



Appendix 15.2

REMEDATION STRATEGY AND VERIFICATION PLAN



Begbroke Innovation District

Remediation Strategy & Verification Plan

*For Oxford University Development
Limited*

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1. Introduction

1.1 Terms of reference

Hydrock Consultants Limited (Hydrock) has been commissioned by Oxford University Development Limited (OUD) (the Client), to prepare a Remediation Strategy and Verification Plan (RS&VP) for a site in Begbroke, Oxfordshire, herein referred to as 'the site'.

A Site Location Plan (Hydrock Drawing 19114-HYD-XX-ZZ-DR-GE-01000) is presented in Appendix A.

The site is 170 hectares in area, located between Kidlington and the A44 Woodstock Road, approximately 8km to the west-north-west of Oxford. The nearest postcode is OX5 1GZ. Currently, the site is mostly open fields surrounding the existing Begbroke Science Park.

Hydrock understands that preliminary plans for the proposed development comprise a mixed housing and non-residential development. The proposed layout of the site has not been finalised at the time of issue of this report. However, it is understood that the built environment will occupy the centre, west and south of the site, with the northern and eastern boundaries and the area of the landfill in central south of the site remaining as open space. In addition, it is understood a noise / visual screening bund is required adjacent to the railway line.

The works have been undertaken in accordance with Hydrock's proposal referenced 19114/GMNO/FPO06, dated 18 April 2023) and the Client's instructions to proceed (email from Linsey Ions to James King, forwarded to Allan Bell dated 18 April 2023).

1.2 Objectives

This report has been written to provide a RS&VP to be used during the development works. The objectives of this RS&VP are to:

- » describe how the remediation of the site will be undertaken inclusive of the landfill area primarily and wider site area beyond;
- » outline how the works will be validated and verified; and
- » explain how the works will be permitted under the current regulatory regime.

The remedial works are designed to ensure that, on completion, the ground conditions at the site can be shown to be suitable for its intended use, such that it will not pose an unacceptable contamination risk to identified receptors. This document includes the protective measures required during construction in preparing the site for the proposed end use, as described in Section 1.1.

Careful consideration of the ground conditions, and the implementation of sound earthworks and materials management practices as part of the remediation works, are critical in ensuring that the redevelopment complies with regulatory requirements likely to be set out in the planning conditions.

This document is a working document and may need to be updated at any stage during development, dependent on the conditions encountered. This version therefore constitutes 19114-HYD-XX-XX-RP-GE-01004-S2-P04 but may be updated with subsequent revisions. Please contact Hydrock if you are unsure of the current issue.

This RS&VP and any amendments are subject to agreement with the Regulators and the Warranty Provider.

1.3 Scope

The scope of the RS&VP comprises:

- » a summary of the results of risk assessments undertaken at the site;
- » a summary of the Conceptual Site Model (CSM);
- » a description of the remediation works required; and
- » validation and verification requirements.

1.4 Available information

Hydrock have prepared the following documents for OUD, which should be read in conjunction with this report:

- » Hydrock. April 2023. 'Begbroke, Oxfordshire. Desk Study Review and Ground Investigation', ref 19114-HYD-XX-XX-RP-GE-01002-S2-P08.

The following relevant information has been provided to Hydrock by OUD for use in the preparation of this report:

- » A topographic survey plan (unreferenced);
- » Jubb Consulting Engineers Limited. May 2018. 'Land at Begbroke, Begbroke. Phase 1 Desk Study Report', Ref: 18182-DTS-011, undertaken for Begbroke Tripartite, Oxfordshire;
- » Jubb Consulting Engineers Limited. December 2019. 'Land at Begbroke, Begbroke. Ground Conditions Assessment Report', Ref: 18182-GCA-1 undertaken for Begbroke Tripartite, Oxfordshire; and
- » Buro Happold. November 2022. 'Proposed Road Alignment and Surface, Option 3', Ref: 0052188 (Sketch Plan).

The Jubb Report (December 2019) included reference to a Factual Report as follows, although this has not been provided to Hydrock:

- » Terra Firma (South) Limited. November 2019. 'Factual Ground Investigation Report - Begbroke, Oxfordshire', Ref: 6307.

1.5 Limitations

Hydrock has prepared this report in accordance with the instructions of the Client, by e-mail dated 18 April 2023 under the terms of appointment for Hydrock, for the sole and specific use of the Client and parties designated by them for the purpose of providing information on the remediation and validation works to be undertaken during the enabling and construction stages of the development. The report contents should only be used in that context. Furthermore, new information, changed practices or new legislation may necessitate revised interpretation of the report after the date of its submission.

Any third parties who use the information contained herein do so at their own risk. Hydrock shall not be responsible for any use of the report or its contents for any purpose other than that for which it was prepared or for use of the report by any parties not defined in Hydrock's appointment.

The report has been prepared by Hydrock on the basis of available information obtained during the study period. Although every reasonable effort has been made to gather all relevant information, not all potential environmental constraints or liabilities associated with the site may have been revealed.

Hydrock has used reasonable skill, care and diligence in the design of the remediation of the site. The inherent variation of ground conditions allows only definition of the actual conditions at the locations and depths of trial pits and boreholes at the time of the investigation. At intermediate locations, conditions can only be inferred. Groundwater data are only representative of the dates on which they were obtained and both levels and quality may vary.

Information provided by third parties has been used in good faith and is taken at face value. However, Hydrock cannot guarantee the accuracy or completeness of any information provided by others.

The work has been carried out in general accordance with recognised best practice as detailed in guidance documents such as in accordance with the principles of LCRM; BS 5930:2015+A1:2020 BS 8485:2015+A1:2019, BS 10175: 2011+A2:2017.

1.6 Glossary

Oxford University Development Limited (OUD) are referred to as 'the Client'.

The 'Enablement Contractor' shall undertake remediation works during a separate Enablement Stage of works (as detailed in Section 5 of this report).

The 'Ground Works Contractor' shall undertake remediation works during construction activity, during the Construction Stage (as detailed in Section 6 of this report).

As additional and supporting information is presented throughout this document, the Contractors shall read and understand the entirety of this report. If there is any doubt with regards to the works required, please contact the Client or Hydrock for clarification.

This document shall be referred to as the 'Remediation Strategy and Verification Plan', or the 'RS&VP'.

The term 'MMP', refers to a Qualified Person (QP) declared Materials Management Plan as defined in the Contaminated Land: Applications in Real Environments (CL:AIRE) document: 'The Definition of Waste: Development Industry Code of Practice' (Version 2) (DoWCoP), dated March 2011. The principles of materials management at the site are discussed in Section 8.

The term 'GDR' refers to the Geotechnical Design Report for the site, which will be required once the design is finalised.

The term 'EWS' refers to the Earthworks Specification, which will be presented as an annex to the GDR.

Where the phrase 'suitable for use' is used, the soils are to be suitable for use in accordance with this RS&VP, the MMP, the GDR and the EWS.

The remediation works are referred to as 'the Contract' or 'the Works'. The Works shall be undertaken in accordance with this RS&VP.

The 'nominated Consultant' shall be the geo-environmental consultant retained by the Client to undertake site watching briefs and audits. Hydrock is the nominated Consultant.

Please refer to OUD for guidance as to Principal Contractor responsibilities during the works.

2. Site Setting

2.1 Introduction

Hydrock has previously prepared a Desk Study Review for the site (reference 19114-HYD-XX-XX-RP-GE-01002). The following section is a summary of the pertinent information presented in the report, which should be referred to for detailed information.

2.2 Site setting and current use

The site currently mostly comprises agricultural fields, used for arable farming, with several fields in the south-west of the site in use for raising poultry and deer. A field in the west of the site is used as allotment gardens. There are several farm storage barns shown as Parkers Farm in the central-east of the site.

The total site area is approximately 170ha with the widest dimensions of approximately 1.5km north to south, and 1.3km west to east.

An historical landfill (filled with inert/industrial waste) is present in the central-south of the site with an area of approximately 5.20ha.

Sandy Lane bisects the site in a west to east orientation, through the approximate centre of the site. A railway line trends north to south, bisecting (but outside of) the site, and separates seven fields in the east (an area of approximately 43 hectares) from the rest of the site area.

The approximately 7.9ha Begbroke Science Park is in the central-northern area and is accessed by a roadway (Begbroke Hill road) off the A44 to the west.

A pedestrian access road joins Begbroke Science Park to Sandy Lane to the east.

A number of public footpaths are present leading to Begbroke Science Park and in the surrounding fields.

An underground sewer crosses the site in a north to south direction and is present to the west of Begbroke Science Park (joining a pumping station in the north), before splitting into two in the south with one spur crossing site to the south of the landfill area (trending east to west), and the other continuing south beyond the site.

The site is bounded by the A44 to the west, to the east by the Oxford Canal, to the north by fields and the Rowel Brook and to the south by open land.

A fuel station is present adjacent to the south-west corner of the site.

There are residential areas to the east of the Oxford Canal (Kidlington), Yarnton to the south-west, and Begbroke to the north-west.

The southern section of Rushy Meadows Site of Special Scientific Interest (SSSI) borders 450m of the northern site boundary.

2.3 Topography

The topography of the site is characterised by a plateau forming a topographic high in the west and centre of the site at approximately 67m Ordnance Datum (OD), sloping away from it as follows:

- » to the north towards Rowel Brook at approximately 63m OD and rising again to the north of Rowel Brook, to approximately 67mOD. and
- » to the east and south to a low-lying area at approximately 61m OD.

The landfill area in the central-south, is between approximately 68.5m OD in the north-west, and slopes gently down to the south-east to approximately 64.5m OD and is between 0.5m and 1.0m higher than the surrounding land.

2.4 Site history

The site is predominantly fields from the earliest available mapping to the present day with Parkers Farm shown in the central-east of the site.

The railway line and Sandy Lane have been present from the earliest available mapping.

Allotment gardens are shown in the west of the site from 1970.

Begbroke Hill Farm (excluded from the site area) is shown in the central-north of the site until 1971 when it is shown as a Weed Research Associated (now Begbroke Science Park).

Begbroke Hill Road is shown constructed off Woodstock Road to enter Begbroke Science Park located in the central-north of the site (excluded from the site area) from 1999.

A number of gravel pits are shown in the surrounding area beyond the north-western boundary (Fern Hill Pits) and within the central-southern part of the site to the south of Sandy Lane, known as Sandy Lane Pits. Following completion of the gravel extraction operations, these pits were used as landfill and were backfilled by the early 1980's. Subsequent residential development has taken place over Fern Hill Pits and the western (off site) of the two Sandy Lane Pits. The eastern most Sandy Lane Pit was shown as a refuse pit until 1978 and remains undeveloped and backfilled slightly above the surrounding ground level.

2.5 Geology

Superficial Geology:

- » River Terrace Deposits (Summertown-Radley Sand and Gravel Member) in the central / northern plateau area of the site at topographically high areas of the site.
- » Alluvium in the east of the site.
- » River Terrace Deposits anticipated to underlie the Alluvium in the east of the site.

Solid Geology:

- » Oxford Clay Formation; comprising a dark grey mudstone; over
- » Kellaways Sand Member comprising interbedded silty sand and mudstone; over
- » Kellaways Clay Member comprising grey mudstone; over
- » Cornbrash Formation comprising bluish grey limestone weathering to olive or yellowish brown.

The solid strata dip gently towards the south (2° or less).

2.6 Hydrogeology and hydrology

The superficial deposits of the River Terrace Deposits and Alluvium are classified as Secondary A Aquifers.

The solid deposits of the Cornbrash Limestone Formation and Kellaways Sand Member are classified as Secondary A Aquifers with the overlying Kellaways Clay Member and the Oxford Clay Formation classified as unproductive strata.

The site is not in a Source Protection Zone.

One abstraction consent is located 960m to the north-east of the site (operated by Unigate Dairies at Langford Lane, Kidlington, for general use).

In areas adjacent to Rowel Brook in the north, and land east of the railway, there are areas identified as either primarily Flood Zone 2 and Flood Zone 3. The remainder of the site is shown as Flood Zone 1.

Rowel Brook enters the site in the north-west and flows west to east through the north of the site towards the Oxford Canal.

A small watercourse (understood to be Thrupp Ditch), runs through Rushy Meadows (located to the north of the site), flowing in a north-south direction and converging with Rowel Brook on the central-northern edge of the site.

There is also a small stream/ditch in the south of the site.

All the streams and ditches on and in the immediate vicinity of the site were dry at the time of the investigation works, after an extended period of dry weather.

The Oxford Canal forms most of the eastern boundary of the site.

2.7 Mining and mineral extraction

A former sand and gravel extraction pit is present in the central-south of the site and several historical sand and gravel pits are shown in the surrounding area, all of which are shown to have ceased and subsequently been backfilled or used as landfills.

Two historical gravel pits have been identified in the immediate vicinity of the site, identified as Fern Hill Gravel Pit / Willow Way landfill, located 168m north; and Sandy Lane West gravel pit and landfill, located to the immediate west of the site. The former gravel pit and landfill area in the central part of the site was Sandy Lane East gravel pit. All locations appear to have been situated within the geological outcrop of the Summertown-Radley Sand and Gravel Member.

Residential properties are now shown to have been constructed over the Fern Hill Gravel Pit and Western Sandy Lane Gravel Pit.

2.8 Waste management

Three historical landfill sites are shown within 250m of the site relating to the backfilling of the historical sand and gravel pits:

- » Willow Way located 168m north (formerly the Fern Hill Gravel Pits) accepted inert, industrial, commercial and household waste. Residential development now covers this area.
- » Sandy Lane West accepted inert waste. Residential development now covers this area.
- » Sandy Lane East accepted inert and industrial waste from unrecorded sources over an unspecified timeframe, but generally in the late 1960s and 1970s. Remains as undeveloped open land, approximately 0.50m to 1.00m above the surrounding ground levels.

2.9 Radon and ground gas

The far northern part of the site, north of Rowel Brook, is in a Radon Affected Area of between 3-5% and 10-30% where either basic or full protection measures are required in any buildings constructed in this area of the site.

The remainder of the site is not in a Radon Affected Area (<3%) and no radon protection measures are required.

2.10 Unexploded ordnance (UXO)

A non-specialist unexploded ordnance (UXO) assessment indicates a low UXO risk.

2.11 Physical ground model

2.11.1 Introduction

The ground conditions at the site, as proven during the site investigations, were in general accordance with the expectations from the published geological literature and Desk Study. The site investigation locations are shown on the 'Exploratory Hole Location Plan' (Hydrock Drawing 19114-HYD-XX-ZZ-DR-GE-01001) in Appendix A. For further details, please refer to the Ground Investigation Report (19114-HYD-XX-XX-RP-GE-01002).

2.11.2 Ground conditions

The ground conditions at the site, as proven during the site investigations, comprised:

- » A surface covering comprising:
 - » Topsoil Made Ground – between 0.05m and 0.80m below ground level (bgl), comprising clay. Gravel of brick and concrete (and occasional glass, metal and fabric) were encountered in the topsoil above the former Sandy Lane landfill.
 - » Landfill Made Ground – in the former Sandy Lane landfill, to between 0.05m and 3.90m bgl, comprising brown gravelly sand (predominantly ash) with abundant man-made putrescible waste and gravel sized fragments of concrete, slag, brick, glass bottles, plastic bottles, plastic wrapping, scrap metal, wires, batteries, bike frames, animal bones and newspaper (dated 1960's).
 - » Localised Made Ground – to between 0.10m and 1.20m bgl, generally comprising sandy gravelly clay or clayey sand with gravel constituents of limestone, sandstone flint and brick.
 - » Agriculturally Disturbed Topsoil across most of the site to between 0.10m bgl to 0.80m (average thickness of 0.31m bgl), comprising a brown slightly gravelly clayey sand or dark brown slightly gravelly sandy clay.
- » Superficial deposits, comprising:
 - » Alluvium; encountered close to the streams in the north and south of the site and across the east of the site between the railway line and Oxford Canal, to depths of between 0.45m bgl and 3.15m bgl, comprising soft orangish and yellowish-brown sandy clay to slightly sandy slightly gravelly clay, and a sandy gravel with gravel constituents of flint and limestone. Locally, an organic odour and remnant rootlets were noted.
 - » Head Deposits; identified locally over the River Terrace Deposits, to depths of between 0.50m bgl to 1.70m bgl comprising orangish brown sandy clay, locally slightly gravelly, of flint.
 - » River Terrace Deposits encountered in the higher areas of the site (west, centre and north) to depths of between 0.80m bgl (where extending down slopes) and 5.90m bgl, comprising generally medium dense to dense (locally loose) slightly gravelly slightly clayey sand / sandy gravel with gravel constituents of flint, limestone and ironstone and underlying the Alluvium in the east and south of the site. Locally, clay was thinly interbedded between the granular layers with a cohesive band at between 62mOd to 59mOD to the east and south of the landfill. The River Terrace Deposits were mostly extracted in the Sandy Lane pits, but a thin band remains beneath the Landfill in the central-south of the site.
- » Solid geology, comprising:
 - » Oxford Clay Formation in the centre and south of the site (at topographic highs) and in the southeast of the site to depths of between >1.90m to >10.45m bgl comprising grey to bluish grey clay, occasionally thinly laminated with shell fragments, selenite crystals and sand pockets. In a number of locations, bluish grey slightly clayey sand and siltstone bands were encountered.

- » Kellaways Sand Member sub-cropping at the surface in the north of the site, south of the site and underlying the Oxford Clay Formation, comprising a soft grey or orangish brown sandy clayey silt, sand or sandy clay.
- » Kellaways Clay Member sub-cropping at the surface in the north of the site, consisting of stiff fissured grey, yellowish brown or greenish grey clay.
- » Cornbrash Limestone Formation comprising a light grey to yellowish brown limestone gravel or stiff yellowish brown sandy gravelly clay. Encountered sub cropping in the north of the site and below the Kellaway's Clay Formation (where penetrated), and considered to extend at depth under the entire site.
- » Forest Marble Formation outcropping in the northeast of the site and underlying the Cornbrash Limestone Formation (where penetrated) comprising an upper grey mudstone with interbeds of a strong grey limestone. Limestone band thickness increased with depth.
- » White Limestone Formation encountered underlying the Forest Marble Formation (at depth where fully penetrated) comprising a light grey strong limestone.
- » The solid geological strata dip gently (0.7° to the south).

