000	9200[sol] (364) / 9700[sol] (899) / 10000
Aromatic EC >12-16	23 / 57 / 130	140 / 330 / 660	1800 / 2300[sol] (419) / 2500	36000[sol] (169) / 37000 / 38000	5100 / 5100 / 5000	10000 / 10000 / 10000
Aromatic EC >16-21 [o]	46 / 110 / 260	260 / 540 / 930	1900 / 1900 / 1900	28000 / 28000 / 28000	3800 / 3800 / 3800	7600 / 7700 / 7800
Aromatic EC >21-35 [o]	370 / 820 / 1600	1100 / 1500 / 1700	1900 / 1900 / 1900	28000 / 28000 / 28000	3800 / 3800 / 3800	7800 / 7800 / 7900
Aromatic EC >35-44 [o]	370 / 820 / 1600	1100 / 1500 / 1700	1900 / 1900 / 1900	28000 / 28000 / 28000	3800 / 3800 / 3800	7800 / 7800 / 7900
Aliphatic + Aromatic EC >44-70 [o]	1200 / 2100 / 3000	1600 / 1800 / 1900	1900 / 1900 / 1900	28000 / 28000 / 28000	3800 / 3800 / 3800	7800 / 7800 / 7900
Chloroalkanes & Chloroalkenes (SOM 1%/ 2.5%/ 6%) [a, b, l, p]						
1,2-Dichloroethane	0.0046 / 0.0083 / 0.016	0.0071 / 0.011 / 0.019	0.0092 / 0.013 / 0.023	0.67 / 0.97 / 1.7	29 / 29 / 29	21 / 24 / 28
1,1,1 Trichloroethane (TCA)	48 / 110 / 240	8.8 / 18 / 39	9.0 / 18 / 40	660 / 1300 / 3000	140000 / 140000 / 140000	57000[vap](1425) 76000[vap](2915)/ 100000[vap](6392)
1,1,1,2 Tetrachloroethane	0.79 / 1.9 / 4.4	1.2 / 2.8 / 6.4	1.5 / 3.5 / 8.2	110 / 250 / 560	1400 / 1400 / 1400	1500 / 1800 / 2100
1,1,2,2 Tetrachloroethane	0.41 / 0.89 / 2.0	1.6 / 3.4 / 7.5	3.9 / 8.0 / 17	270 / 550 / 1100	1400 / 1400 / 1400	1800 / 2100 / 2300
Tetrachloromethane (Carbon Tetrachloride)	0.45 / 1.0 / 2.4	0.026 / 0.056 / 0.13	0.026 / 0.056 / 0.13	2.9 / 6.3 / 14	890 / 920 / 950	190 / 270 / 400
Trichloromethane (Chloroform)	0.42 / 0.83 / 1.7	0.91 / 1.7 / 3.4	1.2 / 2.1 / 4.2	99 / 170 / 350	2500 / 2500 / 2500	2600 / 2800 / 3100
Phenol & Chlorophenols [a, b, l, p]						
Phenol	23 / 42 / 83	120 / 200 / 380	440 / 690 / 1200	440[dir] (26000) / 690[dir] (30000) / 1300[dir] (34000)	440[dir] (10000)/ 690[dir](10000) 1300[dir](10000)	440[dir] (7600) / 690[dir] (8300) / 1300[dir] (93000)
Chlorophenols (excluding PCP) [r]	0.13[s] / 0.3 / 0.7	0.87[s] / 2.0 / 4.5	94 / 150 / 210	3500 / 4000 / 4300	620 / 620 / 620	1100 / 1100 / 1100
Pentachlorophenol (PCP)	0.03 / 0.08 / 0.19	0.22/ 0.52 / 1.2	27[vap] (16.4) / 29 / 31	400 / 400 / 400	60 / 60 / 60	110 / 120 / 120
Other [a, b, l, p]						
Carbon Disulphide	4.8 / 10 / 23	0.14 / 0.29 / 0.62	0.14 / 0.29 / 0.62	11 / 22 / 47	11000 / 11000 / 12000	1300 / 1900 / 2700
Hexachlorobutadiene (HCBD)	0.25 / 0.61 / 1.4	0.29 / 0.7 / 1.6	0.32 / 0.78 / 1.8	31 / 66 / 120	25 / 25 / 25	48 / 50 / 51
Pesticides (SOM 1%/ 2.5%/ 6%) [a, b, l, p]						
Aldrin	3.2 / 6.1 / 9.6	5.7/ 6.6 /7.1	7.3 / 7.4 / 7.5	170 / 170 / 170	18 / 18 / 18	30 / 31 / 31
Atrazine	0.5 / 1.2 / 2.7	3.3 / 7.6 / 17.4	610 / 620 / 620	9300 / 9400 / 9400	1200 / 1200 / 1200	2300 / 2400 / 2400
Dichlorvos	0.0049 / 0.010 / 0.022	0.032 / 0.066 / 0.14	6.4 / 6.5 / 6.6	140 / 140 / 140	16 / 16 / 16	26 / 26 / 27
Dieldrin	0.17/0.41/0.96	0.97/ 2 / 3.5	7.0 / 7.3 / 7.4	170 / 170 / 170	18 / 18 / 18	30 / 30 / 31
Alpha - Endosulfan	1.2 / 2.9 / 6.8	7.4 / 18 / 41	160[vap] (0.003)/ 280[vap] (0.007)/ 410[vap] (0.016)	5600[vap] (0.003) / 7400[vap] (0.007) / 8400[vap] (0.016)	1200 / 1200 / 1200	2400 / 2400 / 2500
Beta - Endosulfan	1.1 / 2.7 / 6.4	7.0 / 17 / 39	190[vap](0.00007) /320[vap](0.0002) /440[vap](0.0004)	6300[vap](0.00007) /7800[vap](0.0002) / 8700	1200 / 1200 / 1200	2400 / 2400 / 2500
Alpha-Hexachlorocyclohexane	0.035/0.087/ 0.21	0.23/0.55 / 1.2	6.9 / 9.2 / 11	170 / 180 / 180	24 / 24 / 24	47 / 48 / 48
Beta - Hexachlorocyclohexane	0.013 / 0.032 / 0.077	0.085 / 0.2 / 0.46	3.7 / 3.8 / 3.8	65 / 65 / 65	8.1 / 8.1 / 8.1	15 / 15 / 16
Gamma – Hexachlorocyclohexane	0.0092 / 0.023 / 0.054	0.06 / 0.14 / 0.33	2.9 / 3.3 / 3.5	67 / 69 / 70	8.2 / 8.2 / 8.2	14 / 15 / 15
Chlorobenzenes [a, b, l, p]						
Chlorobenzene	5.9 / 14 / 32	0.46 / 1.0 / 2.4	0.46 / 1.0 / 2.4	56 / 130 / 290	11000 / 13000 / 14000	1300[sol](675)/ 2000[sol](1520)/ 2900
1,2-dichlorobenzene (1,2-DCB)	94 / 230 / 540	23 / 55 / 130	24 / 57 / 130	2000[sol] (571) / 4800[sol] (1370) / 11000[sol] (3240)	90000 / 95000 / 98000	24000[sol] (571) / 36000[sol] (1370) /51000[sol] (3240)
1,3-dichlorobenzene (1,3-DCB)	0.25 / 0.6 / 1.5	0.4 / 1.0 / 2.3	0.44 /1.1 / 2.5	30 / 73 / 170	300 / 300 / 300	390 / 440 / 470
1-4-dichlorobenzene (1,4-DCB)	15[i] / 37[i] / 88 [i]	61[q] / 150[q] /350 [q]	61[q] / 150[q] / 350[q]	4400[vap,q] (224) / 10000[vap,q] (540) / 25000[vap,q] (1280)	17000[i] / 17000[i] / 17000[i]	36000[vap,i] (224) 36000[vap, i](540)/ 36000[vap,i](1280)
1,2,3-Trichlorobenzene	4.7 / 12 / 28	1.5 / 3.6 / 8.6	1.5 / 3.7 / 8.8	102 / 250 / 590	1800 / 1800 / 1800	770[vap] (134) / 1100[vap] (330) / 1600[vap] (789)
1,2,4- Trichlorobenzene	55 / 140 / 320	2.6 / 6.4 / 15	2.6 / 6.4 / 15	220 / 530 / 1300	15000 / 17000 / 19000	1700[vap] (318) / 2600[vap] (786) / 4000[vap] (1880)

Determinand	Allotment	R_{W}HP	R_{WO}HP	Commercial/ Industrial	POSresi	POSpark
1,3,5- Trichlorobenzene	4.7 / 12 / 28	0.33 / 0.81 / 1.9	0.33 / 0.81 / 1.9	23 / 55 / 130	1700 / 1700 / 1800	380[vap] (36.7) / 580[vap] (90.8) / 860[vap] (217)
1,2,3,4-Tetrachlorobenzene	4.4 / 11 / 26	15 / 36 / 78	24 / 56 / 120	1700[vap] (122) / 3080[vap] (304) / 4400[vap] (728)	830 / 830 / 830	1500[vap] (122) / 1600 / 1600
1,2,3,5- Tetrachlorobenzene	0.38 / 0.90 / 2.2	0.66 / 1.6 / 3.7	0.75 / 1.9 / 4.3	49[vap] (39.4) / 120[vap] (98.1) / 240[vap] (235)	78 / 79 / 79	110[vap] (39.4) / 120 / 130
1,2,4,5- Tetrachlorobenzene	0.06 / 0.16 / 0.37	0.33 / 0.77 / 1.6	0.73 / 1.7 / 3.5	42[sol] (19.7) / 72[sol] (49.1) / 96	13 / 13 / 13	25 / 26 / 26
Pentachlorobenzene (P_ECB)	1.2 / 3.1 / 7.0	5.8 / 12 / 22	19 / 30 / 38	640[sol] (43.0) / 770[sol] (107) / 830	100 / 100 / 100	190 / 190 / 190
Hexachlorobenzene (HCB)	0.47 / 1.1 / 2.5	1.8[vap] (0.20) / 3.3[vap] (0.5) / 4.9	4.1[vap] (0.20) / 5.7[vap] (0.5) / 6.7[vap] (1.2)	110[vap] (0.20) / 120 / 120	16 / 16 / 16	30 / 30 / 30

Units are mg/kg Dry Weight

R_{W}HP Residential with homegrown produce
R_{WO}HP Residential without homegrown produce
POSresi public open spaces near residential housing
POSpark public open space for recreational use but not dedicated sports pitches
SOM Soil Organic Matter – ***the S4UL for all organic compounds will vary according to SOM***

a Based on a sandy loam soil as defined in SR3 (Environment Agency, 2009b) and 6% soil organic matter (SOM)
b Figures rounded to two significant figures
c Based only on a comparison of oral and dermal soil exposure with oral Index Dose
d The background ADE is limited to being no larger than the contribution from the relevant soil ADE
e Based on comparison of inhalation exposure with inhalation TDI only
f Based on a lifetime exposure via the oral, dermal and inhalation pathways
g Based on localised effects comparing inhalation exposure with inhalation ID only
h Based on comparison of inhalation exposure with inhalation ID
i Based on comparison of oral and dermal exposure with oral TDI
j Based on comparison of oral, dermal and inhalation exposure with inhalation TDI
k Based on comparison of all exposure pathways with oral TDI
l S4ULs assume that free phase contamination is not present
m S4ULs based on a sub-surface soil to indoor air correction factor of 10
n The HCV applied is based on the intake of total Xylene and therefore exposure should not consider an isomer in isolation
o Oral, dermal and inhalation exposure compared with oral HCV
p S4ULs based on a sub-surface soil to indoor air correction factor of 1
q Based on a comparison of inhalation exposure with the inhalation TDI for localised effects
r Based on 2,4-dichlorophenol unless otherwise stated
s Based on 2,3,4,6-tetrachlorophenol
t Based on lowest GAC for all three xylene isomers
u Measured concentrations of benzo(a)pyrene should be compared to the S4UL for benzo(a)pyrene as a single compound and to the S4UL for benzo(a)pyrene as a surrogate marker of genotoxic PAHs.
vap S4UL presented exceeded the vapour saturation limit, which is presented in brackets
sol S4UL presented exceeds the solubility saturation limit, which is presented in brackets
dir S4ULs based on a threshold protective of direct skin contact, guideline in brackets based on the health effects following long term exposure provided for illustration only

Table 3: Soil Guideline Values (SGVs) for dioxins, furans and dioxin like PCBs

Determinand	Allotments	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	Commercial
Sum of PCDDs, PCDFs and dioxin-like PCBs	0.008	0.008	0.008	0.24

Units are mg/kg Dry Weight

Table 4: EIC/AGS/CL:AIRE Generic Assessment Criteria (GAC)

	Allotments	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	Commercial	Soil Saturation Concentration
Metals					
Antimony	ND	ND	550	7500	NA
Barium	ND	ND	1300	22000	NA
Molybdenum	ND	ND	670	17000	NA
Organics (SOM 1%/ 2.5%/ 6%)					
1,1,2 Trichloroethane	0.28 / 0.61 / 1.4	0.6 / 1.2 / 2.7	0.88 / 1.8 / 3.9	94 / 190 / 400	4030 / 8210 / 18000
1,1-Dichloroethane	9.2 / 17 / 35	2.4 / 3.9 / 7.4	2.5 / 4.1 / 7.7	280 / 450 / 850	1830 / 2960 / 5600
1,1-Dichloroethene	2.8 / 5.6 / 12	0.23 / 0.4 / 0.82	0.23 / 0.41 / 0.82	26 / 46 / 92	2230 / 3940 / 7940
1,2,4-Trimethylbenzene	0.38 / 0.93 / 2.2	0.35 / 0.85 / 2	0.41 / 0.99 / 2.3	42 / 99 / 220	557 / 1360 / 3250
1,2-Dichloropropane	0.62 / 1.2 / 2.6	0.024 / 0.042 / 0.084	0.024 / 0.042 / 0.085	3.3 / 5.9 / 12	1190 / 2110 / 4240
2,4-Dimethylphenol	3.1 / 7.2 / 17	19 / 43 / 97	210 / 410 / 730	16000 / 24000 / 30000	1380 / 3140 / 7240
2,4-Dinitrotoluene	0.22 / 0.49 / 1.1	1.5 / 3.2 / 7.2	170 / 170 / 170	3700 / 3700 / 3800	141 / 299 / 669
2,6-Dinitrotoluene	0.12 / 0.27 / 0.61	0.78 / 1.7 / 3.9	78 / 84 / 87	1900 / 1900 / 1900	287 / 622 / 1400
2-Chloronaphthalene	40 / 98 / 230	3.7 / 9.2 / 22	3.8 / 9.3 / 22	390 / 960 / 2200	114 / 280 / 669
Biphenyl	14 / 35 / 83	66 / 160 / 360	220 / 500 / 980	18000 / 33000 / 48000	34.4 / 84.3 / 201
Bis (2-ethylhexyl) phthalate	47 / 120 / 280	280 / 610 / 1100	2700 / 2800 / 2800	85000 / 86000 / 86000	8.68 / 21.6 / 51.7
Bromobenzene	3.2 / 7.6 / 18	0.87 / 2 / 4.7	0.91 / 2.1 / 4.9	97 / 220 / 520	853 / 1970 / 4580
Bromodichloromethane	0.016 / 0.032 / 0.068	0.016 / 0.03 / 0.061	0.019 / 0.034 / 0.07	2.1 / 3.7 / 7.6	1790 / 3220 / 6570
Bromoform	0.95 / 2.1 / 4.6	2.8 / 5.9 / 13	5.2 / 11 / 23	760 / 1500 / 3100	2690 / 5480 / 12000
Butyl benzyl phthalate	220 / 550 / 1300	1400 / 3300 / 7200	42000 / 44000 / 44000	940000 / 940000 / 950000	26.3 / 64.7 / 154
Chloroethane	110 / 200 / 380	8.3 / 11 / 18	8.4 / 11 / 18	960 / 1300 / 2100	2610 / 3540 / 5710
Chloromethane	0.066 / 0.13 / 0.23	0.0083 / 0.0098 / 0.013	0.0085 / 0.0099 / 0.013	1 / 1.2 / 1.6	1910 / 2240 / 2990
Cis 1,2 Dichloroethene	0.26 / 0.5 / 1	0.11 / 0.19 / 0.37	0.12 / 0.2 / 0.39	14 / 24 / 47	3940 / 6610 / 12900
Dichloromethane	0.1 / 0.19 / 0.34	0.58 / 0.98 / 1.7	2.1 / 2.8 / 4.5	270 / 360 / 560	7270 / 9680 / 15300
Diethyl Phthalate	19 / 41 / 94	120 / 260 / 570	1800 / 3500 / 6300	150000 / 220000 / 290000	13.7 / 29.1 / 65
Di-n-butyl phthalate	2 / 5 / 12	13 / 31 / 67	450 / 450 / 450	15000 / 15000 / 15000	4.65 / 11.4 / 27.3
Di-n-octyl phthalate	940 / 2100 / 3900	2300 / 2800 / 3100	3400 / 3400 / 3400	89000 / 89000 / 89000	32.6 / 81.5 / 196
Hexachloroethane	0.27 / 0.67 / 1.6	0.2 / 0.48 / 1.1	0.22 / 0.54 / 1.3	22 / 53 / 120	8.17 / 20.1 / 48.1
Isopropylbenzene	32 / 79 / 190	11 / 27 / 64	12 / 28 / 67	1400 / 3300 / 7700	390 / 950 / 2250
Methyl tert-butyl ether (MTBE)	23 / 44 / 90	49 / 84 / 160	73 / 120 / 220	7900 / 13000 / 24000	20400 / 33100 / 62700
Propylbenzene	34 / 83 / 200	34 / 82 / 190	40 / 97 / 230	4100 / 9700 / 21000	402 / 981 / 2330
Styrene	1.6 / 3.7 / 8.7	8.1 / 19 / 43	35 / 78 / 170	3300 / 6500 / 11000	626 / 1440 / 3350
Total Cresols (2-, 3- and 4-methylphenol)	12 / 27 / 63	80 / 180 / 400	3700 / 5400 / 6900	160000 / 180000 / 180000	15000 / 32500 / 73300
Trans 1,2 Dichloroethene	0.93 / 1.9 / 4	0.19 / 0.34 / 0.7	0.19 / 0.35 / 0.71	22 / 40 / 81	3420 / 6170 / 12600
Tributyl tin oxide	0.042 / 0.1 / 0.24	0.25 / 0.59 / 1.3	1.4 / 3.1 / 5.7	130 / 180 / 200	41.3 / 101 / 241

Units are mg/kg Dry Weight

Table 5: Tier 2 Criteria for the Assessment of Soils – Protection of Flora and Fauna

Parameter	ICRCL 70/90 [a]		SSVs [b]	Code of Practice for Agricultural Use of Sewage Sludge [c]	BS 3882:2015 Specification for topsoil and requirements for use
	Maximum				Phytotoxic contaminants
	Livestock	Crop Growth			
	mg/kgDW	mg/kgDW	mg/kgDW	mg/kgDW	mg/kgDW
Antimony			37		
Arsenic	500	1000		50	
Cadmium	30	50	0.6	3	
Chromium				400	
Cobalt			4.2		
Copper	500	250	35.1	80/ 100/ 135/ 200 [d]	<100/<135/<200 [e]
Fluoride	1000			500	
Lead	1000			300	
Mercury				1	
Molybdenum			5.1	4	
Nickel			28.2	50/ 60/ 75/ 110 [d]	<60/<75/<110 [e]
Selenium				3	
Silver			0.3		
Vanadium			2.0		

Parameter	ICRCL 70/90 [a]		SSVs [b]	Code of Practice for Agricultural Use of Sewage Sludge [c]	BS 3882:2015 Specification for topsoil and requirements for use
	Maximum				Phytotoxic contaminants
	Livestock	Crop Growth			
	mg/kgDW	mg/kgDW	mg/kgDW	mg/kgDW	mg/kgDW
Zinc	3000	1000	35.6	200/200/200/300 [d]	<200/<200/<300 [e]
Benzo(a)pyrene			0.15		
Bis(2-ethylhexyl) phthalate			13		
Hexachlorobenzene			0.002		
Pentachlorobenzene					
Pentachlorophenol			0.6		
Perfluorooctanoic acid			0.022		
Perfluorooctane sulfonate			0.014		
Polychlorinated alkanes medium chain			11.9		
Tetrachloroethene					
Toluene					
Triclosan			0.13		
Tris(2-chloroethyl)phosphate			1.1		
Tris(2-chloro-1-methylethyl) phosphate			1.8		

a. Interdepartmental Committee on the Redevelopment of Contaminated Land (ICRCL) 70/90 Restoration and Aftercare of Metalliferous Mining Sites for Pasture and Grazing 1st edition 1990.
b. Soil screening values for assessing ecological risks, EA 2017a Report – ShARE id26
c. Maximum permissible concentration of potentially toxic elements for Arable land from the Sewage sludge in agriculture: code of practice.. There are also criteria for Grassland which are higher than for Arable.
d. Where four values are presented, concentrations are for soils with pH values 5.0-5.5/ 5.5-6.0/ 6.0-7.0/ >7.0 (and the soils contain more than 5% calcium carbonate)
e. Where three values are presented, concentrations are for soils with pH values <6.0/ 6.0-7.0/ >7.0

Table 6: Tier 2 Criteria for Screening Liquids

	Screening Concentration (mg/l)			
	Minimum Reporting Value	Human Consumption	Fresh Water/Inland	Salt Water/Other
Arsenic SP	-	0.01	0.05 [(2)]	0.025 [(2)]
Boron	-	1	-	-
Cadmium PS	0.0001	0.005	≤0.00008, 0.00008, 0.00009, 0.00015, 0.00025 [(14)]	0.0002
Chromium (total)	-	0.05	-	-
Chromium (III) SP	-	-	0.0047	-
Chromium (VI) SP	-	-	0.0034	0.0006
Copper SP	-	2	0.001 bioavailable	0.00376 bioavailable
Iron SP	-	0.2	1	1
Lead PS	-	0.01	0.0012 bioavailable	0.0013 bioavailable
Mercury compounds PS	0.00001	0.001	0.00007 max	0.00007 max
Manganese SP	-	0.05	0.123 bioavailable	-
Nickel PS	-	0.02	0.004 bioavailable	0.0086 bioavailable
Selenium	-	0.01	-	-
Zinc SP	-	5[(3)]	0.0109bioavailable[(13)]	0.0068bioavailable [(13)]
Chlorinated Compounds				
C10-13 chloroalkanes PS short chain chlorinated paraffins	-	-	0.0004	0.0004
Dichloromethane PS	-	-	0.02	0.02
1,2-Dichloroethane PS	0.001	0.003	0.01	0.01

	Screening Concentration (mg/l)			
	Minimum Reporting Value	**Human Consumption**	**Fresh Water/Inland**	**Salt Water/Other**
Trichloroethene PS	0.0001	0.01(5)	0.01	0.01
1,1,1-Trichloroethane	0.0001	-	-	-
1,1,2-Trichloroethane	0.0001	-	-	-
Trichloromethanes PS	-	0.1(1)	0.0025	0.0025
1, 2, 4-Trichlorobenzene	0.00001			
Tetrachloroethene PS	0.0001	0.01(5)	0.01	0.01
Tetrachloromethane/ Carbon tetrachloride PS	0.0001	0.003	0.012	0.012
Tetrachloroethane SP	-		0.140	
Vinyl chloride	-	0.0005	-	-
Trichlorobenzene (TCB) PS	-	-	0.0004	0.0004
Chloroform	0.0001			
Chloronitrotoluenes(CNT)(11)	0.001	-	-	-
Hexachlorobutadiene PS	0.000005	-	0.0006 max	0.0006 max
Hexachlorocyclohexanes (HCH) PS	0.000001	-	0.00002	0.000002
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	-	-	-	-
Acenaphthylene	-	-	-	-
Anthracene PS	-	-	0.0001	0.0001
Benzo(a)anthracene	-	-	-	-
Benzo(b)fluoranthene PS	-	0.0001 (10)	0.000017 max (12)	0.000017 max (12)
Benzo(a)pyrene PS	-	0.00001	0.00000017	0.00000017
Benzo(k)fluoranthene PS	-	0.0001 (10)	0.000017 max (12)	0.000017 max (12)
Benzo(g,h,i)perylene PS	-	0.0001 (10)	0.0000082 max (12)	0.00000082 max (12)
Indeno(1,2,3-cd)pyrene PS	-	0.0001 (10)	- (12)	- (12)
Chrysene		-	-	-
Dibenzo(a,h)anthracene		-	-	-
Fluoranthene PS	-	-	0.0000063	0.0000063
Fluorene	-	-	-	-
Phenanthrene	-	-	-	-
Pyrene	-	-	-	-
Naphthalene PS	-	-	0.002	0.002
Polycyclic Aromatic Hydrocarbons		0.0001(10)		
Petroleum hydrocarbons				
Petroleum hydrocarbons/Mineral oil	-	0.01(3)	-	-
Benzene PS	0.001	0.001	0.01	0.008
Toluene SP	0.004	0.7(9)	0.074	0.074
Ethylbenzene	-	0.3(9)	-	-
Xylenes	0.003(4)	0.5(9)		
Methyl tert-butyl ether (MTBE)	-	0.015(7)	-	-
Pesticides and Herbicides				
Alachlor PS	-	-	0.0003	0.0003
Aldrin PS	0.000003	0.00003	0.00001(8)	0.000005(8)
Dieldrin PS	0.000003	0.00003		
Endrin PS	0.000003	0.0006(9)		
Isodrin	0.000003	-	-	-
2,4 dichlorophenol SP	0.0001	-	0.0042	0.00042
2,4 D ester SP	0.0001	-	0.0003	0.0003
op and pp DDT (each) PS	0.000002	0.001(6)	0.000025 (6)	0.000025 (6)
op and pp DDE (each)	0.000002			
op and pp TDE (each)	0.000002			
Dimethoate SP	0.00001	-	0.00048	0.00048
Endosulfan PS	0.000005	-	0.000005	0.0000005
Hexachlorobenzene PS	0.000001		0.00005 max	0.00005 max
Permethrin SP	0.000001	-	0.000001	0.0000002
Atrazine PS	0.00003	-	0.0006	0.0006
Simazine PS	0.00003	-	0.001	0.001
Linuron SP	-	-	0.0005	0.0005
Mecoprop SP		-	0.018	0.018
Trifluralin PS	0.00001	-	0.00003	0.00003
Total pesticides	-	0.0005		

	Screening Concentration (mg/l)			
	Minimum Reporting Value	Human Consumption	Fresh Water/Inland	Salt Water/Other
Miscellaneous				
Ammoniacal nitrogen (as $NH4+$)	-	0.5	0.26 [16] 0.39 [17]	-
Ammoniacal nitrogen (as N)	-	0.39	0.2 [16] 0.3 [17]	-
Unionised Ammonia (NH3) SP	-	-	-	0.021
Chloride	-	250		
Chlorine SP			0.002	0.01 max
Cyanide SP (hydrogen cyanide)	-	0.05	0.001	0.001
Nitrate (as NO_3)	-	50	-	-
Nitrite (as NO_2)	-	0.1	-	-
Phenol SP	-	0.005 (3)	0.0077	0.0077
Pentachlorophenol PS	0.0001	-	0.0004	0.0004
PCBs (individual congeners)	0.000001	-	-	-
Sodium	-	200	-	-
Sulphate	-	250		-
Tributyl and triphenyl tin compounds (each) PS	0.000001	-	0.0000002	0.0000002
Di(2-ethylhexyl)-phthalate PS	-	-	0.0013	0.0013

Substances highlighted in yellow are hazardous substances, PS = Priority Substances, SP = Specific Pollutants, '-' screening concentration is not available, 'max' – maximum allowable concentration used where no annual average provided

Notes:

1. Concentration for trihalomethanes is the sum of chloroform, bromoform, dibromochloromethane and bromodichloromethane.
2. Concentration is the dissolved fraction of a water sample obtained by filtration through a 0.45um filter.
3. Concentration is taken from Statutory Instrument 1989 No. 1147. The Water Supply (Water Quality) Regulations 1989, as amended.
4. Concentration for xylenes is 0.003mg/l each for o-xylene and m/p xylene.
5. Concentration is the Sum of TCE and PCE.
6. Concentration is for Total DDT. Para DDT on its own has a target concentration of 0.00001mg/l.
7. Concentration for MTBE is taken from Environment Agency guidance, dated 2006.
8. Concentration is the sum of aldrin, dieldrin, endrin.
9. Concentration is taken from WHO (2004) guidelines for drinking-water quality.
10. Sum of benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene
11. Concentration is for 2,6-CNT, 4,2-CNT, 4,3-CNT, 2,4-CNT, 2,5-CNT
12. BAP can be considered as a marker of the other PAHs for comparison with the annual average
13. Concentration plus ambient background concentration (dissolved)
14. For cadmium and its compounds the EQS depends on the hardness of the water (Class 1: < 40 mg CaCO3/l, Class 2: 40 to < 50 mg CaCO3/l, Class 3: 50 to < 100 mg CaCO3/l, Class 4: 100 to < 200 mg CaCO3/l and Class 5: ≥ 200 mg CaCO3/l).
15. Manufactured and used in industrial applications, such as flame retardants and plasticisers, as additives in metal working fluids, in sealants, paints, adhesives, textiles, leather fat and coatings. Persistent, bioaccumulate and toxic to aquatic life (carcinogen in rat studies). Candidate Persistent Organic Pollutant (POP).
16. Acceptable 90th percentile concentration for a freshwater lake/river with "High" chemical quality standard and alkalinity (as mg/l CaCO3) < 50 mg/L or alkalinity < 200 mg/L where river elevation > 80 m above Ordnance Datum (mAOD). See the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 for further details.
17. Acceptable 90th percentile concentration for a freshwater lake/river with "High" chemical quality standard and alkalinity (as mg/l CaCO3) ≥ 50 mg/L where river elevation < 80 m mAOD or > 200 mg/l where river elevation > 80 mAOD. See the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 for further details.

