

RECOMMENDATIONS

1.	<p>Remediation Strategy</p> <p>To facilitate the future development, the following recommendations are made:</p> <ul style="list-style-type: none">• Site clearance and demolition;• Personal Protective Equipment and health and safety controls;• Watching brief and discovery strategy in the event that previously unidentified contamination is encountered;• Asbestos material management following delineation works in July 2021;• Materials management including management of waste;• Barrier pipework for new drinking water supply pipework (to be discussed with local water supply company);• Provision of clean topsoil in areas of proposed soft landscaping (for plant growth);• Decommissioning of boreholes;• Remediation and Verification Reporting. <p>Verification Strategy</p>
2.	<p>To confirm that the mitigation measures outlined by the Remediation Strategy are implemented, a Verification Strategy has been produced and is included in detail within the following report. The strategy sets out the requirements of the main contractor(s) in terms of collating information during development and the responsibilities of an environmental consultant in reporting the findings of third-party verification activities. The verification strategy involves:</p> <ul style="list-style-type: none">• Recording the findings of a watching brief and any onsite control measures such as asbestos air monitoring;• Recording findings and outcomes of a discovery strategy should unforeseen contamination be encountered;• Findings of inspections and compliance testing;• Maintenance and provision of duty of care records (for importation and exportation of materials);• Site photographs;• Provenance data for topsoil / subsoil;• Chemical analysis data;• Confirmation of drinking water supply pipework material used and records of any communication with the local water supply company;• Records of any permits / exemptions (if relevant);• Copies of agreements with statutory consultees on remedial targets (if any) for improvements to ground / surface water quality or betterment;• Records of any baseline and long term water monitoring programme (if any); and• Records of the borehole decommissioning works (including photographs).

3. Periodic site audits would be required to ensure adequate site records and documentation are being maintained during demolition and construction works. There would need to be regular communication between the environmental consultant and the main contractor(s). The purpose of the verification strategy is to produce a final Verification Report, which provides an accurate record of the final land quality as per the requirements of statutory guidance. The report would seek to demonstrate that remediation is successful in addressing the risks raised by the Conceptual Site Model.

Regulatory

4. This Remediation Strategy should be submitted to the Local Planning Authority in support of discharging the planning conditions for the development.

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REMEDIATION STRATEGY

CLIENT NAME: Ark Data Centres Limited

PROPERTY ADDRESS: Longcross Film Studios,
Chobham Lane,
Longcross,
Chertsey,
KT16 0EE

INSPECTION DATE: N/A



1.0 INSTRUCTIONS

- 1.1** Paragon Building Consultancy Limited (Paragon) was instructed by Ark Data Centres Limited on 26 May 2021 to produce a Remediation Strategy for a site referred to as Ark Site A. This strategy has been produced following several phases of ground investigation and has been completed in connection with redevelopment of the site as a data centre campus. This is approved (in this location) in the outline planning permission for the redevelopment of the Longcross Film Studios complex.

2.0 AIMS AND OBJECTIVES

- 2.1** The aims of this report are:
- To provide a summary of ground conditions and geoenvironmental information that has been collated for the site.
 - To assess the potential mitigation measures required to address health and environmental risks associated with the development.
 - To provide remediation recommendations in relation to the proposed development.
- 2.2** The objectives of this report are:
- Provide the strategy for remediation at the site.
 - Provide details of verification procedures that will be adopted during the remediation works.

3.0 SCOPE OF WORKS

3.1	The Remediation Strategy has been completed in general accordance with Stage 3 of Land Contamination Risk Management 2020 (and the Environment Agency document 'Verification of Remediation Land Contamination Report', SCO30114/R1, February 2010. Due regard is made to the Environmental Protection Act (EPA) 1990 Part 2A. It also reflects the requirements of condition 19 of the outline planning permission for the redevelopment of the site.
3.2	<p>The following reports have been used to provide supporting information for this document:</p> <ul style="list-style-type: none"> • Paragon, 2019. Phase 1 Environmental Risk Assessment. Reference: 19.0415. Dated: 25 April 2019. (Wider site area). Completed for Due Diligence purposes. • Paragon, 2019. Phase 2 Site Investigation. Reference: 19.0415/CB/LSG. Dated: 22 August 2019. • Paragon, 2020. Foundation Inspection Pit Report. Reference: 20.0576/CB/KJH. Dated: 28 July 2020. • Paragon, 2020. Phase 1 Environmental Risk Assessment. Reference: 20.0576/CB/KJH. Dated: 13 August 2020. • Paragon, 2020. Phase 2 Ground Investigation. Reference: 20.0576/CB/NW. Dated: 21 August 2020, updated 14 December 2020. • Paragon, 2020. Settlement Analysis Report. Reference: 20.0576. Dated: 21 October 2020. • Paragon, 2021. Environmental Report Review. Reference: 20.1250/CB/ED. Dated: 1 March 2021. • Paragon, 2021. Waste Management Report. Reference: 201250/CB/ED. Dated: 5 March 2021. • Paragon, 2021. Ground Investigation Report for the Sales Agreement. Reference: 20.1250/CB/RM. Revision A. Dated: 12 April 2021, updated 26 April 2021. • Paragon, 2021. Delineation Report. Reference: 211187/Delineation Report. Dated: 17 July 2021.
3.3	It is intended that this report be submitted to assist in discharging planning conditions for the development, which comprises a data centre campus.

