



Thakeham Tiles

Remediation Strategy and Verification Plan

For Redrow Homes Ltd.

Date: 20 April 2022

Doc ref: 08347-HYD-XX-XX-RP-GE-3001

DOCUMENT CONTROL SHEET

Issued by	Hydrock Consultants Limited White Building 1-4 Cumberland Place Southampton Hampshire SO15 2NP United Kingdom	T +44 (0)23 82140907 E southampton@hydrock.com www.hydrock.com
Client	Redrow Homes Ltd.	
Project name	Thakeham Tiles	
Project title	Remediation Strategy and Verification Plan	
BIM reference	08347-HYD-XX-XX-RP-GE-3001	
Project reference	08347-GELO	
Date	20/04/2022	

Document Production Record		
Issue Number	S2 P1	Name
Prepared by	Yacklin Panza BEng MSc FGS	
Checked by	James Macfarlane BSc AFAAM	
Approved by	Andrew James BSc CGeol RoGEP FGS	

Document Revision Record			
Issue Number	Status	Date	Revision Details
S2	P1	20/04/2022	Original issue.

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1. INTRODUCTION

1.1 Terms of reference

In October 2021, Hydrock Consultants Limited (Hydrock) was commissioned by Redrow Homes Ltd. (the Client) to undertake a ground investigation and subsequently prepare a Remediation Strategy and Verification Plan (RSVP) for the site known as Thakeham Tiles, Rock Road, Storrington, RH20 3AD. A site location plan is presented in drawing reference TRS-HYD-XX-ZZ-DR-GE-1000_P2-S2 (Appendix A).

Preparation of this RSVP follows completion of ground investigations carried out at the site in November 2021 and previously by Hydrock, as summarised in Section 1.4.

The site is currently an active concrete products manufacturing facility with a series of large warehouses/industrial units in the northern half of the site and the remnants of an old quarry in the southern half of the site. The site is surrounded by mature trees with residential housing to the east, south and west of the site. To the north of the site is Rock Road with an agricultural field further beyond.

Hydrock understands that the site is being considered for acquisition for the construction of up to 90 residential units. A proposed development layout (Thrive Architects Drawing ref: THAK160703-SKL-03-RevD, dated 14/08/2018) is presented in Appendix A.

The works have been undertaken in accordance with Hydrock's proposal referenced (08347-HYD-XX-XX-FP-GE-0004-P01 dated 09/09/2021) and the Client's instructions to proceed (via email sent by Jack Allan from Redrow Home Limited on 26/10/2021).

1.2 Objectives

The objectives and scope of this RSVP are to present details of the remedial objectives and how remediation of the site will be undertaken and validated. In addition, the strategy explains how the works will be permitted under the current regulatory regime.

The remedial works will ensure that upon completion, the ground conditions at the site can be shown to be appropriate for its intended use and that it will not pose an unacceptable contamination risk to identified receptors. This document therefore, includes the protective measures required during the enabling and construction works phases in preparing the site for a commercial end use.

This is a working document and it may need to be updated, in agreement with the relevant regulatory bodies, at any stage during development dependent on any differences found between the conditions encountered and those expected from the ground investigation. The reference of this version of the RSVP is 08347-HYD-XX-XX-RP-GE-3001 revision S2 P1. Any new revisions will be given updated references. This document and any revisions are subject to the approval of the regulators. Demolition and remediation work should not commence or continued with until such approval has been given.

This document does not cover the geotechnical requirements for the development. A separate Geotechnical Design Report (GDR) and accompanying Earthworks Strategy (EWS) are recommended and this report should be read in conjunction with these documents once available.

1.3 Scope

The scope of the RSVP comprises:

- a summary of the conceptual model;
- a review of the risk assessment;
- a remediation options assessment;
- an outline of the remedial strategy;
- details of the remedial strategy implementation;
- details of supervision, verification and reporting requirements;
- a summary of requirements with regards to reuse of soils on site and material management; and,
- a contingency plan for areas of unexpected contamination.

1.4 Available information

The following documents, reports etc have been produced by Hydrock and were used in the preparation of this report:

- Hydrock. 1st April 2022. Thakeham Tiles Ltd. Supplementary Ground Investigation Report. Reference 08347-HYD-XX-XX-RP-GE-1004, for Redrow Homes Ltd.
- Hydrock. 21st January 2022. Thakeham Tiles Ltd. Supplementary Ground Investigation Factual Report. Reference 08347-HYD-XX-XX-RP-GE-1003, for Redrow Homes Ltd.
- Hydrock. 18th May 2021. Thakeham Tiles Ltd. Supplementary Ground Investigation Report. Reference 08347-HYD-XX-XX-RP-GE-1002, for Thakeham Concrete Products Ltd.
- Hydrock. 24th July 2018. Rock Road, Storrington. Desk Study and Ground Investigation for Thakeham Concrete Products Ltd. Reference TRS-HYD-XX-GI-RP-GE-1001, for Thakeham Concrete Products Ltd.

The following documents, reports etc have been provided to Hydrock by Thakeham Concrete Products Ltd. for use in the preparation of this report:

- Thrive Architects. 14th August 2018. Sketch Layout – 03. Land at Thakeham Tiles. Job no. THAK160703. Drawing No SKL-03.
- Thrive Architects. 21st October 2016. Site Location Plan. Land at Thakeham Tiles. Job no. THAK160703. Drawing No SLP-01.

1.5 Limitations

Hydrock has prepared the report based on available information obtained during the project 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 Redrow Homes Ltd and those parties designated by them for the purpose of providing information on the remediation and verification works to be undertaken during the enablement and construction phase of the development. The contents of this RSVP and associated documents should only be used in that context.

Furthermore, new information, changed practices or new legislation may necessitate revised consideration of the document after its submission and approval.

Hydrock has used reasonable skill, care and diligence in the design of the remediation of the site. The inherent variation of ground conditions allows only definition of the actual conditions at the locations and depths of trial pits and boreholes at the time of the investigation. At intermediate locations, conditions can only be inferred. 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 Land Contamination Risk Management (Environment Agency 2021), BS5930:2015 and BS10175: 2011+A2:2017.

2. CONCEPTUAL MODEL

2.1 Introduction

This section presents a summary of the conceptual model pertaining to the site which was developed in previous ground investigation reports referenced in Section 1.4, and should be referred to for full details.

2.2 Site location and current land use

The site is approximately 4.86 ha in area and slopes down from the south (at approximately 64m OD), to the north (at approximately 48m OD). The site is occupied by an active concrete product manufacturing plant operated by Thakeham Concrete Products Ltd. Within the northern half of site lies a series of large warehouses/ industrial units containing the manufacturing plant. A disused quarry occupies the southern half of the site, which is understood to have been partly infilled with waste materials from the manufacturing plant, including surplus aggregate and waste concrete products, such as blocks and paving slabs. The disused quarry is predominantly used for aggregate storage. There is a public footpath which crosses the middle of the site from west to east. The site is surrounded by mature trees with residential housing to the east, south and west of the site. To the north of the site is Rock Road, with agricultural land beyond to the north.

2.3 Site history

The site was coniferous and mixed woodland from before 1875 until 1937 when a tile works was first shown. According to the Heritage Report produced by Thakeham Tiles, the site was constructed in 1933 with clearance of woodland and construction of additional buildings north of the pit during 1963-1964. Historical maps review indicates minor changes to site layout and ancillary buildings between the 1970s and 2000s. The former sandpit is noted as having been licensed to receive inert waste from the tile works including surplus aggregate and concrete products. The license was held between 1970 and 1994 according to records held by the Environment Agency.

2.4 Geology and physical ground conditions

The British Geological Survey (BGS) indicates the southern end of the site is underlain by the Folkestone Formation of Cretaceous age. This comprises medium and coarse-grained, cross-bedded sands and weakly cemented sandstones, with thicknesses between 0.5m and 80m. This overlies the Fittleworth Member of the Sandgate Formation. The northern part of the site is underlain by the Fittleworth Member of the Sandgate Formation, of Lower Cretaceous age, comprising glauconitic sandy clays and clayey sands (orange-brown where weathered; bright green where unweathered), with thickness between 10 to 60m.

No natural superficial deposits are mapped across the site area.

There is Made Ground at the site which includes waste bricks/tiles and worked ground (age Quaternary) corresponding with the location of the quarry in the southern area of the site.

The ground conditions as proven by ground investigations undertaken by Hydrock are summarised below:

2.4.1 Made Ground

- Surface covering, in the north of the site from ground level to depths between 0.05m and 0.20m bgl, with an average thickness of 0.11m. Generally, comprises grey concrete block paving and concrete slabs.
- General, in the north of the site (industrial production area) to depths of between 0.40m and 5.55m bgl, with an average thickness of 1.64m. Deepest general Made Ground was encountered above the retaining wall on the centre of the site at locations BH202, WS112, WS117, WS118, WS213. Generally, it comprises yellow, brown, reddish brown and dark grey sand with different proportions of gravel and cobbles of brick, concrete and flint and rare pockets of silt/ clay. Possible Made Ground was encountered at location WS210 up to 2.70m bgl due to the presence of possible wood/ timber fragments between 2.40m and 2.70m bgl. A single fragment of Asbestos Containing Material in the form of Hard/Cement Type Material (Chrysotile) was encountered at location HP202 at 0.6m bgl. In addition, previous investigation indicates evidence of visible asbestos at location SA107 and asbestos fibres detected at location SA103.
- Quarry backfill, in the south of the site (former quarry) to depths of between 1.00m and over 5.45m bgl, with an average thickness of 2.39m. Comprises cream, light brown fine to medium sand over reddish brown and grey brown slightly gravelly to gravelly sand, with occasional layers of clay. Gravel is fine to coarse angular to subangular of concrete, brick, metal, plastic and wood fragments. Reinforced concrete over Made Ground was encountered at locations WS119 and TP207, where material transfer from stockpiles to conveyor transport occurs. Made Ground - Quarry backfill over 3.0m bgl was encountered within the central/west area of the former quarry at locations WS119, BH203, TP208, TP209, TP210, TP214, TP215 and TP220, even though no evidence of typical anthropogenic materials, the presence of frequent plant material and the clay content are indicators of probable reworked natural soils from historical activities. Asbestos Containing Material in the form of Hard/Cement Type Material and Rope (Chrysotile), and Insulation Board/Tile (Amosite), was encountered in 1 borehole and 12 trial pits in the current investigation in the south area of the site, at locations BH203, TP208, TP215, TP218, TP219, TP220, TP222, TP224, TP225, TP226, TP229, TP232 and TP236, and asbestos loose fibres at locations TP221, TP222, TP224 and TP229. In addition, visible asbestos was encountered in previous investigations at locations SA105, SA05A, SA105B, WS113 and asbestos loose fibres at locations TP13 and TP14.

Drawing TRS-HYD-XX-ZZ-M2-GE-1005-P3 shows the minimum proven thickness of Made Ground strata across the site.

2.4.2 Topsoil (TS)

Topsoil was encountered in the north-west of the site at locations WS205, WS206 and WS208 between 0.10m and 0.60m thick, with an average thickness of 0.32m. The topsoil comprised dark brown clayey sandy silt with abundant roots and rootlets.

2.4.3 Folkestone Formation (FO)

Folkestone Formation was encountered underlying the Made Ground - Quarry Backfill in the south area of the site, between 1.00m and 4.90m bgl, with an average thickness of 1.20m. This

generally consisted of medium to very dense reddish pink fine to coarse sand with rare interbedded sandstones.

Folkestone Formation was not encountered in the northern area of the site. The BGS mapping shows the apparent contact between the Folkestone and Fittleworth bisecting the site and the site investigation data largely supports this.

2.4.4 Fittleworth Member (FIB)

Fittleworth Member was encountered underlying the Made Ground - General in the north of the site between 0.25m and up to 20.00m bgl. Fittleworth Member was also encountered at the south of the site underlying the Folkestone Formation, between 3.30m and at least 20.00m bgl. The base of the strata was not proven. The composition of the unit varies and generally consisted of soft orange and grey sandy to very sandy clay or fine to coarse sand with various clay proportions (possible weathered strata). Becoming greenish grey from approximately 2.0m bgl. Interbedded very stiff sandy clay, very weak sandstone and weak to medium strong sandy fine-grained siltstone/ sandstone with rare fossils from approximately 6.30m bgl.

The unweathered Fittleworth Member is typified by the presence of green glauconite which was not noted in any of the deep boreholes. This along with the extremely weak strength and interbedded soil and rock profile suggests all materials encountered have been altered by weathering to some degree.

Drawing TRS-HYD-XX-ZZ-DR-GE-1010-P1 presents the extent of bedrock geology across the site.

2.5 Hydrogeology

The Folkestone Formation is classified as a Principal aquifer and the Fittleworth Member as a Secondary A aquifer. The site is not within a groundwater Source Protection Zone. Two groundwater abstractions are located between 440m and 620m to the south of the site, relating to mineral washing.

2.6 Hydrology

The nearest surface water feature to the site is an unnamed River in the Rother and Arun catchment, 78m to the south east of the site. Lancing Brook flows westwards in a valley 1km north of the site. A drainage gully/stream discharges water off-site to the north/north west, probably flowing towards Lancing Brook. There are no licensed surface water abstractions within 1km of the site.

2.7 Mining and mineral extraction

The southern area of the site is recorded to have operated as a sand pit supplying the tile works. Extraction is indicated to have ceased in 1946. There are also two recorded sand pits within 276m and 317m west of the site.

2.8 Waste management and Hazardous Substances

The southern area of the site (former quarry/sand pit), has since been partially infilled with materials related to the waste products from the tile manufacturing. An inert landfill waste license was held for the site between 1970 and 1994. However, there is evidence of frequent

asbestos containing materials and loose fibres within the quarry area. Asbestos is considered as 'hazardous substances' due to its effects on human health. Sporadic asbestos containing materials and loose fibres were identified in the north site area (as proven by previous ground investigations). Information indicating asbestos containing material locations identified at surface and within the ground are presented on drawing references TRS-HYD-XX-ZZ-DR-GE-2001 and TRS-HYD-XX-ZZ-DR-GE-2002 respectively in Appendix A.

There are no records of other landfills or waste management sites within 250m of the site boundary.

2.9 Unexploded ordnance (UXO)

The site was considered to be a low risk from UXO.

2.10 Radon

The site is not located in a Radon Affected Area.

2.11 Ground Model

2.11.1 Physical Ground Model

The physical ground conditions as encountered by Hydrock in 2018 and 2021 are summarised in Table 2.1.

Table 2.1: Ground Conditions Encountered

Stratum	Description	Depth to top (m bgl)	Depth to base (m bgl)	Thickness (m) (range)
Production area (north site area)				
Topsoil	Dark brown clayey sandy silt with abundant roots and rootlets. Sand is generally medium to coarse. Only encountered at (WS205, WS206 and WS208)	0.00	0.10 - 0.60	0.10 - 0.60
Made Ground - Surface Covering	Grey concrete block paving and concrete slabs covering in the north of the site.	0.00 - 0.05	0.05 - 0.20	0.05 - 0.20
Made Ground - General	Yellow, brown, reddish brown and dark grey sand with different proportions of gravel and cobbles of brick, concrete and flint and rare pockets of silt/ clay. A single fragment of Asbestos Containing Material in the form of Hard/Cement Type Material (Chrysotile) was encountered at location HP202.	0.00 - 0.20	0.40 - 5.55	0.25 - 5.47
Fittleworth Member	Soft orange and grey sandy to very sandy clay or fine to coarse sand with various clay proportions. Becoming greenish grey from approximately 2.0m bgl. Interbedded very stiff sandy clay, very weak sandstone and weak to medium strong sandy fine-grained siltstone/	0.25 - 5.55	5.00 - >20.00	>17.70

	sandstone with rare fossils from approximately 6.30m bgl.			
Former quarry area (south site area)				
Topsoil	Brown and dark grey slightly silty fine to coarse SAND with frequent roots and rootlets. Only encountered at locations TP231 and TP235.	0.00	0.10	0.10
Made Ground - Quarry backfill	Cream, light brown fine to medium sand over reddish brown and grey brown slightly gravelly to gravelly sand, with occasional layers of clay. Gravel is fine to coarse angular to subangular of concrete, brick, metal, plastic, wood fragments and rare to frequent ACM predominantly in the form of Hard/Cement Type Material, with minor evidence of Rope (Chrysotile), and Insulation Board/Tile (Amosite). Reinforced concrete over made ground was encountered at locations WS119 and TP207.	0.00 - 0.10	0.90 - >5.45	0.90 - >5.45
Folkestone Formation	Medium to very dense reddish pink fine to coarse sand with rare interbedded sandstones.	1.00 - 3.70	3.30 - 4.90	0.80 - 1.60
Fittleworth Member	Soft orange and grey sandy to very sandy clay or fine to coarse sand with various clay proportions. Becoming greenish grey from approximately 2.0m bgl. Interbedded very stiff sandy clay, very weak sandstone and weak to medium strong sandy fine-grained siltstone/ sandstone with rare fossils from approximately 6.30m bgl.	0.25 - 5.50	>20.00	>4.75

An indicative geological cross section of the site is presented in Figure 2.1 and in Appendix A.

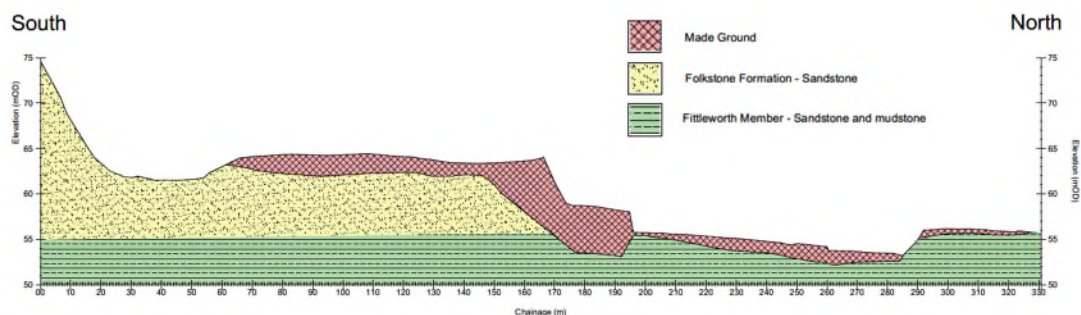


Figure 2.1: Indicative geological cross section (extracted from conceptual site model drawing reference TRS-HYD-XX-XX-DR-GE-1009)

2.11.2 Groundwater

In general, shallow groundwater (<1.0m) was encountered during site works within Made Ground - General between 49.56m AOD to 53.8m AOD; within the Fittleworth Member strata (north) between 49.62m and 50.99m AOD; no groundwater was encountered within the Folkestone Formation during site works. A summary of these is presented in Table 2.2.