Table 7: Tier 2 Criteria for Screening Groundwater Vapour Generation Hazard

Chemical	CAS	GAC_{gwvap}(µg/l)[1,2]		Aqueous Solubility (µg/l)
		Residential	Commercial	
Petroleum Hydrocarbons				
1,2,4-Trimethylbenzene	95-63-6	24	2,200	559,000
Benzene [3]	71-43-2	210	20,000	1,780,000
Ethylbenzene [3]	100-41-4	10,000	*960,000 (sol)*	180,000
Isopropylbenzene	98-82-8	850	*86,000 (sol)*	56,000
Propylbenzene	103-65-1	2,700	*240,000 (sol)*	54,100
Styrene	100-42-5	8,800	*810,000 (sol)*	290,000
Toluene [3]	108-88-3	230,000	*21,000,000 (sol)*	590,000
TPH Aliphatic EC5-EC6 [3]		1,900	*190,000 (sol)*	35,900
TPH Aliphatic >EC6-EC8 [3]		1,500	*150,000 (sol)*	5,370
TPH Aliphatic >EC8-EC10 [3]		57	*5,700 (sol)*	427
TPH Aliphatic >EC10-EC12 [3]		37	*3,600 (sol)*	34
TPH Aromatic >EC5-EC7 [2,3]		210,000	*20,000,000 (sol)*	1,780,000
TPH Aromatic >EC7-EC8 [3]		220,000	*21,000,000 (sol)*	590,000
TPH Aromatic >EC8-EC10 [3]		1,900	*190,000 (sol)*	64,600
TPH Aromatic >EC10-EC12 [3]		6,800	*660,000 (sol)*	24,500
TPH Aromatic >EC12-EC16 [3]		39,000	*3,700,000 (sol)*	5,750
meta-Xylene [3,5]	108-38-3	9,500	*940,000 (sol)*	200,000
ortho-Xylene [3,5]	95-47-6	12,000	*1,100,000 (sol)*	173,000
para-Xylene [3,5]	106-42-3	9,900	*980,000 (sol)*	200,000
Polycyclic Aromatic Hydrocarbons (PAH)				
Acenaphthene	83-32-9	*170,000 (sol)*	*15,000,000 (sol)*	4,110
Acenaphthylene	208-96-8	*220,000 (sol)*	*20,000,000 (sol)*	7,950
Fluorene	86-73-7	*210,000 (sol)*	*18,000,000 (sol)*	1,860
Naphthalene	91-20-3	220	*23,000 (sol)*	19,000
Pesticides				
Aldrin	309-00-2	*47 (sol)*	*3,700 (sol)*	20
alpha-Endosulfan	959-98-8	*7,400 (sol)*	*590,000 (sol)*	530
beta-Endosulfan	33213-65-9	*7,500 (sol)*	*600,000 (sol)*	280
Halogenated Organics				
1,1,1,2-Tetrachloroethane	79-34-5	240	22,000	1,110,000
1,1,1-Trichloroethane	71-55-6	3,000	290,000	1,300,000
1,1,2,2-Tetrachloroethane	79-35-4	1,600	150,000	2,930,000
1,1,2-Trichloroethane	79-00-5	520	49,000	4,491,000
1,1-Dichloroethane	75-34-3	2,700	260,000	3,666,000
1,1-Dichloroethene	75-35-4	160	1,6000	3,100,000
1,2,3,4-Tetrachlorobenzene	634-66-2	240	*31,000 (sol)*	7,800
1,2,3,5-Tetrachlorobenzene	634-90-2	7.0	*600*	3,500
1,2,3-Trichlorobenzene	87-61-7	35	3,100	21,000
1,2,4,5-Tetrachlorobenzene	95-94-3	8.1	*700 (sol)*	600
1,2,4-Trichlorobenzene	120-82-1	68	7,200	41,400
1,2-Dichlorobenzene	95-50-1	2,000	*220,000 (sol)*	133,000
1,2-Dichloroethane	107-06-2	8.9	850	8,680,000
1,2-Dichloropropane	78-87-5	22	2,600	2,050,000
1,3,5-Trichlorobenzene	108-70-3	7.4	660	6,000
1,3-Dichlorobenzene	541-73-1	31	2,800	103,000
1,4-Dichlorobenzene	106-46-7	5,000	*460,000 (sol)*	51,200
Bromobenzene	108-86-1	220	20,000	388,040
Bromodichloromethane	75-27-4	17	1,600	3,000,000
Bromoform (Tribromomethane)	75-25-2	3,100	400,000	3,000,000
Chlorobenzene	108-90-7	98	15,000	387,000
Chloroethane	75-00-3	10,000	1,000,000	5,742,000
Chloroethene (Vinyl Chloride)	75-01-4	0.62	63	2,760,000
Chloromethane	74-87-3	14	1,400	5,350,000
cis-1,2-Dichloroethene	156-59-2	130	13,000	7,550,000
Dichloromethane	75-09-2	3,300	370,000	20,080,000
Hexachlorobenzene	118-74-1	*16 (sol)*	*1,400 (sol)*	10
Hexachlorobutadiene	87-68-3	1.7	230	4,800
Hexachloroethane	67-72-1	8.5	740	49,900

Chemical	CAS	GAC$_{gwvap}$(µg/l)[1,2]		Aqueous Solubility (µg/l)
		Residential	Commercial	
Pentachlorobenzene	608-93-5	140	*12,000 (sol)*	500
Tetrachloroethene	127-18-4	34	4,600	225,000
Tetrachloromethane (Carbon Tetrachloride)	56-23-5	5.3	770	846,000
trans-1,2-Dichloroethene	156-60-5	160	16,000	5,250,000
Trichloroethene	79-01-6	5.7	530	1,370,000
Trichloromethane (Chloroform)	67-66-3	790	85,000	8,950,000
Others (organic and inorganic)				
2-Chloronaphthalene	91-58-7	160	*14,000 (sol)*	11,700
Biphenyl (Lemonene)	92-52-4	*15,000 (sol)*	*1,300,000 (sol)*	4,060
Carbon Disulphide	75-15-0	56	5,600	2,100,000
Mercury, elemental	7439-97-6	1.1	*95 (sol)*	56
Methyl tertiary butyl ether (MTBE)	1634-04-4	83,000	7,800,000	48,000,000

Notes

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

Appendix C Brightside for Soils

TABLE SUMMARISING SOIL RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE SOIL ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

SOM 1%

Analyte	Units	LOD	Assessment Criteria RwHP	Assessment Criteria POSpark	Assessment Criteria Commercial	No. of Tests	Min	Max	No. of Exceedances RwHP	No. of Exceedances POSpark	No. of Exceedances Commercial
Stones Content	%	0.1	-	-	-						
Arsenic*	mg/kg	1	37	170	640	32	7.3	320	**5**	**2**	
Cadmium*	mg/kg	0.2	22	880	410	32	0.2	13			
Chromium Trivalent	mg/kg	1	910	33000	8600	7	7.7	89			
Chromium Hexavalent*	mg/kg	4	21	250	49	32	4	4			
Copper	mg/kg	1	2400	44000	68000	32	7	330			
Lead*	mg/kg	1	200	1300	2300	32	8.7	1400	**16**	**1**	
Mercury	mg/kg	0.3	40	240	1100	32	0.3	6.6			
Nickel	mg/kg	1	130	800	980	32	5	52			
Selenium	mg/kg	1	250	1800	12000	32	1	1			
Zinc	mg/kg	1	3700	170000	730000	32	25	650			
Beryllium	mg/kg		1.7	63	12						
Boron	mg/kg		290	46000	240000						
Vanadium	mg/kg		410	5000	9000						
Cyanide (Total)	mg/kg	1	-	-	-	7	2	46			
Organic matter	mg/kg		-	-	-						
Phenol, Total	mg/kg		120	440	440						
Sulphate (Total) as SO4	mg/l		-	-	-	47	0.014	1200			
pH	pH Units		-	-	-	58	7.4	10			
>C5 to C6 Aliphatic	mg/kg		42	95000	3200	32	0.001	0.001			
>C6 to C8 Aliphatic	mg/kg		100	150000	7800	32	0.001	0.001			
>C8 to C10 Aliphatic	mg/kg		27	14000	2000	32	0.001	0.001			
>C10 to C12 Aliphatic	mg/kg	1	130	21000	9700	32	1	4.7			
>C12 to C16 Aliphatic	mg/kg	2	1100	25000	59000	32	2	32			
>C16 to C21 Aliphatic	mg/kg	8	-	-	-	32	8	83			
>C21 to C35 Aliphatic	mg/kg	8	-	-	-	32	8	580			
>C16 to C35 Aliphatic	mg/kg	16	65000	450000	1600000	32	16	663			
>C35 to C44 Aliphatic	mg/kg		65000	450000	1600000						
Total Aliphatic C5-C35	mg/kg	10	-	-	-	32	10	700			
>C5 to C7 Aromatic	mg/kg		70	76000	26000	32	0.001	0.001			
>C7 to C8 Aromatic	mg/kg		130	87000	56000	32	0.001	0.001			
>C8 to C10 Aromatic	mg/kg		34	7200	3500	32	0.001	0.001			
>C10 to C12 Aromatic	mg/kg	1	74	9200	16000	32	1	32			
>C12 to C16 Aromatic	mg/kg	2	140	10000	36000	32	2	37			
>C16 to C21 Aromatic	mg/kg	10	260	7600	28000	32	10	150			
>C21 to C35 Aromatic	mg/kg	10	1100	7800	28000	32	10	330			
>C35 to C44 Aromatic	mg/kg		1100	7800	28000						
Total Aromatic C5-C35	mg/kg		-	-	-						
TPH Ali/Aro	mg/kg		-	-	-						
EPH (C10-C40)	mg/kg		-	-	-						
Hazard Index - RwHP	-	-	-	-	-	32	0.1	1.4	**2**		
Hazard Index - POSpark	-	-	-	-	-	32	0.0	0.1			
Hazard Index - Commercial	-	-	-	-	-	32	0.0	0.0			
Benzene*	mg/kg	0.001	0.2	190	27	33		0.001			
Ethylbenzene	mg/kg	0.001	47	17000	5700	33		0.001			
Toluene	mg/kg	0.001	130	87000	56000	33		0.001			
Xylene	mg/kg	0.001	60	17000	6600	11	0.001	0.001			
M- & P-Xylene	mg/kg	0.001	-	-	-	31		0.001			
O-Xylene	mg/kg	0.001	-	-	-	33		0.001			
Total Xylene (M, P & O)	mg/kg	0.002	60	17000	6600	33	0.001	0.002			
MTBE	mg/kg	0.001	-	-	-	34	0.001	0.001			
Naphthalene	mg/kg	0.05	2.3	1200	190	43	0.05	6.3	**2**		
Acenaphthylene	mg/kg	0.05	170	29000	83000	34	0.05	5.1			
Acenaphthene	mg/kg	0.05	210	29000	84000	34	0.05	3.8			
Fluorene	mg/kg	0.05	170	20000	63000	43	0.05	5			
Phenanthrene	mg/kg	0.05	95	6200	22000	43	0.05	54			
Anthracene	mg/kg	0.05	2400	150000	520000	43	0.05	17			
Fluoranthene	mg/kg	0.05	280	6300	23000	43	0.05	59			
Pyrene	mg/kg	0.05	620	15000	54000	43	0.05	54			
Benzo(a)anthracene	mg/kg	0.05	7.2	49	170	43	0.05	42	**8**		
Chrysene	mg/kg	0.05	15	93	350	43	0.05	38	**3**		
Benzo(b)fluoranthene	mg/kg	0.05	2.6	13	44	43	0.05	42	**21**	**6**	
Benzo(k)fluoranthene	mg/kg	0.05	77	370	1200	43	0.05	12			
Benzo(a)pyrene (BaP)	mg/kg	0.05	2.2	11	35	43	0.05	36	**22**	**7**	**1**
Indeno(1,2,3-c,d)pyrene	mg/kg	0.05	27	150	500	43	0.05	26			
Dibenzo(a,h)anthracene	mg/kg	0.05	0.24	1.1	3.5	43	0.05	6.9	**24**	**10**	**2**
Benzo(g,h,i)perylene	mg/kg	0.05	320	1400	3900	43	0.05	25			
Total PAH	mg/kg	0.8	-	-	-	32	0.8	415			
Coal Tar (BaP as surrogate)	mg/kg	0.05	0.79	4.4	15	43	0.05	36	**32**	**12**	**6**
BaP* (as surrogate for PAH)	mg/kg	0.05	5	21	77	43	0.05	36	**11**	**3**	
PCB (sum of x Aroclors)	mg/kg		-	-	-						
1,2 Dichloroethane	mg/kg	0.001	1.6	1800	270	11	0.001	0.001			
1,1,1 Trichloroethane (TCA)	mg/kg	0.001	8.8	57000	660	11	0.001	0.001			
1,1,1,2 Tetrachloroethane	mg/kg	0.001	1.2	1500	110	11	0.001	0.001			
1,1,2,2 Tetrachloroethane	mg/kg	0.001	1.6	1800	270	11	0.001	0.001			
Tetrachloroethene (PCE)*	mg/kg	0.001	0.31	1400	24	11	0.001	0.001			
Carbon Tetrachloride	mg/kg		0.026	190	2.9						
Trichloroethene (TCE)*	mg/kg	0.001	0.0093	41	0.73	11	0.001	0.001			
Trichloromethane (Chloroform)	mg/kg	0.001	0.91	2600	99	11	0.001	0.001			
Vinyl Chloride (Chloroethene)*	mg/kg	0.001	0.0064	18	1.1	11	0.001	0.001			
Asbestos (Presence of)	TEXT		-	-	-	32					
Asbestos Analysts Comments	TEXT		-	-	-						
Asbestos Fibre Count	%										

Strata	Sand and Gra	rd Clay Forma	Made Ground	Made Ground	Made Ground	Made Ground	Sand and Gra	Sand and Gra	Topsoil	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Sand and Gra	Sand and Gra	Made Ground	Sand and Gra	rd Clay Forma	rd Clay Forma
Analyte	BH101	BH101	BH103	BH103	BH103	BH103	BH103	BH103	BH104	BH104	BH104	BH104	BH105	BH105	BH105	BH105	BH106	BH106	BH106	BH106
Depth	2.50	9.60	0.05	0.30	2.00	5.00	6.20	7.50	0.05	0.30	1.40	2.10	0.30	2.00	4.20	6.50	0.30	4.00	9.00	14.00
Stones Content																				
Arsenic*			28			22	31			320		32	25	38	210		30			
Cadmium*			0.2			0.2	0.2			0.2		0.2	1.5	0.2	0.2		0.2			
Chromium Trivalent										18			89	26						
Chromium Hexavalent*			4			4	4			4		4	4	4	4		4			
Copper			35			130	7			42		26	100	110	7.9		60			
Lead*			220			490	8.7			260		21	250	60	11		240			
Mercury			1.5			6.6	0.3			0.3		0.3	1.5	0.6	0.3		1.2			
Nickel			25			24	15			18		25	45	52	26		31			
Selenium			1			1	1			1		1	1	1	1		1			
Zinc			160			120	39			340		47	290	61	49		160			
Beryllium																				
Boron																				
Vanadium																				
Cyanide (Total)										46			2	5.5						
Organic matter																				
Phenol, Total																				
Sulphate (Total) as SO4	0.028	0.59	0.2			0.81	0.78	710		1.8	0.41	1.1	0.18	2.1	0.25	650	0.015	770	0.7	0.37
pH	8.2	8.3	8.8	8.2	8.3	8.5	7.7	8	7.8	7.6	7.8	7.6	9.2	7.6	8.2	8	7.9	8.5	7.6	8.3
>C5 to C6 Aliphatic			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
>C6 to C8 Aliphatic			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
>C8 to C10 Aliphatic			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
>C10 to C12 Aliphatic			1			1	1			1		1	1	1	1		1			
>C12 to C16 Aliphatic			2			2	2			4.5		2	2	2	2		2			
>C16 to C21 Aliphatic			8			8	8			28		8	8	8	8		8			
>C21 to C35 Aliphatic			8			8	8			110		8	8	8	8		8			
>C16 to C35 Aliphatic			16			16	16			**138**		16	16	16	16		16			
>C35 to C44 Aliphatic																				
Total Aliphatic C5-C35			10			10	10			140		10	10	10	10		10			
>C5 to C7 Aromatic			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
>C7 to C8 Aromatic			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
>C8 to C10 Aromatic			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
>C10 to C12 Aromatic			1			1	1			2.9		32	1	1	1		1			
>C12 to C16 Aromatic			2			2	2			19		37	11	13	2		2			
>C16 to C21 Aromatic			10			10	10			150		140	55	70	10		10			
>C21 to C35 Aromatic			17			10	10			330		160	80	150	10		10			
>C35 to C44 Aromatic																				
Total Aromatic C5-C35																				
TPH Ali/Aro																				
EPH (C10-C40)																				
Hazard Index - RwHP			0.1			0.1	0.1			1.1		1.4	0.4	0.5	0.1		0.1			
Hazard Index - POSpark			0.0			0.0	0.0			0.1		0.0	0.0	0.0	0.0		0.0			
Hazard Index - Commercial			0.0			0.0	0.0			0.0		0.0	0.0	0.0	0.0		0.0			
Benzene*			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
Ethylbenzene			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
Toluene			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
Xylene						0.001	0.001			0.001			0.001	0.001						
M- & P-Xylene			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
O-Xylene			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
Total Xylene (M, P & O)			0.002			0.002	0.002			0.002		0.002	0.002	0.002	0.002		0.002			
MTBE			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
Naphthalene			0.33	0.34	0.05	0.05	0.05		0.73	0.05		6.3	0.34	0.73	0.05		0.05			
Acenaphthylene			0.26			0.05	0.05			5.1		4.4	0.91	0.47	0.05		0.05			
Acenaphthene			0.05			0.05	0.05			3.8		1	0.05	0.77	0.05		0.05			
Fluorene			0.19	0.05	0.05	0.05	0.05		1	5		4.9	0.41	1.1	0.05		0.05			
Phenanthrene			1.7	1.4	0.64	0.05	0.05		12	48		54	9.5	10	0.05		0.34			
Anthracene			0.5	0.39	0.05	0.05	0.05		3.7	17		13	2.3	3.3	0.05		0.05			
Fluoranthene			3.2	2.9	1.2	0.05	0.59		22	56		59	22	15	0.05		1.3			
Pyrene			2.9	2.6	1	0.05	0.57		22	54		49	18	14	0.05		1.2			
Benzo(a)anthracene			2	1.8	0.76	0.24	0.35		15	42		27	12	16	0.05		0.83			
Chrysene			1.9	1.8	0.75	0.27	0.36		12	38		22	8.5	9.7	0.05		0.66			
Benzo(b)fluoranthene			1.8	2.6	0.83	0.28	0.43		15	42		29	11	12	0.05		0.89			
Benzo(k)fluoranthene			0.85	0.61	0.34	0.17	0.23		5.5	12		8.2	4.6	7.7	0.05		0.43			
Benzo(a)pyrene (BaP)			1.8	2	0.7	0.26	0.42		13	36		27	10	15	0.05		0.83			
Indeno(1,2,3-c,d)pyrene			0.99	1.3	0.4	0.05	0.26		7.5	26		15	6.3	7.4	0.05		0.5			
Dibenzo(a,h)anthracene			0.27	0.05	0.05	0.05	0.05		1.8	6.9		3.7	1.5	2.3	0.05		0.05			
Benzo(g,h,i)perylene			1.1	1.3	0.43	0.05	0.32		8	25		17	6.8	8.3	0.05		0.61			
Total PAH			19.7			1.22	3.53			415		341	115	124	0.8		7.58			
Coal Tar (BaP as surrogate)			1.8	2	0.7	0.26	0.42		13	36		27	10	15	0.05		0.83			
BaP* (as surrogate for PAH)			1.8	2	0.7	0.26	0.42		13	36		27	10	15	0.05		0.83			
PCB (sum of x Aroclors)																				
1,2 Dichloroethane						0.001	0.001			0.001			0.001	0.001						
1,1,1 Trichloroethane (TCA)						0.001	0.001			0.001			0.001	0.001						
1,1,1,2 Tetrachloroethane						0.001	0.001			0.001			0.001	0.001						
1,1,2,2 Tetrachloroethane						0.001	0.001			0.001			0.001	0.001						
Tetrachloroethene (PCE)*						0.001	0.001			0.001			0.001	0.001						
Carbon Tetrachloride																				
Trichloroethene (TCE)*						0.001	0.001			0.001			0.001	0.001						
Trichloromethane (Chloroform)						0.001	0.001			0.001			0.001	0.001						
Vinyl Chloride (Chloroethene)*						0.001	0.001			0.001			0.001	0.001						
Asbestos (Presence of)			Detected			Detected	Not-detected			Not-detected		Not-detected	Not-detected	Not-detected	Not-detected		Detected			
Asbestos Analysts Comments																				
Asbestos Fibre Count																				

Assessment Criteria are the Suitable for Use Levels (S4ULs) punlished by LQM/CIEH (Copyright Land Quality Management Limited Reproduced with Permission; Publication Number S4UL3202. All Rights Reserved) unless the analyte is marked with *. Analytes identified with * the Assessment Criteria are Category 4 Screening Levels (C4SL)

This is a summary table and it is possible that not all analytical results are reproduced. Whilst we endeavour to present the data accurately errors can occur during transcribing. The laboratory certificate should be referred to as the authenticated and complete source of results

Land-use Scenarios - RwHP = Residential with Home Grown Produce, RwoHP = Residential without Home Grown Produce, POSresi = Public Open Space within residential, POSpark = Public Open Space not associated with residential

LOD = Limit of Detection. Results in italics are equal to or less than the LOD

This table should be read in conjunction with the accompanying guide on the selection of evaluation crtieria and the project specific note presenting the justification for selection.