4.0 INTRODUCTION

4.1	Site Location
4.1.1	Several reports including Phase 1, Phase 2 and waste management investigations have been reported separately by Paragon as referenced above. The original Phase 1 should be read in conjunction with this report; the following is a summary.
4.1.2	The site is centred approximately at National Grid Reference: 497740, 165682, and extends to 3.5Ha. The approximate elevation of the site is 54m Above Ordnance Datum (mAOD). A location plan and existing layout plan are provided as Figure 1 and 2 respectively, in Appendix 1.
4.1.3	The site comprises the former Longcross Film Studios. All buildings on site have now been demolished to ground floor slab level. This work was completed in summer 2020.

4.2	<p>Proposed Development</p>
4.2.1	<p>The proposed development includes a data centre campus comprising buildings for data storage, an energy centre building, standby generators and fuel storage and a visitor reception centre.</p>
4.3	<p>Planning</p>
4.3.1	<p>A planning application has been made for the site (ref RU.21/0780) for redevelopment as a data centre campus. At the time of writing the report, the application has been submitted and a decision is awaited.</p>
4.4	<p>General Description and Current Site Use</p>
4.4.1	<p>The site comprises an exposed concrete slab in the centre, a shallow gradient slope in the northern part of the site with an exposed concrete slab and buildings, a car park in the eastern part of the site, canteen and associated parking in the southern part, and a steep slope with office units in the west. The site is immediately surrounded by commercial properties relating to the wider Longcross Studios with Chobham lane to the south. Crest Nicholson are currently constructing residential properties 350m northeast of the site.</p>
4.4.2	<p>All buildings on site have been demolished to ground floor slab level and the site is currently vacant.</p>
4.5	<p>History</p>
4.5.1	<p>Historical mapping indicated that the site was open, undeveloped woodland / scrubland for most of its history until structures were recorded on site on mapping editions from 2002 onwards. It is understood from anecdotal evidence that there was some informal landfilling on the wider film studios (off site). It is known from online research that the site was a military site long before this used for research and experiment relating to vehicles and tanks. Between 1941 and 2005 the site was used by various government military agencies until it became the Defence Evaluation & Research Agency site (DERA) and finally the Defence Logistics Organisation (DLO) Chertsey. The most recent use of the site was for the testing, evaluation and certification of the full range of British Army vehicles. It is understood that the site was later sold off and was then used by Longcross Film Studios.</p>
4.5.2	<p>The site is largely surrounded by undeveloped land / green belt and Chobham Common to the west. Longcross Station and railway are located to the north. The land to the east of the site were used for military use historically; there were also barracks buildings to the south.</p>
4.6	<p>Geology</p>
4.6.1	<p>From a review of British Geological Survey mapping, the geology below the subject site is reported to comprise the Windlesham Formation (Sand, Silt and Clay) and Bagshot Formation (Sand) which are both classified as Secondary (A) Aquifers of high permeability. There are no groundwater abstractions within a 1km radius of the site, and the site is not located within a Source Protection Zone for groundwater. The nearest surface water feature is an unnamed inland river approximately 180m west of the site.</p>

4.6.2 A number of borehole records have been obtained from BGS records that are situated within 50m of the site. The records indicate the ground conditions comprise Made Ground to 3m bgl over Sand, described as ‘peaty, black with layers of brown/green silty sand and stones and roots’, over the Bagshot Beds, described as ‘orange-brown, grey-green silty and clayey with stones’, to the base of the borehole at 15m. Groundwater was noted at 3m bgl.

4.6.3 The ground conditions encountered during the earlier investigations at the site are referenced in Table 1 below.

Table 1. Ground Conditions

Depth From (min/max) mbgl [mOD]	Depth To (min/max) mbgl [mOD]	Soil Type	Description
Ground Level [51.35]	0.7 / 1.5 [50.65 / 49.55]	MADE GROUND / CONCRETE	MADE GROUND. Black, gravelly SAND. Gravel comprised fine to coarse angular to sub-rounded flint. Rare cobble of angular flint. Occasional roots.
0.7 [50.65]	1.2 [50.15]	TOPSOIL	TOPSOIL. Brown gravelly sand. Gravel comprised fine to coarse sub-angular to rounded flint. Occasional roots.
1.2 [50.15]	2.6 / 5.0 [48.75 / 46.35]	SAND / GRAVEL / SILT	Medium dense, orange brown and grey slightly gravelly silty SAND. Gravel comprised fine to coarse, sub-angular to angular flint. Sand is fine to coarse
2.6 [53.78]	5.2 [51.18]	CLAY	Very stiff, reddish brown silty CLAY. (BH01 only)
1.0 / 7.0 50.35 / 44.35]	3.0 / 8.4 [48.35 / 42.95]	SILT	Medium dense to dense, thinly laminated, grey and orange, sandy SILT.
1.4 / 9.0 [42.95 / 42.35]	14.1 / 19.5 [37.25 / 31.85]	SAND	Dense to very dense, orange, brown and grey slightly silty SAND. Sand is fine to coarse.
11.0 / 25.0 [40.35 / 26.35]	17.0 / 35.0 [34.35 / 16.35]	SAND	Very dense grey and black SAND. Sand is fine to coarse.
19.0 / 25.0 [32.35 / 26.35]	25 / 35.0 [26.35 / 16.35]	SAND / SILT / CLAY / SILTSTONE	Very dense, greenish grey and black SILT interbedded with siltstone, sand and clay.

4.7 Hydrogeology

4.7.1 The River Terrace Deposits, Windlesham Formation and Bagshot Formation are classified as Secondary (A) Aquifers.

4.7.2 The site is not within a Groundwater Source Protection Zone (SPZ) and there are no licensed groundwater abstractions within 1km of the site.