Table 2.2: Groundwater occurrence

Stratum	Date	Location	Fieldwork		Comment
			Groundwater depth (m bgl)	Groundwater elevation (m AOD)	
Made Ground - General	17/11/21	HP203	0.70	52.69	Soil recovered damp.
	12/11/21	TP203	0.90	53.80	Moderate seepage.
		TP205	0.20	56.21	Moderate seepage.
	17/11/21	WS201	1.00	49.56	Soil recovered damp.
	17/11/21	WS203B	0.90	50.75	Soil recovered damp.
	17/11/21	WS207	1.00	50.87	Soil recovered damp.
Fittleworth Member	18/11/21	WS205	0.65	49.62	Soil recovered damp.
	18/11/21	WS206	2.3	47.78	Soil recovered damp.
		WS208	0.8	50.99	Soil recovered damp.

Water levels recorded post-fieldwork ranged from 48.86m and 55.77m AOD (Made Ground - General), 47.77m and 54.14m AOD (Fittleworth Member), and 59.72m to 60.30m AOD (Folkestone Formation). A summary of these is presented in Table 2.3.

Table 2.3: Groundwater level data summary

Stratum	Date range	Location*	Post-fieldwork monitoring	
			Depth to groundwater (range) (m bgl)	Groundwater elevation (range) (m OD)
MG - General	01/12/21 - 10/12/21	BH202	2.70 - 2.83	55.64 - 55.77
	02/12/21 - 16/12/21	WS108	1.11 - 1.66	48.86 - 49.41
	01/12/21 - 16/12/21	WS109	1.15 - 1.49	51.16 - 51.50
MG - General and Fittleworth Member	01/12/21 - 16/12/21	WS201	0.51 - 0.87	49.69 - 50.05
MG - Quarry backfill	01/12/21 - 16/12/21	WS115B	Dry	64.39
		WS119	Dry	63.63
MG - Quarry backfill and Folkestone Formation	01/12/21 - 16/12/21	BH203	3.92 - 4.50	59.72 - 60.30
Folkestone Formation	01/12/21 - 10/12/21	WS113	Dry	64.20
	01/12/21 - 16/12/21	WS114	Dry	62.00
Fittleworth Member		BH201	0.54 - 1.10	51.45 - 52.01
		WS102	0.97 - 1.63	50.38 - 51.04

Stratum	Date range	Location*	Post-fieldwork monitoring	
			Depth to groundwater (range) (m bgl)	Groundwater elevation (range) (m OD)
	01/12/21 - 16/12/21	WS103	1.66 - 2.38	48.09 - 48.81
		WS104	2.06 - 2.18	54.02 - 54.14
		WS110	0.38 - 0.90	52.10 - 52.62
		WS202	Dry - 2.10	52.05
		WS203	0.58 - 1.39	50.26 - 51.07
		WS204	1.20 - 1.68	50.10 - 50.58
		WS205	0.78 - 2.50	47.77 - 49.49
		WS206	0.30 - 1.08	49.00 - 49.78
		WS208	1.48 - 2.12	49.67 - 50.31
	02/12/21 - 10/12/21	WS207	0.95 - 1.10	50.77 - 50.92
*Boreholes denoted as WS10x were installed in previous ground investigation works (report reference 08347-HYD-XX-XX-RP-GE-1002).				

2.11.3 Ground gas

Records from the gas monitoring boreholes undertaken are summarised in Table 2.4

Table 2.4: Range of ground gas data

Stratum	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Steady flow rate (l/hr)	Comment
MG - General	0.1 - 0.8	0.1 - 2.2	10.1 - 21.0	-4.1 to 0.0	All methane readings were below 1% and all carbon dioxide were below 5%.
MG - General / Fittleworth Member	ND	0.1 - 0.4	17.6 - 19.2	0.0	
MG - Quarry backfill	ND - 1.9	0.1 - 2.8	3.5 - 20.8	-0.1 to 0.0	Methane readings were above 1% on 2 occasions at location WS115B. All carbon dioxide readings were below 5%.
MG - Quarry backfill/ Folkestone Formation	ND- 0.5	0.1 - 1.3	17.5 - 20.8	0.0	
Folkestone Formation	ND	0.6 - 10.8	11.0 - 20.5	-0.1 to 0.0	Two carbon dioxide readings above 5% at locations WS113 and WS114.
Fittleworth Member	ND - 13.8	0.1 - 6.3	11.5 - 21.1	-6.1 to 0.1	One methane reading above 5% at WS102. Two carbon dioxide readings above 5% at location WS206.
*ND – not detected (<0.1%)					

2.11.4 Organic Vapours

PID readings above 5ppm and up to 55.1ppm were detected at locations WS203B and WS207 in the northern site area. However, the vapour risk assessment previously undertaken in the vicinity of the fuel storage area indicates low risk from VOC and hydrocarbon vapours.

2.11.5 Evidence of contamination

Rare to frequent incidences of visible asbestos and asbestos loose fibres were encountered in a number of locations in the southern site area. Sporadic visible asbestos and loose asbestos fibres were identified in the northern site area. Details of these locations are presented in drawings TRS-HYD-XX-ZZ-DR-GE-2001 and TRS-HYD-XX-ZZ-DR-GE-2002.

There is visual and olfactory evidence of petroleum hydrocarbon contamination in soils associated with contaminant point sources (fuel storage and old filling pump area near the workshop and in some of the storage/ production areas).

A summary of visual evidence of contamination in soils is presented in Table 2.5.

Table 2.5: Visual and olfactory evidence of contamination - soils

Stratum	Location	Depth (m bgl)	Description
Petroleum Hydrocarbons			
Made Ground - General	WS203A	0.35	Slight hydrocarbon odour.
	WS203B	0.30 to 1.00	Strong hydrocarbon odour.
	WS207	1.50 to 2.70	Slight hydrocarbon odour.
	WS102	0.20 to 3.45	Moderate to strong hydrocarbon odour related to old diesel tank next to the workshop.
	WS108	1.30 to 1.60	Mild hydrocarbon odour related to surface run-off from workshops.
	WS116	0.40	Mild hydrocarbon odour related to load/unload operation area.
Fittleworth Member	WS203B	1.20 to 2.70	Strong hydrocarbon odour and black mottling.
		3.50 to 5.0	Slight hydrocarbon odour.
Asbestos			
Made Ground - Quarry backfill	BH203	0.10	Chrysotile- Hard/Cement.
	TP208	2.00	Rare fragments of Chrysotile- Hard/Cement.
	TP215	1.10 to 1.60	Rare fragments of Chrysotile- Hard/Cement.
	TP218	0.40 to 2.70	Frequent fragments of Chrysotile- Hard/Cement.
	TP219	0.60 to 2.00	Frequent fragments of Chrysotile- Hard/Cement.
	TP220	0.30 to 0.60	3 fragments of Chrysotile - Hard/Cement.
	TP222	1.00 to 1.50	Frequent fragments of Chrysotile- Hard/Cement.
	TP224	0.60 to 2.00	Frequent fragments of Chrysotile- Hard/Cement.
	TP225	0.40 to 2.50	Frequent fragments of Chrysotile- Hard/Cement.
	TP226	1.50 to 2.80	5 fragments of Amosite- Insulation Board/Tile.
	TP229	1.50 to 3.00	Frequent fragments of Chrysotile- Hard/Cement.
	TP232	0.40 to 1.90	Frequent fragments of Chrysotile- Hard/Cement.
	TP236	0.90 to 1.50	Rare fragments of Chrysotile- Hard/Cement.

Stratum	Location	Depth (m bgl)	Description
Made Ground - Quarry backfill	Adjacent to former quarry	GL	Stockpiles of cement bound asbestos sheets understood to historically be used within moulding plant. North of SA104, south east of WS119.
Made Ground - General	HP202	0.60	1 fragment of Chrysotile- Hard/Cement.

In the groundwater, petroleum hydrocarbons were detected at WS203B in the vicinity of the fuel storage and old filling pump.

3. CONTAMINATION RISK ASSESSMENT REVIEW

3.1 Geo-Environmental exposure model

This section summarises the risk assessment findings as presented in Hydrock's Supplementary Ground Investigation Report (reference: 08347-HYD-XX-XX-RP-GE-1004).

Further details on the risk assessment procedures, averaging areas, chemical testing results and assessments are included in Hydrock's Ground Investigation Report.

3.1.1 Potential sources of contamination

Potential on-site sources in northern site area

- S 1 Made Ground, associated with historical industrial activities, including elevated concentrations of metals, metalloids and PAH in the north of the site - industrial production area.
Hotspots of lead in the MG- General at WS204, WS108 and WS110.
Hotspots of PAH in the MG- General at TP202.
Hotspots of Zinc and Boron in the MG- General at WS212, WS103, WS108, WS110, SA106 and SA103.
- S 2 Made Ground, associated with historical industrial activities, containing visible asbestos material (ACM) and asbestos loose fibres.
Sporadic asbestos (visible and loose fibres) in MG- General.
- S 3 Asbestos within existing building construction.
- S 4 Hydrocarbon fuels, lubricants, and solvents from the operation of the workshop and on-site storage in the north of the site, including leakage from Underground Storage Tanks (USTs), Above Ground Storage Tanks (ASTs), the pipework between tanks and pumps, former diesel railway and general spillage.
Hotspots of TPH in MG- General at WS203B, WS102, WS105, WS108, WS109, WS110, TP07.
Hotspot of petroleum hydrocarbons in groundwater at WS203B.

Potential on-site sources in southern site area

- S 5 Made Ground, associated with historical industrial activities, including elevated concentrations of metals, metalloids, PAH and petroleum hydrocarbons.
Hotspot of PAH in the MG- Quarry at SA105A.
Hotspots of TPH in MG- Quarry at SA104.
- S 6 Made Ground, associated with historical industrial activities, potentially containing visible asbestos material (ACM) and asbestos loose fibres in the south of the site - former quarry area.
Frequent asbestos (visible and loose fibres) in the MG- Quarry area

3.1.2 Potential pathways

The following potential pathways have been identified.

- P 1 Humans: ingestion, skin contact, inhalation of dust and outdoor air.
- P 2 Direct contact with substances deleterious to building materials.
- P 3 Plant life: root uptake.

- P 4 Groundwater: migration of contaminant into the Folkestone Formation (Principal Aquifer) and Fittleworth Member (Secondary A Aquifer).
- P 5 Surface water: via overland flow.
- P 6 Surface water: via drainage discharge.
- P 7 Surface water: via base flow from groundwater.

3.1.3 Potential receptors

The following potential receptors in relation to the proposed land use have been identified.

- R 1 Humans (site end users and neighbours)
- R 2 Development end use (buildings, utilities and landscaping)
- R 3 Groundwater receptors (Folkestone Formation (Principal Aquifer) and Fittleworth Member (Secondary A Aquifer).
- R 4 Surface water: on-site drainage ditch and stream at the NW of the site.

Health and safety risks to site Contractors and maintenance workers have not been assessed during these works and will need to be considered separately.

3.2 Human Health risk assessment

3.2.1 Metals

Hotspots of lead in the MG- General at WS204, WS108 and WS110 in the north site area which represent unacceptable risks and require mitigation measures (see drawing TRS-HYD-XX-ZZ-DR-GE-2003 for location references).

3.2.2 Asbestos

Asbestos (both visible and loose fibres) was identified frequently in the south site area and sporadically in the northern site area. Stockpiles of cement bound asbestos sheets were encountered at surface adjacent to the former quarry entrance. Asbestos containing material was observed in the existing buildings in the north site area of the site (see drawings TRS-HYD-XX-ZZ-DR-GE-2001 and TRS-HYD-XX-ZZ-DR-GE-2002). Hydrock consider it plausible for asbestos to be present in any of the Made Ground soils and asbestos (even at low concentrations) represents an unacceptable risk. Mitigation measures are required for the north and south of the site.

3.2.3 Petroleum Hydrocarbons

Hotspots of petroleum hydrocarbons have been identified at locations WS203B (old fuel pump station), WS102 (former tank storage above ground level), WS108 (as surface waters run off), WS109 (mineral oil spray treatment warehouse area), WS110 and TP07 (pigment store area), and SA104 (Made Ground - Quarry backfill) (see drawing TRS-HYD-XX-ZZ-DR-GE-2003 for location

references). These exceedances present a potentially unacceptable risk and therefore, mitigation measures are required.

3.2.4 PAH

Hotspots of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Indeno(1,2,3,cd)pyrene, chrysene and dibenz(a,h)anthracene were identified in the MG- General (north site area) and MG- Quarry backfill (see drawing TRS-HYD-XX-ZZ-DR-GE-2003 for location references). The exceedances are considered a risk to human health and mitigation measures are required.

3.2.5 Vapours

The vapour risk assessment identified the majority of VOCs tested were reported below the detection limit, with some hydrocarbons and limited chlorinated solvents detected. A minor exceedance of hexachlorobutadiene was reported in WS208. However, given the conservatism adopted in the derivation of the GACvap, such as the source being directly beneath the foundation, no biodegradation and attenuation being solely due to dilution of soil gas moving through the foundation into indoor air, this is not considered to pose a significant risk to human health.

3.3 Plant life risk assessment

Slight elevated concentration of Zinc at location WS212, WS103, WS108 and WS110 and Boron (SA106 and SA103) have been identified in the plant life assessment within the Made Ground - General. However, the made ground is physically unsuitable as a growing medium; therefore, clean, imported soils will be required in gardens and areas of public open space.

3.4 Controlled Waters risk assessment

Based on the risk assessment undertaken on controlled waters, it was concluded that whilst there are some exceedances of the water quality targets, these are not considered to represent a significant risk of pollution of Controlled Waters.

3.5 Ground Gas risk assessment

Based on the monitoring undertaken as part of the Hydrock ground investigation, the computed worst-case Gas Screening Values for carbon dioxide and methane indicate that CS1 conditions and no gas protection measures are required.

3.6 Water Pipelines risk assessment

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

3.7 Summary

The source-pathway-receptor linkages are presented in Section 3.1.1, following the risk evaluation process, require mitigation by the remediation works described herein. Risks requiring mitigation are presented in Table 3.1 and Table 3.2.

Table 3.1: Risks requiring mitigation – north site area

Contaminant Linkage				
Pollutant Linkage	Sources	Pathways	Receptors	Comments
PL 1	Hotspots of lead in the MG- General at WS204, WS108 and WS110.	Ingestion, inhalation or direct contact.	Human health.	Mitigation required in the form of excavation, disposal and verification or engineered cover system.
PL 2	Hotspots of PAH in the MG- General at TP202.	Ingestion, inhalation or direct contact.	Human health.	
PL 3	Hotspots of TPH in MG- General at WS203B, WS102, WS105, WS108, WS109, WS110, TP07.	Ingestion, inhalation or direct contact.	Human health.	Mitigation required in the form of excavation, disposal and verification.
		Direct contact.	Water supply pipes.	Installation of “Protectaline” (or similar) pipework for the affected areas of the site.
PL 4	Sporadic asbestos (visible and loose fibres) in MG- General.	Inhalation of dust and outdoor air.	Human health.	Mitigation required in the form of an engineered cover system. In addition, any ACM encountered during earthworks will need to be handpicked (as far as reasonably practicable) and removed from site. Removal will be required. However, removal under controlled conditions by a licensed asbestos contractor will minimise the release of airborne fibres.
PL 5	Asbestos-containing materials in the buildings.			
PL 6	Hotspot of petroleum hydrocarbons in groundwater at WS203B	Leaching through unsaturated zone.	Groundwater Aquatic life	Localised remediation to be undertaken based on soil exceedances.
PL 7	Hotspots of Zinc and Boron in the MG- General at WS212, WS103, WS108, WS110, SA106 and SA103.	Root uptake.	Plant life.	Imported growing medium will be required.

Table 3.2: Risks requiring mitigation – south site area

Contaminant Linkage				
Pollutant Linkage	Sources	Pathways	Receptors	Comments
PL 8	Hotspot of PAH in the MG-Quarry at SA105A.	Ingestion, inhalation or direct contact.	Human health.	Mitigation required in the form of excavation, disposal and verification or engineered cover system.
PL 9	Hotspot of TPH in MG- Quarry at SA104.	Ingestion, inhalation or direct contact.	Human health.	Mitigation required in the form of excavation, disposal and verification.
PL 10	Frequent asbestos (visible and loose fibres) in MG- Quarry area.	Inhalation of dust and outdoor air.	Human health.	Mitigation required in the form of an engineered cover system. In addition, any ACM encountered during earthworks will need to be handpicked (as far as reasonably practicable) and removed from site.

Should significant volumes of Made Ground with or without evidence of contamination of other unexpected potential sources of contamination be encountered, the Discovery Strategy presented in Appendix C should be followed. Following this, Hydrock Consultants should be contacted for further advice on how to proceed.

4. REMEDIAL OPTIONS APPRAISAL

4.1 Preliminary Assessment

Investigation and risk assessment have concluded that the site will require remediation to mitigate the risk to the identified receptors from lead, PAH, TPH hotspots and sporadic asbestos in across the north area of the site; and to mitigate the risk of PAH and TPH hotspots and frequent asbestos across the south area of the site.

The objectives of the remediation are to sever one or more of the linkages within the source-pathway-receptor (S-P-R) model. Hydrock would consider the objectives of the remediation works to be as follows:

- To break the linkage between the Made Ground - General in the north of the site (which contains elevated concentrations of lead, PAH, TPH, sporadic asbestos in soils and asbestos containing materials within the building fabrics) and site users (construction workers, future site users and neighbours) from ingestion, inhalation or direct contact.
- To break the linkage between the Made Ground - Quarry backfill in the south area of the site (which contains elevated concentrations of PAH, TPH and frequent asbestos) and site users (construction workers, future site users and neighbours) from ingestion, inhalation or direct contact; and utilities such as water pipelines.

This Remediation Options Appraisal has been undertaken in general accordance with Land contamination: risk management (LCRM) (Environment Agency, 2021). It will inform the remediation of the site and reduce / control the risks associated with relevant pollutant linkages to an acceptable level.

4.2 Scope

The scope of the Remediation Options Assessment comprises:

- Provision of background information (provided in Section 2).
- A summary of the findings of the Risk Assessments (provided in Section 3).
- Selection of feasible remediation options (for each relevant pollutant linkage).
- A detailed evaluation of options.
- Selection of the final remediation options.

