

Appendix 13.2

**OUTLINE REMEDIATION METHOD
STATEMENT**



Fort Halstead

Outline Remediation Method Statement

For Merseyside Pension Fund

Date: 19 September 2019

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1 INTRODUCTION

1.1 Terms of Reference

In October 2018, Hydrock Consultants Limited (Hydrock) was commissioned by CBRE as agent for Merseyside Pension Fund (the Client) to produce and Outline Remediation Method Statement (RMS) for the proposed development at Fort Halstead, Crow Drive, Sevenoaks, Kent TN14 7BS.

Hydrock understands that there has been existing planning consent for the site and that this report will support a revised planning application to comprise 650-750 residential units and 23,000-27,650sqm of commercial floorspace.

A copy of the parameter plans and site plans are presented within Appendix A.

The works have been undertaken in accordance with Hydrock's proposal referenced (C-10730-C_Fort_Halstead_2018_BelowGroundServicesFee_002, 24/09/18).

1.2 Objectives

The objective of this RMS is to present how the remediation of the site will be undertaken and how the works will be validated. In addition, the RMS explains how the works will be permitted under current regulatory regimes and how any unforeseen contamination will be assessed and addressed.

Remediation will ensure that upon completion of the development the ground conditions at the site can be shown to be appropriate for the intended use and that they will not pose unacceptable contamination risks to identified receptors. This document therefore covers the protective measures to be undertaken during the demolition, enablement and construction phases of the redevelopment.

This document is an outline RMS which prescribes the remedial works required to ensure suitability of the end uses proposed. It is anticipated that further investigation works will be undertaken, principally in areas not accessible (eg beneath existing buildings and infrastructure) and consequently this document is a working document and may need to be updated, in agreement with the relevant regulatory bodies, dependent on the conditions encountered.

Depending on the specifics of the construction delivery programme and contractor methodologies, it may be necessary for phase specific Remedial Method Statements to be produced.

This document is subject to the approval of the regulatory parties including the Local Authority, Environment Agency and the NHBC.

1.3 Scope

The scope of the RMS comprises:

- a summary of the results of the various risk assessment reports undertaken at the site;
- a summary of the sites conceptual model;
- a remediation options assessment; and
- Details of the remedial works required to ensure suitability of the end uses proposed.

1.4 Sources of Information

In preparing the remediation strategy the following documents were consulted and should be read in conjunction with it:

- Hydrock, September 2019. 'Desk Study, Ground Investigation and Data Review', Ref: 10730-HYD-XX-XX-RP-GE-1000-S2-P1
- Aspinwall. April 1999. 'DERA Fort Halstead, Land quality Assessment, Phase I Desk Study', Ref: 10469;
- Environmental Resources Management. July 2001. 'Project Lamb: Phase I Environmental Assessment: Fort Halstead, Kent' UK', Ref: 7923;
- Environmental Resources Management. July 2001. 'Project Lamb: Phase II Environmental Assessment: Fort Halstead, Kent, UK', Ref: 7923;
- Enviros Aspinwall. March 2002. 'DERA Fort Halstead Land Quality Assessment Phase II Site Investigation, Land Quality Assessment Report', Ref: 11469;
- RWE Nukem. January 2005. 'Radiological Investigation for QinetiQ at Fort Halstead, Kent', Ref: 96034;
- Jacobs. September 2005. 'QinetiQ Fort Halstead, Documents Review and Intrusive Investigations', Ref: J23008G0;
- Waterman. February 2015. 'Data Review, Preliminary and Generic Environmental Risk Assessments', Ref: EED12715-100.R.1.9.1.KH;
- Waterman. February 2015. 'Outline Remediation Strategy', Ref: EED12715-100.S.1.4.1.KH;
- John Thompson and Partners. 'Land Use and Green Infrastructure Plan', Ref: 00556I_PP01.

A geotechnical design report and earthworks strategy will be required for the proposed development blocks and should be produced as detailed design progresses.

1.5 Limitations

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, all potential environmental constraints or liabilities associated with the site may not have been revealed.

The report has been prepared for the exclusive benefit of Merseyside Pension Fund for the purpose of providing information on the remediation and validation works to be undertaken during the demolition, enablement and construction phase 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.

Hydrock has used reasonable skill, care and diligence in the design of the remediation of the site. The inherent variation in 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. 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 the CLR 11 Model Procedures (Environment Agency 2004), Land Contamination: Risk Management (GOV.UK), BS5930:2015 and BS10175:2011+A2:2017.

2 CONCEPTUAL MODEL AND GROUND MODEL

2.1 Site Location and Current Land Use

Fort Halstead is located off Crow Drive, Sevenoaks, Kent. TN14 7BP. The National Grid Reference of the approximate centre of the site is 159348N, 549845E.

The site occupies a hilltop which is typically 190m-215m above Ordnance Datum (OD). The northern finger of the site encompassing Crow Road, slopes downwards to 165m OD at the northernmost extent of the site. The site is bordered to the south and east by the North Downs escarpment.

It was formerly owned and operated by QinetiQ until its sale in 2005. QinetiQ and Defence Science and Technology Laboratory (DSTL) were the primary tenants until this time and currently remain on site although DSTL are undertaking a programme of relocation to Porton Down. Works focused on research into weapons systems, explosives, propellants and other military operations. As part of DSTL's relocation a number of the buildings are no longer in operational use and have been decommissioned.

The site contains over 300 structures including offices, laboratories, warehouses, a firing range, explosive storage facilities, machine shops, x-ray facilities, a fuel station, burning grounds, a waste compound and storage tanks. Structures are grouped into the A, F, H, M, N, Q, R, S and X Areas.

Ancient woodlands are located within and bordering the site. The site is within an Area of Outstanding Natural Beauty (AONB) and is within the London Green Belt. Halstead Fort contained within the site, is a scheduled monument.

The site boundary consists of security fencing around the perimeter. The surrounding land is primarily fields interspersed with residential villages and industrial units.

The M25 runs approximately 600m from the south and eastern site boundaries.

2.2 History

Historic records indicate that the fort was constructed from 1895-1897 and prior to that the site was ancient woodland. Records in the intervening years are limited, given the sensitivity of the site, with only a nursery and residential developments along Crow Drive shown. The 2002 map was the first to indicate a number of structures and car parks depicting the layout of the site.

Historical records confirm the military use of the site commenced from 1938.

The site was sold in 2005, with further development and alterations shown on the 2014 map.

2.3 Geology

The geology at the site consists of Clay-with-Flints formation overlying Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated). Made Ground is anticipated across the Site.

2.4 Hydrology and Hydrogeology

Based on the inferred geological sequence presented in section 2.3 and the Environment Agency's interactive aquifer designation map, the aquifer system presented in

Table 2.1 applies.

Table 2.1 Aquifer System

Stratum	Aquifer Designation	Hydraulic Characteristics
Clay-with-flints Formation.	Unproductive Strata	Low permeability, negligible significance for water supply or river base flow. May contain a perched water table.
Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated)	Principal Aquifer	High fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale.

There are no active licensed groundwater abstractions within 1000m of the site. The site is not located within a groundwater Source Protection Zone (SPZ).

Groundwater associated with principal aquifers was not encountered during previous site investigations. Based on BGS Hydrogeological map of the Chalk and Lower Greensand of Kent, Sheet 3b, 1970, ground water level is anticipated to be approximately at least 90m bgl.

There are no mapped watercourses within the site boundary. The closest mapped watercourses are unnamed inland rivers, 495m north and 497m north east of the site boundary.

There are no active licensed surface water abstractions or discharges within 1km of the site.

2.5 Physical Ground Conditions

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 the desk study information.

A summary of the ground conditions encountered across all investigations undertaken is presented in Table 2.2 and the individual strata are described in the sections below.

Groundwater was not encountered and is anticipated to be at greater than 90m bgl.

Table 2.2: Strata Encountered

Stratum	Brief Description	Depth to Base (m bgl)
Made Ground	A variety of types of Made Ground were encountered, typically including sandy slightly clayey GRAVEL	Max 3.5m bgl Average 0.5-1.2m bgl
Clay with Flints	Generally comprising firm to stiff red brown mottled orange brown sandy gravelly clay	0.3m bgl and 12.4m bgl
Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation	Weak to moderately strong partly weathered white with occasional yellow staining CHALK. Closely spaced fractures infilled with soft remoulded chalk fragments (Grade IV).	0.4m bgl and >15m bgl

The topography of the site means that the depth to strata detailed above is variable, consequently reference to the 2019 Hydrock GI report should be made for additional area specific information.

2.6 Radon

The site is not in a Radon Affected Area and no radon protection measures are required.

2.7 Obstructions

Obstructions have been encountered at numerous locations across the site. Details of where these have been located has been further specified within the area assessments presented within the Hydrock 2019 GI report.

3 RISK ASSESSMENT REVIEW

3.1 Introduction

This section summarises the risk assessment findings as presented in Hydrock Report 10730-HYD-XX-XX-RP-GE-1000, dated September 2019 and is subject to agreement with the Regulators.

A detailed end use specific risk assessment has been undertaken in the above report and reference should be made to this document where further information is required.

3.2 Human Health Risks

3.2.1 *Made Ground*

Made Ground within the existing waste compound has confirmed to be a source of lead, PAH and petroleum hydrocarbons. This area is proposed for residential end use.

Made Ground around the location of BH556 has been confirmed to be a source of PAH when assessed against the Public Open space (Residential) end use proposed.

Previous site investigations have indicated the Made Ground has historically been confirmed to be a source of Nickel, PAH and petroleum hydrocarbons at and within the vicinity of the Scheduled Monument.

3.2.2 *Asbestos*

Asbestos has been encountered in Made Ground at a number of locations across the site.

3.3 Permanent Gas Risks

Based on the data to date no mitigation measures against permanent ground gas entry to the proposed development are required. Further monitoring is necessary in order to meet CIRIA best practice.

3.4 Risk to Controlled Waters

Based on the data obtained from the investigations undertaken on the site and given the depth to groundwater (>90m) no significant risk to controlled waters has been identified.

3.5 Plant Life

No significant risk to plant life has been identified.

3.6 Water Pipelines

The site is brownfield and organic contamination has been identified in exceedance of the threshold values and Hydrock believes barrier pipe is required. However, confirmation should be sought from the water supply company at the earliest opportunity.

3.7 Depleted Uranium

In September 2005 at the request of QinetiQ, decommissioning of buildings that housed depleted uranium operations was undertaken by RWE Nukem, including a drainage clean up beneath buildings Q7, Q6.3 and N19. Following completion of the works, it was concluded by RWE Nukem that the decontamination work had proceeded satisfactorily.

On 27th July 2016 Hydrock supervised a drainage inspection by Aurora Health Physics Services Limited. All accessible drains surrounding building Q7, Q6.3 and the now demolished N19, were inspected, as well as the drains surrounding the demolished H19 where a uranium salt spill had been recorded historically.

In total 39 drain covers were lifted and surveyed for levels of alpha, beta and gamma emissions. All alpha and beta emission recorded were at background levels. Gamma emission was recorded between 120-330cps (counts per second) which was attributed to natural radiation in the brick making up the drain walls and the geometry of the drain surrounding the probe.

Sediment samples were collected for analysis of uranium by alpha spectrometry and ICP-MS (Inductively Coupled Plasma Mass Spectrometry), where available. Four sediment samples (three from drains surrounding Q7 and one from a drain in the area of the demolished H19) were obtained.

All radionuclide concentrations were 'outside of scope' of the current legislation, (Radioactive Substances Act 1993 and the Environmental Permitting Regulations 2010) as all concentrations recorded were at levels not deemed to be radioactive.

3.8 Explosives

Shallow soils were analysed for traces of explosive residues in twenty-four locations across the site, these were concentrated in the R and M areas due to their use and storage of explosive materials.

Samples were analysed for an extended explosives suite using method ESAL/QC/4 parts a, j and k LCMS soils HPLC soils.

Concentrations of the explosives analysed were below the laboratory limit of detection in all but one sample, TP523 at 0.1m, located in the M area.

Explosives residues are therefore not considered a significant risk.

3.9 Summary

The source-pathway-receptor linkages given in **Error! Reference source not found.** are those which, following the risk evaluation process, require mitigation.

Table 3.1 Final conceptual model and residual risks following risk evaluation

Pollutant Linkage	Sources	Pathways	Receptor	Comment	Mitigation	Land Use Zone Affected
PL 1	Asbestos fibres from asbestos-containing materials in the Made Ground and natural soils.	Inhalation of fugitive dust.	Human Health (End users)	Made Ground seen to contain asbestos-containing materials. Asbestos fibres measured in soil samples.	Following further validation sampling to delineate the extent of ACM within soils, mitigation to be provided by way of a clean capping system in areas of gardens and open landscaping.	<ul style="list-style-type: none"> • Employment • Mixed Use • Public open space (Park) • Public open space (Residential) • QinetiQ • Residential • Scheduled monument
PL 2	Elevated asbestos fibres.	Inhalation of fugitive dust	Human Health (Neighbours)	Elevated concentrations have been recorded.	Potential for generation of contaminated dust. Suitable mitigation measures for dust suppression should be employed during construction.	<ul style="list-style-type: none"> • Employment • Mixed Use • Public open space (Park) • Public open space (Residential) • QinetiQ
PL 3	Elevated asbestos fibres.	Inhalation of fugitive dust	Human Health (Construction Workers)	Elevated concentrations have been recorded.	Construction workers to adopt good hygiene and safe working practices.	<ul style="list-style-type: none"> • Employment • Mixed Use • Public open space (Park) • Public open space (Residential) • QinetiQ • Residential • Scheduled monument
PL 4	Elevated PAH	Ingestion, inhalation or direct contact.	Human Health (End users)	Elevated PAH concentrations have been recorded around BH556 and proposed Mixed use. Remainder of green space	Following further delineation mitigation to be provided by way of a clean capping system in the area of BH556.	<ul style="list-style-type: none"> • Public open space (Residential)

Pollutant Linkage	Sources	Pathways	Receptor	Comment	Mitigation	Land Use Zone Affected
			Human Health (Construction workers)	has no significant exceedances.	Construction workers to adopt good hygiene and safe working practices.	
PL 5	Lead, copper and nickel in the Made Ground.	Ingestion, inhalation or direct contact.	Human Health (site users)	Significant exceedance of the GACs for these metals were recorded during the historical investigations, principally in the former waste compound. However, recent investigations did not record any exceedances of Lead and Copper and only a minor exceedance of Nickel.	As recorded concentrations of these metals are generally below the GAC in the 2016 and 2018 investigation, mitigation would not normally be merited. However, because of the significant exceedances recorded historically within the waste compound, further validation testing will be necessary, pre-construction, to confirm whether or not mitigation may be required.	<ul style="list-style-type: none"> Residential
PL 6	Hotspots of Petroleum Hydrocarbons, PAH and asbestos fibres within Made Ground.	Ingestion, inhalation or direct contact.	Human Health (End users, neighbours, construction workers)	Significant exceedances of the GACs have been recorded within the waste compound of the 'S' Area.	Mitigation by way of a clean cover system and barrier pipe are recommended. Further assessment warranted given current SI density. Outside of the waste compound no mitigation is required. Construction workers to adopt good hygiene and safe working practices.	<ul style="list-style-type: none"> Residential
PL 7	Elevated metals, hydrocarbons, PAH and asbestos fibres.	Direct Contact	New buildings and infrastructure.	Elevated concentrations have been recorded.	Concrete for new foundations to be designed to withstand chemical concentrations. Underground services to be constructed with appropriate barrier piping where necessary.	<ul style="list-style-type: none"> Residential
PL 8	Nickel in the Made Ground.	Ingestion, inhalation or direct contact.	Human Health (End users)	Nickel has been recorded at approximately 5 times the GAC. There is a low volume of samples within the Made Ground.	Increased density of validation sampling is required to conclude whether it will be necessary for mitigation measures. If mitigation is	<ul style="list-style-type: none"> Scheduled monument

Pollutant Linkage	Sources	Pathways	Receptor	Comment	Mitigation	Land Use Zone Affected
					required a clean cover system will be the likely solution.	
PL 9	Elevated metals and asbestos fibres.	Inhalation of fugitive dust	Human Health (Neighbours)	Elevated concentrations have been recorded.	Potential for generation of contaminated dust. Suitable mitigation measures for dust suppression should be employed during construction.	<ul style="list-style-type: none"> Scheduled monument
		Ingestion, inhalation or direct contact.	Human Health (Construction Workers)	Elevated concentrations have been recorded.	Construction workers to adopt good hygiene and safe working practices.	
		Direct Contact	New buildings and infrastructure.	Elevated concentrations have been recorded.	Concrete for new foundations to be designed to withstand chemical concentrations. Underground services to be constructed with appropriate barrier piping where necessary.	

4 REMEDIAL STRATEGY

Earthworks and remediation will be undertaken such that the site is suitable for its proposed new use. Remedial requirements vary depending on the specific end use proposed.

Details of the conceptual model, ground model and the risk assessment are included in the Hydrock Report 10730-HYD-XX-XX-RP-GE-1000, dated September 2019.

The implementation of the works will be in accordance with documented quality assurance procedures to be prepared by the remediation contractor. These will include the following:

- **Outline Remediation Method Statement** – This sets out the remedial requirements necessary to ensure the site is suitable for use and details the data required to demonstrate the effectiveness of the remediation. These are detailed in the following sections of this report.
- **Detailed Remediation Method Statement.** Where phase specific remedial measures are necessary through plot sequence, additional data or contractor methodology these should be captured within a detailed Remediation Method Statement. This document should demonstrate how the proposed works will achieve the remedial requirements specified within the Outline Remediation Method Statement.
- **Verification Report** - this will provide a complete 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. A verification report is anticipated to be required for each phase.

4.1 Summary of Remediation Proposals

Based upon the findings of the ground investigations and risk assessment and the Remediation Options Appraisal (presented in Appendix F), the following works will be undertaken to create a site which is suitable for its proposed end use.

It should be noted that if soils are to be reused on site, works will need to be completed in accordance with the 'CL:AIRE Definition of Waste Development Industry Code of Practice, 2nd Edition' and the Contractor will need to write an appropriate Material Management Plan and provide a 'Qualified Person (QP) Declaration'.

The following remedial activities will be required to deliver the site *Suitable for Use* (SFU) for the defined residential end use and can be separated into Enablement Phase and Construction Phase.

Detailed Geotechnical Design is not considered here and the Contractor shall ensure all works are undertaken to an appropriate Geotechnical Design Report (GDR) Earthworks Method Statement and Specification. Typical geotechnical performance criteria are presented within Appendix B.

4.1.1 Demolition Phase

The following works are considered necessary during the Demolition Phase of works:

- installation of asbestos air monitoring positions at the site boundary;
- establishment and site clearance;
- removal of asbestos by specialist contractors from buildings in accordance with the asbestos survey and relevant legislation;

- controlled decommissioning, decontamination and demolition of site buildings and ancillary structures including tanks, existing drainage system and associated pipework (above ground);
- processing, screening and stockpiling of arisings with appropriate controls for asbestos .

4.1.2 *Enablement Phase*

The following works are considered necessary during the Enablement Phase of works:

- record keeping and reporting during works;
- additional phase specific site investigation works and risk assessment;
- removal of the floor slabs and excavation of all underground/subsurface obstructions;
- removal of tanks, existing drainage system and associated pipework (below ground) where encountered during the above floor slab removal. Due consideration should be given to the localised potential for radionuclide concentrations;
- examination of soils below the slab and investigation of any identified hotspots or soils associated with identified tanks, pipes and drains;
- processing, screening, stockpiling of arisings;
- assessment and mitigation of any unforeseen identified contamination;
- ex situ remediation of contaminated soils (where necessary);
- asbestos mitigation;
- reuse and placement of soils which pass the reuse target values (RTVs) and in accordance with any cut/fill formation levels;
- installation of a working platform (if required)
- off-site disposal of waste material;
- production of a Validation Report by the Enablement Contractor; and
- checking and approval of contractors Validation Report and preparation of a Verification Report.

It is anticipated the Enablement Phase of work will be undertaken by a single Contractor, referred to as the Enablement Contractor. The Enablement Contractor shall ensure all works are undertaken to an appropriate Earthworks Method Statement and Specification, which shall be submitted to the Clients appointed environmental consultant for review and comment prior to commencement.

4.1.3 *Construction Phase*

It is anticipated the Construction Phase of works will be undertaken by a separate Contractor, referred to as the Ground Works Contractor. The Ground Works Contractor shall undertake:

- barrier pipe for potable water supplies (to be confirmed by the regulator);
- excavation of foundation and drainage system including over-excavation of service trenches and backfilling with 'clean' soil;
- installation of the engineered cover system; and
- validation of the construction phase works.

4.2 General Note

All staff for all phases of work, should be made aware of the possible presence for asbestos within the Made Ground soils anywhere on the site at any stage of the development (Demolition, Enablement and Construction).

The Contractors for each stage of works 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. In addition, appropriate working methods, monitoring and reassurance testing will need to be undertaken during the works.

All works on site during any phase of work 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, legislation and deemed necessary. Information is provided in Appendix E to assist. However, it should be noted that the guidance provided in Appendix E 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 the above. Please refer to Appendix E for additional information and general requirements.

All works need to be undertaken in accordance with the Outline Remediation Method Statement (this document) and a Materials Management Plan with a QP Declaration and all remediation works are to be overseen by suitably experienced site staff and a site watching brief or periodic visits will be made by the Clients appointed environmental consultant.

Verification will be undertaken by the appointed contractor and passed to the Clients appointed environmental consultant for approval. Additional verification will be necessary should the Clients appointed environmental consultant consider the data provided insufficient.

4.3 Project Setup and Management

Prior to commencement of site activities, detailed planning of the project shall be undertaken including liaison with relevant stakeholders.

4.4 Project Team

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).

It is assumed that the client will appoint a suitably qualified environmental consultant to oversee the works undertaken by the contractor.

4.5 Appointment of Appropriate Contractors

The Demolition, Enablement and Groundworks Contractors must have suitable experience working in a similar setting, with similar ground conditions and with the Contaminants of Concern (CoCs) present at the site.

The Enablement Contractor is to provide appropriate Geo-environmental Engineering supervision during excavation and validation works.

The Enablement Contractor shall provide a Quality Plan in accordance with Appendix 1/24 included in Appendix B.

The Contractors must 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.

5 SITE WIDE MATERIALS MANAGEMENT STRATEGY

5.1 Materials Management Strategy

The site is a brownfield site; as such any material excavated on site will be classified as waste as soon as it is excavated, unless there is a clear plan in place for the reuse of soils at the site.

One of the ways this can be achieved is set out 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 handling, reuse or disposal of waste is regulated by the Environment Agency. The Agency will take into account the use of the DoWCoP in deciding whether to regulate materials as waste.

If materials are dealt with in accordance with the DoWCoP, the Environment Agency considers that those materials are unlikely to be waste at the point when they are to be used for the purpose of land development. This is because the materials were never discarded in the first place, or because they have been submitted to a recovery operation and have been completely recovered so that they have ceased to be waste.

The procedures to be followed for the production of the MMP are outlined in 'Route B' – Design Statement for the reuse of materials on the site of origin (ref CL:AIRE Code of Practice, Appendix 1).

The Contractors are responsible for writing and ensuring all works that they are responsible for are undertaken in accordance with an MMP signed off by a Qualified Person (QP). The production of a verification report for the MMP is required to be produced by the relevant contractor.

The Contractor shall provide the MMP to the Clients appointed environmental consultant for comment.

