Heyford Park – Western Development

Phases 9, 10, 15, 16 and 16A

Remediation Method Statement

Report for

DORCHESTER LIVING

April 2017

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APPENDICES

1.0 INTRODUCTION

1.1 Background and Terms of Reference

Hydrock Consultants Limited (Hydrock) has been commissioned by Dorchester Living to prepare a Remediation Method Statement (RMS) for the redevelopment of Phases 9, 10, 15, 16 and 16A at the site Heyford Park – Western Development.

Hydrock (2017) has undertaken a desk based study and ground investigation for the redevelopment of Phases 9, 10, 15, 16 and 16A at the site. Waterman Energy, Environment and Design Ltd (2012) has undertaken investigation and assessment of the wider development area to the east of the current site. A remediation strategy associated with these areas was produced by Waterman (Ref. EED10658-109_S_12.2.2_FA).

The findings of the investigations undertaken on Phases 9, 10, 15, 16 and 16A are reported in Hydrock Report Reference HPW-HYD-MS-ZZ-RP-G-0001 and HPW-HYD-P15-ZZ-RP-G-0001-P2, dated February and January 2017, respectively.

This RMS provides further information with regards to the remediation that will be required following the demolition of structures at the site for the above phases.

The five Phases cover approximately 34 ha in total and formerly comprised the Upper Heyford airbase.

The proposed development is understood to comprise residential housing with associated gardens, Public Open Space (POS) and infrastructure. There is the possibility for development plans to change, which may include a school or college.

A Site Location Plan (Hydrock Drawing HPW-HYD-PX-ZZ-DR-GE-1000) is presented in Appendix A.

1.2 Objectives

The objective of this RMS is to present details of the remedial objectives, 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.

Remediation will ensure that upon completion of the proposed 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 installed during the demolition, enablement and construction phases of the redevelopment for a residential end use with gardens (plant uptake), public open space (residential) and depending on the development plans, school end use (residential without plant uptake).

This document is a working document and may need to be updated, in agreement with the relevant regulatory bodies, at any stage during development, dependent on the conditions encountered. The current issue is HPW-HYD-PX-REM-RP-GE-3000-P1-S2. Please contact Hydrock Consultants if you are unsure of the current issue.

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

1.3 Scope

The scope of the RMS comprises:

- a summary of the conceptual model;
- a summary of the results of risk assessment undertaken at the site;
- a remediation options assessment; and
- requirements for remediation works.

1.4 Sources of Information

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

- Waterman Energy, Environment and Design Ltd. May 2012. 'Preliminary Generic Quantitative Environmental Risk Assessment'. Ref. EED10658 - 13.2.2_FA.
- Waterman Energy, Environment and Design Ltd. September 2012. 'Remediation Strategy at New Settlement Area, Upper Heyford'. Ref. EED10658-109_S_12.2.2_FA.
- Hydrock. January 2017. 'Desk Study and Ground Investigation at Heyford Park – Western Development, Phase 15'. Ref. HPW-HYD-P15-ZZ-RP-G-0001-P2-S2.
- Hydrock. February 2017. 'Desk Study and Ground Investigation Report at Heyford Park – Western Development, Phase 9, 10, 16 and 16A'. Ref. HPW-HYD-MS-ZZ-RP-G-0001-P1-S2.
- Pegasus Design. March 2017. 'Heyford Park – Phasing Plan'. Dwg no. D.0341_32 Rev K.

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 Dorchester Living and those parties designated by them for the purpose of providing information on the remediation and validation works to be undertaken during the 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), BS5930:1999 and BS10175:2011.

At the time of writing this report, the conclusions of the Ground Investigation Reports (HWP-HYD-MS-ZZ-RP-G-0001-P1-S2 and HWP-HYD-P15-GI-RP-0001-P2-S2) had not been agreed with the regulatory authorities. This Remediation Method Statement is subject to change depending upon the regulatory discussions.

2.0 CONCEPTUAL MODEL AND GROUND MODEL

2.1 Site Location and Current Land Use

The site (Phases 9, 10, 15, 16 and 16A) of a total of 34 ha is located at the Heyford Park – Western Development. Phases 9, 10, 16 and 16A are on the western edge of the development and Phase 15 is on the eastern edge of the development.

The site is the former Upper Heyford airbase.

A Site Location Plan (Drawing HWP-HYD-PX-ZZ-DR-GE-1000) and a site Phasing Plan are presented in Appendix A.

2.2 History

The site was undeveloped until the 1910s, when the Upper Heyford airbase was constructed. The RAF was present at the airbase until the 1950s, when the United States Air Force took over. The air base was closed in 1994.

2.3 Ground Model

The published geology for the site indicates the site is underlain by the Great Oolite Group, comprising limestone, interbedded with mudstone and clay.

Made Ground is anticipated across Phases 9 and 10 due to the previous development. Made Ground may also be present across Phases 15, 16 and 16A.

The Great Oolite Group is classified by the Environment Agency as a Principal Aquifer. It is likely the groundwater is present within the limestone beds, but not within the mudstone or clay beds.

The site is not within a groundwater Source Protection Zone (SPZ). However, there is one licensed groundwater abstraction within 1km of the site, 975m southeast of Phase 15 for general farming and domestic use.

There are several streams or brooks in the vicinity of the site. An unnamed stream runs adjacent to the eastern boundary of Phase 15. Gallos Brook runs between Phases 16 and 16A and is possibly culverted through Phase 9 from Phases 16 and 16A to Camp Road. An unnamed stream runs along the eastern boundary of Phase 16, but was not visible during the site walkover.

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

The site is in Flood Zone 1 with a low probability of flooding. No further consideration is given to flood risk in this report.

A historical refuse heap is noted on the historical mapping, 200m west of the site. In addition, historical quarry workings were noted adjacent to the southern boundary of Phase 16A. These are not visible at the present time and it is assumed they have been backfilled.

The site is within a Radon Affected Area where 1-3% of homes are above the Action Level. It is recommended to obtain a bespoke BGS Radon Report to determine the site-specific risk.

2.4 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 during the Hydrock investigations is presented in Table 2.1 and the individual strata are described in the sections below. For descriptions of the strata encountered at each Phase, please refer to Hydrock Reports HWP-HYD-MS-ZZ-RP-G-0001-P1-S2 and HPW-HYD-P15-GI-RP-G-0001-P2-S2.

Table 2.1: Strata Encountered

Stratum Description	Depth to Top (m bgl)	Depth to Base (m bgl)	Thickness (m)
Topsoil – Phases 9, 15, 16, 16A	0.00	0.15 – 0.40	0.15 – 0.40
Made Ground – Phases 9, 10, 15	0.00	0.05 – 1.60	0.05 – 1.60
Great Oolite Group – Phases 9, 10, 15, 16, 16A	0.05 – 1.60	>8.00 Base not proven	>7.95 Base not proven

2.4.1 Topsoil

For the purposes of this report, topsoil is defined as the upper layer of an *in situ* soil profile, usually darker in colour and more fertile than the layer below (subsoil), and which is a product of natural chemical, physical, biological and environmental processes, but does not imply compliance with BS 3882:2015.

Topsoil was encountered in Phases 9, 15, 16 and 16A to depths between 0.15m and 0.40m bgl. It comprised brown sandy gravelly clay or clayey gravelly sand, with gravel of limestone.

2.4.2 Made Ground

Made Ground was encountered across the majority of Phase 9, the whole of Phase 10 and in the north of Phase 15 to generally shallow depths of between 0.15m and 0.60m bgl. Deeper Made Ground was encountered in the northeast and southeast of Phase 9 and the central north and east of Phase 10. In general, there were three main types:

- surfacing, including asphalt and concrete (Phase 9);
- brown gravelly sand and clay with limestone, brick, concrete, tile and wood fragments; and
- clayey limestone gravel with occasional concrete, hardcore and other man-made constituents (metal rods and land drains) (Phase 9).

2.4.3 Great Oolite Group

The Great Oolite Group was encountered in every Phase, underlying either the Topsoil or the Made Ground. The maximum proven depth was 8.00m bgl. The upper weathered soils generally comprised brown sandy gravelly clay or light grey and brown clayey sandy gravel of limestone, with occasional cobbles of limestone. These soils grade into the more intact limestone strata from between 0.60m and 2.30m bgl.

2.5 Obstructions

In Phase 9, two trial pits encountered obstructions. At 1.30m bgl in TP08 a buried service was encountered at the base of the Made Ground. At 1.10m bgl in TP107 a possible concrete slab was present in the Made Ground.

2.6 Visual and Olfactory Evidence of Contamination

Visual and olfactory evidence of contamination, in addition to the more common man-made constituents described above, was noted in a number of trial pits and is summarised in Table 2.2.

Table 2.2: Visual and Olfactory Evidence of Contamination

Exploratory Hole	Depth (m bgl)	Description	Stratum
Phase 9			
TP101	0.00 – 0.20	Slight tar odour.	Made Ground
TP102	0.30 – 0.50	Black staining and tar odour.	Made Ground
TP104	0.03 – 0.20	Black staining and tar odour.	Made Ground
TP104	0.20 – 0.80	Some black staining and tar odour.	Great Oolite Group
Phase 10			
TP109	2.70 – 2.90	Slight hydrocarbon odour and sheen on groundwater.	Great Oolite Group
Phase 15			
TP138	0.60	Slight hydrocarbon odour and sheen.	Great Oolite Group

2.7 Groundwater

Groundwater was encountered at varying depths in the Hydrock investigation and at varying levels in the subsequent groundwater monitoring in the Great Oolite Group. Table 2.4 below summarises the groundwater strikes encountered and subsequent groundwater levels monitored in each Phase.

Table 2.4: Groundwater Strikes and Levels

Date Range	Hole Type	Depth Groundwater Encountered During Fieldwork (m bgl)	Depth to Groundwater During Monitoring (m bgl)
Phase 9			
23/11/16 – 19/12/16	Borehole	Not possible due to drilling technique.	2.49 – 7.37
Phase 10			
3/11/16	Trial pit	2.60	-
23/11/16 – 19/12/16	Borehole	Not possible due to drilling technique.	1.69 – 3.74
Phase 15			
9/11/16	Trial pit	1.10 – 1.80	-
9/11/16 – 19/12/16	Borehole	0.90 – 7.30	0.72 – 2.81
Phase 16			
23/11/16 – 19/12/16	Borehole	Not possible due to drilling technique.	1.02 – 2.58
Phase 16A			
7/11/16	Trial pit	1.80 – 3.00	-
23/11/16 – 19/12/16	Borehole	Not possible due to drilling technique.	Dry – 6.74

2.8 Ground Gas

Three monitoring visits have been undertaken by Hydrock (2016) across the site which indicate:

- methane concentrations of between <0.1% v/v and 1.7% v/v;
- carbon dioxide concentrations of between 0.6% v/v and 4.9% v/v;
- oxygen concentrations of between 10.1% v/v and 20.5% v/v; and
- gas flow measurements of <0.01 l/hr.