Obstructions were encountered in a number of locations within the historical landfill during the investigation.

Evidence of petroleum hydrocarbon contamination were noted in some soils, mainly those associated with the landfill. No evidence of hydrocarbon contamination was noted elsewhere including the area of Parkers Farm.

2.11.3 Groundwater conditions

Groundwater was encountered at depths between 0.10m bgl and 4.00m bgl during the investigation. Groundwater levels recorded post-fieldwork ranged between 0.03m bgl and 5.83m bgl (57.52m OD to 67.28m OD). Monitoring is ongoing.

The shallow groundwater flow within the superficial deposits is from the west of the site, from the topographic high, to the east and south-east, although in the north of the site groundwater flow is locally towards Rowel Brook (from the north and the south). In the far east of the site (in the floodplain), groundwater flows are to the south and at a shallower hydraulic gradient, but potentially influenced by the Oxford Canal which borders the east of the site.

Within the bedrock geology in the north of the site, groundwater flow is shown from west to east although this is likely due to a complicated bedrock outcropping and superficial deposits and temporal limits of the investigation. Groundwater flow is likely to be towards the south following the dip of the strata.

2.11.4 Ground gas

Six monitoring visits were undertaken as part of the previous landfill investigation works. Fourteen monitoring visits have been undertaken between September 2022 and July 2023, with ongoing monitoring (three further visits) being undertaken until September 2023.

Within the historical landfill, carbon dioxide was recorded at concentrations up to 16.3%, with maximum steady methane concentrations of 0.3% and maximum steady flow rates of 0.3l/hr recorded.

Outside of the landfill, carbon dioxide was recorded at concentrations up to 4.2%, with maximum steady methane concentrations of 0.1% and maximum steady flow rates of 2.1l/hr recorded.

3. Risk assessment review

3.1 Introduction

This section presents a summary of the findings of the investigation and subsequent assessment, as well as a summary of the source-pathway-receptor (S-P-R) contaminant linkages identified, where the risks may be unacceptable and require mitigation. For further details of the assessments refer to the Ground Investigation Report (19114-HYD-XX-XX-RP-GE-01002).

3.2 Human health risk assessment summary

3.2.1 *Historical landfill area*

Contamination data were against the Generic Assessment Criteria (GAC) applicable to the public open space residential (POS_{resi}) end use, based on the various strata:

- » Landfill Made Ground.
- » Topsoil Made Ground.
- » Natural soils.

The screening exercise identified:

- » elevated beryllium and dibenz(a,h)anthracene in the Topsoil Made Ground;
- » elevated arsenic, beryllium, lead, benzo(b)fluoranthene and dibenz(a,h)anthracene in the Landfill Made Ground;
- » ACM in the Landfill Made Ground; and
- » elevated arsenic and dibenz(a,h)anthracene in the natural soils immediately below the landfill.

These exceedances and the presence of ACM were considered a risk to future site users. As the contaminants are all non-volatile, mitigation in the form of an engineered cover system is required to break the pathway between impacted soils and site end users.

3.2.2 *Wider site area*

Contamination data were against the GAC applicable to the residential with homegrown produce end use, based on the various strata:

- » Made Ground.
- » Topsoil.
- » Natural soils.

The screening exercise identified arsenic in the Made Ground, arsenic, beryllium and dibenz(a,h)anthracene in the Topsoil and arsenic and beryllium in the natural soils at concentrations above the GAC. However, subject to EHO agreement, these exceedances were not considered to pose an unacceptable risk to human health and no mitigation measures are required.

Asbestos

Suspected asbestos cement fragments were observed on the surface in the vicinity of Parkers Farm as well as asbestos sheet roofing as part of the two barn structures. No visible evidence of ACM was noted in the exploratory holes, and no asbestos was detected in the soils on site, including around the farm buildings, suggesting that asbestos risk is limited to ACM on the surface.

Subject to regulatory and Warranty Provider approval, whilst Hydrock consider it plausible for asbestos to be present in any of the Made Ground soils, overall, the risk associated with the identified presence of asbestos is considered to be low. However, mitigation will be required (removal of ACM from barns and removal of Made Ground) to ensure risks remain negligible.

3.1 Phytotoxicity risk assessment

3.1.1 *Historical landfill area*

Within the landfill, the Topsoil Made Ground and the Landfill Made Ground, copper, nickel and zinc exceeded the phytotoxicity GACs. In addition, in the Landfill Made Ground and natural soils boron exceeded the GAC. Whilst the exceedances in the Topsoil Made Ground and natural soils are marginal, the exceedances in the Landfill Made Ground are significant.

Detriment to plant life is difficult to quantify and many of the GAC are based on agricultural crop yields rather than harm to particular plant species. However, the significant exceedance of the GAC, especially for the Landfill Made Ground, indicates the probability of an unacceptable risk to plant life and mitigation should be undertaken.

The requirement for mitigation of risk to human health will also serve (in part) to mitigate risks to plant life.

Notwithstanding the concentrations of contamination identified, there is little to no suitable subsoil or topsoil growing medium on the site and this will require import.

3.1.2 *Wider site area*

For the wider site, there were no exceedances of the GAC, and no mitigation is required in relation to phytotoxicity.

3.2 Pollution of controlled waters risk assessment summary

3.2.1 *Historical landfill area*

The data indicates that the Water Quality Targets (WQTs) were exceeded in relation to chromium (III), copper, manganese, nickel ammoniacal nitrogen and sulphate within groundwater samples taken within the landfill site area.

Whilst there are concentrations of Chemicals of Potential Concern (CoPC) elevated above the WQTs, based on the investigation works undertaken to date, and subject to agreement with the Environment Agency, Hydrock does not believe the site poses a significant risk to Controlled Waters.

3.2.2 *Wider site area*

The data indicates that the WQTs were exceeded in relation to cadmium, cobalt, chromium (III), copper, manganese, nickel, ammoniacal nitrogen and sulphate in groundwater samples taken across the wider site area.

Whilst there are concentrations of CoPC elevated above the WQTs, based on the investigation works undertaken to date, and subject to agreement with the Environment Agency, Hydrock does not believe the site poses a significant risk to Controlled Waters.

3.3 Ground gas risk assessment summary

3.3.1 *Radon*

The far northern part of the site, north of Rowel Brook, is in a Radon Affected Area of between 3-5% and 10-30% where either basic or full protection measures are required in any buildings constructed in this area of the site.

The remainder of the site is not in a Radon Affected Area (<3%) and no radon protection measures are required.

3.3.2 Methane and carbon dioxide

The risks associated with the ground gases methane (CH₄) and carbon dioxide (CO₂) were assessed using BS 8485:2015+A1:2019, which cites the guidelines published by CIRIA (Wilson et al 2007).

3.3.3 Historical landfill area

The key findings of the ground gas assessment within the landfill area are:

- » There is no recognisable difference between the gas concentrations in the landfill and the underlying Oxford Clay, indicating fissuring is present in the Oxford Clay.
- » Recorded concentrations of carbon dioxide are as high as 16.3%, but generally less than 15%.
- » The gas flow readings are generally low (<1.0L/hr).
- » The calculated Gas Screening Values (GSVs) would generally accord with CS1 (Characteristic Situation 1) conditions. However, given the number of carbon dioxide values that are in excess of 10%. Hydrock would recommend the classification is raised to CS2 for the landfill itself.

In conclusion, if the landfill site was proposed for residential land use, on the basis of the low gas flows, the consistently high carbon dioxide concentrations, a CS2 classification is appropriate for the site, subject to agreement by Local Planning Authority (LPA) and Warranty Provider.

As the landfill area is proposed for POS land use, no mitigation is required.

3.3.4 Wider site area

The key findings of the ground gas assessment across the wider site are:

- » Gas flow readings are generally low (<1.0L/hr) which is not considered significant. It is noted that readings of up to 2.1L/hr are present although noted that these are recorded where groundwater levels are high and above the response zone (flooded wells), therefore these data are excluded from the assessment.
- » The calculated GSVs generally accord with CS1 conditions, after excluding data from flooded wells with methane and carbon dioxide at concentrations typically below 1% and 5% respectively.
- » There is no indication of significant gas migration from the landfill to surrounding boreholes.

In conclusion, the wider site is provisionally classified as CS1. Based on the data to date no mitigation measures are required across the wider site.

3.4 Water pipeline and drainage pipes risk assessment summary

3.4.1 Historical landfill area

Within the landfill, polycyclic aromatic hydrocarbons (PAHs) have been identified in exceedance of the threshold values and if potable water pipes are installed across the landfill area, barrier pipe should be used.

Localised concentrations of petroleum hydrocarbons above 100mg/kg were recorded in the landfill. Discussions with regards to non-potable water pipework should be undertaken with suppliers. However, it is likely that if pipes cross the landfill, Protectaline pipework would be required.

In addition, over-excavation of service runs, and replacement with clean soils would be required where pipes cross the landfill.

As no utilities or pipework are to be installed within the landfill area, no mitigation is required.

3.4.2 Wider site area

The wider site is mostly previously undeveloped, and the preliminary risk assessment and investigation has indicated no plausible contaminant sources. It is envisaged that standard pipework will be suitable for delivery of potable water to the site. However, confirmation should be sought from the water supply company at the earliest opportunity.

Concentrations of PAHs and BTEX (benzene, toluene, ethylbenzene and xylene) are below 100mg/kg and concentrations of petroleum hydrocarbons are below 200mg/kg, therefore PVC-U, PP or PE pipework is considered suitable.

3.5 Geo-environmental exposure model

A summary of the S-P-R contaminant linkages for which the risks may be unacceptable and require mitigation based on the risk assessments are discussed below. This assumes the risk to Controlled Waters from the site are agreed by the Environment Agency as low and no further consideration is required. If this assumption is not agreed during regulatory discussions, the S-P-R contaminant linkages noted below will need to be updated.

3.5.1 Potential sources of contamination

Historical landfill area

- S1 CoPC identified in soils.
- S2 Asbestos fibres and ACM in the Landfill Made Ground.

Wider site area

- S1 Asbestos fibres from insulation or asbestos-containing materials in the buildings.
- S2 ACM and possible asbestos fibres within Made Ground soils around Parkers Farm.
- S3 Radon (north of Rowel Brook).

3.5.2 Potential receptors

- R1 Human Health (site end users, neighbours).
- R2 Plant life.
- R3 Property (buildings).

3.5.3 Potential pathways

Human Health

- P1 Ingestion, inhalation or dermal contact with soils.
- P2 Inhalation and ingestion of soil-derived dust.
- P3 Inhalation of fibres.
- P4 Migration through soils and accumulation in indoor air.

Plant Life

- P5 Root uptake.

Property

- P6 Migration through soils and accumulation in indoor air.

3.6 Summary S-P-R Contaminant Linkages

Based on the proposed development, as stated in Section 1.1, the S-P-R contaminant linkages which require mitigation by the remediation works described herein are discussed in Table 3.1 (historical landfill area) and Table 3.2 (wider site area).

The residual risk areas and mitigation requirements are also indicated on Hydrock Drawing 19114-HYD-XX-XX-DR-GE-01037.

Table 3.1: Residual risks following risk evaluation – Historical landfill area

Contaminant Linkage	Sources	Pathways	Receptors	Comments and recommendations
CL1	CoPC identified in soils.	Ingestion, inhalation or dermal contact with soils and soil-derived dust.	Site end users.	Exceedance of the GAC. Mitigation required in the form of an engineered cover system.
		Inhalation and ingestion of soil-derived dust.	Site end users. Neighbours.	
		Root uptake	Plant life.	Exceedance of the GAC. Imported growing material will be required to form the engineered cover system.
CL2	Asbestos fibres and ACM in Landfill Made Ground.	Inhalation of fibres.	Site end users. Neighbours.	Chrysotile and amosite fibres (<0.001% w/w) and chrysotile rope (0.323%w/w) detected in Landfill Made Ground. Mitigation required in the form of an engineered cover system.

Table 3.2: Residual risks following risk evaluation – Wider site area

Contaminant Linkage	Sources	Pathways	Receptors	Comments and recommendations
CL4	Asbestos fibres from ACM at the site surface and in existing building materials.	Inhalation of fibres.	Site end users. Neighbours.	Asbestos sheet roofs were noted in farm structures and sporadic fragments were noted on the site surface in the vicinity of the farm structures.

Contaminant Linkage	Sources	Pathways	Receptors	Comments and recommendations
CL5	Asbestos fibres in soils around Parkers Farm.	Inhalation of fibres.	Site end users. Neighbours.	Although not noted in soils, the potential for fibres remains. Surface ACM and suspected ACM should be removed by a licenced specialist. Any suspected ACM encountered during earthworks will need to be handpicked and removed from site. If ACM encountered in the remaining building on site, removal under controlled conditions will be required. Removal of ACM under controlled conditions should limit off-site emissions. Shallow Made Ground around the farm structures should be removed (and reused in the noise / visual screening bund as part of the MMP) and the remediation documented.
CL6	Radon	Migration through soils and accumulation in indoor air.	End users of new buildings.	The area north of Rowel Brook is in a Radon affected area. Basic or full radon protection measures in buildings in this area. To be installed by competent installer, validated and verified.

3.7 Contamination risks to remediation workers and groundworkers

Whilst risks to remediation, construction and maintenance workers are not discussed in detail, the following section discusses potential risks that should be considered by Contractors working at the site.

Information presented in this document is provided to assist in managing the risks associated with contamination in soil at the site but is not definitive. The Contractors are responsible for undertaking their own assessments and assessing what risks are present and what control measures are required.

Task specific risk assessments and method statements should be in place, and risks and required mitigation measures communicated to all relevant personnel prior to the works commencing. All works on site will require the use of suitable air, dust and noise monitoring, personal protective equipment (PPE) and respiratory protective equipment (RPE) as required by current guidance, practice guidance and legislation, or as deemed necessary.

In addition to the information provided below, the Contractors' attention is drawn to the General Requirements set out in Appendix D, which details the general requirements and responsibilities of the Contractors in relation to health and safety, site set up and operational requirements. It should be noted that the guidance provided in Appendix D is considered to be the minimum standards to be met by the Contractors and it is the Contractors' responsibility to ensure works are undertaken in line with current guidance, practice guidance and legislation.

3.7.1 *Metals, metalloid and PAHs*

The soils contain elevated concentrations of metals, metalloids and PAHs recorded as pervasive throughout the Made Ground of the landfill. Appropriate health and safety precautions will need to be undertaken when working with, or in, soils at the site, in accordance with Ground Works Contactor risk assessments and minimum requirements as detailed in Appendix D.

3.7.2 *Ground gas*

It is noted that concentrations of carbon dioxide (an asphyxiant) in the soil exceed HSE Workplace Exposure Limits for personnel in the working environment of 1.5% for short term (15 minutes) exposure and 0.5% for long term exposure. Furthermore, soil concentrations of oxygen are below the HSE recommendations of 18%.

Soil gas concentrations are not necessarily reflected by those in the breathing zone, as such, all Contractors and maintenance workers should be made aware of the possible presence of carbon dioxide and should take all necessary health and safety precautions when working in trenches or confined spaces, in accordance with Ground Works Contactor risk assessments and minimum requirements as detailed in Appendix D.

3.7.3 *Asbestos*

Visible fragments of suspected asbestos cement sheeting have been identified on the surface around Parkers Farm during the ground investigation and visible on the barn roofs and are likely present at the landfill. In addition, asbestos fibres (<0.001%w/w) and rope loose fibrous debris (0.323%w/w) are present in the soils in the landfill was identified in laboratory testing.

All site staff should be made aware that there is a likelihood of encountering further ACM within the Made Ground anywhere on the site, and at any stage of the development. It is advised that the Contractor should supply suitable and sufficient 'Asbestos Awareness' training (specific to asbestos in soils) to all site staff who could foreseeably encounter asbestos containing materials during the course of their work.

The Contractor for each stage of works must undertake a suitable and sufficient Risk Assessment in accordance the Regulation 6 of the Control of Asbestos Regulations 2012 (CAR2012). The results of the assessment should be used to compile a methodology in accordance with Regulation 7 of CAR2012, which limits potential exposure and spread of asbestos fibre. Appropriate training should be provided to all site staff identified within the risk assessment as having the potential to be exposed or encounter asbestos during their work in accordance with Regulation 10 of CAR2012. It is the responsibility of the Contractor to ensure that methods used and mitigation measures applied are suitable and sufficient to prevent exposure to airborne asbestos so far as is reasonably practicable in accordance with Regulation 11 of CAR2012.

It is recommended that any asbestos cement sheeting encountered is handpicked under controlled conditions in accordance with HSG210 'Asbestos Essentials'. Hand picking needs to be undertaken by suitably qualified Contractors in accordance with HSE guidance and an Environmental Permit. All ACM must be suitably packaged, placed in a dedicated, covered and lockable skip pending off-site disposal to a suitably licensed waste facility.

In addition to the presence of Occasional/Random/Sporadic/Random visible fragments of suspected asbestos cement sheeting, the soils contain low concentrations of asbestos fibre. The Contractors for each stage of works must manage the risks in accordance with HSE Guidance and CAR 2012. However, the asbestos fibres detected at the site are within a soil matrix, and if this is kept damp, this should assist in minimising the risk of the release of airborne fibres. Further details are provided in Appendix D.

4. Remediation strategy

4.1 Overview

The RS&VP, included in the following sections is presented on the basis of a mixed use development, including residential with gardens, non-residential use, POS and associated infrastructure.

In addition to this document, all works shall be completed in accordance with a suitable GDR and EWS which will specify the requirements for any backfilling works.