5.2 Stockpiling of Materials for Re-Use on Site

In accordance with the approved MMP the following tasks will be required to manage materials on site.

1. Establish and maintain a system for identification of all source, storage and destination areas (stockpiles) for all materials.
2. Segregation and stockpiling of materials based on the following criteria:
 - a. materials awaiting processing and screening;
 - b. materials awaiting geotechnical source approval testing and chemical analysis;
 - c. materials potentially suitable for reuse as part of the engineered cover system without treatment segregated by SHW600 Classification.
 - d. materials potentially suitable for reuse below the engineered cover system (i.e. material not suitable for use in the engineered cover system but geotechnically suitable for use) segregated by SHW600 Classification;
 - e. materials unsuitable for re-use on site (i.e. untreated petroleum hydrocarbon hotspots or soils containing gross asbestos containing material (ACM));
 - f. materials awaiting off-Site disposal;
 - g. imported materials.
3. Label stockpiles and maintain the location of the material without mixing with other material types.

4. Maintain a record of material movement(s) identifying the source area, material status, classification, volume and storage location.

The Contractor shall seek approval from the Client and the Clients appointed environmental consultant with reference to the position of stockpile areas prior to the commencement of the works. Stockpile positions must consider future project phases with a view to minimise double handling or relocation of stockpiles throughout the lifecycle of the project.

All materials will be inspected, sorted and tested to ensure they are geotechnically and chemically suitable for re-use on site in accordance with this Specification and any subsequent earthworks specification.

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

The Clients appointed environmental consultant will undertake inspection of the stockpiled material proposed for re-use on site to confirm that the material meets the grading requirements of SHW600 where possible.

The presence of any asbestos in materials proposed to be reused may result in the material being classified as unsuitable. If asbestos is present, approval for the reuse of this material on site will need to be obtained from the LPA and the NHBC. Any material deemed unacceptable by the LPA, the Clients appointed environmental consultant or the NHBC, is not permitted to be left on site and must be disposed of to a suitably licensed waste facility at the Contractors cost.

Materials which cannot be reused as engineered fill shall be removed from site as waste or to suitable off-site facilities for recycling.

5.3 Stockpiling of Materials for the Engineered Cover System

Materials intended for use as part of the engineered cover system shall be:

- stockpiled away from areas designated for storing other materials;
- stockpiled separately by source;
- stockpiled on a geotextile separator to prevent cross contamination;
- identified with clear signage.

Topsoil stockpiles are to be kept below 2m in height at all times and traffic on the stockpile to be minimised.

Each stockpile of imported material should 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 plots the material is to be used on and where (i.e. building reference).

Each entry shall be signed and dated by the Site Manager. A template form is provided in Appendix D. Other templates or documentation may be used.

Stockpile records and consignment notes should be retained and provided to the Clients appointed environmental consultant for inclusion in the verification report

6 REMEDIAL STRATEGY IMPLEMENTATION – DEMOLITION PHASE

The demolition of existing buildings to slab level will comprise the Demolition Phase of work and be undertaken by the Demolition Contractor. The information provided in the following section is to be undertaken in addition to any demolition Specification provided by the Client.

It is anticipated that the Demolition Contractor will be the Principal Contractor.

The demolition works are to be carried out in accordance with all current and relevant British Standards, codes of practice, statutory, local authority and fire officer requirements and Legislation (in particular but not exclusively, BS 6187:2011 “Code of Practice for Full and Partial Demolition”).

In addition to the requirements of the Client, the Contractor’s attention is drawn to the General Requirements set out in Appendix E, which details the general requirements and responsibilities of the Contractor in relation to health & safety, site set up and operational requirements.

The Demolition Contractor will undertake the following works.

6.1 Task D1: Establish Asbestos Air Monitoring

Preliminary air monitoring by a UKAS accredited laboratory should be conducted during site setup prior to excavation works commencing. The data will provide a base line airborne fibre level which can be used as a comparison once site works commence.

Further monitoring should be conducted by a UKAS accredited laboratory upon commencement of the excavation works for a comparative airborne fibre level to be established. This should consist of monitoring being undertaken whilst excavation works are being conducted. The analyst will be able to provide advice on the air monitoring strategy and suitable locations for monitoring points.

The Clients appointed environmental consultant shall be given an opportunity to review the Contractors proposed monitoring strategy and monitoring positions.

Boundary air monitoring results during works shall be compared with acceptable maximum legal standards set by the HSE Control of Asbestos Regulations 2012. For asbestos these air monitoring procedures and limits are given in HSG 248 entitled “Asbestos: The analysts’ guide for sampling, analysis and clearance procedures” and CAR 2012. The limit used is governed by the levels stated in the above guidance documents and the accuracy of the testing used.

However, for asbestos, Hydrock recommends using the most stringent limit set by the HSE clearance limit (<0.01f/ml) as an action level for asbestos as this provides a much more stringent and safe level for site staff and neighbours. Asbestos air monitoring results are acceptable only if they fall below this limit and are as low as reasonably practical (<0.01f/ml). Exposure from work activities involving asbestos must be reduced to as far below the control limit as possible, personal monitoring results should be within the a ‘Assigned Protection Factor’ (APF) of any RPE in use

6.2 Task D2: Pre-start and Site Clearance

The Contractor will be responsible for the true and proper setting-out of the works and for the correctness of the position, levels, dimensions and alignment of all parts of the works and for the provision of all necessary instruments, appliances and labour in connection therewith. The Contractor shall carefully protect and preserve all benchmarks, sight rails, pegs and other things used in setting out the works.

Should the Contractor find any discrepancies on the drawings he is to refer the matter to the Client for verification before proceeding with the part of the works affected.

Before starting the site clearance works, the Contractor will verify with the Client and/or Architect which existing fences, gates, walls, roads, paved areas, trees, shrubs, etc., are to be removed and undertake dilapidation survey of all adjacent features/construction including but not limited to boundary walls/ fences, adjacent footpath and road constructions etc.

The Contractor will be responsible for all costs associated with rectification of damage to adjacent features/construction including but not limited to boundary walls/ fences, adjacent footpath and road constructions etc. resulting from the demolition works.

The Contractor will investigate the features of the structures, ascertain if shock or vibration could damage surrounding property or equipment therein or buried services and check the existence of toxic or flammable substances.

The Contractor is to ensure that the records are current and complete through discussion with all appropriate statutory bodies and is responsible for all disconnection, diversion, sealing or removing of existing services as necessary.

Trees, shrubs, boundaries and other features of interest, which are to be retained, shall be clearly identified and protected by a robust fence to avoid accidental impact damage and prevent excavation within the root zone of influence of foundations. All works shall be undertaken in accordance with BS 5387: 1991 'Trees in relation to Construction'. All other trees and shrubs shall be grubbed up and disposed of appropriately off site. Surface vegetation and Topsoil shall be stripped from all areas prior to trafficking with heavy plant.

All materials removed as part of the site clearance shall be disposed of by the Contractor to appropriately licensed off-site facilities unless otherwise described in the contract.

Any surface refuse shall be removed from site to a suitable waste disposal facility, unless it is intended to reuse these materials.

Prior to any works, the site shall be cleared of rubbish, debris and approved vegetation. All unsuitable material, as defined in the Specification for Highways Works (SHW) and the Remediation Method Statement, to be removed as part of the site clearance shall be transferred by the Contractor to an approved and appropriately licensed facility. All movement of materials shall be recorded and records shall be kept detailing the nature and quantity of materials, haulier details, final destination and any other relevant information.

The Enablement Contractor shall maintain records detailing the approximate location of any material disposed, including a brief description and records of disposal.

Water or liquids shall not be pumped or emptied into the existing sewers/drainage system without the written permission of the relevant authority. If mobile tankers/bowsers are to be used, then disposal shall be at suitably licensed facilities in accordance with current legislation.

Documentation/ certification of all materials disposed are to be included in the H&S file prepared by the Contractor.

6.3 Task D3: Asbestos Survey and Removal

The Contractor is required to have appropriately trained staff with regards to asbestos removal (Category B or Category C trained staff as required), together with appropriate insurances and Method Statements for this particular project and type of work. The Contractor is to provide evidence as to how the works are classified under CAR 2012.

A refurbishment/demolition asbestos survey compliant with the requirements of HSG 264 has been undertaken and is available for review. The Contractor must review this document and determine it is appropriate for use. If the Contractor is not satisfied with the provided survey, they may commission their own at the Contractors expense.

The Contractor is to note there may be a requirement for working at height and all necessary legislation and precautions must be followed.

The Contractor is required to safely remove (by suitably qualified staff) and dispose of all asbestos containing materials encountered during the works to a suitably licenced facility. All works shall be undertaken in compliance with the all current guidance, regulations and relevant legislation.

Prior to commencing the asbestos removal operations, the Contractor is to submit a detailed Method Statement, the name of the Site Supervisor and any other necessary information to the Client. It will be the responsibility of the Contractor to ensure that the methods adopted for the removal of the asbestos will be of a standard acceptable to the Health & Safety Executive.

The Client (or their representative) may engage an independent analytical consultant to check the airborne asbestos concentration at any time. If testing shows that the precautions are in any way inadequate, the Contractor shall be obliged to comply with the Clients recommendations, meeting all costs arising therefrom.

The safe disposal of all materials containing asbestos fibres is to be carried out in compliance with all current and relevant legislation.

Following completion of asbestos removal work, the Contractor shall undertake four stage clearance representative swab testing of all remaining site surfaces to prove the absence of any asbestos fibres to prove the site is suitable for re-occupation.

6.4 Task D4: Demolition of Existing Buildings and Structures

Demolition is to generally encompass all buildings, structures, slabs, hard standings, basements, foundations and other sub-structures, redundant drainage and services.

No demolition shall take place until all asbestos containing materials have been removed from the site in accordance with this document and the Demolition Specification (by others).

The demolition work shall be undertaken by a suitably experienced and qualified Contractor in a safe, systematic and controlled manner. All operations shall confirm to current accepted guidance and legislation. The Contractor shall comply with all legislation currently in force as applicable to the demolition industry and shall execute the Works in accordance with BS 6187:2000, BS 8004 and the Health and Safety Executive Guidance Notes GS29 Parts 1-4 and any amendments thereto or successors thereof.

Additional precautions will apply should the demolition work include the handling of hazardous materials, which may include asbestos. If encountered, the asbestos shall be disposed of in accordance with the current legislation and accepted practices.

The Contractor shall give notice to the Clients appointed environmental consultant and the Client if features not shown on the drawings are encountered which might affect the progress or performance of the permanent or temporary works.

If necessary, the Contractor shall be responsible for the application of any necessary licenses from the local authority and shall ensure that all necessary traffic management is put in place.

The Contractor shall submit all necessary notices to the Local Authority to obtain permission to demolish the buildings. The Contractor shall comply with any additional restrictions or requirements that this authority may impose.

The Contractor is responsible for all temporary works, including design.

6.5 Task D5: Decommissioning Above Ground Tanks

Any existing above ground tanks either identified within the contract documents or encountered during the works are to be treated in accordance with the following general procedure.

All above ground tanks are to be subject to controlled decommissioning, decontamination and removal.

Removal of all tanks and associated infrastructure and surface drainage in accordance with relevant guidance detailed within: 'Groundwater Protection Code: Petrol Stations and Other Fuel Dispensing Facilities Involving Underground Storage Tanks' (Defra, November 2002).

The contents of the tanks are to be investigated and tested by suitably qualified specialist subcontractors.

Demolition activities should take care to prevent the spills and leaks of oils, chemicals etc. that arise or may be stored in current buildings and present in substations. These will need to be removed in a controlled manner, prior to demolition.

All uncharted tanks are to be reported immediately to the Clients appointed environmental consultant on discovery, and protected.

The contents of any tanks are to be disposed of off-site by a specialist Contractor to a suitably licenced waste facility.

The Clients appointed environmental consultant are to be provided with copies of all test copies and certificates of all test results and disposal receipts at the time of publication.

6.6 Task D6: Processing and Reuse of Arisings for Proposed Re-Use On Site

Primary reference should be made to Section 7.7 which details requirements for processing and re-use of arisings.

General re-use criteria are outlined in Section 9. Earthworks Testing Frequency and Acceptability Limits are defined in Appendix B.

6.7 Task D7: Validation

The Contactor's attention is drawn to Section 7.12 (which also applies to demolition) with regards to validation.

7 REMEDIAL STRATEGY IMPLEMENTATION – ENABLEMENT PHASE

The Enablement Contractor will undertake the following works.

7.1 Task E1: Record Keeping During Works

The Contractor shall complete the following tasks and compile the following records throughout the works to support Validation Reporting.

7.1.1 Surveying

The Contractor shall provide full time surveying personnel and equipment 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 co-ordinates in relation to the national grid and topographical survey provided within 1 day of request. Coordinates should also be related to the Site Referencing Grid.

All surveys are to be completed with a Global Positioning System (GPS) instrument capable of achieving $\leq 10\text{mm}$ horizontal and $\leq 15\text{mm}$ vertical positional accuracy to Ordnance Survey 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;
- Setting out the Site Referencing Grid;
- confirmation of positions of existing services and site features;
- ground level following the removal of above ground structures;
- ground level following the removal of hardstanding, below ground structures and obstructions;
- 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;
- position of obstruction probing investigation points;
- position of hotspots and volume of contaminated material removed from hotspots;
- position of all environmental sampling and geotechnical testing;
- source area, position and volumes of site stockpiles;
- 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.;
- as built survey information.
- topographical survey following completion of the enablement works.

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

The Contractor shall submit completed survey data in .dwg format accompanying required as-built drawings as part of Weekly Reporting and/or Validation Reporting as required.

7.1.2 Weekly Reporting and Testing Tracking

The Contractor shall submit to the Client and the Clients appointed environmental consultant a weekly Progress Report detailing works undertaken for the previous week.

At a minimum the Progress Report shall include:

- a summary of works carried out in the reporting period with supporting photographs. Referenced to a site-specific grid;
- materials management records;
- details of any hotspots encountered depicted on a Hotspot Plan;
- stockpile positions volume surveys surveyed at least once during the reporting period;
- up to date environmental and geotechnical testing tracking spreadsheet;
- testing certifications for all soil analysis, geotechnical testing and *in situ* testing returned during the week;
- additional information as requested by the Client.

The results of all testing undertaken (and a copy of the test certificates), shall be submitted to the Clients appointed environmental consultant as soon as they are reported, and no more than one day after issue of the test certificate to the Contractor. It is recognised that different tests may take different time to complete. However, the Contractor shall advise the Clients appointed environmental 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). The Clients appointed environmental consultant shall be given sufficient time to review the content of the testing and the associated test results.

Test results are to be summarised in a single master spreadsheet (which contains all data) and is to be in a format agreed with the Clients appointed environmental consultant. Data that does not meet the specification shall be highlighted and include details of what works were undertaken to address the non-compliance. The master spreadsheet, results of chemical testing and drawings shall be maintained and kept up to date. An updated version of these documents are to be provided to the Clients appointed environmental consultant by 10:00am every Monday morning throughout the Contract.

7.2 Task E2: Additional Ground Investigation and Risk Assessment

Following demolition, an assessment of the requirement for undertaking additional ground investigation should be undertaken. This assessment should be completed by the Enablement Contractor employing an appropriately trained and suitably experienced geo-environmental consultant.

Where merited a scope for additional ground investigation should be produced and submitted to the Clients appointed environmental consultant and the LPA for comment and approval. Once agreed, works should be undertaken and assessed by the Enablement Contractors geo-environmental consultant.

The scope for the additional works should also consider the potential for deep bore soakaways which are anticipated to be the preferred surface water drainage solution. A series of sample boreholes should be undertaken to establish the depth and soakage rates achievable to enable further drainage design. Consideration to any surface contaminants should be made in ensuring potential pollutant pathways are not created in the long term.

Where necessary, as a result of the additional information obtained, a detailed Remediation Method Statement should be produced and agreed with the appointed environmental consultant and the LPA.

7.3 Task E3: Break out of Hardstanding and Below Ground Structures

Site operatives shall be briefed on the hotspot discovery strategy included in Appendix C.

Particular note should be taken to those areas where there is historical use of explosives and depleted uranium. Appropriate risk assessment and management of these areas should be undertaken by a suitably qualified and experienced contractor or consultant appointed by the Enabling Contractor. A task specific method statement and risk assessment shall be produced by the enablement contractor to cover these works and submitted to the Clients appointed environmental consultant for approval.

The Enablement Contractor will demolish, break up and remove visible subsurface structures (obstructions) including, but are not limited to foundation elements, drains, hardstanding, relic structures, service ducts, underground storage tanks and basements.

The Contractor shall notify the appointed environmental consultant and their appointed Geo-Environmental engineer, if any suspected impacted material is encountered during any excavation activity based on visual or olfactory observations.

The Contractor shall inform the appointed environmental consultant after each area is exposed so that they may attend and witness the excavation to identify any contamination hotspots or impacted soils.

All arisings produced from the demolition of obstructions shall be appropriately segregated, processed and stockpiled in accordance with Task E7.

The Contractor will survey using GPS equipment the sides and base of all excavations so as to be able to provide comprehensive and as built records and base of excavation drawings.

Excavations resulting from the demolition of subsurface structures shall be rationalised to allow for plant access and fill to formation level in accordance with Task E10.

All excavations and voids shall be backfilled with suitable material in accordance the requirements of this Specification.

The Contractor will 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.

The Contractor will give notice to the Clients appointed environmental consultant if features not shown on the drawings are encountered which might affect the progress or performance of the permanent or temporary works.

The Contractor is responsible for all temporary works, including design.

7.4 Task E4: Removal of Tanks, Existing Drainage System and Associated Pipework

All encountered tanks are to be protected and reported immediately to the Clients appointed environmental consultant on discovery.

The existing drainage system and any tanks and associated pipework present after demolition are to be subject to controlled decommissioning, decontamination and removal in accordance with relevant guidance detailed within: 'Groundwater Protection Code: Petrol Stations and Other Fuel Dispensing Facilities Involving Underground Storage Tanks' (Defra, November 2002).

The Contractor will take care to assess the contents of any pipes or structures prior to any disturbance to avoid the uncontrolled release of contaminants (including but not limited to petroleum hydrocarbons and asbestos).

The contents of any tanks are to be investigated and tested by suitably qualified specialist subcontractors and disposed of off-site by a specialist contractor to a suitably licenced facility where required. Demolition activities should take care to prevent the spills and leaks of oils, chemicals etc. prior to demolition.

Tank removal activities are to be undertaken under the supervision of the experienced Geo-environmental Engineer appointed by the Contractor. The contractor must take care to prevent the spills and leaks of oils, chemicals etc. from the tank. If impacted material is encountered during excavation, these materials should be quarantined for testing prior to reuse if suitable. In addition, The Clients appointed environmental consultant will undertake a watching brief during tank removal works.

7.5 Task E5: Examination of Hotspots and potentially impacted Soils

Hotspot removal will be undertaken by excavation of soils from hotspots of contamination encountered during remediation (both known and unknown).

The soils below/around all hotspots or areas of visual/olfactory evidence of hydrocarbon contamination uncovered during enablement works shall be inspected, tested and if necessary remediated and validated by chemical testing.

The Enablement Contractor must have an experienced Geo-environmental Engineer present during hotspot excavation to inspect for suspect material and oversee effective segregation, stockpiling and validation of soils.

The delineation of the full extent of hotspots will be required under the supervision of the Contractors appointed Geo-environmental Engineer. Segregated material must be stockpiled at an appropriate quarantine area as detailed in Task E6.

The full extent and depth of the hotspot is to be excavated and the Contractor is to install any temporary works required to allow excavation to the full depth of the impacted soils.

Validation of the removal of the hotspots shall be by the chemical analysis of samples recovered from each side and base of hotspot excavation by the Contractors appointed Geo-Environmental Engineer with a minimum sampling grid of 10m by 10m employed for large excavations.

Validation criteria are outlined in Section 9.2.

Validation sampling locations and the extent of the hotspot are to be surveyed using GPS equipment.

7.6 Task E6: Segregation and Quarantine of Impacted Soils

A quarantine area shall be established for stockpiling material removed from hotspots and for the purpose of ex situ treatment of impacted soils proposed for re-use in subsequent phases.

The treatment area shall be established hard standing or on an impermeable liner so as to prevent to prevent leaching of contaminants to the underlying soil and groundwater. The treatment area shall be sign-posted for restricted access and for the presence of potentially hazardous material.

Where an impermeable liner is chosen it shall consist of a high-density polyethylene (HDPE) or linear low-density polyethylene (LLDPE) material (1.0 mm minimum thickness) or approved suitable equivalent and sealed along any joints.

The treatment area shall be bunded or kerbed and leachate drains shall be constructed to collect water run-off and prevent leaching of contaminants onto adjoining soils and into site drainage. Water collected from the leachate drain is to be treated in accordance with an Environmental Permit prior to discharge under licence or disposal.

Provision should be made for the stockpile or part of the stockpile to be covered with an impermeable membrane, to prevent precipitation from entering potentially impacted soils and mobilising contaminants or the release of potentially contaminated dust resulting from the drying out of the material.

Appropriate mitigation with regards to odours will need to be considered in the design.

7.7 Task E7: Processing, Screening and Stockpiling of Materials

The Contractor shall be responsible for undertaking all geotechnical and chemical testing necessary to ensure that the works have been carried out in accordance and in compliance of the RMS.

Reuse of soils is allowed and will need to be undertaken in accordance with the CL:AIRE 'Development Industry Code of Practice - Definition of Waste' i.e. in accordance with an approved Materials Management Plan (MMP).

General re-use criteria are outlined in Section 9. Earthworks Testing Frequency and Acceptability Limits are defined in Appendix B.

7.7.1 Granular Material

Demolition arisings shall be compliant with WRAP Quality Protocol, Aggregates from Inert Waste and relevant exemptions.

Arisings shall be processed to comply with the grading requirements of relevant material classes in accordance with the Specification for Highway Works Series 600 Earthworks (SHW600).

Classes of material permitted for re-use on site in accordance with SHW600 include:

- Class 6F1 - selected granular material (fine grading).
- Class 6F2 - selected granular material (coarse grading).

The contractor shall segregate and process separately arisings produced from the Demolition Phase (above ground structures) and the Enablement Phase (below ground structures) with a view to regulating the proportions of brick constituents in arisings for the purpose of geotechnical characterisation.

The Contractor shall inspect the crushed product and remove any unsuitable material, including but not limited to, asbestos, metal, steel reinforcement, rags, plastic, timber and degradable material. All recycled and secondary materials shall be tested for constituent parts in accordance with SHW Clause 710, the maximum permitted percentage of Class X material shall be 1%.

Arisings shall be stockpiled according to source (i.e. the building from which they arise) and phase (Enablement or Demolition) with due regard for their subsequent reuse and the above classifications.

7.7.2 *Cohesive Material*

Other classes of material may arise from the works and should be screened to comply with the grading requirements of SHW600.

7.8 Task E8: Ex situ Remediation of Contaminated Soils

It is proposed that any petroleum hydrocarbon impacted soils which fail the RTVs for petroleum hydrocarbon are disposed of offsite. However, it may be possible subject to design for *ex situ* remediation (bioremediation or stabilisation) to be undertaken subject to the opinion of the enablement contractor.

All materials proposed for treatment shall be inspected on behalf of the Contractor by an experienced Geo-environmental Engineer and the Consultant to confirm their suitability for treatment. Any materials deemed unsuitable for treatment will be appropriately controlled and removed from site to a suitably licenced waste facility as soon as possible.