3.0 RISK ASSESSMENT REVIEW

3.1 Introduction

This section summarises the risk assessment findings as presented in Hydrock Reports HPW-HYD-MS-ZZ-RP-G-0001-P1-S2 and HPW-HYD-P15-GI-RP-G-0001-P2-S2, dated February and January 2017 and are subject to agreement with the Regulators.

3.2 Human Health Risks

3.2.1 Inorganic and Organic Determinands

Phase 9 and 10

The US_{95} concentration exceeded the relevant GACs for various PAH and VOCs in the Made Ground. In addition, petroleum hydrocarbon concentrations were above the GAC for two locations in Phase 9 (TP102 and TP104). These correlate to visual and olfactory evidence of contamination noted at these locations.

Mitigation measures for the widespread PAH and VOC contamination and for the petroleum hydrocarbon hotspots, and any other hotspots encountered, will be required.

Phases 15, 16, 16A and Natural Soils

The relevant GACs were not exceeded in samples of the natural soils in Phase 9 and 10, or in any soils in Phases 15, 16 and 16A.

3.2.2 Permanent Gas Risks

Radon

Based on current BRE Guidance (BR211, 1999) no radon protection is required for new buildings at this location. However, since it is in a Radon Affected Area with recorded radon levels in 1-3% of homes above the action level, it is recommended that consideration be given to incorporating basic protection measures.

A BGS Site-Specific Radon Report is recommended once the final layout has been determined.

Ground Gases (Carbon Dioxide and Methane)

Three monitoring visits have been undertaken. The Gas Screening Value (GSV) was <0.07 (the lower limit quoted by CIRIA 665) for all Phases. However, methane concentrations were recorded >1% v/v in Phase 10 on two occasions.

Based on the above, Phases 9, 15, 16 and 16A can be classified as Characteristic Situation 1 (for all development) and Green (for low-rise housing with a vented sub-floor void). Phase 10 can be classified as Characteristic Situation 2 (for all development) and Amber 1 (low-rise housing with a vented sub-floor void).

Phase 10 development will require ground gas mitigation measures.

Additional ground gas monitoring has been recommended to ensure the frequency is compliant with best practice guidance.

Volatile Organic Compounds

Concentrations of petroleum hydrocarbons which may present a vapour risk have been found in excess of the GACs for the indoor air pathway at TP102 and TP104 in Phase 9 and it is possible further hotspots will be encountered. It is proposed to excavate and remediate these soils, which will remove the vapour risk.

If the remediation of these soils is not undertaken a vapour barrier will be required for dwellings in the area surrounding the known hotspots, and any other hotspots encountered.

3.2.3 Risk to Controlled Waters

The risks to Controlled Waters from Phases 9, 10, 16 and 16A are detailed in Hydrock Report HPW-HYD-MS-ZZ-RP-G-0001-P1-S2. No further consideration of risks to Controlled Waters from Phase 15 was required.

A summary of controlled waters risk assessment for Phases 9, 10, 16 and 16A is as follows:

- Elevated concentrations of metals and PAH (above the EQS) and petroleum hydrocarbons (above the DWS) have been recorded in groundwater in the Hydrock investigation.
- The Environment Agency is aware of the poor groundwater quality due to the presence of petroleum hydrocarbons below the air base to the north of the site.
- The closest groundwater abstraction is >1km from Phases 9, 10, 16 and 16A. The River Cherwell is 750m to the West.
- In addition, concentrations of petroleum hydrocarbons were not recorded in Phases 16 and 16A, which form the southeastern boundary of the airbase site and the closest land parcel to the above groundwater abstractions and the River Cherwell.
- Any identified sources of contamination, including tanks and impacted soils from their associated excavation, will be removed during remediation works. Free phase groundwater contamination will also be removed. These works will remove the source of petroleum hydrocarbons, and are in line with the current remediation methodology designed by Waterman.
- Gallos Brook surface waters were sampled and there were no elevated PAH or metals, except for copper. This is considered to be naturally sourced. The EQS for copper is also based on the bioavailability, which has not been calculated and hence the assessment is conservative as it assumed 100% bioavailability. Therefore, the exceedances are not considered to represent a significant risk to surface waters.

3.3 Plant Life

There were no substances that were elevated above the GAC and no further consideration is required.

3.4 Water Pipelines

Phases 9, 10 and 15 are brownfield and organic contamination (PAH and petroleum hydrocarbons) have been identified in exceedance of the threshold values in Phases 9 and 10. However, it is understood that due to Thames Water requirements all water pipes are to be barrier pipes in the development area. This should be confirmed with Thames Water prior to the installation of water pipelines.

3.5 Summary

The source-pathway-receptor linkages given in Table 3.1 are those which, following the risk evaluation process, require mitigation.

Table 3.1: Final Conceptual Model and Residual Risks Following Risk Evaluation

Contaminant Linkage			Comments	
Sources	**Pathways**	**Receptors**	**General**	**Mitigation**
Petroleum hydrocarbons in the Made Ground in Phase 9.	Ingestion, inhalation or direct contact.	Human health.	Significant exceedance of the GACs.	Mitigation required.
PAH and VOCs in the Made Ground in Phases 9 and 10.	Ingestion, inhalation or direct contact.	Human health.	Significant exceedances of the GACs.	Mitigation required.
Elevated concentrations of PHC (above the DWS) in Phases 9 and 10.	Direct.	Drinking water abstraction.	Abstraction is >1km from Phases 9 and 10.	Sources of PHC will be removed and no further mitigation required (subject to regulatory confirmation).
Elevated concentrations of PAH and metals (above the EQS) in the groundwater in Phases 9, 10, 16 and 16A. Elevated copper in Gallos Brook.	Base flow into surface water.	Gallos Brook.	Gallos Brook indicates elevated copper, but based on bioavailability is a conservative assessment.	No further consideration required (subject to regulatory confirmation).
Elevated concentrations of ground gas (methane) in Phase 10.	Migration through soils or groundwater to indoor air.	End users of new buildings (asphyxiation). New buildings (damage by explosion).	Permeable soils present on site.	Characteristic Situation 2 (all development) and Amber 1 (low-rise housing with a vented sub-floor void).
Brownfield site and elevated concentrations of PAH, VOC and PHC in Made Ground.	Migration through potable water pipelines.	Potable water. Human health.	PAH, VOCs and PHC present in Made Ground in Phase 9 and 10.	Thames Water require barrier pipework.

4.0 REMEDIAL STRATEGY

Remediation will be undertaken such that the site is suitable for its proposed new uses, including:

- residential development with gardens;
- Public Open Space (POS) residential; or
- school (residential without gardens).

The required standard of remediation will be achieved through a variety of techniques as outlined in the following sections.

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

- ***Detailed Remediation Method Statement (DRMS)*** – This sets out the requirements for gathering data to demonstrate the effectiveness of the remediation in terms of meeting the remediation objectives. These are detailed in the following sections of this report.
- ***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.

4.1 Summary of Remediation Proposals

Based upon the findings of the ground investigations and risk assessments (Hydrock Report HPW-HYD-MS-ZZ-RP-G-0001-P1-S2 and HPW-HYD-P15-GI-RP-G-0001-P2-S2) and the Remediation Options Appraisal (presented in Appendix G), 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.

Geotechnical Design is not considered here and the Contractor shall ensure all works are undertaken to an appropriate Earthworks Method Statement and Specification.

The following remedial activities may not apply to every Phase of the site (Phases 9, 10, 15, 16 and 16A). The detailed tasks in Section 5 will identify which Phases require remediation.

Demolition Phase

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

- if not already completed, an asbestos survey of the former buildings and structures prior to demolition;
- removal of asbestos by specialist contractors from buildings in accordance with the asbestos survey and relevant legislation; and
- controlled decommissioning, decontamination and demolition of site buildings and ancillary structures including tanks, existing drainage system and associated pipework (above ground).

Enablement Phase

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

- removal of the floor slabs and excavation of all underground/subsurface obstructions;
- break out of all hardstanding and stockpiling;
- processing, screening and reuse of arisings;
- removal of tanks, existing drainage system and associated pipework (below ground);
- delineation and excavation of hotspots and validation of soils below and around all tanks, pipes and drains and hotspots;
- *ex situ* remediation or disposal of petroleum hydrocarbon contaminated soils;
- removal of any free phase hydrocarbons;
- reuse and placement of soils which pass the reuse target values (RTVs);
- off-site disposal of waste material; and
- validation during enablement works.

It is anticipated the Enablement Phase of work will be undertaken by a single Contractor, referred to as the Enablement Contractor.

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 Thames Water);
- installation of gas protection measures;
- installation of basic radon protection measures, as determined by a Site-Specific Radon Report;
- over-excavation of service trenches and backfilling with ‘clean’ soil;
- installation of the engineered cover system; and

- validation of the gas protection measures and engineered cover system.

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 F to assist. However, it should be noted that the guidance provided in Appendix F 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 F for additional information and general requirements.

All works need to be undertaken in accordance with the 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 Hydrock Consultants, to undertake the necessary verification.

4.2 Project Setup and Management

Prior to commencement of site activities, detailed planning of the project shall be undertaken including liaison with relevant stakeholders. This report, along with copies of previous environmental reports regarding the Site, should be submitted to the Local Authority and the NHBC for comment.

4.2.1 Project Team

The project is to be operated under the Construction, Design and Management (CDM) Regulations, (2015). Under the CDM regulations, Dorchester Living 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).

4.2.2 Appointment of Appropriate Contractors

The Demolition, Enablement and Groundworks Contractors will need to have suitable experience working in a similar setting, with similar ground conditions and with the Contaminants of Concern present at the site.

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.

5.0 REMEDIAL STRATEGY IMPLEMENTATION – DEMOLITION PHASE

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

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, BS6187:2011 "Code of Practice for Full and Partial Demolition").

It is assumed the Demolition Contractor is operating as a sub-Contractor to the Enablement Works Contractor who will be the Principal Contractor. If undertaken as a separate operation, the Demolition Contractor will be the Principal Contractor. Where "the Contractor" is used with regards to demolition in this document, it means the Principal Contractor as indicated above.

Unless otherwise agreed with the Client or the Employer's Agent, the Demolition Contractor is deemed to have included in the contract sum for all requirements set out in this document.

Demolition will be undertaken to slab level by the Demolition Contractor and the Enablement Works Contractor will undertake the removal of all below ground obstructions.

In addition to the requirements of the Client, the Contactor's attention is drawn to the General Requirements set out in Appendix F, 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.

5.1 Task D1: Pre-start and Site Clearance (All Phases)

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.

For Statutory service records please refer to the works information. These records are offered for information only. 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 (tips) 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.

5.2 Task D2: Asbestos Survey and Removal (Phases 9 and 10)

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 should be undertaken, compliant with the requirements of HSG 264. Once complete, the Contractor must review this document and determine it is appropriate for use.

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.

5.3 Task D3: Demolition of Existing Buildings and Structures (Phases 9 and 10)

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).

Noting requirements with regards to services, all buildings and above ground structures (unless identified on the contract drawings provided by the Client) shall be demolished by the Contractor.

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 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.

The Contractor is responsible for all 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.