4.8	Hydrology
4.8.1	The nearest surface water feature is an unnamed inland river approximately 180m west of the site.
4.8.2	There are no known discharge consents within 250m of the site.
4.9	Flooding
4.9.1	The Environment Agency website indicates that the flood risk at the site is less than 1 in 1,000 chance of flooding in any year, meaning that there is a low risk of flooding. The site has marginal areas shown to be susceptible to surface water flooding, however this is limited to external areas. The site is shown to be susceptible to groundwater flooding, however the BGS confidence rating in the result is low. It is understood that flooding is to be mitigated against through design of building levels.
4.10	Environmental Database Information
4.10.1	Chobham Common SSSI / SAC is located approximately 150m to the west of the site.
4.11	Ground Stability Hazard
4.11.1	Records indicate that the area in general has a low risk of subsidence hazards as a result of running sands.
4.11.2	The site is not in a coal affected area.
4.12	Unexploded Ordnance (UXO)
4.12.1	The site was formerly owned by the Ministry of Defence (MOD) and historical uses of the site include military use, including manufacture and testing of military tanks. The risk of UXO has been assessed using Zetica mapping and by reviewing the previous Land Quality Assessment prepared by Entec and EOD Contracts.
4.12.2	Although the site was noted to have had an increased risk of discarded, buried, concealed and stored munitions, MOD closure works included clearance and inspection of all parts of the site. Furthermore, in the southern part of the site where the studio canteen was situated, an intrusive UXO survey was undertaken and no UXO were identified. Based on the above, the potential risk of encountering unexploded items is reduced and it would not be necessary for a UXO specialist to be on site for further assessment. Nevertheless, if a suspicious item is encountered during groundworks, then works should cease and a specialist should be contacted.
4.13	Radon
4.13.1	The site is not located in a radon affected area.
4.14	Constraints and Development Site Conditions
4.14.1	There are areas of the site that have not been investigated by Paragon and as such a watching brief and discovery strategy were made as recommendations in the previous reports. As such, the potential for obstructions and below ground structures cannot be entirely discounted.

4.14.2	The results of environmental testing have identified hotspots of asbestos contamination in near surface soils where the asbestos content exceeded <0.001% by weight. Contaminants of Concern (CoC) plans are presented as Figure 4 and 5 in Appendix 1.
4.14.3	Based on the risks identified in connection with the elevated contaminants of concern, the conceptual site model (CSM) presented below was updated in light of the information from the most recent ground investigations and delineation exercises. The CSM is included below as this forms the basis of the remediation strategy, which is required to address the identified risks.

5.0 PRELIMINARY CONCEPTUAL SITE MODEL

5.1	Conceptual Site Model (CSM)												
5.1.1	A CSM has been formulated for the site and is based on the results from the earlier investigations; it is presented in Table 2 below. The results on which the CSM is based are summarised on Contaminants of Concern (CoC) plans which are presented as Figure 4 and 5 in Appendix 1.												
5.1.2	The model is based upon the source-pathway-contaminant linkage concept set out in the Environmental Protection Act 1990 and accompanying statutory guidance. For a site to be designated under Part 2A of the EPA 1990 as contaminated land, there must be at least one plausible contaminant linkage and a significant risk to the receptor must exist as a result.												
5.1.3	Table 2. Updated Conceptual Site Model												
<table border="1"> <thead> <tr> <th data-bbox="236 1160 427 1249">Receptor</th> <th data-bbox="427 1160 619 1249">Potential sources</th> <th data-bbox="619 1160 850 1249">Pathways</th> <th data-bbox="850 1160 967 1249">Risk</th> <th data-bbox="967 1160 1489 1249">Justification</th> </tr> </thead> </table>					Receptor	Potential sources	Pathways	Risk	Justification				
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Human Health													
<table border="1"> <tr> <td data-bbox="236 1310 427 1731" rowspan="2">Construction and maintenance workers / Users of the site</td> <td data-bbox="427 1310 619 1731">Organic and metal contamination</td> <td data-bbox="619 1310 850 1731">Direct contact, ingestion, and inhalation via outdoor soils or translocated soil and dust indoors.</td> <td data-bbox="850 1310 967 1731" style="text-align: center;">L</td> <td data-bbox="967 1310 1489 1731"> <p>Low Risk. The results of the chemical analysis from the soil samples have identified the concentrations of contaminants tested were below the GAC and therefore do not present a risk to human health. In addition, asbestos was not identified onsite in the areas tested by the recent investigation. It is understood that previous areas of known asbestos contamination on site have been remediated by Crest Nicholson.</p> <p>Personal Protective Equipment (PPE) is recommended for construction workers, to ensure mitigation is in place for potentially previously unidentified contamination and to promote good hygiene practices.</p> <p>The risk to current wider users of the film studios from translocated particulates is low.</p> </td> </tr> <tr> <td data-bbox="427 1731 619 1955">Asbestos in Made Ground</td> <td data-bbox="619 1731 850 1955">Inhalation via outdoor soils or translocated soil and dust indoors.</td> <td data-bbox="850 1731 967 1955" style="text-align: center;">M</td> <td data-bbox="967 1731 1489 1955"> <p>Moderate Risk. There are a number of isolated but significant hotspots of asbestos contamination. These have the potential to generate airborne fibres if disturbed.</p> <p>A detailed programme of investigation and sampling has been undertaken to delineate the asbestos hotspots as accurately as possible.</p> </td> </tr> </table>					Construction and maintenance workers / Users of the site	Organic and metal contamination	Direct contact, ingestion, and inhalation via outdoor soils or translocated soil and dust indoors.	L	<p>Low Risk. The results of the chemical analysis from the soil samples have identified the concentrations of contaminants tested were below the GAC and therefore do not present a risk to human health. In addition, asbestos was not identified onsite in the areas tested by the recent investigation. It is understood that previous areas of known asbestos contamination on site have been remediated by Crest Nicholson.</p> <p>Personal Protective Equipment (PPE) is recommended for construction workers, to ensure mitigation is in place for potentially previously unidentified contamination and to promote good hygiene practices.</p> <p>The risk to current wider users of the film studios from translocated particulates is low.</p>	Asbestos in Made Ground	Inhalation via outdoor soils or translocated soil and dust indoors.	M	<p>Moderate Risk. There are a number of isolated but significant hotspots of asbestos contamination. These have the potential to generate airborne fibres if disturbed.</p> <p>A detailed programme of investigation and sampling has been undertaken to delineate the asbestos hotspots as accurately as possible.</p>
Construction and maintenance workers / Users of the site	Organic and metal contamination	Direct contact, ingestion, and inhalation via outdoor soils or translocated soil and dust indoors.	L	<p>Low Risk. The results of the chemical analysis from the soil samples have identified the concentrations of contaminants tested were below the GAC and therefore do not present a risk to human health. In addition, asbestos was not identified onsite in the areas tested by the recent investigation. It is understood that previous areas of known asbestos contamination on site have been remediated by Crest Nicholson.</p> <p>Personal Protective Equipment (PPE) is recommended for construction workers, to ensure mitigation is in place for potentially previously unidentified contamination and to promote good hygiene practices.</p> <p>The risk to current wider users of the film studios from translocated particulates is low.</p>									
	Asbestos in Made Ground	Inhalation via outdoor soils or translocated soil and dust indoors.	M	<p>Moderate Risk. There are a number of isolated but significant hotspots of asbestos contamination. These have the potential to generate airborne fibres if disturbed.</p> <p>A detailed programme of investigation and sampling has been undertaken to delineate the asbestos hotspots as accurately as possible.</p>									