Treatment of the soils will be undertaken in accordance with an appropriate Environmental Permit on an impermeable surface to prevent leaching of contaminants to the underlying soil and groundwater. Leachate drains are to be included in the design to collect any water run-off and the water collected from the leachate drain is to be treated in accordance with an Environmental Permit prior to discharge under licence or disposal.

Appropriate mitigation with regards to odours will need to be considered in the design.

Prior to any of the following *ex situ* remediation techniques being undertaken, pre-treatment of soils is required. As a minimum, this will include the removal of larger constituents from the soil matrix by mechanical screening. If appropriate, screened oversize materials will be crushed to manufacture a secondary aggregate.

7.8.1 *Bioremediation*

Biopiles will need to be designed to reduce the petroleum constituents in excavated soils through the use of biodegradation. Biopiles are to be designed with an appropriate impermeable base to stop leaching of contaminants to the underlying soil and groundwater. Leachate drains are also included in the design to remove any water runoff.

Once the soil concentrations have been reduced to below the RTVs set out in section 9, they are able to be reused on site as part of, or without a cover system. The amount of testing required will depend upon the proposed reuse location.

7.8.2 Solidification and Stabilisation

Solidification and stabilisation are other feasible options to reduce the mobility of the contaminants (and can also be used to geotechnically improve soils). Solidification and stabilisation are discrete processes that are often used together in order to reduce the mobility of contaminants in soils:

- Solidification achieves a reduction in mobility by converting the soil into a solid monolithic mass thereby reducing the permeability of the material.
- Stabilisation reduces the availability of contaminants by changing their chemical form (for example, precipitating metals in an insoluble compound) or increasing the strength of their binding to a solid matrix.

If stabilisation is undertaken with regards to geotechnical works (e.g. creation of a working platform), the Contractor shall discuss the works with the Consultant, present a Specification (in accordance with the working Platform Design requirements) for the works (to also include testing requirements) and obtain approval for the working platform design from the Consultant and the Client.

If stabilisation is undertaken with regards to remediation, prior to undertaking soil stabilisation/solidification, the following will need to be undertaken/noted:

- bench testing and trials are required to determine the most suitable binder formulation and to prove that solidification/stabilisation will be effective in reducing leachate concentrations;
- discussion of the trials with the Environment Agency and the LPA to gain agreement in writing of appropriate targets prior to implementation of solidification/stabilisation;
- careful and appropriate design of the works are required to ensure that the technique does not result in geotechnical constraints on the future redevelopment of the site;
- solidification and stabilisation shall only be used in association with Materials Management to ensure the treated material is not used within any cover system material; and
- solidified/stabilised soils shall not be placed below the water table.

With regards to validation of any solidified/stabilised soils this will be undertaken in accordance with the Contractor's specific proposals, as agreed with the LPA and the Environment Agency.

7.9 Task E9: Asbestos Mitigation

Asbestos fibres are present in the Made Ground soils at the site. The following mitigation measures should be put in place to mitigate the release of airborne fibres during the works, or in case of encountering any visible Asbestos Containing Materials (ACM).

All excavated soils and the formation level shall be inspected for suspect material and, if encountered, any visible ACM will be handpicked and disposed of by a suitably qualified contractor.

With regards to the excavation of soils and as far as reasonably practicable, the removal of gross ACM is required. It should be noted that:

- In accordance with CAR 2012 (Regulation 16) there remains a duty of the Contractor to 'prevent or reduce the spread of asbestos anywhere where work is being carried out under their control'. Where complete prevention is not reasonably practicable (this would constitute such a case), the regulation requires the Contractor to reduce to the lowest level reasonably practicable the spread/potential for fibre release of asbestos from any place where work under the Contractor control is carried out.

- CAR 2012 notes that the Contractor should select and use work methods that will reduce the disturbance and release of asbestos fragments and fibres to minimise the risk of spread, e.g. by removing items intact or whole and by using dust suppression techniques. ACMs must never be left loose or in a state where they can be trampled on or spread. All asbestos waste should be bagged or wrapped promptly after removal and the waste should be removed from the work area regularly.
- Additionally, where enclosures are not used (and this is one of those instances, as it is not reasonably practicable to do so), the Contractor's risk assessment should establish what will be required to make sure that, as far as is reasonably practicable:
 - » the spread of asbestos is prevented (airborne fibres and asbestos in soils);
 - » people not involved in the work are excluded from the area;
 - » the work area is totally cleaned after work is completed.
- For the proposed activities, there are two activities which could release fibres 1) excavation of soils containing gross ACM and 2) placement of soils containing gross ACM. It is reasonably practicable for visible 'gross'/highly fibrous materials to be handpicked and double bagged at the point of excavation. As this material has then been removed, and the potential to liberate fibre on the second activity (placement) has thus been alleviated or reduced to as low a level as is reasonably practicable.
- As such, in addition to a surface inspection and pick, hand picking of gross ACM is required during excavation and placement activities to ensure that as far as is reasonably practicable all visible gross ACM has been removed.

Licensable asbestos lagging has not been detected during the site investigation. However, if during the enablement works it is encountered, all staff undertaking the hand picking must be suitably qualified to handle licenced unbound asbestos. It should be noted that in Hydrock's opinion, Asbestos Awareness is not an appropriate level of competency to pick licenced ACM/asbestos.

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. Appropriate monitoring, PPE and RPE should be provided and utilised. The working method shall be provided to the Client's appointed environmental consultant for comment two weeks prior to commencement on site.

Visible fragments of suspected asbestos containing materials on the site surface shall be handpicked. In addition to the controls required under CAR 2012, there may be a requirement to deploy an Environmental Permit. The Contractor is to form their own opinion and either:

- deploy a permit; or
- in accordance with the Environment Agencies 'Remediation Position Statements', dated 7/11/2010, notify the Environment Agency of the activity a minimum of 5 days before start. The EA may then request deployment of an MPP.

All ACM shall be placed in a dedicated covered and lockable skip pending off-site disposal to a suitably licensed facility. Such remediation measures will be undertaken by suitably qualified contractors and in accordance with CAR 2012.

Air monitoring for asbestos is required on an ongoing basis during the enablement works (frequency to be set out in the Asbestos Working Plan) and the results shall be compared with acceptable maximum standards set by the HSE. These air monitoring procedures and limits are given in HSG 248 entitled

‘Asbestos: The analysts’ guide for sampling, analysis and clearance procedures’ and CAR 2012. The monitoring should be undertaken by a UKAS accredited laboratory. The limit used is governed by the levels stated in the above guidance documents and the accuracy of the testing used. However, Hydrock recommends using the most stringent limit set by the HSE. Air monitoring results are acceptable only if they fall below this limit and are as low as reasonably practicable. Exposure from work activities involving asbestos must be reduced to as far below the control limit as possible.

7.10 Task E10: Cut or Fill to the Required Formation Level

Soils are anticipated to require excavation to the required formation level. Level details remain outstanding and will be provided in due course.

The Contractor shall place and compact material only once the source has been demonstrated to be in full compliance when tested at the frequency defined in Table 1/5 and with the acceptability limits set out in the Earthwork’s Specification Table 6/1 included in Appendix B and the general re-use criteria detailed in Section 9. All in situ testing as defined in Table 1/5 shall be surveyed using GPS equipment.

7.11 Task E11: Off-Site Disposal of Waste Material

Any surplus (i.e. soils which cannot be reused on site due to volumes), or unsuitable soils (i.e. soils which fail the RTVs and cannot be reused in an appropriate location), or are not geotechnically suitable, shall be disposed of by the Contractor.

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 Waste Management Regulations.

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

7.12 Task E12: Validation Reporting

The Enablement Contractor will maintain records of the works and Validation Reports shall be prepared by the Enablement Contractor on those aspects of the works it has completed and is responsible for.

The Contractor will provide the following validation reports:

- Materials Management Validation Report;
- Remediation and Earthworks Validation Report;

The contractor may seek permission for the client to combine Validation Reports. All reports shall be provided in .pdf format digitally bookmarked at each section heading.

7.12.1 *Materials Management Validation Report;*

The Materials Management Validation Report will document the validation of the approved MMP. At a minimum the Materials Management Validation Report shall include:

- Details of the import mechanisms for any imported material source;
- Details of the testing (chemical and geotechnical) of imported materials 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:
 - » volumes of excavated, screened, treated, imported and reused soils;
 - » stockpile plans and inspection records;
 - » material reuse appraisal records including placement location of soils referenced to testing results and inspections;
 - » supporting as-built surveys.
- Copies of all consignment notes, in particular those relating to the hazardous waste regulations; and details of waste facilities where materials were disposed of.
- Records of earthworks excavations including as built drawings, photographs, quantities of materials and records of progress.
- Stockpile plan of all stockpiles generated by the works and remaining on site.

7.12.2 Remediation and Earthworks Validation Reports

The Remediation and Earthworks Validation Report will provide a complete record of the remediation activities undertaken at the site and the data collected 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.

At a minimum Validation Report shall incorporate:

- Results of asbestos air monitoring within the site and at the boundaries and other environmental monitoring (noise/dust);
- Commentary on site stripping and clearance activities;
- Asbestos clearance activities (if required), an outline of the remedial action taken to remove asbestos/hazardous materials and an asbestos/hazardous material close out report;
- Commentary on the works including:
 - » timeline of works referenced to the Site Referencing Grid Plan included in Appendix;
 - » details of hotspots;
 - » record of decisions for over-excavation; and
 - » photographic record of each excavation.
- Materials management records as detailed in Section 5.
- Laboratory analytical and in situ field testing certifications including:
 - » all testing referenced on a plan;
 - » field test kit results and particulars of monitoring (e.g. date, location, personnel);
 - » calibration data for field measurement equipment in accord with manufacturers guidance; and
 - » Chain of Custody forms.
- As built drawings to be appended and provided in .dwg format including:
 - » ground level following the removal of hardstanding;
 - » hotspots;
 - » retained services, obstructions and residual features encountered but not removed;
 - » base of excavation/depth of fill;

- » environmental sampling and geotechnical testing positions;
- » stockpile location plan with volumes;
- » final as-built survey of the site including extents of validation.
- Compaction control records in accordance with BSEN16907-5:2018 clause 7.2. including:
 - » the number of passes;
 - » maximum compacted layer thickness;
 - » type and weight of compactor;
 - » speed of compactor; and
 - » frequency of vibration where used.

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

7.13 Task E13: Enablement Works Verification Report

The Clients appointed environmental consultant will provide a Verification Report following the provision of the Validation Report(s) detailed in Section 7.12 by the Contractor.

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 within appendices.

This will incorporate a summary and commentary of:

- 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);
- 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 documentation will be forwarded to the client and the Local Authority.

8 REMEDIAL STRATEGY IMPLEMENTATION – CONSTRUCTION PHASE

The following will be undertaken during the Construction Works Contractor and will subject to the recommendations of the Hydrock Ground Investigation Report for the site.

8.1 Task C1: Installation of Barrier Pipe

The Contractor shall install Protecta-Line (or approved equivalent) pipework for potable water supply. This is to be validated by the Ground Works Contractor by the provision of delivery tickets showing Protecta-Line pipework has been delivered to site and by photographic proof provided of installation.

8.2 Task C2: Installation of Gas Protection Measures

Based on the data to date no gas protection measures are required, although additional monitoring is necessary to comply with CIRIA best practice. The scope for these works should be captured within Task E2 Additional Ground Investigation and Risk assessment.

Based on current BRE Guidance (BR211, 1999) no radon protection is required at this location.

8.3 Task C3: Excavation of Foundations and Drainage System

Material recovered from foundation and drainage excavations shall be segregated, processed and stockpiled in accordance with an MMP and the materials management strategy detailed in Section 5.1.

Service trenches are to be over excavated to 300mm either side and 300mm below the base of the service being installed to protect future maintenance workers from potentially contaminated soils. Excavations are to be backfilled with clean soils and no exceedances of RTVs detailed in Section 9.2 proven as suitable for use by chemical analysis.

The areas where over excavation is required will be determined during design of the drainage system.

The Ground Works Contractor is to provide photographic proof of over-excavation of service trenches to the Client and the Contractor.

The Ground Works Contractor should note there is the potential for asbestos to be present in the soils at the site and is to take appropriate health and safety precautions to minimise risks to workers in accordance with CAR 2012. Preliminary advice is provided within this document. However, the Ground Works Contractor is to obtain their own advice.

Deep bore soakaways are anticipated to be used for the surface water drainage design. These will be designed by others, however consideration of any near surface contaminants should be considered to ensure that potential pollutant pathways are not created.

8.4 Task C4: Installation of the Engineered Cover System

Landscaped and garden areas will require a cover system to mitigate against the risk from elevated concentrations of asbestos and reported contaminants in the Made Ground.

Hydrock proposes the following cover systems/excavation depths in these areas:

- Beneath building footprints, excavate as required by the foundation design. The floor slab will break the link between the soils and potential receptors.

- Beneath areas of hard standing (roads, drives, pathways etc.), excavate as required by the road design and replace with suitable construction thickness. The hard standing will break the link between the soils and potential receptors.
- Service trenches, over excavation (300mm either side and 300mm below) and backfill with clean materials as detailed in Task C3.
- Beneath landscaped areas, excavate to 450mm below final ground level (deeper where tree pits are required), and replace with an Engineered Cover System.
- Beneath garden areas, excavate to 600mm below final ground level (deeper where tree pits are required), and replace with an Engineered Cover System.

With reference to BRE document reference 465, 'Cover Systems for Land Regeneration, Thickness of Cover Systems for Contaminated Land', the installation of an engineered cover system is required and is proposed to comprise (in order of placement):

- a 150mm layer of 6F2 (with whole bricks removed)/hardcore to act as a physical break layer and a construction platform;
- a high visibility geotextile marker layer; and
- 450mm of Subsoil and Topsoil (minimum 150mm Topsoil) for Garden areas
- 300mm of Subsoil and Topsoil (minimum 150mm Topsoil) for landscaped areas.

For areas of proposed trees, tree pits shall be excavated and additional Subsoil provided above the break layer.

The cover system will be installed by the Ground Works Contractor and verified by the Clients appointed environmental consultant.

Further discussion with regards to the justification of the cover system is provided in Appendix C.

The cover system installation should be undertaken in the following steps:

1. Establish the finished ground levels over the site and from this determine the required level of the underside of the cover system.
2. In areas where trees are planned as part of the landscaping the cover system should be increased to allow for the root ball. The dimensions of the tree pit (if required) are to be specified by a qualified arboriculturist in conjunction with the landscape architect.
3. Install house drainage and other services, over-excavating and replacing the soil in service runs where applicable.
4. Check the level of the ground surface to ensure that it is at the correct level for the underside of the cover system.
5. Place any imported or site won subsoil and Topsoil in stockpiles placed on a geotextile break layer.
6. Place 150mm of crushed stone and verify the thickness.
7. Install the geotextile layer.
8. Place the Subsoil and Topsoil, (of which a minimum 150 mm is to be Topsoil) and verify the thickness.

All soils moved and placed as a cover system need to be transported and stored with care to prevent cross contamination. This will include (but not be limited to):

- using dedicated plant to move the cover system soils, or washing plant thoroughly before use to move cover system soils;
- minimising tracking over contaminated soils;
- separating clean and dirty areas of the site; and
- placing the soils into the final position and not pushing soils across the surface.

All soils intended for use as part of the engineered cover system must comply with the requirements of section 9.1 and be managed appropriately in accordance with Section 5.1.

8.5 Task C5 Verification of the Engineered Cover System

Upon completion of the Engineered Cover System by the Ground Works Contractor, verification pits shall be excavated in order to measure the thickness of Topsoil and Subsoil present. These pits should be excavated in the gardens at a rate of one pit per garden (with additional pits in areas where split level gardens are present).

In addition, pits may be completed in the landscaped areas to the front of the properties. Any communal landscaped areas built on Made Ground soils will also be verified by testing at a rate of one per 625m² (25m x 25m grid).

If the Engineered Cover System is deemed to be insufficient, the Site Manager will be informed and advised on how much more material is needed for the Engineered Cover System to be adequate. In instances where the Engineered Cover System is measured to be inadequate, following the addition of further soil, the verification pits will be re-excavated to confirm that a sufficient thickness of soil is present.

Verification of the Engineered Cover System will only be carried out on areas where the Engineered Cover System has been completed. On completion of the verification works the appropriate verification documentation, detailing the works that have been completed in accordance with the agreed Implementation Plan, will be forwarded to the Client and the Local Authority.

Letter reports for the verification of the capping of landscaped areas will be submitted to the Local Authority.

The cover system verification report will include:

- confirmation of the source of imported material;
- confirmation of the capping thicknesses, including photographs of the verification pits with a scaled marker;
- confirmation of the physical suitability of the material;
- the chemical test results for the samples taken from the stockpiles of Topsoil and Subsoil and confirmation that the material is visually consistent with that tested, or the chemical test results for samples taken once the capping has been placed; and
- confirmation that the soil chemical analysis does not exceed the RTVs in Section 9

The above Verification Report will be provided to the Local Authority and the NHBC for approval.

9 CHEMICAL ANALYSIS AND GEOTECHNICAL TESTING REGIME

All sampling, logging and testing of soils shall be undertaken in accordance with BS 5930:2015 'Code of Practice for Site Investigations' and BS 10175:2011+A1:2013 'Investigation of Potentially Contaminated Sites – Code of Practice'.

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

Groundwater samples will be collected in suitable containers and 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 will be MCERTS accredited where available.

On completion of the verification works the appropriate verification documentation will be forwarded to the client and the Local Authority.

The Contractor shall undertake all testing 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 Contractor shall obtain permission from the Clients appointed environmental consultant for the test to be completed at the proposed laboratory, before the test is undertaken.

9.1 Requirements for Soils Placed Below the Engineered Cover System

Soils may be classed as suitable for reuse on site beneath the engineered cover system and hardstanding in accordance with an approved MMP and the conditions outlined in this section.

Soils proposed for re-use on-site (excluding as part the engineered cover system) shall be tested and screened as follows:

- geotechnical source approval testing as detailed in Table 1/5 at the frequency defined in Table 6/1 included in Appendix B;
- no visual contamination (oil staining etc.) as confirmed by the Enablement Contractor and watching brief;
- no visible asbestos containing material (ACM) as confirmed by the Enablement Contractor and watching brief; and
- <0.01 w/w% asbestos confirmed by laboratory asbestos identification and quantification (if identified) at a rate of 1 test/250m³ of material.
- less than 1% deleterious material by weight (Class X) as confirmed by classification of constituent parts at a rate of 1 test/500m³ of material.

9.2 Hotspot Validation

Validation of petroleum hydrocarbon hotspots by chemical analysis of samples taken at the sides and base of excavations is required with samples taken on a minimum of a 10m x 10m grid for large hotspots.

Hotspot validation sampling is to be undertaken by an experienced Geo-environmental Engineer on behalf of the Contractor and samples are to be analysed as follows:

- against the Remedial Target Values (RTVs) in Table 9.1 for petroleum hydrocarbon hotspots;
- against the RTVs in Table 9.2 for other contaminants of concern;
- <0.01 w/w% asbestos confirmed by laboratory asbestos identification and quantification (if identified)

Soils proposed for re-use on-site (excluding as part the engineered cover system) following remediation in accordance with Task E8 shall be tested and screened as follows:

- geotechnical source approval testing as detailed in Table 1/5 at the frequency defined in Table 6/1 included in Appendix B;
- no exceedances of the RTVs as detailed in Table 9.1 at a rate of 1 test/250m³ of material.
- <0.01 w/w% asbestos confirmed by laboratory asbestos identification and quantification (if identified) at a rate of 1 test/250m³ of material.

If the soils are to be disposed of, the Contractor is to undertake all testing necessary and required by the landfill to classify the waste.

Table 9.1: Remedial Target Values (RTVs) for Petroleum Hydrocarbon Hotspots

	Proposed RTV mg/kg				Proposed RTV mg/kg		
	(1% SOM)	(2.5% SOM)	(6% SOM)		(1% SOM)	(2.5% SOM)	(6% SOM)
Aliphatics EC5-EC6	42	78	160	Aromatics EC5-EC7	73	150	310
Aliphatics >EC6-EC8	100	230	530	Aromatics >EC7-EC8	130	300	680
Aliphatics >EC8-EC10	27	65	150	Aromatics >EC8-EC10	35	84	190
Aliphatics >EC10-EC12	48	120	280	Aromatics >EC10-EC12	75	180	390
Aliphatics >EC12-EC16	24	59	140	Aromatics >EC12-EC16	150	330	670
Aliphatics >EC16-EC35	1000	1000	1000	Aromatics >EC16-EC21	260	550	930
Aliphatics >EC35-EC44	1000	1000	1000	Aromatics >EC21-EC35	1000	1000	1000
				Aromatics >EC35-EC44	1000	1000	1000
				All >EC44-EC70	1000	1000	1000

A maximum hydrocarbon speciated value of 1000mg/kg has been proposed which is lower than the relevant human health GAC's. This has been used to avoid any nuisance concerns relating to visual / olfactory suitability for the material and to ensure inappropriate material is not imported.

9.3 Requirements for the Engineered Cover System

Where site won and imported material is proposed to be used as part of an engineered cover system it shall record no exceedances of the Import and Re-Use criteria as detailed in Table 9.2.

Soils proposed re-use on site as part of the engineered cover shall be tested and screened as follows:

- geotechnical source approval testing as detailed in Table 1/5 at the frequency defined in Table 6/1 included in Appendix B (where required)
- no visual contamination (oil staining etc.) as confirmed by the Enablement Contractor and the Clients appointed environmental consultant watching brief;
- limited deleterious material (organics, wood, metal etc.);

- less than 1% deleterious material by weight (Class X) as confirmed by classification of constituent parts at a rate of 1 test/500m³ of material (granular soils only)
- no visible asbestos containing material (ACM) as confirmed by the enablement contractor;
- <0.001 w/w% asbestos confirmed by laboratory asbestos identification and quantification (if required) at a rate of 1 test/250m³ of material;
- no exceedances of the RTVs as detailed in Table 9.2 with a minimum of four chemical suites to be undertaken on any individual source material or import round at a rate of
 - » 1 test/250m³ of natural material
 - » 1 test/100m³ of anthropogenic material.

Depending on the source or variability of imported material, additional testing may need to be undertaken. If constant sources are used for the Topsoil and Subsoil and the results recorded are consistently low, consideration may be given to reducing the number of samples tested. If any of the RTVs are exceeded the material shall be considered to be unsuitable unless treatment, further testing and risk assessment shows it to be satisfactory.

Prior to importation of Topsoil or Subsoil from a commercial supplier, certification should be obtained from the supplier detailing the source site, its previous and current land use and relevant test results. A copy of this should also be forwarded to the Clients appointed environmental consultant for review and comparison against the import criteria.

If the proposed source is not from a commercial supplier, Hydrock recommend that the source is tested to confirm it is appropriate for use prior to import. Following import (regardless of the source), additional chemical testing of the imported soils will be required to confirm the soils imported are the same as those sampled at the donor site.