4.2 General compliance issues

The implementation of the remediation strategy shall be in accordance with documented quality assurance procedures, including the following:

- » **Remediation Strategy and Verification Plan** - (this document) which sets out the requirements for remediation and for gathering data to demonstrate that the remediation objectives detailed in this report are met.
- » **Verification Report** - this will provide a record of the remediation activities undertaken at the site and the data collected as part of the verification plan to support compliance with remediation objectives and criteria. It will also include descriptions of the works with associated 'as built' drawings and details of any unforeseen conditions encountered during the works and how they were dealt with.

4.3 General comment

In addition to the above, the Contractor must manage the risks in accordance with their legal requirements, will need to prepare appropriate health and safety documentation and obtain appropriate approvals, licences, consents and permits prior to commencement.

The methodology for the remediation is detailed in the RS&VP (this document), which will need to be submitted to the Warranty Provider and the regulatory authorities for approval.

All works need to be undertaken in accordance with the RS&VP (this document) and all remediation works are to be overseen by suitably experienced site staff. A site watching brief or periodic visits shall also be made the nominated Consultant (Hydrock) to undertake the necessary verification.

It should also be noted that if soils are to be reused on site, or excess soil is proposed for use at another (receiver) site, works will need to be completed in accordance with a MMP prepared in accordance with the CL:AIRE DoWCoP. Prior to work starting, the MMP will have been checked and Declared by a Qualified Person (QP), with confirmation of acceptance by CL:AIRE. An MMP cannot be applied retrospectively.

If processing of Made Ground is required, an appropriate Environmental Permit will also be required.

Finally, all earthworks will need to be undertaken to an appropriate Geotechnical Design and Earthworks Specification.

4.4 Summary of remediation proposals

4.4.1 Introduction

Subject to regulatory agreement, Hydrock consider the following remedial activities will be required to deliver the site as Suitable for Use (SFU) for the end use as detailed in Section 1.1.

In addition to any construction phasing, the mitigation works shall be undertaken in a number of stages, separated into:

- » Demolition Stage (to be undertaken by others and not therefore considered in detail within the RS&VP);
- » Enablement Stage; and
- » Construction Stage.

Each stage of remediation shall be undertaken (as required) with each phase of the development validated and verified as the works in that phase are completed. There will also be a requirement to undertake works to ensure any soils imported to the site, or to be reused in the Works, are geotechnically suitable.

4.4.2 Demolition Stage

Buildings which are not to be retained as part of the development will require demolition. The following works are considered necessary during the Demolition Stage:

- » demolition asbestos survey;
- » site clearance;
- » removal of asbestos (both from the buildings (if present) and from the surface of the site) by specialist Contractors in accordance with the asbestos survey and relevant legislation;
- » demolition of remaining site buildings and ancillary structures to slab level; and
- » processing the demolition arisings to a suitable specification in accordance with the WRAP 'Quality Protocol: Aggregates from inert waste'.

Demolition does not form part of this RS&VP and will need to be specified separately.

4.4.3 Enablement Stage

The following works are considered necessary during the Enablement Stage:

Historical landfill area

- E1. Compaction of historical landfill.
- E2. Installation of the engineered cover system on the landfill area.

Wider site area

- E3. Break out of all hardstanding and below ground obstructions and processing for reuse (predominantly Parkers Farm).
- E4. Removal of Made Ground around Parkers Farm and supplementary testing.
- E5. Cut and fill works in accordance with a suitable GDR/EWS, this Remediation Strategy and a MMP, including reuse of excavated Made Ground soils if considered suitable (e.g. in the core of the noise / visual screening bund).
- E6. Stockpiling of topsoil for use in Construction Stage works.
- E7. Disposal of unsuitable soils.
- E8. Validation and verification during enablement works.

4.4.4 Construction Stage

Whilst the groundworks for the Construction Stage may be undertaken by the same Contractor that is undertaking the Enablement Stage, for the benefit of this part of the RS&VP (and to separate out the various sequential works packages), the Contractor for the Construction Stage works is referred to as the Ground Works Contractor.

The Ground Works Contractor shall undertake the following remediation measures during construction:

Historical landfill area

No works are anticipated in the landfill following the enablement works.

Wider site area

- C1. Site watching brief during construction.
- C2. Appropriate materials handling and stockpiling in accordance with the MMP.
- C3. Installation of basic/full radon protection measures in buildings north of Rowel Brook.
- C4. Off-site disposal of unsuitable or excess material.
- C5. Validation during construction works (radon protection measures).

4.5 Project Setup and Management

4.5.1 Background

Prior to appointment of the Contractor(s), this report, along with copies of supporting documents, will be issued to the Local Authority, the Environment Agency and the Warranty Provider for comment. Any comments will be reviewed and this document may require updating to incorporate the comments.

Further information with regard to roles and responsibilities are provided in Table 4.1, which will need to be updated as further details are available.

Unless otherwise agreed with the Client in writing, the Contractor(s) is deemed to have included in the contract sum for all requirements set out in this document. Hydrock are to be notified in writing of any exclusions in the Contract.

Prior to commencement of site activities, detailed planning of the project shall be undertaken by the Contractor(s), including liaison (as necessary) with the key stakeholders and project team as listed in Table 4.1. Principal Contractors, Subcontractors etc. will be confirmed through appointment in advance of commencement of relevant works along with regulators from respective statutory bodies.

The project is to be operated under the Construction, Design and Management (CDM) Regulations, (2015). Under the CDM regulations, the Client should appoint a Principal Designer, who would provide the Pre-Construction Information Report (PCIR) and a Principal Contractor who would provide a site-specific Construction Phase Health and Safety Plan (CPHASP) prior to works commencing. If the Client does not appoint a Principal Designer, they will assume the role. The Principal Designer will review the CPHASP and notify the local office of the Health and Safety Executive (HSE) of the works prior to commencing (via form F10).

The Contractor shall provide to the Client, details of all individuals who will be appointed in the key roles of management and supervisory responsibility, including *curricula vitae* demonstrating their experience, training and competency to undertake the defined roles.

All operatives must be appropriately skilled and experienced for the type of work and hold relevant CITB Certificates of Competence or be training to obtain CITB Certificates of Competence, prior to commencement on site.

Site staff responsible for supervision and control of the work are to be trained Supervisors experienced in the assessment of the risks involved, and in the methods to be used. The Client shall retain the right to reject any personnel considered not to be suitably qualified or competent.

Table 4.1: Project Stakeholders and Project Team

Role	Company / Organisation	Contact Name	Email	Tel
Client Contact	Oxford University Development Limited	-	-	-
Principal Contractor	TBC	-	-	-
Subcontractors	TBC	-	-	-
Principal Designer	Oxford University Development Limited	-	-	-
Designer	TBC	-	-	-
CDM-Advisor	Oxford University Development Limited	-	-	-
Watching Brief Consultant	Hydrock	-	-	01604 842888
Temporary Works Designer	-	-	v	-
Local Planning Authority	Cherwell District Council	Planning Officer	planning@cherwell-dc.gov.uk	01295 227001
Regulator (Environmental Health)	Cherwell District Council	Environmental Health Officer -	HPandCompliance@cherwell-dc.gov.uk	01295 227001
Regulator (controlled waters & waste)	Environment Agency	-	enquiries@environment-agency.gov.uk	03708 506 506
Regulator (ecology)	Natural England	-	enquiries@naturalengland.org.uk	0300 060 3900
Regulator (heritage)	Historic England	-	customers@HistoricEngland.org.uk	020 7973 3700
Health and Safety	Health and Safety Executive	-	None	0300 003 1747
Warranty Provider	-	-	-	-

4.5.2 Appointment of appropriate contractors

At the time of writing this report the Contractor(s) have not been appointed.

The Enablement Contractor(s) will need to have suitable experience working in a similar setting, with similar ground conditions and with the CoPC identified at the site (ACM; and asbestos fibres, metals and PAHs in soil). They must also have experience in the correct materials management of soils and the required earthworks.

The Contractors (Enablement and Groundworks), must also be able to manage the risks in accordance with the legal requirements outlined in this document and will need to prepare appropriate health and safety documentation and obtain appropriate approvals, licences, consents and permits prior to commencement.

It is the responsibility of the Contractor(s) to have read and understood the requirements of the RS&VP (including all cross-referenced documents) and associated designs and specifications. If there are any queries, please contact Hydrock or the Client for clarification.

4.5.3 *Appointment of appropriate subcontractors*

Details of all Subcontractors employed on the project shall be submitted to the Client for approval prior to the commencement of works to demonstrate that they are suitably qualified/experienced to undertake the works and are not considered to pose a risk to the delivery of the project. The Contractor(s) will retain the responsibility for the Works.

The Client will retain the right to reject any Subcontractor that is not considered suitable.

If the Client (or the nominated Consultant) gives notice that Subcontractors are unsuitable, the Contractor(s) shall provide details of alternative Subcontractors for approval.

4.5.4 *Site supervision*

All Works are to be undertaken with a site watching brief by the Client and their nominated Consultant (Hydrock). The nominated Consultant shall be on site on a watching brief and site audit basis (part time or full time as required) and undertake the following tasks:

- » Liaison with the Contractor(s) and the Client Project Manager.
- » Reviewing of testing activities. It should be noted that this does not replace or absolve the Contractor(s) from the responsibilities set out in the Specifications.
- » Observing and commenting on the quality of the Works. It should be noted that this does not replace or absolve the Contractor(s) from the responsibilities set out in the Specifications.

The Contractor(s) is to provide supervision by an appropriate (competent), experienced person who has read and understands the requirements of the RS&VP.

4.5.5 *Collection of samples and testing*

For all stages of the Works, sampling and testing of soils shall be undertaken, using suitably trained staff, in accordance with BS 5930:2015+A1:2020 'Code of Practice for Site Investigations' and BS 10175:2011+A2:2017 'Investigation of Potentially Contaminated Sites – Code of Practice'.

Soils for inorganic analysis shall be sealed in air-tight polythene tubs. Soils for organic analysis shall be sealed in amber glass jars with the minimal practicable headspace.

Groundwater samples shall be collected in suitable containers with the correct preservatives, as provided by the laboratory.

All samples shall be scheduled on Chain of Custody forms prior to being dispatched to the UKAS accredited laboratory for analysis.

All testing shall be undertaken at a laboratory which holds UKAS and MCERTS accreditation for the specific tests. Where it is not possible to obtain the testing of a material for a specific property to a

UKAS or MCERTS accredited method, the Contractors shall obtain permission from the nominated Consultant for the test to be completed at the proposed laboratory, before the test is undertaken.

If testing is not to be undertaken by the nominated Consultant, the results of all testing undertaken (and a copy of the test certificates), shall be submitted to the nominated Consultant as soon as they are reported, and no more than one day after issue of the test certificate to the Contractor(s). It is recognised that different tests may take different time to complete. However, the Contractor(s) shall advise the nominated Consultant of any delay that they are aware of regarding the completion of any tests (e.g. a sample is being retested and the report will be delayed). In addition, the Contractor(s) is to make available on site, at all times, a file containing all test certificates in addition to the testing summary, for inspection by the nominated Consultant.

5. Remedial strategy implementation - Enablement Stage

The tasks detailed in Section 4.4.3 are required in this stage of the works and further description of the works required is presented below. Tasks can occur concurrently with one another and there is no requirement for the tasks to take place in the order presented below.

5.1 Task E1: Compaction of historical landfill

To assist with land forming, it is recommended the landfill is compacted using a High Energy Impact Compactor, utilising specialist compaction equipment fitted with Surface Covering Dynamic Compaction Control (SCDCC) or similar to provide a continuous measurement of the ground response.

Typical compaction plant which is suitable for this operation and can be fitted with SCDCC is the Bomag BW 226 and BW 332). These works would be undertaken to densify the existing landfill soils, reduce site levels and allow the cover system to be placed, whilst minimising disposal.

During compaction, monitoring of ground gas concentrations in immediately adjacent monitoring wells is recommended. Should ground gas concentrations become significantly elevated, works should cease and the nominated Consultant contacted to provide further assessment of the method.

Monitoring of ground gas levels in immediately adjacent wells post-compaction works will be undertaken to confirm levels have returned to pre-compaction concentrations.

5.2 Task E2: Installation of the engineered cover system on the landfill area

In order to break the source pathway receptor linkage between the contaminants in the Landfill Made Ground and the end users of the site, Hydrock proposes the following engineered cover system:

- » Beneath areas of hard standing (roads, pavements etc), excavate as required by the road design and replace with suitable construction thickness as per road design and capping requirements. The hard standing will break the link between the soils and potential receptors.
- » An engineered cover system placed in all landscaped areas.

The engineered cover system will be installed by the Ground Works Contractor and verified by Hydrock, and is to comprise

- » a bonded geogrid (e.g. Tensar TX160G); and
- » imported Subsoil / topsoil (450mm in public open space) of which at least the upper 150mm shall be topsoil.

If a replacement badger tunnel is proposed in the POS area, this will require design measures to prevent the badgers excavating into the underlying landfill and may require some over-excavation of landfill soils.

Discussion with regard to the justification of the cover system is provided in Appendix E.

The engineered cover system installation shall be undertaken in the following steps by the Contractor. It is the responsibility of the Contractor and the OUD Site Supervisor to ensure the cover system is installed as required:

- » Establish the finished ground levels over the site and from this, determine the required level of the underside of the cover system.
- » Install drainage and other services. Trenches are to be over-excavated and backfilled with clean soils as detailed in Section 6.1.

- » Confirm the level of the ground surface to ensure that it is at the level of the underside of the cover system.
- » Place 450mm (in public open space), of clean validated Subsoil and Topsoil (of which a minimum 150mm shall be Topsoil) over a bonded geogrid and verify the thickness. Hydrock are to be called to validate – minimum 48 working hours' notice.

Please refer to see Section 7 for the Contractor validation requirements and the verification requirements to be undertaken by Hydrock.

Section 8 provides details with regards to materials management and suitability for use.

5.3 Task E4: Break out of all hardstanding and below ground obstructions and processing for reuse

5.3.1 *Hardstanding and below ground structures*

The Contractor shall break out all hardstanding and remove below ground structures as necessary.

All broken up materials shall be segregated and stockpiled within the approved working area of the site.

During the excavation of slabs etc., the nominated Consultant will undertake additional visual investigation, with any additional plausible S-P-R contaminant linkages identified (tanks/drainage runs etc.,) to be added to the remedial requirements.

5.3.2 *Excavations and services*

The Contractor shall provide adequate protection against collapse of excavations and suitable groundwater control measures shall be put in place until the voids are in-filled in accordance with the EWS.

The Contractor shall ensure that, where structures or services cross the site boundary and are to remain, the risk of any future contamination entering or leaving the site area through these pathways is negligible.

5.3.3 *Arisings and stockpiling*

All works for the Enablement Stage, are to be undertaken in accordance with a Contractor written and declared MMP.

Where appropriate, brick, concrete etc. arising from the Works are to be processed for reuse as temporary works during construction, or use in the permanent works. Any soils excavated are to be stockpiled separately for processing during the enablement works.

The Contractor shall segregate excavated materials, having due regard for their subsequent reuse and the classifications as per the EWS and MMP.

The Contractor is to sort, screen, crush, process and test all arisings to comply fully with the requirements for a Class 6F material as specified.

These processed materials will be stockpiled at an agreed location for use in the cut to fill works as required.

In accordance with the EWS, the Contractor shall inspect the crushed product and remove any unsuitable material, including but not limited to, metal, steel reinforcement, rags, plastic, timber and degradable material. In addition, the Contractor shall test the crushed product to ensure it is geotechnically and chemically suitable for use on site, in accordance with the EWS, MMP and RS&VP.

All recycled aggregate materials must be produced under the 2013 Aggregates Protocol, with full certificates provided and meet the requirements of this RS&VP, or be part of the MMP. All crushing, screening and processing is to be undertaken using an appropriate Environmental Permit.

Any soils excavated during the demolition works are to be stockpiled separately from hard material for processing and reuse (where suitable) in the site wide earthworks.

Any materials that are not suitable for reuse are to be disposed of by the Contractor to an appropriately licenced facility.

PAK testing is to be undertaken on all asphalt prior to excavation and during processing. Any asphalt containing coal tar is to be disposed of off-site.

The classifications of asset material to be generated from the demolition are:

- » asphalt / brick / block - temporary works material (6F2/TW); and
- » 6F2 (Full Specification) material.

All stockpiles are to be kept separate and clearly labelled.

Concrete, crushed to the 6F2 grading (6F2/TW) is to be used as temporary works during construction. 6F2 (Full Specification) materials are to be used in the permanent construction.

The processed aggregate materials and excavated soils shall be segregated and stockpiled separately at a safe batter on the as free issue to the Client. The stockpile locations are to be agreed with the Client prior to commencement of the works.

The Contractor shall schedule geotechnical testing at a rate as per Table 5.1. Contamination testing shall be undertaken as per Section 8.4 of this document.

Table 5.1: Geotechnical testing requirements (recycled aggregate)

	Work, Goods or Material		Test	Frequency
601, 631 to 637, 640	Class	General Description		
		Temporary Works material	Grading	1 per 2,500m ³
	6F2/TW	6F2 Graded asphalt / brick / block	Effective angle of internal friction and effective cohesion	1 per 5,000m ³
			Coal Tar test (PAK test)	On all asphalt before crushing
			Chemical Suite (see Section 8.4)	1 per 500m ³
			Selected granular fill	Grading/uniformity coefficient/mc
	6F2		Effective angle of internal friction and effective cohesion	1 per 5,000m ³
			OMC/MDD (4.5kg Rammer)	1 per 1,000m ³
			Organic Matter & BRE SD1 (full suite)	1 per 500m ³
			Los Angeles Coefficient	1 per 3,000m ³
			Constituent Parts	1 per 500m ³
			Chemical Suite (see Section 8.4)	1 per 500m ³

The Enablement Contractor shall supply all test results and test certificates as soon as they are issued.