Table 2. Updated Conceptual Site Model (continued)

Receptor	Potential sources	Pathways	Risk	Justification
	Ground gas	Inhalation, migration through granular and fractured soils into confined spaces.	L	<p>Low Risk. The results of the gas monitoring have identified low concentrations of carbon dioxide across the site, and the concentration of methane was found below the limit of detection. The gas risk assessment determined that the site falls within CS1 whereby no gas protection measures are required.</p> <p>Personal Protective Equipment (PPE) and Risk Assessments and Method Statements would be required during construction to mitigate risks associated with specific construction activities.</p>
Future site users including maintenance / landscape workers	Organic and metal contamination	Direct contact, ingestion, and inhalation of outdoor soils or translocated soil and dust indoors.	L	<p>Low Risk. The results of the chemical analysis from the soil samples have identified the concentrations of contaminants tested were below the GAC and therefore do not present a risk to human health.</p> <p>Furthermore, it is envisaged that the landscaped areas will be dressed with imported topsoil to provide a suitable growth medium for vegetation. The topsoil will be subject to chemical analysis to ensure it is suitable for use.</p> <p>Personal Protective Equipment (PPE) is recommended for maintenance / landscape workers.</p>
Human Health				
Future site users including maintenance / landscape workers	Ground gas	Inhalation, migration through granular and fractured soils into confined spaces.	L	<p>Low Risk. The results of the gas monitoring have identified low concentrations of carbon dioxide across the site, and the concentration of methane was found below the limit of detection. The gas risk assessment determined that the site falls within CS1 whereby no gas protection measures are required.</p> <p>Personal Protective Equipment (PPE) and Risk Assessments and Method Statements would be required to mitigate risks associated with construction activities such as working near plant/exhausts or confined spaces.</p>

Table 2. Updated Conceptual Site Model (continued)

Property				
Site structures and services	TPH in site soils	Direct contact between soil and structures or services.		Low to Moderate Risk. The results of the chemical analysis have identified the concentration of TPH within the soil and groundwater marginally exceeds the acceptable limits for water supply pipes. As such, barrier pipework may be required. As the exceedances were only found in two locations, discussions with the water provider should be made to understand their requirements. Furthermore the concrete design class has been determined to be DS-1, AC-1.
	Ground gas	Migration through granular and fractured soils into confined spaces.		Low Risk. The results of the gas monitoring has identified low concentrations of carbon dioxide and methane was identified below the limit of detection. The gas risk assessment determined the site falls within CS1 whereby no gas protection measures are required.
Offsite Residents (380m east)	Organic and metal contamination	Direct contact, ingestion, and inhalation of outdoor soils or translocated soil and dust indoors.		Low Risk. The results of the chemical analysis have identified the concentrations of contaminants tested were below the GAC and therefore do not present a risk to human health.
	Ground gas	Migration through granular and fractured soils into confined spaces.		Low Risk. The results of the gas monitoring has identified low concentrations of carbon dioxide and methane was identified below the limit of detection. The gas risk assessment determined the site falls within CS1 whereby no gas protection measures are required. As such, the risk to off-site properties is considered to be low.
Plants /Landscaping	Organic and metal contamination	Root contact and uptake		Low Risk. Although no significant contamination has been identified within the soils onsite, they may not provide a suitable growth medium for proposed areas of soft landscaping/planting. As such, it is anticipated that imported topsoil will be used to dress these areas.
Groundwater				
Secondary (A) Aquifer	Organic and metal contamination	Soil leaching and migration of potential soil contamination.		Low Risk. The results of the groundwater analysis have identified marginal exceedances of some heavy metals. Due to the absence of a groundwater abstraction, and as the site is not situated within a Source Protection Zone, the impacts are minimal. As such, there is a low risk associated with groundwater contamination.
Surface Water				
Unnamed Inland River (180m west)	Leachable metals and organic contamination	Soil leaching and migration into drains and sewers which discharge into the ditch.		Low Risk. The results of the groundwater analysis have identified marginal exceedances of some heavy metals. Due to the distance from the inland river, the receptor being up-gradient and likely groundwater flow being east, the impacts are minimal. As such, there is a low risk associated with groundwater contamination.