Table 9.2: Engineered Cover System Import and Reuse Criteria

	Proposed RTV mg/kg				Proposed RTV mg/kg		
	(1% SOM)	(2.5% SOM)	(6% SOM)		(1% SOM)	(2.5% SOM)	(6% SOM)
Arsenic	37	37	37	Acenaphthene	220	520	1100
Beryllium	73	73	73	Acenaphthylene	180	430	940
Boron	300	300	300	Anthracene	2400	5500	11000
Cadmium	14	14	14	Benzo(a)anthracene	4.2	6.7	8.6
Chromium (III)	890	890	890	Benzo(a)pyrene	1.5	1.5	1.5
Chromium (VI)	6.1	6.1	6.1	Benzo(b)fluoranthene	7.6	9.4	10
Copper	2500	2500	2500	Benzo(ghi)perylene	64	69	71
Lead	200	200	200	Benzo(k)fluoranthene	12	14	15
Mercury, inorganic	170	170	170	Chrysene	7.7	11	13
Nickel	130	130	130	Dibenz(a,h)anthracene	1.1	1.3	1.4
Selenium	360	360	360	Fluoranthene	290	560	900
Vanadium	410	410	410	Fluorene	170	410	880
Zinc	3900	3900	3900	Indeno(1,2,3,cd)pyrene	4.3	5.5	6.2
Cyanide (free)	790	790	790	Naphthalene	2.2	5.2	12
Phenol (total)	290	560	1100	Phenanthrene	97	220	440
Total PAH	100	100	100	Pyrene	620	1200	2000
Total TPH	100	100	100	Asbestos fibre	<0.0001%	<0.0001%	<0.0001%

Aliphatics EC5-EC6	42	78	160	Aromatics EC5-EC7	73	150	310
Aliphatics >EC6-EC8	100	230	530	Aromatics >EC7-EC8	130	300	680
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Aliphatics >EC10-EC12	48	120	280	Aromatics >EC10-EC12	75	180	390
Aliphatics >EC12-EC16	24	59	140	Aromatics >EC12-EC16	150	330	670
Aliphatics >EC16-EC35	1000	1000	1000	Aromatics >EC16-EC21	260	550	930
Aliphatics >EC35-EC44	1000	1000	1000	Aromatics >EC21-EC35	1000	1000	1000
				Aromatics >EC35-EC44	1000	1000	1000
				All >EC44-EC70	1000	1000	1000

A maximum hydrocarbon speciated value of 1000mg/kg has been proposed which is lower than the relevant human health GAC's. This has been used to avoid any nuisance concerns relating to visual / olfactory suitability for the material and to ensure inappropriate material is not imported.

9.4 Physical Requirements of Cover System Soils

Imported Topsoil should conform to the requirements of BS 3882:2015 (Specification for Topsoil and requirements for use), or as agreed with the Client.

If the Client agrees that Topsoil does not need to conform to BS 3882:2015, it should comprise chalk, clay or sand and should have 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. It should be noted that clay soils are not recommended as they are likely to become waterlogged during handling and placement. The imported material is to be confirmed by visual inspection of the material by a suitably qualified Geo-environmental Engineer and, if necessary, by laboratory Particle Size Distribution assessment.

Topsoil and Subsoil should 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 (especially Japanese Knotweed and Giant Hogweed) and bulk vegetative growth, in order to ensure negligible risk of subsequent weed problems.

10 CONTINGENCY PLAN AND AREAS OF UNEXPECTED CONTAMINATION

There is potential for areas of unexpected contamination to be present, due to the former use of the site. Any significant quantities of suspected oily or odorous material, significant ashy soils and unusual brightly coloured or asbestos containing materials should be considered as possibly contaminated.

The Discovery Strategy, included in Appendix C, must remain on site at all times during the Enablement and Groundworks Phases of works. This 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 will be prepared by the Clients appointed environmental consultant and submitted to the regulatory parties, the Local Authority and the NHBC and the Environment Agency where groundwater may potentially have been impacted.

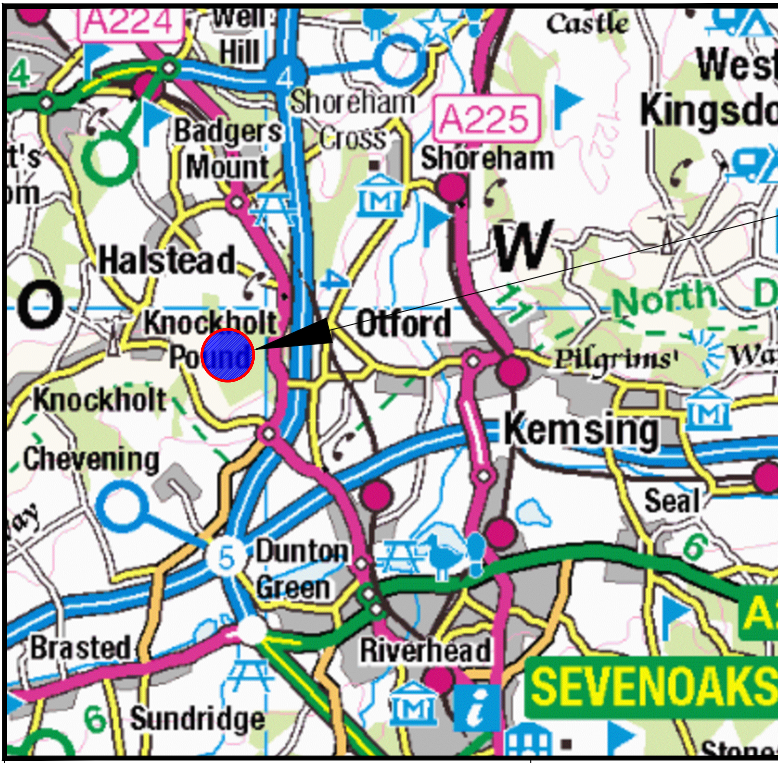
As it is proposed to excavate, screen, sort and where appropriate reuse the soils on site during a separate enablement phase of works, the Discovery strategy will be less relevant to the Construction Phase of works but will still apply.

If additional materials are identified these materials will be subject to the procedures stated in this RMS.

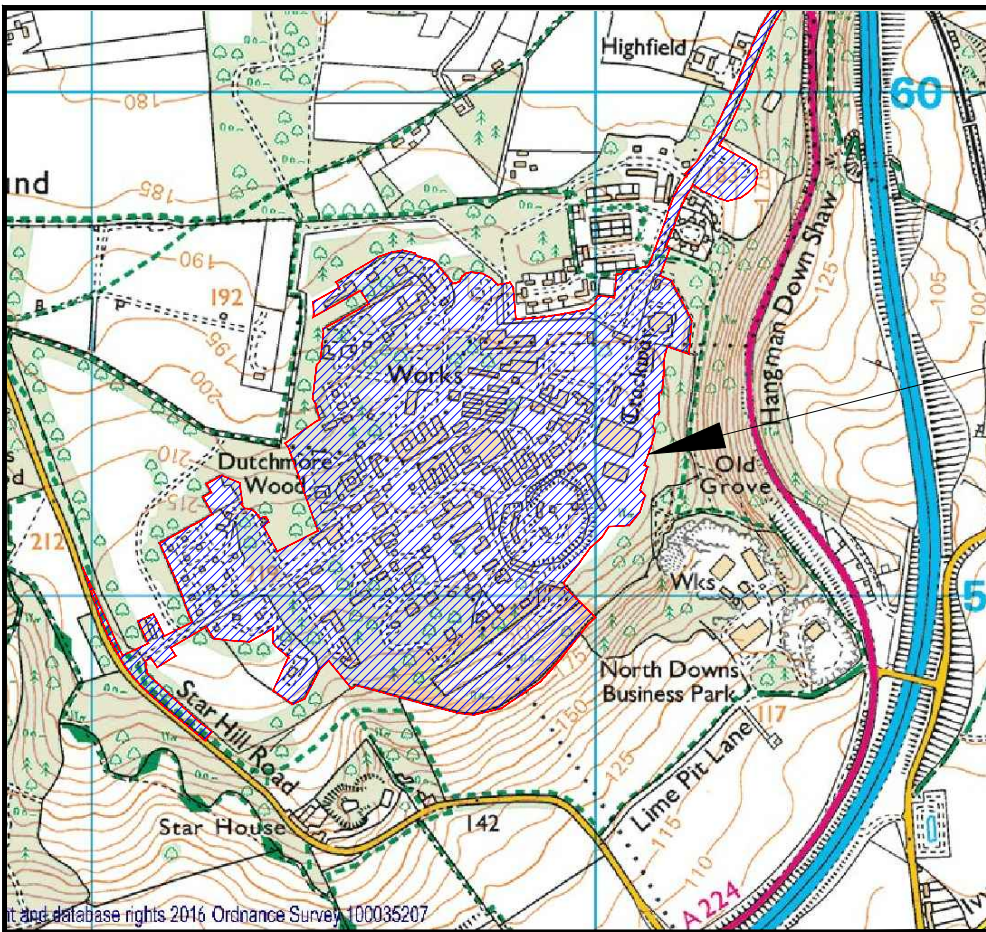
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Appendix A Drawings



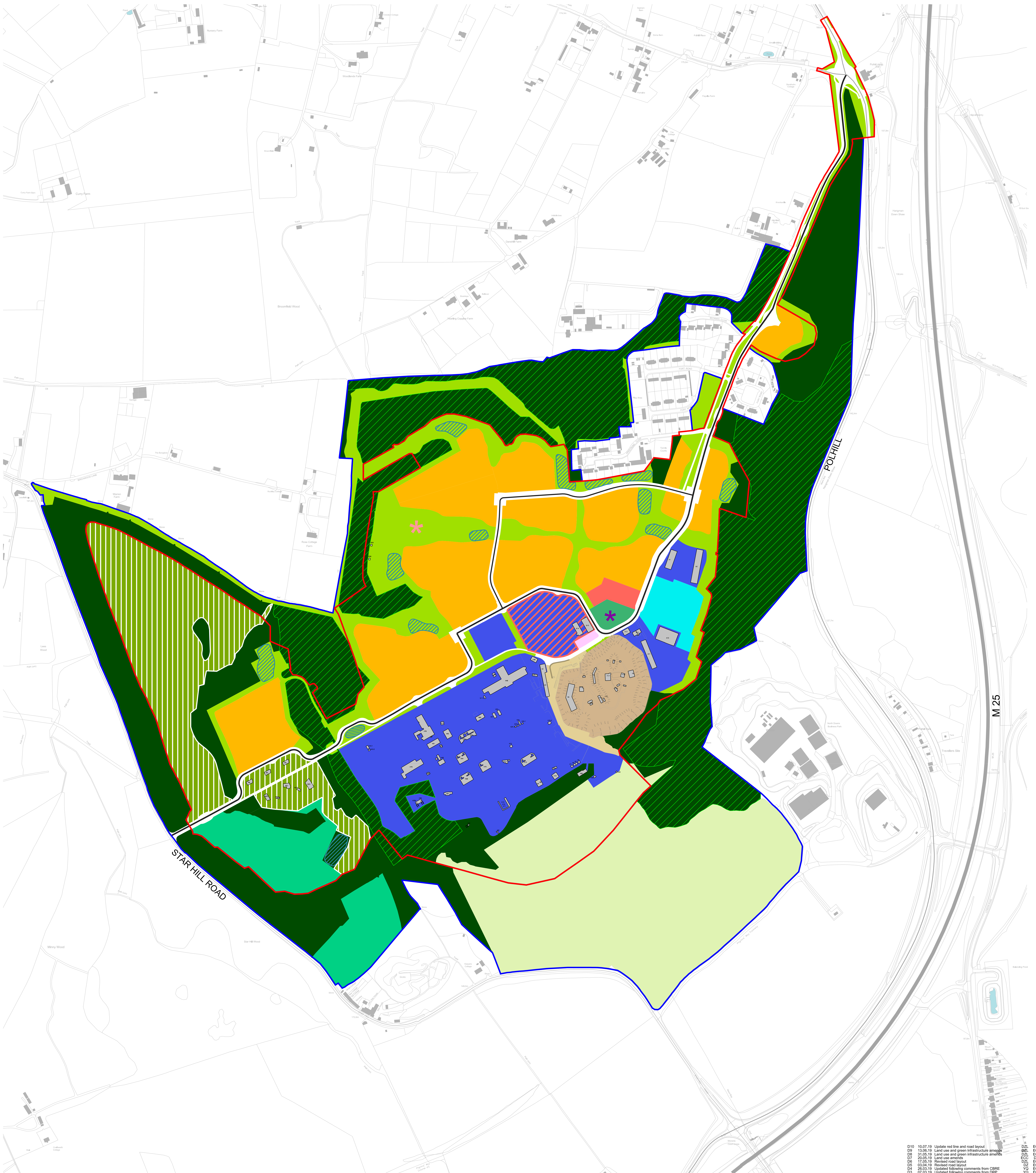
THE SITE



THE SITE

Rev	Date	Description	By	CRD
Architect				
 <small>Hydrock Consultants Ltd 3 Haverhill Park Haverhill Road Sutton, Northampton NN16 8LJ T +44 (0)2524 84288 www.hydrock.com</small>				
Client:				
Merseyside Pension Fund				
Project Title:				
FORT HALSTEAD, KENT				
Drawing Title:				
Site Location Plan				
Reference:				
10730-HYD-XX-ZZ-DR-GE-1000				
Hydrock Job No.:				
C-10730-C				
Drawn	Checked	Date of All	Date	Issue Date
SD	WL	See Drawing	18/12/18	18/12/18
Drawing Number:				Revision:
P1				S2

Notes:
 Do not scale from this drawing.
 All contractors must visit the site and be responsible for taking and checking Dimensions.
 All construction information should be taken from figured dimensions only.
 Any discrepancies between drawings, specifications and site conditions must be brought to the attention of the supervising officer.
 This drawing and the works depicted are the copyright of JTP.
 This drawing is for planning purposes only. It is not intended to be used for construction purposes. Whilst all reasonable efforts are used to ensure drawings are accurate, JTP accepts no responsibility or liability for any reliance placed on, or use made of, this plan by anyone for purposes other than those stated above.



KEY

- Application boundary
- Applicant's land ownership boundary
- Existing buildings for retention
- Proposed vehicular routes
- Scheduled monument (The Fort)
- Residential
- Mixed Use
- Employment
- Employment / Mixed Use
- Primary school
- Village Square
- Hardstanding
- Village Green
- Public Open Space (incl. woodland buffer, SuDS, Children's play area)
- Community Recreation Area
- Existing Woodland
- Existing Ancient Woodland
- Ecologically Enhanced Grassland / Mitigation Zone
- Existing Chalk Grassland
- Indicative Neighbourhood Equipped Area for Play (NEAP)
- Indicative Local Equipped Area for Play (LEAP)
- Indicative location for SuDS ponds

Notes:
 All land uses can deviate +/-3m within the application boundary, subject to on-site constraints.

*The shapes and sizes of the ponds as shown on the plan are indicative only.

Rev	Date	Description	Drawn	Chkd
D10	10.07.19	Update red line and road layout	DZL	ECC
D9	13.06.19	Land use and green infrastructure amendments	DZL	ECC
D8	13.06.19	Land use and green infrastructure amendments	DZL	ECC
D7	20.05.19	Land use amendments	ECC	DZL
D6	17.05.19	Revised road layout	DZL	ECC
D5	03.04.19	Revised road layout	DZL	ECC
D4	28.03.19	Updated following comments from CBRE	DZL	ECC
D3	07.03.19	Updated following comments from CBRE	DZL	ECC
D2	16.01.19	New vehicles, M20, other people's housing removed	YO	ECC
D1	15.01.19	Road network, VC and GO updated, fence added	YO	ECC
—	07.12.18	Final Issue	—	—

Drawing Status
DRAFT

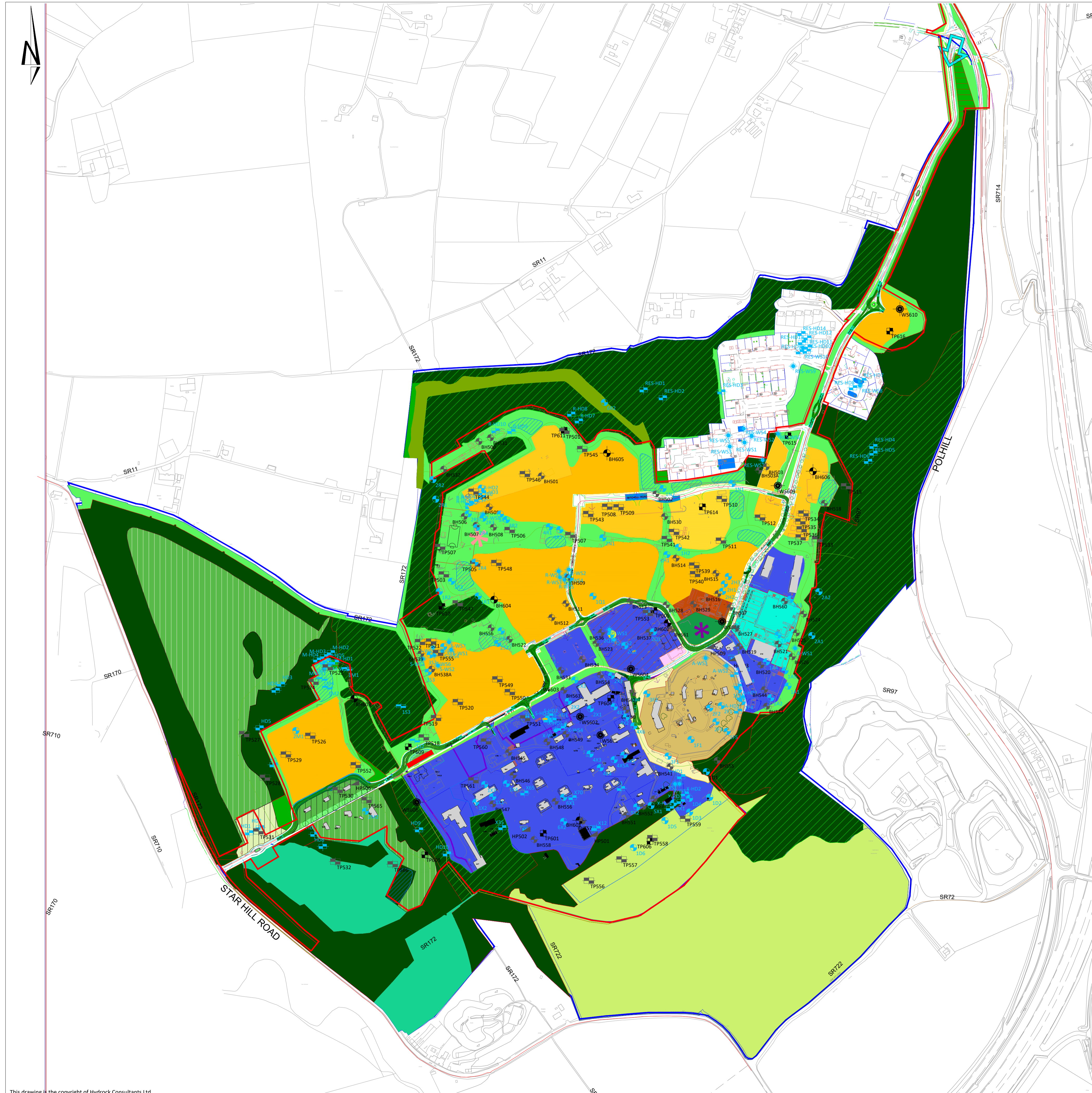


Project
 Fort Halstead

Drawing Title
Land Use and Green Infrastructure Plan

Scale @ A0 1:2500 Job Ref. 005561
 Drawing No. 005561_PP01 Revision D10
 Scale Bar 0 20 40 60 80 100m

M 25



- KEY**
- Existing buildings for retention
 - Scheduled monument (The Fort)
 - Residential
 - Mixed Use
 - Employment
 - Employment / Mixed Use
 - Primary school
 - Village Square
 - Hardstanding
 - Village Green
 - Public Open Space (inc', woodland buffer, SuDs, Children's play area)
 - Community Recreation Area
 - Proposed Woodland Gap Planting/Screening
 - Existing Woodland
 - Existing Ancient Woodland
 - Ecologically Enhanced Grassland / Mitigation Zone
 - Existing Chalk Grassland
 - Indicative Neighbourhood Equipped Area for Play (NEAP)
 - Indicative Local Equipped Area for Play (LEAP)
 - Indicative location for SuDS ponds

- Notes:**
1. 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.
 2. This drawing is to be read in conjunction with all relevant Engineers' and Service Engineers' Drawings and specifications.
 3. Based on Topographical Survey drawing No: 10323 Master Rev 1 by Greenhatch Group. Drawing dated: 13-12-07
 4. Land use information based on drawing Number: 005561 by John Thompson & Partners dated: 07-12-18. Drawing for planning purposes only, it is not intended to be used for construction purposes.