5.4 Task D4: Removal of Existing Above Ground Tanks (Phases 9 and 10)

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 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.

Hydrock are to be provided with copies of all test copies and certificates of all test results and disposal receipts at the time of publication.

It should be noted that there are three mainly above ground storage tanks (each approximately 33m^2) located in Phase 10.

5.5 Task D5: Processing and Reuse of Arisings

Where appropriate, soil, brick, concrete etc. arising from the demolition works (including below ground structures) should be screened, crushed and processed at an agreed location for free issue to the Client for use in the permanent works.

The Enablement Contractor will sort, screen, crush, process and test all arisings to comply fully with the requirements for a Class 1 or 6F2 material as specified in the latest version of the SHW, Series 600 Earthworks.

With regards to demolition materials, the SHW notes a number of different classes of fill which are suitable for reuse as part of the enablement works, including, but not limited to:

- Class 1 A - Well graded granular fill;
- Class 1 B - Uniformly graded granular fill;
- Class 6F2 - Selected granular fill (coarse grading).

Other materials which may result from the Contractors works include:

- Class 2 A – Wet cohesive fill;
- Class 2 B – Dry cohesive fill; and
- Class 2 C – Stoney cohesive fill.

Stockpile locations are to be agreed with the Client prior to commencement of the works.

The Contractor will segregate materials from the demolition works having due regard for their subsequent reuse and the above classifications.

In accordance with the SHW, the Contractor will 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 unsuitable materials will be removed from site.

All materials will be inspected, sorted and tested to ensure they are geotechnically and chemically suitable for use on site in accordance with the RMS. For all excavated or processed material including crushed concrete and soil, the Contractor shall include for all necessary testing to demonstrate that grading conforms with the SHW and relevant requirements and material properties described in Table 6/1 or in the case of Type 1 unbound mixtures in accordance with relevant SHW clauses 801 & 805 and that unacceptable levels of foreign matter are not present.

The Contractor will supply all test results and test certificates as soon as they are issued. All test results should be issued within seven days of the sample being taken. If results are not available within seven days of sampling, the Contractor will inform the Consultant of the delay, the reason for the delay and the associated scope of testing.

The presence of any asbestos in materials proposed to be crushed and reused as aggregate material 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 NHBC or the Consultant is not permitted to be left on site and must be disposed of to a suitably licensed waste facility at the Contractors cost.

The crushed aggregate materials and excavated soils (unless proven unsuitable for use) shall be stockpiled at a safe batter on the site (at a location to be agreed) as free issue to the Client.

All crushed materials and soils are to be kept in quarantine and be clearly kept in identifiable storage areas until acceptable test results have been approved by the Consultant prior to the material being used for the infilling of voids and in general earthworks. The Contractor shall seek approval from the Client and the Consultant for all stockpiling areas for materials arising from the demolition works prior to the commencement of the works.

All suitable materials produced from the works can be used where appropriate within the enablement works and the Contractor is to backfill all excavations with site won crushed concrete as a Class 1 well graded granular material, which can be sourced from the processed crushed concrete compliant with the 6F2 Capping requirements.

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

5.6 Validation

The Contactor's attention is drawn to Section 6.8 (which also applies to demolition) with regards to validation.

6.0 REMEDIAL STRATEGY IMPLEMENTATION – ENABLEMENT PHASE

The Enablement Contractor will undertake the following works.

6.1 Task E1: Break out of Hardstanding and Below Ground Structures (All Phases where applicable)

The Enablement Contractor will demolish, break up and remove all below ground structures. These include, but are not limited to slabs, slurry pits, drains, hardstanding, foundations, relic structures, service ducts, underground storage tanks, basements etc.

All hardstanding and below ground structures shall be broken up, segregated and stockpiled within the approved working area of the site. Material will be stockpiled at locations to be agreed with the Client and after submission of the detailed Method Statements.

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 Contractor should inform the Consultant after each area is exposed so that they may attend and witness the excavation. The Contractor will survey to Ordnance Survey Grid (using Total Station survey equipment) the sides and base of all excavations so as to be able to provide composite base of excavation drawings for reference during the works, and as built records.

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.

All unsuitable materials will be removed from site to a suitably licensed facility.

All voids/excavations will be surveyed (to OS Grid, including level) prior to being backfilled with suitable fill in accordance with the Client's requirements.

The Contractor will give notice to the 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 will provide adequate protection against collapse of the excavations and suitable groundwater control measures shall be put in place until the voids are backfilled.

The Contractor is responsible for all temporary works.

6.2 Task E2: Removal of Tanks, Existing Drainage System and Associated Pipework (Phases 9 and 10)

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 contents of any 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. prior to demolition.

All uncharted tanks are to be reported immediately to the 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 facility.

Removal activities should take care to prevent the spills and leaks of oils, chemicals etc. that are stored in current buildings.

A watching brief should be kept during the works by an independent environmental Consultant and if impacted material is present during excavation, these materials should be stockpiled separately for testing prior to reuse if suitable.

The excavation of any buried tanks (if encountered) is to be witnessed by the Consultant (Hydrock).

6.3 Task E3: Examination of Hotspots and Soils Below and Around All Tanks, Pipes and Drains (Phases 9 and 10)

6.3.1 Examination and Removal

Hotspot removal will be undertaken by excavation of soils from known hotspots (TP102 and TP104) and any additional areas of contamination encountered during demolition and remediation.

The Contractor will need to have an experienced Geo-environmental Engineer present during hotspot excavation to inspect for suspect material and oversee effective segregation, stockpiling and validation of soils. In addition, Hydrock will undertake a watching brief.

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

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

It should be noted that there are three mainly above ground storage tanks in Phase 10 (each of approximately 33m^2). Following the removal of these tanks, the soils in these areas will require examination and removal if visual or olfactory evidence is noted.

Any Hydrock drawings indicating the extent of contamination are schematic. The Contractor is to satisfy itself with regards to volumes of soil to be excavated, remediated or disposed of and replaced.

6.3.2 Validation

Validation of the removal of the hotspots and soils below and around tanks, pipes and drain where petroleum hydrocarbons were noted is proposed by the chemical analysis of samples recovered from the sides and base of hotspot excavations. For large excavations, a 10m validation grid (base and sides) is proposed.

Validation is to be undertaken on behalf of the Contractor by an experienced Geo-environmental Engineer in accordance to the RTVs as detailed in the relevant table in Appendix B.1.1 with regards to petroleum hydrocarbons. These RTVs are for the protection of human health and groundwater.

Once the excavation has been validated, the excavations are to be backfilled in accordance with Section 6.7, the Specification for Highways Works, or as required by the Infrastructure Engineer.

Materials excavated from the hotspots can be reused on site in accordance with the Materials Management Plan once they have been treated, tested and assessed to confirm that they comply with the RTVs (or in the case of stabilised soils are in accordance with the agreement with the Environment Agency).

6.4 Task E4: *Ex situ* Remediation of Petroleum Hydrocarbon Contaminated Soils (Where Applicable)

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.

6.4.1 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 the relevant Tables in Appendix B.1.1 and B1.2, 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 (see Section 6.10 and 7.5.4).

6.4.2 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 residential gardens areas; 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.

6.5 Task E5: Removal of Free Phase Hydrocarbons (Where Applicable)

It is the responsibility of the Enablement Contractor to manage all water on site (surface water, leachate and groundwater). Any water removed (from excavations or surface water) will need to be managed appropriately and if necessary disposed off-site to an appropriate waste disposal facility or treated to an appropriate standard/permit prior to disposal under licence to sewer or watercourse.

The Contractor will submit a plan for the appropriate management of water at the site during the Enablement Works and obtain any appropriate licences from the Water Authority, the Environment Agency and the South Cambridgeshire District Council and ensure any water from the site is suitable to discharge.

Although no grossly impacted groundwater was encountered during the investigation works, it is possible it is present in the vicinity of tanks and remedial design requires that any free product encountered will require removal to a sheen.

Free product encountered on the groundwater (i.e. LNAPL) will be removed using skimming pumps or use of adsorbent pads to secure above ground containers, prior to removal from site to a licensed facility. The free phase hydrocarbons would be collected in above ground storage tanks and if required separated from water prior to disposal.

6.6 Task E6: Excavate to the Required Formation Level (All Phases)

Soils are to be excavated to the required formation level, as follows:

- Beneath proposed building footprints, excavate as per the structural design (by others) and the working platform design (by others).
- Beneath areas of proposed hardstanding (roads, car park areas etc.), excavate as required by the road design to the formation level of the pavement.
- In proposed garden and landscape areas where a cover system is required (Phases 9 and 10), the site is to be left 600mm below final ground level to allow the full cover system to be placed.

The required formation level will be confirmed by the Client prior to commencement.

All excavated soils and the formation level shall be inspected for suspect material and, if encountered, any visible Asbestos Containing Materials (ACM) will be handpicked and disposed of by a suitably qualified contractor. These works are to be undertaken under a Hydrock watching brief in accordance with the appropriate legislation.

6.7 Task E7: Reuse Soils Which Pass the Reuse RTVs and Placement of Soils (All Phases)

Following excavation and remediation of soils as necessary, suitable soils are to be placed to a level 600mm below final ground level in areas requiring a cover system (Phases 9 and 10), or 150mm below final ground level in all other areas.

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).

The Contractor is responsible to providing an MMP signed off by a Qualified Person to Hydrock for comment.

If reuse of soils in accordance with a MMP is proposed, segregation and stockpiling of soils will be based on the following suitability criteria:

- Soils potentially suitable for reuse on site as part of the cover system without treatment (e.g. Topsoil, Subsoil, crushed hard-core material, single size stone), which comply with the requirements of Appendix B.1.2.
- Soils potentially suitable for reuse on site below the cover system (i.e. soils which fail the RTVs, but are geotechnically suitable for use).
- Soils unsuitable for use (e.g. untreated petroleum hydrocarbon hotspots or soils containing gross ACM). These will be disposed of off-site.
- Type 6A material should be used to backfill excavations (i.e. from below ground obstructions, tank and hotspots) in the saturated zone.

Soils that are to be reused on site will be recorded in a MMP/site waste management plan and accompanied with supporting excavation and placement logs.

The reuse of soils on site and materials management is discussed further in Section 9.0.

6.8 Task E8: Off-Site Disposal of Waste Material (Where Applicable)

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 at the Contractors cost. If in the opinion of the Consultant the material is not suitable for use, the Contractor is to remove and dispose of it in accordance with the RMS.

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.

All testing to allow disposal of waste is to be undertaken by the Contractor at the Contractors cost.

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

A Site Waste Management Plan may be required and it is the responsibility of the Enablement Contractor to ensure one is in place if required.

6.9 Validation Criteria during Enablement Works (All Phases)

The following sections detail validation criteria to be used during the enablement works.

6.9.1 Testing

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'.

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 Consultant for the test to be completed at the proposed laboratory, before the test is undertaken.

The results of all testing undertaken (and a copy of the test certificates), shall be submitted to the 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 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 Consultant shall be given sufficient time to review the content of the testing and the associated test results.