6.0 REMEDIATION OPTION APPRAISAL

<p>6.1</p>	<p>Introduction</p>
<p>6.1.1</p>	<p>The development proposals are for a data centre campus. On this basis the laboratory results from the earlier investigation were compared against the Generic Assessment Criteria for a commercial land use. This section evaluates the mitigation measures required to address risks to potential receptors at the site from elevated chemical contamination. Potential receptors have been identified, within the CSM presented in Table 2, with reference to available environmental guidance, whereby all receptors (principally construction workers and future site users) have been considered.</p>
<p>6.1.2</p>	<p>In line with Stage 3 of Land Contamination: Risk Management (2020), the following considerations must be made when appraising the options for remediation. Remediation must:</p> <ul style="list-style-type: none"> • Be practical, effective and durable; • Be compatible with other aspects of work such as redevelopment; • Be achievable, sustainable and able to deal with uncertainty; • Be verifiable by testing, measuring, monitoring or other recording methods; and • Consider potential nuisance and disruption to local residents.
<p>6.1.3</p>	<p>The remediation works must ensure:</p> <ul style="list-style-type: none"> • Unacceptable risks have been satisfactorily mitigated; and • The remedial works do not cause harm to human health or the environment.
<p>6.2</p>	<p>Risks to Human Health from Soil Contaminants</p>
<p>6.2.1</p>	<p>The various investigations undertaken at the site in recent years have not identified any significant contamination in terms of metals, hydrocarbons or chemicals. However, some areas of asbestos contamination in the near surface Made Ground have been identified. Detailed delineation work has reduced the known extent of the three hotspots to 10m³, 30m³ and 5m³ of materials that would be classified as Hazardous Waste. This is on account of the materials containing over 0.1% by weight of asbestos.</p>
<p>6.2.2</p>	<p>Asbestos fibres pose a significant risk to human health when inhaled. Asbestos in soils can be released as free fibres into the air when disturbed in uncontrolled conditions. Although the final development will include extensive hard cover in the form of buildings and car parks, there will also be areas of landscaping / soft cover. The biggest risk is posed to current and future construction workers from active disturbance of the asbestos contaminated soils as part of their work.</p>
<p>6.2.3</p>	<p>The risk to human health from the asbestos hotspots in near surface Made Ground is considered unacceptable and remediation is required. Given the relatively small and well-defined areas of asbestos contamination, it is considered that off site disposal is the most pragmatic option.</p>
<p>6.2.4</p>	<p>Excavation and disposal of the asbestos hotspots must be undertaken by suitably qualified and licensed contractors in line with the Control of Asbestos Regulations 2012: Asbestos in Soil (CAR-SOIL).</p>

6.3	Property and Infrastructure
6.3.1	The results of previous investigations have indicated that barrier pipes may be required for potable water supplies. This should be confirmed with the local water supply company.

7.0 REMEDIATION STRATEGY

7.1	Introduction
7.1.1	The following sections set out the outline approach to the remediation works required at the development site; this forms the remediation strategy for the site. The strategy should be read in conjunction with earlier phases of ground investigation and other reports as set out in Section 3.
7.1.2	It is intended that this strategy would be agreed in principle with the Local Authority Contaminated Land Officer (CLO) and submitted in support of discharging planning conditions.
7.1.3	The areas asbestos identified through the delineation exercise are shown on plans presented as Figure 4 and 5 in Appendix 1.
7.1.4	To facilitate the future development, the following recommendations are made: <ul style="list-style-type: none"> • Site clearance and demolition; • Personal Protective Equipment and health and safety controls; • Watching brief and discovery strategy in the event that previously unidentified contamination is encountered; • Asbestos material management following delineation works in July 2021; • Materials management including management of waste; • Barrier pipework for new drinking water supply pipework (to be discussed with local water supply company); • Provision of clean topsoil in areas of proposed soft landscaping (for plant growth); • Decommissioning of boreholes; • Remediation and Verification Reporting.
7.2	Site Clearance and Demolition
7.2.1	It is understood that the existing covering of hardstanding across the site will be removed as part of the development works. Therefore, the main contractor should be supplied with a copy of earlier environmental reports including this document to ensure that risks, particularly to site workers, are mitigated.