- Legend**
- Land ownership boundary
 - Application boundary
- Hydrock 2018**
- Cable Percussion Borehole
 - Trial Pit
 - Window Sampler Borehole
- Hydrock 2016**
- Trial Pit
 - Window Sampler Borehole
 - Hand Dug Trial Pit
- Historical Investigations**
- Window Sampler Borehole
 - Hand Dug Trial Pit
 - Window Sampler Borehole
 - Machine Dug Trial Pit
 - Indicative boundary fence to Qinetiq's demise

P2.1	04/07/19	Changes to Land use and key	SD	WL
P2.2	15/01/19	Amendments to Key, Legend & descriptions	SD	WL

Rev	Date	Description	By	Ckd
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Architect :

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Client :

Merseyside Pension Fund

Project Title:

FORT HALSTEAD, KENT

Drawing Title:

Land Use Plan

Reference:
10730-HYD-XX-ZZ-DR-GE-1002

Hydrock Job No: **C-10730-C**

Drawn	Checked	Scale @ A1	Date	Issue Date
SD	WL	1:3500	15/01/19	04/07/19

Revision:	Status:
P2	S02

Appendix B Geotechnical Specification

APPENDIX 0/3: LIST OF NUMBERED APPENDICES REFERRED TO IN THE SPECIFICATION AND INCLUDED IN THE CONTRACT

Appendix No.	Title.
	PRELIMINARIES
1/5	Testing to be carried out by Contractor
1/24	Quality Management System
	EARTHWORKS
6/1	Requirements for Acceptability & Testing etc. of Earthworks Materials
6/2	Requirements for dealing with Class U1B and Class U2 unsuitable materials
6/3	Requirements for Excavation, Deposition, Compaction (Other Than Dynamic Compaction)

APPENDIX 1/5: TESTING TO BE CARRIED OUT BY THE CONTRACTOR

Table 1/5.1 – Earthworks testing requirements

CLAUSE	WORK, GOODS OR MATERIAL		TEST	FREQUENCY	TEST CERTIFICATE	COMMENTS
Series 600	Earthworks					
601, 631 to 637, 640	Acceptable Limits				Required	<p>Test frequency relates to the class of material from each source.</p> <p>If multiple sources of the same class are used, each source shall be tested at the frequency stated in Appendix 1/5.</p> <p>Where the volume of a single source used in the earthworks operation is in excess of 10,000m³, once 10,000m³ has been used the rate of testing <i>may</i> be reduced by the Engineer.</p> <p>See Table 6/1 (Specification app 6/1) for specific testing requirements for individual material subclasses.</p> <p>Refer to Clause 612 for <i>in situ</i> testing requirements during the placement and compaction of fill.</p>
	Class	General Description				
	6F	General Granular Fill/Capping	MC, Grading, UC (U)	1 per 1000m ³ , min of 3		
			OMC/MDD ¹ by Vibrating Hammer to include Particle Density	1 per 1000m ³ , min of 3		
			Los Angeles Value (U)	Source Approval, min of 3		
			TRL 447 Sulphate Suite to include SO ₄ , S, TPS, OS (U)	1 per 1000m ³ , min of 3		
			Constituent parts Clause 710 (U)	1 per 500m ³ , min 3 per source.		
			Chemical Analysis (U)	Refer to RMS		
		Asbestos Identification and Quantification if Detected	1 per 250m ³ , min of 3			
612	Compaction of Fills					<p>Compaction Trial to be completed in accordance with App 6/3 and be witnessed by the Client and/or Employers Agent.</p> <p>Where the Nuclear Density Gauge (NDG) is used for the measurement of density and moisture content it shall be calibrated for the particular source material under test.</p> <p>Plate load testing to be carried out in accordance with DMRB IAN 73/06 Rev 1 for equivalent CBR at formation level.</p>
	Method Compaction External areas only.	Class 6F1 and Class 6F2	Compaction Trial	1 per method per source. To be witnessed by the Clients appointed environmental consultant		
			Dual Cycle Plate Load Test for equivalent CBR in accordance with Table 1/5-2. (BS 1377-9 and DMRB IAN 73/06)	1 test per 20m x 20m at earthworks formation level and after capping		

CLAUSE	WORK, GOODS OR MATERIAL	TEST	FREQUENCY	TEST CERTIFICATE	COMMENTS
		Field dry density & moisture content (U)	1 per 20m x 20m grid per layer (min of 3 per source)		Refer to Appendix 6/1 for minimum compaction requirements to be met

Notes:

1. (U) indicates that a UKAS test report or certificate is required.
2. Unless otherwise shown in this Appendix, tests and test certificates for works, goods or materials as scheduled under any one clause are required for all such work, goods or materials in the works.
3. Frequency of testing applies to each separate earthworks material within each of the earthworks material class.
4. Unless specifically stated to the contrary, all samples used in the testing shall be taken from materials after delivery to the site for incorporation into the works.
5. The Contractors attention is drawn to the requirements of the relevant Specification Appendices for the form of all deliverables, storage of test records and storage of records of materials imported to and exported from site.
6. Where source approval is specified, source testing shall be carried out at each quarry or stockpile used for supply to site and at each location of borrow/site winnings used for on-site material.
7. Definitions of abbreviations:
 - mc: natural moisture content.
 - Organic Matter: Organic Matter Content as determined from the 'Walkley Black' Method.
 - OMC: Optimum Moisture Content.
 - MDD: Maximum Dry Density.
 - HSV: Hand Shear Vane.
 - IDD: Intact Dry Density.
 - ACM: Asbestos and Asbestos Containing Materials.
8. For chemical testing requirements refer to the relevant Appendix for class of material and the requirements of the Hydrock RMS

Table 1/5.2 – Plate Load Test Methodology for k762 and Equivalent CBR

DUAL CYCLE PLATE LOAD TEST; CONFIRMATION OF MODULUS OF SUBGRADE REACTION k_s , k762 AND EQUIVALENT CBR
<p>This test should be undertaken with a minimum 0.6m diameter plate, and whilst plates of smaller diameter may be used this should not be less than 0.3m. The method of analysis should follow DMRB IAN 73/06 Rev 1 for an equivalent CBR. The modulus of subgrade reaction is an elastic modulus, and can only be proven if the test is done cyclically to ensure repeatable results. Therefore, the testing protocols to be followed are:</p> <ol style="list-style-type: none"> 1. The initial seating stress is to be based on the stress required to induce at least 1.5mm settlement. 2. The first load cycle is applied incrementally, to achieve cumulative settlement intervals of 0.25mm, 0.50mm, 0.75mm, 1.00mm, 1.25mm and 1.50mm respectively. Each incremental stress is maintained until there is less than 0.05mm per minute per increment before the next load is applied. 3. Upon achieving the 1.50mm settlement at less than 0.05mm per minute requirement, the plate is unloaded back to zero and the non-recoverable settlement at a stress of 0kPa is recorded. 4. The dial gauges are re-set to zero, and the test is repeated to achieve the same number of increments with the corresponding same level of deformation (e.g. stress applied to achieve 0.25mm increments, up to a maximum nominal deformation of 1.50mm). <p>The results are assessed by:</p> <ol style="list-style-type: none"> 1. Checking that the non-recoverable settlement after the first load cycle is less than 50% of the total (e.g. if the total settlement was 1.50mm, then after unloading back to zero the gauges should return to less than 0.75mm). If this is not achieved, additional stress cycles can be undertaken until repeatable values are recorded as this is indicative of poor compaction and required re-engineering. 2. Comparison of the stiffness (E, Eplt) of the final cycle divided by the stiffness of the previous cycle. The target ratio is less than 2.0, and never above 2.2. Where the ratio is greater than 2.2, this indicates the fill has not been fully compacted. 3. The modulus of subgrade reaction (k_s, k762) for the first cycle, shall be equal to or more than the design value for the subgrade and checked against the design requirements. This can be converted to equivalent CBR if required by the design, using the equation in DMRB IAN 73/06 Rev 1.

APPENDIX 1/24: QUALITY MANAGEMENT SYSTEMS

1. GENERAL

- 1.1 The Contractor shall institute and operate a quality management system complying with BS EN ISO 9001 and SHW Clause 104. The quality management system shall be described in a Quality Plan that shall be submitted to the Employers Agent for their acceptance before the commencement of any site works.
- 1.2 The Quality Plan shall cover the following items:
- i) Contractor's organisation and management;
 - ii) Contractor's method statements and construction procedures
 - iii) Contractor's construction quality control
 - iv) Organisation's Quality Plans.
- 1.3 The Quality Plan shall conform to the requirements of 2.0, 3.0 and 4.0.
- 1.4 Items i) and ii) of the Quality Plan shall be submitted to the Employers Agent for its acceptance not later than 28 days after award of contract.
- 1.5 Method statements are required for each major activity to be undertaken by the Contractor. The Contractor shall agree in writing with the Employers Agent the full scope of activities which require the production of individual Method Statements.

2. CONTRACTOR'S ORGANISATION AND MANAGEMENT

- 2.1 This section of the Quality Plan shall include:
- i) Definition of the Contract and its documentation.
 - ii) The organisation of the Contract, including the line of command and communication and communication links between parties involved in the Contract.
 - iii) Names, roles responsibilities and authority of the principals and key personnel.
 - iv) Control of liaison and meetings with third parties.
 - v) Identification of the Contractors own staff responsible for overseeing each major activity.
 - vi) The Contractors control systems for any sub-contractors to be appointed by them.
 - vii) Document control.
 - viii) Programme for submission of Method Statements and Organisations Quality Plans.
 - ix) The quality plans for subcontractors and suppliers of work, goods and materials which are the subject of quality management schemes.
 - x) Procedure for the preparation, review and adjustment of programmes for the effective progression of the Works and the recording of this.
 - xi) Control and approval of purchases of materials.
 - xii) Control of off-site activities (where appropriate).
-

- xiii) Procedures for the regular review and recording by the Contractor of the quality of the works.
- xiv) Control of personnel selection, based on their care, skill and experience.
- xv) Management review/audits to monitor and exercise adequate control over the implementation of the Quality Plan.
- xvi) Any other relevant item, specific to the methods of work proposed by the Contractor.

3. CONTRACTOR'S METHOD STATEMENTS AND CONSTRUCTION PROCEDURES

3.1 This section of the Quality Plan shall include:

- i) Detailed method statements for each major activity whether directly controlled or subcontracted.
- ii) The method statements for all activities that might affect the quality of the permanent and temporary works shall identify hold points and invoke:
 - (1) Work instructions.
 - (2) Quality control procedures.
 - (3) Compliance testing and inspection arrangements.
 - (4) Work acceptance procedures.
- ii) Identify the relevant construction procedures in the Contractor's own Quality Management System, and provide copies on request.

4. CONTRACTOR'S CONSTRUCTION QUALITY CONTROL

4.1 This section of the Quality Plan shall include:

- i) Statement of the Contractors organisation for quality control.

4.2 The Quality Plan shall identify procedures (which may be part of the Contractors general procedures) that cover the topics listed below:

- i) Arrangements for 'receiving' and 'in-process' testing.
 - ii) Control of test laboratories.
 - iii) Control of test, measuring and inspection equipment.
 - iv) Document control.
 - v) Procedures for monitoring and recording the inspection, test and approval status of the constructed/installed work.
 - vi) Procedures for tests and inspections for the purpose of the Contractor certifying that prior to covering up, each part of the Works is complete and conforms to the Contract.
 - vii) Procedures for the review of work submitted for review but not accepted as conforming to the Contract.
 - viii) Procedure for the collation of quality records as identified in BS EN ISO 9001 and provision of copies when requested by the Employers Agent.
-

5. ORGANISATION QUALITY PLANS

5.1 The Quality Plan shall include:

- i) Definition of the product or service to be provided.
- ii) The organisation organogram shall describe the line of command and state the name of the senior manager responsible for the contracted Work and the name of the Organisations on-site Management Representative. Contact addresses, telephone numbers etc. shall be provided.
- iii) Identification of the relevant parts of the Organisations quality system relevant to the product or service being provided. Copies to be provided to the Employers Agent on request.
- iv) The control of personnel selection (at works and on site), including special requirements for skilled personnel e.g. certification of welders, training of operatives, experience requirements etc.

5.2 Specific procedures shall be provided for the following:

- i) Receipt and examination of certificates of conformity and test results for purchased products.
- ii) Product identification and traceability.
- iii) Handling, storage, packaging and delivery to site and storage and handling on site.
- iv) Quality records.

6. TESTING

6.1 The Contractor shall undertake all compliance testing required during the course of the filling operation to check the material classification, acceptance limits and, the method of compaction control as defined by Appendix 6/1. The minimum frequency of testing is defined in Appendix 1/5 of the specification with the material aspirational target limits set out in Appendix 6/1 and specifically in Table 6/1.

6.2 The compliance testing of the earthworks materials shall be carried out at a laboratory which holds UKAS (for geotechnical tests) or MCERTS (for chemical and contaminations tests) accreditation for the specific test. Where it is not possible to obtain the testing of a material for a specific property to a UKAS or MCERTS accredited method, the Contractor shall obtain permission from the Employers Agent for the test to be completed at by the proposed laboratory, before the test is undertaken.

- 6.3 The Contractor shall provide to the Employers Agent, by mid-day on the first working day of each week, an updated electronic summary (Microsoft Excel 2010 or later) of all testing which has been completed up to the end of works for the previous week.
- 6.4 The testing summary shall be in a form agreed with the Employers Agent, and shall include the results of all *in situ* test results (if the final validated report has not been issued by the appointed laboratory, these results shall be denoted with a draft to show that they are not final results). The summary shall also include a list of all samples submitted for laboratory testing, and provide the results of those laboratory tests where report certificates have been issued.
- 6.5 The information to be included for the summary of testing shall include, but not be limited to, the following:
- i) sequential test number,
 - ii) date of test;
 - iii) coordinated position to include easting & northing, correct to National Grid Reference;
 - iv) reduced level, correct to m AOD;
 - v) site reference;
 - vi) test grid reference;
 - vii) layer number (during placement of fill);
 - viii) test type, including whether or not the sample is for contamination testing, geotechnical testing or a combination of both;
 - ix) whether results are Draft (before the issue of certificate) or Final (certificate issued and received by Contractor); and
 - x) the results of the testing, compliance with the Specification and any comments relating to the test.
- 6.6 The contractor 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 Employers Agent.
- 6.7 The results of all testing shall be submitted to the Employers Agent as soon as they are reported, and no more than 1 day after issue of the test certificate to the Contractor. It is recognised that different tests may take different time to complete; however the Contractor shall advise the Employers Agent of any delay that they are aware of regarding the completion of any tests (e.g. a sample is being re-tested and the report will be delayed). The Employers Agent shall be given sufficient time to review the content of the testing and the associated test results.
-

- 6.8 If in the opinion of the Employers Agent, the material alters in classification during the course of the filling operations, the Contractor may be required to repeat the compliance testing. Equally, if the Contractor considers the classification of a material to have changed from that given in Appendix 6/1 they shall inform the Employers Agent immediately.
- 6.9 The Contractor shall be responsible for removing from site any unacceptable material to suitably licensed facilities before the completion of their works.

7. EMPLOYERS AGENT - SUPERVISOR

- 7.1 In addition to the detailed description of the role of the Employers Agent Supervisor, as defined by the NEC 3 Engineering and Construction Contract (ISBN 978 07277 3382 5), the Employers Agent shall be on site with regular attendance and undertake the following role:
- i) Liaison with the Contractor, Project Manager and Employers Agent.
 - ii) Reviewing of testing activities, this does not replace or absolve the Contractor from the responsibilities set out in the Specification requirements.
 - iii) Observing and commenting on the quality of the earthworks activities. This does not replace or absolve the Contractor from the responsibilities set out in the Specification requirements.
 - iv) Reviewing of soil/fill sampling as required under the specification and advising the Contractor of the results in order to allow the satisfactory progress of the works.

8. CONTRACTOR'S VALIDATION AND VERIFICATION REPORT

- 8.1 The Contractor will maintain records of the works to include, but not be limited to, the following:
- i) daily record sheets to include a summary of the day's activities;
 - ii) progress photographs (not less than weekly);
 - iii) weather conditions;
 - iv) plant, personnel and visitors present;
 - v) aspects relating to Health and Safety, Environmental Control; and
 - vi) test results
- 8.2 The Contractor will ensure that the requirements of this Specification are complied with. Upon receipt of satisfactory demonstration that all of the works have been undertaken in accordance with the Specification, the Contractor shall provide a validation report. This report will include relevant site records and illustrate that the remedial and ground preparation works have been carried out in accordance with the Specification.
-

- 8.3 During the works and in areas of excavation, compaction or fill placement the Contractor will be required to undertake weekly topographical survey of the earthworks profile to provide a continuous record of the earthworks operations.
- 8.4 A verification report in accordance with the RMS and the MMP is required to be prepared by the Contractor on those aspects of the works they have completed and are responsible for. The Contractor's report will include, where appropriate, the following:
- i) daily record sheets to include a summary of the day's activities;
 - ii) progress photographs;
 - iii) general description of the works completed, including any earthworks, excavations (including excavations of hard obstructions or foundations), placement and compaction methodology and plant used;
 - iv) detailed weather conditions;
 - v) formation and foundation treatment, including drainage and treatment of soft areas;
 - vi) plant, personnel and visitors present;
 - vii) aspects relating to Health and Safety, Environmental control;
 - viii) waste transfer notes;
 - ix) application of target acceptability criteria and summary of control test results for each specific earthworks material placed during the earthworks operations;
 - x) chemical and geotechnical test certificates and monitoring data including location correct to National Grid Reference and level to m AOD with associated drawings;
 - xi) as built surveys, including base of excavations to include drawings;
 - xii) coordinates, levels, invert levels and diameters of services remaining on site;
 - xiii) drawings showing the location and level of each specific earthworks material placed during the earthworks operations, any feature or operation relevant to the earthworks including any instrumentation and the location of trial areas and control tests; and
 - xiv) all correspondence with Statutory Authorities.
-

1. ACCEPTABLE LIMITS FOR FILLS

1.1 Earthworks materials are to comply in general with the 600 series of the Highways Agency 'The Manual of Contract Documents for Highway Works', BS 6031:2009 and with the specific requirements of this appendix. Permitted classes of construction materials are defined in the following tables:

- Table 6/1 Acceptable Earthworks Materials: Classification and Compaction Requirements
- SHW Table 6/2 Grading Requirements for Acceptable Earthworks Materials
- SHW Table 6/7 Material Sources and Source Codes for Imported Materials.

1.2 All earthworks materials are to meet the target acceptability limits as set out in Table 6/1 and SHW Table 6/2

1.3 Following excavation of contaminated materials and obstructions all excavations shall be backfilled in accordance with the requirements of this specification.

1.4 All materials on site should be segregated by type and nature at the time of excavation. Following any required processing, including crushing and screening, the material should be placed in temporary stockpiles and tested at the frequency specified in Appendix 1/5

1.5 In general, engineered fill to raise site levels are to be constructed of Class 6F1 General Fill.

1.6 Processed Class U1A or U1B material may be used as earthworks materials subject to meeting the target acceptability limits as set out in Table 6/1, SHW Table 6/2, Appendix 6/14, 6/15 and site specific requirements.

1.7 Where 'recycled aggregate except recycled asphalt' is used in this Series, the aggregate shall have been tested in accordance with SHW Clause 710 at a frequency of 1 test per 500m³. Content of asphalt (mineral aggregate with a bituminous binder) shall not exceed 2% by mass, and the content of other materials (Class X) including wood, plastic and metal shall not exceed 1% by mass.

11.1

2. SPECIAL REQUIREMENTS FOR DETERMINING ACCEPTABILITY, WHO CLASSIFIES WHERE, AND WHETHER TRIAL PITTING IS REQUIRED

- 2.1 Acceptability testing is to be the responsibility of the Contractor and be carried out in accordance with Specification Appendix 6/1 and at the frequencies given in Appendix 1/5 in a UKAS accredited testing laboratory. The Contractor is to include the location for each sampling point or in situ test position with the relevant test result which shall have a unique identification number.
- 2.2 Where source approval of imported material is shown, the testing is to be the responsibility of the Contractor and be carried out in accordance with Specification Appendix 6/1. Source approval will comprise (as a minimum) 3 sets of the relevant test on each sub-unit of material to be used in the Contract.
- 2.3 On completion of each site-specific earthworks operations a Geotechnical Feedback Report (GFR) is to be prepared by the Contractor and submitted as part of the Remediation Validation Report to the Project Manager and is to comply with the requirements of HD 22/08 and shall include as a minimum the following information:
- a) General description of the earthworks, excavations, placement and compaction methodology and plant used;
 - b) Detailed weather conditions;
 - c) Formation and foundation treatment, drainage measures and location of soft areas;
 - d) Application of aspirational target acceptability criteria and summary of the control test results for each specific earthworks material placed during the earthworks operations;
 - e) A copy of all relevant test results including grid location and level;
 - f) Drawings showing the location of each specific earthworks material placed during the earthworks operations, any feature or operation relevant to the earthworks including instrumentation and the location of the trial areas and control tests; and
 - g) An electronic copy of all the test results and monitoring associated with the earthworks operations.
- 2.4 Should any material be placed which has not been given prior written approval from the Clients appointed environmental consultant, the Contractor shall have done this at their own risk and they will be responsible for any and all remedial works required to rectify the situation. All costs associated with this remedial work are to be borne by the Contractor.
-

3. RENDERING UNACCEPTABLE MATERIAL ACCEPTABLE

- 3.1 The Employers Agent must be informed if Class U1B material is to be processed to meet the target acceptability limits as set out in Table 6/1 so that appropriate acceptability criteria for the control of contamination can be set and agreed upon by all parties before the commencement of such remedial works.
- 3.2 Earthworks materials generated by demolition works or from excavation of concrete hardstanding/foundations/piles, not classified as Class U1B or Class U2, are to be classified as Class U1A and be processed to meet the 'recycled aggregate' requirements of Clause 601.12 of SHW and the target acceptability limits as set out in Table 6/1, Table 6/2 and site-specific requirements. As far as it is practical, the Contractor should process Class U1A Made Ground material or excavated material into Selected Fill in preference to General Fill.

4. REQUIREMENTS FOR GROUNDWATER LOWERING OR OTHER TREATMENT

- 4.1 The Contractor is responsible for all groundwater lowering where this is required for the purposes of the construction works.
- 4.2 The Contractor is responsible for obtaining all permits and/or licences required to undertake groundwater lowering and for treatment and/or disposal of said groundwater.
- 4.3 Where earthworks operations or ground improvement measures result in the expelling of groundwater into drainage layers or onto earthworks surfaces the discharged water shall be collected, treated if necessary and disposed of by the Contractor.

5. REQUIREMENTS FOR REMOVAL OFF SITE OF EXCAVATED ACCEPTABLE MATERIAL OR UNACCEPTABLE MATERIAL REQUIRING PROCESSING OR RETENTION OF SURPLUS MATERIAL ON SITE

- 5.1 No material is to be removed off site without the agreement of the Employer.
- 5.2 Surplus material is to be temporarily stockpiled in areas designated for spoil storage. The earthworks design of the temporary stockpile is the responsibility of the Earthworks Contractor's Temporary Works Designer.

6. PERMITTED USE OF ACCEPTABLE MATERIAL OR UNACCEPTABLE MATERIAL REQUIRED TO BE PROCESSED FOR PURPOSES OTHER THAN GENERAL FILL

- 6.1 Earthworks materials derived from processed Class U1B material is to be used in the works only where shown on the Drawings or where agreed with the NR.