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 Consultant.

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 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 is to be provided to the Consultant by 10:00am every Monday morning throughout the Contract.

6.9.2 Hotspots

Validation of hotspots by the chemical analysis of the sides and base of excavations is required. If the excavation is greater than 100m^2, a 10m validation grid (on all sides and base) is required.

With regards to treated soils, samples should be taken and tested at a rate of one test per 250m^3.

Validation sampling is to be undertaken by an experienced geo-environmental engineer on behalf of the Contractor and samples are to be tested in accordance to the Remedial Target Values (RTVs) as detailed in Appendix B.1.1 for petroleum hydrocarbons and Appendix B.1.2 if other CoC hotspots are identified.

These RTVs are based on information to date and due to the volumes anticipated from the site work it is expected that material will be removed and disposed of off-site, instead of treating and reused on site. If a substantially larger volume of material is removed from hotspots and below/around tanks, it may be more cost effective to treat soils and reuse on site. If this is the case, Site Specific Remedial Values (SSRV) for petroleum hydrocarbons can be produced to increase the volume of treated material reused on site.

If SSRV are to be used, these supersede the RTVs in Appendix B.1.1.

It should be noted that if other CoC hotspots are identified, only the relevant CoC requires testing during validation.

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.

6.9.3 Asbestos

There is the potential for asbestos to be encountered during all phases of development and it is important that the control measures in place are sufficiently robust to prevent release of airborne asbestos fibres into the surrounding environment.

Asbestos has not been detected in the Made Ground during the investigation. However, the Contractor should assume asbestos may be found in the soils and shall have in place at the start of the contract work procedures designed to ensure the Contractor is working in full compliance of all Health and Safety requirements (including, but not exclusively CAR 2012).

If during the Enablement Works, asbestos in soils is proven to be present by laboratory testing, it will be quantified and the data incorporated into the updated remediation plan.

If Asbestos Containing Materials (ACM) are encountered during the Enablement Works, this will need to be removed (using appropriately trained staff, appropriate methodologies and Health and Safety provision).

If asbestos is found to be present in the soil following removal of the ACM, a cover system will be required for that area of the site, unless the soils containing asbestos are removed from site, or excavated and placed elsewhere below a cover system in accordance with an approved MMP.

The type and thickness of the cover system will be dependent upon the type and concentrations of asbestos present and will need to be presented by the Contractor as part of the Validation Report. If required, the updated remediation plan and the proposed cover system with regards to asbestos shall be agreed with the Consultant and then the LPA.

6.9.4 General Reuse

Following removal of any hotspots and confirmation that the soils are free of ACM the following applies.

For granular soils proposed for general reuse as sub-base etc., Hydrock proposes the soils be tested at a rate of 1 test per 500m^3 and compared to the following guidelines:

- no visual contamination (oil staining etc.) as confirmed by Hydrock Consultants watching brief;
- limited deleterious material (organics, wood, metal etc.), in accordance with the Specification for Highway Works;
- no visible asbestos containing material (ACM) as confirmed by Hydrock Consultants watching brief; and
- asbestos <0.01 w/w%, as confirmed by laboratory testing.

For excavated soils proposed for reuse as part of the cover system or as subsoil/topsoil without a cover system Hydrock proposes the soils be tested at a minimum rate of 1 test per 250m^3 (or as agreed with the LPA and the NHBC) and compared to the following guidelines:

- no visual contamination (oil staining etc.) as confirmed by Hydrock Consultants watching brief;
- limited deleterious material (organics, wood, metal etc.);
- no visible asbestos containing material (ACM) as confirmed by Hydrock Consultants watching brief; and
- less than the RTVs as detailed in Appendix B.1.2.

Soils to be placed below a cover system in accordance with an approved MMP do not require supplementary testing during placement.

6.10 Task E12: Enablement Contractor's Verification Reports (All Phases)

The Contractor will provide the following validation reports:

- Materials Management Validation Report;
- Remediation Validation Report.

All reports provided by the Enablement Contractor shall be available in Adobe pdf format which has been digitally bookmarked at each section heading. Four hard copies shall be provided and all chemical data is also required in Excel format.

6.10.1 Materials Management Validation Report

The Materials Management Validation Report is to document the validation of the approved Materials Management Plan and will include the validation of imported soils, site won soils

and placed soils. A separate MMP will be required for the import of subsoil and topsoil for the cover system.

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

- Details of the import mechanisms for each material source.
- Detailing the testing (chemical and geotechnical) of imported materials to prove each source is suitable for use;
- Detailing the testing (chemical and geotechnical) of site won materials to prove each source is suitable for use;
- Records of material movement, including:
    1. stockpile inspection records;
    2. stockpile reuse appraisal record;
    3. volumes, origin and placement location of soils referenced to field results and inspections;
    4. details and quantities of excavated, screened, treated, imported and reused soils; and
- Records of earthworks excavations including as built drawings, photographs, quantities of materials and records of progress.

6.10.2 Remediation Validation Report

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

The 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.

This Validation Report shall incorporate a summary of and commentary on:

- Site stripping and clearance activities.
- Asbestos clearance activities (if required) and an asbestos/hazardous materials close out report.
- An outline of the remedial action taken to remove asbestos/hazardous materials.
- Results of asbestos air monitoring activities within the site and at the boundaries and other environmental monitoring (noise/dust).
- Details of retained services and obstructions encountered but not removed.
- Records of excavations, including:
    - Ordnance Datum survey of extents and depth;

- Ordnance Datum survey of extents and depth of any residual features;
- record of decisions for over-excavation;
- photographic record of each excavation; and
- records of inspection and final extents of validation.

- Records of laboratory analytical and *in situ* field test results, including:
  - laboratory results and location plan for each analytical test;
  - field test kit results and particulars of monitoring (e.g. date, location, personnel);
  - laboratory measurements of accuracy and precision;
  - calibration data for field measurement equipment in accord with manufacturers guidance; and
  - Chain of Custody forms.
- Waste classification and management documentation, including:
  - copies of all consignment notes, in particular those relating to the hazardous waste regulations;
  - details of waste facilities where materials were disposed of;
- Stockpile plan of all stockpiles generated by the works and remaining on site.
- Copies of geotechnical testing and chemical testing of the stockpiles.
- Final as-built survey of the as excavated voids.
- Final as-built survey of the site (in AutoCAD format).
- Confirmation that site levels are as required 150mm below final ground level (where no cover system required) or 600mm below final ground level (where a cover system is required).

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.

7.0 REMEDIAL STRATEGY IMPLEMENTATION – CONSTRUCTION PHASE

The following will be undertaken during the Construction Phase of Works by the Ground Works Contractor.

7.1 Task C1: Installation of Barrier Pipe (All Phases)

It is understood that Thames Water require the installation of barrier pipe across the site. The Ground Works Contractor is to install Protectaline (or similar) pipework for potable water supply. This is to be validated by the Ground Works Contractor by the provision of delivery tickets showing Protectaline (or similar) has been delivered to site and by photographic proof provided by the Contractor to the Client and the Contractor that Protectaline pipework or similar has been installed.

7.2 Task C2: Installation of Gas Protection Measures (All Phases, Where Applicable)

Ground gas protection measures are required in Phase 10 in line with Characteristic Situation 2 (all development) and Amber 1 (low-rise housing with a vented sub-floor void). These are detailed in CIRA 665.

In addition, based on current BRE Guidance (BR211, 1999) no radon protection is required for new buildings at this location. However, since it is in a Radon Affected Area with recorded radon levels in 1-3% of homes above the action level, it is recommended that consideration be given to incorporating basic protection measures. A Site-Specific Radon Report should be commissioned to determine the requirement for protection measures.

If basic radon protection measures are to be installed in the proposed residential buildings in Phase 10, it is recommended a DPM of higher density is used in line with the requirements for protection against methane.

If the remediation of hydrocarbons is not undertaken fully, a foil backed membrane for VOCs may be required. If required, the plots requiring the membrane and the membrane specification will be detailed during the Enablement remediation works.

7.3 Task C3: Excavation of Foundations and Drainage System (All Phases)

It is possible to reuse materials excavated from foundations and drainage systems.

In Phases 9 and 10, if natural soils are segregated from the Made Ground and pass the RTVs with regards to reuse, they can be used in the upper 600mm of the soil profile (i.e. in the cover system).

Made Ground soils or natural soils mixed with Made Ground can be reused below the cover system.

Any soils proposed for reuse will need to be tested by Hydrock in accordance with Section 7.5.

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.

7.4 Task C4: Over-Excavation of Service Trenches and Backfilling with 'Clean' Soil (Phases 9 and 10)

For areas where a cover system is proposed, if excavation of services is required below the cover system (in effect below the enablement works level); to protect future maintenance workers, these service trenches are to be over excavated by the Ground Works Contractor, 300mm either side and 300mm below the edge of the service being installed. The excavation is to be backfilled with soils as per Section 6.7 and which are proven as suitable for use by comparison to the reuse RTVs.

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

The excavated soils from over excavation of services and the excavation of foundations are to be disposed of off-site by the Ground Works Contractor in accordance with Section 9.

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

7.5 Task C5: Installation of the Engineered Cover System (Phases 9 and 10)

Phases 9 and 10 require an engineered cover system in all garden and landscaped areas.

Garden areas are defined as areas of soft landscaping to the front, side and rear of properties, including areas beneath paving slabs, patio areas and sheds.

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

- Beneath building footprints, excavate to allow a void below a suspended ground floor slab as per the structural design (by others). The floor slab and gas membrane, where required, 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 as per road design and capping requirements. 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 Section 7.4.
- Beneath landscaped and 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):

1. a 200mm layer of 6F2 (with whole bricks removed)/Type 1 to act as a physical break layer and a construction platform;
2. a geotextile marker layer; and
3. 400mm of Subsoil and Topsoil (minimum 150mm Topsoil).

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

The cover system will be installed by the Ground Works Contractor and verified by Hydrock Consultants.

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

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 200mm of crushed stone and verify the thickness (Hydrock are to be called to validate – minimum 48 hours' notice).
7. Install the geotextile layer.
8. Place the 400mm (minimum) of Subsoil and Topsoil, (of which a minimum 150 mm is to be Topsoil) and verify the thickness (Hydrock are to be called to validate – minimum 48 hours' notice).

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):

- the stockpiling of soils on a geotextile separator layer;
- 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.

7.5.1 Sourcing of Material for the Engineered Cover System

Site won materials may used in the cover system and imported materials will be required as part of the cover system. Any imported soils should be from a source not expected to be contaminated.

All soils used in the cover system should meet both physical and chemical criteria as detailed in Sections 7.5.3 and 7.5.4. If any of these thresholds 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 Hydrock Consultants 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 to site (regardless of the source), chemical testing of the imported soils will be required to confirm the soils imported are the same as those sampled at the donor site.

See Section 7.5.3 for quantities of testing and testing schedules.

7.5.2 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 on behalf of the Consultant 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.