4.3 Constrains

Any remediation works need to be designed and undertaken with recognition of the site constraints. Whilst the site itself is relatively open and unconstrained, it is located within a residential area and a main road (Rock Road) in the north of the site. Any remediation works will (as much as possible) need to:

- Reduce impact to the adjacent structures with regards to noise, dust, odour and vibration.
- Minimise road traffic by reducing the amount of disposal and maximising re-use of excavated materials.

Regulatory constraints will also need to be addressed. Detailed regulatory discussions and agreement will be required prior to the finalisation of the remediation scheme.

The site is located on a Principal aquifer (Folkestone Formation) over a Secondary A aquifer (Fittleworth Member). The remediation works (and associated geotechnical mitigation) will need ensure that additional risks to the environment are not caused.

4.4 Selection of feasible remediation options (Options Assessment Tier 1)

In accordance with LCRM (2021), the first stage of an options assessment is to select feasible remediation techniques which can be applied to achieve a site which is suitable for the proposed development.

The initial screening process considers the available remedial techniques based on the 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.
- Environmental impact. The remediation treatment should not affect the quality of the environment during or following remediation.
- Relative Cost. The strategy must not entail excessive cost.
- Relative Operational Time. The strategy should work in a feasible and realistic time scale.
- Sustainability. More sustainable options are preferred.

Table 4.1 summarises the accepted remedial techniques readily available in the UK and assesses each against the key parameters listed above.

Initially the effectiveness at treating the contamination is assessed. This is broken down into: effective (Y), partially effective (P) or ineffective (N).

Previous site experience, technical literature and Hydrock's in house knowledge have been used to reject impractical and or unsuitable remediation options. The primary reasons for rejection of an option are due to the ongoing operational constraints, the cost and the inability to treat all the required contaminants. If an option is deemed impractical, it is noted in the comments.

The durability of each of the remediation options is assessed as either: durable (D) i.e. providing a long-term solution; durable with maintenance requirements (D-M) e.g. gas venting trenches or permeable reactive groundwater barrier, which may require inspections and maintaining; or temporary (T) i.e. providing a short-term solution, but not necessarily effective in the long term e.g. groundwater pump and treat without source removal.

The environmental impact is then assessed as: Low (L), Moderate (M) or High (H).

The listed techniques are then assessed in terms of relative cost ranging from: low cost (£), moderately expensive (££), expensive (£££), to prohibitively expensive for the site under consideration (£££+).

Timescale over which the remediation technique is operational has been broadly assessed in units of weeks (W), months (M), years (Y) and decades (D). 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.

Sustainability is assessed based on a relative comparison of: Sustainable (S) or Unsustainable (U).

Table 4.1: Applicability of Remediation Options and Initial Assessment

Method	Remediation options	Effectiveness					Durability	Environmental Impact	Relative Cost	Relative Time	Sustainability	Comments	Feasibility
		Lead	PAH	TPH	Asbestos	Ground gas							
Civil Engineering	Cover System	Y	Y	Y	Y	N	D	L	£-££	W	S	Will prevent contact between future site users and shallow soils and break the S-P-R linkage. May need to be undertaken in association with a Materials Management Plan (MMP)). Will incorporate a preferential pathway for gas migration.	Y
	Excavation and Disposal	Y	Y	Y	Y	P	D	M	£££	W	U	Will effectively remove the source of the contamination but is much less sustainable compared to other feasible options (cost, take up of landfill space, transport issues, need to replace with clean material). Expensive, as soils contain asbestos, petroleum hydrocarbons and PAH at elevated concentrations. However, dependent upon other factors some disposal may be unavoidable. Disposal to be minimised as much as possible by reuse of appropriate soils. May also involve pre-treatment by hand picking, screening and sorting.	Y

	In-situ soil remediation	N	P	P	P	N	D	M	££	W	S	In-situ soil remediation via excavation and processing for reuse may be effective to remove or reduce fragments of asbestos. However, loose fibres would likely remain in the soil limiting the locations and depth at which soils can be reused. In-situ processing may also assist in reducing the financial implications of disposing of waste material by further segregating visible asbestos and thereby reducing the overall waste classification of the bulk of the waste soils. Cannot be undertaken in isolation. Not considered suitable for high concentrations of asbestos fibres. However, soils with low concentrations of asbestos can be used below the cover system.	Y
	Ex-situ soil remediation	Y	Y	Y	P	N	D	M	£££	M	U	Ex-situ soil remediation via excavation and processing for reuse may be effective to remove or reduce fragments of asbestos. However, loose fibres would likely remain in the soil. Low concentrations of asbestos fibres would be difficult to treat. This method is labour intensive, slow and expensive and unlikely to be feasible	N
	Materials Management (Excavation and Re-Use of Suitable Materials)	Y	P	P	Y	N	D	L	££	W	S	Will effectively remove the source of the contamination (lead, PAH, TPH and asbestos) and place it below hardstanding cover to break the pathway. Would need to be undertaken in association with a Materials Management Plan (MMP) prepared in accordance with the CL:AIRE: Definition of Waste Code of Practice (DowCop) and signed off by a Qualified Person.	Y

Physical	Soil washing	N	P	Y	N	N	D	H	£££	M	S	Whilst this may technically work, it is considered impractical due to the creation of a potentially significant volume of geotechnically unsuitable soils, which would require disposal. Large scale plant and equipment. Need to treat process streams (water, sediment) and route to appropriate off-site disposal, as required.	N
	Hydraulic binders	Y	N	Y	P	N	D	M	££ £££	W	S	Feasible, although there are other techniques which may be preferable and pre-treatment may be necessary. 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. May be an option if used in association with other techniques, dependent on volumes to be cost effective. Not appropriate for PAH contamination. May be of limited effectiveness for reducing fibre release potential of loose asbestos fibres in some circumstances	Y
Biological	Biopiles											Will effectively reduce petroleum hydrocarbon concentrations. However, would not remove metals, PAH or asbestos contamination.	N
	Windrow Turning with addition of additives to stimulate aerobic microbial activity	N	N	Y	N	N	D	L	£££	M	S	Will not mitigate the ground gas risk. May be an option if used in association with other techniques, dependent on volumes to be cost effective.	

4.5 Detailed evaluation of options (Options Assessment Tier 2)

The short-list of options presented below represents those technologies which were not rejected during the Tier 1 Options Assessment, and are taken forward to the Tier 2 Options Assessment:

- Excavation and removal of hotspots of lead, PAH and petroleum hydrocarbon impacted soils;
- installation of an engineered cover system in all areas of soft landscaping, comprising a high visibility geotextile layer beneath clean subsoil and topsoil;
- in-situ remediation (hand picking of visible asbestos)
- Materials management (excavation, processing and reuse of suitable materials);
- disposal of excess or unsuitable soils;
- stabilisation and solidification of soils.

The above remediation techniques are discussed in more detail below. It should also be recognised that in addition to the above mitigation works, there is a requirement for:

- geotechnical mitigation to ensure a stable development platform;
- the use of Protectaline (or similar) potable water supply pipework;
- the use of below ground building materials which are resistant to petroleum hydrocarbons.

4.5.1 *Examination and removal of impacted soils and removal of free phase hydrocarbons*

Any petroleum hydrocarbon impacted soils shall be excavated and either treated to make them suitable for use (bioremediation or stabilisation), or disposed off-site, as preferred by the Client and Enablement Contractor.

Any free phase hydrocarbons encountered will be removed from soils and groundwater.

4.5.2 *Installation of an engineered 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.

4.5.3 *In-situ remediation*

In-situ soil remediation via excavation and processing for reuse may be effective to remove or reduce visible fragments of asbestos from the made ground, and it may also assist in reducing the financial implications of disposing of waste material by further segregating visible asbestos and thereby reducing the overall waste classification of the bulk of the waste soils.

After excavations, all soils and the formation level shall be inspected for evidence of visible ACM and, if encountered, the visible ACM will be handpicked (as far as reasonably practicable) and disposed of by a

suitably qualified contractor in line with the mitigation measures presented in this report and all relevant legislation and best practice guidance.

However, loose fibres would likely remain in the soil limiting the locations and depth at which soils can be reused. Soils with suitably low concentrations of asbestos fibres can be used below the cover system.

4.5.4 *Materials management – excavation and reuse of suitable materials*

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 the soils 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.

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, in this case the geotechnical constraints of the site require a robust solution to deal with both the geotechnical and contamination issues.

Detailed discussions will be required with the Environment Agency with regards to waste management at the site. It is envisaged that the DoWCoP will be able to be used (at least in part) for the earthworks and materials management at the site. However, there may be a requirement for an Environmental Permit and potentially the requirement for a waste recovery licence.

4.5.5 *Disposal of excess or unsuitable soils*

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 or if material is proven to be unsuitable.

4.5.6 *Soil stabilisation/solidification*

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

- petroleum hydrocarbons; 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 landscaped 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.

4.6 Selection of the final remediation options

The selected most appropriate remediation options include a combination of:

- appropriate materials handling and stockpiling in accordance with the Materials Management Plan (MMP) (PL1 to PL10).

- In-situ Remediation of soils (hand picking visible ACM) (PL4, PL10);
- watching brief during groundworks (PL1 to PL10);
- installation of Protectaline or similar protective pipework for supply of potable water to the properties (PL3);
- import of subsoil and topsoil in accordance with the Materials Management Plan (MMP) (PL1, PL2, PL3, PL4, PL5, PL7, PL8, PL9, PL10);
- the installation of an engineered cover system in private gardens and POS areas (PL1, PL2, PL3, PL4, PL5, PL7, PL8, PL9, PL10);) comprising:
 - » A geotextile marker layer; and
 - » Imported subsoil / topsoil (600mm in private gardens and 450mm in public open space), comprising a minimum of 150mm topsoil.

5. REMEDIAL STRATEGY AND VERIFICATION PLAN

5.1 Overview

The Remediation Strategy and Verification Plan is presented in the following sections. In addition to this document, all works shall be completed in accordance with a suitable geotechnical specification which will specify the requirements for any backfilling works.

5.2 General Compliance Issues

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

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

5.3 General Comment

The Contractor will be required to secure all necessary permits and licences to allow remediation to be undertaken and prepare appropriate Health and Safety Risk Assessments and Method Statements.

The Contractor shall manage the risks in accordance with their legal requirements. The Contractor will need to prepare appropriate health and safety documentation and obtain appropriate approvals, licences, consents and permits prior to commencement in accordance with the Control of Asbestos Regulations (CAR) 2012. All works on site will require the use of suitable air, dust and noise monitoring, personal protective equipment (PPE) and respiratory protective equipment (RPE) as required by current guidance, practice guidance, legislation and deemed necessary. For more information, refer to Appendix C. However, it should be noted that the guidance provided in Appendix C is the minimum standard to be met by the Contractor(s) and it is the Contractors responsibility to ensure works are undertaken in line with the above.

All works need to be undertaken in accordance with the Remediation Strategy and Verification Plan (this document) and all remediation works are to be overseen by suitably experienced site staff, with a site watching brief or periodic visits made by Hydrock to undertake the necessary verification.

It should also be noted that because soils and other materials arising from the works are to be reused on site, works will need to be completed in accordance with a Materials Management Plan (MMP) prepared in accordance with the ‘CL:AIRE Definition of Waste Development Industry Code of Practice, Version 2, 2011’. Prior to work starting the MMP will have to have been checked and Declared by a Qualified Person, with confirmation of acceptance by CL:AIRE. An MMP cannot be applied retrospectively.

5.4 Summary of Remediation Stages

Based upon the findings of the ground investigation and risk assessment and the Remediation Options Appraisal (presented in Section 4), 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, which is anticipated, works will need to be completed in accordance with the 'CL:AIRE Definition of Waste Development Industry Code of Practice, 2nd Edition'. The Contractor shall produce an appropriate Material Management Plan and provide a 'Qualified Person (QP) Declaration' covering all aspects of the works. Submission of an MMP validation report to CL:AIRE on completion of the works shall also be a responsibility of the appointed contractor.

The following remedial activities will be required to deliver the site Suitable for Use (SFU) for the

The remediation works should aim to maximise the reuse of soils on site and minimise off-site disposal, whilst recognising the end goals of the various Specifications.

The site remediation plan (reference TRS-HYD-XX-XX-DR-GE-3001) is presented in Appendix A.

5.4.1 Pre-Demolition Phase

- Task 1: Project setup and management including liaison with the Local Authority, Environment Agency and Health and Safety Executive, where necessary, with appropriate permits / licences / consents / approvals granted.
- Task 2: Appointment of an appropriate contractor and appropriate permits / licences / consents / approvals.
- Task 3: Pre-works air quality boundary monitoring for dust and asbestos, before demolition and earthworks commence and during the earthworks. Site boundary assessment.

5.4.2 Demolition Phase

- Task 4: refurbishment / demolition asbestos survey;
- Task 5: site clearance;
- Task 6: removal of asbestos by specialist Contractors in accordance with the asbestos survey and relevant legislation (PL5);
- Task 7: removal of above ground tanks and associated pipework;
- Task 8: demolition of site buildings and ancillary structures to slab level; and
- Task 9: processing the demolition arisings to a suitable specification in accordance with the WRAP 'Quality Protocol: Aggregates from inert waste'.

5.4.3 Enablement Phase

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

- Task 10: Demolition, break out of hardstanding and below-ground obstructions and below slab inspection.
- Task 11: Decommission of historical boreholes as required.
- Task 12: Removal of any below ground tanks, existing drainage system and associated pipework.

- Task 13: Examination of soils below and around all potential point sources (tanks, drums, pipes, drains and areas of staining) and known hotspots (WS203B, WS204, WS102, WS105, WS108, WS109, WS110, TP07, SA104 and SA105A) and excavation of impacted soils (PL1, PL2, PL3, PL8, PL9);
- Task 14: Disposal of petroleum hydrocarbon contaminated soils (or treatment and reuse if considered viable);
- Task 15: Removal of any free phase hydrocarbons (soil and groundwater) and treatment (pump and treat / chemical oxidation / etc.) of dissolved phase petroleum hydrocarbons in groundwater at hotspot WS203B and potentially the wider fuel storage area as required during soil remediation (PL6);
- Task 16: Removal and mitigation of asbestos in soils (PL4, PL10).
- Task 17: Excavation of Made Ground and natural soils as required to allow construction with appropriate materials management and processing of excavated soils using a combination of: excavation and stockpiling and screening of soils to leave the site at the level required for the installation of a working platform, pavement construction and to allow the installation of a 600mm engineered cover system in private gardens and 450mm in Public Open Space (PL1, PL2, PL3, PL4, PL7, PL8, PL9, PL10);
- Task 18: Reuse and placement of soils (Materials management)
- Task 19: Off-site disposal of unsuitable or excess material; and
- Task 20: Verification during Enablement Works.

During the works, appropriate mitigation in line with the Control of Asbestos Regulations and CARSoil for asbestos should be undertaken.

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

Due to the potential for low concentrations of dissolved phase petroleum hydrocarbons in the groundwater, treatment of any water pumped from excavations (via a granulated activated carbon plant) may be required prior to discharge from the site. This would apply to both the enablement and construction phase of works.

5.4.4 Construction Phase

The Construction Phase of works will either be undertaken by a separate Contractor, or the same Enablement Works Contractor. The Contractor shall undertake:

- Task 21: installation of Protectaline or similar protective pipework for supply of potable water to the properties (PL3);
- Task 22: Import of subsoil and topsoil in accordance with the Materials Management Plan (MMP);
- Task 23: Installation of an engineered cover system (600mm in private gardens and 450mm in public open space), comprising a geotextile marker layer, subsoil and a minimum of 150mm topsoil.
- Task 24: Verification during Construction Works

5.4.5 General Note

All site staff shall be made aware of the possible presence for contamination, and specifically asbestos, within the Made Ground soils anywhere on the site at any stage of the development. The Contractor

shall also keep a watching brief for other contaminants, including hydrocarbons such as diesel, petrol, paraffin, heating oil, lubricating oils and hydraulic oils. The Discovery Strategy is included in Appendix C.

The Contractor shall manage all risks in accordance with their legal requirements and will need to prepare appropriate health and safety and environmental compliance 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 appropriately trained staff, 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 that deemed necessary.

In addition to information provided by the Client, the Contractor's attention is drawn to the General Requirements set out in Appendix D, which detail the general requirements and responsibilities of the Contractor in relation to Health and Safety, site set up and operational requirements. It should be noted that the guidance provided in Appendix D and is the minimum standards to be met by the Contractor(s). It is the Contractors' responsibility to ensure works are undertaken in line with current guidance, practice guidance and legislation.

6. REMEDIAL STRATEGY IMPLEMENTATION - PRE-DEMOLITION PHASE

6.1 Task 1: Project set-up

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, the Environment Agency where required, and the NHBC for comment.

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

6.2 Task 2: Contractor appointment

Under the CDM regulations, Redrow Homes Ltd (the Client) should appoint a Principal Designer, who would provide the Pre-construction Information Report (PCIR) and a Principal Contractor who would provide a site-specific Construction Phase Health and Safety Plan (CPHASP) prior to works commencing. If the client does not appoint a Principal Designer, they will assume the role.

The Principal Designer will review the CPHASP and notify the local office of the Health and Safety Executive (HSE) of the works prior to commencing (via form F10).

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

It is the contractor's responsibility to decide, based on the information presented, whether the works required (both demolition and earthworks) are notifiable and/or require the assistance of a 'Licensed Asbestos Removal Contractor' with respect to the Control of Asbestos Regulations (CAR) 2012 and the associated industry guidance, CAR-SOIL™ (Interpretation for Managing and Working with Asbestos in Soils and Construction and Demolition Materials – 2016).

The Principal Contractor will be responsible for implementing any MMP for the site developed by a suitably qualified and experienced consultant.

The 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.

6.3 Task 3: Air quality boundary monitoring for asbestos and dust, boundary assessment

From the investigations undertaken, frequent asbestos has been encountered in the Made Ground-Quarry Backfill (south of the site), and sporadic asbestos has been encountered in the Made Ground-General (north of the site). Asbestos containing materials were also identified as part of the building construction (north site area). Consequently, boundary air quality monitoring will be undertaken before site works commence to establish baseline conditions and include airborne asbestos fibres. This monitoring will continue during enablement works to determine if during the works there is evidence of an increased risk of release of fibres to the air/surface soils.

Boundary air monitoring results during works shall be compared with acceptable maximum standards set by the HSE. For asbestos these air monitoring procedures and limits are given in HSG 248 entitled "Asbestos: The analysts' guide for sampling, analysis and clearance procedures" and CAR 2012. The limit

used is governed by the levels stated in the above guidance documents and the accuracy of the testing used.