7. RESPONSIBILITY FOR THE WORKS

- 7.1 The Contractor is to be responsible for the works covered by the specification and is permitted to self certify the works, in accordance with the requirements of the specification.
-

Table 6/1 ACCEPTABLE EARTHWORKS MATERIALS: CLASSIFICATION AND COMPACTION REQUIREMENTS (SEE FOOTNOTES)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and Appendix 6/1)	Material Properties Required for Acceptability In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631				COMPACTION REQUIREMENTS IN CLAUSE 612 & ADDITIONAL NOTES	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable limits Within:					
									Lower	Upper				
6	F	1	Selected granular material (fine grading)	Capping - Below road subbase only	Any material, or combination of materials (other than colliery spoil, argillaceous rock or chalk). Recycled aggregate	(i) grading	BS 1377-2	Table 6/2	Table 6/2	SHW Table 6/4 Method 6 OMC to be determined using Vibrating Hammer Refer to Hydrock RMS	6	F	1	
						(ii) OMC	BS 1377-4: 3.7	-	-					
						(iii) mc	BS 1377-2	OMC -2%	OMC+1%					
						(iv) Los Angeles coefficient	SHW Clause 635	-	50					
						(v) Chemical ¹ & ACM	Hydrock RMS	Hydrock RMS						
						(vi) CBR	IAN 73/06	5% at FFL 15% at Site Handover Level	-					
6	F	2	Selected granular material (fine grading)	Capping - Below road subbase only	Any material, or combination of materials (other than colliery spoil, argillaceous rock or chalk). Recycled aggregate	(i) grading	BS 1377-2	Table 6/2	Table 6/2	SHW Table 6/4 Method 6 OMC to be determined using Vibrating Hammer Refer to Hydrock RMS	6	F	2	
						(ii) OMC	BS 1377-4: 3.7	-	-					
						(iii) mc	BS 1377-2	OMC -2%	OMC+1%					
						(iv) Los Angeles coefficient	SHW Clause 635	-	50					
						(v) Chemical ¹ & ACM	Hydrock RMS	Hydrock RMS						
						(vi) CBR	IAN 73/06	5% at FFL 15% at Site Handover Level	-					

Footnotes to Table 6/1:

1. App = Appendix
 2. Tab = Table
 3. Where in the Acceptable Limits column reference is made to App 6/1, only those properties having limits ascribed to them in Appendix 6/1 shall apply. Where Appendix 6/1 gives limits for other properties not listed in this Table such limits shall also apply.
 4. Where BS 1377:Part 2 is specified for m_c , this shall mean BS 1377:Part 2 or BS EN 1097-5 as appropriate.
 5. Uniformity coefficient is defined as the ratio of the particle diameters D_{60} to D_{10} on the particle-size distribution curve, where: D_{60} = particle diameter at which 60% of the soil by weight is finer and D_{10} = particle diameter at which 10% of the soil by weight is finer.
 6. The limiting values for Class U1B material are given in Appendix 6/14 and Appendix 6/15.
 7. The contents of this table may be revised following periodic engineering assessments and design by the Project Manager.
 8. Where values for Plate Load Tests are given in Table 6/1, only one test type is required. If Plate Load Tests are carried out, it is recommended that they are Dual Cycle Plate Load Tests following the method set out in Annex 1.
 9. Where supplementary clauses and tables are reference in Table 6/1 above, they shall refer to the equivalent clause or table from the Manual of Contract Documents for Highway Works, Specification for Highway Works: Volume 1: (SHW).
-

APPENDIX 6/2: REQUIREMENTS FOR DEALING WITH CLASS U1B AND CLASS U2 UNSUITABLE MATERIALS

1. GENERAL

- 1.1 Notwithstanding the requirements of the Hydrock RMS, unacceptable material, Class U2 shall be defined as in SHW Clause 601.3.
 - 1.2 If unacceptable material is encountered within the works, a risk assessment will be carried out and the contractor shall make all necessary arrangements for their safe handling and disposal after consultation with the appropriate environmental authority in accordance with SHW Clause 602. As such the Contractor shall put in place contingency measures to deal with U2 materials if encountered during the earthworks.
 - 1.3 The Contractor shall make all necessary enquiries and arrangements for the transfer of U1B and U2 materials for their disposal off-site and shall liaise with the relevant regulatory bodies prior to initiating removal of any material from site.
 - 1.4 Where Class U1B material is identified and are unsuitable for treatment on site, the Contractor shall undertake appropriate testing including Waste Acceptance Criteria (WAC) Tests to determine the waste type and whether the waste will comprise U2 material, i.e. Hazardous Waste.
 - 1.5 The Contractor shall inform the Employers Agent immediately of the discovery of U1B or U2 materials, asbestos or other gross contamination. The Contractor shall define in their Method Statement the procedures for handling asbestos, U1B or U2 materials or other waste.
 - 1.6 No groundwater or surface water encountered during excavation shall be discharged to foul or storm sewer, nor to watercourses without the prior written approval of the Sewer provider or the Environment Agency respectively.
 - 1.7 The Contractor shall ensure at all times that:
 9. The exposure of site personnel and the general public to hazards is avoided; and
 10. Contamination or pollution migrating within the site or beyond the site boundaries is prevented.
 11. Throughout the Works the Contractor shall pay particular attention to the following:
 12. Handling and disposal of contaminated soils and water
 13. Keep the waste safe. Holders should protect the waste both whilst in their possession and for its future handling requirements. Security precautions where waste is to be held prior to removal from site should prevent theft, vandalism, waste scavenging and fly tipping. Waste shall be removed from site in appropriate containers.
 14. Transfer to the correct person. Waste may only be handed on to authorised persons or to persons authorised for transport purposes. The Contractor shall pay due regard to Duty of Care and associated regulations.
 15. The Contractor shall ensure that waste is collected regularly. The maximum volume of material in a single stockpile on site at any time shall not exceed 500m³.
-

16. The Contractor shall ensure that all waste is stockpiled in accordance with a method statement approved by the Employers Agent and shall as a minimum included for bunding, basal membrane and top cover membrane to prevent rainfall infiltration and run-off.
17. The Contractor shall comply with Duty of Care Regulations and shall keep records of waste dispatched from site, including waste transfer notes. All records are to be made available to the Employers Agent and/or Regulator upon request. The Contractor shall ensure that all landfill gate receipts are copied to the Employers Agent within two working days of dispatch from site.
18. The Contractor shall ensure that all waste is taken to a disposal facility which is licensed to receive that specific waste type (as determined by chemical analyses and WAC tests).
19. All waste leaving the site shall be sheeted, without holes or tears in the sheeting fabric. Where possible, the Contractor shall use self sheeting lorries to haul waste from the site. Where these are not available, the Contractor shall take appropriate measures to construct a safe and suitable sheeting gantry. Where sheets are to be laid over the container, they shall be secured in place. In the event of any loss of waste during transit, the Contractor shall ensure that the lost waste is collected and transported correctly to the receiving facility.
20. The Contractor shall supply the Employers Agent with a schedule containing vehicle registration number, owner, weight (unladen and gross maximum permitted) and driver details of each vehicle used for transport of materials off-site.

Sub-contracting

21. In order to ensure compliance with the Duty of Care Regulations, the Contractor must nominate all Sub-Contractors before a contract is entered into for undertaking this work.
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APPENDIX 6/3: REQUIREMENTS FOR EXCAVATION, DEPOSITION, COMPACTION (OTHER THAN DYNAMIC COMPACTION)

1. EARTHWORKS GENERAL

- 1.1 No ground disturbing activities, including any earthmoving activities, are to commence prior to the Contractor obtaining any necessary permits or licences relating to protected species or habitats. If a licence or permit for such works is granted, those works shall only be undertaken during the periods as stated on the licence or permit under the direction of the licence or permit holder. A copy of the licence and/or permit shall be provided to the Client's Agent prior to commencement of the relevant activities.
- 1.2 Material excavated and designated for processing shall be transported to the appropriate process area for stockpiling and treatment. Clearly defined segregated stockpiles are required for different sub-classes of processed material. The maximum permitted height of stockpiles, excluding topsoil Class 5, shall be 5.0 m unless otherwise agreed.
- 1.3 For temporary storage of earthworks materials, except topsoil Class 5, maximum permitted height of stockpiles shall be 5.0 metres unless otherwise agreed, subject to other restrictions noted elsewhere in this specification. Earthworks materials requiring to be stockpiled shall be stored in individual stockpiles for each earthworks class and end-use.
- 1.4 On completion of a stockpile the slopes shall be trimmed to falls to shed rain water and the surface sealed to limit infiltration. Temporary drainage shall be provided at the base of the stockpile to collect runoff from the stockpile and to carry any surface water away from the base of the stockpile.
- 1.5 The Contractor shall provide and maintain such measures as necessary to eliminate the production of dust from the stockpile during the life of the stockpile.

2. CUTTING FACES

- 2.1 No specific limitations or restrictions on undercutting are included. The Contractor will be responsible for providing to the Engineer a Temporary Works Design for any excavations that may affect the stability of adjacent slopes.
- 2.2 The Contractor shall provide additional drainage measures to intercept and discharge seepages from cutting slopes. The Contractor is responsible for all drainage required to carry out the works and to protect them upon completion, which will include, where necessary, temporary drainage measures.

3. WATER COURSES

- 3.1 Redundant watercourses shall be drained and cleaned. Watercourses shall be filled with earthworks materials with a base layer of free draining granular material.
-

- 3.2 The Contractor shall provide for such measures as may be necessary to ensure that water, whether ground water, from precipitation or any other source does not accumulate in excavations or on sub-grades.
- 3.3 The Contractor shall arrange for the rapid dispersal of water shed on to the surface of earthworks or completed formation during construction or which enters the earthworks above the water table or from any other source.
- 3.4 The Contractor shall provide where necessary temporary watercourses, ditches, drains, pumping or other means of maintaining the earthworks free from water. Such provision shall include carrying out the work of forming the earthworks in such a manner that their surfaces have at all times a sufficient minimum cross-fall and, where practicable, a sufficient longitudinal gradient to enable them to shed water and prevent ponding. This shall include the provision of temporary measures to remove water expelled from the ground due to the application of load from the engineered fill and surcharge material.
- 3.5 All works and associated costs relating the control and management of water on site, from existing, proposed or redundant watercourses or from any other sources including groundwater, rainfall and surface water is the responsibility of the Contractor. All costs are to be borne by the Contractor and the Contractor is deemed to have read, understood and fully accounted for these costs within their Tender submission. Any uncertainty over the issues associated with water or groundwater control should be submitted to the Engineer for clarification, as soon as any such issue is noted or identified by any party.

4. CONSTRUCTION GENERAL REQUIREMENTS

- 4.1 Any fill placed within the influencing zone of structures shall not be compacted.
 - 4.2 Details of benching are to be a maximum of 0.50m in height with the length of the bench cut to meet the profile of the excavation. In addition to this, where structural loads may span across an excavation where benching has been employed, the length of each bench must be at least twice the height.
 - 4.3 The height of each bench shall reflect the thickness of the compacted layer, and shall be no more than 2 compacted layers in height.
 - 4.4 All bench details shall be agreed with the Engineer.
 - 4.5 Over-steepening of embankment side slopes shall only be permitted with the approval of the Engineer.
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5. CONSTRUCTION OF FILL

- 5.1 Embankment slopes shall not be constructed steeper than that shown on the Drawings. Temporary over-widening or steepening to achieve adequate compaction of the shoulders of the embankment is permitted.
- 5.2 Any areas requiring staged construction of fills and surcharge material, details of staged construction and hold periods are shown on the Drawings and under the direction of the Engineer.
- 5.3 The proposed staged process of earthworks are as detailed within this Specification.
- 5.4 Formation for earthworks construction and cutting formations shall be proof-rolled using a minimum compactive effort as detailed in Specification Clause 613.11 and 613.12. This minimum compactive effort shall be increased for cutting formations where different compactive efforts, dependent on the type of follow-on earthworks operations, are required by the Specification. The identification of a 'soft spot' is qualitative and depends on the response of the ground to the compactive effort during the proof-rolling. As a minimum excessive matting, bow-waving or ground heave shall be indicative of a 'soft spot'. The Contractor is to agree with the Engineer the extent of 'soft spot' treatment.
- 5.5 It is considered likely that localised 'soft spots' may occur during the during the proof rolling exercise and as such detailed discussion and agreement will be required with the Client's Agent and Engineer at the outset in order to adopt a standardised procedure for dealing with this occurrence.

6. COMPACTION

General

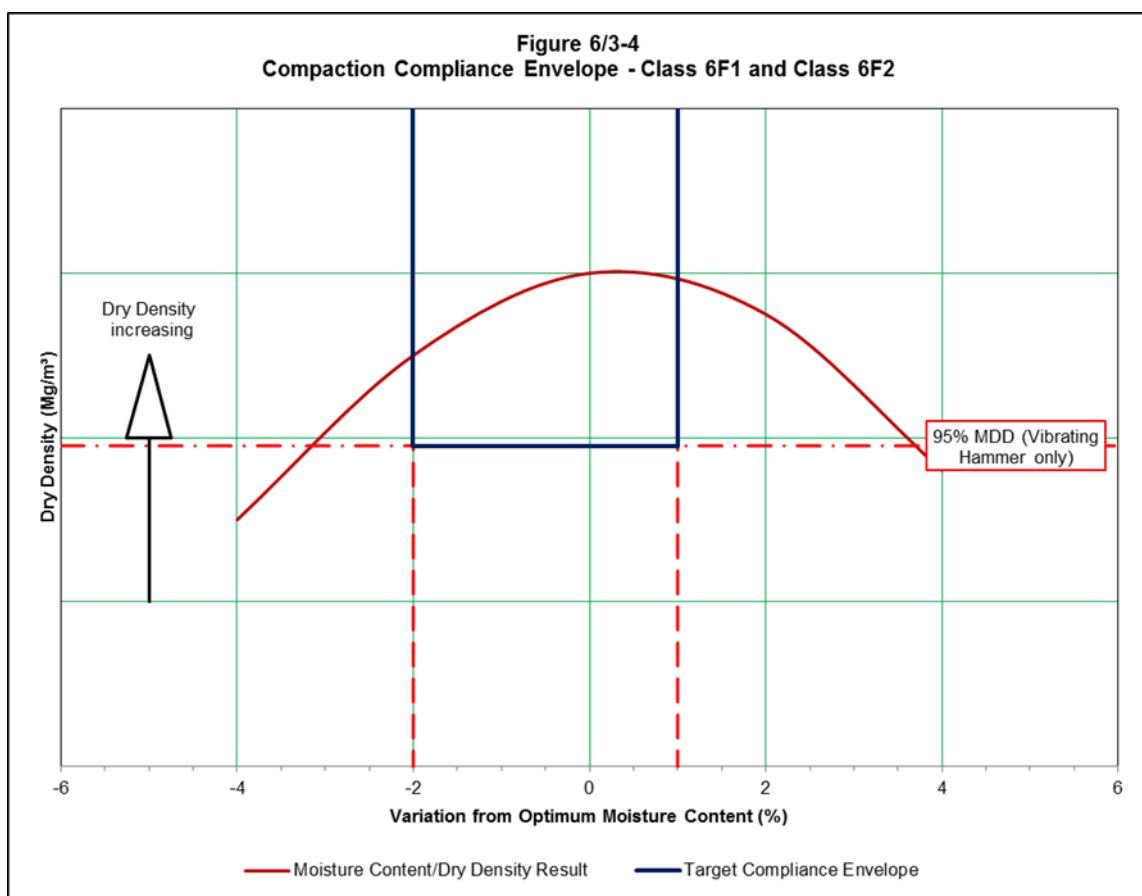
- 6.1 It is envisaged that most of the fill to be used on this site will be derived from site won materials which will be classed as selected fill to structures. Requirements for compaction of earthworks materials shall comply with Clause 612 of SHW and HA 70. Compaction requirements shall be as described below.
 - 6.2 Material shall be compacted in accordance with SHW Table 6/4 Method 6 outside of proposed building footprints and not compacted inside of proposed building footprints.
-

11.2 Method Compaction

6.3 For method compaction of earthworks materials, the frequency of field dry density testing shall be as set out in Appendix 1/5.

6.4 A series of Compaction Compliance Envelopes, presented as figures, have been produced which represent the requirements from Table 6/1 on the compaction requirements for the main types of fill to be used in this project. Reference shall be made to these figures and a source specific envelope shall be provided by the Contractor based upon the results of the classification testing for each material and shall be used in the assessment of compliance.

11.3



11.4

11.5

6.5 The in-situ testing shall be undertaken in accordance with the frequency defined in Appendix 1/5 and shall demonstrate that the adopted method achieves the minimum end product performance detailed in Table 6/1. Where the testing identifies that the minimum end product performance is not being met, then the method of compaction shall change, and a new compaction trial shall be undertaken.

Earthworks Testing

- 6.6 The Contractor appointed to undertake the placement of the engineered fill and any preload & surcharge material will be required to undertake material acceptability testing of all earthworks materials used in the Works. The testing requirements, including the test type and frequency of testing, are described Appendix 1/5, 6/1 & 6/3 of the Earthworks Specification.
- 6.7 It should be noted that in situ testing will be required even where Method Placement is to be adopted by the Contractor, in order to monitor and check that the adopted method is achieving the requisite end-performance. The testing to be undertaken is to demonstrate the method achieves the minimum requirements as detailed in Table 6/1 of this Specification.
- 6.8 The in situ measurement of the material will be required to confirm the applied loadings on the ground and the suitability of the imported material for subsequent inclusion within the permanent works.
- 6.9 The selected method of placement, depth of layer and selection of compaction plant may be derived initially from Table 6/1 and SHW Table 6/4 but will be subject to confirmation following site compaction trials to prove this method can achieve the required end-performance. Any necessary amendments to the guidance from SHW Table 6/4 to ensure the requisite end-performance of the fill material will be made and issued as part of the adopted earthworks specification.
- 6.10 Where fill is compacted – a minimum equivalent CBR of 5% is required at Finished Floor Level (FFL). A minimum equivalent CBR of 15% is required at Site Handover Level. Equivalent CBR shall be determined by static plate load testing, in accordance with DMRB IAN 73/06. It is recommended that dual cycle plate load tests are used for conformance testing, so as to mitigate any erroneous data due to equipment set up. Refer to Group 1 test procedure in Hydrock Technical Bulletin 001 (Annex 1) for guidance on dual cycle plate load

Placing and Compacting Fill

- 6.11 Where different classes of fill material are to be employed, they shall be deposited in such a way that all parts of the fill area receive roughly equal amounts of a given material in roughly the same sequence, thus ensuring a uniform distribution of fill types over the whole fill thickness unless otherwise shown on the Drawings.
- 6.12 The Contractor shall take all necessary steps to ensure that the fill is placed at the moisture content necessary to achieve the compaction specification and shall, where necessary, add water to or dry the fill, in order to obtain this value. Where it is necessary to add water, this shall be done as a fine spray and in such a way that there is time for the water to be absorbed into the fill before being rolled by the plant.
-

- 6.13 Compaction plant and compaction method shall be selected having regard to the proximity of existing trenches, excavations, retaining walls or other structures and all work shall be performed in such a way as to ensure that their stability is not impaired. Any restrictions on size of compaction plant shall be shown on the Drawings. Each compaction method shall only be approved through the completion of a satisfactory compaction trial which can demonstrate that the minimum engineering performance can be met.
- 6.14 If the results of control tests indicate that the fill is being placed and compacted in such a way that the desired end product is not being achieved, the Contractor shall further compact or, if necessary, shall excavate the affected work and replace with new fill, compacted to meet the specification requirements.
- 6.15 If the results of control tests indicate that antecedent weather conditions (such as frost or heavy rain) have caused deterioration of finished work such that the work no longer meets specification, the Contractor shall take such steps as are necessary to bring the fill to the specification requirements.

Compaction Trial

- 6.16 A compaction trial is required to be completed for each compaction method to be used and for each source of material. Prior to undertaking the trial, the Contractor shall confirm to the Engineer the following:
- What method of compaction is to be used in the trial and whether or not it has been based upon the guidance from SHW Table 6/4.
 - What compaction plant is to be used, including but not limited to the type of equipment, manufacture, mass per metre width and any other relevant information which can be used to assess its suitability for the material to be compacted.
 - Confirmation of the source of material to be used, and whether or not there are any geotechnical results available from source suitability testing prior to the commencement of the trial.
 - Confirmation that they understand the minimum specification requirements for end-performance of the fill which are to be assessed and demonstrated during the trial.
 - The methodology for assessing fill, including test type and frequency and who will be undertaking the testing both on site and for the subsequent laboratory analysis.
 - Confirmation that all parties who are to attend the trial have been informed of when and where the trial will be undertaken.
- 6.17 For each Class of material as defined in Table 6/1, and each proposed compaction method, a number of test panels shall be constructed in order to allow a full assessment to be completed. Key criteria to identify during the compaction trial will be:
- Change in density and air voids against number of passes.
 - Change in density and air voids against depth of layer.
 - Change in engineering performance against compactive effort.
 - Identification of point of over-compaction/softening of fill.
-

- Comparative analysis between different plant [where more than one roller is proposed]
- Suitability of material for use on site for the proposed end-use.
- Confirmation of classification and engineering performance of material, including sampling, laboratory testing and classification of the material.
- Comparison of actual performance of material against specification design values.
- Calibration of testing equipment, in particular where the use of a Nuclear Density Gauge [NDG] is proposed for the monitoring of earthworks operation.
- Selection of End Product Requirements to be Demonstrated during Compaction Trial

Reference shall be made to the Compaction Compliance Envelope, presented as Figures 6/3-4

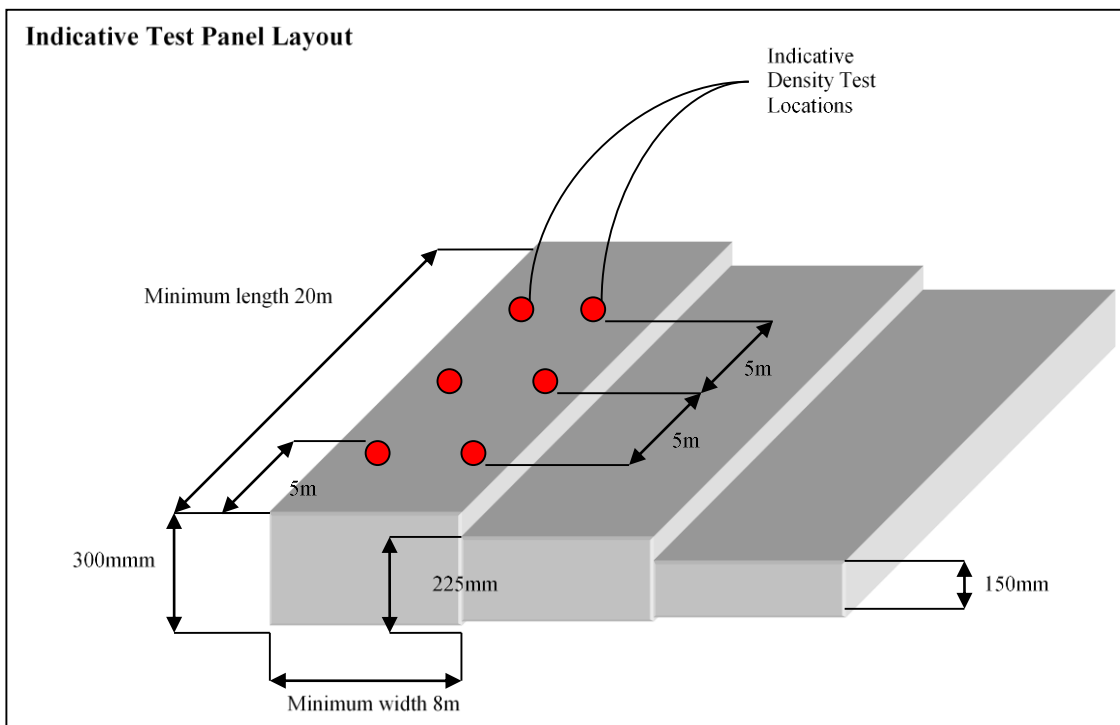
Construction of Compaction Trial Test Panels

- 6.18 For each material type, a number of test panels may be required in order that a full assessment of the material and compaction method can be completed, which would then constitute the Compaction Trial. Although the size of each panel will need to reflect the size of the compaction plant and methodology of work proposed, a minimum width of 8m by 20m in length is recommended, with a number of different layer depths as indicated in Figure 6/3-6.
- 6.19 Each test panel should be laid out and clearly identified and defined separately from any other test panel to avoid cross-contamination, accidental influence from adjacent works and located on site away from other works.
- 6.20 The depth of each layer forming the test panel should reflect the likely depth of compacted material, post completion of the compaction trial, i.e. sufficient material should be placed so that the final depth of the compacted layer is in accordance with the guidance provided in Table 6/4 of the SHW. In the unlikely event that a material is proposed to be compacted and it is not possible to classify the material in order to identify the most likely method of compaction, a significantly higher number of test panels will be required in order to identify the optimum plant, layer thickness and number of passes.
- 11.6 Compaction of Test Panels**
- 6.21 Unless specifically instructed within the site specific documentation, earthmoving plant shall not be accepted as compaction equipment, nor the use of lighter compaction plant to provide any preliminary compaction prior to the use of heavier equipment.
- 6.22 Although the guidance from Table 6/4 of the SHW may indicate the optimum number of passes of the appropriate plant, it is important that the progression of improvement of the material is monitored throughout the compaction process. Therefore, after each and every two passes of the appropriate roller, in situ assessment of the density of the material is to be undertaken. One pass of the roller is defined as a single movement of the compaction plant, in one direction, over a given strip of the test panel.
- 6.23 Where the width of the test panel or roller requires a number of passes in order to ensure the full width of the surface is compacted, it is acceptable for the roller to overlap the previous strip by a small margin (no more than 25% of the maximum roller width). However, it should be ensured that no in situ testing is undertaken in this zone to prevent the effect of over-compaction influencing the assessment of the performance of the plant and material.
- 6.24 The compaction of the test panel should continue incrementally until a clear indication has been obtained to show that the soil has either achieved a maximum density, i.e. where after a number of repeat passes is completed no change is identified or has been over compacted and the performance of the material begins to deteriorate. The exception to this will be where the final performance of the test panel is required to be confirmed using plate load testing, and in this instance it is recommended that a separate panel is constructed, to the same specification as has been identified during the compaction trial, in order that the assessment of the performance can be completed without the detrimental influence of over-compacted material.
-

6.25 Guidance on the point of over compaction may be readily identifiable on site from a number of key parameters:

- Reduction in bulk density/dry density with increasing compaction.
- Increase in moisture content, where the over-compaction of the material drives moisture up through the material to the surface [mobilisation of excess pore pressure]. This may also be observed during the passage of the roller, with material adhering to the roller, and/or the surface of the compacted layer beginning to tear.
- Reduction in engineering performance of the material with increasing compaction.
- Visible movement of the surface of the material during the passage of the compaction plant, typically exhibited as a 'bow wave' in front of the roller.