TABLE SUMMARISING SOIL RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE SOIL ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

SOM 1%

Analyte	Units	LOD	Assessment Criteria RwHP	Assessment Criteria POSpark	Assessment Criteria Commercial	No. of Tests	Min	Max	No. of Exceedances RwHP	No. of Exceedances POSpark	No. of Exceedances Commercial
Stones Content	%	0.1	-	-	-						
Arsenic*	mg/kg	1	37	170	640	32	7.3	320	**5**	**2**	
Cadmium*	mg/kg	0.2	22	880	410	32	0.2	13			
Chromium Trivalent	mg/kg	1	910	33000	8600	7	7.7	89			
Chromium Hexavalent*	mg/kg	4	21	250	49	32	4	4			
Copper	mg/kg	1	2400	200	68000	32	7	330		**1**	
Lead*	mg/kg	1	200	1300	2300	32	8.7	1400	**16**	**1**	
Mercury	mg/kg	0.3	40	240	1100	32	0.3	6.6			
Nickel	mg/kg	1	130	110	980	32	5	52			
Selenium	mg/kg	1	250	1800	12000	32	1	1			
Zinc	mg/kg	1	3700	300	730000	32	25	650		**4**	
Beryllium	mg/kg		1.7	63	12						
Boron	mg/kg		290	46000	240000						
Vanadium	mg/kg		410	5000	9000						
Cyanide (Total)	mg/kg	1	-	-	-	7	2	46			
Organic matter	mg/kg		-	-	-						
Phenol, Total	mg/kg		120	440	440						
Sulphate (Total) as SO4	mg/l		-	-	-	47	0.014	1200			
pH	pH Units		-	-	-	58	7.4	10			
>C5 to C6 Aliphatic	mg/kg		42	95000	3200	32	0.001	0.001			
>C6 to C8 Aliphatic	mg/kg		100	150000	7800	32	0.001	0.001			
>C8 to C10 Aliphatic	mg/kg		27	14000	2000	32	0.001	0.001			
>C10 to C12 Aliphatic	mg/kg	1	130	21000	9700	32	1	4.7			
>C12 to C16 Aliphatic	mg/kg	2	1100	25000	59000	32	2	32			
>C16 to C21 Aliphatic	mg/kg	8	-	-	-	32	8	83			
>C21 to C35 Aliphatic	mg/kg	8	-	-	-	32	8	580			
>C16 to C35 Aliphatic	mg/kg	16	65000	450000	1600000	32	16	663			
>C35 to C44 Aliphatic	mg/kg		65000	450000	1600000						
Total Aliphatic C5-C35	mg/kg	10	-	-	-	32	10	700			
>C5 to C7 Aromatic	mg/kg		70	76000	26000	32	0.001	0.001			
>C7 to C8 Aromatic	mg/kg		130	87000	56000	32	0.001	0.001			
>C8 to C10 Aromatic	mg/kg		34	7200	3500	32	0.001	0.001			
>C10 to C12 Aromatic	mg/kg	1	74	9200	16000	32	1	32			
>C12 to C16 Aromatic	mg/kg	2	140	10000	36000	32	2	37			
>C16 to C21 Aromatic	mg/kg	10	260	7600	28000	32	10	150			
>C21 to C35 Aromatic	mg/kg	10	1100	7800	28000	32	10	330			
>C35 to C44 Aromatic	mg/kg		1100	7800	28000						
Total Aromatic C5-C35	mg/kg		-	-	-						
TPH Ali/Aro	mg/kg		-	-	-						
EPH (C10-C40)	mg/kg		-	-	-						
Hazard Index - RwHP	-	-	-	-	-	32	0.1	1.4	**2**		
Hazard Index - POSpark	-	-	-	-	-	32	0.0	0.1			
Hazard Index - Commercial	-	-	-	-	-	32	0.0	0.0			
Benzene*	mg/kg	0.001	0.2	190	27	33		0.001			
Ethylbenzene	mg/kg	0.001	47	17000	5700	33		0.001			
Toluene	mg/kg	0.001	130	87000	56000	33		0.001			
Xylene	mg/kg	0.001	60	17000	6600	11	0.001	0.001			
M- & P-Xylene	mg/kg	0.001	-	-	-	31		0.001			
O-Xylene	mg/kg	0.001	-	-	-	33		0.001			
Total Xylene (M, P & O)	mg/kg	0.002	60	17000	6600	33	0.001	0.002			
MTBE	mg/kg	0.001	-	-	-	34	0.001	0.001			
Naphthalene	mg/kg	0.05	2.3	1200	190	43	0.05	6.3	**2**		
Acenaphthylene	mg/kg	0.05	170	29000	83000	34	0.05	5.1			
Acenaphthene	mg/kg	0.05	210	29000	84000	34	0.05	3.8			
Fluorene	mg/kg	0.05	170	20000	63000	43	0.05	5			
Phenanthrene	mg/kg	0.05	95	6200	22000	43	0.05	54			
Anthracene	mg/kg	0.05	2400	150000	520000	43	0.05	17			
Fluoranthene	mg/kg	0.05	280	6300	23000	43	0.05	59			
Pyrene	mg/kg	0.05	620	15000	54000	43	0.05	54			
Benzo(a)anthracene	mg/kg	0.05	7.2	49	170	43	0.05	42	**8**		
Chrysene	mg/kg	0.05	15	93	350	43	0.05	38	**3**		
Benzo(b)fluoranthene	mg/kg	0.05	2.6	13	44	43	0.05	42	**21**	**6**	
Benzo(k)fluoranthene	mg/kg	0.05	77	370	1200	43	0.05	12			
Benzo(a)pyrene (BaP)	mg/kg	0.05	2.2	11	35	43	0.05	36	**22**	**7**	**1**
Indeno(1,2,3-c,d)pyrene	mg/kg	0.05	27	150	500	43	0.05	26			
Dibenzo(a,h)anthracene	mg/kg	0.05	0.24	1.1	3.5	43	0.05	6.9	**24**	**10**	**2**
Benzo(g,h,i)perylene	mg/kg	0.05	320	1400	3900	43	0.05	25			
Total PAH	mg/kg	0.8	-	-	-	32	0.8	415			
Coal Tar (BaP as surrogate)	mg/kg	0.05	0.79	4.4	15	43	0.05	36	**32**	**12**	**6**
BaP* (as surrogate for PAH)	mg/kg	0.05	5	21	77	43	0.05	36	**11**	**3**	
PCB (sum of x Aroclors)	mg/kg		-	-	-						
1,2 Dichloroethane	mg/kg	0.001	1.6	1800	270	11	0.001	0.001			
1,1,1 Trichloroethane (TCA)	mg/kg	0.001	8.8	57000	660	11	0.001	0.001			
1,1,1,2 Tetrachloroethane	mg/kg	0.001	1.2	1500	110	11	0.001	0.001			
1,1,2,2 Tetrachloroethane	mg/kg	0.001	1.6	1800	270	11	0.001	0.001			
Tetrachloroethene (PCE)*	mg/kg	0.001	0.31	1400	24	11	0.001	0.001			
Carbon Tetrachloride	mg/kg		0.026	190	2.9						
Trichloroethene (TCE)*	mg/kg	0.001	0.0093	41	0.73	11	0.001	0.001			
Trichloromethane (Chloroform)	mg/kg	0.001	0.91	2600	99	11	0.001	0.001			
Vinyl Chloride (Chloroethene)*	mg/kg	0.001	0.0064	18	1.1	11	0.001	0.001			
Asbestos (Presence of)	TEXT		-	-	-	32					
Asbestos Analysts Comments	TEXT		-	-	-						
Asbestos Fibre Count	%										

Strata	Sand and Gra	rd Clay Forma	Made Ground	Made Ground	Made Ground	Made Ground	Sand and Gra	Sand and Gra	Topsoil	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Sand and Gra	Sand and Gra	Made Ground	Sand and Gra	rd Clay Forma	rd Clay Forma
Analyte	BH101	BH101	BH103	BH103	BH103	BH103	BH103	BH103	BH104	BH104	BH104	BH104	BH105	BH105	BH105	BH105	BH106	BH106	BH106	BH106
Depth	2.50	9.60	0.05	0.30	2.00	5.00	6.20	7.50	0.05	0.30	1.40	2.10	0.30	2.00	4.20	6.50	0.30	4.00	9.00	14.00
Stones Content																				
Arsenic*			28			22	31			320		32	25	38	210		30			
Cadmium*			*0.2*			*0.2*	*0.2*			*0.2*		*0.2*	1.5	*0.2*	*0.2*		*0.2*			
Chromium Trivalent										18			89	26						
Chromium Hexavalent*			*4*			*4*	*4*			*4*		*4*	*4*	*4*	*4*		*4*			
Copper			35			130	7			42		26	100	110	7.9		60			
Lead*			220			490	8.7			260		21	250	60	11		240			
Mercury			1.5			6.6	*0.3*			*0.3*		*0.3*	1.5	0.6	*0.3*		1.2			
Nickel			25			24	15			18		25	45	52	26		31			
Selenium			*1*			*1*	*1*			*1*		*1*	*1*	*1*	*1*		*1*			
Zinc			160			120	39			340		47	290	61	49		160			
Beryllium																				
Boron																				
Vanadium																				
Cyanide (Total)										46			2	5.5						
Organic matter																				
Phenol, Total																				
Sulphate (Total) as SO4	0.028	0.59	0.2			0.81	0.78	710		1.8	0.41	1.1	0.18	2.1	0.25	650	0.015	770	0.7	0.37
pH	8.2	8.3	8.8	8.2	8.3	8.5	7.7	8	7.8	7.6	7.8	7.6	9.2	7.6	8.2	8	7.9	8.5	7.6	8.3
>C5 to C6 Aliphatic			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
>C6 to C8 Aliphatic			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
>C8 to C10 Aliphatic			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
>C10 to C12 Aliphatic			*1*			*1*	*1*			*1*		*1*	*1*	*1*	*1*		*1*			
>C12 to C16 Aliphatic			*2*			*2*	*2*			4.5		*2*	*2*	*2*	*2*		*2*			
>C16 to C21 Aliphatic			*8*			*8*	*8*			28		*8*	*8*	*8*	*8*		*8*			
>C21 to C35 Aliphatic			*8*			*8*	*8*			110		*8*	*8*	*8*	*8*		*8*			
>C16 to C35 Aliphatic			*16*			*16*	*16*			**138**		*16*	*16*	*16*	*16*		*16*			
>C35 to C44 Aliphatic																				
Total Aliphatic C5-C35			*10*			*10*	*10*			140		*10*	*10*	*10*	*10*		*10*			
>C5 to C7 Aromatic			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
>C7 to C8 Aromatic			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
>C8 to C10 Aromatic			0.001			0.001	0.001			0.001		0.001	0.001	0.001	0.001		0.001			
>C10 to C12 Aromatic			*1*			*1*	*1*			2.9		32	*1*	*1*	*1*		*1*			
>C12 to C16 Aromatic			*2*			*2*	*2*			19		37	11	13	*2*		*2*			
>C16 to C21 Aromatic			*10*			*10*	*10*			150		140	55	70	*10*		*10*			
>C21 to C35 Aromatic			17			*10*	*10*			330		160	80	150	*10*		*10*			
>C35 to C44 Aromatic																				
Total Aromatic C5-C35																				
TPH Ali/Aro																				
EPH (C10-C40)																				
Hazard Index - RwHP			0.1			0.1	0.1			1.1		1.4	0.4	0.5	0.1		0.1			
Hazard Index - POSpark			0.0			0.0	0.0			0.1		0.0	0.0	0.0	0.0		0.0			
Hazard Index - Commercial			0.0			0.0	0.0			0.0		0.0	0.0	0.0	0.0		0.0			
Benzene*			*0.001*			*0.001*	*0.001*			*0.001*		*0.001*	*0.001*	*0.001*	*0.001*		*0.001*			
Ethylbenzene			*0.001*			*0.001*	*0.001*			*0.001*		*0.001*	*0.001*	*0.001*	*0.001*		*0.001*			
Toluene			*0.001*			*0.001*	*0.001*			*0.001*		*0.001*	*0.001*	*0.001*	*0.001*		*0.001*			
Xylene						*0.001*	*0.001*			*0.001*			*0.001*	*0.001*						
M- & P-Xylene			*0.001*			*0.001*	*0.001*			*0.001*		*0.001*	*0.001*	*0.001*	*0.001*		*0.001*			
O-Xylene			*0.001*			*0.001*	*0.001*			*0.001*		*0.001*	*0.001*	*0.001*	*0.001*		*0.001*			
Total Xylene (M, P & O)			*0.002*			*0.002*	*0.002*			*0.002*		*0.002*	*0.002*	*0.002*	*0.002*		*0.002*			
MTBE			*0.001*			*0.001*	*0.001*			*0.001*		*0.001*	*0.001*	*0.001*	*0.001*		*0.001*			
Naphthalene			0.33	0.34	*0.05*	*0.05*	*0.05*		0.73	*0.05*		6.3	0.34	0.73	*0.05*		*0.05*			
Acenaphthylene			0.26			*0.05*	*0.05*			5.1		4.4	0.91	0.47	*0.05*		*0.05*			
Acenaphthene			*0.05*			*0.05*	*0.05*			3.8		1	*0.05*	0.77	*0.05*		*0.05*			
Fluorene			0.19	*0.05*	*0.05*	*0.05*	*0.05*		1	5		4.9	0.41	1.1	*0.05*		*0.05*			
Phenanthrene			1.7	1.4	0.64	*0.05*	*0.05*		12	48		54	9.5	10	*0.05*		0.34			
Anthracene			0.5	0.39	*0.05*	*0.05*	*0.05*		3.7	17		13	2.3	3.3	*0.05*		*0.05*			
Fluoranthene			3.2	2.9	1.2	*0.05*	0.59		22	56		59	22	15	*0.05*		1.3			
Pyrene			2.9	2.6	1	*0.05*	0.57		22	54		49	18	14	*0.05*		1.2			
Benzo(a)anthracene			2	1.8	0.76	0.24	0.35		15	42		27	12	16	*0.05*		0.83			
Chrysene			1.9	1.8	0.75	0.27	0.36		12	38		22	8.5	9.7	*0.05*		0.66			
Benzo(b)fluoranthene			1.8	2.6	0.83	0.28	0.43		15	42		29	11	12	*0.05*		0.89			
Benzo(k)fluoranthene			0.85	0.61	0.34	0.17	0.23		5.5	12		8.2	4.6	7.7	*0.05*		0.43			
Benzo(a)pyrene (BaP)			1.8	2	0.7	0.26	0.42		13	36		27	10	15	*0.05*		0.83			
Indeno(1,2,3-c,d)pyrene			0.99	1.3	0.4	*0.05*	0.26		7.5	26		15	6.3	7.4	*0.05*		0.5			
Dibenzo(a,h)anthracene			0.27	*0.05*	*0.05*	*0.05*	*0.05*		1.8	6.9		3.7	1.5	2.3	*0.05*		*0.05*			
Benzo(g,h,i)perylene			1.1	1.3	0.43	*0.05*	0.32		8	25		17	6.8	8.3	*0.05*		0.61			
Total PAH			19.7			1.22	3.53			415		341	115	124	*0.8*		7.58			
Coal Tar (BaP as surrogate)			1.8	2	0.7	0.26	0.42		13	36		27	10	15	*0.05*		0.83			
BaP* (as surrogate for PAH)			1.8	2	0.7	0.26	0.42		13	36		27	10	15	*0.05*		0.83			
PCB (sum of x Aroclors)																				
1,2 Dichloroethane						*0.001*	*0.001*			*0.001*			*0.001*	*0.001*						
1,1,1 Trichloroethane (TCA)						*0.001*	*0.001*			*0.001*			*0.001*	*0.001*						
1,1,1,2 Tetrachloroethane						*0.001*	*0.001*			*0.001*			*0.001*	*0.001*						
1,1,2,2 Tetrachloroethane						*0.001*	*0.001*			*0.001*			*0.001*	*0.001*						
Tetrachloroethene (PCE)*						*0.001*	*0.001*			*0.001*			*0.001*	*0.001*						
Carbon Tetrachloride																				
Trichloroethene (TCE)*						*0.001*	*0.001*			*0.001*			*0.001*	*0.001*						
Trichloromethane (Chloroform)						*0.001*	*0.001*			*0.001*			*0.001*	*0.001*						
Vinyl Chloride (Chloroethene)*						*0.001*	*0.001*			*0.001*			*0.001*	*0.001*						
Asbestos (Presence of)			Detected			Detected	Not-detected			Not-detected		Not-detected	Not-detected	Not-detected	Not-detected		Detected			
Asbestos Analysts Comments																				
Asbestos Fibre Count																				

Assessment Criteria are the Suitable for Use Levels (S4ULs) punlished by LQM/CIEH (Copyright Land Quality Management Limited Reproduced with Permission; Publication Number S4UL3202. All Rights Reserved) unless the analyte is marked with *. Analytes identified with * the Assessment Criteria are Category 4 Screening Levels (C4SL)

This is a summary table and it is possible that not all analytical results are reproduced. Whilst we endeavour to present the data accurately errors can occur during transcribing. The laboratory certificate should be referred to as the authenticated and complete source of results

Land-use Scenarios - RwHP = Residential with Home Grown Produce, RwoHP = Residential without Home Grown Produce, POSresi = Public Open Space within residential, POSpark = Public Open Space not associated with residential

LOD = Limit of Detection. Results in italics are equal to or less than the LOD

This table should be read in conjunction with the accompanying guide on the selection of evaluation crtieria and the project specific note presenting the justification for selection.

TABLE SUMMARISING SOIL RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE SOIL ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

SOM 1%			Assessment Criteria		Strata	Topsoil	ord Clay Forma	Alluvium	ord Clay Forma	Topsoil	Alluvium	Made Ground	Sand and Gra	ord Clay Forma	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Topsoil	Made Ground	Made Ground	Made Ground	Made Ground	Alluvium	Made Ground	Made Ground
						BH107	BH107	BH108	BH108	BH109	BH109	BH110	BH110	BH110	TT101	TT101	TT101	TT102	TT102	TT102	TT102	WS101	WS101A	WS102	WS103	WS103A	WS103A	WS104	WS104
Analyte	Units	LOD	RwHP	POSpark	Commercial	0.05	5.00	0.30	10.50	0.10	0.40	1.30	4.00	11.00	0.30	1.10	1.30	0.05	0.40	1.00	2.00	0.05	1.30	0.30	0.05	1.40	2.20	0.30	0.80
Stones Content	%	0.1	-	-	-																								
Arsenic*	mg/kg	1	37	170	640			23			35	24			19		23	22		24		19	19	29	22		37	21	
Cadmium*	mg/kg	0.2	22	880	410			0.2			0.2	0.2			0.2		0.2	0.2		0.2		0.2	0.2	0.2	0.2		0.2	0.2	
Chromium Trivalent	mg/kg	1	910	33000	8600																								
Chromium Hexavalent*	mg/kg	4	21	250	49			4			4	4			4		4	4		4		4	4	4	4		4	4	
Copper	mg/kg	1	2400	200	68000			49			21	72			30		50	36		40		27	37	21	49		7.4	34	
Lead*	mg/kg	1	200	1300	2300			200			41	260			350		280	230		170		97	57	210	360		25	220	
Mercury	mg/kg	0.3	40	240	1100			0.3			0.3	3.1			0.3		1.6	1		1.3		0.3	0.3	0.7	0.9		0.3	0.3	
Nickel	mg/kg	1	130	110	980			35			34	21			23		19	20		18		25	30	16	22		26	18	
Selenium	mg/kg	1	250	1800	12000			1			1	1			1		1	1		1		1	1	1	1		1	1	
Zinc	mg/kg	1	3700	300	730000			160			110	120			290		120	140		140		120	74	140	340		77	140	
Beryllium	mg/kg		1.7	63	12																								
Boron	mg/kg		290	46000	240000																								
Vanadium	mg/kg		410	5000	9000																								
Cyanide (Total)	mg/kg	1	-	-	-																								
Organic matter	mg/kg		-	-	-																								
Phenol, Total	mg/kg		120	440	440																								
Sulphate (Total) as SO4	mg/l		-	-	-		1200	0.14	0.54	890	0.16	0.03	890	0.72	0.022	0.059	0.039	0.027		0.077		0.014	0.062	0.18	0.08	2.1	0.94		0.46
pH	pH Units		-	-	-	7.8	7.8	8.2	8.2	7.8	7.9	8	8.6	8.7	7.9	7.9	8.1	7.7	8.1	8.2	7.7	8.1	8.2	8.1	7.8	7.6	7.7	8.9	10
>C5 to C6 Aliphatic	mg/kg		42	95000	3200			0.001			0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
>C6 to C8 Aliphatic	mg/kg		100	150000	7800			0.001			0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
>C8 to C10 Aliphatic	mg/kg		27	14000	2000			0.001			0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
>C10 to C12 Aliphatic	mg/kg	1	130	21000	9700			1			1	1			1		1	1		1		1	1	1	1		1	1	
>C12 to C16 Aliphatic	mg/kg	2	1100	25000	59000			2			2	2			2		2	2		2		2	2	2	2		2	2	
>C16 to C21 Aliphatic	mg/kg	8	-	-	-			8			8	8			8		8	8		8		8	8	8	8		8	8	
>C21 to C35 Aliphatic	mg/kg	8	-	-	-			8			8	8			8		8	8		8		8	8	8	8		8	8	
>C16 to C35 Aliphatic	mg/kg	16	65000	450000	1600000			16			16	16			16		16	16		16		16	16	16	16		16	16	
>C35 to C44 Aliphatic	mg/kg		65000	450000	1600000																								
Total Aliphatic C5-C35	mg/kg	10	-	-	-			10			10	10			10		10	10		10		10	10	10	10		10	10	
>C5 to C7 Aromatic	mg/kg		70	76000	26000			0.001			0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
>C7 to C8 Aromatic	mg/kg		130	87000	56000			0.001			0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
>C8 to C10 Aromatic	mg/kg		34	7200	3500			0.001			0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
>C10 to C12 Aromatic	mg/kg	1	74	9200	16000			1			1	1			1		1	1		1		1	1	1	1		1	2.3	
>C12 to C16 Aromatic	mg/kg	2	140	10000	36000			8.5			2	2			2		2	2		2		2.6	4	2	2		2	3.9	
>C16 to C21 Aromatic	mg/kg	10	260	7600	28000			28			10	29			11		10	10		18		11	10	13	24		15	23	
>C21 to C35 Aromatic	mg/kg	10	1100	7800	28000			34			10	53			21		28	22		43		31	10	70	53		25	45	
>C35 to C44 Aromatic	mg/kg		1100	7800	28000																								
Total Aromatic C5-C35	mg/kg		-	-	-																								
TPH Ali/Aro	mg/kg		-	-	-																								
EPH (C10-C40)	mg/kg		-	-	-																								
Hazard Index - RwHP	-	-	-	-	-			0.2			0.1	0.2			0.1		0.1	0.1		0.1		0.1	0.1	0.2	0.2		0.1	0.2	
Hazard Index - POSpark	-	-	-	-	-			0.0			0.0	0.0			0.0		0.0	0.0		0.0		0.0	0.0	0.0	0.0		0.0	0.0	
Hazard Index - Commercial	-	-	-	-	-			0.0			0.0	0.0			0.0		0.0	0.0		0.0		0.0	0.0	0.0	0.0		0.0	0.0	
Benzene*	mg/kg	0.001	0.2	190	27						0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
Ethylbenzene	mg/kg	0.001	47	17000	5700						0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
Toluene	mg/kg	0.001	130	87000	56000						0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
Xylene	mg/kg	0.001	60	17000	6600																								
M- & P-Xylene	mg/kg	0.001	-	-	-						0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
O-Xylene	mg/kg	0.001	-	-	-						0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
Total Xylene (M, P & O)	mg/kg	0.002	60	17000	6600						0.002	0.002			0.002		0.002	0.002		0.002		0.002	0.002	0.002	0.002		0.002	0.002	
MTBE	mg/kg	0.001	-	-	-			0.001			0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
Naphthalene	mg/kg	0.05	2.3	1200	190	0.23		0.42			0.05	0.05			0.05		0.05	0.33	0.05	0.22	0.05	0.05	0.05	0.05	0.05		0.05	0.24	
Acenaphthylene	mg/kg	0.05	170	29000	83000			0.05			0.05	0.7			0.33		0.05	0.21		0.05		0.05	0.05	0.27	0.35		0.28	0.77	
Acenaphthene	mg/kg	0.05	210	29000	84000			0.05			0.05	0.05			0.05		0.05	0.05		0.05		0.05	0.05	0.26	0.14		0.05	0.3	
Fluorene	mg/kg	0.05	170	20000	63000	0.05		0.23			0.05	0.05			0.05		0.05	0.05	0.43	0.05	0.05	0.05	0.05	0.29	0.28		0.3	0.7	
Phenanthrene	mg/kg	0.05	95	6200	22000	0.55		5.7			0.05	2.9			2.4		1	1.4	5.4	1.8	0.05	1.5	0.6	3.1	3.2		3.3	7.7	
Anthracene	mg/kg	0.05	2400	150000	520000	0.05		1.4			0.05	0.85			0.76		0.28	0.51	1.3	0.49	0.05	0.34	0.05	0.75	0.8		0.9	1.8	
Fluoranthene	mg/kg	0.05	280	6300	23000	1.2		18			0.05	8.7			4.8		1.6	3.3	8.3	4.1	0.05	4.5	1.6	5.4	6.5		5.2	12	
Pyrene	mg/kg	0.05	620	15000	54000	1.1		9.5			0.05	8.3			4.4		1.5	2.9	6.4	3.4	0.05	3.9	1.5	4.8	5.8		4.7	10	
Benzo(a)anthracene	mg/kg	0.05	7.2	49	170	0.91		6.6			0.05	6.7			3.2		1	2.3	4.2	2.7	0.05	3	0.96	3.3	4.6		2.3	6.4	
Chrysene	mg/kg	0.05	15	93	350	0.7		4.6			0.05	4.2			2.2		0.86	1.6	3.8	2	0.05	2.3	0.92	2.3	3.5		2	4.5	
Benzo(b)fluoranthene	mg/kg	0.05	2.6	13	44	1		7.3			0.05	6.8			3.7		1.1	2.3	4.6	2.8	0.05	3.3	1.1	2.9	4		2	4.7	
Benzo(k)fluoranthene	mg/kg	0.05	77	370	1200	0.34		3.9			0.05	3.7			1.2		0.47	1.3	1.6	1.2	0.05	1.8	0.6	2	1.6		1.4	4.3	
Benzo(a)pyrene (BaP)	mg/kg	0.05	2.2	11	35	0.89		6.2			0.05	7.1			3.2		0.96	2.4	3.6	2.4	0.05	3.3	1.1	3.5	3.8		2.6	5.6	
Indeno(1,2,3-c,d)pyrene	mg/kg	0.05	27	150	500	0.52		6.8			0.05	4.4			1.6		0.51	1.3	2	1.4	0.05	1.8	0.66	1.5	1.9		1.4	3	
Dibenzo(a,h)anthracene	mg/kg	0.05	0.24	1.1	3.5	0.05		1.6			0.05	1.3			0.44		0.05	0.37	0.53	0.38	0.05	0.37	0.05	0.46	0.53		0.3	0.73	
Benzo(g,h,i)perylene	mg/kg	0.05	320	1400	3900	0.52		7.5			0.05	5.4			1.8		0.59	1.4	2.2	1.5	0.05	2.1	0.8	2.2	2		1.7	3.5	
Total PAH	mg/kg	0.8	-	-	-			61.7			0.8	61			30.1		9.91	21.6		24.3		28.2	9.81	32.9	38.9		28.3	66.2	
Coal Tar (BaP as surrogate)	mg/kg	0.05	0.79	4.4	15	0.89		6.2			0.05	7.1			3.2		0.96	2.4	3.6	2.4	0.05	3.3	1.1	3.5	3.8		2.6	5.6	
BaP* (as surrogate for PAH)	mg/kg	0.05	5	21	77	0.89		6.2			0.05	7.1			3.2		0.96	2.4	3.6	2.4	0.05	3.3	1.1	3.5	3.8		2.6	5.6	
PCB (sum of x Aroclors)	mg/kg		-	-	-																								
1,2 Dichloroethane	mg/kg	0.001	1.6	1800	270																								
1,1,1 Trichloroethane (TCA)	mg/kg	0.001	8.8	57000	660																								
1,1,1,2 Tetrachloroethane	mg/kg	0.001	1.2	1500	110																								
1,1,2,2 Tetrachloroethane	mg/kg	0.001	1.6	1800	270																								
Tetrachloroethene (PCE)*	mg/kg	0.001	0.31	1400	24																								
Carbon Tetrachloride	mg/kg		0.026	190	2.9																								
Trichloroethene (TCE)*	mg/kg	0.001	0.0093	41	0.73																								
Trichloromethane (Chloroform)	mg/kg	0.001	0.91	2600	99																								
Vinyl Chloride (Chloroethene)*	mg/kg	0.001	0.0064	18	1.1																								
Asbestos (Presence of)	TEXT		-	-	-			Not-detected			Not-detected	Not-detected			Detected		Detected	Not-detected		Not-detected		Not-detected	Not-detected	Not-detected	Not-detected		Not-detected	Detected	
Asbestos Analysts Comments	TEXT		-	-	-																								
Asbestos Fibre Count	%																												

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This is a summary table and it is possible that not all analytical results are reproduced. Whilst we endeavour to present the data accurately err
Land-use Scenarios - RwHP = Residential with Home Grown Produce, RwoHP = Residential without Home Grown Produce, POSresi = Publi
LOD = Limit of Detection. Results in italics are equal to or less than the LOD
This table should be read in conjunction with the accompanying guide on the selection of evaluation crtieria and the project specific note prese

TABLE SUMMARISING SOIL RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE SOIL ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