For granular soils (Type 1/6F2 etc.), which are to be used as part of the cover system, Hydrock propose the following guidelines:

- no visual contamination (oil staining, asphalt, etc.) as confirmed by Hydrock Consultants watching brief;
- limited deleterious material (organics, wood, metal etc.); and
- no visible asbestos containing material (ACM) as confirmed by Hydrock Consultants watching brief.

7.5.3 Chemical Requirements of Cover System Soils

For imported soils, chemical testing will be required once the material arrives at site. It is also recommended that testing is undertaken at the source to determine if the materials are likely to be suitable prior to import.

For material from a natural source (including site won), testing should be undertaken at a rate of one test per 250m^3, with a minimum of four chemical suites to be undertaken on any individual source material or import round.

If the source of the material is not natural, chemical testing should be undertaken at a rate of one test per 100m^3, with a minimum of four chemical suites to be undertaken on any individual source material or import round.

Depending on the source or variability of imported material, the Consultant may, at their discretion, request additional testing 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.

Testing should be carried out on all materials for use in the cover system (topsoil, subsoil and the hard to dig layer (6F2/Type 1)) for the following general suite of contaminants and the results and compared to Appendix B.1.2:

- As, B (water soluble), Be, Cd, Cr (total), Cr(VI), Cu, Hg, Ni, Pb, S (elemental), Se, V, Zn, cyanide (total), sulfide, pH, asbestos fibres, speciated polycyclic aromatic hydrocarbons (PAH, by GC-FID), total phenols and fraction of organic carbon;
- total TPH (speciated TPH (TPHCWG) if >100mg/kg); and
- asbestos screen (asbestos quantification if detected).

7.5.4 Stockpiling of Materials for the Cover System

On importation of Topsoil and other materials, the materials should be stockpiled at a suitable location on site. Copies of the carrier's consignment notes should be retained and a copy forwarded to Hydrock and be available on request.

Topsoil and Subsoil should be stockpiled separately and away from areas designated for storing other materials or potential sources of contamination. Soils should be stockpiled on geotextile separator layers to prevent cross contamination.

Separate stockpiles should also be created for each different source. Topsoil stockpiles to be kept below 2m in height at all times and traffic on the stockpile to be minimised.

All stockpiles should be identified with clear signs and 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. Plot number and front or rear garden).

Each entry shall be signed and dated by the Site Manager or their Assistant. A template form is provided in Appendix C. Other templates or documentation may be used. These sheets should be available for inspection by the Client, the Consultant, NHBC Inspectors, Local Authority staff and others involved with this development. A copy should also be given to the Consultant when verification visits are made.

8.0 SUPERVISION, VERIFICATION AND REPORTING

Necessary changes to the agreed Implementation Plan, arising during the course of the works, are to be agreed in writing with the Local Authority, Environment Agency and NHBC prior to being undertaken on site.

It is advised (although not required by the regulators) that details of the environmental works undertaken, the rationale and design for the implementation of this strategy and verification details of the works undertaken are appended to the deeds for the property to ensure the site is sold with full knowledge of the works undertaken and the ground conditions present.

8.1 Site Supervision

All remediation works are to be undertaken with a site watching brief by Hydrock Consultants (The Consultant).

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

8.2 Collection of Samples

All samples are to be taken in accordance with relevant guidance (e.g. BS 10175:2013).

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.

8.3 Verification – Demolition and Enablement Phase

Upon the provision of a Verification Report from the Enablement Contractor (see Section 6.10), to demonstrate that all of the remediation works and placement of fill have been undertaken in accordance with the Remediation Method Statement, Hydrock Consultants will provide a Verification Report.

The report will be prepared by Hydrock Consultants and 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 shall be based upon CLR 11, output 5 and specifically 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.

8.4 Verification - Construction Phase

8.4.1 Protectaline Pipework

Where Protectaline pipework (or similar) is required to be installed, this is to be verified by delivery tickets showing suitable pipework has been delivered to site.

The Contractor will provide validation information (as per Section 7.1) and Hydrock will collate into the Verification Report.

8.4.2 Over-Excavation of Services

Where protection of services is required (i.e. Phase 9 and 10, areas which need a cover system) and where placed below the cover system, the service trenches need to be over excavated (300mm either side and 300mm below) and backfilled with clean material. The Contractor will provide information on the works carried out (as per Section 7.4) and Hydrock will collate into the Verification Report.

8.4.3 Ground Gas Verification

Ground gas mitigation measures shall be installed in accordance with CIRIA 665 and NHBC (Boyle and Witherington 2007). Validation of ground gas membranes will be undertaken in accordance with CIRIA 735 (Amber 1 conditions) as summarised in Table 8.1.

Table 8.1: Gas Mitigation Validation Measures

Slab type	Installer experience	Levels of verification and integrity testing
All slabs with min 150 mm ventilated sub floor void.	General builder/ground worker without a NVQ Level 2 in gas protection installation.	Hydrock to conduct a thorough verification (visual) inspection of all plots after placement of the membrane has been undertaken by the Ground Works Contractor and before installation of the screed. Any defects to be corrected and Hydrock to re-inspect. Consideration to be given to the need for integrity testing if concerns identified by visual inspections.
	Qualified and experienced installer (minimum one operative to hold a NVQ Level 2 in gas protection installation).	Hydrock to conduct a thorough verification (visual) inspection of the first plot (and two other random plots) after placement of the membrane has been undertaken by

		the Ground Works Contractor and before installation of the screed. The Ground Works Contractor is to supply sign off sheets (verification evidence) including photographs for all other plots. Consideration to be given to the need for integrity testing if concerns identified by visual inspections.

8.4.4 Cover System

Hydrock Consultants will verify the placement of the cover system. Once the cover system has been installed, verification pits shall be excavated through the topsoil and subsoil, a small hole cut through the geotextile and into the hard to dig layer. The thickness of the hard to dig layer, subsoil and topsoil will be measured and recorded. These pits should be excavated in the rear gardens at a rate of one pit per garden (with additional pits in areas where split level gardens are present).

In addition, and as directed by Hydrock Consultants, pits may be completed in the landscaped areas to the front of the properties as well as the rear gardens. 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, the NHBC and the Local Authority.

Letter reports for the verification of the cover system in garden and landscaped areas will be submitted to the NHBC to enable Land Quality Conditions to be lifted as plots are completed, and will be issued to the Local Authority at the same time.

The cover system verification letter 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 materials for use in the cover system 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 chemical test results pass when compared to the RTVs in Appendix B.1.2.

9.0 REUSE OF SOILS ON SITE AND MATERIAL MANAGEMENT

9.1 Waste Management Background

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) (CoP), 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 CoP in deciding whether to regulate materials as waste.

If materials are dealt with in accordance with the CoP, 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 will need to follow the protocols outlined for 'Route B' – Design Statement (as outlined by CL:AIRE) for the reuse of materials on the site of origin (ref CL:AIRE Code of Practice, Appendix 1).

A Materials Management Plan (MMP) will be required. The Enablement Contractor is responsible for writing and ensuring all works are undertaken in accordance with a MMP. The Contractor is responsible for writing and managing, payment for and obtaining QP sign off.

A separate MMP is required with regards to the reuse of materials following the completion of the enablement works (including placement of the cover system and reuse of Subsoils and Topsoil).

9.2 Material Suitability

9.2.1 Chemical Suitability

The following section is a summary of chemical suitability based on the site investigation works undertaken at the site.

Made Ground

A cover system is required for the Made Ground present across Phases 9 and 10, due to the presence of PAH and VOCs.

Hotspots

Petroleum hydrocarbon hotspots have been encountered in Phase 9 during the works to date and other hotspots may be present. If encountered, any hotspots which fail the RTVs in Appendix B.1.1 will be excavated and either disposed of off-site or reused on site following *ex situ* remediation.

Topsoil

Topsoil is present on site (Phases 9, 15, 16 and 16A) and subject to further testing during excavation will be suitable for reuse on the site to form a growing medium in residential gardens and areas of landscaping/POS.

Topsoil materials considered suitable for reuse will require confirmatory testing in accordance with the RMS following excavation.

Subsoil

Subsoil will be required for the following reasons:

1. to raise levels;
2. to backfill voids;
3. to alter site levels to allow the design levels; and
4. as Subsoil in the engineered cover system.

Following hotspot remediation (and subject to the results of further assessment once the slab has been removed) the Made Ground Subsoil on site may be suitable for use below a cover system.

Subsoil materials considered suitable for reuse will require confirmatory testing in accordance with the RMS following excavation.

Granular Soil

During the excavation, screening and processing of the soils, granular Class 1/Class 6F2 graded soils will be processed and stockpiled.

Careful stockpile management will be required to allow reuse of materials at the site. However, the use of Materials Management Plans should allow the reuse of soils at the site in accordance with the Code of Practice.

It is envisaged that a significant proportion of soil excavated during the Enablement Works will be able to be reused to create the final development platform. Stockpiles remaining following the Enablement Works shall be tested to prove they are suitable for use during the Construction Phase. Any soil materials not suitable for use, or not required during construction, will need to be disposed of to an appropriate waste disposal facility at the cost to the Contractor.

9.2.2 Geotechnical Suitability

An assessment has been completed on the potential to reuse site-won materials. This indicates the site won soils which can be classified as Class 4 Landscape fill, Class 2 cohesive fill or in the case of crushed stone, Class 1 granular fill which, subject to minor reprocessing may be suitable for use as General Fill Material.

The Contractor will be responsible for undertaking the geotechnical testing as required and placing the material to a suitable geotechnical specification which is to be agreed with the Client.

9.3 Certainty of Use and Quantity of Material

There will be an opportunity to reuse some soils at the site following excavation, any excess soils will be disposed of. The following excavation, treatment and placement is proposed during the enablement works:

- excavate hotspots and dispose of, or treat;
- excavate Made Ground, screen and process;
- excavate clean natural soils for use as Subsoil and Topsoil during construction phase works;
- placement of granular soils as backfill in excavations from below ground obstructions, tanks and hotspots, below road and pavements and as working platforms; and
- placement of soils to the required specification to a level 600mm below final ground level in areas of a cover system (Phase 9 and 10) or 150mm in all other areas.

Materials excavated during the Enablement Works will be able to be reused on site as levels and the soil characteristics allow.

Following the Enablement Works and only for those areas requiring a cover system (to be determined during the Enablement Works), the following will be required during the Construction Phase:

- over-excavation (300mm either side and 300mm below) of service corridors and subsequent backfilling with 'clean' soil;
- excavation of sub-grade in accordance with the pavement design; and
- excavation of ring beam foundations.

Materials excavated during the Construction Phase will need to be disposed of off-site.

There will also be a requirement for clean Subsoil and Topsoil to be imported to garden areas and clean granular (Type 1, 6F2/6F5) material for pavement construction.

Only materials deemed suitable for use by an appropriately qualified person will be utilised on site. Any out of specification material obtained from the site which is not deemed suitable for use will, if appropriate, be classified as waste and will be disposed of or recovered in the proper manner and in accordance with waste legislation.

Material reused or imported to site will be subject to the necessary testing/review prior to delivery to site to minimise the risk of the importation material unsuitable for the required specification. Any material deemed unsuitable upon arrival at the site will be rejected.