Figure 6/3-6: Indicative Trial Panel Layout



6.26 The importance of identifying the point at which the materials become over-compacted is important for a number of reasons. Should the material not be competent to undergo additional compaction and/or trafficking, then an engineering decision will be required by the Engineer prior to the commencement of the main earthworks program.

Assessment of Test Panels

- 6.27 In order to assess the compaction trials fully, a stringent series of in situ testing after each incremental compactive effort will be required. The type and nature of the tests which can be used to achieve this will be dependent upon the material type/class, proposed end-use of the material and the adopted specification requirements as detailed within this site documentation.
- 6.28 For each compaction increment the determination of in situ density should be completed with a minimum of 6 number of tests evenly spaced in two rows at distances of 5m, 10m and 15m along the test panel. Each row shall be separated by sufficient distance in order to prevent accidental influence from overlapping roller passes and adjacent test panels. Given the high number of tests that this requires and unless the nature of the material precludes its use, testing shall be undertaken using a Nuclear Density Gauge [NDG]. The results of this test are to be used to assess the following key engineering parameters:
- Bulk Density;
 - Moisture Content;
 - Dry Density;
 - Air Void Content; and
 - Degree of Compaction, compared against the MDD.
 -
- 6.29 In conjunction with the assessment of the density of the material, the following tests shall be included as part of the compaction trial:
- 2 no bulk samples for lab classification, 1 to be sampled prior to compacting the test panel and 1 post completion of the test panel. In order to confirm the engineering characteristics of the material, each source should be sampled and submitted to the laboratory and the scope of testing shall be to determine the grading before and after compaction as well as the MDD using the using the method defined in Table 6/1.
 - Plate Load Testing, to be completed at the end of the trial in order to define the following:
 - » Equivalent CBR;
 - » Modulus of Sub-grade Reaction, k; and
 - » Modulus of Sub-grade Reaction, k760 based on 760mm diameter plate.
-

- 6.30 For the purposes of the compaction trials only, the plate load tests should be completed in accordance with IAN 73/06 in order to determine the Modulus of Sub-grade Reaction and Equivalent CBR value. This testing will require multiple cycles to be completed and as such consideration of the time element to complete each test should be taken.
- 6.31 In order to adopt a standard procedure for assessing compaction trials, Table 6/3-1 summarises the recommended testing requirements.
- 6.32 The purpose of the compaction trials will be to prove the engineering performance of the placed and compacted fill and the suitability of the method to be adopted by the Contractor. The method to be adopted for the main earthworks program should satisfy the following key criteria, which will be further reviewed upon receipt of the results of the compaction trials.
- 6.33 Plate load test completed in accordance with IAN 73/06 shall be used to assess the equivalent CBR value. Loads for the incremental plate load tests completed in accordance with BS 1377-9 are presented in Appendix 1/5, Table 1/5-2

Table 6/3-1 Compaction Trial Testing Requirements

Test Property	Recommended Frequency of Testing
Bulk Sample before compaction	1 sample per material for MC, PSD, OMC and particle density
Bulk Sample post compaction	1 sample per material for MC, PSD, OMC and particle density
Bulk Density	6 tests per compaction increment per layer using NDG
Moisture Content	6 tests per compaction increment per layer using NDG
Dry Density	6 tests per compaction increment per layer using NDG
NDG Calibration	1 per material/test panel
Plate Load Test to IAN 73/06	1 per trial panel, multiple cycles as defined in IAN 73/06

Appendix C COVER SYSTEM JUSTIFICATION

C.1 COVER SYSTEM JUSTIFICATION

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

- simple cover systems: 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 site regarding the suitability of a cover system has been undertaken. This has included:

- an assessment of the suitability of a 'simple' cover system;
- design of the cover system.

An assessment of the suitability of a 'simple' cover system as per Hollingsworth, 2004 (BRE 465) has been undertaken. This indicates that due to the elevated concentrations of PAH and the presence of asbestos a simple cover system is not appropriate and an engineered cover system will be required for areas of landscaping and garden to break the source – pathway – receptor links present at the site with regards to human health. This engineered cover system beneath landscaped and garden areas is proposed to consist of in order of placement:

- capillary break;
- 150mm no dig layer;
- geotextile marker layer; and
- 300mm of clean cover (including a minimum of 150mm topsoil) – Landscaped areas
- 400mm of clean cover (including a minimum of 150mm topsoil) – Garden areas

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 permeable geotextile consisting of non-woven geotextile and HDPE mesh is designed to provide warning against excavation of the underlying soils.

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 C.1 in accordance with BRE 465.

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.

Table C.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.	Additional measures will be installed with regards to soil gases and vapours, if present.
Location and mobility of water table and solubility of contaminants	Liquid or soluble contaminants may be brought to the surface by rising water table.	There is perched water in the Made Ground and the water table is shallow. The granular layer will act as a capillary break layer.
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.	Following removal of free phase hydrocarbons and 'gross' contamination, the site does not pose a risk to controlled waters.
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.	Any significant contamination and 'gross' asbestos will be removed by the demolition and remediation contractors and as such it is considered that there are no significant concentrations of contamination present.
Deep Excavations	Exposing the contaminated material below the cover.	The deep excavations will be carried out prior to the emplacement of the cover system.
Excavations for buried services	Exposing the contaminated material below the cover. Contamination of water services.	Barrier pipework is recommended for the site, dependent on confirmation from the water supply company. Site workers will be made aware of the hygiene requirements regarding the material below the cover system.
Slopes	The combined effects of gravity and seeping waters on a slope could lead to the failure of the cover system.	The site is not significantly sloping.
Areas where mole, badger, rabbit and fox populations are significant.	Contaminated material can be brought to the surface.	As the site is a proposed residential area without the presence of rabbits or badgers they will not present an obstacle to the implementation of the cover system.

In addition to the considerations covered in Table C.1 above, additional considerations with respect to the cover system are: the growing of vegetables, and the future planting of trees in gardens.

C.2 Growing of Vegetables in Gardens

With regards to the thickness of the soil cover in gardens, Hydrock is proposing a 400mm thickness of Topsoil and Subsoil (of which a minimum 150mm has to be Topsoil).

In proposing the 400mm soil cover, Hydrock have considered (with reference to BRE 465) the following points, to determine if 400mm of soil is sufficient as a soil cover, specifically with regards to the potential future growing of vegetables:

- depth of earthworm activity;
- depth of burrows from burrowing animals;
- effects from plant/tree roots; and
- gardening activities.

C.2.1 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 worm activity in a depth of 400mm Topsoil/Subsoil will not have a significant impact on its capacity to protect against extreme contamination.

C.2.2 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 residential 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).

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 400mm Topsoil/Subsoil will not be at risk from rats. In addition, infestation by rats will be actively discouraged by residents.

Wood mice live in burrows to depths limited to 70mm to 180mm.

C.2.3 Effects from Plant/Tree Roots

Plants tend to have a shallow root mat influenced by soil density, and availability of nutrients, and moisture. Based on advice from horticultural consultant such as that provided in proprietary topsoil fertilizers. 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 tree roots. However, tree pits will be dug for trees planned for installation during construction. Trees planted by the residents are discussed later in this Appendix.

It can be concluded that a depth of 400mm Topsoil/Subsoil will be suitable for plants in gardens.

C.2.4 Gardening Activities

Whilst double digging (to approximately 600mm depth) is often undertaken by gardeners who are planting vegetables, it is recognised that this comprises digging out the soil to one spade depth (or to the depth of the Topsoil if less than this) and then loosening the soil to another spade depth using a fork moved backwards and forwards. However, it is considered that mixing below the first spade depth will be minimal.

As discussed earlier in Section C.3, roots will preferentially grow laterally, not vertically and not penetrate the capillary break layer. The combination of geotextile and granular capillary break layer/no dig layer, will make it difficult for excavation through it using hand tools.

Uptake of contaminants by crops is not a concern as the crops will root in the validated (uncontaminated) cover system soils.

Due to the size of the gardens proposed at the site, it is considered likely that any planting of vegetables will be minimal, and that raised beds may be preferred to improve the aesthetics of the gardens, thus increasing the thickness of soils available for growing. However, taking the above into consideration, even if raised beds are not used, Hydrock conclude that a depth of 400mm Topsoil/Subsoil will be suitable for gardening activities.

C.3 *Future Planting of Trees in Gardens*

With regards to future planting of trees by residents:

1. The 400mm soil provision in the cover system will be sufficient to allow small shrubs and grass to be planted within the cover system.
2. Trees planned as landscaping will need to be planted in tree pits.
3. The combination of geotextile and granular capillary break layer/no dig layer, will make it difficult for excavation below the capillary break layer using hand tools.
4. The size of the gardens will limit the widespread planting of significant trees.
5. According to studies reported by the Forestry commission, the use of geotextile will restrict root growth into the capillary break layer. As such, if larger trees are planted, and the soil in the cover system is moist, the preferential direction for root spread will be sideways, rather than down as the combination of geotextile and granular capillary break layer/no dig layer, will make it difficult for tree roots to penetrate below the cover system.
6. If a tree falls over the majority of the roots will be in the soil part of the cover system. However, if disruption to the cover system occurs, Hydrock believes that the contamination risks are low due to the amount of mixing that would occur during the disruption. In addition, any reinstatement of the garden would most likely be undertaken with the deeper materials being placed at depth for aesthetic reasons.

Hydrock conclude that a depth of 400mm Topsoil/Subsoil is appropriate for the proposed development.

Appendix D DISCOVERY STRATEGY

DISCOVERY STRATEGY – Fort Halstead

DISPLAY AND AWARENESS

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 white asbestos sheeting, coal/coke clinker.
- Sand bags, and or/subsurface concrete structures.
- Unusual colour e.g. Blue, red or green.
- Asbestos cement/lagging.

(Examples only – This list is not exhaustive. If in any doubt ask the Site Manager)

PROCEDURE

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

1. All site works at the position of the suspected contamination should stop.
7. Site Personnel to inform the Site Manager/Agent.
8. Visual and olfactory observations of the condition of the ground and the extent of contamination should be made and notification shall be given to the Clients appointed environmental consultant, 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.
9. In the presence of a suitably qualified Geo-Environmental engineer on behalf of the Contractor and the Clients appointed environmental consultant staff, 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.
10. Should the Clients appointed environmental consultant deem it appropriate, the affected material may be excavated and placed in a stockpile on a suitable impermeable surface. This should be suitably quarantined with no addition to, or removal of, the stockpile while chemical analysis is being undertaken. Alternatively, the material should remain in situ until laboratory test results have been obtained.
11. A photographic recorded should be made of relevant observations.
12. A GPS survey of the hotspot position shall be undertaken.
13. The Clients appointed environmental consultant will determine an appropriate testing suite based on visual and olfactory observations.

14. Test results will be compared against current assessment criteria suitable for the future use of the area of the site affected.
15. If after testing the ground is found to be contaminated, the Local Authority and NHBC shall be informed. After consultation with the Local Authority, NHBC and if necessary the Environment Agency, materials should either be removed for disposal to a licensed waste management facility or remediated to agreed clean-up criteria.
16. If the evidence for contamination is severe, as if it leads to pollution of water courses, the Environment Agency shall be informed immediately as an environmental incident (see EA website).

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:

1. All site works at the position of the tanks should stop.
17. Site Personnel to inform the Site Manager/Agent.
18. The Clients appointed environmental consultant shall be notified.
19. A description of the tank should be made by a suitably qualified Geo-Environmental engineer on behalf of the Contractor; including condition and surround, along with visual and olfactory observations should any contents in the tank be apparent. A photographic record should also be made of relevant observations.
20. The tank's position and depth shall be surveyed.
21. The Clients appointed environmental consultant will inform the Local Authority within 24 hours.
22. During the presence of a suitably qualified a suitably qualified Geo-Environmental engineer on behalf of the Contractor, investigation works should be undertaken to obtain samples of any liquid or sludge contents and to establish dimensions of the tank.
23. Laboratory testing will be determined by a suitably qualified Geo-Environmental engineer on behalf of the Contractor in agreement with the Clients appointed environmental consultant based on visual and olfactory observations of the material.
24. Test results will be compared against current assessment criteria and proposals for disposal of any contents determined in agreement with the appropriate Regulatory Parties.
25. Emptying the tank and disposal of contents to a suitable licenced disposal facility.
26. Once the tank has been emptied in accordance with the above proposals, it is to be removed for disposal to a licensed waste management facility. Copies of the relevant waste consignment notes are to be forwarded to the Clients appointed environmental consultant.
27. Excavation and remediation of any contaminated soils in accordance with Section 7.8.
28. Samples of the base and sides of the resultant hole will be sampled as per the Clients appointed environmental consultants instruction and an assessment as to whether this may have been a source for groundwater contamination made.

A report will be prepared by the Clients appointed environmental consultant and submitted to the regulatory parties, the Local Authority and the Environment Agency where groundwater may potentially have been impacted.

OTHER UNEXPECTED BELOW GROUND STRUCTURES

It is possible that previously unidentified / unexpected underground pipes, wells, sumps or shafts may be discovered during the earthworks exercise. Redundant underground pipework may cross the site boundary. The following procedures are to be adhered to if other unexpected below ground structures are identified:

1. All site works at the position of the obstruction should stop.
 2. The earthworks/remediation contractor to inform the Clients appointed environmental consultant and provide a description of the below ground structure, including condition, location and any visual and olfactory observations. A photographic recorded should also be made of relevant observations.
 3. A GPS survey of the below ground structure shall be undertaken if safe to do so.
 4. An appropriate strategy for removal / decommissioning of the structure should be agreed between the earthworks/remediation contractor and the Clients appointed environmental consultant.
 5. Should these structures be defined as unusual or significantly risky (in terms of the formation of preferential pathways) beyond underground structures that would typically be expected to be encountered during redevelopment of former wharf land, then the methodology for mitigation / removal should be submitted to the EA for review in an additional RMS;
 6. Details of the structure and the removal / decommissioning strategy shall be included in the verification report as detailed in Section 7.12 .
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Appendix E Form Templates

Fort Halstead, Sevenoaks

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 F Contractor Requirements

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.

Whilst not an exhaustive list, works shall be in compliance with the latest revision of all relevant legislation, HSE Guidelines and good working practice including, but not be limited to, the following:

- The Health and Safety at Work etc. Act 1974;
- Construction Health Safety and Welfare Regulations 1996;
- Health and Safety Executive 'Protection of Workers and the General Public during Redevelopment of Contaminated Land' HS (G) 66, HMSO 1991;
- The Construction, Design and Management Regulations 2015;
- The Control of Substances Hazardous to Health Regulations 2002 (COSHH Regulations);
- The Control of Asbestos Regulations, 2012; and
- BS6187:2011 'Code of Practice for Full and Partial Demolition'.

The Contractor is responsible for obtaining all necessary approvals, licences, consents and permits from regulatory bodies and third parties prior to commencement.

Licences, Permits and Consents

Any conditions associated planning permission should be addressed prior to carrying out the works.

It will be a requirement of the Contractor to obtain any of the necessary permits and undertake the appropriate notifications and assessments. The Contractor should only expect approvals have been sought by others where explicitly provided to the Contractor or advised in writing by the Client or the Clients appointed environmental consultant.

If treatment of the soils is to be undertaken (e.g. bioremediation of unexpected contamination), it will need to be undertaken in accordance with an appropriate Environmental Permit.

Any reuse of soils 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 (MMP) and Qualified Person Declaration. The Contractor is responsible for the MMP.

Health and Safety Requirements

The Contractors must manage the risks in accordance with their legal requirements and all works are to be undertaken in compliance with all relevant regulations, guidance and legislation.

A Construction Phase Plan (CPP) will be required to be submitted to the Principal Designer, the Client and the LPA in advance of mobilisation to site.

The CPP will be passed to the Site Manager who will implement all Health and Safety measures on site. The Site Manager will fully induct the Site Operatives prior to commencement of any works. The CPP will be kept as an open document and will be adapted as required to during the project. This will (as a minimum) include:

- welfare arrangements, storage and security;
- air monitoring requirements (and action levels);
- traffic management plan;
- segregation of working areas and site welfare (and decontamination units if required);
- site inductions, daily safety briefings and toolbox talks;
- activity specific risk assessments;
- method statement briefings;
- daily inspection records; and
- permits to work.

During the works it will be necessary to protect the health and safety of the site personnel. General guidance on these matters is given in the Health and Safety Executive (HSE) document 'Protection of Workers and the General Public during the Redevelopment of Contaminated Land' HS (G) 66. In summary, the following measures are suggested to provide a minimum level of protection:

- all ground workers should be issued with protective clothing (including high visibility clothing), hard hats, footwear and gloves, personnel instructed as to how it should be used;
- all personnel shall wear hard hats, high visibility clothing and protective footwear at all times;
- ensure that everyone on site complies with the health and safety plan;
- take reasonable steps to ensure that only authorised persons are allowed on site (or part thereof as the case may be);
- display, where they can be easily read, any notification that has been sent to the Health and Safety Executive;
- hand washing and boot cleaning facilities shall be provided;
- no smoking except in designated areas;
- good practices relating to personal hygiene shall be adopted;
- prepare method statements for construction operations as required by the CDM Co-ordinator; and
- provide the Principal Designer with any other relevant information.

Before site operations are commenced, the necessary COSHH Assessments, Method Statements and Health and Safety Plans should be completed, approved to the Principal Designer's satisfaction and issued in accordance with the CDM Regulations.

The Health and Safety Plan should pay particular attention to the following hazards which may be encountered:

- potentially hazardous or contaminated materials used or encountered on site;
- deep excavations;
- the potential for ground gases and risks on confined spaced entry;
- working in the vicinity of existing underground or overhead services;

- working in confined spaces;
- working on, or in the vicinity of highways;
- working with materials which have the potential to contain asbestos and the risk of inhalation of asbestos fibres;
- manual handling;
- the potential for fire;
- working with electrical apparatus in the vicinity of mobile plant and the potential presence of water;
- poor lighting;
- the potential for falling/slipping/tripping and sustaining injury;
- the possibility for biological agents to be present, including, but not limited to: psittacosis, leptospirosis (Weill's disease), tetanus, legionella, human waste; and
- working in the vicinity of voids and openings.

The Contractor shall take all necessary safety precautions throughout the ground treatment operations and shall comply with the Health and Safety at Work Act 1974 or any subsequent re-enactment thereof.

The Contractor shall submit for approval all necessary method statements to the Client and the Clients appointed environmental consultant prior to commencing the works.

The Contractor shall provide details of emergency procedures. Emergency services shall be informed of the site operations prior to commencement.

All statutory records to be kept in the site manager's office and these may include (not an exhaustive list and note not all may be required):

- ASB>NNLW1 – Notification of non-licensed asbestos work if the work is deemed not be requiring a licence;
- appropriate licence with regards to CAR 1012 if the work is deemed to require a licence;
- HSE Notification F10;
- Pre-construction Information Pack;
- Construction Phase Health and Safety Plan;
- Method Statements and Risk Assessments;
- Environmental Permit deployment form and associated paperwork;
- Discharge Consents for disposal of groundwater;
- competence records (including asbestos awareness training and face-fit test records
- service records;
- plant and machinery maintenance records;
- Duty of Care paperwork.

In addition, if asbestos is found during the demolition works/enablement works, it is recommended that:

- Asbestos Awareness training / briefing to be given to all staff;
- background and ongoing air dust monitoring (to include asbestos) to be undertaken to check for presence of asbestos fibres during the works; and
- licensed asbestos contractors are employed to manage the licensed asbestos controlled areas, all other operatives involved in the operations must have appropriate training to satisfy the requirements of the Control of Asbestos Regulations 2012.

Site Establishment and Security

Prior to the commencement of any works, the Contractor, in conjunction with the Client, shall establish the boundaries of the site and working areas.

The Contractor shall make adequate provision to secure the site boundary and prevent unauthorised access onto the site during the course of the works.

Prior to the commencement of any works, the Contractor, shall undertake a dilapidation survey of all adjacent features/construction including but not limited to boundary walls/ fences, adjacent footpath and road constructions etc. The survey is to be agreed with the Client or their representative prior to commencing any work on site.

The Contractor shall be responsible for all costs associated with rectification of damage to adjacent features/construction including but not limited to boundary walls/ fences, adjacent footpath and road constructions etc. resulting from the demolition works. If damage is not noted on the dilapidation survey (or the dilapidation survey is not undertaken) and damage is later reported, it is the responsibility of the Contractor to rectify.

The Contractor is to provide surveying capability as set out in this document facilitate the above.

Prior to the completion of the works the Contractor is to discuss the continuation of the site security, including the fences, with the client and acceptable arrangements for continued security are to be agreed prior to the removal of the Contractor's security provision.

Traffic Safety and Management

The Contractor shall comply in all respects with Chapter 8 of the Traffic Signs Manual for works on or affected the public highway and/or private roads forming the highway access to/from the site. The Enabling Works 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 and or the Works.

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

Suitable precautions shall be taken to prevent the spread of mud and debris on the public highways. Regular inspections of the public highway adjacent to the site shall be carried out. If deemed necessary by the Contractor, the Client or the Clients appointed environmental consultant, the highway shall be swept regularly to remove any mud, slurry or dust deposited by vehicles entering or departing the site. If Hydrock considers that significant amounts of any detritus have been deposited on the public highway

then operations shall be temporarily suspended until appropriate cleaning operations have been undertaken.

The Contractor is to co-operate with other contractors if they are present during the works.

The proposed works will generate a number of vehicle movements associated with the removal of soils and delivery to site of materials. Consideration should be given to the route and the timing of these vehicle movements, to minimise risk and disturbance to sensitive locations (such as schools, residential areas).

Risks associated with the transport of soils that are potentially containing contaminated, such as dust emission, should be appropriately managed by the Contractor.

Welfare Facilities

Site cabins and welfare facilities will be established at a location to be agreed with the Client.

The Contractor is deemed to have made provision and arrangements for all temporary services associated with the welfare facilities.

Working Hours

Noisy operations i.e. the use of hydraulic breakers shall be restricted to operating times as specified by the Client.

Prior to commencement the Contractor is to make contact with the Local Authority to establish if any further restrictions apply.

All working hours are set out in the Construction Phase Plan.

Mobile Plant

Mobiles plant shall be operated by suitably trained and qualified operators experienced for each item of plant. When not in use all plant shall be locked to prevent all plant shall be locked to prevent unauthorised operation.

All traffic entering or working on site shall obey a maximum 10 mph speed limit.

Fuelling of any plant shall be undertaken in a designated area and all above ground fuel storage tanks shall comply with the requirements of the Pollution Prevention Guidelines PPG2.

Specifically, any storage tanks used should:

- be sited within an oil-tight secondary containment system such as an impermeable bund;
- the secondary containment must provide storage for at least 110% of the tanks maximum capacity;
- be located within a secure area; and
- all taps and valves should be fitted with a lock and kept locked shut when not in use.

Maintenance of mobile plant should be undertaken in a designated area, unless absolutely necessary.