All crushed materials and soils are to be kept in quarantine and in clearly identifiable storage areas until acceptable test results have been approved by the nominated Consultant prior to the material being used for the infilling of voids and in general earthworks.

Processed aggregate materials which fail to meet the Specification and cannot be reused, and other unsuitable materials shall be removed from site, at the Enablement Contractors cost, as waste to an appropriately licenced facility or to suitable off-site facilities for recycling. The Contractor shall replace at their cost, on a like for like volume basis, any processed material (6F2, 6F2/TW etc.) that is removed from site.

5.4 Task E5: Removal of Made Ground around Parkers Farm and supplementary testing

Made Ground in and around Parkers Farm will be removed by the contractor, stockpiled and tested for reuse potential as detailed in Section 8.3 and 8.4.

From testing of Made Ground during ground investigation, no exceedances of contaminants have been reported based on a POS_{resi} scenario. Although asbestos fibres have been reported in these soils, they are considered to be suitable for use in the core of the noise / visual screening bund once any visual ACM has been removed, as a 1.00m 'cover' of the 'core' will be implemented.

5.5 Task E6: Cut and fill works in accordance with a suitable GDR/EWS, this Remediation Strategy and a MMP

5.5.1 Cut and fill

Cut to fill / excavation is envisaged during enablement to:

- » excavate soils to the level required (as per the fill requirements below);
- » process soils to ensure removal of all unsuitable material (in accordance with the MMP and EWS) and render Made Ground soils suitable for use in the earthworks;
- » fill as required to construct the noise / visual screening bund;
- » fill areas of the site to a level to allow construction, leaving the site at a level to be agreed with the Engineers; and
- » install the cover system in the landfill area.

5.5.2 Processing

During the Enablement Works, materials shall be excavated and consolidated into designated stockpiles, with the different soil types stockpiled in different, clearly marked stockpiles. The stockpiles are to be managed by the Contractor and shall be subject to operational constraints at the time of stockpiling.

Further information with regard to reuse and processing is provided in Section 8.6.

Following excavation, the Contractor shall segregate materials, having due regard for their subsequent reuse, and testing is to be undertaken in accordance with the RS&VP and the EWS.

Soils and hardstanding/obstructions are to be processed as required. For the avoidance of doubt, processing (as used in this RS&VP) includes crushing, sorting, screening, separating, addition of additives (e.g. lime or cement during modification, if necessary), treatment, stockpiling, inspection and testing to ensure the excavated soils are suitable for use in accordance with this RS&VP and an appropriate EWS.

Any processed Made Ground soils are to be stockpiled for reuse in the bulk fill earthworks. Appropriate precautions shall be taken by the Contractor to ensure that the stockpiled material does not result in risks to neighbouring land users, and is to take appropriate mitigation measures and environmental precautions as considered necessary at storage locations. However, as a minimum, stockpiles shall be compacted to prevent dust and shall be kept wet in periods of dry weather.

Stockpile locations (permanent and temporary) shall be clearly marked and documented on working drawings maintained in the site office.

Any excavated soils proposed for reuse shall be reused in accordance with the QP declared MMP. A record of the excavated quantities and reuse locations shall be maintained on site. Example tracking system and forms are to be provided in Appendix B. A copy of all tracking forms shall be held at the site office.

5.5.3 *Placement of soils and appropriate materials handling*

Suitable site-won soils shall be used at the site as fill material in all fill areas (if required) and void spaces (for example following obstruction removal). Further details are provided in Section 8. However, it is expected that all soils excavated during construction can be reused, subject to appropriate processing, the type of soil, available cut and fill volume and treatment of otherwise unsuitable soils. If unsuitable or excess soils are present, they are to be disposed of off-site.

Backfilling of excavations during the Enablement Stage shall be undertaken in accordance with the GDR and EWS.

Made Ground and natural soils are to be excavated as part of the Enablement Works. The Contractor is to make every effort to segregate the different soil types during excavation, to:

- » allow the maximum possibility of reuse on site of suitable soils (preventing cross-contamination);
- » reduce the possibility of excavated soils being/becoming geotechnically unsuitable (or minimise the volumes of unsuitable soils); and
- » reduce disposal costs (by preferentially disposing of natural soils (which are likely to be inert)).

Reuse of soils will need to be undertaken in accordance with this RS&VP and the CL:AIRE DoWCoP.

The Contractor is to write and declare the MMP for the enablement works, with the MMP written in general accordance with an overarching Materials Management Strategy. The Contractor is to undertake the management of the MMP and provide the required validation information.

The Contractor is to undertake a watching brief for materials which may be contaminated (see Section 9). The most likely contamination is observable fragments of ACM. If suspect materials are encountered, please contact Hydrock immediately. If ACM is encountered, it is to be dealt with as per Appendix D (D8).

Subject to removal of any ACM encountered (during excavation or placement), no testing of soils is required during the bulk cut and fill (as these have been tested during the site investigation and are suitable for use as part of bund construction, below floor slabs, pavements and the cover system).

Any excavated materials are to be processed as necessary and confirmed suitable for use (as per Section 8).

Any imported materials or site-won soils to be reused as part of the cover system are to be tested as detailed in Section 8.

5.6 *Task E7: Stockpiling of topsoil for use in Construction Stage works.*

Topsoil will be used within the Enablement Stage for areas outside of the development plots, but will also be placed on each development parcel for use in the Construction Stage.

Topsoil is to be managed in accordance with the Enablement Stage MMP, with the final placement managed in accordance with a parcel specific MMP.

Topsoil may be placed in a thin, controlled layer across the individual development parcels, or may be placed in a stockpile for reuse during construction.

5.7 Task E8: Disposal of impacted soils (or treatment and/or reuse if considered suitable)

Any observed ACM must be removed from the soils by hand picking.

The presence of asbestos fibres in materials does not mean they are unsuitable for use as long as appropriate mitigation is employed and they are reused in accordance with the MMP and reused in the core of the noise / visual screening bund, or below buildings or roads/pavements (except where utilities are present).

Any surplus (i.e. soils which cannot be reused on site due to volumes), unsuitable soils (i.e. soils which fail the reuse criteria or the Remedial Target Values (RTVs) (see Section 8.4) where required, and cannot be reused in an appropriate location, or soils which are not geotechnically suitable (as defined by the EWS), shall be disposed of by the Contractor.

Please refer to Section 8.7 for further information with regard to disposal of soils.

5.8 Task E9: Enablement works verification

The Contractor shall maintain a daily written and photographic record of the works undertaken. Further details are provided in Appendix D.

In addition to the Geotechnical Feedback Report (GFR) (as detailed in the GDR and EWS), the Contractor shall provide the following validation reports in relation to the remediation:

- » Remediation Validation Report; and
- » Materials Management Validation Report.

It should be noted that the above reports can be phased as required. However, where phased, at the completion of the project, a single overarching report for each element shall be provided.

All reports are to be provided by the Contractor in Adobe pdf format, which has been digitally bookmarked at each section heading. All chemical data is to be provided in Excel format. No hard copy is required.

Reports may be combined. However, in the combined report, all aspects of the above proposed reports (as detailed below) are to be included.

Information associated with regulatory health and safety, control of noise, nuisance, dust, and waste shall be excluded from the technical verification reporting and shall be submitted to the Client as separate documentation. This separation is made to differentiate between technical remediation requirements stated herein and operational controls of the work.

5.8.1 Remediation validation report

The Remediation Validation Report shall provide a complete record of the remediation activities undertaken at the site and the data collected to support compliance with remediation objectives and criteria. The Remediation Validation Report shall also include descriptions of the works with associated 'as built' drawings and details of any unforeseen conditions encountered during the works and how they were dealt with.

The Remediation Validation Report shall incorporate a summary of, and commentary on:

- » Records of excavations, including:
 - » observations as to why each excavation was undertaken;
 - » Ordnance Datum survey of extents and depth (including a final composite base of excavation drawing);
 - » Ordnance Datum survey of extents and depth of any residual features;

- » record of decisions for over-excavation;
- » photographic record of each excavation; and
- » records of inspection and final extents of validation.
- » Records of where treated material has been placed.
- » Records of any ACM encountered during the works (type and location) and details of works to mitigate the risk from ACM.
- » Quantities of materials removed from the site.
- » Waste classification and management documentation, including:
 - » copies of all consignment notes; and
 - » details of waste facilities to which materials were disposed.
- » Plan of all stockpiles remaining for use in the permanent works.
- » Copies of the results of the geotechnical and chemical testing of the stockpiles.
- » Record of the installation of the cover system, comprising:
 - » photographic proof of the basal geo-grid, subsoil and topsoil placement as specified).
 - » Survey of the formation level and final level (with difference plot showing the minimum thickness has been achieved).
 - » Hydrock confirmation (inspections and verification check pits on a 40m grid.
- » A composite topographical survey of the as-excavated voids (in pdf and AutoCAD format).
- » Final as-built survey of the site (in pdf and AutoCAD format).

The report is to make comment on the above in the context of the relevant tasks as set out in Section 4.4.3 and described in detail above.

On completion of the verification works the appropriate verification documentation will be forwarded to the Client, for forwarding to the Warranty Provider and the Local Authority for acceptance.

5.8.2 *Materials management validation report*

The Materials Management Validation Report is to document the validation of the declared MMP and will include, as necessary, the validation of imported soils, site-won soils and placed soils.

As a minimum, the Materials Management Validation Report is to include:

- » Details of the reuse mechanisms for each material source.
- » Details of the testing (chemical and geotechnical) of imported materials (if material is imported) to prove each source is suitable for use.
- » Details of the testing (chemical and geotechnical) of site-won materials to prove each source is suitable for use.
- » Records of material movement, including:
 - » stockpile inspection records;
 - » stockpile reuse appraisal record;
 - » volumes, origin and placement location of soils referenced to field results and inspections; and
 - » details and quantities of excavated, processed, treated, imported and reused soils.
- » Confirmation that all materials used on the project were chemically suitable for use.
- » Confirmation that all materials used on the project were geotechnically suitable for use (may be included as a reference to the separate GFR).
- » Records of earthworks excavations including as-built drawings, photographs, quantities of materials and records of progress (may be included as a reference to the separate GFR).

The report is to make comment on the above in the context of the relevant tasks as set out in Section 4.4.3 and described in detail above.

On completion of the declared movement works the Material Management Validation Report is to be issued to CL:AIRE.

6. Remedial strategy implementation – Construction Stage

Before starting works, the Ground Works Contractor shall verify with the Client and Hydrock any areas where Enablement Stage works are ongoing.

It is the responsibility of the Contractor to have read and understood the requirements of the RS&VP. If there are any queries, please contact Hydrock for clarification.

Following the Enablement Works, the Ground Works Contractor shall undertake the remediation tasks presented below. It should be noted that the Enablement Works will have mitigated the risks from the soils at the landfill area and at Parkers Farm and radon is the only other site wide risk identified.

6.1 Task C1: Site watching brief during construction

Whilst all known contaminated soils will have been mitigated during the enablement works (either by excavation and reuse or disposal) or by the installation of a cover system), there is potential for unexpected contamination during any future construction works.

All Contractors working at the site will need to operate in accordance with Section 9 of this report (Contingency Plan for Unexpected Contamination).

If additional materials are identified these materials shall be subject to the procedures stated in this RS&VP.

6.2 Task C2: Appropriate materials handling and stockpiling in accordance with the MMP

The enablement works are anticipated to undertake cut to fill as necessary to leave the site at the required formation level (level to be determined as part of the engineering works). It is anticipated that the levels are to be planned such that the arisings from excavations during construction are accommodated on each proposed development plot.

Excavation and placement of soils during construction will be required:

- » beneath areas of hardstanding (roads, pavements etc.), where excavation to the design depth (or over-excavation) will be required as per the road design and replacement of soils with suitable construction thickness as per road design and capping requirements;
- » to construct foundations and floor slabs as per the structural design;
- » to fill below floor slabs to allow services to be installed in soil (rather than hung off the floor slab);
- » for service trenches to allow services to be installed; and
- » beneath gardens and landscaped areas as growing medium.

All excavation and filling is to include appropriate testing to ensure the excavated soils are suitable for use in accordance with this RS&VP, the MMP and the EWS to ensure the fill has been placed appropriately.

All soils excavated by the Ground Works Contractor are expected to comprise natural soils (either in situ or placed fill) and following the enablement works are expected to be suitable for use during construction.

The Contractor is to undertake a watching brief for materials which may potentially be contaminated. If suspect materials are encountered, please contact Hydrock immediately.

Any imported materials (if required) are to be tested as per the import criteria set out in Section 8 and should confirm with the import criteria or the RTVs (see Section 8.4).

Reuse of soils excavated by the Contractor will need to be undertaken in accordance with the CL:AIRE DoWCoP', i.e. in accordance with a QP declared MMP. The Construction stage MMP is likely to be separate from the site wide enablement works MMP and would be undertaken on an individual development parcel basis.

6.3 Task C3: Installation of basic/full radon protection measures in buildings north of Rowel Brook

6.3.1 Introduction

Mitigation of the risk from radon in all buildings north of Rowel Brook needs to be undertaken in accordance with BR 211.

The final design of radon protection measures is to be specified by the designer (in accordance with BR11 and the protection will depend on the foundation types utilised for buildings north of Rowel Brook.

Radon protection is to be installed by the Ground Works and the installer should be suitably competent.

The installer is to present an installation methodology and a QA/QC plan for installation to Hydrock for comment, with particular attention given to sealing the membrane and penetrations. Whilst tape can be utilised to seal the seams, Hydrock would recommend the membranes are sealed using welded seams and the use of specialist seals around penetrations (top hats etc).

Validation and verification will be required, and the Contractor is referred to in Section 6.5 for details on the validation and verification requirements.

6.4 Task C4: Off-site disposal of unsuitable or excess material

During construction, unsuitable soils are not likely to be present (but cannot be fully discounted), and excavations are to be subject to a watching brief by the Contractor.

Any surplus (i.e. soils which cannot be reused on site due to volumes), unsuitable soils (i.e. soils which fail the RTVs and cannot be reused in an appropriate location), or soils which are not geotechnically suitable (as defined by the EWS), shall be disposed of by the Ground Works Contractor. Please refer to Section 8.7 for further information with regards to disposal of soils.

6.5 Task C5: Ground Works Contractor validation

6.5.1 Introduction

The Ground Works Contractor shall maintain records of the works undertaken and shall note the information presented below, which is required to validate their works.

6.5.2 Materials management validation report (Construction Stage)

A Construction Stage Materials Management Validation Report will be required for each of the separate development phases, to document the validation of the approved Materials Management Plan and shall include the validation of the management of site-won and imported soils. As a minimum the Materials Management Validation Report is to include:

- » details of excavated and reused soils;
- » details of the import mechanisms for each material source;
- » details of the testing (chemical and geotechnical) of imported materials to prove each source is suitable for use;
- » records of material movement, including;

- » stockpile inspection records;
- » stockpile reuse appraisal record;
- » volumes, origin and placement location of soils referenced to field results and inspections;
- » details and quantities of excavated, screened, treated, imported and reused soils; and
- » chemical test results/inspection records.

6.5.3 *Radon protection validation*

Radon protection measures shall be designed by the architect or structural engineer and installed by the Ground Works Contractor (or its specialist installer) in accordance with BR 211.

The Ground Works Contractor is to supply sign-off sheets (validation evidence) including photographs, for all plots. Hydrock will undertake verification check visits as required.

7. Verification and reporting

7.1 Introduction

Verification will be undertaken by Hydrock.

Necessary changes to the agreed RS&VP, arising during the course of the Works, are to be agreed in writing by Hydrock with the Local Authority, Environment Agency and Warranty Provider prior to being undertaken on site.

The Contractors during both the Enablement and Construction Stages of Works, shall undertake the validation of works as detailed in this RS&VP and provide information in the required format to Hydrock.

7.2 Enablement works verification

On the provision of validation reports from the Enablement Contractor (see Section 5.6), to demonstrate that all of the works have been undertaken in accordance with the RS&VP, Hydrock will provide a Verification Report.

The report will provide a summary of the key elements of work and will be referenced to the agreed redevelopment strategy and planning requirements, with supporting information presented in appendices. This report will be based on LCRM, and specifically will incorporate a summary of and commentary on:

- » details of methodology (key documents) and programme;
- » decision records covering agreements with regulators;
- » records of works undertaken and associated validation and monitoring records obtained from the Contractor (specified above e.g. chemical testing data);
- » specialist Contractors' validation reports for particular elements of work;
- » supporting data (e.g. as-built drawings);
- » confirmation of Made Ground removal (where necessary);
- » confirmation of the cover system thickness (where necessary);
- » confirmation that the soils excavated and reused at the site are suitable for use at their proposed reuse location;
- » final status of remediation and achievement of remedial objectives to satisfy the planning conditions; and
- » additional risk assessments/non-scheduled reactive works undertaken.

On completion of the verification works the appropriate verification documentation will be forwarded to the Client, for forwarding to the Warranty Provider and the Local Authority.

7.3 Construction works verification

7.3.1 Radon protection measures verification

Radon protection measures and validation requirements (by the Ground Works Contractor) are detailed in Section 6.5.3. Appendix B of BR 211 presents a Radon protection measures quality management checklist, which should be utilised for verification purposes.

Radon protection measures verifications will be forwarded to the Client and the Warranty Provider when completed and the Local Authority when requested, or at the completion of the remediation.

8. Import and reuse of soils and materials

8.1 Waste management background

As the soils to be managed at the site will comprise both the reuse of soils from the site and the import of soils (Topsoil) to the site, the procedures to be followed for the production of the MMP will need to follow the protocols outlined for:

- » Site of Origin - Route A: Land affected by contamination or suspected of being affected by contamination (ref CL:AIRE DoWCoP, Appendix 1); and
- » Direct Transfer - Route B: Direct use of clean naturally occurring soils on another development site (ref CL:AIRE DoWCoP, Appendix 2).