However, for asbestos, Hydrock recommend using the most stringent limit set by the HSE. Asbestos air monitoring results are acceptable only if they fall below this limit and are as low as reasonably practical (<0.01f/ml). Exposure from work activities involving asbestos must be reduced to as far below the control limit as possible, personal monitoring results should be within the a 'Assigned Protection Factor' (APF) of any RPE in use.

The appointed contractor shall produce a photographic record of all boundaries of the site. In addition, the contractor shall identify those areas where they consider remedial works will not be able to be undertaken to the boundary line. A drawing, with justification, showing any offset from the boundary line shall be provided to Hydrock for review and comment.

7. REMEDIAL STRATEGY IMPLEMENTATION - DEMOLITION PHASE

7.1 Task 4 to 8:

Demolition to ground level is anticipated to be covered by a standalone demolition strategy to be provided by the Contractor. This should include removal of all identified and encountered asbestos within buildings under controlled conditions in line with CAR 2012.

8. REMEDIAL STRATEGY IMPLEMENTATION - ENABLEMENT PHASE

The Enablement Contractor will undertake the following works.

8.1 Task 10: Demolition, breaking out of hardstanding and below ground obstructions and below slab inspection

The enabling works contractor shall demolish, break up and remove below ground structures in accordance with, but not limited to, the GDR and EWS (to be completed). These include, but are not limited to slabs, pits, drains, hardstanding, foundations, relic structures, service ducts, underground storage tanks and basements etc.

Below ground obstructions should be removed to a minimum depth of 2m below ground level (bgl). It should be noted that this is not a formation level, as this cannot be established at this stage as design is on-going. It should also be noted that the formation level may require excavation to a depth exceeding 2m bgl, subject to final design.

All materials shall be segregated and stockpiled within the approved working area of the site. Material shall be stockpiled at locations to be agreed with the Client and after submission of the detailed method statements.

The contractor shall inform the consultant after each area is exposed to the required contract level so that they may attend and witness the excavation. The contractor shall survey to Ordnance Survey Grid (using Total Station survey equipment) the base and sides of all excavations and will provide a composite base of excavation drawing for reference during the works, and as built records.

During the excavation of slabs etc. the contractor will undertake additional visual investigation, with any additional plausible contaminant sources identified (hotspots/tanks/drainage runs/visible ACM etc) to be dealt with as a hotspot and addressed as per the tasks below.

The contractor shall provide adequate protection against collapse of the excavations and suitable groundwater control measures shall be put in place until the voids are backfilled to a suitable geotechnical specification.

The contractor shall ensure that, where structures or services cross the site boundary and are to remain, the risk of any future contamination entering or leaving the site area through these pathways is negligible. The contractor shall state his methodology for ensuring this requirement.

Any residual obstruction proposed to be left in-situ beyond the 2m bgl removal shall be agreed with Hydrock and surveyed to OS grid.

All unsuitable material is to be removed from site to a suitably licensed facility.

8.2 Task 11: Decommission of historical boreholes

A number of ground investigation boreholes are present within the site boundary, potentially acting as pathway for contamination. It is recommended that these be decommissioned in line with EA guidance (Good practice for decommissioning redundant boreholes and wells, 2012) to ensure no contamination pathways between the shallow and deep groundwater are present.

8.3 Task 12: Removal of any below ground tanks, existing drainage system and associated pipework

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

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.

A watching brief should be kept during the removal works of below ground tanks and all other potential point sources by an independent environmental Consultant and if impacted material is present during excavation, these materials should be stockpiled separately (i.e. quarantined) for testing prior to reuse if suitable.

The excavation of buried tanks is to be witnessed by the Consultant (the Enablement Contractor is to notify the Consultant when tanks are encountered and are to be removed) and the base of excavations are to be surveyed.

8.4 Task 13: Examination of soils below and around all potential point sources (tanks, drums, pipes, drains and areas of staining) and known hotspots (WS203B, WS204, WS102, WS105, WS108, WS109, WS110, TP07, SA104 and SA105A) and excavation/ removal of impacted soils (PL1, PL2, PL3, PL8, PL9);

Elevated concentrations of lead, petroleum hydrocarbons and PAH, in excess of the GAC, have been detected in the Made Ground (both north and south site areas). These are shown on Hydrock drawing TRS-HYD-XX-ZZ-DR-GE-2003. Known hotspots of lead have been identified at locations WS108, WS110 and WS204 (in the north of the site); and hotspots of petroleum hydrocarbons and PAH have been identified during the Hydrock ground investigations at locations SA104 and SA105A (south site area), and at locations TP07, TP202, WS102, WS108, WS105, WS109, WS110 and WS203B (north site area). There is significant potential for additional petroleum hydrocarbon hotspots and impacted soils to be identified post demolition and site clearance. As such, petroleum hydrocarbon hotspots are required to be examined, assessed and potentially removed to prevent adverse impact on controlled waters.

Lead, petroleum hydrocarbon and PAH impacted soils removal will be undertaken by excavation of soils from areas of contamination encountered during remediation (both known and unknown). The Enablement Contractor will need to have an experienced Geo-environmental Engineer present during excavation to inspect for suspect material and oversee effective segregation, stockpiling and validation

of soils. In addition, Hydrock will undertake a watching brief and the Enablement Contractor is to inform Hydrock prior to hotspot excavation.

The delineation of the full extent of all hotspots or contamination has not been undertaken during the works to date. Delineation will be required by the Enablement Contractor during remediation to define the extents of all hotspots and contamination encountered. Any 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. Hydrock Consultants accept no liability with regards to volume estimates calculated.

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

Validation of the removal of the hotspots is proposed by the chemical analysis of samples recovered from the sides and base of hotspot excavations. For large excavations in excess of 100m², a 5m validation grid (on all sides and base) is proposed.

After excavations, all soils and the formation level shall be inspected for evidence of visible ACM and, if encountered, the visible ACM will be handpicked (as far as reasonably practicable) and disposed of by a suitably qualified contractor in line with the mitigation measures presented in this report and all relevant legislation and best practice guidance.

Validation is to be undertaken by an experienced geo-environmental engineer (working on behalf of the contractor or the Client) in accordance with the remedial target values (RTVs) described below and as detailed in Table 8.1. If hotspots for other contaminants of concern (CoC) are identified during further investigation works, RTVs will be developed for the relevant CoC.

The following chemical criteria shall be used for excavation validation and re-use criteria with respect to petroleum hydrocarbon contamination. The values are those derived in Hydrock report 08347-HYD-XX-XX-RP-GE-1004 for a soil source of hydrocarbons with respect to contaminated soils. Additionally, materials shall comply with the following:

- no visual contamination (oil staining etc.);
- limited deleterious material (organics, wood, metal etc.), in accordance with any geotechnical specification;
- no visible ACM (as far as reasonably practicable);
- asbestos fibres content <0.001%.

Once impacted soils have been removed, tested and assessed to confirm that they comply with the relevant RTV, materials excavated from the hotspots can be reused on site when in accordance with an approved Materials Management Plan.

Once the excavation has been validated, the excavations are to be backfilled in accordance with the Geotechnical Design Report and Earthworks Specification, where required.

Table 8.1: Lead and petroleum hydrocarbons validation criteria (GAC for residential with private gardens end-use 1% SOM)

Chemical of Concern	Proposed RTV mg/kg		Chemical of Concern	Proposed RTV mg/kg
Lead	200		Acenaphthene	220
Aliphatics EC5-EC6	42		Acenaphthylene	180
Aliphatics >EC6-EC8	100		Anthracene	2400
Aliphatics >EC8-EC10	27		Benz(a)anthracene	4.2
Aliphatics >EC10-EC12	48		Benzo(a)pyrene	1.5
Aliphatics >EC12-EC16	24		Benzo(b)fluoranthene	7.6
Aliphatics >EC16-EC35	65,000		Benzo(ghi)perylene	64
Aliphatics >EC35-EC44	65,000		Benzo(k)fluoranthene	12
Aromatics EC5-EC7	73		Chrysene	7.7
Aromatics >EC7-EC8	130		Dibenz(a,h)anthracene	1.1
Aromatics >EC8-EC10	35		Fluoranthene	290
Aromatics >EC10-EC12	75		Fluorene	170
Aromatics >EC12-EC16	150		Indeno(1,2,3,cd)pyrene	4.3
Aromatics >EC16-EC21	260		Naphthalene	2.2
Aromatics >EC21-EC35	1,100		Phenanthrene	97
Aromatics >EC35-EC44	1,100		Pyrene	620

8.5 Task 14: disposal of petroleum hydrocarbon contaminated soils (or treatment and reuse if considered viable);

With regards to off-site disposal of petroleum hydrocarbons:

- Where recorded concentrations of are greater than the RTV, they shall be excavated and removed from site to a licenced treated or disposal facility; and
- Where free product is present, this is to be removed.
- Any Asbestos Containing Material (ACM) encountered during the works is to be removed (as afar as reasonably practicable) during the excavation and placement works.
- Removal of all soils that exceed the RTVs or contain free product is to be undertaken regardless of depth.

As an alternative to off-site disposal, any hydrocarbon impacted soils which fail the RTV for hydrocarbons may be remediated ex situ through the use of a suitable technique.

All materials proposed for treatment shall be inspected on behalf of the contractor by an experienced geo-environmental engineer 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 need to be undertaken in accordance with an appropriate environmental permit, deployed by the contractor.

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.

With regards to treated soils, samples should be taken and tested at a rate of one test per 250m³ to prove they are suitable for use and compared, in accordance with the shallow soil target values obtained from the detailed quantitative risk assessment and defined in Table 6.1, unless subsequently revised with the agreement of the regulator.

8.6 Task 15: Removal of free phase hydrocarbons and treatment (pump and treat / chemical oxidation / etc.) of dissolved phase petroleum hydrocarbons in groundwater at hotspot WS203B and potentially the wider fuel storage area as required during soil remediation (PL6);

During the Enablement works, any free phase hydrocarbons encountered are to be removed by excavation of the impacted area, skimming pumps or the use of absorbent pads (or if perched water is present by pumping or skimming) to secure above ground containers.

Any free phase hydrocarbons removed from the surface of perched water shall be treated and discharged to sewer or disposed of by tanker according to current legislation and agreed permit. The method of discharge and the RTVs for groundwater discharge are to be agreed with the relevant licencing or permitting authority.

Any water pumped from excavations, especially in areas within the vicinity of hotspot WS203B (former fuel storage area) is likely to need to be passed via a Granulated Activated Carbon treatment system and settlement tanks before being discharged to the sewer or surface drainage. The Contractor shall allow for this in its rates.

If soils containing free product are excavated, they are to be placed in a secure bunded area on an impermeable membrane with the free phase product being allowed to drain to a sump for collection. The excavated soils are to be then added to the ex situ remediation works as described in Section 8.5. If materials escape, the Enablement Contractor is to undertake (at their cost) appropriate remedial action as soon as possible.

8.7 Task 16: Removal and mitigation of asbestos

Asbestos has been identified by laboratory testing of samples of the Made Ground - General in the north site area at location SA103 (<0.001%w/w); and Made Ground - Quarry Backfill in the south area of the site at locations TP13, TP14, TP221, TP222, TP224, TP229 (between <0.001% and 0.424% w/w) as presented in drawing reference TRS-HYD-XX-ZZ-DR-GE-2002. In addition, viable asbestos has been identified in multiple locations, predominantly in the in the Made Ground - Quarry Backfill with two locations in the north site area (HP202 and SA107).

An engineered cover system (detailed in Task 23, Section 9.3) will be required to mitigate the risk to human health from asbestos in soils.

In addition, all excavated soils and the formation level shall be inspected for evidence of visible ACM and, if encountered, the visible ACM will be handpicked (as far as reasonably practicable) and disposed of by a suitably qualified contractor in line with the mitigation measures detailed in Section 8.11 and all relevant legislation and best practice guidance.

If hotspots of visible ACM are found, these should be excavated under a watching brief by a suitably trained and experienced Geo-environmental Engineer, the sides and base of the excavation validated by visual inspection and if required, testing to confirm <0.001% w/w asbestos. For large excavations a 10m validation grid (base and sides) is proposed.

- 8.8 Task 17: Excavation of Made Ground and natural soils as required to allow construction with appropriate materials management and processing of excavated soils using a combination of: excavation and stockpiling and screening of soils to leave the site at the level required for the installation of a working platform, pavement construction and to allow the installation of an engineered cover system (PL1, PL2, PL3, PL4, PL7, PL8, PL9, PL10);

Soils on site will be excavated to reach the required formation level, which is to be established after a design for the proposed development is finalised. Excavated materials will be stockpiled visually inspected (for ACM), and tested to determine their fate (on-site re-use or off-site disposal) in accordance with a Materials Tracking System which the contractor will be required to formulate.

The Principal and Main Contractor will manage Works in accordance with relevant legislation.

Any areas of unexpected contamination encountered during excavation works should be dealt with in line with the Discovery Strategy at Appendix C and the relevant Task in this RSVP.

- 8.9 Task 18: Reuse and placement of soils (Materials management)

Reuse of soils is recommended where appropriate 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).

If reuse of soils in accordance with an 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 clean cover for landscaped areas (e.g. natural soils), which comply with the requirements of Table 8.1.

Soils potentially suitable for reuse on site below clean cover for landscaped areas, buildings and hardstanding areas (i.e. soils which comply with the RTVs in Table 8.1. but fail the cover system criteria in Table 9.1).

- Soils unsuitable for use (e.g. untreated petroleum hydrocarbon hotspots or soils containing gross ACM. These will be disposed of off-site).
- Soils that are to be reused on site will be recorded in an MMP/site waste management plan and accompanied with supporting excavation and placement logs.

The reuse of soils on site and material management is discussed further in Section 10.

- 8.10 Task 19: Off-site disposal of unsuitable or excess material

Any surplus (i.e. soils which cannot be reused on site due to volumes), or unsuitable soils (i.e. soils which fail the RTVs and cannot be reused in an appropriate location), or are not geotechnically suitable, shall be disposed of by the Contractor at the Contractors cost. If the material is not suitable for use, the Contractor is to remove and dispose of it in accordance with the RSVP.

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.

8.11 Mitigation measures during enablement works

8.11.1 Asbestos

The following mitigation measures should be put in place to mitigate the release of airborne fibres during excavation works and in case of encountering any gross visible Asbestos Containing Materials (ACM).

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

- In accordance with CAR 2012 (Regulation 16) the Contractor has a duty to 'prevent or reduce the spread of asbestos anywhere where work is being carried out under their control'. Where complete prevention is not reasonably practicable (this would constitute such a case), the regulation requires the Contractor to reduce to the lowest level reasonably practicable the spread/potential for fibre release of asbestos from any place where work under the Contractor control is carried out.
- CAR 2012 notes that the Contractor should select and use work methods that will reduce the disturbance and release of asbestos fragments and fibres to minimise the risk of spread, e.g. by removing items intact or whole and by using dust suppression techniques. ACMs must never be left loose or in a state where they can be trampled on or spread. All asbestos waste should be bagged or wrapped promptly after removal and the waste should be removed from the work area regularly.

Additionally, where enclosures are not used (and this is one of those instances, as it is not reasonably practicable to do so), the Contractors risk assessment should establish what will be required to make sure that, as far as is reasonably practicable:

- the spread of asbestos is prevented (airborne fibres and asbestos in soils);
- people not involved in the work are excluded from the area;
- the work area is totally cleaned after work is completed.

For the proposed activities, there are two activities which could release fibres 1) excavation of soils containing gross ACM and 2) placement of soils containing gross ACM. It is reasonably practicable for visible 'gross'/highly fibrous materials to be handpicked and double bagged at the point of excavation. As this material has then been removed, and the potential to liberate fibre on the second activity (placement) has thus been alleviated or reduced to as low a level as reasonably practicable.

As such, in addition to a surface inspection and pick, hand picking of gross ACM is required during excavation and placement activities to ensure that as far as reasonably practicable all visible gross ACM has been removed.

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

The working Detailed Remediation Method Statement (DRMS), including task specific risk assessments and method statements should be prepared by the Contractor and be in place, and risks and required mitigation measures communicated to all relevant personnel prior to the works commencing. Appropriate monitoring, PPE and RPE should be provided and utilised. The working method shall be provided to Hydrock for comment two weeks prior to commencement on site.

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

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

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

Air monitoring for asbestos is required on an ongoing basis during the enablement works (frequency to be set out in the Asbestos Working Plan) and the results shall be compared with acceptable maximum standards set by the HSE. These air monitoring procedures and limits are given in HSG 248 entitled 'Asbestos: The analysts' guide for sampling, analysis and clearance procedures' and CAR 2012. The monitoring should be undertaken by a UKAS accredited laboratory. The limit used is governed by the levels stated in the above guidance documents and the accuracy of the testing used. However, Hydrock recommends using the most stringent limit set by the HSE. Air monitoring results are acceptable only if they fall below this limit and are as low as reasonably practicable. Exposure from work activities involving asbestos must be reduced to as far below the control limit as possible.

8.11.2 Control of risk from dust emissions

8.11.2.1 Dust suppression

To reduce the potential for the generation of dust, it is recommended that double handling of soils is kept to a minimum and soils are disposed of by direct transfer to wagons and measures to minimise dust (e.g. wind or plant / vehicle movements) should be undertaken.

Appropriate risk assessment and mitigation measures should be in place throughout the development. As a minimum, this should include damping down of the site surface, excavations and stockpiles to prevent the generation of dust, additional measures may include:

- stockpiles (if any are created) should be kept to a minimum to reduce 'wind whip' causing potentially hazardous material to be blown from the pile;
- air quality and dust monitoring stations will be set up and monitored by the contractor to record the dust concentrations during the works;
- stockpiles shall be placed on a suitable and robust polythene membrane or hardstanding to prevent any cross contamination;
- 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 Contractor, based on site constraints, should make the final choice, the options may include covering with plastic/polythene membrane, or by a layer of clean soil material;
- plant will be appropriately loaded to prevent spillages;
- the drop distance from excavator bucket to stockpile/process plant will be kept as short as reasonably practicable to reduce dust; and
- appropriate signage should be displayed so that site workers/visitors are alerted to the potential hazards associated with the material to be stored on site, and roadways within the site will be kept moist by spraying from a water bowser.

8.11.2.2 Vehicle movements

Risks associated with the transport of soils that potentially contain asbestos fibres, such as dust emission, should be appropriately managed.