Only sufficient material required on site for the purposes of raising levels in accordance with the pre-determined proposals (planning conditions and drainage strategy) will be imported or reused on site.

Any surplus material or material which does not meet the required specification arising from development will be disposed of off-site. It is the responsibility of the Contractor at each stage of the works to have checked all volume calculations and have allowed for disposal of unsuitable or excess materials.

Any materials considered suitable for reuse will require confirmatory testing following excavation or processing. Where confirmed following additional testing, these materials are considered suitable for reuse within garden and landscaped areas.

9.4 On Site Material Management

9.4.1 Stockpiles

Site won material for potential reuse will be stored on site in stockpiles. The stockpiles are to be managed by the Enablement Works and Ground Works Contractors during the relevant phases of work and will be subject to operational constraints at the time of stockpiling.

Stockpile locations will be clearly marked and documented on working drawings maintained in the site office.

The Contractor for each phase of works is to take appropriate mitigation measures and environmental precautions as considered necessary at storage locations. However, as a minimum, stockpiles should be compacted to prevent dust and they should be kept wet in periods of dry weather.

During the remediation works, materials will be excavated and consolidated into designated stockpiles, with the different soil types stockpiled in different clearly marked stockpiles. A record of the excavated quantities and reuse locations will also be maintained on site. An example tracking system and example forms are provided at Appendix D. A copy of all tracking forms and delivery tickets used for transportation of soils to site will be held at the site office.

9.4.2 Confirmatory Testing

Material for On Site Reuse – Excavated Material

Any soils proposed for reuse will be sampled at the rate set out in Section 7.5.

Materials found to be out of specification are to remain on site in segregated stockpiles until such time that they can be disposed to a suitably licenced waste disposal facility.

At each phase of works a record should be maintained by the Contractor of the movement of the stockpiled material and the area within the excavation into which it is placed.

Material for Off-Site Disposal

Any material requiring disposal (during any phase of works) shall be disposed of in accordance with Section 6.8. It is the responsibility of the Contractor to ensure adequate and appropriate disposal, including testing to satisfy the proposed waste facility.

Records of the removal of stockpiles off site should be maintained by the Contractor including details of the disposal or treatment site to which they have been taken. These details are to be passed to Hydrock to form part of the verification report.

Appropriate precautions should be taken by the Contractor to ensure that the stockpiled material does not result in risks to neighbouring land users.

Imported Material

Imported soil will be tested to determine it is suitable for use in accordance with Section 7.5 and Appendix B.

The Contractor importing the material is to provide laboratory analysis to Hydrock to prove the suitability of the material to be brought on to site in line with the requirements specified in Section 7.5 and Appendix B.

Once the soils are present on site, additional testing will be undertaken.

10.0 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 E, 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 Hydrock 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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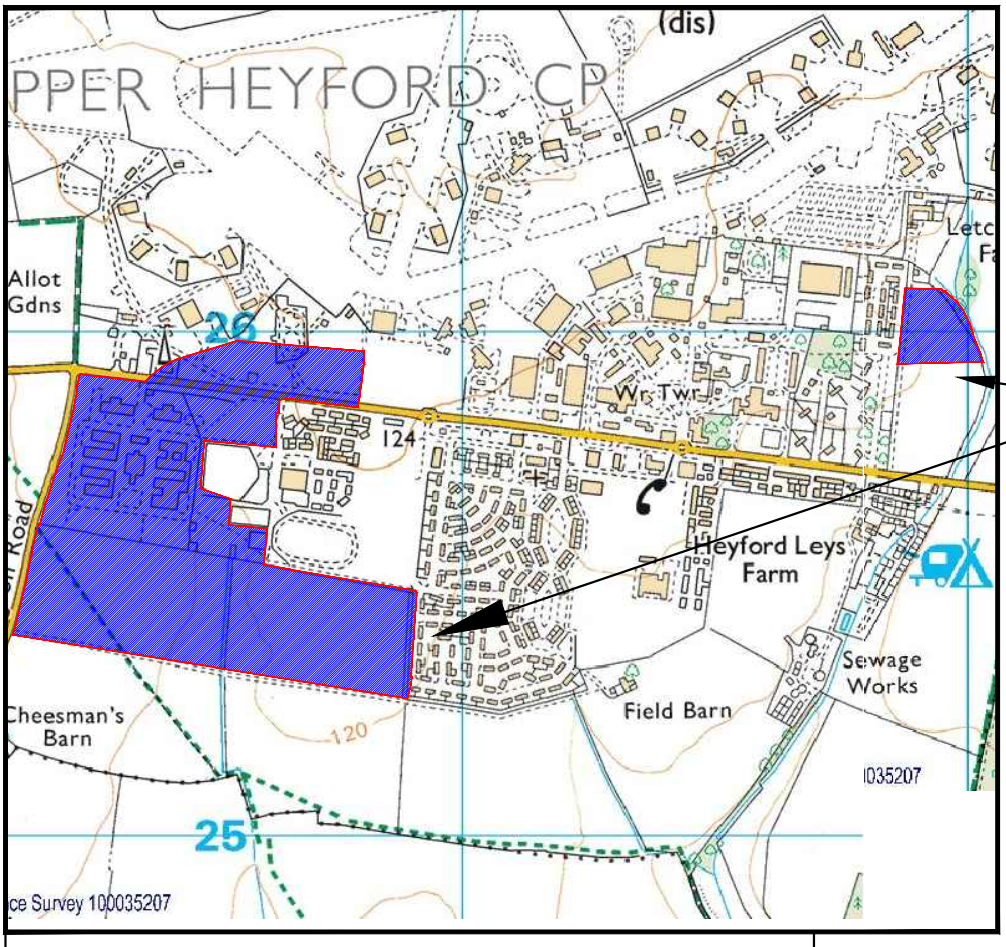
Hydrock Consultants Limited

Appendix A

DRAWINGS

Notes:

1. Contains Ordnance Survey data © Crown copyright and database right 2015



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Project Title:

HEYFORD PARK - WESTERN DEVELOPMENT, Phase 9, 10, 15, 16 and 16A

Drawing Title:

Site Location Plan

Reference:

HPW-HYD-PX-ZZ-DR-GE-1000

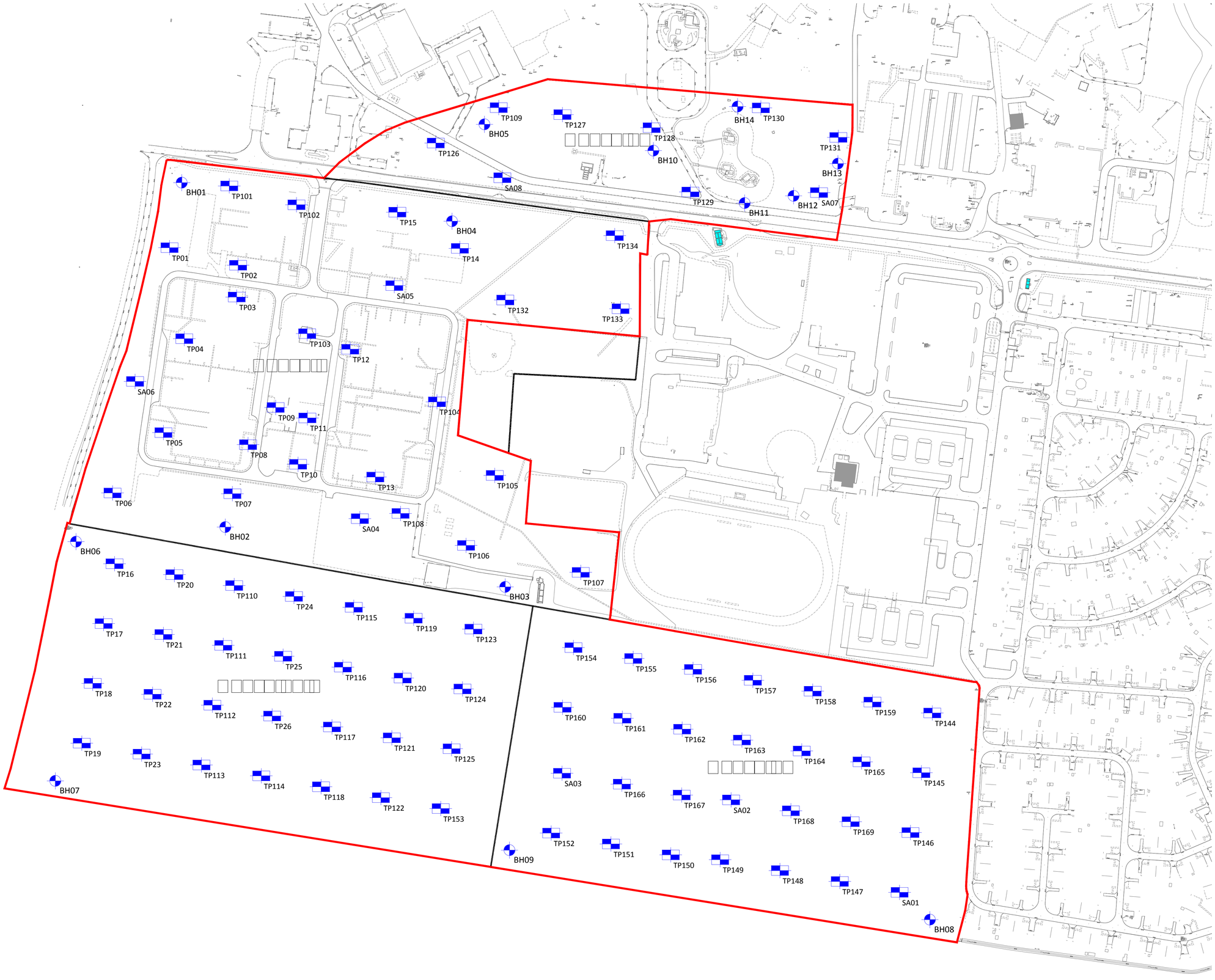
Hydrock Job No:

C-04583-C

Drawn	Checked	Scale @ A4	Date	Issue Date
RP	PS	See Drawing	27/03/17	27/03/17

Revision: P1

Status: S2



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.