SOM 1%

Analyte	Units	LOD	Assessment Criteria: RwHP	Assessment Criteria: POSpark	Assessment Criteria: Commercial	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground
						WS104	WS105	WS105A	WS105A	WS105A	WS105A	WS106	WS107A	WS107A	WS108	WS109	WS109	WS109	WS110	WS112	WS113
						1.60	0.40	0.30	1.20	2.40	3.20	0.30	0.30	1.30	0.30	0.05	0.30	0.30	0.30	0.30	0.30
Stones Content	%	0.1	-	-	-																
Arsenic*	mg/kg	1	37	170	640	15		25			7.3	29	30	11	19	27	18		41		
Cadmium*	mg/kg	0.2	22	880	410	13		0.2			0.6	1.8	0.2	0.2	0.2	0.2	0.2		0.2		
Chromium Trivalent	mg/kg	1	910	33000	8600	26					7.7					24	38				
Chromium Hexavalent*	mg/kg	4	21	250	49	4		4			4	4	4	4	4	4	4		4		
Copper	mg/kg	1	2400	200	68000	330		33			9.6	120	17	30	34	32	37		57		
Lead*	mg/kg	1	200	1300	2300	380		270			16	1400	42	27	59	120	75		25		
Mercury	mg/kg	0.3	40	240	1100	0.3		0.8			0.3	2.2	1	0.3	0.3	1.2	1		0.3		
Nickel	mg/kg	1	130	110	980	32		24			5	34	12	12	30	24	29		44		
Selenium	mg/kg	1	250	1800	12000	1		1			1	1	1	1	1	1	1		1		
Zinc	mg/kg	1	3700	300	730000	650		180			25	640	59	47	98	130	110		170		
Beryllium	mg/kg		1.7	63	12																
Boron	mg/kg		290	46000	240000																
Vanadium	mg/kg		410	5000	9000																
Cyanide (Total)	mg/kg	1	-	-	-	2.4					9.4					4.9	6.2				
Organic matter	mg/kg		-	-	-																
Phenol, Total	mg/kg		120	440	440																
Sulphate (Total) as SO4	mg/l		-	-	-			1.4		0.91	1.6	0.042	1.1	1.6	0.15	0.16	1.4		0.23		
pH	pH Units		-	-	-	8.1	8.4	7.8	8.3	7.8	8	7.9	7.9	7.7	8.1	8.6	7.4	8.2	7.9		
>C5 to C6 Aliphatic	mg/kg		42	95000	3200	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001		
>C6 to C8 Aliphatic	mg/kg		100	150000	7800	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001		
>C8 to C10 Aliphatic	mg/kg		27	14000	2000	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001		
>C10 to C12 Aliphatic	mg/kg	1	130	21000	9700	1		1			1	1	1	1	1	1	1		4.7		
>C12 to C16 Aliphatic	mg/kg	2	1100	25000	59000	2		2			2	2	2	2	2	2	2		**32**		
>C16 to C21 Aliphatic	mg/kg	8	-	-	-	8		8			8	9.4	8	8	8	8	8		83		
>C21 to C35 Aliphatic	mg/kg	8	-	-	-	8		8			8	63	8	8	8	8	8		580		
>C16 to C35 Aliphatic	mg/kg	16	65000	450000	1600000	16		16			16	**72.4**	16	16	16	16	16		**663**		
>C35 to C44 Aliphatic	mg/kg		65000	450000	1600000																
Total Aliphatic C5-C35	mg/kg	10	-	-	-	10		10			10	72	10	10	10	10	10		700		
>C5 to C7 Aromatic	mg/kg		70	76000	26000	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001		
>C7 to C8 Aromatic	mg/kg		130	87000	56000	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001		
>C8 to C10 Aromatic	mg/kg		34	7200	3500	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001		
>C10 to C12 Aromatic	mg/kg	1	74	9200	16000	1		3.5			1	1	1	1	1	3.9	1		1		
>C12 to C16 Aromatic	mg/kg	2	140	10000	36000	2		17			7.7	2	9.4	2	2	23	2		2		
>C16 to C21 Aromatic	mg/kg	10	260	7600	28000	10		78			15	38	21	10	10	100	10		27		
>C21 to C35 Aromatic	mg/kg	10	1100	7800	28000	10		88			41	210	29	14	43	140	10		220		
>C35 to C44 Aromatic	mg/kg		1100	7800	28000																
Total Aromatic C5-C35	mg/kg		-	-	-																
TPH Ali/Aro	mg/kg		-	-	-																
EPH (C10-C40)	mg/kg		-	-	-																
Hazard Index - RwHP	-	-	-	-	-	0.1		0.6			0.2	0.4	0.2	0.1	0.1	0.7	0.1		0.4		
Hazard Index - POSpark	-	-	-	-	-	0.0		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0		
Hazard Index - Commercial	-	-	-	-	-	0.0		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0		
Benzene*	mg/kg	0.001	0.2	190	27	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001	0.001	0.001
Ethylbenzene	mg/kg	0.001	47	17000	5700	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001	0.001	0.001
Toluene	mg/kg	0.001	130	87000	56000	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001	0.001	0.001
Xylene	mg/kg	0.001	60	17000	6600	0.001					0.001					0.001	0.001			0.001	0.001
M- & P-Xylene	mg/kg	0.001	-	-	-	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001		
O-Xylene	mg/kg	0.001	-	-	-	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001	0.001	0.001
Total Xylene (M, P & O)	mg/kg	0.002	60	17000	6600	0.002		0.002			0.002	0.002	0.002	0.002	0.002	0.002	0.002		0.002	0.001	0.001
MTBE	mg/kg	0.001	-	-	-	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001	0.001	0.001
Naphthalene	mg/kg	0.05	2.3	1200	190	0.05	0.05	2.3	0.05		0.05	0.05	0.05	0.05	0.05	0.85	0.05	0.39	0.05	0.05	0.05
Acenaphthylene	mg/kg	0.05	170	29000	83000	0.05		3.3			0.05	0.34	0.56	0.05	0.05	2.5	0.05		0.05	0.05	0.58
Acenaphthene	mg/kg	0.05	210	29000	84000	0.05		0.92			0.05	0.05	0.05	0.05	0.05	1.5	0.05		0.05	0.05	0.05
Fluorene	mg/kg	0.05	170	20000	63000	0.05	0.05	2.2	0.05		0.05	0.05	0.43	0.05	0.05	2.6	0.05	0.35	0.05	0.05	0.28
Phenanthrene	mg/kg	0.05	95	6200	22000	0.05	1.8	19	0.49		1.2	3.6	3.5	0.86	1	20	0.05	4.5	0.05	0.05	2.3
Anthracene	mg/kg	0.05	2400	150000	520000	0.05	0.49	5.7	0.05		0.38	0.95	1.1	0.29	0.25	6.4	0.05	1.1	0.05	0.05	0.73
Fluoranthene	mg/kg	0.05	280	6300	23000	0.05	3.2	29	0.52		2.7	16	3.8	1.7	1.6	36	0.05	9	0.05	0.05	5.5
Pyrene	mg/kg	0.05	620	15000	54000	0.05	2.8	26	0.45		2.9	15	3.3	1.3	1.6	31	0.05	7.7	0.05	0.05	5.5
Benzo(a)anthracene	mg/kg	0.05	7.2	49	170	0.05	1.9	18	0.28		2.4	13	1.8	0.8	1.2	22	0.05	5.6	0.05	0.05	3.7
Chrysene	mg/kg	0.05	15	93	350	0.05	1.9	11	0.28		1.9	10	1.4	1	1.2	17	0.05	3.7	0.05	0.05	3.5
Benzo(b)fluoranthene	mg/kg	0.05	2.6	13	44	0.05	2	13	0.29		3.9	21	1.7	1.1	1.8	22	0.05	5	0.05	0.05	3.1
Benzo(k)fluoranthene	mg/kg	0.05	77	370	1200	0.05	1	9	0.16		1.6	5.8	0.89	0.51	0.58	11	0.05	2	0.05	0.05	1.6
Benzo(a)pyrene (BaP)	mg/kg	0.05	2.2	11	35	0.05	2	15	0.29		4.1	16	1.6	0.89	1.4	21	0.05	4.6	0.05	0.05	2.9
Indeno(1,2,3-c,d)pyrene	mg/kg	0.05	27	150	500	0.05	1.2	7.2	0.05		3.2	8.6	0.81	0.49	0.71	11	0.05	2.4	0.05	0.05	1.6
Dibenzo(a,h)anthracene	mg/kg	0.05	0.24	1.1	3.5	0.05	0.32	1.8	0.05		0.6	1.9	0.05	0.05	0.05	3.1	0.05	0.68	0.05	0.05	0.47
Benzo(g,h,i)perylene	mg/kg	0.05	320	1400	3900	0.05	1.4	7.2	0.05		4.4	9.1	0.95	0.58	0.88	12	0.05	2.6	0.05	0.05	1.7
Total PAH	mg/kg	0.8	-	-	-	0.8		171			29.1	122	21.8	9.6	12.2	220	0.8		0.8		
Coal Tar (BaP as surrogate)	mg/kg	0.05	0.79	4.4	15	0.05	2	15	0.29		4.1	16	1.6	0.89	1.4	21	0.05	4.6	0.05	0.05	2.9
BaP* (as surrogate for PAH)	mg/kg	0.05	5	21	77	0.05	2	15	0.29		4.1	16	1.6	0.89	1.4	21	0.05	4.6	0.05	0.05	2.9
PCB (sum of x Aroclors)	mg/kg		-	-	-																
1,2 Dichloroethane	mg/kg	0.001	1.6	1800	270	0.001					0.001					0.001	0.001			0.001	0.001
1,1,1 Trichloroethane (TCA)	mg/kg	0.001	8.8	57000	660	0.001					0.001					0.001	0.001			0.001	0.001
1,1,1,2 Tetrachloroethane	mg/kg	0.001	1.2	1500	110	0.001					0.001					0.001	0.001			0.001	0.001
1,1,2,2 Tetrachloroethane	mg/kg	0.001	1.6	1800	270	0.001					0.001					0.001	0.001			0.001	0.001
Tetrachloroethene (PCE)*	mg/kg	0.001	0.31	1400	24	0.001					0.001					0.001	0.001			0.001	0.001
Carbon Tetrachloride	mg/kg		0.026	190	2.9																
Trichloroethene (TCE)*	mg/kg	0.001	0.0093	41	0.73	0.001					0.001					0.001	0.001			0.001	0.001
Trichloromethane (Chloroform)	mg/kg	0.001	0.91	2600	99	0.001					0.001					0.001	0.001			0.001	0.001
Vinyl Chloride (Chloroethene)*	mg/kg	0.001	0.0064	18	1.1	0.001					0.001					0.001	0.001			0.001	0.001
Asbestos (Presence of)	TEXT		-	-	-	Not-detected		Detected			Not-detected	Detected	Detected	Not-detected	Not-detected	Detected	Detected		Not-detected		
Asbestos Analysts Comments	TEXT		-	-	-																
Asbestos Fibre Count	%																				

Assessment Criteria are the Suitable for Use Levels (S4ULs) punlished by LQM/CIEH (Copyright Land Quality Management Limited Reproduc

This is a summary table and it is possible that not all analytical results are reproduced. Whilst we endeavour to present the data accurately err

Land-use Scenarios - RwHP = Residential with Home Grown Produce, RwoHP = Residential without Home Grown Produce, POSresi = Publi

LOD = Limit of Detection. Results in italics are equal to or less than the LOD

This table should be read in conjunction with the accompanying guide on the selection of evaluation crtieria and the project specific note prese

TABLE SUMMARISING SOIL RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE SOIL ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

					Strata	Topsoil	ord Clay Forma	Alluvium	ord Clay Forma	Topsoil	Alluvium	Made Ground	Sand and Gra	ord Clay Forma	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Topsoil	Made Ground	Made Ground	Made Ground	Made Ground	Alluvium	Made Ground	Made Ground
SOM 1%			Assessment Criteria			BH107	BH107	BH108	BH108	BH109	BH109	BH110	BH110	BH110	TT101	TT101	TT101	TT102	TT102	TT102	TT102	WS101	WS101A	WS102	WS103	WS103A	WS103A	WS104	WS104
Analyte	Units	LOD	RwHP	POSpark	Commercial	0.05	5.00	0.30	10.50	0.10	0.40	1.30	4.00	11.00	0.30	1.10	1.30	0.05	0.40	1.00	2.00	0.05	1.30	0.30	0.05	1.40	2.20	0.30	0.80
Stones Content	%	0.1	-	-	-																								
Arsenic*	mg/kg	1	37	170	640			23			35	24			19		23	22		24		19	19	29	22		37	21	
Cadmium*	mg/kg	0.2	22	880	410			0.2			0.2	0.2			0.2		0.2	0.2		0.2		0.2	0.2	0.2	0.2		0.2	0.2	
Chromium Trivalent	mg/kg	1	910	33000	8600																								
Chromium Hexavalent*	mg/kg	4	21	250	49			4			4	4			4		4	4		4		4	4	4	4		4	4	
Copper	mg/kg	1	2400	44000	68000			49			21	72			30		50	36		40		27	37	21	49		7.4	34	
Lead*	mg/kg	1	200	1300	2300			200			41	260			350		280	230		170		97	57	210	360		25	220	
Mercury	mg/kg	0.3	40	240	1100			0.3			0.3	3.1			0.3		1.6	1		1.3		0.3	0.3	0.7	0.9		0.3	0.3	
Nickel	mg/kg	1	130	800	980			35			34	21			23		19	20		18		25	30	16	22		26	18	
Selenium	mg/kg	1	250	1800	12000			1			1	1			1		1	1		1		1	1	1	1		1	1	
Zinc	mg/kg	1	3700	170000	730000			160			110	120			290		120	140		140		120	74	140	340		77	140	
Beryllium	mg/kg		1.7	63	12																								
Boron	mg/kg		290	46000	240000																								
Vanadium	mg/kg		410	5000	9000																								
Cyanide (Total)	mg/kg	1	-	-	-																								
Organic matter	mg/kg		-	-	-																								
Phenol, Total	mg/kg		120	440	440																								
Sulphate (Total) as SO4	mg/l		-	-	-		1200	0.14	0.54	890	0.16	0.03	890	0.72	0.022	0.059	0.039	0.027		0.077		0.014	0.062	0.18	0.08	2.1	0.94		0.46
pH	pH Units		-	-	-	7.8	7.8	8.2	8.2	7.8	7.9	8	8.6	8.7	7.9	7.9	8.1	7.7	8.1	8.2	7.7	8.1	8.2	8.1	7.8	7.6	7.7	8.9	10
>C5 to C6 Aliphatic	mg/kg		42	95000	3200			0.001			0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
>C6 to C8 Aliphatic	mg/kg		100	150000	7800			0.001			0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
>C8 to C10 Aliphatic	mg/kg		27	14000	2000			0.001			0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
>C10 to C12 Aliphatic	mg/kg	1	130	21000	9700			1			1	1			1		1	1		1		1	1	1	1		1	1	
>C12 to C16 Aliphatic	mg/kg	2	1100	25000	59000			2			2	2			2		2	2		2		2	2	2	2		2	2	
>C16 to C21 Aliphatic	mg/kg	8	-	-	-			8			8	8			8		8	8		8		8	8	8	8		8	8	
>C21 to C35 Aliphatic	mg/kg	8	-	-	-			8			8	8			8		8	8		8		8	8	8	8		8	8	
>C16 to C35 Aliphatic	mg/kg	16	65000	450000	1600000			16			16	16			16		16	16		16		16	16	16	16		16	16	
>C35 to C44 Aliphatic	mg/kg		65000	450000	1600000																								
Total Aliphatic C5-C35	mg/kg	10	-	-	-			10			10	10			10		10	10		10		10	10	10	10		10	10	
>C5 to C7 Aromatic	mg/kg		70	76000	26000			0.001			0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
>C7 to C8 Aromatic	mg/kg		130	87000	56000			0.001			0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
>C8 to C10 Aromatic	mg/kg		34	7200	3500			0.001			0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
>C10 to C12 Aromatic	mg/kg	1	74	9200	16000			1			1	1			1		1	1		1		1	1	1	1		1	2.3	
>C12 to C16 Aromatic	mg/kg	2	140	10000	36000			8.5			2	2			2		2	2		2		2.6	4	2	2		2	3.9	
>C16 to C21 Aromatic	mg/kg	10	260	7600	28000			28			10	29			11		10	10		18		11	10	13	24		15	23	
>C21 to C35 Aromatic	mg/kg	10	1100	7800	28000			34			10	53			21		28	22		43		31	10	70	53		25	45	
>C35 to C44 Aromatic	mg/kg		1100	7800	28000																								
Total Aromatic C5-C35	mg/kg		-	-	-																								
TPH Ali/Aro	mg/kg		-	-	-																								
EPH (C10-C40)	mg/kg		-	-	-																								
Hazard Index - RwHP	-	-	-	-	-			0.2			0.1	0.2			0.1		0.1	0.1		0.1		0.1	0.1	0.2	0.2		0.1	0.2	
Hazard Index - POSpark	-	-	-	-	-			0.0			0.0	0.0			0.0		0.0	0.0		0.0		0.0	0.0	0.0	0.0		0.0	0.0	
Hazard Index - Commercial	-	-	-	-	-			0.0			0.0	0.0			0.0		0.0	0.0		0.0		0.0	0.0	0.0	0.0		0.0	0.0	
Benzene*	mg/kg	0.001	0.2	190	27						0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
Ethylbenzene	mg/kg	0.001	47	17000	5700						0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
Toluene	mg/kg	0.001	130	87000	56000						0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
Xylene	mg/kg	0.001	60	17000	6600																								
M- & P-Xylene	mg/kg	0.001	-	-	-						0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
O-Xylene	mg/kg	0.001	-	-	-						0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
Total Xylene (M, P & O)	mg/kg	0.002	60	17000	6600						0.002	0.002			0.002		0.002	0.002		0.002		0.002	0.002	0.002	0.002		0.002	0.002	
MTBE	mg/kg	0.001	-	-	-			0.001			0.001	0.001			0.001		0.001	0.001		0.001		0.001	0.001	0.001	0.001		0.001	0.001	
Naphthalene	mg/kg	0.05	2.3	1200	190	0.23		0.42			0.05	0.05			0.05		0.05	0.33	0.05	0.22	0.05	0.05	0.05	0.05	0.05		0.05	0.24	
Acenaphthylene	mg/kg	0.05	170	29000	83000			0.05			0.05	0.7			0.33		0.05	0.21		0.05		0.05	0.05	0.27	0.35		0.28	0.77	
Acenaphthene	mg/kg	0.05	210	29000	84000			0.05			0.05	0.05			0.05		0.05	0.05		0.05		0.05	0.05	0.26	0.14		0.05	0.3	
Fluorene	mg/kg	0.05	170	20000	63000	0.05		0.23			0.05	0.05			0.05		0.05	0.05	0.43	0.05	0.05	0.05	0.05	0.29	0.28		0.3	0.7	
Phenanthrene	mg/kg	0.05	95	6200	22000	0.55		5.7			0.05	2.9			2.4		1	1.4	5.4	1.8	0.05	1.5	0.6	3.1	3.2		3.3	7.7	
Anthracene	mg/kg	0.05	2400	150000	520000	0.05		1.4			0.05	0.85			0.76		0.28	0.51	1.3	0.49	0.05	0.34	0.05	0.75	0.8		0.9	1.8	
Fluoranthene	mg/kg	0.05	280	6300	23000	1.2		18			0.05	8.7			4.8		1.6	3.3	8.3	4.1	0.05	4.5	1.6	5.4	6.5		5.2	12	
Pyrene	mg/kg	0.05	620	15000	54000	1.1		9.5			0.05	8.3			4.4		1.5	2.9	6.4	3.4	0.05	3.9	1.5	4.8	5.8		4.7	10	
Benzo(a)anthracene	mg/kg	0.05	7.2	49	170	0.91		6.6			0.05	6.7			3.2		1	2.3	4.2	2.7	0.05	3	0.96	3.3	4.6		2.3	6.4	
Chrysene	mg/kg	0.05	15	93	350	0.7		4.6			0.05	4.2			2.2		0.86	1.6	3.8	2	0.05	2.3	0.92	2.3	3.5		2	4.5	
Benzo(b)fluoranthene	mg/kg	0.05	2.6	13	44	1		7.3			0.05	6.8			3.7		1.1	2.3	4.6	2.8	0.05	3.3	1.1	2.9	4		2	4.7	
Benzo(k)fluoranthene	mg/kg	0.05	77	370	1200	0.34		3.9			0.05	3.7			1.2		0.47	1.3	1.6	1.2	0.05	1.8	0.6	2	1.6		1.4	4.3	
Benzo(a)pyrene (BaP)	mg/kg	0.05	2.2	11	35	0.89		6.2			0.05	7.1			3.2		0.96	2.4	3.6	2.4	0.05	3.3	1.1	3.5	3.8		2.6	5.6	
Indeno(1,2,3-c,d)pyrene	mg/kg	0.05	27	150	500	0.52		6.8			0.05	4.4			1.6		0.51	1.3	2	1.4	0.05	1.8	0.66	1.5	1.9		1.4	3	
Dibenzo(a,h)anthracene	mg/kg	0.05	0.24	1.1	3.5	0.05		1.6			0.05	1.3			0.44		0.05	0.37	0.53	0.38	0.05	0.37	0.05	0.46	0.53		0.3	0.73	
Benzo(g,h,i)perylene	mg/kg	0.05	320	1400	3900	0.52		7.5			0.05	5.4			1.8		0.59	1.4	2.2	1.5	0.05	2.1	0.8	2.2	2		1.7	3.5	
Total PAH	mg/kg	0.8	-	-	-			61.7			0.8	61			30.1		9.91	21.6		24.3		28.2	9.81	32.9	38.9		28.3	66.2	
Coal Tar (BaP as surrogate)	mg/kg	0.05	0.79	4.4	15	0.89		6.2			0.05	7.1			3.2		0.96	2.4	3.6	2.4	0.05	3.3	1.1	3.5	3.8		2.6	5.6	
BaP* (as surrogate for PAH)	mg/kg	0.05	5	21	77	0.89		6.2			0.05	7.1			3.2		0.96	2.4	3.6	2.4	0.05	3.3	1.1	3.5	3.8		2.6	5.6	
PCB (sum of x Aroclors)	mg/kg		-	-	-																								
1,2 Dichloroethane	mg/kg	0.001	1.6	1800	270																								
1,1,1 Trichloroethane (TCA)	mg/kg	0.001	8.8	57000	660																								
1,1,1,2 Tetrachloroethane	mg/kg	0.001	1.2	1500	110																								
1,1,2,2 Tetrachloroethane	mg/kg	0.001	1.6	1800	270																								
Tetrachloroethene (PCE)*	mg/kg	0.001	0.31	1400	24																								
Carbon Tetrachloride	mg/kg		0.026	190	2.9																								
Trichloroethene (TCE)*	mg/kg	0.001	0.0093	41	0.73																								
Trichloromethane (Chloroform)	mg/kg	0.001	0.91	2600	99																								
Vinyl Chloride (Chloroethene)*	mg/kg	0.001	0.0064	18	1.1																								
Asbestos (Presence of)	TEXT		-	-	-			Not-detected			Not-detected	Not-detected			Detected		Detected	Not-detected		Not-detected		Not-detected	Not-detected	Not-detected	Not-detected		Not-detected	Detected	
Asbestos Analysts Comments	TEXT		-	-	-																								
Asbestos Fibre Count	%																												

Assessment Criteria are the Suitable for Use Levels (S4ULs) punlished by LQM/CIEH (Copyright Land Quality Management Limited Reproduc
This is a summary table and it is possible that not all analytical results are reproduced. Whilst we endeavour to present the data accurately err
Land-use Scenarios - RwHP = Residential with Home Grown Produce, RwoHP = Residential without Home Grown Produce, POSresi = Publi
LOD = Limit of Detection. Results in italics are equal to or less than the LOD
This table should be read in conjunction with the accompanying guide on the selection of evaluation crtieria and the project specific note prese

TABLE SUMMARISING SOIL RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE SOIL ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

SOM 1%			Assessment Criteria		Strata	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground
						WS104	WS105	WS105A	WS105A	WS105A	WS105A	WS106	WS107A	WS107A	WS108	WS109	WS109	WS109	WS110	WS112	WS113
Analyte	Units	LOD	RwHP	POSpark	Commercial	1.60	0.40	0.30	1.20	2.40	3.20	0.30	0.30	1.30	0.30	0.05	0.30	0.30	0.30	0.30	0.30
Stones Content	%	0.1	-	-	-																
Arsenic*	mg/kg	1	37	170	640	15		25			7.3	29	30	11	19	27	18		41		
Cadmium*	mg/kg	0.2	22	880	410	13		0.2			0.6	1.8	0.2	0.2	0.2	0.2	0.2		0.2		
Chromium Trivalent	mg/kg	1	910	33000	8600	26					7.7					24	38				
Chromium Hexavalent*	mg/kg	4	21	250	49	4		4			4	4	4	4	4	4	4		4		
Copper	mg/kg	1	2400	44000	68000	330		33			9.6	120	17	30	34	32	37		57		
Lead*	mg/kg	1	200	1300	2300	380		270			16	1400	42	27	59	120	75		25		
Mercury	mg/kg	0.3	40	240	1100	0.3		0.8			0.3	2.2	1	0.3	0.3	1.2	1		0.3		
Nickel	mg/kg	1	130	800	980	32		24			5	34	12	12	30	24	29		44		
Selenium	mg/kg	1	250	1800	12000	1		1			1	1	1	1	1	1	1		1		
Zinc	mg/kg	1	3700	170000	730000	650		180			25	640	59	47	98	130	110		170		
Beryllium	mg/kg		1.7	63	12																
Boron	mg/kg		290	46000	240000																
Vanadium	mg/kg		410	5000	9000																
Cyanide (Total)	mg/kg	1	-	-	-	2.4					9.4					4.9	6.2				
Organic matter	mg/kg		-	-	-																
Phenol, Total	mg/kg		120	440	440																
Sulphate (Total) as SO4	mg/l		-	-	-			1.4		0.91	1.6	0.042	1.1	1.6	0.15	0.16	1.4		0.23		
pH	pH Units		-	-	-	8.1	8.4	7.8	8.3	7.8	8	7.9	7.9	7.7	8.1	8.6	7.4	8.2	7.9		
>C5 to C6 Aliphatic	mg/kg		42	95000	3200	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001		
>C6 to C8 Aliphatic	mg/kg		100	150000	7800	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001		
>C8 to C10 Aliphatic	mg/kg		27	14000	2000	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001		
>C10 to C12 Aliphatic	mg/kg	1	130	21000	9700	1		1			1	1	1	1	1	1	1		4.7		
>C12 to C16 Aliphatic	mg/kg	2	1100	25000	59000	2		2			2	2	2	2	2	2	2		**32**		
>C16 to C21 Aliphatic	mg/kg	8	-	-	-	8		8			8	9.4	8	8	8	8	8		83		
>C21 to C35 Aliphatic	mg/kg	8	-	-	-	8		8			8	63	8	8	8	8	8		580		
>C16 to C35 Aliphatic	mg/kg	16	65000	450000	1600000	16		16			16	**72.4**	16	16	16	16	16		**663**		
>C35 to C44 Aliphatic	mg/kg		65000	450000	1600000																
Total Aliphatic C5-C35	mg/kg	10	-	-	-	10		10			10	72	10	10	10	10	10		700		
>C5 to C7 Aromatic	mg/kg		70	76000	26000	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001		
>C7 to C8 Aromatic	mg/kg		130	87000	56000	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001		
>C8 to C10 Aromatic	mg/kg		34	7200	3500	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001		
>C10 to C12 Aromatic	mg/kg	1	74	9200	16000	1		3.5			1	1	1	1	1	3.9	1		1		
>C12 to C16 Aromatic	mg/kg	2	140	10000	36000	2		17			7.7	2	9.4	2	2	23	2		2		
>C16 to C21 Aromatic	mg/kg	10	260	7600	28000	10		78			15	38	21	10	10	100	10		27		
>C21 to C35 Aromatic	mg/kg	10	1100	7800	28000	10		88			41	210	29	14	43	140	10		220		
>C35 to C44 Aromatic	mg/kg		1100	7800	28000																
Total Aromatic C5-C35	mg/kg		-	-	-																
TPH Ali/Aro	mg/kg		-	-	-																
EPH (C10-C40)	mg/kg		-	-	-																
Hazard Index - RwHP	-	-	-	-	-	0.1		0.6			0.2	0.4	0.2	0.1	0.1	0.7	0.1		0.4		
Hazard Index - POSpark	-	-	-	-	-	0.0		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0		
Hazard Index - Commercial	-	-	-	-	-	0.0		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0		
Benzene*	mg/kg	0.001	0.2	190	27	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001	0.001	0.001
Ethylbenzene	mg/kg	0.001	47	17000	5700	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001	0.001	0.001
Toluene	mg/kg	0.001	130	87000	56000	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001	0.001	0.001
Xylene	mg/kg	0.001	60	17000	6600	0.001					0.001					0.001	0.001			0.001	0.001
M- & P-Xylene	mg/kg	0.001	-	-	-	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001		
O-Xylene	mg/kg	0.001	-	-	-	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001	0.001	0.001
Total Xylene (M, P & O)	mg/kg	0.002	60	17000	6600	0.002		0.002			0.002	0.002	0.002	0.002	0.002	0.002	0.002		0.002	0.001	0.001
MTBE	mg/kg	0.001	-	-	-	0.001		0.001			0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001	0.001	0.001
Naphthalene	mg/kg	0.05	2.3	1200	190	0.05	0.05	2.3	0.05		0.05	0.05	0.05	0.05	0.05	0.85	0.05	0.39	0.05	0.05	0.05
Acenaphthylene	mg/kg	0.05	170	29000	83000	0.05		3.3			0.05	0.34	0.56	0.05	0.05	2.5	0.05		0.05	0.05	0.58
Acenaphthene	mg/kg	0.05	210	29000	84000	0.05		0.92			0.05	0.05	0.05	0.05	0.05	1.5	0.05		0.05	0.05	0.05
Fluorene	mg/kg	0.05	170	20000	63000	0.05	0.05	2.2	0.05		0.05	0.05	0.43	0.05	0.05	2.6	0.05	0.35	0.05	0.05	0.28
Phenanthrene	mg/kg	0.05	95	6200	22000	0.05	1.8	19	0.49		1.2	3.6	3.5	0.86	1	20	0.05	4.5	0.05	0.05	2.3
Anthracene	mg/kg	0.05	2400	150000	520000	0.05	0.49	5.7	0.05		0.38	0.95	1.1	0.29	0.25	6.4	0.05	1.1	0.05	0.05	0.73
Fluoranthene	mg/kg	0.05	280	6300	23000	0.05	3.2	29	0.52		2.7	16	3.8	1.7	1.6	36	0.05	9	0.05	0.05	5.5
Pyrene	mg/kg	0.05	620	15000	54000	0.05	2.8	26	0.45		2.9	15	3.3	1.3	1.6	31	0.05	7.7	0.05	0.05	5.5
Benzo(a)anthracene	mg/kg	0.05	7.2	49	170	0.05	1.9	18	0.28		2.4	13	1.8	0.8	1.2	22	0.05	5.6	0.05	0.05	3.7
Chrysene	mg/kg	0.05	15	93	350	0.05	1.9	11	0.28		1.9	10	1.4	1	1.2	17	0.05	3.7	0.05	0.05	3.5
Benzo(b)fluoranthene	mg/kg	0.05	2.6	13	44	0.05	2	13	0.29		3.9	21	1.7	1.1	1.8	22	0.05	5	0.05	0.05	3.1
Benzo(k)fluoranthene	mg/kg	0.05	77	370	1200	0.05	1	9	0.16		1.6	5.8	0.89	0.51	0.58	11	0.05	2	0.05	0.05	1.6
Benzo(a)pyrene (BaP)	mg/kg	0.05	2.2	11	35	0.05	2	15	0.29		4.1	16	1.6	0.89	1.4	21	0.05	4.6	0.05	0.05	2.9
Indeno(1,2,3-c,d)pyrene	mg/kg	0.05	27	150	500	0.05	1.2	7.2	0.05		3.2	8.6	0.81	0.49	0.71	11	0.05	2.4	0.05	0.05	1.6
Dibenzo(a,h)anthracene	mg/kg	0.05	0.24	1.1	3.5	0.05	0.32	1.8	0.05		0.6	1.9	0.05	0.05	0.05	3.1	0.05	0.68	0.05	0.05	0.47
Benzo(g,h,i)perylene	mg/kg	0.05	320	1400	3900	0.05	1.4	7.2	0.05		4.4	9.1	0.95	0.58	0.88	12	0.05	2.6	0.05	0.05	1.7
Total PAH	mg/kg	0.8	-	-	-	0.8		171			29.1	122	21.8	9.6	12.2	220	0.8		0.8		
Coal Tar (BaP as surrogate)	mg/kg	0.05	0.79	4.4	15	0.05	2	15	0.29		4.1	16	1.6	0.89	1.4	21	0.05	4.6	0.05	0.05	2.9
BaP* (as surrogate for PAH)	mg/kg	0.05	5	21	77	0.05	2	15	0.29		4.1	16	1.6	0.89	1.4	21	0.05	4.6	0.05	0.05	2.9
PCB (sum of x Aroclors)	mg/kg		-	-	-																
1,2 Dichloroethane	mg/kg	0.001	1.6	1800	270	0.001					0.001					0.001	0.001			0.001	0.001
1,1,1 Trichloroethane (TCA)	mg/kg	0.001	8.8	57000	660	0.001					0.001					0.001	0.001			0.001	0.001
1,1,1,2 Tetrachloroethane	mg/kg	0.001	1.2	1500	110	0.001					0.001					0.001	0.001			0.001	0.001
1,1,2,2 Tetrachloroethane	mg/kg	0.001	1.6	1800	270	0.001					0.001					0.001	0.001			0.001	0.001
Tetrachloroethene (PCE)*	mg/kg	0.001	0.31	1400	24	0.001					0.001					0.001	0.001			0.001	0.001
Carbon Tetrachloride	mg/kg		0.026	190	2.9																
Trichloroethene (TCE)*	mg/kg	0.001	0.0093	41	0.73	0.001					0.001					0.001	0.001			0.001	0.001
Trichloromethane (Chloroform)	mg/kg	0.001	0.91	2600	99	0.001					0.001					0.001	0.001			0.001	0.001
Vinyl Chloride (Chloroethene)*	mg/kg	0.001	0.0064	18	1.1	0.001					0.001					0.001	0.001			0.001	0.001
Asbestos (Presence of)	TEXT		-	-	-	Not-detected		Detected			Not-detected	Detected	Detected	Not-detected	Not-detected	Detected	Detected		Not-detected		
Asbestos Analysts Comments	TEXT		-	-	-																
Asbestos Fibre Count	%																				