The works could create mud from vehicle movements and subsequent tracking off site on vehicle tyres. This will be managed during the works to prevent off site mud transfer. Measures to control these issues may include the provision of a wheel wash facility and when necessary, a mechanical road sweeper to further ensure that the road is kept clean.

8.11.2.3 Personal monitoring

As a matter of good practice, construction workers and services personnel should follow guidance stated in 'HSG 66 Protection of Workers and the General Public during Redevelopment of Contaminated Land' during development works. Adequate standard personal protective equipment and the implementation of basic hygiene measures will be necessary.

Ground workers and sub-surface maintenance workers should be made aware of the possibility of encountering contaminants within soils or groundwater at the site through 'toolbox' talks.

Safe working procedures should be implemented in accordance with CIRIA132, 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.

Ground operatives must be provided with access to a combination of suitable personal protective equipment (PPE) and respiratory protective equipment (RPE) for immediate use if required. When working in known area of risk, groundworkers are to have appropriate personal UKAS accredited air monitoring to monitor for the presence of airborne asbestos fibres and assess the suitability of the RPE provided. The monitoring should be carried out to provide proof that control measure effective in reducing fibre liberation as far as reasonably practicable and that provided PPE/RPE are sufficient. However, constant personal monitoring throughout the remediation process is not required.

Should elevated levels of airborne asbestos fibres be recorded during personal monitoring, the work item or area shall be suspended and the area affected will be declared a total exclusion zone, the perimeter of which being 3m beyond the limit of the asbestos. A further 3m safety zone shall be established and clearly marked. The Principal Contractor Site Manager shall be immediately informed, who will consider if further mitigation measures are necessary, e.g. whether materials need to be further covered. The Site Manager will inform the client and the EHO within 24 hours of the

encountering suspected asbestos materials / the airborne asbestos fibres recorded and agree measures necessary.

8.11.3 *Management of groundwater*

There will be a requirement to appropriately manage any accumulation of groundwater in excavations. The Contractor will be required to make arrangements for the treatment and disposal of accumulated groundwater during excavation works.

If treatment of groundwater is required (e.g. in the vicinity of fuel storage infrastructure and contaminated groundwater at WS203B) it is the Contractor's responsibility to obtain all relevant licences and consents.

8.12 **Task 20: Validation criteria during enablement works**

The following sections detail the role of the contractor in providing validation criteria to be used during the enablement works.

8.12.1 *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+A2:2017 '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. Updated versions of these documents are to be provided to the Consultant by 10:00am every Monday morning throughout the Contract.

8.12.2 *Asbestos*

There is 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 been detected in the Made Ground (both north and south site areas) during the investigation and the Contractor shall 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).

8.12.3 Hotspots

8.12.3.1 Soils

Validation of hotspots ((WS203B, WS204, WS102, WS105, WS108, WS109, WS110, TP07, SA104 and SA105A) by the chemical analysis of the sides and base of excavations is required. If the excavation is greater than 100m², a 10m validation grid (on all sides and base) is required.

If soils have been treated, samples should be taken and tested at a rate of one test per 250m³. A minimum of four test should be undertaken.

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 Table 8.1.

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.

8.12.3.2 Controlled Waters

While localised groundwater contamination has been identified, it was determined that the site presents a low risk to controlled waters.

Notwithstanding the above, it is recommended that protection of controlled waters form part of a Construction Environmental Management Plan and mitigation measures be in place to prevent any further contamination. Surface water courses must be protected from any impact from site activities.

Any groundwater containing contaminants in excess of the RTVs, the affected water will require treatment or disposal using a suitable discharge license.

8.12.4 Enablement Contractor's Verification Reports

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. All chemical data is also required in Excel format.

8.12.4.1 Materials Management validation report

The Materials Management Validation Report is to document the validation of the approved Materials Management Plan and is intended to be submitted to CL:AIRE to close out the declaration. This shall 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:
 - » stockpile inspection records;
 - » stockpile reuse appraisal record;
 - » volumes, origin and placement location of soils referenced to field results and inspections;
 - » details and quantities of excavated, screened, treated, imported and reused soils; and
- Records of earthworks excavations including as built drawings, photographs, quantities of materials and records of progress.

8.12.4.2 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 material 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; and
 - » details of waste facilities where materials were disposed of.
- Stockpile plan of all stockpiles generated by the works and remaining on site.
- Copies of 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 by the structural design and Geotechnical Design Report.

Information associated with regulatory health and safety, control of noise, nuisance, dust, and waste will be excluded from the technical validation 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.

9. REMEDIATION STRATEGY IMPLEMENTATION - CONSTRUCTION PHASE

The following will be undertaken during the Construction Phase of Works either by the Enablement Contractors or a separate Ground Works Contractor.

9.1 Task 21: installation of Protectaline or similar protective pipework for supply of potable water to the properties (PL3)

It is recommended the Contractor is to install Protectaline (or similar) pipework for potable water supply in areas where the contaminated Made Ground is present (hotspots TP202, WS203B, WS102, WS105, WS108, WS109, WS110, TP07 in the north area of the site and hotspots SA104 and SA105A in the south area of the site). This is to be confirmed with the water supply company at the earliest opportunity.

Where barrier pipework is required, it is to be validated by the Contractor as per Section 8.4.1.

9.2 Task 22: Import of subsoil and topsoil in accordance with the Materials Management Plan (MMP)

Any imported subsoil and topsoil will need to meet the chemical criteria as detailed in Table 9.1.

Depending on the source or variability of imported material, Hydrock, at their discretion, request additional testing be undertaken. If constant sources are used and the results recorded are consistently low, consideration may be given to reducing the number of samples tested.

Any soils proposed for use in the works should be from a source not expected to be contaminated and meet both physical and chemical criteria detailed in Section 8.3.3 and 8.3.4.

The procedure for importation of soils to site is provided in Section 10.

If the materials are won from the site, they need to be tested prior to reuse and the test results provided to the Consultant.

9.3 Task 23: Installation of an engineered cover system (600mm in private gardens and 450mm in public open space), comprising a geotextile marker layer, subsoil and a minimum of 150mm topsoil

All private gardens and Public Open Space areas (POS) will require a cover system to mitigate against the risk from elevated concentrations of asbestos and hydrocarbons in the Made Ground (both north and south of the site).

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

- Beneath building footprints, excavate as per the structural design (by others). The floor slab will break the link between the soils and potential receptors.
- Beneath areas of hard standing (roads, drives, pathways etc.), excavate as required by the road design and replace with suitable construction thickness as per road design and capping requirements. The hard standing will break the link between the soils and potential receptors.
- Service trenches, over excavation (450mm both sides and 450mm below) and backfill with clean materials.

- Beneath private gardens, excavate to 600mm below final ground level (deeper where tree pits are required), and replace with a cover system.
- Beneath POS areas, excavate to 450mm below final ground level (deeper where tree pits are required), and replace with a cover system.

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

- a high visibility geotextile marker layer; and
- Imported subsoil / topsoil (600mm in private gardens and 450mm in public open space), comprising a minimum of 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 Contractor and verified by Hydrock Consultants (or another independent consultant).

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. Any imported or site won subsoil and imported Topsoil should be stored on site in stockpiles on a geotextile break layer.
6. Install the high visibility geotextile layer.
7. Place the required thickness of clean Subsoil and Topsoil, (of which a minimum 150 mm is to be Topsoil) and verify the thickness (Hydrock are to be contacted to validate).

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.

In order to ensure compliance with any proposed MMP it is necessary for imported material to achieve both the physical and chemical properties stipulated in Sections 9.3.3 and 9.3.4.

9.3.1 *Sourcing of material*

The criteria for site won material (subsoil) and imported subsoil and Topsoil is detailed in Sections 9.3.3 and 9.3.4. Any imported soils should be from a natural source not expected to be contaminated.

Prior to importation of clean 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 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 prior to import to confirm it is appropriate for use within the cover system. Material which is imported and subsequently found to fail the criteria will need to be removed from site to an appropriate facility with all costs borne by the contractor.

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 9.3 for quantities of testing and testing schedules.

9.3.2 *Stockpiling of Materials*

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.

Imported 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 notes 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 B. Other templates or documentation may be used. These sheets should be available for inspection by the Client, the Consultant, Local Authority staff and others involved with this development. A copy should also be given to the Consultant when verification visits are made.

9.3.3 *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 and/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.

Imported soils 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.

Furthermore, there shall be no visual contamination (oil staining, etc.) as confirmed by Hydrock Consultants watching brief.

9.3.4 *Chemical Requirements of Cover System Soils*

For all imported soils as part of the cover system, certification from the commercial supplier should be reviewed prior to import, or if not a commercial supplier, then the soils should be tested at source.

Chemical testing will then be required once the material arrives at site. Testing should be undertaken at a rate of one test per 250m³, with a minimum of four tests per import round, or 1 per 4 plots of each topsoil and subsoil. For site won material, this should be tested at a rate of one test per 100m³, with a minimum of four tests per testing 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 acceptable, consideration may be given to reducing the number of samples tested.

The results of chemical testing of all material to be used in the cover system are to be compared with the cover system criteria presented in Table 9.1. If any of these thresholds are exceeded the material shall be considered to be unsuitable and disposed off-site.

Testing should be carried out for the following general suite of contaminants and the results compared to Table 9.1:

- As, B (water soluble), Be, Cd, Cr (total), Cr(VI), Cu, Hg, Ni, Pb, S (elemental), Se, V, Zn, cyanide (total), sulfide, pH, asbestos screen, speciated polycyclic aromatic hydrocarbons (PAH, by GC-FID), total phenols and fraction of organic carbon; and
- TPH level 2.
- Asbestos fibres <0.01% for re-use Made Ground material below the cover system/hardstanding.

Table 9.1: Import and Reuse Criteria – Cover System

Contaminant	RTV (mg/kg)	Contaminant	RTV (mg/kg)
Arsenic	37	Acenaphthene	220
Beryllium	73	Acenaphthylene	180
Boron	3*	Anthracene	2400
Cadmium	14	Benz(a)anthracene	4.2
Chromium (III)	400*	Benzo(a)pyrene	1.5
Chromium (VI)	6.1	Benzo(b)fluoranthene	7.6
Copper	135*	Benzo(ghi)perylene	64
Lead	200	Benzo(k)fluoranthene	12
Mercury, inorganic	170	Chrysene	7.7
Nickel	75*	Dibenz(a,h)anthracene	1.1
Selenium	360	Fluoranthene	290
Vanadium	410	Fluorene	170
Zinc	300*	Indeno(1,2,3,cd)pyrene	4.3
Cyanide (free)	790	Naphthalene	2.2
Phenol (total)	290	Phenanthrene	97
Asbestos w/w (%)	Nil	Pyrene	620
Total TPH	100	Total PAH	50
If Total TPH exceeds 50mg/kg:			
Aliphatics EC5-EC6	42	Aromatics EC5-EC7	73
Aliphatics >EC6-EC8	100	Aromatics >EC7-EC8	130
Aliphatics >EC8-EC10	27	Aromatics >EC8-EC10	35
Aliphatics >EC10-EC12	48	Aromatics >EC10-EC12	75
Aliphatics >EC12-EC16	24	Aromatics >EC12-EC16	150
Aliphatics >EC16-EC35	1,000**	Aromatics >EC16-EC21	260
Aliphatics >EC35-EC44	1,000**	Aromatics >EC21-EC35	1,000**
		Aromatics >EC35-EC44	1,000**
If not marked, demotes protective of human health. *denotes protective of plant life. **limited to 1000 mg/kg. A minimum of four chemical analyses shall be undertaken on any individual source material or import round. Depending on the source or variability of imported material, the nominated Consultant may, at their discretion, request additional testing 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 analysed. Based on residential with plant uptake GAC for 1% SOM for Human Health and pH 7 for plant life.			

Table 9.2: Import and Reuse Criteria – Below Hardstanding

Contaminant	Proposed RTV mg/kg	Contaminant	Proposed RTV mg/kg
Arsenic	79	Acenaphthene	15,000
Beryllium	92	Acenaphthylene	15,000
Boron	21,000	Anthracene	74,000
Cadmium	120	Benz(a)anthracene	17
Chromium (total)	1,500	Benzo(a)pyrene	2.6
Copper	12,000	Benzo(b)fluoranthene	18
Lead	630	Benzo(ghi)perylene	120
Mercury, inorganic	470	Benzo(k)fluoranthene	26
Nickel	290	Chrysene	25
Selenium	1,400	Dibenz(a,h)anthracene	2.3
Vanadium	2,000	Fluoranthene	3,100

Contaminant	Proposed RTV mg/kg	Contaminant	Proposed RTV mg/kg
Zinc	81,000	Fluorene	9,900
Cyanide	1,600	Indeno(1,2,3,cd)pyrene	11
Phenol (total)	760	Naphthalene	3,900
Asbestos	<0.01%*	Phenanthrene	3,100
Total TPH	100	Pyrene	7,400
If Total TPH exceeds 100mg/kg:			
Aliphatics EC5-EC6	300	Aromatics EC5-EC7	1,000**
Aliphatics >EC6-EC8	140	Aromatics >EC7-EC8	870
Aliphatics >EC8-EC10	78	Aromatics >EC8-EC10	610
Aliphatics >EC10-EC12	48	Aromatics >EC10-EC12	360
Aliphatics >EC12-EC16	24	Aromatics >EC12-EC16	1,000**
Aliphatics >EC16-EC35	1,000**	Aromatics >EC16-EC21	1,000**
Aliphatics >EC35-EC44	1,000**	Aromatics >EC21-EC35	1,000**
		Aromatics >EC35-EC44	1,000**
*plus absence of significant visible asbestos			
**limited to 2000 mg/kg.			
Based on residential POS park GAC for 1% SOM for Human Health			

9.4 Task 24: Verification during Construction Works

9.4.1 Protectaline Pipework

Where Protectaline pipework (or similar) is required to be installed, the Contractor will validate by the provision of delivery tickets showing Protectaline (or similar) has been delivered to site and by providing photographic proof to the Client and the Consultant that Protectaline pipework or similar has been installed and Hydrock will collate into the Verification Report.

9.4.2 Engineered cover system

Upon completion of the Engineered Cover System by the Contractor, verification pits shall be excavated by Hydrock Consultants in order to measure the thickness of Topsoil and Subsoil present and presence of the high visibility geotextile layer.

These pits will be excavated at a rate of:

- one per four plots in gardens (front and back); and
- one per 40m x 40m area of POS (where soils have been placed).

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.

Hydrock will undertake chemical testing of soils as necessary (see Section 9.3) to confirm the soils are suitable for use.

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.

The cover system verification report will include:

- confirmation of the source of imported material;
- confirmation of the capping thicknesses, including photographs of the verification pits with a scaled marker;
- confirmation of the physical suitability of the material in accordance with Section 9.3;
- the chemical test results for the samples taken from the stockpiles of soils 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 Table 9.1.

9.4.3 *Materials movement*

Hydrock (or another nominated independent Consultant) will undertake a visiting watching brief with regard to materials movement and earthworks.

On the provision of validation reports from the Contractor (see Section 8.12.4), to demonstrate that all of the works have been undertaken in accordance with the RSVP and the MMP, Hydrock Consultants will provide a Verification Report.

Verification may be undertaken in Phases (or parts of Phases).

The report will be prepared by Hydrock Consultants, 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 report will be based on LCRM 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 verification documentation will be forwarded to the Client, for forwarding to the Warranty Provider and the Local Authority.

10. REUSE OF SOILS ON SITE AND MATERIAL MANAGEMENT

10.1 Waste Management Background

The site is considered to be brownfield, and 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 to use a Materials Management Plan (MMP) as 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 MMP must be produced in advance of commencement on site. The Contractor is responsible for complying with and managing the MMP during the works and providing validation information to the Consultant. The Contractor may instruct the Consultant to undertake the management of the MMP on their behalf as a separate commission.

10.2 Material Suitability

It is envisaged that the majority of soil excavated during the Works will be Made Ground. These soils may be suitable for use below the cover system.

Some of the soil excavated will comprise naturally occurring uncontaminated soils (north site area - Fittleworth Member). It is envisaged that clean naturally occurring soil will be won from the site and stockpiled for use in the general cut to fill and as clean cover system soils. Soil to be used in the cover system or a clean backfill shall be assessed and tested to prove they are suitable for use in accordance with Section 9.3.

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

10.2.1 Chemical Suitability

The following section is a summary of chemical suitability with regards to materials management, based on the site investigation works undertaken at the site.

Any soil materials not suitable for use, or not required, will need to be disposed of to an appropriate waste disposal facility.

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

1. For placement as part of the clean cover system (where required) in gardens and POS. This will comprise Subsoil (envisaged to be won from the site) and Topsoil (envisaged to be won from the site).

2. Made Ground subsoil or natural subsoil to backfill remediation excavations and demolition voids and adjust site levels (general cut and fill) to allow design levels to be met and the geotechnical requirements to be met. It is envisaged that these soils will utilise site-won Made Ground and natural soils, placed below the cover system (if Made ground) to leave the site at a level to allow the installation of the cover system (where required) and allow construction.

All materials imported or excavated for reuse on site in the cover system are to be assessed and tested (if necessary) prior to use. Any soil not suitable for use, or not required, will need to be disposed of to an appropriate waste disposal facility in accordance with this RSVP. Chemical suitability of soils is discussed below.

10.2.2 Hotspots

Petroleum hydrocarbon hotspots have been encountered during the works to date and other hotspots may be present. If encountered, any hotspots which fail the RTVs in Table 8.1 will be excavated and either reused on site following ex situ remediation or disposed of off-site.

Any soils containing gross contamination or containing visible ACM shall be excavated and disposed of off-site/treated as appropriate.

10.2.3 Made Ground

A cover system is required for all garden and POS areas where unremediated Made Ground is present. The Made Ground contains asbestos and other contaminants.

After hotspot removal, Made Ground soils may be suitable for reuse on site below the cover system depths, in accordance with the criteria in for reuse below a cover system presented in Table 9.2.

Testing is required for any use as earthworks fill (to be detailed in the GDR and EWS).

10.2.4 Topsoil

Topsoil is not widely present on site and will be imported for use as part of the Cover System.

10.2.5 Subsoil

Subsoil will be required to backfill voids, to alter site levels to create the design levels and as part of the engineered cover system. The Subsoil (Made Ground) on site may be suitable for use below a cover system. Subsoil materials considered suitable for reuse on site will require confirmatory testing following excavation in accordance with the criteria in Table 9.2 for reuse below a cover system.