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TPXX □ydr□k□r□□□□

BHXX □ydr□k□B□r□□□□

Rev	Date	Description	By	Ckd

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Client :

DORCHESTER LIVING

Project Title:

HEYFORD PARK WESTERN DEVELOPMENT, Phase 9, 10, 16 & 16A

Drawing Title:

Exploratory Hole Location Plan

Reference:

HPW-HYD-MS-ZZ-DR-GE-0003

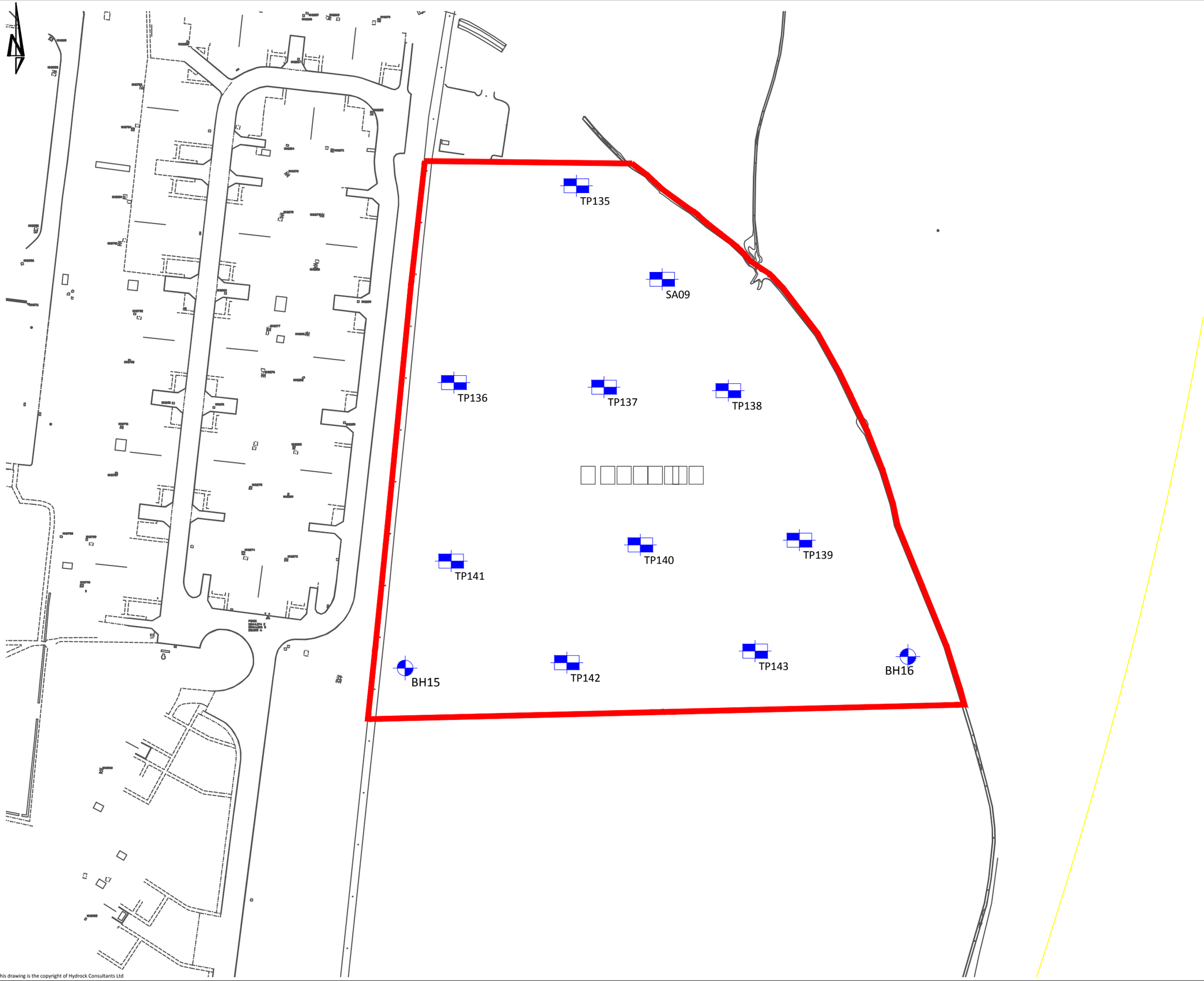
Hydrock Job No:

C/04583

Drawn	Checked	Scale @ A1	Date	Issue Date
SD	DM	1:1500	06/12/16	06/12/16

Revision: P1.1

Status: S0



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.

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TPXX □ydr□□k□□r□□□□□□□

BHXX □ydr□□k□B□r□□□□□

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Client :

DORCHESTER LIVING

Project Title:

HEYFORD PARK, WESTERN DEVELOPMENT (PHASE 15) BICESTER

Drawing Title:

Exploratory Hole Location Plan

Reference:

HPW-HYD-P15-ZZ-DR-GE-0003

Hydrock Job No: C-04583-C

Drawn	Checked	Scale @ A3	Date	Issue Date
SD	DM	1:1000	06/12/16	06/12/16

Revision: P1.1

Status: S0

Appendix B

REMEDIAL TARGET VALUES

B.1 REMEDIAL TARGET VALUES

B.1.1 Petroleum Hydrocarbons

RTVs for the validation of removal of petroleum hydrocarbon hotspots (known or encountered hotspots or soils below or around tanks etc.) and the backfilling of hotspots.

Table B.1: Remedial Target Values (RTVs) for Petroleum Hydrocarbons (Residential with Plant Uptake)

	Proposed RTV mg/kg		
Contaminant	(1% SOM)	(2.5% SOM)	(6% SOM)
Aliphatics EC5-EC6	42	78	160
Aliphatics >EC6-EC8	100	230	530
Aliphatics >EC8-EC10	27	65	150
Aliphatics >EC10-EC12	48	120	280
Aliphatics >EC12-EC16	24	59	140
Aliphatics >EC16-EC35	1000	1000	1000
Aliphatics >EC35-EC44	1000	1000	1000

	Proposed RTV mg/kg		
Contaminant	(1% SOM)	(2.5% SOM)	(6% SOM)
Aromatics EC5-EC7	73	150	310
Aromatics >EC7-EC8	130	300	680
Aromatics >EC8-EC10	35	84	190
Aromatics >EC10-EC12	75	180	390
Aromatics >EC12-EC16	150	330	670
Aromatics >EC16-EC21	260	550	930
Aromatics >EC21-EC35	1000	1000	1000
Aromatics >EC35-EC44	1000	1000	1000
All >EC44-EC70	1000	1000	1000

Table B.2: Remedial Target Values (RTVs) for Petroleum Hydrocarbons (Public Open Space (Residential)

	Proposed RTV mg/kg		
Contaminant	(1% SOM)	(2.5% SOM)	(6% SOM)
Aliphatics EC5-EC6	300	1000	1000
Aliphatics >EC6-EC8	1000	1000	1000
Aliphatics >EC8-EC10	1000	1000	1000
Aliphatics >EC10-EC12	1000	1000	1000
Aliphatics >EC12-EC16	1000	1000	1000
Aliphatics >EC16-EC35	1000	1000	1000
Aliphatics >EC35-EC44	1000	1000	1000

	Proposed RTV mg/kg		
Contaminant	(1% SOM)	(2.5% SOM)	(6% SOM)
Aromatics EC5-EC7	1000	1000	1000
Aromatics >EC7-EC8	1000	1000	1000
Aromatics >EC8-EC10	1000	1000	1000
Aromatics >EC10-EC12	1000	1000	1000
Aromatics >EC12-EC16	1000	1000	1000
Aromatics >EC16-EC21	1000	1000	1000
Aromatics >EC21-EC35	1000	1000	1000
Aromatics >EC35-EC44	1000	1000	1000
All >EC44-EC70	1000	1000	1000

Table B.3: Remedial Target Values (RTVs) for Petroleum Hydrocarbons (School (Residential without Plant Uptake)

	Proposed RTV mg/kg		
Contaminant	(1% SOM)	(2.5% SOM)	(6% SOM)
Aliphatics EC5-EC6	42	78	160
Aliphatics >EC6-EC8	100	230	530
Aliphatics >EC8-EC10	27	65	160
Aliphatics >EC10-EC12	48	120	280
Aliphatics >EC12-EC16	24	59	140
Aliphatics >EC16-EC35	1000	1000	1000
Aliphatics >EC35-EC44	1000	1000	1000

	Proposed RTV mg/kg		
Contaminant	(1% SOM)	(2.5% SOM)	(6% SOM)
Aromatics EC5-EC7	370	690	1000
Aromatics >EC7-EC8	860	1000	1000
Aromatics >EC8-EC10	47	120	270
Aromatics >EC10-EC12	250	590	1000
Aromatics >EC12-EC16	1000	1000	1000
Aromatics >EC16-EC21	1000	1000	1000
Aromatics >EC21-EC35	1000	1000	1000
Aromatics >EC35-EC44	1000	1000	1000
All >EC44-EC70	1000	1000	1000

B.1.2 Cover System

RTVs for the soils to be used within the cover system (topsoil, subsoil and 6F2/hardcore).

Table B.4: Import and Reuse Criteria within Cover System (Residential with Plant Uptake)

Contaminant	Proposed RTV mg/kg		
	(1% SOM)	(2.5% SOM)	(6% SOM)
Arsenic	37	37	37
Beryllium	73	73	73
Boron	300	300	300
Cadmium	14	14	14
Chromium (III)	890	890	890
Chromium (VI)	6.1	6.1	6.1
Copper	2500	2500	2500
Lead	200	200	200
Mercury, inorganic	170	170	170
Nickel	130	130	130
Selenium	360	360	360
Vanadium	410	410	410
Zinc	3900	3900	3900
Cyanide (free)	790	790	790
Phenol (total)	290	560	1100
Total PAH	100	100	100
Total TPH	100	100	100
Aliphatics EC5-EC6	42	78	160
Aliphatics >EC6-EC8	100	230	530
Aliphatics >EC8-EC10	27	65	150
Aliphatics >EC10-EC12	48	120	280
Aliphatics >EC12-EC16	24	59	140
Aliphatics >EC16-EC35	1000	1000	1000
Aliphatics >EC35-EC44	1000	1000	1000

Contaminant	Proposed RTV mg/kg		
	(1% SOM)	(2.5% SOM)	(6% SOM)
Acenaphthene	220	520	1100
Acenaphthylene	180	430	940
Anthracene	2400	5500	11000
Benz(a)anthracene	4.2	6.7	8.6
Benzo(a)pyrene	1.5	1.5	1.5
Benzo(b)fluoranthene	7.6	9.4	10
Benzo(ghi)perylene	64	69	71
Benzo(k)fluoranthene	12	14	15
Chrysene	7.7	11	13
Dibenz(a,h)anthracene	1.1	1.3	1.4
Fluoranthene	290	560	900
Fluorene	170	410	880
Indeno(1,2,3,cd)pyrene	4.3	5.5	6.2
Naphthalene	2.2	5.2	12
Phenanthrene	97	220	440
Pyrene	620	1200	2000
Asbestos	Nil	Nil	Nil
Aromatics EC5-EC7	73	150	310
Aromatics >EC7-EC8	130	300	680
Aromatics >EC8-EC10	35	84	190
Aromatics >EC10-EC12	75	180	390
Aromatics >EC12-EC16	150	330	670
Aromatics >EC16-EC21	260	550	930
Aromatics >EC21-EC35	1000	1000	1000
Aromatics >EC35-EC44	1000	1000	1000
All >EC44-EC70	1000	1000	1000

Table B.5: Import and Reuse Criteria within Cover System (Public Open Space (Residential))