Waste oil, hydraulic fluid etc. should not be tipped directly or discharged on to site. Such materials shall be stored separately, in a secure bunded area, for off-site disposal. Waste oil may be a special waste and disposal shall be undertaken by a registered carrier in accordance with the Duty of Care Regulations.

A spill kit shall be kept on site in an accessible place adjacent to the designated refuelling area and used in the event of a spillage or leak.

Surveying

The Contractor shall provide full time surveying personnel and equipment 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 co-ordinates in relation to the national grid and topographical survey provided within 1 day of request.

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 Client 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 features, changes in slope, structures, services and any 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.

Testing

The Contractor shall be responsible for undertaking all testing necessary to satisfy the Clients appointed environmental consultant that the works have been carried out in accordance with and comply with the specification.

All soils and chemical testing shall be carried out by a UKAS and MCERTS accredited laboratory, with accreditation for the specific analysis, to the approval of the Clients appointed environmental consultant. The lowest level of detection shall be used for all testing. The Contractor is to submit to the Clients appointed environmental consultant the proposed levels of detection for all proposed testing.

The Contractor is to make available on site at all times a file containing all test data received for inspection by the Client or the Clients appointed environmental consultant or Named Representative (NR). The Contractor is to prepare a summary table for presentation with the contractors report detailing test results and associated status.

This summary table will be in Excel format and be updated and sent to the Clients appointed environmental consultant by 10:00am every Monday. This summary will include an up to date location plan, all samples taken, tests scheduled, laboratory results received and outstanding testing.

Offsite Disposal

Materials for offsite disposal shall be sampled and analysed, by the Contractor, 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 Duty of Care Regulations, 1991 and where appropriate the Special Waste Regulations, 1996.

A transfer note 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.

The waste transfer notes shall be kept by the Contractor for a period of at least 2 years.

Contamination

Contractors should be made aware of the possibility of encountering contaminants within soils or groundwater at the site (including asbestos) through 'toolbox' talks.

Safe working procedures should be implemented in accordance with CIRIA132 and good standards of personal hygiene should be observed and appropriate levels of PPE provided and utilised.

Eating, drinking and smoking should be strictly prohibited in the development site other than in designated mess areas.

The Control of Noise, Vibration and Dust Nuisance

The Contractor shall comply with the recommendations for practical measures to reduce noise and vibration set out in BS5228-1:2009 and BS5228-2:2009 and with any specific Principal Contractor requirements.

The Contractor shall take all reasonable measures to prevent dust nuisance from being generated by construction traffic, etc.

If necessary, working methods will be altered in order to ensure that the level of noise generated from the works is within published tolerable limits.

The requirements of the LPA are to be sought and undertaken.

General

No fires shall be permitted on site.

Dust Mitigation

Appropriate measures shall be implemented at all times during the demolition and enabling works to minimise any dust emissions.

Any main temporary haul roads shall, where practical to do so, be constructed of crushed hardcore products. The haul roads shall be maintained for the duration of their use to minimise any build-up of loose spoil etc.

Traffic both entering and working on site shall obey a maximum speed limit of 10 mph (unless otherwise agreed).

Mobile water bowsers and sprayers shall be available on site at all times to water unpaved haul roads and working areas. The water spray may include chemical dust suppressants or wetting agents to improve dust control.

Wagons that are to be used for the haulage of any contaminated material from site shall be appropriately sealed or sheeted to prevent the release of fugitive dust.

An adequate supply of water shall be maintained on site at all times to allow for dust suppression activities to be carried out at short notice.

Where mobile water bowsers are no effective in suppressing dust then vapour masts shall be used. Such vapour masts shall be deployed at 20m centres on the downwind side of haul roads or excavations giving rise to significant dust or emissions of odour.

Air quality and dust monitoring stations will be set up and monitored by the Contractor to record the dust concentrations during the works.

With regards to stockpiles:

- stockpiles should be kept to a minimum to reduce 'wind whip' causing potentially hazardous material to be blown from the pile;
- stockpiles should be placed on a suitable polythene membrane to prevent any cross contamination and care should be taken not to pierce the sheeting when placing the bulky elements of the material;
- stockpiles should be dampened down or covered to prevent dust, whilst the final choice should be made by the Contractor based on site constraints, but the options include covering with plastic/polythene membrane, or by a layer of clean soil material; and
- the drop distance from excavator bucket to stockpile will be kept as short as reasonably practicable to reduce dust.

Odour

In general terms the excavation works are not considered likely to give rise to any significant odour problems.

If highly odorous materials are encountered, which may give rise to nuisance to neighbouring properties, appropriate vapour masts shall be deployed to provide suitable odour control. Any odorous materials shall be covered at the end of each working day and any stockpiles will be located away from any sensitive areas.

Plant and machinery shall be serviced regularly to ensure that exhaust fumes are compliant with best practice and relevant regulations.

Noise

The requirements of the Local Planning Authority and BS 5228: 1997 'Noise and vibration control on construction sites' shall be adhered to at all times.

All machinery shall be fitted with effective silencers and shall be serviced at regular intervals. No items of plant shall be operated with engine covers raised.

The location of any crushing plant shall take into consideration the location of neighbouring properties and other noise sensitive receptors and shall be located away from these areas and located adjacent to proposed stockpile locations where possible.

Asbestos in Soils

The Contractor for each phase of works 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.

The remediation works are designed to break the source-pathway-receptor linkage with regards to contaminants within the soil. Whilst appropriate measures are required for all contaminants present, the Contractor should note the additional details provided below with regards to asbestos in the soils:

- Asbestos is a hazard to Human Health when airborne fibres are inhaled. Asbestos containing material (ACM) that is in a bound form (such as asbestos cement tiles) is a low risk where the asbestos fibres cannot become airborne. However, if lagging is present or the ACM is broken or crumbled in a dry condition the asbestos fibres could become airborne and could then be inhaled. When soil with asbestos is covered by hardstanding, buildings or a cover of clean soil or when the soil is kept damp, the asbestos fibres are less likely to become airborne and the risk is greatly reduced.
- The Health and Safety at Work Act 1974 forms the basis of health and safety legislation in the UK. In addition, the Control of Asbestos Regulations 2012 (CAR 2012) applies throughout the UK. CAR 2012 applies if land has significant asbestos content and is relevant to any work conducted on asbestos contaminated land.
- CAR 2012 defines a 'control limit' of 0.1 fibres per cubic centimetre of air averaged over a continuous period of 4 hours. This limit is not risk based and may be much higher than the levels for control of environmental pollution.
- CAR 2012 applies even where exposure to asbestos of employees is sporadic and of low intensity and where exposure to asbestos of any employee will not exceed the control limit. In addition, the work must be of short non-continuous activities where non-friable materials

are handled, or removal without deterioration of non-degraded materials in which asbestos fibres are firmly linked in a matrix.

- Lagging, broken fragments of asbestos and loose fibres have the potential to release airborne fibres in dry conditions. In addition, as the ACM and asbestos fibres have been contained in the soil for many years, the likelihood is that they would be degraded to some extent. However, if 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.
- Given the above factors, it is possible that the works being undertaken would not be exempt from CAR 2012 licencing requirements and it is the Contractors responsibility to assess the licencing position.
- It should be noted that information presented in this document is provided to assist in managing the soil at the site which contains asbestos. Hydrock cannot be held responsible for how the control measures associated with these risks are implemented and recommend that an appropriate asbestos specialist assist with both the preparation of documents and licences and site supervision.

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. Appropriate PPE and if required RPE should be provided and utilised.

Visible fragments of suspected asbestos containing materials on the site surface should be handpicked. If hand picking is being undertaken it needs to be undertaken in accordance with and Environmental Permit and ACM shall be placed in a dedicated covered and lockable skip pending off-site disposal to a suitably licensed facility. Such remediation measures will be undertaken by suitably qualified contractors and in accordance with CAR 2012.

Water Quality Controls

The Contractor shall provide for such measures as may be necessary to ensure that water, whether ground water, from precipitation or any other source does not accumulate in excavations or on sub-grades.

Adequate drainage sumps will be installed during works and cut off trenches/dewatering measures will be used as required to manage surface water run-off, to prevent any water from entering watercourses, either directly as surface water run-off, or indirectly via the surface water drainage systems.

If materials escape, appropriate the Contractor is to undertake (at their cost) appropriate remedial action as soon as possible.

Services

Service records are to be provided by the Client for information purposes within the enabling works documentation. However, the Contractor shall be responsible for liaison with the statutory service providers to ensure all service records are current and correct. The Contractor is also responsible for the safe disconnection of existing services entering the site, except those which are to remain operational.

Prior to site work commencing, the position of all services indicated as on site or offsite but close to the site boundary shall be determined and clearly identified where on site. The locations should be confirmed

on site by appropriate investigation, observations and survey. Any discrepancies between the anticipated positions and confirmed locations are to be reported to the Client.

All retained manholes should be located and clearly identified on site to prevent damage. The location, depth, diameter and invert level of each manhole and the size and depth of all stream connections shall be recorded. Where drains or sewers are to be grubbed up the downstream ends should be plugged prior to commencement to prevent offsite systems becoming blocked or contaminated.

Where existing drains or sewers are to remain, CCTV surveys are to be provided by the contractor. These surveys must be undertaken on commencement prior to any physical work and on completion to demonstrate no damage has occurred.

Where damage has occurred, any remedial work must be agreed with the Client and relevant authority/owner prior to repairs commencing. The repair costs will be borne by the contractor.

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.

The Contractor is responsible for ensuring that all hydrant covers, stop tap boxes manhole covers and the like are raised or lowered to suit the finished levels associated with the proposed enabling works plateaus and future construction thicknesses.

Following the completion of the works, a survey plan of the location of terminated services is to be provided.

Damage to Property

All works are to be undertaken in accordance with the Party Wall etc. Act 1996.

The Contractor shall ensure that all precautions are taken in order to avoid any damage to existing property arising from the Works and shall be responsible for same in the event that any damage should arise from his failure to exercise due care.

Any adjacent structures, services and the like shall be inspected prior to commencement of the Works for evidence of existing defects and, if necessary, a dilapidation survey shall be carried out by the contractor, with the agreement of the Client, prior to works commencing on site. A re-inspection shall take place on completion of the Contract to verify that no damage or deterioration of the said structure, service or apparatus has occurred as a result of the Works. A schedule of the findings of this re-inspection shall be circulated to all parties concerned for their records.

The Contractor shall execute the works with care so as to avoid damage to existing structures and drains or other services to be retained.

All fences, trees, paths, shrubs, grassed areas and other surfaces required to be retained shall be protected by the Contractor from spillage and damage caused by site operations and upon completion of the works they shall be handed over in an undamaged and proper state to the satisfaction of the Client.

Refer to landscape architect drawings and specifications that define the areas that require protection. The Contractor shall not raise or lower the ground level beneath the spread of the branches of any tree to be retained without the approval of the Client.

Drawings and Supplied Information

Whilst efforts have 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 to report any discrepancies encountered or anticipated to the Client 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.

Photographs

A detailed dilapidation survey shall be undertaken of the site and adjacent properties including joint site boundaries, in conjunction with adjacent land owners.

Such survey shall include (but not be limited to) roads, footpaths, street lighting and road signs. A copy of the survey, including record photographs shall be provided to the Client within seven days of commencement of site works.

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 report. Photographs are to be made available to the Clients appointed environmental consultant and the Client in electronic format should they be requested during the contract. Record photographs should be provided as part of the validation information.

Appendix G Options Appraisal

G.1 Introduction

This Options Appraisal has been undertaken in general accordance with Chapter 3 (Options Appraisal) of CLR11 (Model Procedures for Management of Land Contamination), DEFRA, 2004. There are four main stages to this appraisal:

2. Identifying Key Risk Drivers.
3. Identifying feasible remediation options for each relevant pollutant linkage.
4. Carrying out a detailed evaluation of feasible remediation options to identify the most appropriate option for any particular linkage.
5. Producing a remediation strategy that addresses all relevant pollutant linkages, where appropriate by combining remediation options.

G.2 Key Risk Drivers for Remedial Action

Hydrock Report 10730-HYD-XX-XX-RP-GE-1000 has identified that the key risk drivers with regards to the requirement for remediation are:

- elevated PAH and metals in the Made Ground;
- asbestos in the Made Ground.

The following sections of this report are intended to identify optimum remedial techniques which can be applied in order to achieve a site which is suitable for the proposed residential development.

In addition it must be borne in mind there is a requirement to remove, as far as practicable, all underground obstructions and create a development platform, which is geotechnically suitable for use.

It should be noted that with regards to potable water pipelines, these are not discussed in the Remediation Options Assessment as they are mitigated by prescriptive measures identified by British Standards and good practice.

G.3 Remediation Options and Evaluation of Feasibility

11.6.1 Preliminary Assessment of Remediation Options

Investigation and risk assessment has concluded that the site will require remediation in order to mitigate the risk to the identified receptors.

The objectives of the remediation are to sever one or more elements of each of the *source-pathway-receptor* linkages.

The initial screening process considers the available remedial techniques based on following key criteria:

- Effectiveness. The strategy must work within the context of the site and be effective in the removal of contamination linkages.

- Practicality. The strategy has to have been successfully used in similar situations on other sites and readily available within the UK market. Novel solutions or those still in the research stage are not considered here.
- Durability. The strategy needs to be durable and not reliant on ongoing maintenance to continue being effective.
- Relative Cost. The strategy must not be excessive cost.
- Relative Operational Time: The strategy should work in a feasible and realistic time scale.
- Sustainability. More sustainable options are preferred.

Table F.1 below summarises all of the accepted remedial techniques readily available in the UK and assess each against the six key parameters listed above.

In the first instance, the feasibility of each of the listed remedial option is assessed in terms of effectiveness at treating the contamination, which is broken down into; effective (Y), partially effective (P) or ineffective (N).

The listed techniques are then assessed in terms of relative cost ranging from negligible cost (£) through moderately expensive (££) to prohibitively expensive (£££+).

Timescale over which the remediation technique is operational has been broadly assessed in units of weeks, months, years and decades. If for example a given technique is only effective over a period in the order of years to decades then its overall feasibility is diminished.

Previous site experience, technical literature and Hydrock's in house knowledge have been used to reject unsuitable remediation options. The primary reasons for rejection of an option were generally the ongoing operational constraints, the cost and the inability to treat all the required contaminants present. In some instances there may be a number of treatment options identified with the best practicable option unable to be determined at this stage. In these instances all potential remedial options are carried forward.

Table G.1: Applicability of Remediation Options and Initial Assessment – Soils

Remedial Activity	Effective on Petroleum Hydrocarbons	Effective on Asbestos	Effective on PAH	Relative Cost	Relative Operational Time	Comments (Practicality/Sustainability/Durability)	Feasibility (Y- Yes, N – No)
Cover System	Y	Y	Y	£	Weeks	Will prevent contact between future site users and deeper soils and break the S-P-R linkage.	Y – in conjunction with other technologies.
Excavation and Disposal (may also involve pre-treatment by screening and sorting).	Y	Y	Y	£££+	Weeks	Will effectively remove the source of the contamination. Excavation and disposal is not considered sustainable. However, dependent upon other factors may be unavoidable. Disposal to be minimised as much as possible by re-use of appropriate soils.	Y – in conjunction with other technologies.
Excavation, Processing and Replacement	Y	Y	N/Y	££	Weeks	Will effectively remove the source of the contamination where it is an identifiable zone. Would need to be undertaken in association with MMP.	Y – in conjunction with other technologies.
Materials Management (Excavation processing and Re-Use of Suitable Materials)	N	Y	Y	££	Weeks	Will effectively remove the source of the contamination and place it below the cover system if required. Would not remove hydrocarbons. Would need to be undertaken in association with Material Management Plan (MMP).	Y – in conjunction with other technologies.
Bio-piles	Y	N	N	££	Months	Will effectively reduce petroleum hydrocarbons concentrations.	Y – to be determined with the Enablement Contractor and Client.
Windrow Turning	Y	N	N	££	Months		
Windrow Turning with addition of additives to stimulating aerobic microbial activity	Y	N	N	££	Weeks to Months	Will effectively reduce petroleum hydrocarbons concentrations in soils.	
Soil Washing	Y	N	N/Y	£££+	Months	Treat process streams (water, sediment) and route to appropriate off-site disposal, as required. Will potentially result in a significant proportion of soils which are geotechnically unsuitable without extensive treatment.	N – due to the creation of geotechnically unsuitable soils, which would require disposal.
Hydraulic Binders	Y	N	Y	££	Weeks to Months	Mixing of additives into soils to bind contamination thereby minimising migration from soil to vapour and dissolved phases. Additives may include binding agents for organics and cementitious materials.	Y – but discounted as there is no need for such an aggressive remediation technique and sulphates in the soils may create heave.

G.3.2 Viable Remedial Options

As described above, certain technologies were rejected on the basis of ineffectiveness, excessive cost, sustainability, or those which are required to operate in timescales of years or greater. The short-list of options presented below represents those technologies which were not rejected at the pre-screening process and as such, are taken forward to the options appraisal process:

- installation of a cover system in garden and landscaped areas where elevated PAH and asbestos is detected;
- Materials Management (excavation, screening, reprocessing and reuse of suitable materials);
- excavation of any petroleum hydrocarbon impacted soils;
- *ex situ* treatment of petroleum hydrocarbon impacted soils; and
- disposal of excess or unsuitable soils.

Cover System

Cover systems have been widely used in the UK for managing risks associated with brownfield land developed for residential land uses. The technology involves the placement of a cover to form a barrier between the contaminant and site users thus breaking the source-pathway-receptor linkage.

Subject to site levels available for the installation of the cover, this option is technically simple and represents a low cost strategy that can be implemented rapidly. However, site levels will not allow the installation of a cover system from the existing levels.

The timescale for installing a barrier is relatively quick allowing for rapid completion of the remediation objectives and this remediation solution could be designed and implemented within a matter of months.

Materials Management (Excavation, Screening out of the Fines, Re-processing and Reuse of Suitable Materials) – potentially with a Cover System

Excavation and reuse of suitable materials has been widely used in the UK for managing risks associated with brownfield land. The method involves the excavation of soils, determining their suitability (both chemically and geotechnically) and replacement as part of an earthworks programme. The final part of the remediation (if the contaminated soils are not removed from site) would be the placement of a cover to form a barrier between the contaminants and site users, thus breaking the source-pathway-receptor linkages.

This option is technically simple and represents a low cost strategy that can be implemented rapidly. However, there are two principal disadvantages to this strategy:

6. because the contaminants present in the soils are potentially not removed, there remains a risk of future site users exposing the contaminants and therefore the potential for long term liabilities must be considered during the design process; and
7. the presence of a cap across the defined area would place a constraint on the potential future land use for that area.

There are a number of measures to mitigate the risks associated with the contaminants being exposed in the future that can be implemented, for example planning the works (in accordance with a MMP) to

ensure any potential Contaminant of Concern (for example soils containing asbestos) are placed at depths where the risk of future contact is low.

Whilst in some instances presence of a cover system may place a constraint on the potential future land use for that area. Hydrock believes in this instance as long as the cover system is installed in line with Hollingsworth (2004) and CIRIA SP124 (1996), it will be robust and the site will not pose a risk to future site users.

As the exercise is predominantly an earthworks exercise, the timescales are relatively short allowing for rapid completion of the remediation objectives and this remediation solution could be designed and implemented within a matter of months.

This strategy lies outside of the EA waste management regime; therefore an Environmental Permit would not be required to allow the installation of the cover system.

Excavation of Petroleum Hydrocarbon Impacted Soils

Any Petroleum Hydrocarbon Impacted Soils shall be excavated and either treated to make them suitable for use (bioremediation or stabilisation), or disposed of off-site, as preferred by the Client and Enablement Contractor.

Bioremediation

Bioremediation is typically utilised for soil and groundwater remediation primarily impacted with VOCs and petroleum hydrocarbons. Whilst it is accepted that in some instances less degradable species are not suitable for bio-remediation, given the presence of VOCs and low end carbon chain petroleum hydrocarbons, bioremediation should be very effective for these site conditions. The benefits of this option are:

- parameters can be monitored during the works, to ensure maximum efficiency of the bio pile;
- bioremediation and then reuse of suitable materials on site would be able to be undertaken within the programme;
- it is consistent with the principles of the Landfill Directive i.e. a reduction in the quantity of materials sent for landfill disposal;
- it will reduce haulage wagon movements to a minimum; and
- soil stabilisation/ solidification and bioremediation are tried and tested techniques.

Whilst an Environmental Permit will be required, Hydrock do not see any significant disadvantages with regards to the use of ex-situ treatment to treat hotspot contamination at the site.

Soil stabilisation/solidification

Soil stabilisation/solidification is able to target a wide target of contaminants including:

- petroleum hydrocarbons;
- inorganic gas works type wastes; and
- heavy metals.

Solidification and stabilisation are discrete processes that are often used together in order to reduce the mobility of contaminants in soils:

- Solidification achieves a reduction in mobility by converting the soil into a solid monolithic mass thereby reducing the permeability of the material.
- Stabilisation reduces the availability of contaminants by changing their chemical form (for example, precipitating metals in an insoluble compound) or increasing the strength of their binding to a solid matrix.

Solidification and stabilisation processes often involve a combination of cement, fly ash, lime, clays or asphalt. As such the soil stabilisation/ solidification technique can be applied to the majority of the contaminants present on the site. In addition, if any unforeseen contamination is uncovered, soil stabilisation/ solidification could be applied to address the contamination without having significantly altered the remediation process.

If required, contaminated soils could be treated in batches and once proven suitable for use will be reused during the earthworks. The benefits of this option are:

- any stabilisation would be able to be undertaken within the programme;
- it is consistent with the principles of the Landfill Directive i.e. a reduction in the quantity of materials sent for landfill disposal, however, this would be partly offset by use of cementitious binders;
- it would reduce haulage wagon movements to a minimum; and
- it is a tried and tested technique.

Prior to undertaking soil stabilisation / solidification, the following will need to be considered:

- bench testing and trials are required to determine the most suitable binder formulation and to prove that solidification / stabilisation will be effective in reducing leachate concentrations;
- discussion of the trials with the Environment Agency and the Council needs to be undertaken, and agreement in writing of appropriate leachate targets prior to implementation of solidification / stabilisation;
- careful and appropriate design of the works are required to ensure that the technique does not result in geotechnical constraints to the future redevelopment of the site;
- potential issues to neighbours and environs are controlled (such as odour and dust);
- solidification and stabilisation should only be used in association with Materials Management to ensure the treated material is not used within residential gardens areas; and
- solidified / stabilised soils shall not be placed below the water table.

On balance, subject to appropriate bench scale testing and agreement with the regulators, soil stabilisation / stabilisation will provide a suitable remediation option for soils following screening and sorting.

Disposal

Disposal involves the removal of contaminant material from site and disposal at an appropriately licensed waste management facility.

The advantages with regards to excavation and disposal are:

- it represents a relatively rapid remediation strategy; and
- provides a high degree of certainty in the suitability of the site for its intended end use.

The main disadvantages with full Excavation and Disposal are:

- cost of disposal, especially as the majority of the soils would be suitable for use as general fill below the cover system; and
- does not represent a sustainable remediation strategy as significant vehicle movement will be required to and from the site and the contamination is not destroyed but simply relocated to a waste management facility, thus taking up valuable landfill space.

Hydrock does not believe that full disposal of all impacted soils is applicable at the site. However, partial disposal may be required and this option is considered viable if used in conjunction with other techniques.

It is proposed to dispose of any significant petroleum hydrocarbon contaminated soils encountered (which are proven unsuitable for use) off site.