Assessment Criteria are the Suitable for Use Levels (S4ULs) punlished by LQM/CIEH (Copyright Land Quality Management Limited Reproduc

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LOD = Limit of Detection. Results in italics are equal to or less than the LOD

This table should be read in conjunction with the accompanying guide on the selection of evaluation crtieria and the project specific note prese

Appendix D Brightside for Waters

TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

England & Wales			Assessment Criteria			ChemCode	No. of Tests	Min	Max	No. of Exceedences			BH103	BH104	BH105	BH107	DOWN-STREAM	UP-STREAM	WS103	BH105	BH105	WS104	WS105A	WS109	WS109
Analyte	Units	LOD	MRV	Human Consumption	Fresh Water	↓				MRV	Human Consumption	Fresh Water								Leach @ 0.3m	Leach @ 2.0m	Leach @ 1.6m	Leach @ 3.2m	Leach @ 3.2m	Leach @ 4.7m
Alkalinity as $CaCO_3$	µg/l	3	-	-	-	P1335	7	240	420				310	280	300	350	240	240	420						
Arsenic	µg/l	0.15	-	10	50	7440-38-2	13	0.61	13		1		1.17	1.51	1.34	0.83	0.61	0.67	7.11	13	8.6	1.6	1.5	2.3	6
Boron	µg/l		-	1000	-	7440-42-8																			
Cadmium	µg/l	0.02	0.1	5	0.08	7440-43-9	13	0.02	0.72	6		6	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.15	0.23	0.72	0.28	0.14	0.16
Chromuim (Total)	µg/l	0.2	-	50	-	7440-47-3	13	0.4	6.4				1.6	1.3	1.6	1.7	0.8	1	2.2	1.5	0.7	6.4	1	4.2	0.4
Chromium Trivalent	µg/l		-	-	4.7	16065-83-1																			
Chromium Hexavalant	µg/l	5	-	-	3.4	18540-29-9	13	5	5			13	5	5	5	5	5	5	5	5	5	5	5	5	5
Copper	µg/l	0.5	-	2000	17.57	7440-50-8	13	0.9	14				2.1	2	4	2.9	4.3	3.8	0.9	10	2.8	9.4	6.4	14	9.3
Iron	µg/l		-	200	1000	7439-89-6																			
Lead	µg/l	0.2	-	10	7.31	7439-92-1	13	0.2	8.2			1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	5.7	4	5.6	2.6	8.2	3.7
Mercury	µg/l	0.05	0.01	1	0.07	7439-97-6	13	0.05	0.05	13			0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Manganese	µg/l		-	50	123	7439-96-5																			
Nickel	µg/l	0.5	-	20	10.83	7440-02-0	13	1.8	8.3				4.7	3.6	4.9	4.3	1.8	3.6	8.3	7.1	6.3	2.5	3.9	5.5	4.2
Selenium	µg/l	0.6	-	10	-	7782-49-2	7	0.6	1.9	6		6	0.6	0.6	0.8	0.6	0.6	0.6	1.9	<4.0	<4.0	< 4.0	< 4.0	< 4.0	< 4.0
Zinc	µg/l	0.5	-	5000	33.13	7440-66-6	13	5.1	26				12	7.5	7.9	6.6	6.4	5.1	7.7	9.4	9.1	26	21	18	16
Ammoniacal Nitrogen as NH_4	µg/l	15	-	500	260	P1140	7	15	2300		1	1	2300	190	240	15	15	15	200						
Ammoniacal Nitrogen as NH_3	µg/l		-	-	200	P1000	7	14	2172			2	2172	179	227	14	14	14	189						
Chloride	µg/l	150	-	250000	-	16887-00-6	7	23000	85000				67000	60000	53000	85000	23000	24000	24000						
Chlorine	µg/l		-	-	2	7782-50-5																			
Cyanide	µg/l		-	50	1	57-12-5	6	10	290		3	6								10	43	10	92	290	290
Nitrate as NO_3	µg/l		-	50000	-	P1348																			
Nitrite as NO_2	µg/l		-	100	-	P1349																			
Phenol	µg/l	0.05	-	500	7.7	108-95-2	7	0.05	0.05				0.05	0.05	0.05	0.05	0.05	0.05	0.05						
Pentachlorophenol	µg/l		0.1	-	0.4	87-86-5																			
PCBs	µg/l		0.001	-	-	1336-36-3																			
Sodium	µg/l		-	200000	-	7440-23-5																			
Sulphate	µg/l	45	-	250000	-	14808-79-8	7	40800	1010000		2		147000	110000	278000	104000	40800	40800	1010000						
pH	pH Units		-	-	-	P1334	7	6.9	8.2				7.4	7.2	7.8	7.1	8.2	8.1	6.9						
Dichloromethane	µg/l		-	-	20	75-09-2																			
1,2 Dichloroethane	µg/l	1	1	3	10	107-06-2	7	1	1				1	1	1	1	1	1	1						
Trichloroethene (PCE)	µg/l	1	0.1	10	10	79-01-6	7	1	1	7			1	1	1	1	1	1	1						
1,1,1 Trichloroethane	µg/l	1	0.1	-	-	71-55-6	7	1	1	7			1	1	1	1	1	1	1						
1,1,2 Trichloroethane	µg/l	1	0.1	-	-	79-00-5	7	1	1	7			1	1	1	1	1	1	1						
Trichloromethane (Chloroform)	µg/l	1	0.1	100	2.5	67-66-3	7	1	1	7			1	1	1	1	1	1	1						
1,2,3 Trichlorobenzene	µg/l	1	-	-	-	87-61-6	7	1	1				1	1	1	1	1	1	1						
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	-	120-82-1	7	1	1	7			1	1	1	1	1	1	1						
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	-	0.4	xxx	7	2	2			7	2	2	2	2	2	2	2						
Tetrachloroethene	µg/l	1	0.1	10	10	127-18-4	7	1	1	7			1	1	1	1	1	1	1						
Tetrachloromethane	µg/l	1	0.1	3	12	56-23-5	7	1	1	7			1	1	1	1	1	1	1						
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	140	630-20-6	7	1	1				1	1	1	1	1	1	1						
2-chlorophenol	µg/l	0.05	0.1	-	-	95-57-8							0.05	0.05	0.05	0.05	0.05	0.05	0.05						
4-chloro-3-methylphenol	µg/l	0.05	0.1	-	-	59-50-7							0.05	0.05	0.05	0.05	0.05	0.05	0.05						
Hexachlorobutadiene	µg/l	1	0.005	-	0.6	87-68-3				7		7	1	1	1	1	1	1	1						
Vinyl Chloride (Chloroethene)	µg/l	1	-	0.5	-	75-01-4	7	1	1		7		1	1	1	1	1	1	1						
>C5 to C6 Aliphatic	µg/l	1	-	-	-	P1407	7	1	1				1	1	1	1	1	1	1						
>C6 to C8 Aliphatic	µg/l	1	-	-	-	P1408	7	1	1				1	1	1	1	1	1	1						
>C8 to C10 Aliphatic	µg/l	1	-	-	-	P1409	7	1	1				1	1	1	1	1	1	1						
>C10 to C12 Aliphatic	µg/l	10	-	-	-	P1410	7	10	10				10	10	10	10	10	10	10						
>C12 to C16 Aliphatic	µg/l	10	-	-	-	P1411	7	10	10				10	10	10	10	10	10	10						
>C16 to C21 Aliphatic	µg/l	10	-	-	-	P1412	7	10	10				10	10	10	10	10	10	10						
>C21 to C35 Aliphatic	µg/l	10	-	-	-	P1413	7	10	10				10	10	10	10	10	10	10						
>C35 to C44 Aliphatic	µg/l		-	-	-	P1415																			
Total Aliphatic C5-35	µg/l	10	-	-	-	P1418	7	10	10				10	10	10	10	10	10	10						
>C5 to C7 Aromatic	µg/l	1	-	-	-	P1441	7	1	1				1	1	1	1	1	1	1						
>C7 to C8 Aromatic	µg/l	1	-	-	-	P1355	7	1	1				1	1	1	1	1	1	1						
>C8 to C10 Aromatic	µg/l	1	-	-	-	P1356	7	1	1				1	1	1	1	1	1	1						
>C10 to C12 Aromatic	µg/l	10	-	-	-	P1357	7	10	10				10	10	10	10	10	10	10						
>C12 to C16 Aromatic	µg/l	10	-	-	-	P1358	7	10	10				10	10	10	10	10	10	10						
>C16 to C21 Aromatic	µg/l	10	-	-	-	P1359	7	10	10				10	10	10	10	10	10	10						
>C21 to C35 Aromatic	µg/l	10	-	-	-	P1360	7	10	10				10	10	10	10	10	10	10						
>C35 to C44 Aromatic	µg/l		-	-	-	P1362																			
Total Aromatic C5-C35	µg/l	10	-	-	-	P1365	7	10	10				10	10	10	10	10	10	10						
TPH Ali/Aro	µg/l		-	10	-	P2096																			
Benzene	µg/l	1	1	1	10	71-43-2	7	1	1				1	1	1	1	1	1	1						
Ethylbenzene	µg/l	1	-	300	-	100-41-4	7	1	1				1	1	1	1	1	1	1						
Toluene	µg/l	1	4	700	74	108-88-3	7	1	1				1	1	1	1	1	1	1						
Xylene	µg/l		3	500	30	1330-20-7																			
M- & P-Xylene	µg/l	1	-	-	-	P1374	7	1	1				1	1	1	1	1	1	1						
O-Xylene	µg/l	1	-	-	-	95-47-6	7	1	1				1	1	1	1	1	1	1						
Total Xylene (M, P & O)	µg/l	2	-	-	-	xxx	7	2	2				2	2	2	2	2	2	2						
MTBE	µg/l	1	-	15	-	1634-04-4	7	1	1				1	1	1	1	1	1	1						
naphthalene	µg/l	1	-	-	2	91-20-3	7	1	1				1	1	1	1	1	1	1						
acenaphthylene	µg/l	0.01	-	-	-	208-96-8	7	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01						
acenaphthene	µg/l	0.01	-	-	-	83-32-9	7	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01						
fluorene	µg/l	0.01	-	-	-	86-73-7	7	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01						
phenanthrene	µg/l	0.01	-	-	-	85-01-8	7	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01						
anthracene	µg/l	0.01	-	-	0.1	120-12-7	7	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01						
fluoranthene	µg/l	0.01	-	-	0.0063	206-44-0	7	0.01	0.01			7	0.01	0.01	0.01	0.01	0.01	0.01	0.01						
pyrene	µg/l	0.01	-	-	-	129-00-0	7	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01						
benzo(a)anthracene	µg/l	0.01	-	-	-	56-55-3	7	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01						
chrysene	µg/l	0.01	-	-	-	218-01-9	7	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01						
benzo(b)fluoranthene	µg/l	0.01	-	0.1	0.017	205-99-2	7	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01						
benzo(k)fluoranthene	µg/l	0.01	-	0.1	0.017	207-08-9	7	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01						
benzo(a)pyrene	µg/l	0.01	-	0.01	0.00017	50-32-8	7	0.01	0.01			7	0.01	0.01	0.01	0.01	0.01	0.01	0.01						
benzo(g,h,i)perylene	µg/l	0.01	-	0.1	0.0082	193-39-5	7	0.01	0.01			7	0.01	0.01	0.01	0.01	0.01	0.01	0.01						
dibenzo(ah)anthracene	µg/l	0.01	-	-	-	53-70-3	7	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01						
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	0.1	-	191-24-2	7	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01						
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	0.1	-	xxx	7	0.04	0.04				0.04	0.04	0.04	0.04	0.04	0.04	0.04						
Total PAH	µg/l	0.16	-	-	-	P1706	7	0.16	0.16				0.16	0.16	0.16	0.16	0.16	0.16	0.16						

TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

England & Wales			Assessment Criteria							No. of Exceedences		
Analyte	Units	LOD	MRV	Human Consumption	Fresh Water	ChemCode ↓	No. of Tests	Min	Max	MRV	Human Consum ption	Fresh Water
Alkalinity as $CaCO_3$	µg/l	3	-	-	-	P1335	7	240	420			
Arsenic	µg/l	0.15	-	10	50	7440-38-2	13	0.61	13		1	
Boron	µg/l		-	1000	-	7440-42-8						
Cadmium	µg/l	0.02	0.1	5	0.08	7440-43-9	13	0.02	0.72	6		6
Chromuim (Total)	µg/l	0.2	-	50	-	7440-47-3	13	0.4	6.4			
Chromium Trivalent	µg/l		-	-	4.7	16065-83-1						
Chromium Hexavalant	µg/l	5	-	-	3.4	18540-29-9	13	5	5			13
Copper	µg/l	0.5	-	2000	17.57	7440-50-8	13	0.9	14			
Iron	µg/l		-	200	1000	7439-89-6						
Lead	µg/l	0.2	-	10	7.31	7439-92-1	13	0.2	8.2			1
Mercury	µg/l	0.05	0.01	1	0.07	7439-97-6	13	0.05	0.05	13		
Manganese	µg/l		-	50	123	7439-96-5						
Nickel	µg/l	0.5	-	20	10.83	7440-02-0	13	1.8	8.3			
Selenium	µg/l	0.6	-	10	-	7782-49-2	7	0.6	1.9	6		6
Zinc	µg/l	0.5	-	5000	33.13	7440-66-6	13	5.1	26			
Ammoniacal Nitrogen as NH_4	µg/l	15	-	500	260	P1140	7	15	2300		1	1
Ammoniacal Nitrogen as NH_3	µg/l		-	-	200	P1000	7	14	2172			2
Chloride	µg/l	150	-	250000	-	16887-00-6	7	23000	85000			
Chlorine	µg/l		-	-	2	7782-50-5						
Cyanide	µg/l		-	50	1	57-12-5	6	10	290		3	6
Nitrate as NO_3	µg/l		-	50000	-	P1348						
Nitrite as NO_2	µg/l		-	100	-	P1349						
Phenol	µg/l	0.05	-	500	7.7	108-95-2	7	0.05	0.05			
Pentachlorophenol	µg/l		0.1	-	0.4	87-86-5						
PCBs	µg/l		0.001	-	-	1336-36-3						
Sodium	µg/l		-	200000	-	7440-23-5						
Sulphate	µg/l	45	-	250000	-	14808-79-8	7	40800	1010000		2	
pH	pH Units		-	-	-	P1334	7	6.9	8.2			
Dichloromethane	µg/l		-	-	20	75-09-2						
1,2 Dichloroethane	µg/l	1	1	3	10	107-06-2	7	1	1			
Trichloroethene (PCE)	µg/l	1	0.1	10	10	79-01-6	7	1	1	7		
1,1,1 Trichloroethane	µg/l	1	0.1	-	-	71-55-6	7	1	1	7		
1,1,2 Trichloroethane	µg/l	1	0.1	-	-	79-00-5	7	1	1	7		
Trichloromethane (Chloroform)	µg/l	1	0.1	100	2.5	67-66-3	7	1	1	7		
1,2,3 Trichlorobenzene	µg/l	1	-	-	-	87-61-6	7	1	1			
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	-	120-82-1	7	1	1	7		
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	-	0.4	xxx	7	2	2			7
Tetrachloroethene	µg/l	1	0.1	10	10	127-18-4	7	1	1	7		
Tetrachloromethane	µg/l	1	0.1	3	12	56-23-5	7	1	1	7		
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	140	630-20-6	7	1	1			
2-chlorophenol	µg/l	0.05	0.1	-	-	95-57-8						
4-chloro-3-methylphenol	µg/l	0.05	0.1	-	-	59-50-7						
Hexachlorobutadiene	µg/l	1	0.005	-	0.6	87-68-3				7		7
Vinyl Chloride (Chloroethene)	µg/l	1	-	0.5	-	75-01-4	7	1	1		7	
>C5 to C6 Aliphatic	µg/l	1	-	-	-	P1407	7	1	1			
>C6 to C8 Aliphatic	µg/l	1	-	-	-	P1408	7	1	1			
>C8 to C10 Aliphatic	µg/l	1	-	-	-	P1409	7	1	1			
>C10 to C12 Aliphatic	µg/l	10	-	-	-	P1410	7	10	10			
>C12 to C16 Aliphatic	µg/l	10	-	-	-	P1411	7	10	10			
>C16 to C21 Aliphatic	µg/l	10	-	-	-	P1412	7	10	10			
>C21 to C35 Aliphatic	µg/l	10	-	-	-	P1413	7	10	10			
>C35 to C44 Aliphatic	µg/l		-	-	-	P1415						
Total Aliphatic C5-35	µg/l	10	-	-	-	P1418	7	10	10			
>C5 to C7 Aromatic	µg/l	1	-	-	-	P1441	7	1	1			
>C7 to C8 Aromatic	µg/l	1	-	-	-	P1355	7	1	1			
>C8 to C10 Aromatic	µg/l	1	-	-	-	P1356	7	1	1			
>C10 to C12 Aromatic	µg/l	10	-	-	-	P1357	7	10	10			
>C12 to C16 Aromatic	µg/l	10	-	-	-	P1358	7	10	10			
>C16 to C21 Aromatic	µg/l	10	-	-	-	P1359	7	10	10			
>C21 to C35 Aromatic	µg/l	10	-	-	-	P1360	7	10	10			
>C35 to C44 Aromatic	µg/l		-	-	-	P1362						
Total Aromatic C5-C35	µg/l	10	-	-	-	P1365	7	10	10			
TPH Ali/Aro	µg/l		-	10	-	P2096						
Benzene	µg/l	1	1	1	10	71-43-2	7	1	1			
Ethylbenzene	µg/l	1	-	300	-	100-41-4	7	1	1			
Toluene	µg/l	1	4	700	74	108-88-3	7	1	1			
Xylene	µg/l		3	500	30	1330-20-7						
M- & P-Xylene	µg/l	1	-	-	-	P1374	7	1	1			
O-Xylene	µg/l	1	-	-	-	95-47-6	7	1	1			
Total Xylene (M, P & O)	µg/l	2	-	-	-	xxx	7	2	2			
MTBE	µg/l	1	-	15	-	1634-04-4	7	1	1			
naphthalene	µg/l	1	-	-	2	91-20-3	7	1	1			
acenaphthylene	µg/l	0.01	-	-	-	208-96-8	7	0.01	0.01			
acenaphthene	µg/l	0.01	-	-	-	83-32-9	7	0.01	0.01			
fluorene	µg/l	0.01	-	-	-	86-73-7	7	0.01	0.01			
phenanthrene	µg/l	0.01	-	-	-	85-01-8	7	0.01	0.01			
anthracene	µg/l	0.01	-	-	0.1	120-12-7	7	0.01	0.01			
fluoranthene	µg/l	0.01	-	-	0.0063	206-44-0	7	0.01	0.01			7
pyrene	µg/l	0.01	-	-	-	129-00-0	7	0.01	0.01			
benzo(a)anthracene	µg/l	0.01	-	-	-	56-55-3	7	0.01	0.01			
chrysene	µg/l	0.01	-	-	-	218-01-9	7	0.01	0.01			
benzo(b)fluoranthene	µg/l	0.01	-	0.1	0.017	205-99-2	7	0.01	0.01			
benzo(k)fluoranthene	µg/l	0.01	-	0.1	0.017	207-08-9	7	0.01	0.01			
benzo(a)pyrene	µg/l	0.01	-	0.01	0.00017	50-32-8	7	0.01	0.01			7
benzo(g,h,i)perylene	µg/l	0.01	-	0.1	0.0082	193-39-5	7	0.01	0.01			7
dibenzo(ah)anthracene	µg/l	0.01	-	-	-	53-70-3	7	0.01	0.01			
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	0.1	-	191-24-2	7	0.01	0.01			
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	0.1	-	xxx	7	0.04	0.04			
Total PAH	µg/l	0.16	-	-	-	P1706	7	0.16	0.16			

TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

England & Wales			Assessment Criteria			ChemCode ↓	No. of Tests	Min	Max	No. of Exceedences		
Analyte	Units	LOD	MRV	Human Consumption	Fresh Water					MRV	Human Consumption	Fresh Water
Alkalinity as $CaCO_3$	µg/l	3	-	-	-	P1335	7	240	420			
Arsenic	µg/l	0.15	-	10	50	7440-38-2	13	0.61	13		1	
Boron	µg/l		-	1000	-	7440-42-8						
Cadmium	µg/l	0.02	0.1	5	0.08	7440-43-9	13	0.02	0.72	6		6
Chromuim (Total)	µg/l	0.2	-	50	-	7440-47-3	13	0.4	6.4			
Chromium Trivalent	µg/l		-	-	4.7	16065-83-1						
Chromium Hexavalant	µg/l	5	-	-	3.4	18540-29-9	13	5	5			13
Copper	µg/l	0.5	-	2000	17.57	7440-50-8	13	0.9	14			
Iron	µg/l		-	200	1000	7439-89-6						
Lead	µg/l	0.2	-	10	7.31	7439-92-1	13	0.2	8.2			1
Mercury	µg/l	0.05	0.01	1	0.07	7439-97-6	13	0.05	0.05	13		
Manganese	µg/l		-	50	123	7439-96-5						
Nickel	µg/l	0.5	-	20	10.83	7440-02-0	13	1.8	8.3			
Selenium	µg/l	0.6	-	10	-	7782-49-2	7	0.6	1.9	6		6
Zinc	µg/l	0.5	-	5000	33.13	7440-66-6	13	5.1	26			
Ammoniacal Nitrogen as NH_4	µg/l	15	-	500	260	P1140	7	15	2300		1	1
Ammoniacal Nitrogen as NH_3	µg/l		-	-	200	P1000	7	14	2172			2
Chloride	µg/l	150	-	250000	-	16887-00-6	7	23000	85000			
Chlorine	µg/l		-	-	2	7782-50-5						
Cyanide	µg/l		-	50	1	57-12-5	6	10	290		3	6
Nitrate as NO_3	µg/l		-	50000	-	P1348						
Nitrite as NO_2	µg/l		-	100	-	P1349						
Phenol	µg/l	0.05	-	500	7.7	108-95-2	7	0.05	0.05			
Pentachlorophenol	µg/l		0.1	-	0.4	87-86-5						
PCBs	µg/l		0.001	-	-	1336-36-3						
Sodium	µg/l		-	200000	-	7440-23-5						
Sulphate	µg/l	45	-	250000	-	14808-79-8	7	40800	1010000		2	
pH	pH Units		-	-	-	P1334	7	6.9	8.2			
Dichloromethane	µg/l		-	-	20	75-09-2						
1,2 Dichloroethane	µg/l	1	1	3	10	107-06-2	7	1	1			
Trichloroethene (PCE)	µg/l	1	0.1	10	10	79-01-6	7	1	1	7		
1,1,1 Trichloroethane	µg/l	1	0.1	-	-	71-55-6	7	1	1	7		
1,1,2 Trichloroethane	µg/l	1	0.1	-	-	79-00-5	7	1	1	7		
Trichloromethane (Chloroform)	µg/l	1	0.1	100	2.5	67-66-3	7	1	1	7		
1,2,3 Trichlorobenzene	µg/l	1	-	-	-	87-61-6	7	1	1			
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	-	120-82-1	7	1	1	7		
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	-	0.4	xxx	7	2	2			7
Tetrachloroethene	µg/l	1	0.1	10	10	127-18-4	7	1	1	7		
Tetrachloromethane	µg/l	1	0.1	3	12	56-23-5	7	1	1	7		
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	140	630-20-6	7	1	1			
2-chlorophenol	µg/l	0.05	0.1	-	-	95-57-8						
4-chloro-3-methylphenol	µg/l	0.05	0.1	-	-	59-50-7						
Hexachlorobutadiene	µg/l	1	0.005	-	0.6	87-68-3				7		7
Vinyl Chloride (Chloroethene)	µg/l	1	-	0.5	-	75-01-4	7	1	1		7	
>C5 to C6 Aliphatic	µg/l	1	-	-	-	P1407	7	1	1			
>C6 to C8 Aliphatic	µg/l	1	-	-	-	P1408	7	1	1			
>C8 to C10 Aliphatic	µg/l	1	-	-	-	P1409	7	1	1			
>C10 to C12 Aliphatic	µg/l	10	-	-	-	P1410	7	10	10			
>C12 to C16 Aliphatic	µg/l	10	-	-	-	P1411	7	10	10			
>C16 to C21 Aliphatic	µg/l	10	-	-	-	P1412	7	10	10			
>C21 to C35 Aliphatic	µg/l	10	-	-	-	P1413	7	10	10			
>C35 to C44 Aliphatic	µg/l		-	-	-	P1415						
Total Aliphatic C5-35	µg/l	10	-	-	-	P1418	7	10	10			
>C5 to C7 Aromatic	µg/l	1	-	-	-	P1441	7	1	1			
>C7 to C8 Aromatic	µg/l	1	-	-	-	P1355	7	1	1			
>C8 to C10 Aromatic	µg/l	1	-	-	-	P1356	7	1	1			
>C10 to C12 Aromatic	µg/l	10	-	-	-	P1357	7	10	10			
>C12 to C16 Aromatic	µg/l	10	-	-	-	P1358	7	10	10			
>C16 to C21 Aromatic	µg/l	10	-	-	-	P1359	7	10	10			
>C21 to C35 Aromatic	µg/l	10	-	-	-	P1360	7	10	10			
>C35 to C44 Aromatic	µg/l		-	-	-	P1362						
Total Aromatic C5-C35	µg/l	10	-	-	-	P1365	7	10	10			
TPH Ali/Aro	µg/l		-	10	-	P2096						
Benzene	µg/l	1	1	1	10	71-43-2	7	1	1			
Ethylbenzene	µg/l	1	-	300	-	100-41-4	7	1	1			
Toluene	µg/l	1	4	700	74	108-88-3	7	1	1			
Xylene	µg/l		3	500	30	1330-20-7						
M- & P-Xylene	µg/l	1	-	-	-	P1374	7	1	1			
O-Xylene	µg/l	1	-	-	-	95-47-6	7	1	1			
Total Xylene (M, P & O)	µg/l	2	-	-	-	xxx	7	2	2			
MTBE	µg/l	1	-	15	-	1634-04-4	7	1	1			
naphthalene	µg/l	1	-	-	2	91-20-3	7	1	1			
acenaphthylene	µg/l	0.01	-	-	-	208-96-8	7	0.01	0.01			
acenaphthene	µg/l	0.01	-	-	-	83-32-9	7	0.01	0.01			
fluorene	µg/l	0.01	-	-	-	86-73-7	7	0.01	0.01			
phenanthrene	µg/l	0.01	-	-	-	85-01-8	7	0.01	0.01			
anthracene	µg/l	0.01	-	-	0.1	120-12-7	7	0.01	0.01			
fluoranthene	µg/l	0.01	-	-	0.0063	206-44-0	7	0.01	0.01			7
pyrene	µg/l	0.01	-	-	-	129-00-0	7	0.01	0.01			
benzo(a)anthracene	µg/l	0.01	-	-	-	56-55-3	7	0.01	0.01			
chrysene	µg/l	0.01	-	-	-	218-01-9	7	0.01	0.01			
benzo(b)fluoranthene	µg/l	0.01	-	0.1	0.017	205-99-2	7	0.01	0.01			
benzo(k)fluoranthene	µg/l	0.01	-	0.1	0.017	207-08-9	7	0.01	0.01			
benzo(a)pyrene	µg/l	0.01	-	0.01	0.00017	50-32-8	7	0.01	0.01			7
benzo(g,h,i)perylene	µg/l	0.01	-	0.1	0.0082	193-39-5	7	0.01	0.01			7
dibenzo(ah)anthracene	µg/l	0.01	-	-	-	53-70-3	7	0.01	0.01			
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	0.1	-	191-24-2	7	0.01	0.01			
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	0.1	-	xxx	7	0.04	0.04			
Total PAH	µg/l	0.16	-	-	-	P1706	7	0.16	0.16			

TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

England & Wales			Assessment Criteria			ChemCode	No. of Tests	Min	Max	No. of Exceedences		
Analyte	Units	LOD	MRV	Human Consumption	Fresh Water	↓				MRV	Human Consumption	Fresh Water
Alkalinity as $CaCO_3$	µg/l	3	-	-	-	P1335	7	240	420			
Arsenic	µg/l	0.15	-	10	50	7440-38-2	13	0.61	13		1	
Boron	µg/l		-	1000	-	7440-42-8						
Cadmium	µg/l	0.02	0.1	5	0.08	7440-43-9	13	0.02	0.72	6		6
Chromuim (Total)	µg/l	0.2	-	50	-	7440-47-3	13	0.4	6.4			
Chromium Trivalent	µg/l		-	-	4.7	16065-83-1						
Chromium Hexavalant	µg/l	5	-	-	3.4	18540-29-9	13	5	5			13
Copper	µg/l	0.5	-	2000	17.57	7440-50-8	13	0.9	14			
Iron	µg/l		-	200	1000	7439-89-6						
Lead	µg/l	0.2	-	10	7.31	7439-92-1	13	0.2	8.2			1
Mercury	µg/l	0.05	0.01	1	0.07	7439-97-6	13	0.05	0.05	13		
Manganese	µg/l		-	50	123	7439-96-5						
Nickel	µg/l	0.5	-	20	10.83	7440-02-0	13	1.8	8.3			
Selenium	µg/l	0.6	-	10	-	7782-49-2	7	0.6	1.9	6		6
Zinc	µg/l	0.5	-	5000	33.13	7440-66-6	13	5.1	26			
Ammoniacal Nitrogen as NH_4	µg/l	15	-	500	260	P1140	7	15	2300		1	1
Ammoniacal Nitrogen as NH_3	µg/l		-	-	200	P1000	7	14	2172			2
Chloride	µg/l	150	-	250000	-	16887-00-6	7	23000	85000			
Chlorine	µg/l		-	-	2	7782-50-5						
Cyanide	µg/l		-	50	1	57-12-5	6	10	290		3	6
Nitrate as NO_3	µg/l		-	50000	-	P1348						
Nitrite as NO_2	µg/l		-	100	-	P1349						
Phenol	µg/l	0.05	-	500	7.7	108-95-2	7	0.05	0.05			
Pentachlorophenol	µg/l		0.1	-	0.4	87-86-5						
PCBs	µg/l		0.001	-	-	1336-36-3						
Sodium	µg/l		-	200000	-	7440-23-5						
Sulphate	µg/l	45	-	250000	-	14808-79-8	7	40800	1010000		2	
pH	pH Units		-	-	-	P1334	7	6.9	8.2			
Dichloromethane	µg/l		-	-	20	75-09-2						
1,2 Dichloroethane	µg/l	1	1	3	10	107-06-2	7	1	1			
Trichloroethene (PCE)	µg/l	1	0.1	10	10	79-01-6	7	1	1	7		
1,1,1 Trichloroethane	µg/l	1	0.1	-	-	71-55-6	7	1	1	7		
1,1,2 Trichloroethane	µg/l	1	0.1	-	-	79-00-5	7	1	1	7		
Trichloromethane (Chloroform)	µg/l	1	0.1	100	2.5	67-66-3	7	1	1	7		
1,2,3 Trichlorobenzene	µg/l	1	-	-	-	87-61-6	7	1	1			
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	-	120-82-1	7	1	1	7		
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	-	0.4	xxx	7	2	2			7
Tetrachloroethene	µg/l	1	0.1	10	10	127-18-4	7	1	1	7		
Tetrachloromethane	µg/l	1	0.1	3	12	56-23-5	7	1	1	7		
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	140	630-20-6	7	1	1			
2-chlorophenol	µg/l	0.05	0.1	-	-	95-57-8						
4-chloro-3-methylphenol	µg/l	0.05	0.1	-	-	59-50-7						
Hexachlorobutadiene	µg/l	1	0.005	-	0.6	87-68-3				7		7
Vinyl Chloride (Chloroethene)	µg/l	1	-	0.5	-	75-01-4	7	1	1		7	
>C5 to C6 Aliphatic	µg/l	1	-	-	-	P1407	7	1	1			
>C6 to C8 Aliphatic	µg/l	1	-	-	-	P1408	7	1	1			
>C8 to C10 Aliphatic	µg/l	1	-	-	-	P1409	7	1	1			
>C10 to C12 Aliphatic	µg/l	10	-	-	-	P1410	7	10	10			
>C12 to C16 Aliphatic	µg/l	10	-	-	-	P1411	7	10	10			
>C16 to C21 Aliphatic	µg/l	10	-	-	-	P1412	7	10	10			
>C21 to C35 Aliphatic	µg/l	10	-	-	-	P1413	7	10	10			
>C35 to C44 Aliphatic	µg/l		-	-	-	P1415						
Total Aliphatic C5-35	µg/l	10	-	-	-	P1418	7	10	10			
>C5 to C7 Aromatic	µg/l	1	-	-	-	P1441	7	1	1			
>C7 to C8 Aromatic	µg/l	1	-	-	-	P1355	7	1	1			
>C8 to C10 Aromatic	µg/l	1	-	-	-	P1356	7	1	1			
>C10 to C12 Aromatic	µg/l	10	-	-	-	P1357	7	10	10			
>C12 to C16 Aromatic	µg/l	10	-	-	-	P1358	7	10	10			
>C16 to C21 Aromatic	µg/l	10	-	-	-	P1359	7	10	10			
>C21 to C35 Aromatic	µg/l	10	-	-	-	P1360	7	10	10			
>C35 to C44 Aromatic	µg/l		-	-	-	P1362						
Total Aromatic C5-C35	µg/l	10	-	-	-	P1365	7	10	10			
TPH Ali/Aro	µg/l		-	10	-	P2096						
Benzene	µg/l	1	1	1	10	71-43-2	7	1	1			
Ethylbenzene	µg/l	1	-	300	-	100-41-4	7	1	1			
Toluene	µg/l	1	4	700	74	108-88-3	7	1	1			
Xylene	µg/l		3	500	30	1330-20-7						
M- & P-Xylene	µg/l	1	-	-	-	P1374	7	1	1			
O-Xylene	µg/l	1	-	-	-	95-47-6	7	1	1			
Total Xylene (M, P & O)	µg/l	2	-	-	-	xxx	7	2	2			
MTBE	µg/l	1	-	15	-	1634-04-4	7	1	1			
naphthalene	µg/l	1	-	-	2	91-20-3	7	1	1			
acenaphthylene	µg/l	0.01	-	-	-	208-96-8	7	0.01	0.01			
acenaphthene	µg/l	0.01	-	-	-	83-32-9	7	0.01	0.01			
fluorene	µg/l	0.01	-	-	-	86-73-7	7	0.01	0.01			
phenanthrene	µg/l	0.01	-	-	-	85-01-8	7	0.01	0.01			
anthracene	µg/l	0.01	-	-	0.1	120-12-7	7	0.01	0.01			
fluoranthene	µg/l	0.01	-	-	0.0063	206-44-0	7	0.01	0.01			7
pyrene	µg/l	0.01	-	-	-	129-00-0	7	0.01	0.01			
benzo(a)anthracene	µg/l	0.01	-	-	-	56-55-3	7	0.01	0.01			
chrysene	µg/l	0.01	-	-	-	218-01-9	7	0.01	0.01			
benzo(b)fluoranthene	µg/l	0.01	-	0.1	0.017	205-99-2	7	0.01	0.01			
benzo(k)fluoranthene	µg/l	0.01	-	0.1	0.017	207-08-9	7	0.01	0.01			
benzo(a)pyrene	µg/l	0.01	-	0.01	0.00017	50-32-8	7	0.01	0.01			7
benzo(g,h,i)perylene	µg/l	0.01	-	0.1	0.0082	193-39-5	7	0.01	0.01			7
dibenzo(ah)anthracene	µg/l	0.01	-	-	-	53-70-3	7	0.01	0.01			
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	0.1	-	191-24-2	7	0.01	0.01			
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	0.1	-	xxx	7	0.04	0.04			
Total PAH	µg/l	0.16	-	-	-	P1706	7	0.16	0.16			

TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

England & Wales			Assessment Criteria							No. of Exceedences		
Analyte	Units	LOD	MRV	Human Consumption	Fresh Water	ChemCode ↓	No. of Tests	Min	Max	MRV	Human Consumption	Fresh Water
Alkalinity as $CaCO_3$	µg/l	3	-	-	-	P1335	7	240	420			
Arsenic	µg/l	0.15	-	10	50	7440-38-2	13	0.61	13		1	
Boron	µg/l		-	1000	-	7440-42-8						
Cadmium	µg/l	0.02	0.1	5	0.08	7440-43-9	13	0.02	0.72	6		6
Chromuim (Total)	µg/l	0.2	-	50	-	7440-47-3	13	0.4	6.4			
Chromium Trivalent	µg/l		-	-	4.7	16065-83-1						
Chromium Hexavalant	µg/l	5	-	-	3.4	18540-29-9	13	5	5			13
Copper	µg/l	0.5	-	2000	17.57	7440-50-8	13	0.9	14			
Iron	µg/l		-	200	1000	7439-89-6						
Lead	µg/l	0.2	-	10	7.31	7439-92-1	13	0.2	8.2			1
Mercury	µg/l	0.05	0.01	1	0.07	7439-97-6	13	0.05	0.05	13		
Manganese	µg/l		-	50	123	7439-96-5						
Nickel	µg/l	0.5	-	20	10.83	7440-02-0	13	1.8	8.3			
Selenium	µg/l	0.6	-	10	-	7782-49-2	7	0.6	1.9	6		6
Zinc	µg/l	0.5	-	5000	33.13	7440-66-6	13	5.1	26			
Ammoniacal Nitrogen as NH_4	µg/l	15	-	500	260	P1140	7	15	2300		1	1
Ammoniacal Nitrogen as NH_3	µg/l		-	-	200	P1000	7	14	2172			2
Chloride	µg/l	150	-	250000	-	16887-00-6	7	23000	85000			
Chlorine	µg/l		-	-	2	7782-50-5						
Cyanide	µg/l		-	50	1	57-12-5	6	10	290		3	6
Nitrate as NO_3	µg/l		-	50000	-	P1348						
Nitrite as NO_2	µg/l		-	100	-	P1349						
Phenol	µg/l	0.05	-	500	7.7	108-95-2	7	0.05	0.05			
Pentachlorophenol	µg/l		0.1	-	0.4	87-86-5						
PCBs	µg/l		0.001	-	-	1336-36-3						
Sodium	µg/l		-	200000	-	7440-23-5						
Sulphate	µg/l	45	-	250000	-	14808-79-8	7	40800	1010000		2	
pH	pH Units		-	-	-	P1334	7	6.9	8.2			
Dichloromethane	µg/l		-	-	20	75-09-2						
1,2 Dichloroethane	µg/l	1	1	3	10	107-06-2	7	1	1			
Trichloroethene (PCE)	µg/l	1	0.1	10	10	79-01-6	7	1	1	7		
1,1,1 Trichloroethane	µg/l	1	0.1	-	-	71-55-6	7	1	1	7		
1,1,2 Trichloroethane	µg/l	1	0.1	-	-	79-00-5	7	1	1	7		
Trichloromethane (Chloroform)	µg/l	1	0.1	100	2.5	67-66-3	7	1	1	7		
1,2,3 Trichlorobenzene	µg/l	1	-	-	-	87-61-6	7	1	1			
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	-	120-82-1	7	1	1	7		
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	-	0.4	xxx	7	2	2			7
Tetrachloroethene	µg/l	1	0.1	10	10	127-18-4	7	1	1	7		
Tetrachloromethane	µg/l	1	0.1	3	12	56-23-5	7	1	1	7		
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	140	630-20-6	7	1	1			
2-chlorophenol	µg/l	0.05	0.1	-	-	95-57-8						
4-chloro-3-methylphenol	µg/l	0.05	0.1	-	-	59-50-7						
Hexachlorobutadiene	µg/l	1	0.005	-	0.6	87-68-3				7		7
Vinyl Chloride (Chloroethene)	µg/l	1	-	0.5	-	75-01-4	7	1	1		7	
>C5 to C6 Aliphatic	µg/l	1	-	-	-	P1407	7	1	1			
>C6 to C8 Aliphatic	µg/l	1	-	-	-	P1408	7	1	1			
>C8 to C10 Aliphatic	µg/l	1	-	-	-	P1409	7	1	1			
>C10 to C12 Aliphatic	µg/l	10	-	-	-	P1410	7	10	10			
>C12 to C16 Aliphatic	µg/l	10	-	-	-	P1411	7	10	10			
>C16 to C21 Aliphatic	µg/l	10	-	-	-	P1412	7	10	10			
>C21 to C35 Aliphatic	µg/l	10	-	-	-	P1413	7	10	10			
>C35 to C44 Aliphatic	µg/l		-	-	-	P1415						
Total Aliphatic C5-35	µg/l	10	-	-	-	P1418	7	10	10			
>C5 to C7 Aromatic	µg/l	1	-	-	-	P1441	7	1	1			
>C7 to C8 Aromatic	µg/l	1	-	-	-	P1355	7	1	1			
>C8 to C10 Aromatic	µg/l	1	-	-	-	P1356	7	1	1			
>C10 to C12 Aromatic	µg/l	10	-	-	-	P1357	7	10	10			
>C12 to C16 Aromatic	µg/l	10	-	-	-	P1358	7	10	10			
>C16 to C21 Aromatic	µg/l	10	-	-	-	P1359	7	10	10			
>C21 to C35 Aromatic	µg/l	10	-	-	-	P1360	7	10	10			
>C35 to C44 Aromatic	µg/l		-	-	-	P1362						
Total Aromatic C5-C35	µg/l	10	-	-	-	P1365	7	10	10			
TPH Ali/Aro	µg/l		-	10	-	P2096						
Benzene	µg/l	1	1	1	10	71-43-2	7	1	1			
Ethylbenzene	µg/l	1	-	300	-	100-41-4	7	1	1			
Toluene	µg/l	1	4	700	74	108-88-3	7	1	1			
Xylene	µg/l		3	500	30	1330-20-7						
M- & P-Xylene	µg/l	1	-	-	-	P1374	7	1	1			
O-Xylene	µg/l	1	-	-	-	95-47-6	7	1	1			
Total Xylene (M, P & O)	µg/l	2	-	-	-	xxx	7	2	2			
MTBE	µg/l	1	-	15	-	1634-04-4	7	1	1			
naphthalene	µg/l	1	-	-	2	91-20-3	7	1	1			
acenaphthylene	µg/l	0.01	-	-	-	208-96-8	7	0.01	0.01			
acenaphthene	µg/l	0.01	-	-	-	83-32-9	7	0.01	0.01			
fluorene	µg/l	0.01	-	-	-	86-73-7	7	0.01	0.01			
phenanthrene	µg/l	0.01	-	-	-	85-01-8	7	0.01	0.01			
anthracene	µg/l	0.01	-	-	0.1	120-12-7	7	0.01	0.01			
fluoranthene	µg/l	0.01	-	-	0.0063	206-44-0	7	0.01	0.01			7
pyrene	µg/l	0.01	-	-	-	129-00-0	7	0.01	0.01			
benzo(a)anthracene	µg/l	0.01	-	-	-	56-55-3	7	0.01	0.01			
chrysene	µg/l	0.01	-	-	-	218-01-9	7	0.01	0.01			
benzo(b)fluoranthene	µg/l	0.01	-	0.1	0.017	205-99-2	7	0.01	0.01			
benzo(k)fluoranthene	µg/l	0.01	-	0.1	0.017	207-08-9	7	0.01	0.01			
benzo(a)pyrene	µg/l	0.01	-	0.01	0.00017	50-32-8	7	0.01	0.01			7
benzo(g,h,i)perylene	µg/l	0.01	-	0.1	0.0082	193-39-5	7	0.01	0.01			7
dibenzo(ah)anthracene	µg/l	0.01	-	-	-	53-70-3	7	0.01	0.01			
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	0.1	-	191-24-2	7	0.01	0.01			
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	0.1	-	xxx	7	0.04	0.04			
Total PAH	µg/l	0.16	-	-	-	P1706	7	0.16	0.16			

TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

England & Wales			Assessment Criteria							No. of Exceedences		
Analyte	Units	LOD	MRV	Human Consumption	Fresh Water	ChemCode ↓	No. of Tests	Min	Max	MRV	Human Consumption	Fresh Water
Alkalinity as $CaCO_3$	µg/l	3	-	-	-	P1335	7	240	420			
Arsenic	µg/l	0.15	-	10	50	7440-38-2	13	0.61	13		1	
Boron	µg/l		-	1000	-	7440-42-8						
Cadmium	µg/l	0.02	0.1	5	0.08	7440-43-9	13	0.02	0.72	6		6
Chromuim (Total)	µg/l	0.2	-	50	-	7440-47-3	13	0.4	6.4			
Chromium Trivalent	µg/l		-	-	4.7	16065-83-1						
Chromium Hexavalant	µg/l	5	-	-	3.4	18540-29-9	13	5	5			13
Copper	µg/l	0.5	-	2000	17.57	7440-50-8	13	0.9	14			
Iron	µg/l		-	200	1000	7439-89-6						
Lead	µg/l	0.2	-	10	7.31	7439-92-1	13	0.2	8.2			1
Mercury	µg/l	0.05	0.01	1	0.07	7439-97-6	13	0.05	0.05	13		
Manganese	µg/l		-	50	123	7439-96-5						
Nickel	µg/l	0.5	-	20	10.83	7440-02-0	13	1.8	8.3			
Selenium	µg/l	0.6	-	10	-	7782-49-2	7	0.6	1.9	6		6
Zinc	µg/l	0.5	-	5000	33.13	7440-66-6	13	5.1	26			
Ammoniacal Nitrogen as NH_4	µg/l	15	-	500	260	P1140	7	15	2300		1	1
Ammoniacal Nitrogen as NH_3	µg/l		-	-	200	P1000	7	14	2172			2
Chloride	µg/l	150	-	250000	-	16887-00-6	7	23000	85000			
Chlorine	µg/l		-	-	2	7782-50-5						
Cyanide	µg/l		-	50	1	57-12-5	6	10	290		3	6
Nitrate as NO_3	µg/l		-	50000	-	P1348						
Nitrite as NO_2	µg/l		-	100	-	P1349						
Phenol	µg/l	0.05	-	500	7.7	108-95-2	7	0.05	0.05			
Pentachlorophenol	µg/l		0.1	-	0.4	87-86-5						
PCBs	µg/l		0.001	-	-	1336-36-3						
Sodium	µg/l		-	200000	-	7440-23-5						
Sulphate	µg/l	45	-	250000	-	14808-79-8	7	40800	1010000		2	
pH	pH Units		-	-	-	P1334	7	6.9	8.2			
Dichloromethane	µg/l		-	-	20	75-09-2						
1,2 Dichloroethane	µg/l	1	1	3	10	107-06-2	7	1	1			
Trichloroethene (PCE)	µg/l	1	0.1	10	10	79-01-6	7	1	1	7		
1,1,1 Trichloroethane	µg/l	1	0.1	-	-	71-55-6	7	1	1	7		
1,1,2 Trichloroethane	µg/l	1	0.1	-	-	79-00-5	7	1	1	7		
Trichloromethane (Chloroform)	µg/l	1	0.1	100	2.5	67-66-3	7	1	1	7		
1,2,3 Trichlorobenzene	µg/l	1	-	-	-	87-61-6	7	1	1			
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	-	120-82-1	7	1	1	7		
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	-	0.4	xxx	7	2	2			7
Tetrachloroethene	µg/l	1	0.1	10	10	127-18-4	7	1	1	7		
Tetrachloromethane	µg/l	1	0.1	3	12	56-23-5	7	1	1	7		
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	140	630-20-6	7	1	1			
2-chlorophenol	µg/l	0.05	0.1	-	-	95-57-8						
4-chloro-3-methylphenol	µg/l	0.05	0.1	-	-	59-50-7						
Hexachlorobutadiene	µg/l	1	0.005	-	0.6	87-68-3				7		7
Vinyl Chloride (Chloroethene)	µg/l	1	-	0.5	-	75-01-4	7	1	1		7	
>C5 to C6 Aliphatic	µg/l	1	-	-	-	P1407	7	1	1			
>C6 to C8 Aliphatic	µg/l	1	-	-	-	P1408	7	1	1			
>C8 to C10 Aliphatic	µg/l	1	-	-	-	P1409	7	1	1			
>C10 to C12 Aliphatic	µg/l	10	-	-	-	P1410	7	10	10			
>C12 to C16 Aliphatic	µg/l	10	-	-	-	P1411	7	10	10			
>C16 to C21 Aliphatic	µg/l	10	-	-	-	P1412	7	10	10			
>C21 to C35 Aliphatic	µg/l	10	-	-	-	P1413	7	10	10			
>C35 to C44 Aliphatic	µg/l		-	-	-	P1415						
Total Aliphatic C5-35	µg/l	10	-	-	-	P1418	7	10	10			
>C5 to C7 Aromatic	µg/l	1	-	-	-	P1441	7	1	1			
>C7 to C8 Aromatic	µg/l	1	-	-	-	P1355	7	1	1			
>C8 to C10 Aromatic	µg/l	1	-	-	-	P1356	7	1	1			
>C10 to C12 Aromatic	µg/l	10	-	-	-	P1357	7	10	10			
>C12 to C16 Aromatic	µg/l	10	-	-	-	P1358	7	10	10			
>C16 to C21 Aromatic	µg/l	10	-	-	-	P1359	7	10	10			
>C21 to C35 Aromatic	µg/l	10	-	-	-	P1360	7	10	10			
>C35 to C44 Aromatic	µg/l		-	-	-	P1362						
Total Aromatic C5-C35	µg/l	10	-	-	-	P1365	7	10	10			
TPH Ali/Aro	µg/l		-	10	-	P2096						
Benzene	µg/l	1	1	1	10	71-43-2	7	1	1			
Ethylbenzene	µg/l	1	-	300	-	100-41-4	7	1	1			
Toluene	µg/l	1	4	700	74	108-88-3	7	1	1			
Xylene	µg/l		3	500	30	1330-20-7						
M- & P-Xylene	µg/l	1	-	-	-	P1374	7	1	1			
O-Xylene	µg/l	1	-	-	-	95-47-6	7	1	1			
Total Xylene (M, P & O)	µg/l	2	-	-	-	xxx	7	2	2			
MTBE	µg/l	1	-	15	-	1634-04-4	7	1	1			
naphthalene	µg/l	1	-	-	2	91-20-3	7	1	1			
acenaphthylene	µg/l	0.01	-	-	-	208-96-8	7	0.01	0.01			
acenaphthene	µg/l	0.01	-	-	-	83-32-9	7	0.01	0.01			
fluorene	µg/l	0.01	-	-	-	86-73-7	7	0.01	0.01			
phenanthrene	µg/l	0.01	-	-	-	85-01-8	7	0.01	0.01			
anthracene	µg/l	0.01	-	-	0.1	120-12-7	7	0.01	0.01			
fluoranthene	µg/l	0.01	-	-	0.0063	206-44-0	7	0.01	0.01			7
pyrene	µg/l	0.01	-	-	-	129-00-0	7	0.01	0.01			
benzo(a)anthracene	µg/l	0.01	-	-	-	56-55-3	7	0.01	0.01			
chrysene	µg/l	0.01	-	-	-	218-01-9	7	0.01	0.01			
benzo(b)fluoranthene	µg/l	0.01	-	0.1	0.017	205-99-2	7	0.01	0.01			
benzo(k)fluoranthene	µg/l	0.01	-	0.1	0.017	207-08-9	7	0.01	0.01			
benzo(a)pyrene	µg/l	0.01	-	0.01	0.00017	50-32-8	7	0.01	0.01			7
benzo(g,h,i)perylene	µg/l	0.01	-	0.1	0.0082	193-39-5	7	0.01	0.01			7
dibenzo(ah)anthracene	µg/l	0.01	-	-	-	53-70-3	7	0.01	0.01			
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	0.1	-	191-24-2	7	0.01	0.01			
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	0.1	-	xxx	7	0.04	0.04			
Total PAH	µg/l	0.16	-	-	-	P1706	7	0.16	0.16			

TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

England & Wales			Assessment Criteria							No. of Exceedences		
Analyte	Units	LOD	MRV	Human Consumption	Fresh Water	ChemCode ↓	No. of Tests	Min	Max	MRV	Human Consumption	Fresh Water
Alkalinity as $CaCO_3$	µg/l	3	-	-	-	P1335	7	240	420			
Arsenic	µg/l	0.15	-	10	50	7440-38-2	13	0.61	13		1	
Boron	µg/l		-	1000	-	7440-42-8						
Cadmium	µg/l	0.02	0.1	5	0.08	7440-43-9	13	0.02	0.72	6		6
Chromuim (Total)	µg/l	0.2	-	50	-	7440-47-3	13	0.4	6.4			
Chromium Trivalent	µg/l		-	-	4.7	16065-83-1						
Chromium Hexavalant	µg/l	5	-	-	3.4	18540-29-9	13	5	5			13
Copper	µg/l	0.5	-	2000	17.57	7440-50-8	13	0.9	14			
Iron	µg/l		-	200	1000	7439-89-6						
Lead	µg/l	0.2	-	10	7.31	7439-92-1	13	0.2	8.2			1
Mercury	µg/l	0.05	0.01	1	0.07	7439-97-6	13	0.05	0.05	13		
Manganese	µg/l		-	50	123	7439-96-5						
Nickel	µg/l	0.5	-	20	10.83	7440-02-0	13	1.8	8.3			
Selenium	µg/l	0.6	-	10	-	7782-49-2	7	0.6	1.9	6		6
Zinc	µg/l	0.5	-	5000	33.13	7440-66-6	13	5.1	26			
Ammoniacal Nitrogen as NH_4	µg/l	15	-	500	260	P1140	7	15	2300		1	1
Ammoniacal Nitrogen as NH_3	µg/l		-	-	200	P1000	7	14	2172			2
Chloride	µg/l	150	-	250000	-	16887-00-6	7	23000	85000			
Chlorine	µg/l		-	-	2	7782-50-5						
Cyanide	µg/l		-	50	1	57-12-5	6	10	290		3	6
Nitrate as NO_3	µg/l		-	50000	-	P1348						
Nitrite as NO_2	µg/l		-	100	-	P1349						
Phenol	µg/l	0.05	-	500	7.7	108-95-2	7	0.05	0.05			
Pentachlorophenol	µg/l		0.1	-	0.4	87-86-5						
PCBs	µg/l		0.001	-	-	1336-36-3						
Sodium	µg/l		-	200000	-	7440-23-5						
Sulphate	µg/l	45	-	250000	-	14808-79-8	7	40800	1010000		2	
pH	pH Units		-	-	-	P1334	7	6.9	8.2			
Dichloromethane	µg/l		-	-	20	75-09-2						
1,2 Dichloroethane	µg/l	1	1	3	10	107-06-2	7	1	1			
Trichloroethene (PCE)	µg/l	1	0.1	10	10	79-01-6	7	1	1	7		
1,1,1 Trichloroethane	µg/l	1	0.1	-	-	71-55-6	7	1	1	7		
1,1,2 Trichloroethane	µg/l	1	0.1	-	-	79-00-5	7	1	1	7		
Trichloromethane (Chloroform)	µg/l	1	0.1	100	2.5	67-66-3	7	1	1	7		
1,2,3 Trichlorobenzene	µg/l	1	-	-	-	87-61-6	7	1	1			
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	-	120-82-1	7	1	1	7		
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	-	0.4	xxx	7	2	2			7
Tetrachloroethene	µg/l	1	0.1	10	10	127-18-4	7	1	1	7		
Tetrachloromethane	µg/l	1	0.1	3	12	56-23-5	7	1	1	7		
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	140	630-20-6	7	1	1			
2-chlorophenol	µg/l	0.05	0.1	-	-	95-57-8						
4-chloro-3-methylphenol	µg/l	0.05	0.1	-	-	59-50-7						
Hexachlorobutadiene	µg/l	1	0.005	-	0.6	87-68-3				7		7
Vinyl Chloride (Chloroethene)	µg/l	1	-	0.5	-	75-01-4	7	1	1		7	
>C5 to C6 Aliphatic	µg/l	1	-	-	-	P1407	7	1	1			
>C6 to C8 Aliphatic	µg/l	1	-	-	-	P1408	7	1	1			
>C8 to C10 Aliphatic	µg/l	1	-	-	-	P1409	7	1	1			
>C10 to C12 Aliphatic	µg/l	10	-	-	-	P1410	7	10	10			
>C12 to C16 Aliphatic	µg/l	10	-	-	-	P1411	7	10	10			
>C16 to C21 Aliphatic	µg/l	10	-	-	-	P1412	7	10	10			
>C21 to C35 Aliphatic	µg/l	10	-	-	-	P1413	7	10	10			
>C35 to C44 Aliphatic	µg/l		-	-	-	P1415						
Total Aliphatic C5-35	µg/l	10	-	-	-	P1418	7	10	10			
>C5 to C7 Aromatic	µg/l	1	-	-	-	P1441	7	1	1			
>C7 to C8 Aromatic	µg/l	1	-	-	-	P1355	7	1	1			
>C8 to C10 Aromatic	µg/l	1	-	-	-	P1356	7	1	1			
>C10 to C12 Aromatic	µg/l	10	-	-	-	P1357	7	10	10			
>C12 to C16 Aromatic	µg/l	10	-	-	-	P1358	7	10	10			
>C16 to C21 Aromatic	µg/l	10	-	-	-	P1359	7	10	10			
>C21 to C35 Aromatic	µg/l	10	-	-	-	P1360	7	10	10			
>C35 to C44 Aromatic	µg/l		-	-	-	P1362						
Total Aromatic C5-C35	µg/l	10	-	-	-	P1365	7	10	10			
TPH Ali/Aro	µg/l		-	10	-	P2096						
Benzene	µg/l	1	1	1	10	71-43-2	7	1	1			
Ethylbenzene	µg/l	1	-	300	-	100-41-4	7	1	1			
Toluene	µg/l	1	4	700	74	108-88-3	7	1	1			
Xylene	µg/l		3	500	30	1330-20-7						
M- & P-Xylene	µg/l	1	-	-	-	P1374	7	1	1			
O-Xylene	µg/l	1	-	-	-	95-47-6	7	1	1			
Total Xylene (M, P & O)	µg/l	2	-	-	-	xxx	7	2	2			
MTBE	µg/l	1	-	15	-	1634-04-4	7	1	1			
naphthalene	µg/l	1	-	-	2	91-20-3	7	1	1			
acenaphthylene	µg/l	0.01	-	-	-	208-96-8	7	0.01	0.01			
acenaphthene	µg/l	0.01	-	-	-	83-32-9	7	0.01	0.01			
fluorene	µg/l	0.01	-	-	-	86-73-7	7	0.01	0.01			
phenanthrene	µg/l	0.01	-	-	-	85-01-8	7	0.01	0.01			
anthracene	µg/l	0.01	-	-	0.1	120-12-7	7	0.01	0.01			
fluoranthene	µg/l	0.01	-	-	0.0063	206-44-0	7	0.01	0.01			7
pyrene	µg/l	0.01	-	-	-	129-00-0	7	0.01	0.01			
benzo(a)anthracene	µg/l	0.01	-	-	-	56-55-3	7	0.01	0.01			
chrysene	µg/l	0.01	-	-	-	218-01-9	7	0.01	0.01			
benzo(b)fluoranthene	µg/l	0.01	-	0.1	0.017	205-99-2	7	0.01	0.01			
benzo(k)fluoranthene	µg/l	0.01	-	0.1	0.017	207-08-9	7	0.01	0.01			
benzo(a)pyrene	µg/l	0.01	-	0.01	0.00017	50-32-8	7	0.01	0.01			7
benzo(g,h,i)perylene	µg/l	0.01	-	0.1	0.0082	193-39-5	7	0.01	0.01			7
dibenzo(ah)anthracene	µg/l	0.01	-	-	-	53-70-3	7	0.01	0.01			
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	0.1	-	191-24-2	7	0.01	0.01			
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	0.1	-	xxx	7	0.04	0.04			
Total PAH	µg/l	0.16	-	-	-	P1706	7	0.16	0.16			

TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

England & Wales			Assessment Criteria			ChemCode ↓	No. of Tests	Min	Max	No. of Exceedences		
Analyte	Units	LOD	MRV	Human Consumption	Fresh Water					MRV	Human Consumption	Fresh Water
Alkalinity as $CaCO_3$	µg/l	3	-	-	-	P1335	7	240	420			
Arsenic	µg/l	0.15	-	10	50	7440-38-2	13	0.61	13		1	
Boron	µg/l		-	1000	-	7440-42-8						
Cadmium	µg/l	0.02	0.1	5	0.08	7440-43-9	13	0.02	0.72	6		6
Chromuim (Total)	µg/l	0.2	-	50	-	7440-47-3	13	0.4	6.4			
Chromium Trivalent	µg/l		-	-	4.7	16065-83-1						
Chromium Hexavalant	µg/l	5	-	-	3.4	18540-29-9	13	5	5			13
Copper	µg/l	0.5	-	2000	17.57	7440-50-8	13	0.9	14			
Iron	µg/l		-	200	1000	7439-89-6						
Lead	µg/l	0.2	-	10	7.31	7439-92-1	13	0.2	8.2			1
Mercury	µg/l	0.05	0.01	1	0.07	7439-97-6	13	0.05	0.05	13		
Manganese	µg/l		-	50	123	7439-96-5						
Nickel	µg/l	0.5	-	20	10.83	7440-02-0	13	1.8	8.3			
Selenium	µg/l	0.6	-	10	-	7782-49-2	7	0.6	1.9	6		6
Zinc	µg/l	0.5	-	5000	33.13	7440-66-6	13	5.1	26			
Ammoniacal Nitrogen as NH_4	µg/l	15	-	500	260	P1140	7	15	2300		1	1
Ammoniacal Nitrogen as NH_3	µg/l		-	-	200	P1000	7	14	2172			2
Chloride	µg/l	150	-	250000	-	16887-00-6	7	23000	85000			
Chlorine	µg/l		-	-	2	7782-50-5						
Cyanide	µg/l		-	50	1	57-12-5	6	10	290		3	6
Nitrate as NO_3	µg/l		-	50000	-	P1348						
Nitrite as NO_2	µg/l		-	100	-	P1349						
Phenol	µg/l	0.05	-	500	7.7	108-95-2	7	0.05	0.05			
Pentachlorophenol	µg/l		0.1	-	0.4	87-86-5						
PCBs	µg/l		0.001	-	-	1336-36-3						
Sodium	µg/l		-	200000	-	7440-23-5						
Sulphate	µg/l	45	-	250000	-	14808-79-8	7	40800	1010000		2	
pH	pH Units		-	-	-	P1334	7	6.9	8.2			
Dichloromethane	µg/l		-	-	20	75-09-2						
1,2 Dichloroethane	µg/l	1	1	3	10	107-06-2	7	1	1			
Trichloroethene (PCE)	µg/l	1	0.1	10	10	79-01-6	7	1	1	7		
1,1,1 Trichloroethane	µg/l	1	0.1	-	-	71-55-6	7	1	1	7		
1,1,2 Trichloroethane	µg/l	1	0.1	-	-	79-00-5	7	1	1	7		
Trichloromethane (Chloroform)	µg/l	1	0.1	100	2.5	67-66-3	7	1	1	7		
1,2,3 Trichlorobenzene	µg/l	1	-	-	-	87-61-6	7	1	1			
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	-	120-82-1	7	1	1	7		
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	-	0.4	xxx	7	2	2			7
Tetrachloroethene	µg/l	1	0.1	10	10	127-18-4	7	1	1	7		
Tetrachloromethane	µg/l	1	0.1	3	12	56-23-5	7	1	1	7		
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	140	630-20-6	7	1	1			
2-chlorophenol	µg/l	0.05	0.1	-	-	95-57-8						
4-chloro-3-methylphenol	µg/l	0.05	0.1	-	-	59-50-7						
Hexachlorobutadiene	µg/l	1	0.005	-	0.6	87-68-3				7		7
Vinyl Chloride (Chloroethene)	µg/l	1	-	0.5	-	75-01-4	7	1	1		7	
>C5 to C6 Aliphatic	µg/l	1	-	-	-	P1407	7	1	1			
>C6 to C8 Aliphatic	µg/l	1	-	-	-	P1408	7	1	1			
>C8 to C10 Aliphatic	µg/l	1	-	-	-	P1409	7	1	1			
>C10 to C12 Aliphatic	µg/l	10	-	-	-	P1410	7	10	10			
>C12 to C16 Aliphatic	µg/l	10	-	-	-	P1411	7	10	10			
>C16 to C21 Aliphatic	µg/l	10	-	-	-	P1412	7	10	10			
>C21 to C35 Aliphatic	µg/l	10	-	-	-	P1413	7	10	10			
>C35 to C44 Aliphatic	µg/l		-	-	-	P1415						
Total Aliphatic C5-35	µg/l	10	-	-	-	P1418	7	10	10			
>C5 to C7 Aromatic	µg/l	1	-	-	-	P1441	7	1	1			
>C7 to C8 Aromatic	µg/l	1	-	-	-	P1355	7	1	1			
>C8 to C10 Aromatic	µg/l	1	-	-	-	P1356	7	1	1			
>C10 to C12 Aromatic	µg/l	10	-	-	-	P1357	7	10	10			
>C12 to C16 Aromatic	µg/l	10	-	-	-	P1358	7	10	10			
>C16 to C21 Aromatic	µg/l	10	-	-	-	P1359	7	10	10			
>C21 to C35 Aromatic	µg/l	10	-	-	-	P1360	7	10	10			
>C35 to C44 Aromatic	µg/l		-	-	-	P1362						
Total Aromatic C5-C35	µg/l	10	-	-	-	P1365	7	10	10			
TPH Ali/Aro	µg/l		-	10	-	P2096						
Benzene	µg/l	1	1	1	10	71-43-2	7	1	1			
Ethylbenzene	µg/l	1	-	300	-	100-41-4	7	1	1			
Toluene	µg/l	1	4	700	74	108-88-3	7	1	1			
Xylene	µg/l		3	500	30	1330-20-7						
M- & P-Xylene	µg/l	1	-	-	-	P1374	7	1	1			
O-Xylene	µg/l	1	-	-	-	95-47-6	7	1	1			
Total Xylene (M, P & O)	µg/l	2	-	-	-	xxx	7	2	2			
MTBE	µg/l	1	-	15	-	1634-04-4	7	1	1			
naphthalene	µg/l	1	-	-	2	91-20-3	7	1	1			
acenaphthylene	µg/l	0.01	-	-	-	208-96-8	7	0.01	0.01			
acenaphthene	µg/l	0.01	-	-	-	83-32-9	7	0.01	0.01			
fluorene	µg/l	0.01	-	-	-	86-73-7	7	0.01	0.01			
phenanthrene	µg/l	0.01	-	-	-	85-01-8	7	0.01	0.01			
anthracene	µg/l	0.01	-	-	0.1	120-12-7	7	0.01	0.01			
fluoranthene	µg/l	0.01	-	-	0.0063	206-44-0	7	0.01	0.01			7
pyrene	µg/l	0.01	-	-	-	129-00-0	7	0.01	0.01			
benzo(a)anthracene	µg/l	0.01	-	-	-	56-55-3	7	0.01	0.01			
chrysene	µg/l	0.01	-	-	-	218-01-9	7	0.01	0.01			
benzo(b)fluoranthene	µg/l	0.01	-	0.1	0.017	205-99-2	7	0.01	0.01			
benzo(k)fluoranthene	µg/l	0.01	-	0.1	0.017	207-08-9	7	0.01	0.01			
benzo(a)pyrene	µg/l	0.01	-	0.01	0.00017	50-32-8	7	0.01	0.01			7
benzo(g,h,i)perylene	µg/l	0.01	-	0.1	0.0082	193-39-5	7	0.01	0.01			7
dibenzo(ah)anthracene	µg/l	0.01	-	-	-	53-70-3	7	0.01	0.01			
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	0.1	-	191-24-2	7	0.01	0.01			
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	0.1	-	xxx	7	0.04	0.04			
Total PAH	µg/l	0.16	-	-	-	P1706	7	0.16	0.16			

TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

England & Wales			Assessment Criteria			ChemCode ↓	No. of Tests	Min	Max	No. of Exceedences		
Analyte	Units	LOD	MRV	Human Consumption	Fresh Water					MRV	Human Consumption	Fresh Water
Alkalinity as $CaCO_3$	µg/l	3	-	-	-	P1335	7	240	420			
Arsenic	µg/l	0.15	-	10	50	7440-38-2	13	0.61	13		1	
Boron	µg/l		-	1000	-	7440-42-8						
Cadmium	µg/l	0.02	0.1	5	0.08	7440-43-9	13	0.02	0.72	6		6
Chromuim (Total)	µg/l	0.2	-	50	-	7440-47-3	13	0.4	6.4			
Chromium Trivalent	µg/l		-	-	4.7	16065-83-1						
Chromium Hexavalant	µg/l	5	-	-	3.4	18540-29-9	13	5	5			13
Copper	µg/l	0.5	-	2000	17.57	7440-50-8	13	0.9	14			
Iron	µg/l		-	200	1000	7439-89-6						
Lead	µg/l	0.2	-	10	7.31	7439-92-1	13	0.2	8.2			1
Mercury	µg/l	0.05	0.01	1	0.07	7439-97-6	13	0.05	0.05	13		
Manganese	µg/l		-	50	123	7439-96-5						
Nickel	µg/l	0.5	-	20	10.83	7440-02-0	13	1.8	8.3			
Selenium	µg/l	0.6	-	10	-	7782-49-2	7	0.6	1.9	6		6
Zinc	µg/l	0.5	-	5000	33.13	7440-66-6	13	5.1	26			
Ammoniacal Nitrogen as NH_4	µg/l	15	-	500	260	P1140	7	15	2300		1	1
Ammoniacal Nitrogen as NH_3	µg/l		-	-	200	P1000	7	14	2172			2
Chloride	µg/l	150	-	250000	-	16887-00-6	7	23000	85000			
Chlorine	µg/l		-	-	2	7782-50-5						
Cyanide	µg/l		-	50	1	57-12-5	6	10	290		3	6
Nitrate as NO_3	µg/l		-	50000	-	P1348						
Nitrite as NO_2	µg/l		-	100	-	P1349						
Phenol	µg/l	0.05	-	500	7.7	108-95-2	7	0.05	0.05			
Pentachlorophenol	µg/l		0.1	-	0.4	87-86-5						
PCBs	µg/l		0.001	-	-	1336-36-3						
Sodium	µg/l		-	200000	-	7440-23-5						
Sulphate	µg/l	45	-	250000	-	14808-79-8	7	40800	1010000		2	
pH	pH Units		-	-	-	P1334	7	6.9	8.2			
Dichloromethane	µg/l		-	-	20	75-09-2						
1,2 Dichloroethane	µg/l	1	1	3	10	107-06-2	7	1	1			
Trichloroethene (PCE)	µg/l	1	0.1	10	10	79-01-6	7	1	1	7		
1,1,1 Trichloroethane	µg/l	1	0.1	-	-	71-55-6	7	1	1	7		
1,1,2 Trichloroethane	µg/l	1	0.1	-	-	79-00-5	7	1	1	7		
Trichloromethane (Chloroform)	µg/l	1	0.1	100	2.5	67-66-3	7	1	1	7		
1,2,3 Trichlorobenzene	µg/l	1	-	-	-	87-61-6	7	1	1			
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	-	120-82-1	7	1	1	7		
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	-	0.4	xxx	7	2	2			7
Tetrachloroethene	µg/l	1	0.1	10	10	127-18-4	7	1	1	7		
Tetrachloromethane	µg/l	1	0.1	3	12	56-23-5	7	1	1	7		
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	140	630-20-6	7	1	1			
2-chlorophenol	µg/l	0.05	0.1	-	-	95-57-8						
4-chloro-3-methylphenol	µg/l	0.05	0.1	-	-	59-50-7						
Hexachlorobutadiene	µg/l	1	0.005	-	0.6	87-68-3				7		7
Vinyl Chloride (Chloroethene)	µg/l	1	-	0.5	-	75-01-4	7	1	1		7	
>C5 to C6 Aliphatic	µg/l	1	-	-	-	P1407	7	1	1			
>C6 to C8 Aliphatic	µg/l	1	-	-	-	P1408	7	1	1			
>C8 to C10 Aliphatic	µg/l	1	-	-	-	P1409	7	1	1			
>C10 to C12 Aliphatic	µg/l	10	-	-	-	P1410	7	10	10			
>C12 to C16 Aliphatic	µg/l	10	-	-	-	P1411	7	10	10			
>C16 to C21 Aliphatic	µg/l	10	-	-	-	P1412	7	10	10			
>C21 to C35 Aliphatic	µg/l	10	-	-	-	P1413	7	10	10			
>C35 to C44 Aliphatic	µg/l		-	-	-	P1415						
Total Aliphatic C5-35	µg/l	10	-	-	-	P1418	7	10	10			
>C5 to C7 Aromatic	µg/l	1	-	-	-	P1441	7	1	1			
>C7 to C8 Aromatic	µg/l	1	-	-	-	P1355	7	1	1			
>C8 to C10 Aromatic	µg/l	1	-	-	-	P1356	7	1	1			
>C10 to C12 Aromatic	µg/l	10	-	-	-	P1357	7	10	10			
>C12 to C16 Aromatic	µg/l	10	-	-	-	P1358	7	10	10			
>C16 to C21 Aromatic	µg/l	10	-	-	-	P1359	7	10	10			
>C21 to C35 Aromatic	µg/l	10	-	-	-	P1360	7	10	10			
>C35 to C44 Aromatic	µg/l		-	-	-	P1362						
Total Aromatic C5-C35	µg/l	10	-	-	-	P1365	7	10	10			
TPH Ali/Aro	µg/l		-	10	-	P2096						
Benzene	µg/l	1	1	1	10	71-43-2	7	1	1			
Ethylbenzene	µg/l	1	-	300	-	100-41-4	7	1	1			
Toluene	µg/l	1	4	700	74	108-88-3	7	1	1			
Xylene	µg/l		3	500	30	1330-20-7						
M- & P-Xylene	µg/l	1	-	-	-	P1374	7	1	1			
O-Xylene	µg/l	1	-	-	-	95-47-6	7	1	1			
Total Xylene (M, P & O)	µg/l	2	-	-	-	xxx	7	2	2			
MTBE	µg/l	1	-	15	-	1634-04-4	7	1	1			
naphthalene	µg/l	1	-	-	2	91-20-3	7	1	1			
acenaphthylene	µg/l	0.01	-	-	-	208-96-8	7	0.01	0.01			
acenaphthene	µg/l	0.01	-	-	-	83-32-9	7	0.01	0.01			
fluorene	µg/l	0.01	-	-	-	86-73-7	7	0.01	0.01			
phenanthrene	µg/l	0.01	-	-	-	85-01-8	7	0.01	0.01			
anthracene	µg/l	0.01	-	-	0.1	120-12-7	7	0.01	0.01			
fluoranthene	µg/l	0.01	-	-	0.0063	206-44-0	7	0.01	0.01			7
pyrene	µg/l	0.01	-	-	-	129-00-0	7	0.01	0.01			
benzo(a)anthracene	µg/l	0.01	-	-	-	56-55-3	7	0.01	0.01			
chrysene	µg/l	0.01	-	-	-	218-01-9	7	0.01	0.01			
benzo(b)fluoranthene	µg/l	0.01	-	0.1	0.017	205-99-2	7	0.01	0.01			
benzo(k)fluoranthene	µg/l	0.01	-	0.1	0.017	207-08-9	7	0.01	0.01			
benzo(a)pyrene	µg/l	0.01	-	0.01	0.00017	50-32-8	7	0.01	0.01			7
benzo(g,h,i)perylene	µg/l	0.01	-	0.1	0.0082	193-39-5	7	0.01	0.01			7
dibenzo(ah)anthracene	µg/l	0.01	-	-	-	53-70-3	7	0.01	0.01			
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	0.1	-	191-24-2	7	0.01	0.01			
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	0.1	-	xxx	7	0.04	0.04			
Total PAH	µg/l	0.16	-	-	-	P1706	7	0.16	0.16			

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TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