10.2.6 Topsoil and imported soils

Soils imported to site shall be tested by Hydrock at a rate of 1 test per 250m³ or 1 per 4 plots of each topsoil and subsoil.

All testing shall be undertaken at a UKAS accredited laboratory for the following general suite of contaminants:

- As, B (water soluble), Be, Cd, Cr (total), Cr (VI), Cu, Hg, Ni, Pb, S (elemental), Se, V, Zn, cyanide (total), sulfide, pH, asbestos fibres, speciated polycyclic aromatic hydrocarbons (PAH, by GC-FID), total phenols and fraction of organic carbon;
- total TPH and (if required) speciated TPH (TPH-CWG); and

The test data are to be compared to the values indicated in Table 9.1.

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

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

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

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

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

10.2.7 Material for Off-Site Disposal

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

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

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

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

10.2.8 Physical requirements of soils

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

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

If the Client agrees that Topsoil and Subsoil do not need to conform to BS 3882:2015 and/or BS 8601:2013, they shall comprise chalk, clay or sand with a maximum of 60% of fragments in excess of

2mm, a maximum of 30% in excess of 20mm and a maximum of 10% in excess of 50mm, with nothing in excess of 75mm.

If the use of soils with a high clay content are proposed, their use is to be agreed by the Client.

Topsoil and Subsoil used as part of the upper 1,000mm shall be free of asbestos, metal, plastic, wood, glass, tarmac, brick, paper, concrete or other potentially hazardous foreign material which could cause injury.

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

10.2.9 *Geotechnical suitability*

A review of geotechnical data obtained during site works (report reference 08347-HYD-XX-XX-RP-GE-1004), indicates that:

- Made Ground may be suitable for reuse as general fill; however, this is subject to testing and specification, including contamination testing; and compliance with any earthwork specification (when produced) for the proposed development.
- the soils of the Folkestone Formation and Fittleworth Member are likely to be Class 1A /1B (Granular) - General Fill in accordance to the Specification for Highways Works (SHW).
- Subject to further design it may be possible to reuse the quarry Made Ground noted in the southern area of the site to form a suitable founding material for conventional shallow footings.

Fill is to be placed in accordance with the GDR and EWS.

Roads and pavements are to be placed as per the civil engineering design.

The Enablement Contractor will be responsible for undertaking the required processing, treatment, modification, geotechnical testing and placing the material to the Earthworks Formation level in accordance with the GDR and EWS.

10.2.10 *Certainty of Use and Quantity of Material*

There will be an opportunity to reuse soils at the site following excavation and processing. Any excess or unsuitable soils shall be disposed of off-site. The following excavation, treatment and placement is proposed during the enablement works:

- excavate hotspots and dispose of, or treat;
- excavate Made Ground and natural soils as per the structural design;
- placement of suitable soils and/or imported soils to formation level (not anticipated); and
- placement of granular soils in road and pavements and as working platforms.

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

Following the Enablement Works the following will be required during the Construction Phase:

- excavation of foundations;
- placement of sub-grade in accordance with the pavement design;
- placement of the engineered cover system where Made Ground remains at formation level.

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

There will be a requirement for clean Subsoil and Topsoil to be imported for the engineered cover system and clean granular (Type 1, 6F2/6F5) material for pavement construction.

Volumes of the separate material types are to be determined as part of the MMP.

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 shall be disposed of or recovered in the proper manner and in accordance with waste legislation.

Material reused or imported to site shall be subject to the necessary testing/review and comparison to the RSVP and the Earthworks Specification prior to reuse or delivery to site to minimise the risk of the importation of unsuitable material. Any material deemed unsuitable upon arrival at the site shall 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) shall be imported or reused on site. Any surplus material or material which does not meet the required specification shall be disposed of off-site. It is the responsibility of the Contractor at each stage of the works to have checked all volume calculations and have allowed for disposal of unsuitable or excess materials.

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.

All testing is to be undertaken in accordance with a QP approved MMP.

10.3 On Site Material Management

10.3.1 Stockpiles

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

Stockpile locations shall 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 shall be compacted to prevent dust and kept wet in periods of dry weather.

During the works, materials shall be excavated and consolidated into designated stockpiles, with the different soil types stockpiled in different clearly marked stockpiles.

Topsoil, Subsoil and Made Ground should be stockpiled separately and away from areas designated for storing other materials or potential sources of contamination. Soils proposed for use in the works should be stockpiled on a membrane to prevent cross contamination.

A record of the excavated quantities and reuse locations shall also be maintained on site. A copy of all tracking forms used for transportation of soils to site shall be held at the site office. Example tracking forms are presented in Appendix B.

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 notes 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 B. Other templates or documentation may be used. These sheets should be available for inspection by the Client, the Consultant, Warranty Provider's Inspectors, Local Authority staff and others involved with this development. A copy should also be given to the Consultant when verification visits are made.

11. CONTINGENCY PLAN AND AREAS OF UNEXPECTED CONTAMINATION

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

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

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

A report will be prepared by 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 RSVP.

12. REFERENCES

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- NHBC. 2021. NHBC Standards. NHBC, Milton Keynes.

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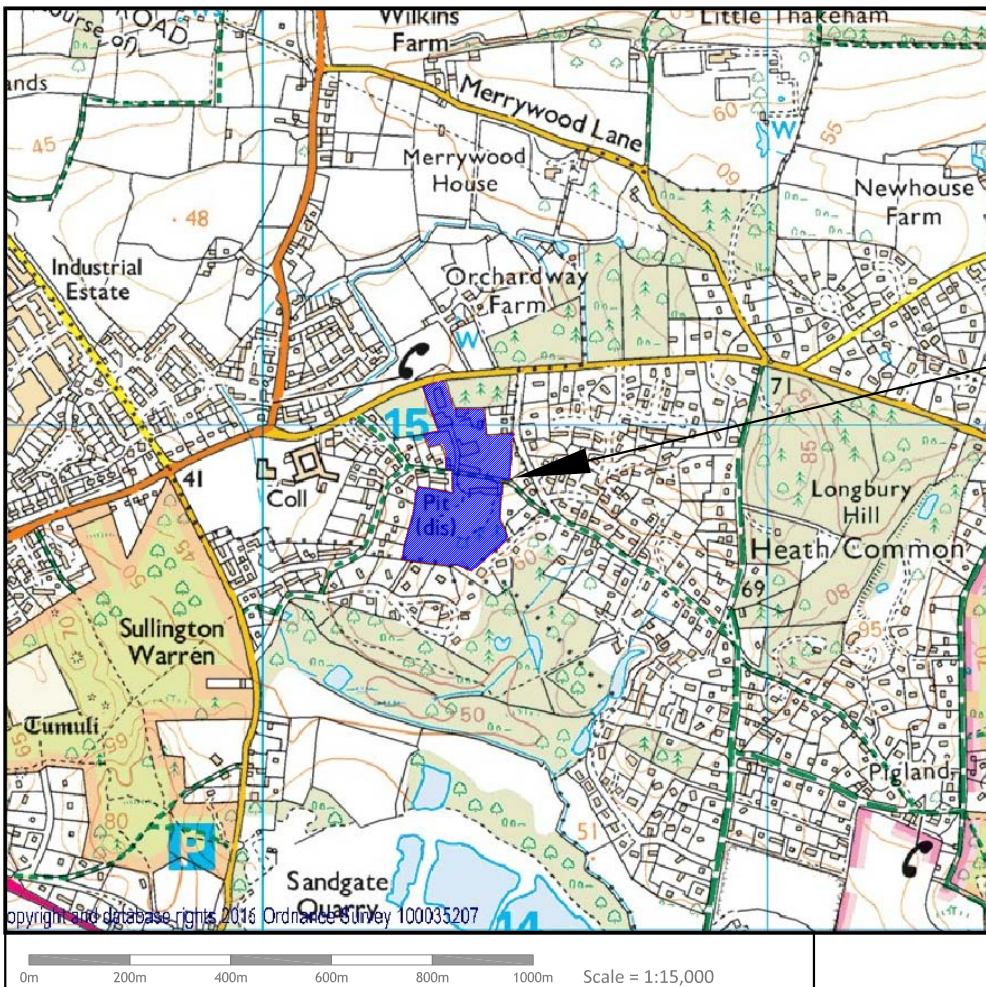
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Appendix A Drawings

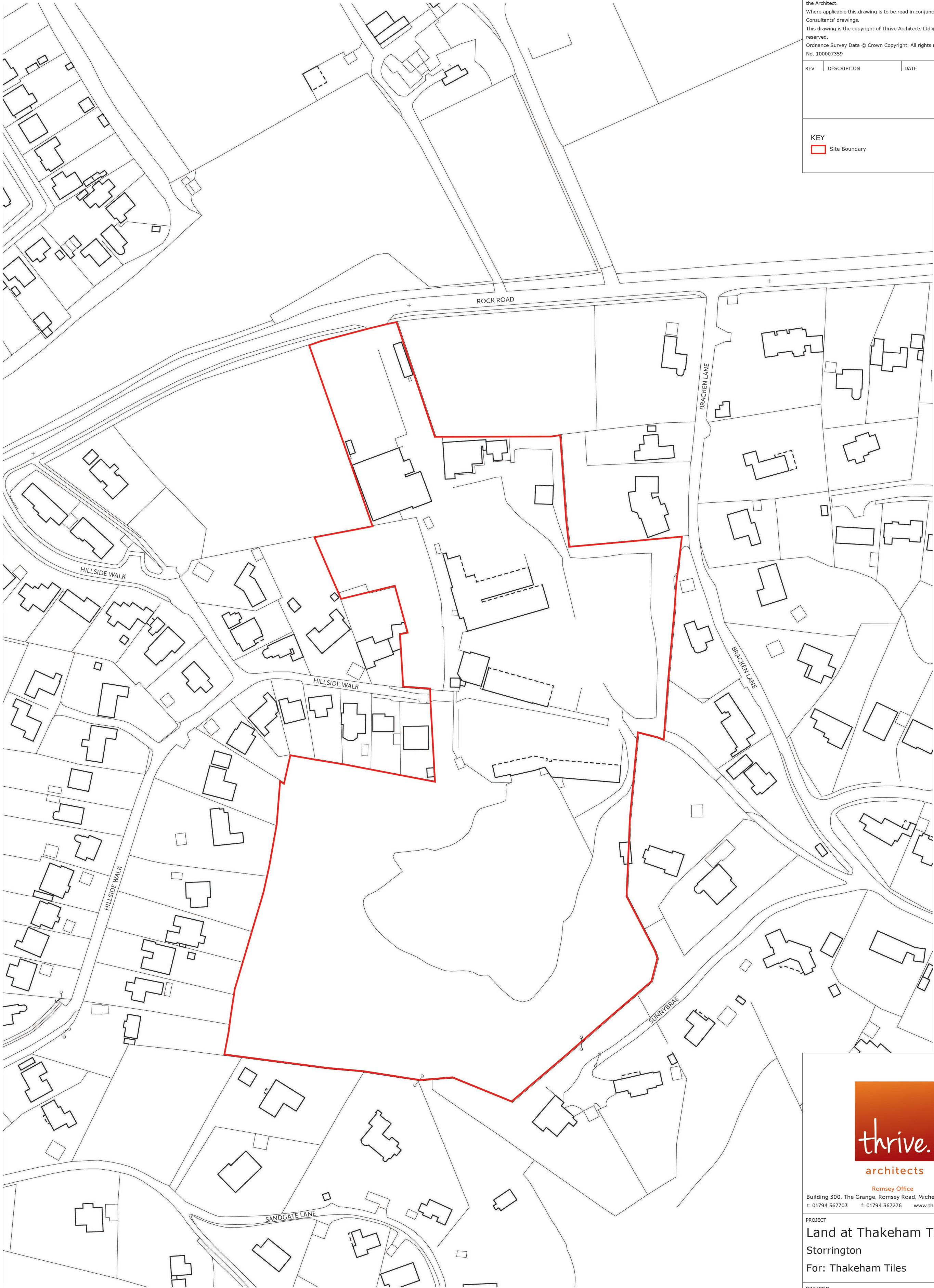


THE SITE



THE SITE

P2-S2	11-06-18	Client name amended	SD	AJ
Revised	Date	Description	By	For
Architect:				
 Hydrock Consultants Ltd 3 Hawthorn Park Hawthorn Road Sparton, Northampton NN6 8JL T +44 (0)1604 842888 northampton@hydrock.com www.hydrock.com				
Client:				
THAKEHAM CONCRETE PRODUCTS LTD				
Project Title:				
THAKEHAM TILES, ROCK ROAD, STORRINGTON				
Drawing Title:				
Site Location Plan				
Reference:				
TRS-HYD-XX-ZZ-DR-GE-1000				
Hydrock Job No:				
C-08347-C				
Drawn	Checked	Scale @ A4	Date	Issue Date
SD	AJ	See Drawing	22/02/18	11/06/18
Revision:		Status:		
P2		S2		



NOTES

Permission is granted to scale from this drawing for the purpose of Local Authority Planning Approval only. In all other circumstances DO NOT scale from this drawing, please contact this office for any additional information required.

Contractors, Sub Contractors and Suppliers are to check all relevant dimensions and levels of the site and building before commencing any shop drawings or building work. Any discrepancies should be recorded to the Architect.

Where applicable this drawing is to be read in conjunction with the Consultants' drawings.

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REV	DESCRIPTION	DATE	AUTHOR	CHK'D

KEY

Site Boundary



Romsey Office
Building 300, The Grange, Romsey Road, Michelmersh, SO51 0AE
t: 01794 367703 f: 01794 367276 www.thrivearchitects.co.uk

PROJECT

Land at Thakeham Tiles

Storrington

For: Thakeham Tiles

DRAWING

Site Location Plan - 01

SCALE	DATE	AUTHOR	CHK'D
1:1250 @ A2	21/10/16	BA/hm	BA
JOB NO.	DRAWING NO.	REV	
THAK160703	SLP-01	-	





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Contractors, Sub-contractors and suppliers are to check all relevant dimensions and levels of the site and building before commencing any shop drawings or building work. Any discrepancies should be recorded to the Architect.
Where applicable this drawing is to be read in conjunction with the Consultants' drawings.

REV	DESCRIPTION	DATE	AUTHOR	CHKD
A	Updates to arrangement	27/07/18	KS/DR	KS
B	Red Lin amended at junction	14/08/18	KS	GP
C	Revised layout	10/08/18	KS/DR	-
D	Additional landscaping	28/11/18	KS/DR	-

KEY	
[Red Line]	Site Boundary
[29]	Plot Number
[28]	House Type
[House Icon]	Built Form
[Tree Icon]	Existing Tree
[Tree Icon]	Proposed Tree
[Hedge Icon]	Proposed Hedge
[Green Box]	Back Garden
[Green Box]	Front Garden
[Green Box]	Public Open Space
[Blue Box]	Attenuation Pond/Swale
[Grey Line]	Road
[Dashed Line]	Shared Surface or similar
[Dotted Line]	Private Drive
[Blue Dotted Line]	Public Right of Way

Accommodation Schedule				
PRIVATE House Type	No of Bedrooms	SqFt	No	Total SqFt
18F	1	500	4	2000
28	2	750	23	17250
381	3	850	12	10200
382	3	950	14	13300
383	3	1070	8	8560
384	3	1100	2	2200
481	4	1250	9	11250
482	4	1350	11	14850
483	4	1420	2	2840
484	4	1650	3	4950
485	4	2000	2	4000
TOTALS			90	91400
SITE TOTALS			90	91400



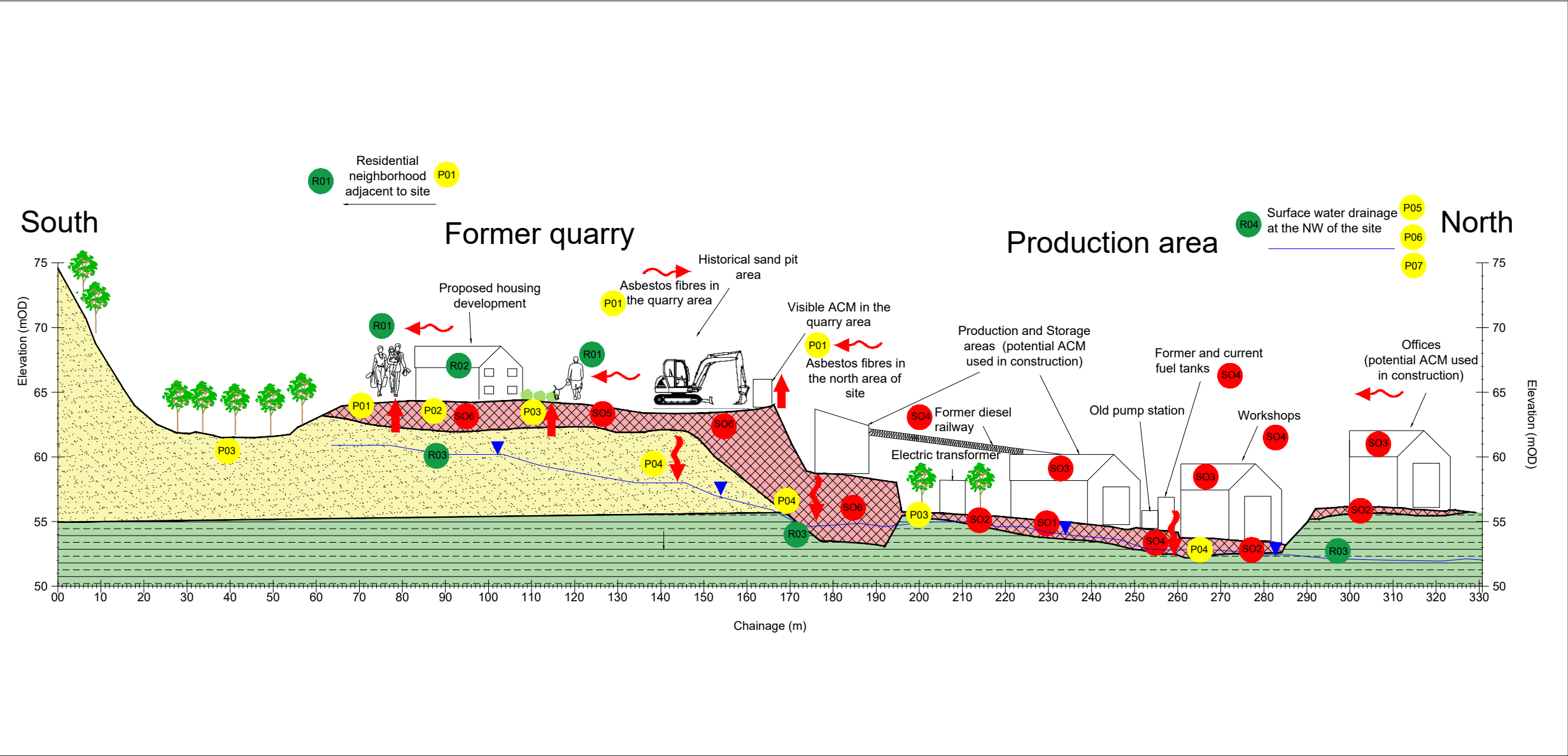
Romsey Office
Building 305, The Grange, Romsey Road, Michelmersh, SO51 0AE
T: 01794 367763 F: 01794 367276 www.thrivearchitects.co.uk

PROJECT
Land at Thakeham Tiles
Storrington
For: Thakeham Tiles

DRAWING
Sketch Layout - 03

SCALE	DATE	AUTHOR	CHKD
1:500 @ A0	14/08/18	KS/dr	GP

JOB NO.	DRAWING NO.	REV
THAK160703	SKL-03	D



KEY	
	GROUNDWATER TABLE
	Made Ground
	Folkstone Formation - Sandstone
	Fittleworth Member - Sandstone and mudstone

- NOTES
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 2. This drawing is to be read in conjunction with all relevant Engineers' and Service Engineers' drawings and specifications.
 3. This drawing is indicative only.