7.2.2	<p>As part of the site clearance works, the appointed contractor(s) will be responsible for the surplus arisings generated as part of their works unless a suitable re-use strategy for materials can be agreed. For example, the contractor may wish to consider the re-use of processed site won concrete from relic foundations and slabs under WRAP, which forms a quality protocol for the production and re-use of aggregate from inert waste. The contractor will be responsible for demonstrating that re-used materials are compliant for use on site, i.e. free from asbestos fibres. Estimated frequencies of testing for aggregates are considered reasonable at 1 sample per 500m³.</p>
7.2.3	<p>It is understood that a reduced dig is required as part of the initial phase of works. Limited Made Ground has been identified during the previous phases of investigation and in many places the hardstanding rests directly on natural strata. It is recommended that the inert material is removed from site under a re-use strategy whereby the site would be set up as a donor site under a Materials Management Plan (MMP) using Definition of Waste: Code of Practice (DoWCoP). This would form a more sustainable strategy for materials management.</p>
7.2.4	<p>The appointed contractor(s) would be required to develop detailed method statements, and management plans with reference to currently available Health and Safety guidelines as set out by the Health and Safety Executive. These plans would define how works would be undertaken but as a minimum it is expected that the following would be considered:</p> <ul style="list-style-type: none"> • Welfare and decontamination facilities, together with PPE; • Measures to mitigate the potential for generation of dust and nuisance odours; • Covering and / damping down of stockpiles; • Measures to avoid surface water run-off and pollution prevention controls to mitigate risks to any nearby surface water drains; • Regular cleaning of site roads and public highways; • All waste haulage vehicles should be covered when leaving site to minimise the release of dust and fibres.
7.2.5	<p>As part of the remediation work, the main contractor(s) would also have obligations to maintain a watching brief for unforeseen contamination (see Section 7.3) and gather relevant data to be collated and submitted within a final verification report for the site.</p>
7.3	Watching Brief
7.3.1	<p>A watching brief should be maintained by the main contractor(s) at all times during groundworks.</p>

<p>7.3.2</p>	<p>Care must be taken during excavation works to inspect soils and breaking out and site preparation works progress to identify areas of unforeseen contamination. Such contamination would be identified by means of visual and olfactory appraisal by the main contractor(s) in the first instance. For example, this might mean:</p> <ul style="list-style-type: none"> • Soil or groundwater (if encountered) which appears by eye to have an unusual appearance, such as fibrous materials, Asbestos Containing Materials (ACMs), ash, oil or tar and any unusual discolouration. • Soil or groundwater that presents an odour such as fuel, oil and chemical / solvent type odours or unusual odours such as sweet or rotten egg odours. • Soil or groundwater that, when encountered affects the wellbeing of ground workers, for example reports of personnel feeling light headed, nausea, complaining of stinging eyes or nasal passages and blistering or other forms of skin irritation.
<p>7.3.3</p>	<p>Should areas of unexpected contamination be encountered, an environmental consultant / the CLO will be informed and the risk associated with the contamination assessed. To address such areas of concern the following methodology is recommended:</p> <ol style="list-style-type: none"> 1. Stop works in the area immediately, note the location and cordon off the area if safe to do so. 2. Notify a suitably qualified environmental consultant who will attend site (if not already present) within a reasonable timeframe to sample the identified area. 3. Notify statutory regulators if required. 4. In order to allow works to progress, an environmental consultant will supervise the excavation of contaminated material, which should be placed in a dedicated bunded area and covered to prevent rainwater infiltration from spreading the contamination. 5. Excavations should be progressed outwards from the obviously impacted (discoloured / odorous) material until no further evidence of impact is observed. Soil samples will be obtained by a suitably qualified environmental consultant from both the excavated material and the soils in the sides and base of the excavation to demonstrate that the full area of contamination has been excavated. If appropriate, in-situ testing can be undertaken for verification purposes also, for example for asbestos fibres which cannot be seen by eye. Soil sampling of asbestos will subsequently be carried out using a Hand Auger to obtain a sample of the soil, in concentric circles around known areas of impact, which will be submitted for asbestos identification and quantification by an independently accredited soils testing laboratory. 6. Contamination testing will be scheduled that is commensurate with the visual / olfactory observations made about the possible type of contamination encountered at the time. However, as a minimum a suite of contamination (heavy metals, asbestos, TPHCWG, speciated PAH, pH, SOM, VOCs and SVOCs) will be completed on all samples. 7. Upon receipt of the chemical test results, the soils can be dealt with accordingly i.e. treatment, disposal or re-use (subject to the wider Remediation Strategy and any materials management plan – see Section 7.5).
<p>7.3.4</p>	<p>In areas where hotspot removal is completed, open excavations should be cordoned off until testing results are received and it is possible to backfill the area (if required). Imported materials will require provenance data certifying them as 'clean' and free from ACMs and asbestos fibres. Soils are to be compacted upon placement to achieve a suitable California Bearing Ratio (CBR) value for a formation level.</p>

7.3.5 Records and testing certification will be maintained for inclusion into a verification report. The main contractor should provide their daily records / log books for the watching brief.

7.4 Waste Management

7.4.1 Paragon undertook a site-wide ground investigation in January 2021 which included 90no exploratory locations and 151no soil samples to provide comprehensive coverage of the site. The results of the investigation were assessed in terms of waste classification and reported in the Paragon Waste Management Report (Ref 201250/CB/ED, dated 5th March 2021). The results of this are summarised in Table 4.

Table 4 – Waste Classification

Waste Classification	Number of Samples
Inert Waste	101
Non-Hazardous Waste	33
Stable Non-Reactive Hazardous Waste	10
Hazardous Waste	7

7.4.2 The seven Hazardous Waste classifications were all due to asbestos. The Hazardous Waste (England and Wales) Regulations 2005 requires that any waste having an asbestos (ACM) content greater than 0.1% by weight/weight be classified as hazardous waste. Waste with an asbestos content of less than 0.1% w/w can be classified as non-hazardous waste, unless there are other contaminants present which would make the waste hazardous.