In addition, there may be a requirement to import aggregate (6F2 and Type 1) to the site for use in construction. These aggregates will either comprise primary aggregates or recycled materials produced in accordance with the WRAP protocol. As such, whilst the volumes will need to be accounted for, these sources of material would not need to be included within the MMP.

8.2 Materials movements

The proposed general sequence of materials movement at the site will comprise:

- 1) Undertake Enablement Stage remediation works, including breaking out of all hardstanding, removal of below ground obstruction, processing and reuse in accordance with the earthworks specification and MMP.
- 2) Undertake general cut to fill works to leave the site at appropriate 'enablement levels' below the final ground level (in accordance with the GDR and EWS), to ensure:
 - » the landfill area is 450mm below finished levels to allow installation of cover system; and
 - » there is sufficient space below buildings, in accordance with the design (to be determined);
- 3) Excavate service trenches, drainage and road boxes, in accordance with the civil engineering design, excavated soils can be reused as part of the general cut to fill.
- 4) Backfill any service trenches in the landfill area with clean naturally occurring soil from the site-won stockpile or imported soil as available (if required).
- 5) Place the clean cover system in the landfill area using site-won Topsoil and subsoil.
- 6) Construct the roads using imported (primary or recycled aggregate) or site-won recycled aggregate.
- 7) Install the piles / VSC / strip foundations for the properties.
- 8) Dispose of excess soils.

A detailed Materials Management Strategy will need to be developed for the site. It is expected that this will be an outline of the MMP, but can be prepared earlier in the project than the MMP and will cover the whole site to allow for Site of Origin movements rather than direct transfer for reuse of on site materials.

It is envisaged that Enablement stage works will be ongoing in parts of the site as Construction stage works are underway in other parts of the site. These separate stages will be kept separate from a materials management perspective.

8.3 Stockpiling of materials

Topsoil and Subsoil for use in the cover system or as a growing medium shall be stockpiled separately and away from Made Ground stockpiles and areas designated for storing other materials (e.g. processed aggregate), or potential sources of contamination. Separate stockpiles shall be created for each different source.

Topsoil and subsoil stockpiles need to be managed in accordance with the MMP in both the Enablement and Construction Stages. If stockpiles are to be present for more than 12 months (which they will be), a bespoke agreement will be required in agreement with the local Environment Agency waste team.

Topsoil stockpiles shall be kept below 2m in height at all times (to prevent the build-up of heat in the stockpile, which will reduce the amount of soil bacteria) and traffic on the stockpile shall be minimised (to prevent compaction).

All stockpiles shall be identified with clear signs, and each stockpile of imported material shall be given a clear reference number and designated sheet recording the following:

- » identification reference (e.g. Stockpile A, B, C etc.);
- » material type (e.g. Topsoil);
- » source site;
- » the carrier's consignment note reference numbers;
- » the approximate volume (number of loads); and
- » which areas the material is to be used on.

Each entry shall be signed and dated by the Ground Works Contractor. A template form is provided in Appendix B. Other approved templates or documentation may be used.

These sheets shall be available for inspection by the Client, the nominated Consultant, Local Authority staff and others involved with this development at any time. A copy shall also be given to the nominated Consultant when verification visits are made.

The Ground Works Contractor is responsible for ensuing materials handling and materials management are undertaken in accordance with the MMP. If materials are mismanaged, the Ground Works Contractor is responsible for correcting the mismanagement at their cost.

8.4 Material suitability

8.4.1 Enablement works

It is envisaged that the soils excavated during the Enablement Works will be a combination of Made Ground soils and natural soils (subsoil and Topsoil), which will be used to create the final development platform. It is anticipated that the majority of soils excavated and proposed for reuse during the Enablement phase will be suitable for use on the site (subject to confirmation during excavation and placement).

The site will be left at 'enablement levels' below the final ground level to allow for the reuse of soils during construction. However, it is anticipated that some parts of the site (for example open space areas, attenuation areas, landfill area, and noise / visual screening bunds will be left at the final ground level at the completion of enablement.

Hardstanding will be processed as necessary (See Section 4.4.3) and reused during enablement works.

8.4.2 Construction works

The majority of soil excavated during the Construction Stage of Works will comprise natural soils (either in situ or placed fill) and Made Ground (which has been proven suitable for use). These soils will be excavated from general cut to fill, service trenches, permeable paving storage, roads, piles and foundation construction.

These excavated soils are likely to be suitable for use (based on the testing undertaken during the enablement stage). However, the ability to reuse will be subject to space constraints during construction and may require disposal off-site.

Careful stockpile management by both the Enablement Contractor and the Ground Works Contractors will be required to allow reuse of materials at the site.

8.4.3 Chemical suitability

The following section is a summary of chemical suitability based on the site investigation works undertaken at the site and the proposed remediation works. In addition, the requirement to prove soils are chemically suitable for use are set out.

It should be noted that a cover system is required in the landfill area, due to the presence of elevated asbestos fibres, metals and PAHs concentrations in the Landfill Made Ground, which pose a risk to Human Health.

It should also be noted that the Made Ground at Parkers Farm is to be excavated (and is proposed for reuse in the core noise / visual screening bund). Whilst ACM has been encountered at the surface, the soils around Parkers Farm are free from asbestos and deemed suitable for use in the core of the noise / visual screening bund (following hand picking of any ACM).

Subject to a site watching brief for unexpected contamination, all other soils are considered suitable for use.

During the development of the site, soil will be required for the following reasons:

- » For placement as part of the clean cover system proposed for the landfill area. This will comprise Subsoil and Topsoil (envisaged to be won from site).
- » Subsoil for placement as clean backfill in any service trenches within the landfill area (if installed) (envisaged to be won from the site).
- » Subsoil to backfill remediation excavations, adjust site levels (general cut and fill) to allow design levels to be met and construct the noise / visual screening bund during enablement. It is envisaged that these works will utilise site-won soils and the general cut to fill will leave the site at a level to allow the installation of roads and infrastructure, with localised future cut to fill being undertaken during the Construction works.
- » Subsoil to: undertake final site levels adjustment (construction stage cut and fill) to allow design levels to be met during construction: backfill service trenches; backfill void space below buildings; to place soils in gardens as subsoil and topsoil growing medium. It is envisaged that these works will utilise site-won soils.
- » Topsoil, to be placed as a growing medium in gardens and POS

All materials imported or excavated for reuse on site during the enablement works are to be tested prior to use.

It is envisaged that soils excavated and reused during the Construction phase do not need further testing (subject to the watching brief with regards unexpected contamination).

Any soil not suitable for use, or not required, will need to be disposed of to an appropriate waste disposal facility in accordance with this RS&VP.

In addition to the required geotechnical testing (as per the GDR and EWS) the Enablement Contractor shall inspect arisings and test these with regards to geo-environmental criteria as discussed below.

Processed Aggregate

For the 6F2/TW and 6F2 materials (crushed asphalt / brick / block), which is proposed to be reused as temporary works or in construction), Hydrock proposes the following reuse criteria:

- » no visual contamination (oil staining etc.) as confirmed by Hydrock watching brief;
- » limited deleterious material (organics, wood, metal etc.), in accordance with the Specification for Highway Works;
- » no coal tar (based on PAK spray test and PAH double ratio test);
- » inspection to confirm no visible ACM by Hydrock watching brief; and
- » asbestos laboratory testing, with the quantification analysis showing asbestos concentrations of <0.001%.

Testing is to be undertaken at a rate of 1 test per 500m³.

Topsoil for use in the Cover System and Subsoil for use in Service Trenches and the Cover System

In addition to the geotechnical testing required by the EWS, all site-won and imported soils proposed for use as part of the cover system or to fill service trenches will require testing to confirm they are suitable for use.

Soils imported to site or to be used as part of the cover system, shall be tested at a rate of 1 test per 100m³ at a UKAS accredited laboratory for the following general suite of contaminants:

- » As, B (water soluble), Be, Cd, Cr (total), Cr (VI), Cu, Hg, Ni, Pb, S (elemental), Se, V, Zn, cyanide (total), sulphide, pH, asbestos fibres, speciated polycyclic aromatic hydrocarbons (PAH, by GC-FID), total phenols and fraction of organic carbon;
- » total TPH and (if required) speciated TPH (TPHCWG); and
- » asbestos quantification to a level of 0.001% w/w (if asbestos fibres are encountered).

The test data are to be compared to the following guidelines:

- » no gross visual contamination (oil staining etc.);
- » limited deleterious material (organics, wood, metal etc.), in accordance with the geotechnical Specification;
- » no visible ACM; and
- » asbestos laboratory testing, with the quantification analysis showing asbestos concentrations of <0.001% (subject to Warranty Provider and EHO approval).

Site-won Soils

There is suitable Topsoil available to be 'won' from the site.

The natural strata comprise a mixture of granular and cohesive superficial deposits. The use of clayey soils is not recommended for Subsoil as they are likely to become waterlogged during handling and placement. If soils with a high clay content are proposed, their use is to be agreed by the Client.

Testing is to be undertaken at a rate of 1 test per 1,000m³ during the enablement works and soils for reuse will be tested at a UKAS accredited laboratory for the following general suite of contaminants:

- » As, B (water soluble), Be, Cd, Cr (total), Cr (VI), Cu, Hg, Ni, Pb, S (elemental), Se, V, Zn, cyanide (total), sulphide, pH, asbestos fibres, speciated polycyclic aromatic hydrocarbons (PAH, by GC-FID), total phenols and fraction of organic carbon;
- » total TPH and (if required) speciated TPH (TPHCWG); and
- » asbestos quantification to a level of 0.001% w/w (if asbestos fibres are encountered).

The soils will also confirm to the following guidelines:

- » no gross visual contamination (oil staining etc.);
- » limited deleterious material (organics, wood, metal etc.), in accordance with the geotechnical Specification;
- » no visible ACM; and
- » asbestos laboratory testing, with the quantification analysis showing asbestos concentrations of <0.001% (subject to Warranty Provider and EHO approval).

From testing of Made Ground during ground investigation, no exceedances of contaminants have been reported based on a POS_{resi} scenario, and therefore the soils are considered to be suitable for use in the core of the noise / visual screening bund once any visual ACM has been removed, as a 1.00m 'cover' of the 'core' will be implemented.

Imported Topsoil and Subsoil

If Topsoil and Subsoil is to be imported, it shall be from a source not expected to be contaminated and meet both physical and chemical criteria, as detailed below.

Prior to importation of Topsoil from a commercial supplier, certification shall be obtained from the supplier detailing the source site, the previous land use and relevant test results. A copy of this information shall be forwarded to Hydrock for review and comparison against the import criteria. If the Topsoil is sourced from a recognised commercial supplier of natural Topsoil (e.g. British Sugar, Freeland Horticultural, etc.), no further testing (prior to import) is required.

If the proposed Topsoil or Subsoil import source is not a commercial supplier, the Ground Works Contractor is to provide Hydrock with copies of the site investigation, confirming the soils are naturally occurring and uncontaminated. Hydrock recommend that the soils are tested at source to confirm they are appropriate for use, prior to import. If any of the RTVs are exceeded, the material shall be considered to be unsuitable and is not to be imported.

Following import, soils are to be stockpiled on a Terram separator layer and additional chemical testing is to be undertaken and assessed in accordance with the criteria set out above (to ensure the imported material is the same as that for which chemical analysis has been provided). If suitable, the imported soils are to remain stockpiled for later use during construction. If unsuitable, or excess to the quantity requirements, they are to be disposed of off-site.

If soils are imported and placed directly, without stockpiling and testing, these works will be deemed to be undertaken at the Ground Works Contractor's risk, and if the soils are later proven not to be suitable for use, the Ground Works Contractor is to meet all associated excavation, disposal and replacement costs (including additional costs from the nominated Consultant).

Import and reuse chemical criteria (as part of the cover system)

The Import RTVs have been developed based on Hydrock's in-house GAC, with reference to the proposed end use and in consideration of the CL:AIRE DoWCoP, specifically Watch Point 15, which states that the following general restrictions are applied to materials imported to a site:

- » The hazards to human health and the environment must not be increased beyond those which already exist at the Receiver site, by importing materials with elevated concentrations of potentially harmful substances. A project may be regarded as "sham recovery" if it involves importation of soils with levels of contamination significantly above those already present i.e. to a degree that would require intervention should the site be redeveloped in the future; and
- » The importation of material at receiver sites must not introduce new hazards beyond those that already exist at the Receiver site, by importing materials containing new contaminants present at problematic levels. In any case this includes the importation and use of materials containing new contaminants present above hazardous waste thresholds.

The Import RTVs are therefore based on the most conservative value of:

- » Human Health GAC (details of the derivation of the Hydrock GAC are presented in Hydrock Report 19114-HYD-XX-XX-RP-GE-01002);
- » Phytotoxicity GAC (for materials to be placed within the upper 600mm/450mm of the final site levels in gardens/landscaped areas)
- » Soil Saturation Limit (to prevent soils containing non-aqueous phase liquids (NAPL) being used, except where site concentrations have been detected above this value and were not associated with NAPL); and
- » Geometric mean site concentration multiplied by 2.

For Reuse Criteria RTVs, the above applies except for the geometric mean site concentrations as the soils are already on site and therefore Watchpoint 15 does not apply.

Regarding protection of Controlled Waters, the following applies:

- » Importation of material will be limited to topsoil for use in gardens and landscaping/POS areas. Topsoil will either be sourced and used in accordance with BS 3882:2015 such that the provenance of the soil will indicate a non-contaminative source, and/or be sourced using the DoWCoP Direct Transfer option for "clean naturally occurring materials" - material defined as "devoid of anthropogenic contamination to a degree or level that is considered harmful to living organisms". On the basis that the combination of the human health GAC, phytotox GAC and consideration of existing site concentrations meets this definition it is not considered necessary to consider specific Controlled Waters criteria further.
- » Based on groundwater data, the soils at the site have not been impacting on the water environment, and no complete contaminant linkage has been identified. Therefore, reuse of site-won soils in accordance with the RS&VP and MMP should not present any unacceptable risk to Controlled Waters.

Although there is no definition of 'clean' within the DoWCoP, Hydrock have taken the mean and maximum of the rural soils data for England from the UK Soil and Herbage Pollutant Survey as a range of concentrations representing 'clean and naturally occurring' soils. All RTVs are below these concentrations.

The import and reuse criteria are set out in Table 8.1 and Table 8.2 respectively for the Wider Site Area. Table 8.3 presents the import criteria for the historical landfill cover system and cover of core noise / visual screening bund. Table 8.4 presents the reuse criteria for the core materials for the noise / visual screening bund.

Table 8.1: Import Criteria - Wider Site

Contaminant	Human Health GAC ¹ / Phytotox GAC	Soil Saturation Limit	Mean Site Concentration x 2	RTV
Arsenic	37 / 250	N/A	86	37
Beryllium	1.7	N/A	2.4	1.7
Boron	300 / 5	N/A	1.6	1.6
Cadmium	22	N/A	0.41	0.41
Chromium (III)	890 / 400	N/A	84	84
Chromium (VI)	21 / 25	N/A	3.6	3.6
Copper	2,500 / 200	N/A	31	31
Lead	200	N/A	51	51
Mercury, inorganic	40	N/A	0.6	0.6
Nickel	130 / 110	N/A	56	56

Contaminant	Human Health GAC ¹ / Phytotox GAC	Soil Saturation Limit	Mean Site Concentration x 2	RTV
Selenium	260	N/A	2	2
Vanadium	410	N/A	145	145
Zinc	3,900 / 300	N/A	165	165
Cyanide (free)	24	N/A	2	2
Phenol (total)	120	24,237	2	2
Acenaphthene	230	57	0.10	0.10
Acenaphthylene	180	86	0.11	0.11
Anthracene	2,400	1.17	0.11	0.12
Benz(a)anthracene	8.9	1.71	0.12	0.12
Benzo(a)pyrene	5	0.91	0.12	0.12
Benzo(b)fluoranthene	2.6	1.21	0.12	0.12
Benzo(g,h,i)perylene	320	0.15	0.11	0.11
Benzo(k)fluoranthene	78	0.69	0.11	0.11
Chrysene	15	0.44	0.12	0.12
Dibenz(a,h)anthracene	0.25	0.004	0.10 ²	0.10
Fluoranthene	290	19	0.13	0.13
Fluorene	180	31	0.10	0.10
Indeno(1,2,3-c,d)pyrene	28	0.06	0.11 ²	0.11
Naphthalene	13	76	0.11	0.11
Phenanthrene	98	36	0.12	0.12
Pyrene	620	2.12	0.13	0.13
Total TPH	N/A	N/A	29	250 ³
Asbestos w/w (%)	Detect	N/A	Not Detected	<LoD ⁴

Notes:

All values in mg/kg

¹ Residential with Homegrown Produce, conservatively based on 1% SOM.

² Mean site concentration x 2 exceeds soil saturation limit, but is not associated with visual evidence of contamination or presence of free phase.

³ A limit of 250mg/kg has been applied to represent 'clean' soils and to prevent odorous or visually oily materials.

⁴ Below the quantifiable limit of detection (<0.001%).