LEGEND	
POTENTIAL PATHWAYS	
	DIRECT CONTACT INGESTION, INHALATION
	LEACHING DISSOLUTION / WATER RUN-OFF
	WINDBLOWN DUST/FIBRES
	DISSOLVED PHASE MIGRATION
	VAPOUR
CONTAMINATION LINKAGES	
	SOURCE
	PATHWAY
	RECEPTOR

Potential on-site sources of contamination in the northern area

- (S01) Made Ground, associated with historical industrial activities, including elevated concentrations of metals, metalloids and PAH in the north of the site - industrial production area.
Hotspots of lead in the MG- General at WS204, WS108 and WS110.
Hotspots of PAH in the MG- General at TP202.
Hotspots of Zinc and Boron in the MG- General at WS212, WS103, WS108, WS110, SA106 and SA103.
- (S02) Made Ground, associated with historical industrial activities, containing visible asbestos material (ACM) and asbestos loose fibres.
Sporadic asbestos (visible and loose fibres) in MG- General.
- (S03) Asbestos within existing building construction.
- (S04) Hydrocarbon fuels, lubricants, and solvents from the operation of the workshop and on-site storage in the north of the site, including leakage from Underground Storage Tanks (USTs), Above Ground Storage Tanks (ASTs), the pipework between tanks and pumps, former diesel railway and general spillage.
Hotspots of TPH in MG- General at WS203B, WS102, WS105, WS108, WS109, WS110, TP07.
Hotspot of petroleum hydrocarbons in groundwater at WS203B.

Potential on-site sources of contamination in the southern area

- (S05) Made Ground, associated with historical industrial activities, including elevated concentrations of metals, metalloids, PAH and petroleum hydrocarbons.
Hotspot of PAH in the MG- Quarry at SA105A.
Hotspots of TPH in MG- Quarry at SA104.
- (S06) Made Ground, associated with historical industrial activities, potentially containing visible asbestos material (ACM) and asbestos loose fibres in the south of the site - former quarry area.
Frequent asbestos (visible and loose fibres) in the MG- Quarry area.

Potential pathways

- (P01) Ingestion, skin contact, inhalation of dust and outdoor air by people.
- (P02) Direct contact with substances deleterious to building materials.
- (P03) Root uptake by plant.
- (P04) Groundwater: Migration of contaminant via leachate migration through the unsaturated zone in the Folkestone Formation and Fittleworth Member
- (P05) Surface water: via overland flow.
- (P06) Surface water: via drainage discharge.
- (P07) Surface water: via base flow from groundwater.

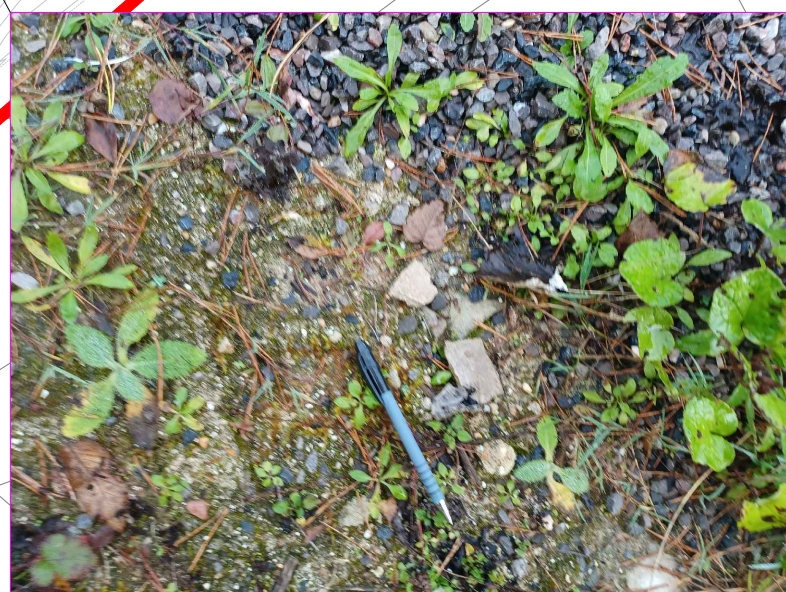
Potential receptors

- (R01) Humans (neighbours, site end users).
- (R02) Development end use (buildings, utilities and landscaping).
- (R03) Groundwater: Principal aquifer status of Folkestone Formation and Secondary A Aquifer status of the Fittleworth Member.
- (R04) Surface water: on-site drainage ditch and stream at the NW of the site.

P03	UPDATED FROM FINAL GAS MONITORING RESULTS					
	YP	19/04/22	YP	19/04/22	AJ	19/04/22
P02	UPDATED FROM SUPPLEMENTARY GI (NOVEMBER 2021)					
	YP	24/01/22	YP	24/01/22	AJ	26/01/22
P01	FIRST ISSUE					
	YP	14/05/21	YP	14/05/21	AJ	14/05/21
REV.	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
Hawthorn Park Holdenby Road Spratton Northampton NN6 8LD TEL: 01604 842 888 E-Mail: northampton@hydrock.com or visit www.hydrock.com						
CLIENT						
Redrow Homes Limited						
PROJECT						
Thakeham Tiles						
TITLE						
Conceptual Site Model						
HYDROCK PROJECT NO. 08347-GELO				SCALE @ A3 Not to Scale		
PURPOSE OF ISSUE SUITABLE FOR INFORMATION						STATUS S2
DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER) TRS-HYD-XX-ZZ-DR-GE-1009						REVISION P03



- Legend**
-  Site Boundary (approximate)
 -  Chrysotile - Hard/Cement
 -  Amosite - Insulation Board/Tile
 -  Chrysotile - Rope/Textile
 -  Approximate extent of surface inspection



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 2. This drawing is to be read in conjunction with all relevant Engineers' and Service Engineers' drawings and specifications.
 3. Based on Topographical Survey No: 22664 by MK Surveys. Survey dated: July 2016.

- Site Boundary (approximate)
- Rotary borehole
- Historical Trial Pit (Hydrock 2018 and 2021)
- Trial Pit
- Historical windowless sampler borehole (2021)
- Windowless sampler borehole
- Historical Hand Dug Trial Pit (2021)
- Hand Dug Trial Pit
- Locations where visible ACM encountered
- Locations where asbestos fibres encountered

Visible asbestos fragments		
Location	Depth (mbgl)	Comment
SA107	0	One piece of asbestos cement.
SA105	1.2	2 fragments of Chrysotile- Hard/Cement.
SA105A	0.2	3 fragments of Chrysotile- Hard/Cement.
SA105A	0.5	2 fragments of asbestos cement.
SA105B	0.3	One fragment of asbestos cement.
SA105B	0.4	Multiple fragments of Chrysotile- Hard/Cement.
WS113	1.5	Four fragments of Chrysotile- Hard/Cement.
BH203	0.1	Chrysotile- Hard/Cement.
TP208	2	Rare fragments of Chrysotile- Hard/Cement.
TP215	1.1 - 1.6	Rare fragments of Chrysotile- Hard/Cement.
TP218	0.4 - 2.7	Frequent fragments of Chrysotile- Hard/Cement.
TP219	0.6 - 2.0	Hard/Cement.
TP220	0.3 - 0.6	3 fragments of Chrysotile - Hard/Cement.
TP222	1.0 - 1.5	
TP224	0.6 - 2.0	Frequent fragments of Chrysotile- Hard/Cement.
TP225	0.4 - 2.5	
TP226	1.5 - 2.8	5 fragments of Amosite- Insulation Board/Tile.
TP229	1.5 - 3.0	Frequent fragments of Chrysotile- Hard/Cement.
TP232	0.4 - 1.9	Hard/Cement.
TP236	0.9 - 1.5	Rare fragments of Chrysotile- Hard/Cement.
HP202	0.6	Chrysotile- Hard/Cement.

Loose fibres		
Location	Depth (mbgl)	Comment
SA103	0.2	Loose Fibres (chrysotile <0.001).
TP13	1.2	Loose Fibres (chrysotile 0.037).
TP14	0.3	Loose Fibres (chrysotile <0.001).
TP224	1	Loose Fibres (chrysotile <0.424).
TP229	1.9	Loose Fibres (chrysotile <0.004).
TP222	1	Loose Fibres (chrysotile <0.236).
TP221	1	Loose Fibres (chrysotile <0.006).

P2	10/01/22	Laboratory results updated	YP	AJ
P1	08/12/21	Locations where ACM encountered	YP	AJ
Rev	Date	Description	By	Ckd

Architect :



Client :
REDROW HOMES LIMITED

Project Title:
THAKEHAM TILES, ROCK ROAD, STORRINGTON

Drawing Title:
LOCATIONS WHERE ACM ENCOUNTERED IN GROUND

Reference:
TRS-HYD-XX-ZZ-DR-GE-2002

Hydrock Job No:
08347-GELO

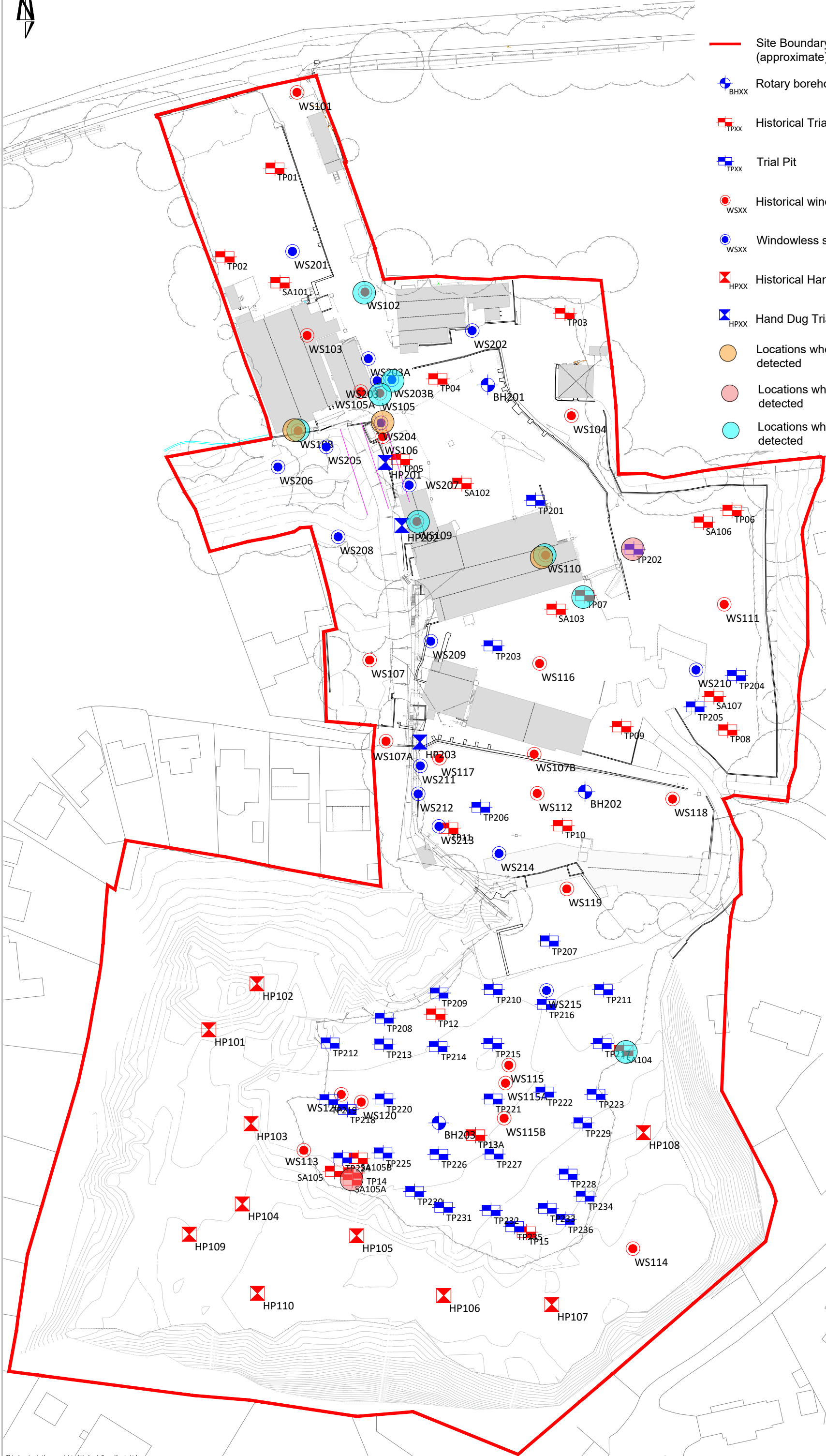
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YP	1	1:500	08/12/21	1

Revision:	Status:
P02	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.
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- Windowless sampler borehole
- Historical Hand Dug Trial Pit (2021)
- Hand Dug Trial Pit
- Locations where Lead exceedances were detected
- Locations where PAH exceedances were detected
- Locations where TPH exceedances were detected



Location	Depth (m bgl)	Contaminant exceedances
North area of the site		
WS110	0.3	Lead (250mg/kg)
WS108	0.3	Lead (310mg/kg)
WS204	0.2	Lead (370mg/kg)
TP202	0.5	Benzo(a)anthracene (5.3mg/kg) Benzo(a)pyrene (9.6mg/kg) Benzo(b)fluoranthene (11mg/kg) Indeno(1,2,3,cd)pyrene (5.0mg/kg)
WS203B	0.5	Aliphatic 12 – 16 (280mg/kg) Aromatic 12 – 16 (270mg/kg) Aromatic 16 – 21 (460mg/kg)
WS203B	0.8	Aliphatic 10 – 12 (280mg/kg) Aliphatic 12 – 16 (800mg/kg) Aromatic 12 – 16 (420mg/kg) Aromatic 16 – 21 (630mg/kg)
WS102	0.5	Aliphatic 12 – 16 (79mg/kg)
	2.5	Aliphatic 12 – 16 (36mg/kg vs)
WS108	1.4	Aliphatic 12 – 16 (140mg/kg)
WS105	0.2	Total TPH (C10-C40) 12000 mg/kg
WS110	0.3	Total TPH (C10-C40) 150mg/kg
TP07	0.9	Aliphatic 12 – 16 (26mg/kg)
WS109	0.8	Total TPH (C10-C40) 200 mg/kg
South area of the site		
SA104	0.8	Total TPH (C10-C40) 340 mg/kg
SA105A	0.8	Benzo(a)anthracene (36mg/kg) Benzo(a)pyrene (36mg/kg) Benzo(b)fluoranthene (39mg/kg) Chrysene (26mg/kg) Indeno(1,2,3,cd)pyrene (14mg/kg)

P1	26/01/22	Locations where contaminant exceedances were encountered	YP	AJ
Rev	Date	Description	By	Ckd

Architect :

Hydrock Consultants Ltd
3 Newthorn Park
Holdenby Road
Sparton, Northampton
NN6 8JQ
T +44 (0)1604 842888
northampton@hydrock.com
www.hydrock.com

Client :
REDROW HOMES LIMITED

Project Title:
THAKEHAM TILES, ROCK ROAD, STORRINGTON

Drawing Title:
HUMAN HEALTH EXCEEDANCES IN SOILS

Reference:
TRS-HYD-XX-ZZ-DR-GE-2003

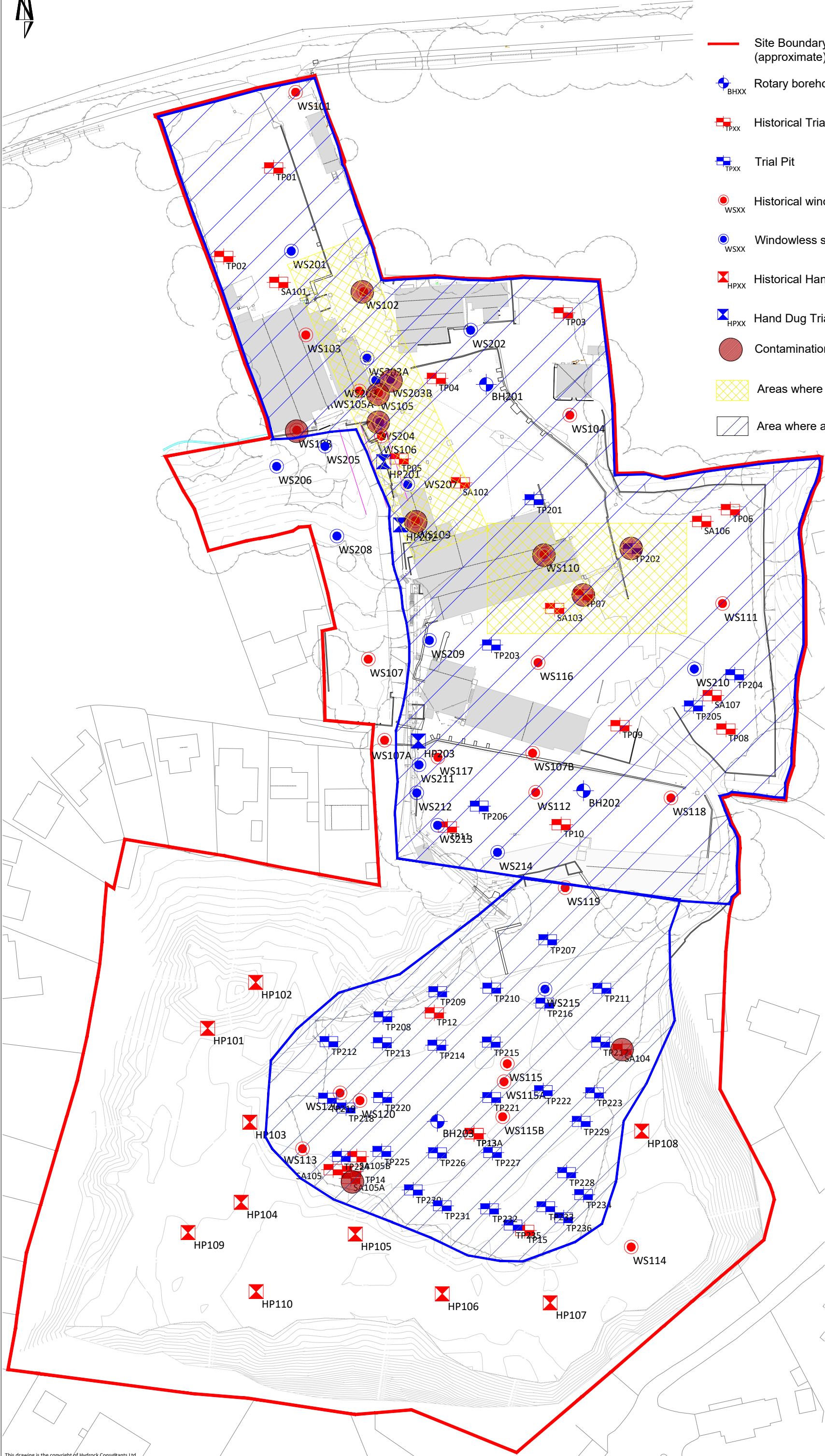
Hydrock Job No:
08347-GELO

Drawn	Checked	Scale @ A1	Date	Issue Date
YP	1	1:500	26/01/22	1
Revision:	P01		Status:	S2



- Notes:
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 3. Based on Topographical Survey No: 22664 by MK Surveys. Survey dated: July 2016.