7.4.3 The laboratory certificates, waste classification outputs and drilling logs should be provided to the waste receivers to confirm their ability to accept waste arisings from the site. It is the waste producer’s (the main contractor(s)) responsibility to classify and appropriately manage waste under duty of care (Section 34 of the Environmental Protection Act 1990. Owing to the nature of arisings leaving the site, the main contractor(s) may need to put a Materials Management Plan in place to monitor volumes of material leaving site together with the associated Duty of Care records, which should be maintained for inclusion into a final Verification Report.

7.4.4 With the exception of the samples containing elevated concentrations of asbestos, no other significant contamination was identified in the various investigations of the site. As such, no other remediation is considered necessary.

7.5 Imported Material

7.5.1 In the event that material is to be imported to site, such as for areas of soft landscaping, the topsoil and subsoil are to meet the requirements of BS3882, Specification for Topsoil. The supplier should provide a test certificate prior to purchase. It is then recommended to test the soils once they arrive onsite to ensure they meet the requirements for a commercial land use based on S4ULs and C4SLs. The importation criteria are included in Appendix 3.

7.5.2	<p>The chemical quality of imported soils used in soft landscaped areas should be verified laboratory chemical analysis to be completed by an MCERTS and UKAS accredited laboratory. Estimated frequencies of testing for soft-landscaped areas are as follows:</p> <ul style="list-style-type: none"> • 1 sample per 100m³ of topsoil and • 1 sample per 250m³ subsoil.
7.6	<p>Decommissioning of Boreholes</p>
7.6.1	<p>Redundant boreholes are to be decommissioned by the contractor(s) in general accordance with the Environment Agency Document ‘Good Practice on Decommissioning Redundant Boreholes and Wells’.</p>
7.7	<p>Buried Services</p>
7.7.1	<p>The results of the chemical analysis have identified the concentration of TPH within the soil and groundwater marginally exceeds the acceptable limits for water supply pipes. As such, barrier pipework may be required. As the exceedances were only found in two locations, discussions with the water provider should be made to understand their requirements.</p>
7.8	<p>Verification Strategy</p>
7.8.1	<p>Based on the Stage 3 requirements of Land Contamination: Risk Management (2020), the remediation strategy requires verification to demonstrate that the remediation has worked. The Verification Strategy must make sure that:</p> <ul style="list-style-type: none"> • Unacceptable risks have been satisfactorily mitigated; • The remedial works do not cause harm to human health or the environment; and • There is an accurate final record of the land quality.
7.8.2	<p>The following strategy sets out the requirements of the main contractor(s) in terms of collating information during development and the responsibilities of an environmental consultant in reporting on the findings of third-party verification activities.</p>
7.8.3	<p>Periodic site audits would be required to ensure adequate site records and documentation are being maintained during demolition and construction works. There would need to be regular communication between the environmental consultant and the main contractor(s). The purpose of the verification strategy is to provide a final Verification Report, which provides an accurate record of the final land quality as per the requirements of statutory guidance. The report would seek to demonstrate that remediation is successful in addressing the risks raised by the Conceptual Site Model.</p>

7.8.4	<p>The purpose of the verification strategy is to obtain essential 'lines of evidence' that remediation has been satisfactorily completed and will involve:</p> <ul style="list-style-type: none"> • Agreement by regulators to the proposed Remediation Strategy and details of associated permits or exemptions required for the remediation works (if any); • Details and findings any health and safety controls implemented on site with regard to asbestos management (e.g.: asbestos air monitoring); • Records from the watching brief and outcomes of any areas of unexpected contamination and the actions undertaken; • Plan showing location of any additional samples obtained for testing for delineation and management of materials; • Results of any additional chemical / Waste Acceptance Criteria (WAC) testing including details of laboratory quality assurance and accreditation; • Details of material (solid / liquid) disposed off-site including waste classification, details of the receiving site(s) and hauliers and copies of all Duty of Care records; • Details of any re-using of material including details of location and any re-use protocols; • Details of the above ground tank decommissioning and removal including all associated records from a tank specialist; • Records of the installation of the clean capping layers including a layout plan, demonstration of chemical compliance (via review of provenance data prior to importing material and subsequent chemical testing of material on-site), records of the thickness placed and the presence a demarcation layer (including photographs); • Quantities of materials imported to site and chemical testing results and information on the source of any imported material and plans showing where this material has been used; and • As Built information.
7.8.5	<p>On completion of the above, the Verification Report would be submitted to the Local Planning Authority for their approval. A copy of the report would need to be retained within the health and safety file for the scheme.</p>
7.8.6	<p>In the first instance, this Remediation Strategy should be submitted to the Local Planning Authority in support of discharging planning conditions.</p>

APPENDIX 2: MATERIAL IMPORTATION CRITERIA

APPENDIX 3: EXTENT OF SURVEY AND LIMITATIONS

EXTENT OF SURVEY AND LIMITATIONS

This report is for your sole use, and consequently no responsibility whatsoever is undertaken or accepted to any third party for the whole or any part of its contents. Paragon accept no responsibility or liability for the consequences of this document being used for any purpose or project other than for which it was commissioned or a third party with whom an agreement has not been executed. Should any third party which to use or rely upon the contents of the report, written approval must be sought from Paragon, a charge may be levied against such approval.