Table 8.2: Reuse Criteria - Wider Site

Contaminant	Human Health GAC ¹ / Phytotox GAC	Soil Saturation Limit	RTV
Arsenic	37 / 250	N/A	37
Beryllium	17	N/A	17
Boron	300 / 5	N/A	300 / 2 ²
Cadmium	22	N/A	22
Chromium (III)	890 / 400	N/A	890
Chromium (VI)	21 / 25	N/A	21
Copper	2,500 / 200	N/A	2,500 / 200 ²
Lead	200	N/A	200
Mercury, inorganic	40	N/A	40
Nickel	130 / 110	N/A	130 / 110 ²
Selenium	260	N/A	260

Contaminant	Human Health GAC ¹ / Phytotox GAC	Soil Saturation Limit	RTV
Vanadium	410	N/A	410
Zinc	3,900 / 300	N/A	3,900 / 300 ²
Cyanide (free)	24	N/A	24
Phenol (total)	120	24,237	120
Acenaphthene	230	57	57 / 230 ³
Acenaphthylene	180	86	86 / 180 ³
Anthracene	2,400	1.17	1.17 / 2,400 ³
Benz(a)anthracene	8.9	1.71	1.71 / 8.9 ³
Benzo(a)pyrene	5	0.91	0.91 / 5 ³
Benzo(b)fluoranthene	2.6	1.21	1.21 / 26 ³
Benzo(g,h,i)perylene	320	0.15	0.15 / 320 ³
Benzo(k)fluoranthene	78	0.69	0.69 / 78 ³
Chrysene	15	0.44	0.44 / 15 ³
Dibenz(a,h)anthracene	0.25	0.004	0.25 ⁴
Fluoranthene	290	19	19 / 290 ³
Fluorene	180	31	31 / 180 ³
Indeno(1,2,3-c,d)pyrene	28	0.06	28 ⁴
Naphthalene	13	76	13
Phenanthrene	98	36	36 / 98 ³
Pyrene	620	2.12	2.12 / 620 ³
Total TPH	N/A	N/A	250 ⁵
Asbestos w/w (%)	Detect	N/A	<LoD ⁶

Notes:

All values in mg/kg

¹ Residential with Homegrown Produce, conservatively based on 1% SOM.

² RTV protective of phytotoxic risks, for upper 600mm of garden/landscape fill only.

³ If lower RTV exceeded this may indicate the presence of free phase. If following visual inspection, no visual or olfactory evidence of contamination is noted, the higher RTV should be adopted.

⁴ Saturation limit not adopted based on laboratory limit of reporting levels.

⁵ A limit of 250mg/kg has been applied to represent 'clean' soils and to prevent odorous or visually oily materials.

⁶ Below the quantifiable limit of detection (<0.001%).

Table 8.3: Import Criteria – Landfill cover system and cover of core noise / visual screening bund

Contaminant	Human Health GAC ¹ / Phytotox GAC	Soil Saturation Limit	Mean Site Concentration x ₂	RTV
Arsenic	79 / 250	N/A	96	79
Beryllium	2.2	N/A	3.4	2.2
Boron	21,000 / 5	N/A	7.7	5
Cadmium	220	N/A	0.8	0.8
Chromium (III)	1,500 / 400	N/A	82	82
Chromium (VI)	23 / 25	N/A	2.4	2.4
Copper	12,000 / 200	N/A	137	137
Lead	630	N/A	252	252
Mercury, inorganic	120	N/A	0.7	0.7
Nickel	230 / 110	N/A	89	89

Contaminant	Human Health GAC ¹ / Phytotox GAC	Soil Saturation Limit	Mean Site Concentration x 2	RTV
Selenium	1,100	N/A	2	2
Vanadium	2,000	N/A	158	158
Zinc	81,000 / 300	N/A	565	565
Cyanide (free)	24	N/A	2	2
Phenol (total)	440	24,237	2	2
Acenaphthene	15,000	57	0.13	0.13
Acenaphthylene	15,000	86	0.13	0.13
Anthracene	74,000	1.17	0.19	0.19
Benz(a)anthracene	29	1.71	0.57	0.57
Benzo(a)pyrene	10	0.91	0.58	0.58
Benzo(b)fluoranthene	7.2	1.21	0.66	0.66
Benzo(g,h,i)perylene	640	0.15	0.43	0.43 ²
Benzo(k)fluoranthene	190	0.69	0.40	0.40
Chrysene	57	0.44	0.53	0.53 ²
Dibenz(a,h)anthracene	0.57	0.004	0.18	0.18 ²
Fluoranthene	3,100	19	1.02	1.02
Fluorene	9,900	31	0.13	0.13
Indeno(1,2,3-c,d)pyrene	82	0.06	0.40	0.40 ²
Naphthalene	3,900	76	0.10	0.10
Phenanthrene	3,100	36	0.50	0.50
Pyrene	7,400	2.12	1.0	1.0
Total TPH	N/A	N/A	143	250 ³
Asbestos w/w (%)	Detect	N/A	Detected	<LoD ⁴

Notes:

All values in mg/kg

¹ POSresi, conservatively based on 1% SOM.

² Mean site concentration x 2 exceeds soil saturation limit, but is not associated with visual evidence of contamination or presence of free phase.

³ A limit of 250mg/kg has been applied to represent 'clean' soils and to prevent odorous or visually oily materials.

⁴ Below the quantifiable limit of detection (<0.001%).

Table 8.4: Reuse Criteria – Core of noise / visual screening bund

Contaminant	RTV
ACM	No visual ACM

Notes:

From testing of Made Ground during ground investigation, no exceedances of contaminants have been reported based on a POSresi scenario, and therefore the soils are considered to be suitable for use in the core of the noise / visual screening bund once any visual ACM has been removed, as a 1.00m 'cover' of the 'core' will be implemented.

Imported Aggregate

Primary source aggregate will be suitable for use if imported, and does not require testing.

Secondary source (i.e. recycled) aggregate will be suitable for use if produced in accordance with the WRAP protocol but requires the following inspection and chemical testing to be undertaken by the Contractor to prove it is suitable for use:

- » no visual contamination (oil staining etc.) as confirmed by watching brief and site audits;

- » limited deleterious material (organics, wood, metal etc.), in accordance with the Specification for Highway Works;
- » no coal tar (based on PAK spray test and PAH double ratio test);
- » inspection to confirm no visible ACM as confirmed by watching brief and site audits; and
- » asbestos laboratory testing, with the quantification analysis showing asbestos concentrations of <0.001% (subject to Warranty Provider and EHO approval).

Testing is to be undertaken at a rate of 1 test per 500m³.

Material for Off-Site Disposal

Materials found to be out of specification are to remain on site in segregated stockpiles until they can be disposed of to a suitably licenced waste disposal facility. Any material requiring disposal shall be disposed of in accordance with Section 8.7.

It is the responsibility of the Contractor to ensure adequate and appropriate disposal, including testing to satisfy the proposed waste facility.

Records of the removal of material off site shall be maintained by the Contractor, including details of the disposal or treatment site to which they have been taken. These details are to be passed to Hydrock to form part of the Verification Report.

8.4.4 Physical requirements of soils

Soil used in general earthworks, are to conform to the requirements of the GDR and EWS.

Imported Topsoil should conform to the requirements of BS 3882:2015 'Specification for Topsoil and requirements for use', unless otherwise agreed with the Client. Imported Subsoil should conform to the requirements of BS 8601:2013 'Specification for Subsoil and requirements for use', unless agreed with the Client.

If the Client agrees that Topsoil and Subsoil do not need to conform to BS 3882:2015 or BS 8601:2013 respectively, they shall comprise chalk, clay or sand with a maximum of 60% of fragments in excess of 2mm, a maximum of 30% in excess of 20mm and a maximum of 10% in excess of 50mm, with nothing in excess of 75mm.

The use of clay soils is possible for Subsoil and Topsoil (growing medium), although is not recommended as they are likely to become waterlogged during handling and placement. If soils with a high clay content are proposed, their use is to be agreed by the Client.

Topsoil and Subsoil used as part of the cover system, growing medium or to backfill service trenches shall be free of asbestos, metal, plastic, wood, glass, tarmac, brick, paper, concrete or other potentially hazardous foreign material which could cause injury.

In addition, all materials must be free from aggressive/invasive weeds and bulk vegetative growth, in order to ensure negligible risk of subsequent weed problems.

8.4.5 Geotechnical suitability

An assessment of the potential to reuse site-won materials has been completed. This indicates that subject to appropriate segregation and processing, the site-won Made Ground (Parkers Farm) and natural soils can be classified as Class 1 / Class 2 General Fill (of Class 6 / Class 7 Structural Fill), in accordance with the Specification for Highway Works (SHW), which may be suitable for reuse at the site, subject to further testing.

Fill is to be placed in accordance with the GDR and EWS. Roads and pavements are to be placed as per the civil engineering design. Fill in gardens and POS are to be placed to a Landscape Fill

Specification. Fill to the noise / visual screening bund will be placed as a combination of Structural / General Fill and Landscape Fill, subject to the design.

The Enablement Contractor will be responsible for undertaking the required processing, geotechnical testing and placing the material in accordance with the GDR and EWS.

8.5 Certainty of use and quantity of material

The following excavation, treatment and placement is proposed:

- » excavate Made Ground as necessary and process as necessary as part of the general cut to fill (with placement in the core of the noise / visual screening bund);
- » excavate natural soils as necessary and process as necessary as part of the general cut to fill);
- » excavate natural soils to install services, drainage, roads and foundations;
- » excavate Made Ground soils (as necessary) to allow the installation of the cover system and to install services (if installed in the landfill) – note any made Ground soils excavated from the landfill will need to be disposed of off-site;
- » finalise levels to the formation level (as per the design) so that construction can be undertaken or the cover system for the landfill can be placed;
- » place the cover system using either site won Subsoil and Topsoil; and
- » stockpile the topsoil for construction on each development phase.

Only materials deemed suitable for use by an appropriately qualified person shall be utilised on site. Material reused on site shall be subject to the necessary testing/review and comparison to the requirements of the RS&VP, GDR and EWS prior to reuse.

Any out of specification material which is deemed unsuitable for use shall, if appropriate, be classified as waste and shall be disposed of in accordance with waste legislation.

Only sufficient material required on site for the purposes of changing levels in accordance with the pre-determined proposals (planning conditions, design levels and drainage strategy) shall be imported or reused on site. Any surplus material or material which does not meet the required specification shall be disposed of off-site. It is the responsibility of the Contractor at each stage of the works to have checked all volume calculations and have allowed for disposal of unsuitable or excess materials.

8.6 On site material management and processing

Any excavated soils proposed for reuse shall be reused in accordance with the QP declared MMP and the Contractors shall segregate materials having due regard for their subsequent reuse. The MMP shall be managed by the Contractor.

Assessment and testing are to be undertaken by the Contractor (as required) in accordance with this RS&VP, the GDR and the EWS.

Soils are to be processed as required. For the avoidance of doubt, processing includes crushing (unlikely as demolition and obstruction removal will have been undertaken previously), sorting, screening, separating, addition of additives (e.g. lime or cement during modification (if necessary)), treatment, stockpiling, inspection and testing to ensure the excavated soils are suitable for use. It should be noted that not all of the above may be required, and it is up to the Contractor to allow for appropriate processing as required.

The processed Made Ground soils are to be stockpiled for reuse in the earthworks and the different soil types are to be stockpiled in different clearly marked stockpiles. A record of the excavated quantities and reuse locations shall also be maintained on site. An example tracking system and

example forms are provided at Appendix B (other tracking forms and systems may be utilised). A copy of all tracking forms shall be held at the site office.

Stockpiles of soil shall be stored on site in stockpiles managed by the Enablement Contractor and the Ground Works Contractor and shall be subject to operational constraints at the time of stockpiling.

Stockpiles of crushed and processed aggregate materials for use in the permanent works shall be stockpiled at locations to be agreed with the Client.

Stockpile locations (permanent and temporary) shall be clearly marked and documented on working drawings maintained in the site office. At the end of the enablement works the stockpiles shall be surveyed to provide an accurate volume of material in each.

Appropriate precautions shall be taken by the Contractor to ensure that the stockpiled material does not result in risks to neighbouring land users and the Enablement Contractor is to take appropriate mitigation measures and environmental precautions as considered necessary at storage locations. However, as a minimum, stockpiles shall be compacted to prevent dust and shall be kept wet in periods of dry weather.

8.7 Off-site disposal of unsuitable or excess material

Any material excavated on site may be classified as waste and it is the responsibility of the holder of a material (i.e. the Enablement Contractor) to form their own view on whether or not it is waste. This includes determining when waste that has been treated in some way it can cease to be classed as waste for a particular purpose. All arisings should be regarded as contaminated unless proven otherwise.

Any soils to be removed from site are to be removed to a licensed waste management facility and the waste is to be transported by a registered waste carrier in accordance with applicable Transport and Waste Management and Carrier Regulations.

Materials for offsite disposal shall be sampled and analysed, by the Contractor at their cost, at rates sufficient to allow the material to be adequately categorised.

Material exported from site to landfill, or other appropriately licensed facility, shall be hauled by a registered waste carrier in accordance with the requirements of 'The Environment Protection Act 1990 (including Duty of Care regulations)' and where appropriate 'The Controlled Waste (England and Wales) Regulations 2012', 'The Hazardous Waste Directive', and 'The Hazardous Waste Regulations and The Hazardous Waste (Northern Ireland) Regulations 2005'

Consignment notes (as required) shall be completed, signed and retained by all parties involved. The transfer note shall state the volume of waste, the nature of the material and statement to the chemical composition. Consignment notes shall be kept by the Contractor for the time period required by legislation.

Waste consignment/transfer notices will be required and are to be retained by the Enablement Contractor. Copies of all waste consignment/transfer notices are to be provided to Hydrock for inclusion in a verification report.

9. Contingency plan and areas of unexpected contamination

There is potential for unexpected contamination during the works due to the former use of the site.

Any significant quantities of suspected oily or odorous material, significantly ashy, unusually brightly coloured, or asbestos containing soils/materials shall be considered as possibly contaminated.

The Discovery Strategy, included in Appendix C, must remain on site at all times during the Enablement Stage of works and demonstrates a clear allocation of responsibility for reporting and dealing with contamination.

A copy of the Discovery Strategy must be placed on the Health & Safety Notice Board and/or displayed in a prominent area where all site staff are able to take note of and consult the document at any time. Any member of the workforce entering the site to undertake any excavation must be made aware of the potential to discover contamination and the requirement to follow the Discovery Strategy.

A report shall be prepared by the Geo-environmental Engineer and submitted to the regulatory parties, the Local Authority and the Warranty Provider and, where groundwater may have been impacted, the Environment Agency.

If additional materials are identified these materials shall be subject to the procedures stated in this RS&VP.

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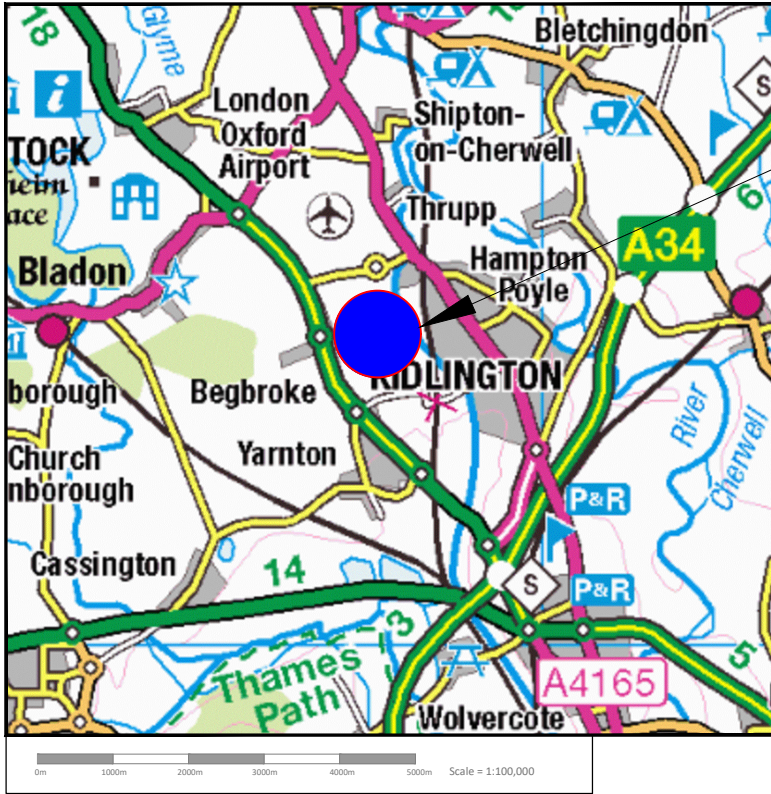
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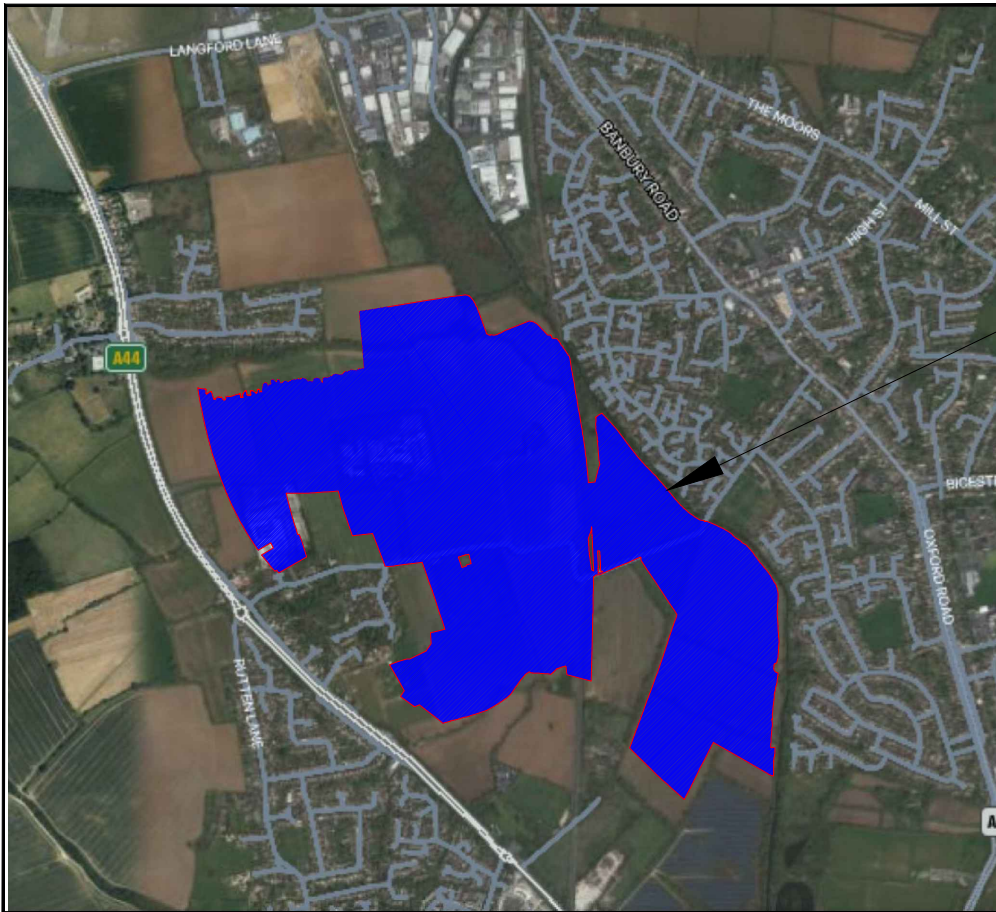
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Appendix A Drawings