England & Wales			Assessment Criteria							No. of Exceedences		
Analyte	Units	LOD	MRV	Human Consumption	Fresh Water	ChemCode ↓	No. of Tests	Min	Max	MRV	Human Consumption	Fresh Water
Alkalinity as $CaCO_3$	µg/l	3	-	-	-	P1335	7	240	420			
Arsenic	µg/l	0.15	-	10	50	7440-38-2	13	0.61	13		1	
Boron	µg/l		-	1000	-	7440-42-8						
Cadmium	µg/l	0.02	0.1	5	0.08	7440-43-9	13	0.02	0.72	6		6
Chromuim (Total)	µg/l	0.2	-	50	-	7440-47-3	13	0.4	6.4			
Chromium Trivalent	µg/l		-	-	4.7	16065-83-1						
Chromium Hexavalant	µg/l	5	-	-	3.4	18540-29-9	13	5	5			13
Copper	µg/l	0.5	-	2000	17.57	7440-50-8	13	0.9	14			
Iron	µg/l		-	200	1000	7439-89-6						
Lead	µg/l	0.2	-	10	7.31	7439-92-1	13	0.2	8.2			1
Mercury	µg/l	0.05	0.01	1	0.07	7439-97-6	13	0.05	0.05	13		
Manganese	µg/l		-	50	123	7439-96-5						
Nickel	µg/l	0.5	-	20	10.83	7440-02-0	13	1.8	8.3			
Selenium	µg/l	0.6	-	10	-	7782-49-2	7	0.6	1.9	6		6
Zinc	µg/l	0.5	-	5000	33.13	7440-66-6	13	5.1	26			
Ammoniacal Nitrogen as NH_4	µg/l	15	-	500	260	P1140	7	15	2300		1	1
Ammoniacal Nitrogen as NH_3	µg/l		-	-	200	P1000	7	14	2172			2
Chloride	µg/l	150	-	250000	-	16887-00-6	7	23000	85000			
Chlorine	µg/l		-	-	2	7782-50-5						
Cyanide	µg/l		-	50	1	57-12-5	6	10	290		3	6
Nitrate as NO_3	µg/l		-	50000	-	P1348						
Nitrite as NO_2	µg/l		-	100	-	P1349						
Phenol	µg/l	0.05	-	500	7.7	108-95-2	7	0.05	0.05			
Pentachlorophenol	µg/l		0.1	-	0.4	87-86-5						
PCBs	µg/l		0.001	-	-	1336-36-3						
Sodium	µg/l		-	200000	-	7440-23-5						
Sulphate	µg/l	45	-	250000	-	14808-79-8	7	40800	1010000		2	
pH	pH Units		-	-	-	P1334	7	6.9	8.2			
Dichloromethane	µg/l		-	-	20	75-09-2						
1,2 Dichloroethane	µg/l	1	1	3	10	107-06-2	7	1	1			
Trichloroethene (PCE)	µg/l	1	0.1	10	10	79-01-6	7	1	1	7		
1,1,1 Trichloroethane	µg/l	1	0.1	-	-	71-55-6	7	1	1	7		
1,1,2 Trichloroethane	µg/l	1	0.1	-	-	79-00-5	7	1	1	7		
Trichloromethane (Chloroform)	µg/l	1	0.1	100	2.5	67-66-3	7	1	1	7		
1,2,3 Trichlorobenzene	µg/l	1	-	-	-	87-61-6	7	1	1			
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	-	120-82-1	7	1	1	7		
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	-	0.4	xxx	7	2	2			7
Tetrachloroethene	µg/l	1	0.1	10	10	127-18-4	7	1	1	7		
Tetrachloromethane	µg/l	1	0.1	3	12	56-23-5	7	1	1	7		
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	140	630-20-6	7	1	1			
2-chlorophenol	µg/l	0.05	0.1	-	-	95-57-8						
4-chloro-3-methylphenol	µg/l	0.05	0.1	-	-	59-50-7						
Hexachlorobutadiene	µg/l	1	0.005	-	0.6	87-68-3				7		7
Vinyl Chloride (Chloroethene)	µg/l	1	-	0.5	-	75-01-4	7	1	1		7	
>C5 to C6 Aliphatic	µg/l	1	-	-	-	P1407	7	1	1			
>C6 to C8 Aliphatic	µg/l	1	-	-	-	P1408	7	1	1			
>C8 to C10 Aliphatic	µg/l	1	-	-	-	P1409	7	1	1			
>C10 to C12 Aliphatic	µg/l	10	-	-	-	P1410	7	10	10			
>C12 to C16 Aliphatic	µg/l	10	-	-	-	P1411	7	10	10			
>C16 to C21 Aliphatic	µg/l	10	-	-	-	P1412	7	10	10			
>C21 to C35 Aliphatic	µg/l	10	-	-	-	P1413	7	10	10			
>C35 to C44 Aliphatic	µg/l		-	-	-	P1415						
Total Aliphatic C5-35	µg/l	10	-	-	-	P1418	7	10	10			
>C5 to C7 Aromatic	µg/l	1	-	-	-	P1441	7	1	1			
>C7 to C8 Aromatic	µg/l	1	-	-	-	P1355	7	1	1			
>C8 to C10 Aromatic	µg/l	1	-	-	-	P1356	7	1	1			
>C10 to C12 Aromatic	µg/l	10	-	-	-	P1357	7	10	10			
>C12 to C16 Aromatic	µg/l	10	-	-	-	P1358	7	10	10			
>C16 to C21 Aromatic	µg/l	10	-	-	-	P1359	7	10	10			
>C21 to C35 Aromatic	µg/l	10	-	-	-	P1360	7	10	10			
>C35 to C44 Aromatic	µg/l		-	-	-	P1362						
Total Aromatic C5-C35	µg/l	10	-	-	-	P1365	7	10	10			
TPH Ali/Aro	µg/l		-	10	-	P2096						
Benzene	µg/l	1	1	1	10	71-43-2	7	1	1			
Ethylbenzene	µg/l	1	-	300	-	100-41-4	7	1	1			
Toluene	µg/l	1	4	700	74	108-88-3	7	1	1			
Xylene	µg/l		3	500	30	1330-20-7						
M- & P-Xylene	µg/l	1	-	-	-	P1374	7	1	1			
O-Xylene	µg/l	1	-	-	-	95-47-6	7	1	1			
Total Xylene (M, P & O)	µg/l	2	-	-	-	xxx	7	2	2			
MTBE	µg/l	1	-	15	-	1634-04-4	7	1	1			
naphthalene	µg/l	1	-	-	2	91-20-3	7	1	1			
acenaphthylene	µg/l	0.01	-	-	-	208-96-8	7	0.01	0.01			
acenaphthene	µg/l	0.01	-	-	-	83-32-9	7	0.01	0.01			
fluorene	µg/l	0.01	-	-	-	86-73-7	7	0.01	0.01			
phenanthrene	µg/l	0.01	-	-	-	85-01-8	7	0.01	0.01			
anthracene	µg/l	0.01	-	-	0.1	120-12-7	7	0.01	0.01			
fluoranthene	µg/l	0.01	-	-	0.0063	206-44-0	7	0.01	0.01			7
pyrene	µg/l	0.01	-	-	-	129-00-0	7	0.01	0.01			
benzo(a)anthracene	µg/l	0.01	-	-	-	56-55-3	7	0.01	0.01			
chrysene	µg/l	0.01	-	-	-	218-01-9	7	0.01	0.01			
benzo(b)fluoranthene	µg/l	0.01	-	0.1	0.017	205-99-2	7	0.01	0.01			
benzo(k)fluoranthene	µg/l	0.01	-	0.1	0.017	207-08-9	7	0.01	0.01			
benzo(a)pyrene	µg/l	0.01	-	0.01	0.00017	50-32-8	7	0.01	0.01			7
benzo(g,h,i)perylene	µg/l	0.01	-	0.1	0.0082	193-39-5	7	0.01	0.01			7
dibenzo(ah)anthracene	µg/l	0.01	-	-	-	53-70-3	7	0.01	0.01			
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	0.1	-	191-24-2	7	0.01	0.01			
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	0.1	-	xxx	7	0.04	0.04			
Total PAH	µg/l	0.16	-	-	-	P1706	7	0.16	0.16			

TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

England & Wales			Assessment Criteria			ChemCode ↓	No. of Tests	Min	Max	No. of Exceedences		
Analyte	Units	LOD	MRV	Human Consumption	Fresh Water					MRV	Human Consumption	Fresh Water
Alkalinity as $CaCO_3$	µg/l	3	-	-	-	P1335	7	240	420			
Arsenic	µg/l	0.15	-	10	50	7440-38-2	13	0.61	13		1	
Boron	µg/l		-	1000	-	7440-42-8						
Cadmium	µg/l	0.02	0.1	5	0.08	7440-43-9	13	0.02	0.72	6		6
Chromuim (Total)	µg/l	0.2	-	50	-	7440-47-3	13	0.4	6.4			
Chromium Trivalent	µg/l		-	-	4.7	16065-83-1						
Chromium Hexavalant	µg/l	5	-	-	3.4	18540-29-9	13	5	5			13
Copper	µg/l	0.5	-	2000	17.57	7440-50-8	13	0.9	14			
Iron	µg/l		-	200	1000	7439-89-6						
Lead	µg/l	0.2	-	10	7.31	7439-92-1	13	0.2	8.2			1
Mercury	µg/l	0.05	0.01	1	0.07	7439-97-6	13	0.05	0.05	13		
Manganese	µg/l		-	50	123	7439-96-5						
Nickel	µg/l	0.5	-	20	10.83	7440-02-0	13	1.8	8.3			
Selenium	µg/l	0.6	-	10	-	7782-49-2	7	0.6	1.9	6		6
Zinc	µg/l	0.5	-	5000	33.13	7440-66-6	13	5.1	26			
Ammoniacal Nitrogen as NH_4	µg/l	15	-	500	260	P1140	7	15	2300		1	1
Ammoniacal Nitrogen as NH_3	µg/l		-	-	200	P1000	7	14	2172			2
Chloride	µg/l	150	-	250000	-	16887-00-6	7	23000	85000			
Chlorine	µg/l		-	-	2	7782-50-5						
Cyanide	µg/l		-	50	1	57-12-5	6	10	290		3	6
Nitrate as NO_3	µg/l		-	50000	-	P1348						
Nitrite as NO_2	µg/l		-	100	-	P1349						
Phenol	µg/l	0.05	-	500	7.7	108-95-2	7	0.05	0.05			
Pentachlorophenol	µg/l		0.1	-	0.4	87-86-5						
PCBs	µg/l		0.001	-	-	1336-36-3						
Sodium	µg/l		-	200000	-	7440-23-5						
Sulphate	µg/l	45	-	250000	-	14808-79-8	7	40800	1010000		2	
pH	pH Units		-	-	-	P1334	7	6.9	8.2			
Dichloromethane	µg/l		-	-	20	75-09-2						
1,2 Dichloroethane	µg/l	1	1	3	10	107-06-2	7	1	1			
Trichloroethene (PCE)	µg/l	1	0.1	10	10	79-01-6	7	1	1	7		
1,1,1 Trichloroethane	µg/l	1	0.1	-	-	71-55-6	7	1	1	7		
1,1,2 Trichloroethane	µg/l	1	0.1	-	-	79-00-5	7	1	1	7		
Trichloromethane (Chloroform)	µg/l	1	0.1	100	2.5	67-66-3	7	1	1	7		
1,2,3 Trichlorobenzene	µg/l	1	-	-	-	87-61-6	7	1	1			
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	-	120-82-1	7	1	1	7		
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	-	0.4	xxx	7	2	2			7
Tetrachloroethene	µg/l	1	0.1	10	10	127-18-4	7	1	1	7		
Tetrachloromethane	µg/l	1	0.1	3	12	56-23-5	7	1	1	7		
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	140	630-20-6	7	1	1			
2-chlorophenol	µg/l	0.05	0.1	-	-	95-57-8						
4-chloro-3-methylphenol	µg/l	0.05	0.1	-	-	59-50-7						
Hexachlorobutadiene	µg/l	1	0.005	-	0.6	87-68-3				7		7
Vinyl Chloride (Chloroethene)	µg/l	1	-	0.5	-	75-01-4	7	1	1		7	
>C5 to C6 Aliphatic	µg/l	1	-	-	-	P1407	7	1	1			
>C6 to C8 Aliphatic	µg/l	1	-	-	-	P1408	7	1	1			
>C8 to C10 Aliphatic	µg/l	1	-	-	-	P1409	7	1	1			
>C10 to C12 Aliphatic	µg/l	10	-	-	-	P1410	7	10	10			
>C12 to C16 Aliphatic	µg/l	10	-	-	-	P1411	7	10	10			
>C16 to C21 Aliphatic	µg/l	10	-	-	-	P1412	7	10	10			
>C21 to C35 Aliphatic	µg/l	10	-	-	-	P1413	7	10	10			
>C35 to C44 Aliphatic	µg/l		-	-	-	P1415						
Total Aliphatic C5-35	µg/l	10	-	-	-	P1418	7	10	10			
>C5 to C7 Aromatic	µg/l	1	-	-	-	P1441	7	1	1			
>C7 to C8 Aromatic	µg/l	1	-	-	-	P1355	7	1	1			
>C8 to C10 Aromatic	µg/l	1	-	-	-	P1356	7	1	1			
>C10 to C12 Aromatic	µg/l	10	-	-	-	P1357	7	10	10			
>C12 to C16 Aromatic	µg/l	10	-	-	-	P1358	7	10	10			
>C16 to C21 Aromatic	µg/l	10	-	-	-	P1359	7	10	10			
>C21 to C35 Aromatic	µg/l	10	-	-	-	P1360	7	10	10			
>C35 to C44 Aromatic	µg/l		-	-	-	P1362						
Total Aromatic C5-C35	µg/l	10	-	-	-	P1365	7	10	10			
TPH Ali/Aro	µg/l		-	10	-	P2096						
Benzene	µg/l	1	1	1	10	71-43-2	7	1	1			
Ethylbenzene	µg/l	1	-	300	-	100-41-4	7	1	1			
Toluene	µg/l	1	4	700	74	108-88-3	7	1	1			
Xylene	µg/l		3	500	30	1330-20-7						
M- & P-Xylene	µg/l	1	-	-	-	P1374	7	1	1			
O-Xylene	µg/l	1	-	-	-	95-47-6	7	1	1			
Total Xylene (M, P & O)	µg/l	2	-	-	-	xxx	7	2	2			
MTBE	µg/l	1	-	15	-	1634-04-4	7	1	1			
naphthalene	µg/l	1	-	-	2	91-20-3	7	1	1			
acenaphthylene	µg/l	0.01	-	-	-	208-96-8	7	0.01	0.01			
acenaphthene	µg/l	0.01	-	-	-	83-32-9	7	0.01	0.01			
fluorene	µg/l	0.01	-	-	-	86-73-7	7	0.01	0.01			
phenanthrene	µg/l	0.01	-	-	-	85-01-8	7	0.01	0.01			
anthracene	µg/l	0.01	-	-	0.1	120-12-7	7	0.01	0.01			
fluoranthene	µg/l	0.01	-	-	0.0063	206-44-0	7	0.01	0.01			7
pyrene	µg/l	0.01	-	-	-	129-00-0	7	0.01	0.01			
benzo(a)anthracene	µg/l	0.01	-	-	-	56-55-3	7	0.01	0.01			
chrysene	µg/l	0.01	-	-	-	218-01-9	7	0.01	0.01			
benzo(b)fluoranthene	µg/l	0.01	-	0.1	0.017	205-99-2	7	0.01	0.01			
benzo(k)fluoranthene	µg/l	0.01	-	0.1	0.017	207-08-9	7	0.01	0.01			
benzo(a)pyrene	µg/l	0.01	-	0.01	0.00017	50-32-8	7	0.01	0.01			7
benzo(g,h,i)perylene	µg/l	0.01	-	0.1	0.0082	193-39-5	7	0.01	0.01			7
dibenzo(ah)anthracene	µg/l	0.01	-	-	-	53-70-3	7	0.01	0.01			
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	0.1	-	191-24-2	7	0.01	0.01			
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	0.1	-	xxx	7	0.04	0.04			
Total PAH	µg/l	0.16	-	-	-	P1706	7	0.16	0.16			

TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
OSNEY PATH WORKS, OXFORD

England & Wales			Assessment Criteria							No. of Exceedences		
Analyte	Units	LOD	MRV	Human Consumption	Fresh Water	ChemCode ↓	No. of Tests	Min	Max	MRV	Human Consumption	Fresh Water
Alkalinity as $CaCO_3$	µg/l	3	-	-	-	P1335	7	240	420			
Arsenic	µg/l	0.15	-	10	50	7440-38-2	13	0.61	13		1	
Boron	µg/l		-	1000	-	7440-42-8						
Cadmium	µg/l	0.02	0.1	5	0.08	7440-43-9	13	0.02	0.72	6		6
Chromuim (Total)	µg/l	0.2	-	50	-	7440-47-3	13	0.4	6.4			
Chromium Trivalent	µg/l		-	-	4.7	16065-83-1						
Chromium Hexavalant	µg/l	5	-	-	3.4	18540-29-9	13	5	5			13
Copper	µg/l	0.5	-	2000	17.57	7440-50-8	13	0.9	14			
Iron	µg/l		-	200	1000	7439-89-6						
Lead	µg/l	0.2	-	10	7.31	7439-92-1	13	0.2	8.2			1
Mercury	µg/l	0.05	0.01	1	0.07	7439-97-6	13	0.05	0.05	13		
Manganese	µg/l		-	50	123	7439-96-5						
Nickel	µg/l	0.5	-	20	10.83	7440-02-0	13	1.8	8.3			
Selenium	µg/l	0.6	-	10	-	7782-49-2	7	0.6	1.9	6		6
Zinc	µg/l	0.5	-	5000	33.13	7440-66-6	13	5.1	26			
Ammoniacal Nitrogen as NH_4	µg/l	15	-	500	260	P1140	7	15	2300		1	1
Ammoniacal Nitrogen as NH_3	µg/l		-	-	200	P1000	7	14	2172			2
Chloride	µg/l	150	-	250000	-	16887-00-6	7	23000	85000			
Chlorine	µg/l		-	-	2	7782-50-5						
Cyanide	µg/l		-	50	1	57-12-5	6	10	290		3	6
Nitrate as NO_3	µg/l		-	50000	-	P1348						
Nitrite as NO_2	µg/l		-	100	-	P1349						
Phenol	µg/l	0.05	-	500	7.7	108-95-2	7	0.05	0.05			
Pentachlorophenol	µg/l		0.1	-	0.4	87-86-5						
PCBs	µg/l		0.001	-	-	1336-36-3						
Sodium	µg/l		-	200000	-	7440-23-5						
Sulphate	µg/l	45	-	250000	-	14808-79-8	7	40800	1010000		2	
pH	pH Units		-	-	-	P1334	7	6.9	8.2			
Dichloromethane	µg/l		-	-	20	75-09-2						
1,2 Dichloroethane	µg/l	1	1	3	10	107-06-2	7	1	1			
Trichloroethene (PCE)	µg/l	1	0.1	10	10	79-01-6	7	1	1	7		
1,1,1 Trichloroethane	µg/l	1	0.1	-	-	71-55-6	7	1	1	7		
1,1,2 Trichloroethane	µg/l	1	0.1	-	-	79-00-5	7	1	1	7		
Trichloromethane (Chloroform)	µg/l	1	0.1	100	2.5	67-66-3	7	1	1	7		
1,2,3 Trichlorobenzene	µg/l	1	-	-	-	87-61-6	7	1	1			
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	-	120-82-1	7	1	1	7		
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	-	0.4	xxx	7	2	2			7
Tetrachloroethene	µg/l	1	0.1	10	10	127-18-4	7	1	1	7		
Tetrachloromethane	µg/l	1	0.1	3	12	56-23-5	7	1	1	7		
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	140	630-20-6	7	1	1			
2-chlorophenol	µg/l	0.05	0.1	-	-	95-57-8						
4-chloro-3-methylphenol	µg/l	0.05	0.1	-	-	59-50-7						
Hexachlorobutadiene	µg/l	1	0.005	-	0.6	87-68-3				7		7
Vinyl Chloride (Chloroethene)	µg/l	1	-	0.5	-	75-01-4	7	1	1		7	
>C5 to C6 Aliphatic	µg/l	1	-	-	-	P1407	7	1	1			
>C6 to C8 Aliphatic	µg/l	1	-	-	-	P1408	7	1	1			
>C8 to C10 Aliphatic	µg/l	1	-	-	-	P1409	7	1	1			
>C10 to C12 Aliphatic	µg/l	10	-	-	-	P1410	7	10	10			
>C12 to C16 Aliphatic	µg/l	10	-	-	-	P1411	7	10	10			
>C16 to C21 Aliphatic	µg/l	10	-	-	-	P1412	7	10	10			
>C21 to C35 Aliphatic	µg/l	10	-	-	-	P1413	7	10	10			
>C35 to C44 Aliphatic	µg/l		-	-	-	P1415						
Total Aliphatic C5-35	µg/l	10	-	-	-	P1418	7	10	10			
>C5 to C7 Aromatic	µg/l	1	-	-	-	P1441	7	1	1			
>C7 to C8 Aromatic	µg/l	1	-	-	-	P1355	7	1	1			
>C8 to C10 Aromatic	µg/l	1	-	-	-	P1356	7	1	1			
>C10 to C12 Aromatic	µg/l	10	-	-	-	P1357	7	10	10			
>C12 to C16 Aromatic	µg/l	10	-	-	-	P1358	7	10	10			
>C16 to C21 Aromatic	µg/l	10	-	-	-	P1359	7	10	10			
>C21 to C35 Aromatic	µg/l	10	-	-	-	P1360	7	10	10			
>C35 to C44 Aromatic	µg/l		-	-	-	P1362						
Total Aromatic C5-C35	µg/l	10	-	-	-	P1365	7	10	10			
TPH Ali/Aro	µg/l		-	10	-	P2096						
Benzene	µg/l	1	1	1	10	71-43-2	7	1	1			
Ethylbenzene	µg/l	1	-	300	-	100-41-4	7	1	1			
Toluene	µg/l	1	4	700	74	108-88-3	7	1	1			
Xylene	µg/l		3	500	30	1330-20-7						
M- & P-Xylene	µg/l	1	-	-	-	P1374	7	1	1			
O-Xylene	µg/l	1	-	-	-	95-47-6	7	1	1			
Total Xylene (M, P & O)	µg/l	2	-	-	-	xxx	7	2	2			
MTBE	µg/l	1	-	15	-	1634-04-4	7	1	1			
naphthalene	µg/l	1	-	-	2	91-20-3	7	1	1			
acenaphthylene	µg/l	0.01	-	-	-	208-96-8	7	0.01	0.01			
acenaphthene	µg/l	0.01	-	-	-	83-32-9	7	0.01	0.01			
fluorene	µg/l	0.01	-	-	-	86-73-7	7	0.01	0.01			
phenanthrene	µg/l	0.01	-	-	-	85-01-8	7	0.01	0.01			
anthracene	µg/l	0.01	-	-	0.1	120-12-7	7	0.01	0.01			
fluoranthene	µg/l	0.01	-	-	0.0063	206-44-0	7	0.01	0.01			7
pyrene	µg/l	0.01	-	-	-	129-00-0	7	0.01	0.01			
benzo(a)anthracene	µg/l	0.01	-	-	-	56-55-3	7	0.01	0.01			
chrysene	µg/l	0.01	-	-	-	218-01-9	7	0.01	0.01			
benzo(b)fluoranthene	µg/l	0.01	-	0.1	0.017	205-99-2	7	0.01	0.01			
benzo(k)fluoranthene	µg/l	0.01	-	0.1	0.017	207-08-9	7	0.01	0.01			
benzo(a)pyrene	µg/l	0.01	-	0.01	0.00017	50-32-8	7	0.01	0.01			7
benzo(g,h,i)perylene	µg/l	0.01	-	0.1	0.0082	193-39-5	7	0.01	0.01			7
dibenzo(ah)anthracene	µg/l	0.01	-	-	-	53-70-3	7	0.01	0.01			
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	0.1	-	191-24-2	7	0.01	0.01			
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	0.1	-	xxx	7	0.04	0.04			
Total PAH	µg/l	0.16	-	-	-	P1706	7	0.16	0.16			

Appendix E Metal Bioavailability Tool (M-BAT)

Pb Screening Tool 1.0

Back

Calculate

Clear Data

INPUT DATA						RESULTS (Pb)			
ID	Location	Waterbody	Date	Measured Pb Concentration (dissolved) (µg l^{-1})	DOC	Site Specific PNEC Dissolved Pb (µg l^{-1})	BioF	Available Pb (µg l^{-1})	Risk Characterisation Ratio
1	upstream	River Thames - Oxpen			6.09	7.31	0.16	0.00	
2	downstream	River Thames - Oxpen			7.82	9.38	0.13	0.00	

Metal Bioavailability Assessment Tool (M-BAT)

Back

Calculate

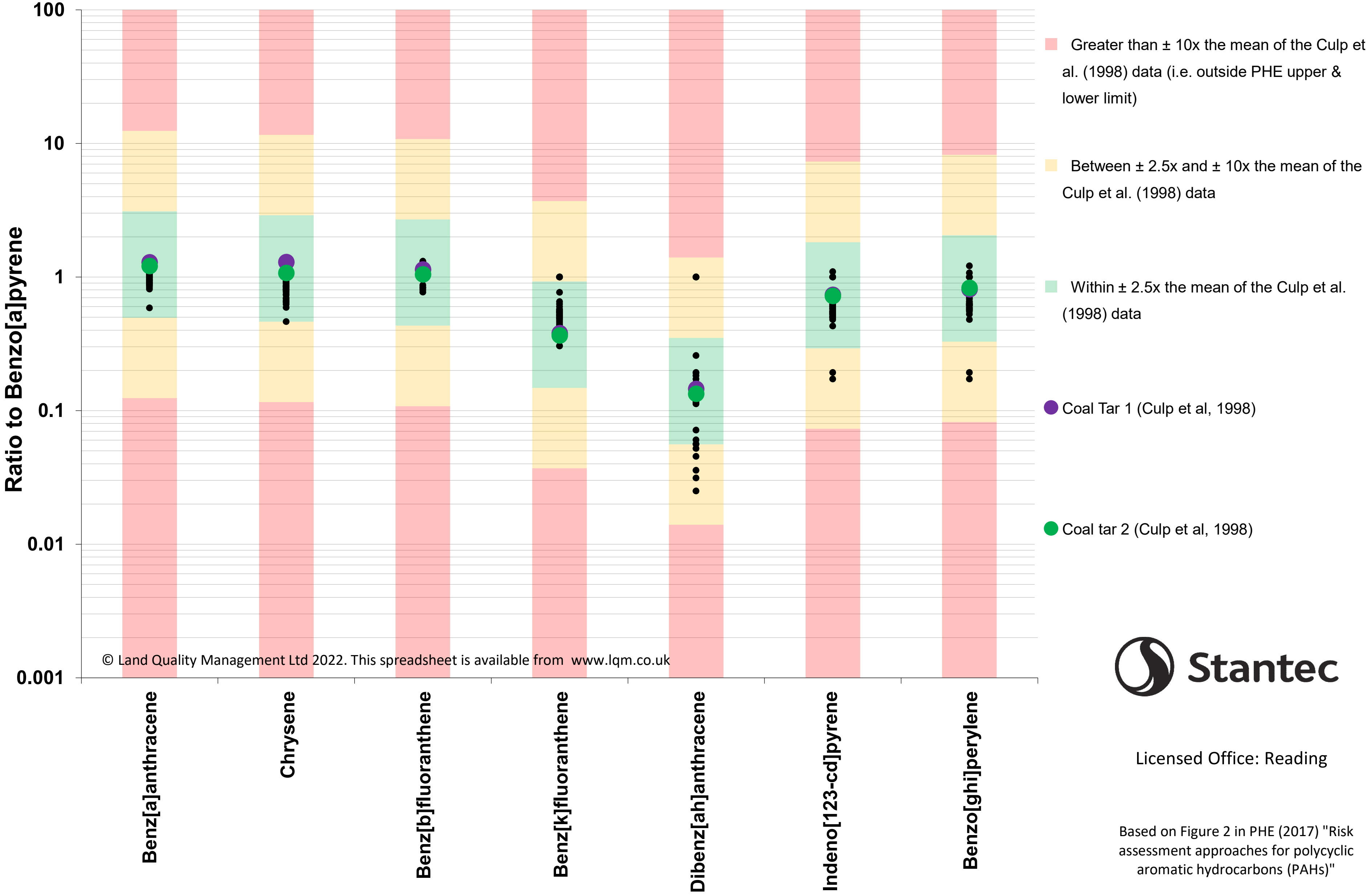
Clear Data

INPUT DATA										
ID	Location	Waterbody	Date	Measured Cu Concentration (dissolved) (µg l^{-1})	Measured Zn Concentration (dissolved) (µg l^{-1})	Measured Mn Concentration (dissolved) (µg l^{-1})	Measured Ni Concentration (dissolved) (µg l^{-1})	pH	DOC	Ca
1	upstream	River Thames - Oxpen						8.1	6.09	130
2	downstream	River Thames - Oxpen						8.2	7.82	120

ID	RESULTS (Copper)				RESULTS (Zinc)				RESULTS (Mn)				RESULTS (Ni)			
	Site-specific PNEC Dissolved Copper (µg l^{-1})	BioF	Bioavailable Copper Concentration (µg l^{-1})	Risk Characterisation Ratio	Site-specific PNEC Dissolved Zinc (µg l^{-1})	BioF	Bioavailable Zinc Concentration (µg l^{-1})	Risk Characterisation Ratio	Site-specific PNEC Dissolved Manganese (µg l^{-1})	BioF	Bioavailable Manganese Concentration (µg l^{-1})	Risk Characterisation Ratio	Site-specific PNEC Dissolved Nickel (µg l^{-1})	BioF	Bioavailable Nickel Concentration (µg l^{-1})	Risk Characterisation Ratio
1	17.57	0.06			33.13	0.33			180.91	0.68			10.83	0.37		
2	19.70	0.05			39.16	0.28			149.07	0.83			11.38	0.35		

Appendix F LQM PAH Profiling Tool

J:\330610555\3500 - Geotechnical\04 Data\Chem lab\assessment plots\Stantec_Reading_PAH profiling v1.3 FULL.xlsx



Stantec

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Based on Figure 2 in PHE (2017) "Risk assessment approaches for polycyclic aromatic hydrocarbons (PAHs)"