The report has been designed to address potential source, pathway and receptor pollutant linkages associated with the proposed development, by means of intrusive investigation. The content and findings of the report are based on data obtained by employing site assessment methods and techniques, considered appropriate to the site as far as can be interpreted from desk-based materials and a visual walkover of the site. Such techniques and methods are subject to limitations and constraints set out in the report. The findings and opinions are relevant at the time of writing, and should not be relied upon at a substantially later date as site conditions can change. For example, seasonal groundwater levels, natural degradation of contaminants etc.

No liability can be accepted for the conditions that have not been revealed by the exploratory hole locations, or those which occur between each location. Whilst every effort will be made to interpolate the conditions between exploratory locations, such information is only indicative and liability cannot be accepted for its accuracy. By their nature, exploratory holes provide a relatively small and localised snapshot of the ground conditions relative to the size of the site.

Specific comment is made regarding the site's status under Part 2A of the Environmental Protection Act (EPA) 1990, which provides a statutory definition of Contaminated Land and as revised under The Contaminated Land (England) (Amendment) Regulations 2012. Unless specifically stated as relating to this definition, references to 'contamination' and 'contaminants' relate in general terms to the presence of potentially hazardous substances in, on or under the site.

The opinions given within this report have been dictated by the finite data on which they are based and are relevant only to the purpose for which the report was commissioned. If additional information or data becomes available which may affect the opinions expressed in this report, Paragon reserves the right to review such information and, if warranted, to modify the opinions accordingly. Paragon reserves the right to charge additional fees for; un-anticipated second opinion reviewing of previous reports.

Paragon has prepared this report with reasonable skill, care and diligence. The recommendations contained in this report represent our professional opinions. These opinions were arrived at in accordance with currently accepted industry practices at this time. The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources. We cannot provide guarantees or warranties for the accuracy of third-party data, which is reviewed in good faith and assumed to be representative and accurate.

It should be noted that any risks identified in this report are perceived risks based on the information reviewed. No liability can be accepted for the effects of any future changes to such guidelines and legislation. In the event that guidance / legislation changes it may be necessary for Paragon to update or modify reports. The risk assessment is completed in line with the relevant land use agreed for the site and the time of completing the works. Changes to site conditions or land use may require a reassessment.

DEFINITIONS

For the avoidance of doubt, Paragon Building Consultancy Limited (Paragon) has prepared the following alphabetical list of definitions and reservations to aid the client in understanding the content of our advice and or written reports(s):

Accuracy	Level of agreement between true value and observed value.
ACM's	Asbestos Containing Materials
Conceptual Site Model	<p>Textual and or schematic hypothesis of the nature and sources of contamination, potential migration pathways (including description of the ground and groundwater) and potential receptors, developed on the base of the information from the preliminary investigation and refined during subsequent phases of investigation and which is an essential part of the risk assessment process.</p> <p>Note 1: The conceptual exposure model is initially derived from the information obtained by the preliminary investigation. This conceptual model is used to focus subsequent investigations, where these are considered to be necessary, in order to meet the objectives of the investigations and the risk assessment. The results of the field investigation can provide additional data that can be used to further refine the conceptual model.</p>
Contamination	<p>Presence of a substance which is in, on or under land, and which has <u>the potential</u> to cause significant harm or to cause significant pollution of controlled water.</p> <p>Note 1: There is no assumption in this definition that harm results from the presence of the contamination.</p> <p>Note 2: Naturally enhanced concentrations of harmful substances can fall within this definition of contamination.</p> <p>Note 3: Contamination may relate to soils, groundwater or ground gas.</p>
Controlled Water	<p>Inland freshwater (any lake, pond or watercourse above the freshwater limit), water contained in underground strata and any coastal water between the limit of highest tide or the freshwater line to the three-mile limit of territorial waters.</p> <p>Note 1: See Section 104 of The Water Resources Act 1991.</p>
Enquiries	Any enquiries undertaken by Paragon of local authorities and statutory undertakers are made verbally in respect of environmental issues. Local searches are not undertaken and no responsibility is accepted for any inaccurate information provided. It is further assumed unless otherwise stated that all necessary licences, permits etc. either run with the property or are transferable to a new occupier as appropriate.
Harm	Adverse effect on the health of living organisms, or other interference with ecological systems of which they form part, and, in the case humans, including property.
Hazard	Inherently dangerous quality of a substance, procedure or event.
Pathway	Mechanism or route by which a contaminant comes into contact with, or otherwise affects, a receptor.
Precision	Level of agreement within a series of measurements of a parameter.
Receptor	Persons, living organisms, ecological systems, controlled water, atmosphere, structures and utilities that could be adversely affected by the contaminant(s).

Risk	Probability of the occurrence, magnitude and consequences of an unwanted adverse effect on a receptor.
Risk Assessment	Process of establishing, to the extent possible, the existence, nature and significance of risk.
Sampling	Methods and techniques used to obtain a representative sample of the material under investigation.
Soil	<p>Upper layer of the earth's crust composed of mineral parts, organic substance, water, air and living matter.</p> <p>Note 1: In general accordance with BS 10175:2001 the term soil has the meaning ascribed to it through general use in civil engineering and includes topsoil and subsoil; deposits such as clays, silt, sand, gravel, cobbles, boulders and organic deposits such as peat; and material of natural or human origin (e.g. fills and deposited wastes). The term embraces all components of soil, including mineral matter, organic matter, soil gas and moisture, and living organisms.</p>
Source	<p>Location from which contamination is, or was, derived.</p> <p>Note 1: This could be the location of the highest soil or groundwater concentration of the contaminant(s).</p>
Uncertainty	Parameter, associated with the result of a measurement that characterises the dispersion of the values that could reasonably be attributed to the measurement.

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