OS NORTH

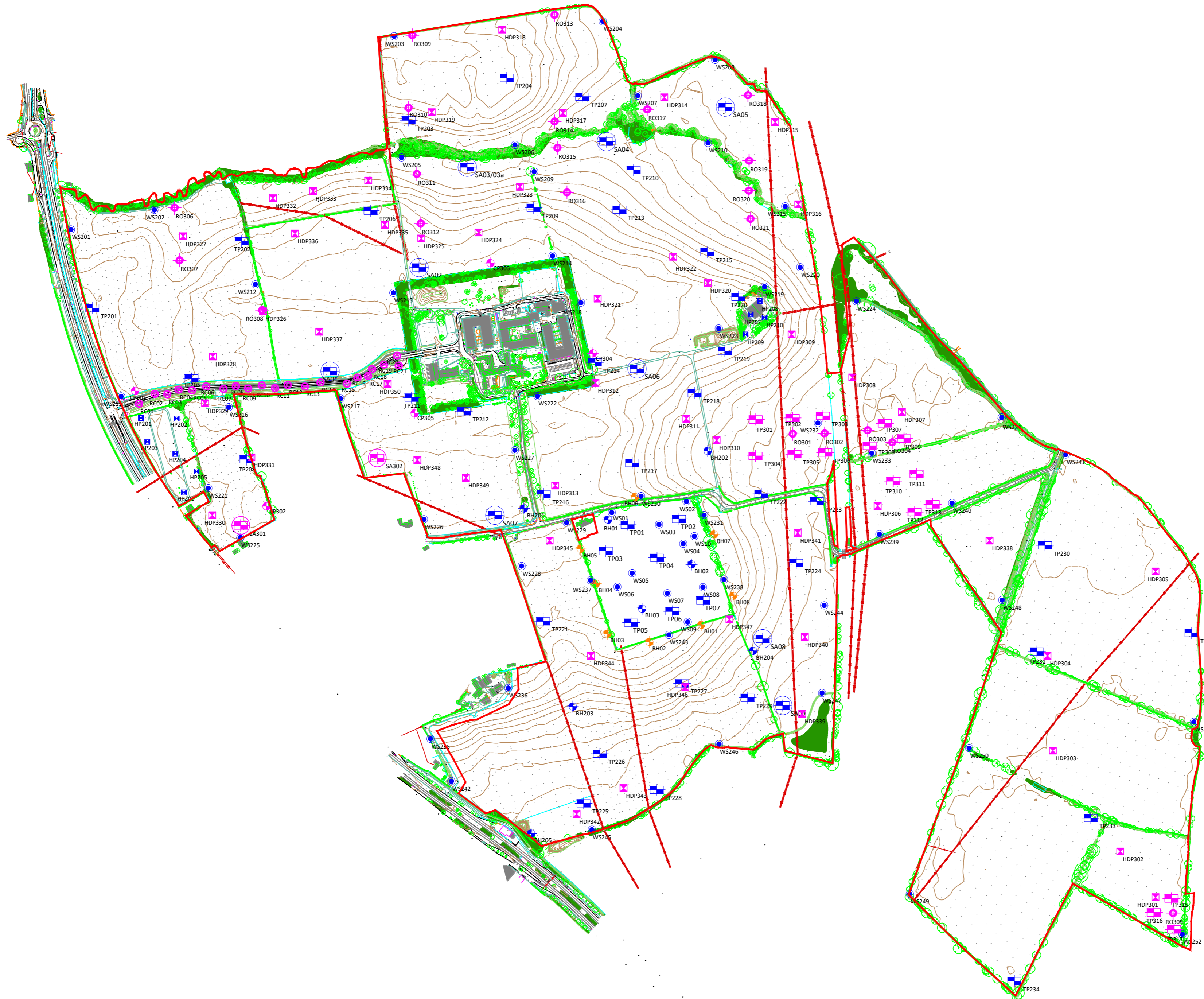


THE SITE



THE SITE

P03	FIRST ISSUE					
	SD	12/04/23	NT	12/04/23	CD	12/04/23
P02	FIRST ISSUE					
	SD	01/11/22	NT	01/11/22	AB	01/11/22
P01	FIRST ISSUE					
	SD	06/10/21	NT	06/10/21	AB	06/10/21
REV.	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
		Hawthorn Park Holdenby Road Sparston Northampton NN6 8LD TEL: 01604 842 888 E-Mail: northampton@hydrock.com or visit www.hydrock.com				
CLIENT						
Oxford University Development Ltd						
PROJECT						
Begbroke, Oxfordshire						
TITLE						
SITE LOCATION PLAN						
HYDROCK PROJECT NO.			SCALE @ A4			
19114			See Drawing			
PURPOSE OF ISSUE					STATUS	
SUITABLE FOR INFORMATION					S2	
DRAWING NO. (PROJECT - ORIGINATOR VOLUME LEVEL TYPE ROLE NUMBER)					REVISION	
19114-HYD-XX-ZZ-DR-GE-01000					P03	



KEY

Cable Percussion Borehole	Rotary Borehole	Soakaway Pit	Trial Pit
Hydrock Soil Infiltration Rate Test Pit	Hydrock Dynamic Sampler Borehole	Hydrock Trial Pit	Hydrock Borehole
Hydrock Hand Dug Pit	JUBB Site Investigation (December 2019) Borehole	Road Core Location	Hand Dug Pit

NOTES

- All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.
- This drawing is to be read in conjunction with all relevant Engineers' and Service Engineers' drawings and specifications.
- This drawing has been based on the following drawings and information: Topographical Survey number:180133 by:Interlock Surveys dated:11/02/2019.
- A minimum 9metre stand off zone has been applied to (and must be adhered to for all siteworks) all proposed SI positions in relation to Overhead power lines shown on the Survey.

LEGEND

Site Boundary

P07	SITE BOUNDARY ADDED					
	SD	12/04/23	NT	12/04/23	CD	12/04/23
P06	HAND PITS ADDED					
	SD	14/03/23	NT	14/03/23	AB	14/03/23
P05	UPDATED FOLLOWING FURTHER SITE INVESTIGATION					
	SD	21/02/23	NT	21/02/23	AB	21/02/23
P04	SURVEYED LOCATIONS FOLLOWING SITE INVESTIGATION					
	NS	27.10.22	NT	27.10.22	AB	27.10.22
P03	THIRD ISSUE - UPDATED LOCATIONS					
	SD	15/08/22	NT	16/08/22	AB	16/08/22
P02	SECOND ISSUE - PROPOSED LOCATIONS					
	NT	29/06/22	AB	29/06/22	AB	29/06/22
P01	FIRST ISSUE					
	SD	07/12/21	NT	07/12/21	AB	07/12/21
REV.	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE

Hydrock

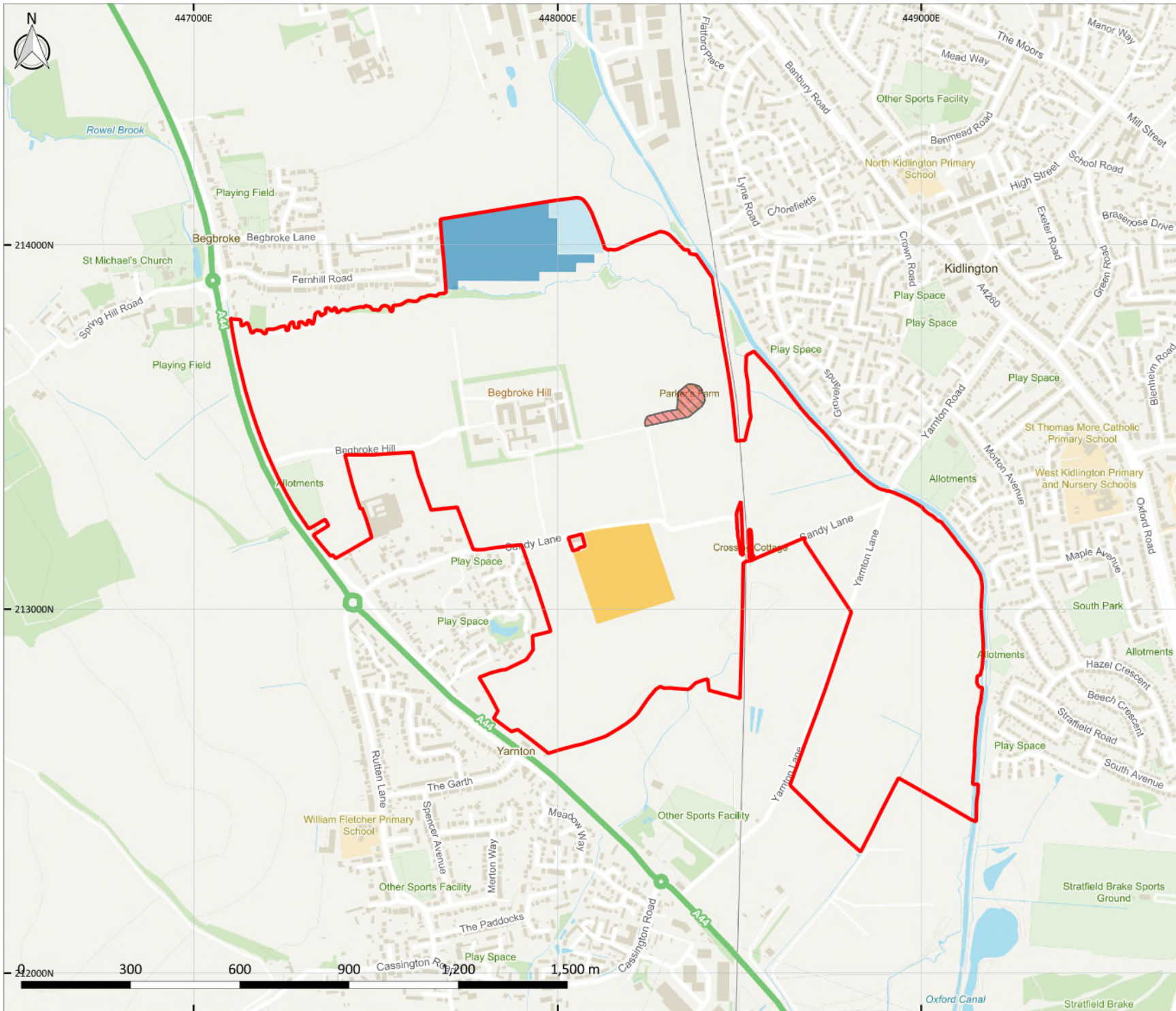
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CLIENT
Oxford University Development Ltd

PROJECT
Begbroke, Oxfordshire

TITLE
Exploratory Hole Location Plan

HYDROCK PROJECT NO. C-19114-C	SCALE @ A2 1:5000
PURPOSE OF ISSUE SUITABLE FOR INFORMATION	STATUS S2
DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER) 19114-HYD-XX-ZZ-DR-GE-01001	REVISION P07



KEY PLAN

- Site Boundary
- Remedial Measures
 - ACM Removal
 - Made Ground Excavation
 - Cover System
 - Basic Radon Protection
 - Full Radon Protection

NOTES

- Contains OS data © Crown copyright and database right (2021)

REVISIONS

REV.	DRAWN BY INITIALS	CHECKED BY INITIALS	DATE	REVISION NOTES/COMMENTS
P01	CLD	AB	26/05/23	First Issue

Hydrock

CLIENT
Oxford University Developments Ltd

PROJECT
Begbroke, Oxfordshire

TITLE
Remedial Measures

HYDROCK PROJECT NO. 19114	SCALE @ A3 1:10,000
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PURPOSE OF ISSUE SUITABLE FOR INFORMATION	STATUS S2
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DRAWING NO. 19114-HYD-XX-ZZ-DR-GE-01037	REVISION P01
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Appendix B Form Templates

*Begbroke Innovation District
Imported Soil Documentation Form*

Stockpile Identification Reference	
Material Type	
Source Site	
Consignment Note Reference Numbers	
Volume of Stockpile (or number of loads)	
Plots Material to be used in	
Stockpile Identification Reference	

Sketch Plan of Stockpile Location and Sample Points

Signed _____

Position_____

Date_____

Appendix C Discovery Strategy

DISCOVERY STRATEGY- CONSTRUCTION STAGE CONTAMINATED MATERIALS DISPLAY AND AWARENESS

SITE: Begbroke, Oxfordshire

The Discovery Strategy must be placed on the Health & Safety Notice Board and/or displayed in a prominent area where all site staff are able to consult the document at any time.

Any member of the workforce entering the site to undertake any excavation must be made aware of the potential to discover contamination and the discovery strategy.

HOW TO IDENTIFY POTENTIAL CONTAMINATED MATERIAL

- » Looks oily and has an oily odour.
- » Solvent type of odour.
- » Man-made materials in fill such as paint cans, car parts, glass fragments.
- » Contains fragments of coal/coke cinder.
- » Sand bags, and/or subsurface concrete structures.
- » Asbestos cement.
- » Fibrous material.
- » Asbestos lagging or Asbestos Insulation Board.

PROCEDURE

If evidence of unexpected contamination is found the following procedures shall be adhered to:

- » All site works at the position of the suspected contamination should stop.
- » Site personnel shall inform the Site Manager/Agent.
- » Visual and olfactory observations of the condition of the ground and the extent of contamination shall be made and notification shall be given to the Geo-environmental Engineer, who will inform the Local Authority within circa 24 hours after discovery. Should the contamination be likely to affect controlled waters the Environment Agency shall also be informed.
- » In the presence of a suitably qualified geo-environmental engineer, investigation works shall commence to recover samples for testing and, using visual and olfactory observations of the condition of the ground, delineate the area over which contaminated materials are present.
- » Should the Geo-environmental Engineer deem it appropriate, the affected material may be excavated and placed in a stockpile on a suitable impermeable surface. This shall be suitably quarantined with no addition to, or removal of, the stockpile while chemical analysis is being undertaken. Alternatively, the material shall remain in situ until laboratory test results have been obtained.
- » A photographic record shall be made of relevant observations.
- » The Geo-environmental Engineer shall determine the testing suite based on visual and olfactory observations.
- » Test results shall be compared against current assessment criteria suitable for the future use of the area of the site affected.
- » If after testing the ground is found to be contaminated, the Local Authority and Warranty Provider shall be informed. After consultation with the Local Authority, Warranty Provider and if

necessary, the Environment Agency, materials shall either be removed for disposal to a licensed waste management facility or remediated to agreed clean-up criteria.

UNEXPECTED TANKS

It is possible that underground tanks, which have not been identified by the investigations to date, may be present. The following procedures are to be adhered to if tanks are identified:

- » All site works at the position of the tanks should stop.
- » The tank's position and depth shall be determined and marked on a plan of the site.
- » Notification shall be given to the Geo-environmental Engineer who will inform the Local Authority within 24 hours.
- » A description of the tank shall be made by the Geo-environmental Engineer including: condition and surround, along with visual and olfactory observations should any contents in the tank be apparent. A photographic record shall be made of relevant observations.
- » In the presence of a suitably qualified geo-environmental engineer, investigation works shall be undertaken to obtain samples of any liquid or sludge contents and to establish the dimensions of the tank.
- » Laboratory testing will be determined by the geo-environmental engineer based on visual and olfactory observations of the material.
- » Test results shall be compared against current assessment criteria and proposals for disposal of any contents determined in agreement with the appropriate Regulatory Parties.
- » The tank shall be emptied (by suitably qualified personnel) and the contents disposed of to a suitably licenced disposal facility.
- » Once the tank has been emptied in accordance with the above proposals, it shall be removed (by suitably qualified personnel) for disposal to a licensed waste management facility. Copies of the relevant waste consignment notes are to be forwarded to the Geo-environmental Engineer for verification.
- » Excavation and remediation of any contaminated soils shall be undertaken in accordance with Section 5 of the RS&VP.
- » Samples of the base and sides of the resultant hole shall be sampled as per the Geo-environmental Engineer's instructions, and an assessment made as to whether this may have been a source of groundwater contamination.
- » A report will be prepared by the Geo-environmental Engineer and submitted to the regulatory parties, the Local Authority and, where groundwater may have been impacted, the Environment Agency.

Appendix D General Requirements

E.1 Introduction

In addition to the specific requirements detailed in the text above, the following general requirements will also apply to the remediation works.

In addition, the Contractor(s) should refer to the requirements of the Keepmoat Homes Limited Specification for Works. Where there is conflict between documents, the most onerous applies.

E2. Compliance with Legislation and Standards

The works are to be undertaken in compliance with all relevant British Standards, codes of practice, regulations, guidance and legislation including, but not be limited to, the following:

- » The Health and Safety at Work etc. Act, 1974;
- » Electricity at Work Regulations, 1989;
- » The Environment Protection Act (including Duty of Care regulations), 1990;
- » Health and Safety Executive 'Protection of Workers and the General Public during Redevelopment of Contaminated Land' HS (G) 66, HMSO, 1991;
- » Party Wall etc. Act, 1996;
- » Provision and Use of Work Equipment Regulations, 1998;
- » The Lifting Operations and Lifting Equipment Regulations, 1998;
- » The Management of Health & Safety at Work Regulations, 1999;
- » The Control of Substances Hazardous to Health (Amendment) Regulations, 2004 (COSHH 2004);
- » Control of Vibration at Work Regulations, 2005;
- » The Noise at Work Regulations, 2005;
- » The Hazardous Waste Directive;
- » The Hazardous Waste Regulations and The Hazardous Waste (Northern Ireland) Regulations, 2005;
- » Health and Safety Executive Guidance Note EH40/98 relating to Occupational Exposure limits;
- » The Work at Height (Amendment) Regulations, 2007;
- » The Controlled Waste (England and Wales) Regulations, 2012;
- » The Control of Asbestos Regulations, 2012 (CAR 2012); and
- » The Construction, Design and Management Regulations, 2015.