- Site Boundary (approximate)
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- Historical windowless sampler borehole (2021)
- Windowless sampler borehole
- Historical Hand Dug Trial Pit (2021)
- Hand Dug Trial Pit
- Contamination Hotspots
- Areas where barrier pipe is required
- Area where asbestos mitigation is required



P1	08/04/22	SITE REMEDIATION PLAN	YP	AJ
Rev	Date	Description	By	Ckd

Architect :



Hydrock Consultants Ltd
3 Newthorn Park
Holdenby Road
Sparton, Northampton
NN6 8LD
T +44 (0)1604 842888
northampton@hydrock.com
www.hydrock.com

Client :
REDROW HOMES LIMITED

Project Title:
THAKEHAM TILES, ROCK ROAD, STORRINGTON

Drawing Title:
SITE REMEDIATION PLAN

Reference:
TRS-HYD-XX-ZZ-DR-GE-3001

Hydrock Job No:
08347-GELO

Drawn	Checked	Scale @ A1	Date	Issue Date
YP	1	1:500	08/04/22	1
Revision:	P01		Status:	S2

Appendix B Form Templates

Project:

Remediation Strategy

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	

Sketch Plan of Stockpile Location and Sample Points

Signed_____

Name_____

Company_____

Position_____

Date_____

Appendix C Discovery Strategy

DISCOVERY REMEDIATION STRATEGY

CONTAMINATED MATERIALS

DISPLAY AND AWARENESS

This Discovery Strategy shall be placed on the Health and 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 this Discovery Strategy.

HOW TO IDENTIFY POTENTIAL CONTAMINATED MATERIAL

- Looks oily and has an oily odour.
- Solvent type of odour.
- Any other odours.
- Man-made materials in fill such as paint cans, car parts, glass fragments, plastic, metal...
- Contains asbestos sheeting, coal/coke clinker.
- Sand, aggregate and or/ subsurface concrete structures.
- 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 to:

All site works at the position of the suspected contamination should stop.

Site Personnel to inform the Site Manager / Agent.

Notification of evidence of contamination of the condition of the ground and the extent of contamination should be given to Hydrock Consultants within 24 hours. Should the contamination be likely to affect controlled waters Hydrock and the Ground Worker shall inform the Environment Agency shall be informed.

In the presence of a suitably qualified geo-environmental engineer, investigation works shall commence to recover samples for testing and, using visual and olfactory observations of the condition of the ground, delineate the area over which contaminated materials are present.

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 and suitability managed to prevent further disturbance until laboratory test results have been obtained.

A photographic record should also be made of relevant observations, along with sketches.

Hydrock will determine the in situ laboratory testing suite based on visual and olfactory observations.

Test results will be compared against assessment criteria suitable to maintain safe working conditions and for the future use of the area of the site affected.

If after testing the ground is found to be contaminated, Hydrock will determine the remediation strategy as appropriate. This may include removal for disposal to a licensed waste management facility or remediated to an agreed clean-up criterion. Hydrock will determine whether the Local Authority, Warranty Provider and if necessary, the Environment Agency shall be notified, following consultation with Hydrock.

UNEXPECTED TANKS

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

All site works at the position of the tanks should stop. Health and Safety assessment to be undertaken.

A description of the tank (material, size, condition, content) should be made by Hydrock including; condition and surround, along with visual and olfactory observations should any contents in the tank and details of any associated pipework. A photographic record should also be made of relevant observations.

The tank's position and depth shall be marked on a plan of the site.

Notification shall be given to Hydrock Consultants within 24 hours.

Under the supervision of Hydrock, investigation works should be undertaken to obtain samples of any liquid or sludge contents and to establish dimensions of the tank.

Testing will be determined based by Hydrock Consultants.

Test results will be compared against assessment criteria and proposals for disposal of any contents determined in agreement with the appropriate Regulatory Parties.

Emptying the tank and disposal of contents to a suitable licenced disposal facility by a suitably licensed Contractor.

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 by a suitably licensed Contractor. Copies of the relevant waste consignment notes are to be forwarded to Hydrock Consultants.

Excavation and remediation of any contaminated soils in accordance with the RSVP.

Samples of the base and sides of the resultant hole will be sampled as per Hydrock'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 where groundwater may potentially have been impacted the Environment Agency.

Appendix D General Requirements

Compliance with Legislation and Standards

The works are to be undertaken in compliance with all relevant British Standards, codes of practice, regulations, guidance and legislation.

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

- The Health and Safety at Work etc. Act 1974;
- Construction Health Safety and Welfare Regulations 1996;
- Health and Safety Executive 'Protection of Workers and the General Public during Redevelopment of Contaminated Land' HS (G) 66, HMSO 1991;
- The Construction, Design and Management Regulations 2007;
- The Control of Substances Hazardous to Health Regulations 2002 (COSHH Regulations); and
- The Control of Asbestos Regulations, 2012.
- BS6187:2011 "Code of Practice for Full and Partial Demolition".
- The Contractor is responsible for obtaining all necessary approvals, licences, consents and permits from regulatory bodies and third parties prior to commencement.

Licences, Permits and Consents

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

It will be the responsibility of the Contractor (to be appointed) 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.

If treatment of the soils is to be undertaken, 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 and Qualified Person Declaration.

Health and Safety Requirements

The Principal Contractor 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 need to be submitted to the CDM co-ordinator, 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 operations as required by the CDM Co-ordinator; and
- provide the CDM Co-ordinator 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 CDM Coordinator'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 (limited risk based on monitoring data);
 - 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 Supervising Engineer 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):
- 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, it is recommended that:

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

Site Establishment and Security

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

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

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

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

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

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

Traffic Safety and Management

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

On-site access and haul routes should be provided and maintained by the Enabling Works 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 Clients 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 Supervising Engineer, the highway shall be swept regularly to remove any mud, slurry or dust deposited by vehicles entering or departing the site. If the Supervising Engineer 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.

Welfare Facilities

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

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

Working Hours

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

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

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 tank's 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.

Unexploded Ordnance

The Contractor is to undertake their own searches or investigations to satisfy themselves.

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

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

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

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

Testing

The Contractor is responsible for undertaking any geotechnical testing required.

The Consultant shall undertake testing of hotspots to confirm remediation has been successful and shall sample and test imported soils (or those soils proposed for re-use in the cover system or as topsoil to prove suitability for use).

The Contractor shall undertake testing of site won or imported soils proposed for use in the cover system or as topsoil to prove suitability for use.

Off Site Disposal

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

Material exported from site to landfill, or other appropriately licensed facility, shall be hauled by a registered waste carrier in accordance with the requirements of the Duty of Care Regulations, 1991 and where appropriate the Special Waste Regulations, 1996. A transfer note shall be completed, signed and retained by all parties involved. The transfer note shall state the volume of waste, the nature of the material and statement to the chemical composition. The waste transfer notes shall be kept by the Contractor for a period of at least 2 years.

Contamination

Contractors should be made aware of the possibility of encountering contaminants within soils or groundwater at the site (specifically including asbestos fibres) 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.

Contamination risks to ground workers

Whilst risks to construction workers are not discussed in detail, the following section discusses potential risks that should be considered. Information presented in this document is provided to assist in managing the risk associated with contamination in soil and groundwater at the site but is not definitive. The Contractors are responsible for undertaking their own assessments and assessing what risks are present and what control measures are required.

Task specific risk assessments and method statements should be in place, and risks and required mitigation measures communicated to all relevant personnel prior to the works commencing. Appropriate PPE and, if required, RPE should be provided and utilised.

Ground Gas

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

Soil gas concentrations are not necessarily reflected by those in the breathing zone, as such, all Contractors and maintenance workers should be made aware of the possible presence of carbon dioxide and should take all necessary health and safety precautions when working in trenches or confined spaces.

Asbestos

ACM has been encountered during the site investigation, and the site investigation has identified concentrations of asbestos fibres (up to <0.424%) in the soils.

All site staff should be made aware of the possibility to encounter unidentified fragments of asbestos within the Made Ground soils anywhere on the site at any stage of the development. It is advised that the Contractor should consider supplying suitable and sufficient 'Asbestos Awareness' training (specific to asbestos in soils) to all site staff who could foreseeably encounter asbestos containing materials during the course of their work.

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

The Contractor for each stage of works must undertake a suitable and sufficient Risk Assessment in accordance the Regulation 6 of the Control of Asbestos Regulations 2012 (CAR2012). The results of the assessment should be used to compile a methodology in accordance with Regulation 7 of CAR2012,

which limits the potential exposure and spread of asbestos fibre. Appropriate training should be provided to all site staff identified within the risk assessment as having the potential to be exposed or encounter asbestos during their work in accordance with Regulation 10 of CAR2012.

It is the responsibility of the Contractor to ensure that mitigation measures are suitable and sufficient to prevent exposure to airborne asbestos so far as is reasonably practicable in accordance with Regulation 11 of CAR2012.

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 not hazardous where the asbestos fibres cannot become airborne. However, if lagging is present or the ACM is broken or crumbled in a dry condition the asbestos fibres could become airborne and could then be inhaled. When soil with asbestos is covered by hardstanding, buildings or a cover of clean soil or when the soil is kept damp, the asbestos fibres are less likely to become airborne and the risk is greatly reduced.
- The Health and Safety at Work Act 1974 forms the basis of health and safety legislation in the UK. In addition, the Control of Asbestos Regulations 2012 (CAR 2012) applies throughout the UK. CAR 2012 applies if land has significant asbestos content and is relevant to any work conducted on asbestos contaminated land.
- CAR 2012 defines a 'control limit' of 0.1 fibres per cubic centimetre of air averaged over a continuous period of 4 hours. This limit is not risk based and may be much higher than the levels for control of environmental pollution.
- CAR 2012 applies even where exposure to asbestos of employees is sporadic and of low intensity and where exposure to asbestos of any employee will not exceed the control limit. In addition, the work must be of short non-continuous activities where non-friable materials are handled, or removal without deterioration of non-degraded materials in which asbestos fibres are firmly linked in a matrix.
- Lagging, broken fragments of asbestos and loose fibres have the potential to release airborne fibres in dry conditions. In addition, as the ACM and asbestos fibres have been contained in the soil for many years, the likelihood is that they would be degraded to some extent. However, 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. Therefore, until proven otherwise, Hydrock considers that the contractor should treat the work involving handling of the soils as licensed work as defined in CAR 2012.
- 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 should be undertaken by suitably qualified contractors and in accordance with CAR 2012.

Appropriate mitigation measures (by suitably trained operatives) will need to be designed and put in place by the Contractor during excavation, processing and placement of soils to prevent asbestos fibres becoming airborne. Task specific risk assessments and method statements shall 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, shall be provided and utilised.

With regard to the excavation of soils, as far as reasonably practicable the removal of easily identifiable ACM is required. It should be noted that:

- In accordance with CAR 2012 (Regulation 16) there remains a duty of the Contractor to 'prevent or reduce the spread of asbestos anywhere where work is being carried out under their control'. Where complete prevention is not reasonably practicable (this would constitute such a case), the regulation requires the Contractor to reduce to the lowest level reasonably practicable level, the spread/potential for asbestos fibre release from any place where work under the Contractor's control is carried out.
- CAR 2012 notes that the Contractor should select and use work methods that will reduce the disturbance and release of asbestos fragments and fibres to minimise the risk of spread, e.g. by removing items intact or whole and by using dust suppression techniques. ACMs must never be left loose, or in a state where they can be trampled on or spread. All asbestos waste should be bagged or wrapped promptly after removal and the waste should be removed from the work area regularly.
- Additionally, where enclosures are not used (and this is one of those instances, as it is not reasonably practicable to do so), the Contractor's risk assessment should establish what will be required to make sure that, as far as is reasonably practicable:
 - the spread of asbestos is prevented (airborne fibres and asbestos in soils);
 - people not involved in the work are excluded from the area;
 - the work area is totally cleaned after work is completed.
- For the proposed activities, there are two activities which could release fibres
- excavation of soils containing gross ACM; and
- placement of soils containing gross ACM.

It is reasonably practicable for visible 'gross'/highly fibrous materials to be handpicked and double bagged at the point of excavation, as this material has then been removed, and the potential to liberate fibre on the second activity (placement) has thus been alleviated or reduced to as low a level as reasonably practicable. As such, in addition to a surface inspection and pick, hand picking of gross ACM is required during excavation and placement activities to ensure that as far as reasonably practicable all visible gross ACM has been removed.

There is a possibility of potentially licensable asbestos being encountered during the remediation works. The Contractor will need to undertake an assessment of the works and provide a written record detailing if it should be considered 'notifiable' or not.

Hand picking needs to be undertaken by suitably qualified personnel (in Hydrock's opinion, Asbestos Awareness is not sufficient) in accordance with HSE guidance and an Environmental Permit. Visible fragments of suspected asbestos containing materials on the site surface shall be handpicked. In addition to the controls required under CAR 2012, there may be a requirement to deploy an Environmental Permit. The Contractor is to form their own opinion and either:

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

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

Air monitoring for asbestos is required on an ongoing basis during the works (frequency to be set out in the Asbestos Working Plan) and the results shall be compared with acceptable maximum standards set by the HSE. These air monitoring procedures and limits are given in HSG 248 'Asbestos: The analysts' guide for sampling, analysis and clearance procedures' and CAR 2012. The monitoring should be undertaken by a UKAS accredited laboratory. The limit used is governed by the levels stated in the above guidance documents and the accuracy of the testing used. However, Hydrock recommends using the most stringent limit set by the HSE. Air monitoring results are acceptable only if they fall below this limit and are as low as reasonably practicable. Exposure from work activities involving asbestos must be reduced to as far below the control limit as possible.

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.

If necessary, working methods should 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.

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

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.

Mobile water bowsters 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 bowsters are not 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 should be set up and monitored by the Contractor to record the dust concentrations, including the presence of asbestos fibres 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 should 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, possible odours cannot be discounted during excavation of Made Ground materials and it is advised that odours are formally assessed by twice daily inspections of all site boundaries when excavation works in Made Ground materials are undertaken.

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 should 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.

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

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

Services

Prior to site work commencing, the Contractors shall establish the position of all services. The locations should be confirmed on site by appropriate investigation, observations and survey.

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 and/or the Supervising Engineer, 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 Engineer.

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 Engineer.

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 Supervising Engineer immediately.

Photographs

A detailed dilapidation survey shall be undertaken of the site and adjacent properties including joint site boundaries, in conjunction with adjacent land owners. Such survey shall include 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 Engineer/Client in electronic format should they be requested during the contract. Record photographs should be provided as part of the validation information.

Appendix E Roles and Responsibilities

Table E.1 provides a summary of works and responsibilities required during the Works. Table E.1 should not be used as a separate document. In addition, whilst every effort to summarise the responsibilities has been made, the main document takes priority and omission from the summary table is not a valid reason for not undertaking works as detailed in the Specification. All works summarised below are to be undertaken in accordance with the relevant Specifications.

Table E.1: Summary of roles and responsibilities

WORK ACTIVITY	RESPONSIBILITY
Pre- Contract	
Remediation Strategy and Verification Plan (this document)	Consultant
Regulatory discussion and agreement.	Consultant
Pre- Commencement	
H&S risk assessments and working methods. Asbestos is present in the soils and all appropriate measures will need to be undertaken by the Contractor(s) with regard to CAR 2012.	Contractor
Obtaining any licenses and / or permits considered necessary.	Contractor
Materials Management Plan and Qualified Person declaration.	Consultant
Construction works	
Review of levels and delineation of Made Ground.	Contractor
Watching brief during remediation.	Consultant
Validation testing of remediation in accordance with the RSVP.	Consultant
Excavation and reuse (cut to fill) of soils as appropriate to the required levels in accordance with the RSVP and MMP and placement to the Earthworks Specification (including earthworks testing).	Contractor
Appropriate management, stockpiling and materials tracking of soils as per the RSVP and MMP	Contractor
Watching brief during excavation and re-use of soils and earthworks.	Consultant
Import and stockpiling of topsoil.	Contractor
Provision of test data to the Consultant, prior to import.	Contractor
Provision of evidence of barrier pipe installation to the Consultant	Contractor
Testing of any site won or imported soils (as required).	Consultant
Disposal of unsuitable material.	Contractor
Provision of all validation data / requirements as per the RSVP and MMP (and the GDR).	Contractor
Inspection of soils as necessary.	Consultant
Chemical testing of soils as necessary.	Consultant
Verification Report	Consultant