Contaminant	Proposed RTV mg/kg		
	(1% SOM)	(2.5% SOM)	(6% SOM)
Arsenic	79	79	79
Beryllium	92	92	92
Boron	21000	21000	21000
Cadmium	120	120	120
Chromium (III)	1500	1500	1500
Chromium (VI)	7.7	7.7	7.7
Copper	12000	12000	12000
Lead	630	630	630
Mercury, inorganic	470	470	470
Nickel	290	290	290
Selenium	1400	1400	1400
Vanadium	2000	2000	2000
Zinc	81000	81000	81000
Cyanide (free)	1600	1600	1600
Phenol (total)	760	1500	3200
Total PAH	100	100	100
Total TPH	100	100	100
Aliphatics EC5-EC6	300	1000	1000
Aliphatics >EC6-EC8	1000	1000	1000
Aliphatics >EC8-EC10	1000	1000	1000
Aliphatics >EC10-EC12	1000	1000	1000
Aliphatics >EC12-EC16	1000	1000	1000
Aliphatics >EC16-EC35	1000	1000	1000
Aliphatics >EC35-EC44	1000	1000	1000

Contaminant	Proposed RTV mg/kg		
	(1% SOM)	(2.5% SOM)	(6% SOM)
Acenaphthene	15000	15000	15000
Acenaphthylene	15000	15000	15000
Anthracene	74000	74000	74000
Benz(a)anthracene	17	18	18
Benzo(a)pyrene	2.6	2.6	2.6
Benzo(b)fluoranthene	18	18	18
Benzo(ghi)perylene	120	120	120
Benzo(k)fluoranthene	26	26	26
Chrysene	25	26	26
Dibenz(a,h)anthracene	2.3	2.3	2.32
Fluoranthene	3100	3100	3100
Fluorene	9900	9900	9900
Indeno(1,2,3,cd)pyrene	11	11	11
Naphthalene	3900	4100	4200
Phenanthrene	3100	3100	3100
Pyrene	7400	7400	7400
Asbestos	Nil	Nil	Nil
Aromatics EC5-EC7	1000	1000	1000
Aromatics >EC7-EC8	1000	1000	1000
Aromatics >EC8-EC10	1000	1000	1000
Aromatics >EC10-EC12	1000	1000	1000
Aromatics >EC12-EC16	1000	1000	1000
Aromatics >EC16-EC21	1000	1000	1000
Aromatics >EC21-EC35	1000	1000	1000
Aromatics >EC35-EC44	1000	1000	1000
All >EC44-EC70	1000	1000	1000

Table B.6: Import and Reuse Criteria within Cover System (School (Residential without Plant Uptake))

Contaminant	Proposed RTV mg/kg (1% SOM)	(2.5% SOM)	(6% SOM)
Arsenic	40	40	40
Beryllium	73	73	73
Boron	11000	11000	11000
Cadmium	87	87	87
Chromium (III)	890	890	890
Chromium (VI)	6.1	6.1	6.1
Copper	7300	7300	7300
Lead	310	310	310
Mercury, inorganic	240	240	240
Nickel	180	180	180
Selenium	600	600	600
Vanadium	1200	1200	1200
Zinc	40000	40000	40000
Cyanide (free)	800	800	800
Phenol (total)	750	1300	2300
Total PAH	100	100	100
Total TPH	100	100	100
Aliphatics EC5-EC6	42	78	160
Aliphatics >EC6-EC8	100	230	530
Aliphatics >EC8-EC10	27	65	160
Aliphatics >EC10-EC12	48	120	280
Aliphatics >EC12-EC16	24	59	140
Aliphatics >EC16-EC35	1000	1000	1000
Aliphatics >EC35-EC44	1000	1000	1000

Contaminant	Proposed RTV mg/kg (1% SOM)	(2.5% SOM)	(6% SOM)
Acenaphthene	3000	4700	6000
Acenaphthylene	2900	4600	6000
Anthracene	31000	35000	37000
Benz(a)anthracene	5.5	7.8	9.4
Benzo(a)pyrene	1.5	1.6	1.6
Benzo(b)fluoranthene	11	11	11
Benzo(ghi)perylene	71	72	72
Benzo(k)fluoranthene	15	16	16
Chrysene	13	16	15
Dibenz(a,h)anthracene	1.3	1.4	1.4
Fluoranthene	1500	1600	1600
Fluorene	2800	3800	4500
Indeno(1,2,3,cd)pyrene	6.3	6.6	6.7
Naphthalene	2.3	5.6	13
Phenanthrene	1300	1500	1500
Pyrene	3700	3800	3800
Asbestos	Nil	Nil	Nil
Aromatics EC5-EC7	370	690	1400
Aromatics >EC7-EC8	860	1800	3900
Aromatics >EC8-EC10	47	120	270
Aromatics >EC10-EC12	250	590	1200
Aromatics >EC12-EC16	1000	1000	1000
Aromatics >EC16-EC21	1000	1000	1000
Aromatics >EC21-EC35	1000	1000	1000
Aromatics >EC35-EC44	1000	1000	1000
All >EC44-EC70	1000	1000	1000

Appendix C

STOCKPILE TEMPLATE FORM

Heyford Park – Western Development – Phase 9, 10, 15, 16 and 16A (delete as appropriate)

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 D

COVER SYSTEM JUSTIFICATION

D.1 COVER SYSTEM JUSTIFICATION

There are two broad categories of cover system available for use in the remediation of contaminated land[1]:

- 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 VOCs a simple cover system is not appropriate in Phases 9 and 10 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:

- 200mm hard to dig layer;
- geotextile marker layer; and
- 400mm of clean cover (including a minimum of 150mm topsoil).

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

The 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 D.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 D.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.	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 PHC hotspots and free phase hydrocarbons, 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. 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 bought 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 D.1 above, additional considerations with respect to the cover system are: the growing of vegetables, and the future planting of trees in gardens.

D.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.

D.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.

D.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.

D.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.

D.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 D.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.

D.3 Future Planting of Trees in Gardens

With regards to future planting of trees by residents:

a. The 400mm soil provision in the cover system will be sufficient to allow small shrubs and grass to be planted within the cover system.

b. Trees planned as landscaping will need to be planted in tree pits.

c. 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.

d. The size of the gardens will limit the widespread planting of significant trees.

e. 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.

f. 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 E

DISCOVERY STRATEGY

DISCOVERY STRATEGY- CONSTRUCTION PHASE

CONTAMINATED MATERIALS

HEYFORD PARK – WESTERN DEVELOPMENT – PHASES 9, 10, 15, 16 and 16A

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.
2. Site Personnel to inform the Site Manager/Agent.
3. Visual and olfactory observations of the condition of the ground and the extent of contamination should be made and notification shall be given to Hydrock Consultants, 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.
4. In the presence of a suitably qualified geo-environmental engineer on behalf of the Consultant, 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.
5. Should Hydrock 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.

6. A photographic recorded should also be made of relevant observations.
7. Hydrock will determine an appropriate testing suite based on visual and olfactory observations.
8. Test results will be compared against current assessment criteria suitable for the future use of the area of the site affected.
9. 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.
10. If the evidence for contamination is sever, 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.
2. A description of the tank should be made by Hydrock including; condition and surround, along with visual and olfactory observations should any contents in the tank be apparent. A photographic recorded should also be made of relevant observations.
3. The tank's position and depth should be determined and marked on a plan of the site.
4. Notification shall be given to Hydrock Consultants who will inform the Local Authority within 24 hours.
5. During the presence of a suitably qualified geo-environmental engineer on behalf of the Consultant, investigation works should be undertaken to obtain samples of any liquid or sludge contents and to establish dimensions of the tank.
6. Laboratory testing will be determined by Hydrock Consultants based on visual and olfactory observations of the material.
7. Test results will be compared against current assessment criteria and proposals for disposal of any contents determined in agreement with the appropriate Regulatory Parties.
8. Emptying the tank and disposal of contents to a suitable licenced disposal facility.
9. 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 Hydrock Consultants.
10. Excavation and remediation of any contaminated soils in accordance with Section 6.1.
11. Samples of the base and sides of the resultant hole will be sampled as per the Consultant's instructions and an assessment as to whether this may have been a source for groundwater contamination made.

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

Appendix F

CONTRACTOR REQUIREMENTS

F.1 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.

F.2 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 Hydrock.

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.

F.3 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 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.

F.4 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.

F.5 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 Consultant, the highway shall be swept regularly to remove any mud, slurry or dust deposited by vehicles entering or departing the site. If the Consultant 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.

F.6 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.

F.7 Working Hours

Noisy operations i.e. the use of hydraulic breakers shall be restricted to operating times as specified by the Client and by the planning permission. It is understood that these are 8:30 am to 5:30 pm, or other hours agreed with the Local Authority, Monday to Friday and 9.00 am to 13.00 pm on Saturday. No working shall take place on Sunday or Bank Holidays.

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

F.8 Mobile Plant

Mobile 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.

F.9 Unexploded Ordnance

As the site is adjacent to a former military facility, a specialist UXO Desk Top Study has been commissioned, which confirms that the UXO risk at the site is low.

The Contractor is to satisfy themselves of the risks and have allowed for appropriate mitigation measures.

F.10 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.

F.11 Testing

The Contractor shall be responsible for undertaking all testing necessary to satisfy the 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 Consultant. The lowest level of detection shall be used for all testing. The Contractor is to submit to the 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 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 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.

F.12 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.

F.13 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.

F.14 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. However; there is a known ‘hotspot’ of hydrocarbon contamination and it is advised that odours are formally assessed by twice daily inspections of all site boundaries.

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.

F.15 Asbestos in Soils

To date, asbestos has not been detected in samples of the soils at the site. However, the Contractors should work with the knowledge that asbestos may be encountered.

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 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 licensing 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.

If encountered, 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.

F.16 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.

F.17 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.

F.18 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.

F.19 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.

F.20 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 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

REMEDIATION 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:

1. Identifying Key Risk Drivers.
2. Identifying feasible remediation options for each relevant pollutant linkage.
3. Carrying out a detailed evaluation of feasible remediation options to identify the most appropriate option for any particular linkage.
4. 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 Reports HPW-HYD-MS-ZZ-RP-G-0001 and HPW-HYD-P15-GI-RP-G-P2 have identified that the key risk drivers with regards to the requirement for remediation are:

- Phase 9 and 10: elevated PAH and VOC in the Made Ground; and
- Phase 9 and 10: petroleum hydrocarbon hotspots.

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 and ground gas, 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

G.3.1 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 PAH	Relative Cost	Relative Operational Time	Comments (Practicality/Sustainability/Durability)	Feasibility (Y- Yes, N – No)
Cover System	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	£££+	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	££	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	££	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	££	Months	Will effectively reduce petroleum hydrocarbons concentrations.	Y – to be determined with the Enablement Contractor and Client.
Windrow Turning	Y	N	££	Months		
Windrow Turning with addition of additives to stimulating aerobic microbial activity	Y	N	££	Weeks to Months	Will effectively reduce petroleum hydrocarbons concentrations in soils.	
Soil Washing	Y	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	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 VOCs are present (Phase 9 and 10);
- Materials Management (excavation, screening, reprocessing and reuse of suitable materials);
- excavation of any petroleum hydrocarbon impacted soils (Phase 9 and around tanks);
- *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:

1. 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

2. 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.