E.3 Licences, Permits and Consents

The Contractor(s) shall obtain all necessary approvals, licences, consents and permits from regulatory bodies and third parties prior to commencement. These are to be provided to Hydrock for review and comment a minimum of one week prior to commencement of the Works.

The Contractor(s) should only conclude that approvals have been sought by others where such approval has been provided to the Contractor(s), or where the Contractor has been advised in writing that others are obtaining approvals.

If treatment of the soils is to be undertaken (e.g. bioremediation of contamination), it will need to be undertaken in accordance with an appropriate Environmental Permit, which is likely to be a Standard Rules Permit (SR2008 Number 27).

If crushing of recycled aggregate is to be undertaken, it will need to be undertaken in accordance with an appropriate Environmental Permit (Mobile Plant), likely a SR2010 Number 11 or Number 12.

Any reuse of soils or below ground materials will need to be undertaken in accordance with the 'Definition of Waste: Development Industry Code of Practice - Definition of Waste. Development Industry Code of Practice', Version 2 2011 i.e. in accordance with an approved Materials Management Plan and Qualified Person Declaration.

All recycled materials (6F2 etc.) must be produced under the 2013 Aggregates Protocol. If they are not, they will be deemed a waste and can only be used on site under a permit. More information can be found at <https://www.gov.uk/government/publications/quality-protocol-production-of-aggregates-from-inert-waste>.

E4. Traffic safety and management

The Contractor shall comply in all respects with Chapter 8 of the Traffic Signs Manual for works on, affected by, or affecting, the public highway and/or private roads forming the highway access to/from the site. The Contractor shall obtain all necessary consents from the Local Highway Authority for works on the public highway.

On-site access and haul routes should be provided and maintained by the Contractor in such a manner so as not to endanger either the user, those working in the vicinity of such accesses/haul routes or the Works.

Access to the site will be agreed with the Client prior to commencement.

The Contractor shall take all necessary measures to prevent the spread of mud and debris on the public highways or private roads. Regular inspections of the public highway/any private roads adjacent to the site shall be carried out. The Contractor shall ensure that the highway/private roads are swept regularly to remove any mud, slurry or dust deposited by vehicles entering or departing the site. If the Client considers that significant amounts of any detritus have been deposited on the public highway/private roads then operations shall be temporarily suspended until appropriate cleaning operations have been undertaken. The costs for all wheel washing facilities and cleaning of the public highways/private roads as required, or as requested by the Client, are deemed to have been included in the tender.

The Contractor shall co-operate with other Contractors or site users present during the works and shall co-ordinate their activities to minimise disruption.

Risks associated with the transport of hazardous/contaminated materials should be appropriately managed to keep the risk of spread of contamination as low as reasonably possible.

E5. Services

Service records are provided by the Client for information purposes only.

It should be noted there is an existing electricity substation on site that serves the wider area and is to remain on-line throughout the remediation works. It should also be noted that where mains services need to remain during and following remediation, it is the Contractor's responsibility to ensure they understand which services are to remain and ensure the correct services remain following demolition.

The Contractor is to report the location of any previously unidentified services.

Prior to site work commencing, the position of all services indicated as on site, or off site but close to the site boundary, shall be determined, and clearly identified where on site. The locations should be confirmed on site by appropriate inspection, investigation (vacuum excavation), observations and survey. Any discrepancies between the anticipated positions and confirmed locations are to be reported to the Client.

All services on site that are to be retained through the works are to be positively located on site; reliance shall not be placed on existing records. Services are to be visibly marked and protected for the duration of the works. Appropriate methods are to be put in place to ensure all site staff working in the vicinity of retained services are fully briefed.

E6. Drawings and supplied information

Whilst every effort has been made to ensure that the information provided to the Contractor is correct and current, the Contractor is responsible for corroborating the existing information with the benefit of their site presence, and reporting any discrepancies encountered or anticipated, to the Supervising Engineer immediately.

Where cutting and filling operations are to be carried out the Contractor is to undertake comparative assessments with the benefit of existing information, additional survey and their anticipated sequence of work to ensure sufficient and suitable material is available to undertake the works as proposed. Any anticipated shortfall or surplus is to be report immediately.

E7. Photographs and progress reports

The Contractor is to provide on site a digital camera and e-mail facilities, to enable electronic transfer of site photographs and other information, for the full duration of the contract.

Progress photographs are to be taken at least weekly across all parts of the site for inclusion within the Contractor's progress reports.

A weekly photograph log is to be collated and submitted to the Client. The photograph log is to be collated as a document, with captions describing each photograph. The weekly photograph log / progress report, shall include: details of works undertaken; representative photographs (with captions explaining the works in each photograph); details of test locations and laboratory test certificates together with any other relevant information. The weekly photograph log, shall also include a plan showing where photographs were taken from and the direction photographs were taken.

A progress report is to be provided on a monthly basis (or more regularly, if meetings are more frequent), prior to the progress meeting. The progress report may include the weekly photograph logs as appendices, to show progress.

All completed excavations are to be photographically recorded and presented as a collated document for each excavation. Photographs are to include: the excavation during excavation; the excavation prior to backfilling, showing the trimmed surfaces; the filling operation and the completed backfilled excavation.

Photographs are to be made available to the Client in electronic format should they be requested during the contract. Record photographs should be provided as part of the validation information. The weekly photograph log can be used to assist in the validation report.

E8. Asbestos mitigation during earthworks

It should be noted that Asbestos Containing Materials (ACM) and asbestos fibres have not been detected in soils at the site. However, the Contractor(s) should assume that asbestos may be found in all Made Ground soils and those formed during the demolition works.

As part of the proposed remediation works and earthworks, during excavation, processing and placement of Made Ground soils, there will be a requirement to remove any identifiable ACM encountered and to mitigate the risks of asbestos fibres from soil becoming airborne.

The Principal Contractor must manage the risks in accordance with their legal requirements and will need to prepare appropriate health and safety documentation and obtain appropriate approvals, licences, consents and permits prior to commencement.

All ACM encountered during works shall be hand-picked and disposed of off-site.

If ACM is encountered, the Contractor is required to have in place all appropriate licences and insurances specific to this project and the type of work required (or to employ a suitably licensed and insured Subcontractor). The Contractor is to provide evidence to the Client as to how the works are classified under the Control of Asbestos Regulations 2012 (CAR 2012).

Prior to commencing ground works, the Contractor shall ensure a detailed Method Statement and Risk Assessment, and any other necessary information, are written and submitted to the Client for approval. It will be the responsibility of the Contractor to ensure that the methods adopted for the removal of the asbestos is of a standard acceptable to the Health & Safety Executive (HSE) and in accordance with relevant guidance and legislation.

The remediation works are designed to break the source-pathway-receptor linkage with regard to contaminants in the soil (by the removal of identifiable ACM, hydrocarbon impacted soils (hotspots) and the installation of an engineered cover system).

The Ground Works Contractor shall have in place at the start of the contract, work procedures designed to ensure they are working in full compliance of all Health and Safety requirements (including, but not exclusively CAR 2012 and CAR Soils) and that control measures are sufficiently robust to prevent release of airborne asbestos fibres into the surrounding environment. Appropriate PPE, and if required RPE, shall be provided and utilised.

E9. Surveying

The Contractor shall provide surveying personnel and equipment as necessary to undertake the following activities and any other requirement for topographical information relating to the project that arises through the duration of the enabling works contract.

The survey personnel and equipment should be capable of providing accurate levels and coordinates in relation to the national grid.

The following key activities are covered by the requirements for surveying:

- » confirmation of topographical survey on possession of the site, and setting out of the site boundary;
- » confirmation of positions of existing services and site features;
- » surveying the base and extent of all excavations and remaining obstructions (to be undertaken prior to backfilling);
- » all setting out and levelling relating to delivery of the enabling works;
- » the location of sub-structures removed;
- » interim surveys to be undertaken during the infilling works to provide information on issues such as depth of excavation, progress of earthwork, quantities of materials etc.;
- » the location and elevation of test samples and locations; and
- » as built survey information.

A topographical survey of the site is provided in the Site Information. The Contractor is required to undertake all necessary topographical survey works to verify these levels before the commencement of the contract. Should the Contractor find any discrepancies on the drawings they are to refer the matter to the Engineer for verification before proceeding with the part of the works affected.

The Contractor shall undertake a topographical survey following completion of the enablement works.

All topographical surveys shall include levels at maximum 10m spacing and details of any changes in slope, structures, services and other features of interest.

All of the above features shall be surveyed for line and level at the site boundary and marked on a plan. Levels shall be to Ordnance Datum and locations to National Grid. The survey shall be calibrated against existing site surveys and benchmarks in the vicinity of the site.

Appendix E Cover System Justification

Cover System Justification

There are two broad categories of cover system available for use in the remediation of contaminated land¹:

- » simple cover systems/growing medium: designed to provide a reduction of risk to human health and to provide a suitable medium for plant growth; and
- » engineered cover systems: designed to provide complete separation of the receptor from the source and to perform a number of functions including limiting upward migration of contaminants due to capillary rise and controlling the downward infiltration of water.

An assessment of the suitability of a 'simple' cover system as per Hollingsworth, 2004 (BRE 465) has been undertaken. This indicates that a simple cover system is not appropriate (due to the presence of asbestos fibres). As such an engineered cover system is proposed.

The engineered cover system beneath landscaped and garden areas is proposed to consist of (bottom up):

- » a bonded geogrid (e.g. Tensar TX160G); and
- » Subsoil (450mm in gardens and 300mm in public open space); and
- » a minimum of 150mm Topsoil.

For trees planted as part of the wider landscaping, tree pits will need to be excavated in the underlying soils and the cover system deepened to allow these trees to have sufficient soil for the root ball. The depth of this deepening will need to be designed in conjunction with the landscape architects.

The engineered cover system will need to be validated by the Consultant once final installation has been undertaken.

An assessment of the design limitations and considerations regarding the proposed cover system has been undertaken and is detailed in Table E.1 in accordance with BRE 465.

Table E.1: Design Considerations for a Cover System

Factor affecting suitability of a cover system	Design limitation	Consideration
Presence of soil gases and vapours	A simple cover system will not inhibit the movement of soil gases or vapours.	In the landfill area, no buildings are proposed, therefore no gas protection measures are required.
Location and mobility of water table and solubility of contaminants	Liquid or soluble contaminants may be brought to the surface by rising water table.	A perched water table is present at relatively shallow depths, but will be controlled by the installation of plot drainage and road drainage. As such, the risk from a rising water table is low.
Risk to Controlled Waters	If mobile elements are in continuity with the Controlled Waters a cover system would provide no additional increased protection to the groundwater.	There are no significant risks to Controlled Waters identified.

¹ BRE 465 'Cover Systems for Land Regeneration, Thickness of Cover Systems for Contaminated Land' 2004 is a useful discussion document, but as noted in the publication, the principle aim of the research is focussed on a *reduction in risk* rather than the *prevention* of exposure.

Factor affecting suitability of a cover system	Design limitation	Consideration
Significant Contamination	If the concentrations of contaminants are significantly elevated the short-term exposure risk due to any excavation is likely to be unacceptable along with other potential risks associated with the cover system being compromised.	ACM is present. ACM will be removed by suitably licenced Contractors.
Deep Excavations	Exposing the contaminated material below the cover.	No deep excavations will be carried out in the landfill area.
Excavations for buried services	Exposing the contaminated material below the cover. Contamination of water services.	No services are proposed in the landfill area.
Slopes	The combined effects of gravity and seeping waters on a slope could lead to the failure of the cover system.	No significant slopes are present in the landfill area.
Areas where mole, badger, rabbit and fox populations are significant.	Contaminated material can be brought to the surface.	The site is a proposed mixed-use development with the presence of badgers and rabbits, they may present an obstacle to the implementation of the cover system.

In addition to the factors covered in Table E.1 above, additional considerations with respect to the cover system are detailed below.

Depth of Earthworm Activity

Worms can cause intermixing of the soils, including bringing soils from depth to the surface. However, the research also indicates that the main worm activity within the soil profile is within the upper 150mm, reducing rapidly with depth. The temporary shallow sub-horizontal burrows, which are more likely to lead to soil intermixing (due to their regular collapse) are generally to depths of 300mm to 350mm, with more permanent near vertical burrows to greater depths.

It can be concluded that a depth of 450mm to 600mm Topsoil/Subsoil will not have a significant impact from worm activity.

Depth of Burrows from Burrowing Animals

The main burrowing animals that are likely to affect soil cover in gardens are rats, mice moles, rabbits, badgers and foxes.

As the site is a proposed mixed-use area the presence of moles, rabbits, badgers and foxes will not present an obstacle to the implementation of the cover system (as they will be actively discouraged by the residents and site users or prefer alternative locations in the fields surrounding the site).

Rats live in burrows often near a food source such as houses, farms or near rubbish bins. The burrows are generally to depths of around 500mm, and they frequently occupy disused rabbit burrows. As there are not going to be disused rabbit burrows in the engineering cover system, a depth of 600mm Topsoil/Subsoil will not have a significant impact on rats. In addition, rats will be actively discouraged by residents and site users as a pest.

The burrowing animals that are likely to be present on site may cause the greatest disturbance is rats which may dig to 500mm. However, rats are not seen as a desirable animal to encourage in a

residential area and will have many alternative locations and it is concluded that a depth of 450mm to 600mm Topsoil/Subsoil will not have a significant impact on burrowing animal activity.

Wood mice also live in burrows to depths of 70mm to 180mm.

Effects from Plant/Tree Roots

Plants tend to have a shallow root mat influenced by: soil density, availability of nutrients and availability of moisture. Ranges of the minimum soil layer thickness required for various plants include: 150mm for grass, 200mm to 300mm for garden crops and up to 500mm for shrubs. However, it is considered that significant root penetration can be reduced if shallow soils have suitable nutrients and moisture.

Deeper pits are required for trees. However, tree pits will be dug for trees planned for installation during construction.

It is concluded that a depth of 450mm to 600mm Topsoil/Subsoil will be suitable for plants in gardens.

Appendix F Roles and Responsibilities

Table F.1: Roles and responsibilities

WORK ACTIVITY	RESPONSIBILITY
Pre-Contract	
Remediation Statement and Verification Plan	Hydrock
Regulatory discussion and agreement (yet to be undertaken / commissioned)	Hydrock
Geotechnical Design/Earthworks Specification (yet to be undertaken / commissioned)	Hydrock
Pre-Commencement	
H&S Risk assessments and working methods.	Enablement Contractor Ground Works Contractor
MMP and QP sign off for Enablement Works.	Enablement Contractor
MMP Qualified Person declaration and provision of declaration to Hydrock (before any excavation works commence).	Enablement Contractor
Applying for any necessary licenses and permits	Enablement Contractor Ground Works Contractor
Groundwater disposal licence/permit for water pumped from the site.	Enablement Contractor Ground Works Contractor
Detailing of the radon protection measures.	Structural Engineer or Architect
Enablement Remediation	
Site strip, testing and stockpiling.	Enablement Contractor
Any required groundwater control and discharge.	Enablement Contractor
Examination of soils below and around all potential point sources (tanks, drums, pipes, drains and areas of staining).	Enablement Contractor With watching brief by Hydrock (see discovery strategy)
Appropriate mitigation measures (by suitably trained operatives) to remove identifiable ACM and mitigate the risks of asbestos fibres becoming airborne.	Enablement Contractor
Excavation of impacted soils	Enablement Contractor
<i>Ex situ</i> remediation of hydrocarbon impacted soils and associated testing (if present (unlikely))	Enablement Contractor
Reuse of soils as appropriate to the required levels (general cut to fill) in accordance with the RS&VP and placement as set out in the Earthworks Specification.	Enablement Contractor
Chemical and geotechnical testing (classification and placement) as set out in the Earthworks Specification and EWS	Enablement Contractor
Disposal of unsuitable material	Enablement Contractor
Provision of an Enablement Validation report as per the RS&VP and the Earthworks Specification.	Enablement Contractor
Verification Report and Geotechnical Feedback Report	Hydrock
Cont...	

WORK ACTIVITY	RESPONSIBILITY
Construction works	
MMP and QP sign off and declaration for Construction Works.	Ground Works Contractor
Any required groundwater control and discharge.	Ground Works Contractor
Testing of excavated soils to ensure they are suitable for use	Hydrock
Final cut to fill and appropriate materials management and handling to ensure excavated soils are suitable for use.	Ground Works Contractor
Site watching brief and visual observation and assessment of soils to ensure they are suitable for use below the cover system.	Ground Works Contractor Hydrock
Installation of radon protection measures.	Ground Works Contractor
Validation of the radon protection measures, including provision of photographic proof of installation.	Ground Works Contractor or Specialist Installer
Provision of preliminary test data for imported soils (if not a commercial source) prior to import to Hydrock.	Ground Works Contractor
Provision of import certificates for commercial Topsoil (testing to pass the RTVs)	Ground Works Contractor
Testing of any imported soils.	Hydrock
Placement of the cover system using imported and site-won soil.	Ground Works Contractor
Provision of all validation data/requirements as per the RS&VP	Ground Works Contractor
Validation of the Cover System, including provision of photographic proof of installation.	Ground Works Contractor
Verification of the cover system.	Hydrock
Verification of radon protection measures installation.	Ground Works Contractor