Tiznow Property Company Limited
(Comer Group Ireland)

Former Cork Warehouse Site

Land Contamination Remedial Strategy

267365-ARUP-XX-XX-RP-YE-0006

P03 | 11 March 2022

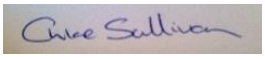
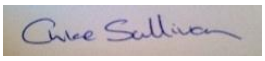
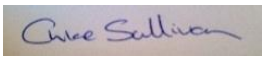
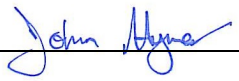
Job number 267365

Arup Ltd
One Albert Quay
Cork
T12 X8N6
Ireland
www.arup.com

ARUP

Document verification

ARUP

Job title		Former Cork Warehouse Site		**Job number** 267365	
Document title		Remedial Strategy		**File reference**	
Document ref		267365-ARUP-XX-XX-RP-YE-0006			
Revision	**Date**	**Filename**	267365-ARUP-XX-XX-RP-YE-0006		
P01	20 Dec 2021	Description	S2- Suitable for information-Draft Planning Issue		
			Prepared by	Checked by	Approved by
		Name	Chloe Sullivan	Christopher Newton	John Hynes
		Signature			
P02	3 Feb 2022	Filename	267365-ARUP-XX-XX-RP-YE-0006.docx		
		Description	S2- Suitable for Information-Draft Planning Issue		
			Prepared by	Checked by	Approved by
		Name	Chloe Sullivan	Christopher Newton	John Hynes
		Signature			
P03	11 March 2022	Filename	267365-ARUP-XX-XX-RP-YE-0006.docx		
		Description	S2- Suitable for Information - Planning Issue		
			Prepared by	Checked by	Approved by
		Name	Chloe Sullivan	Christopher Newton	John Hynes
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			

Issue Document verification with document ✓

Contents

1 Introduction

Arup were commissioned to design and interpret a Ground Investigation (GI) to review the potential for contamination on a section of the Former Cork Warehouse Company Site. This report presents a summary of the findings and highlights the proposed remedial strategy and method statement for the management of contaminated soils.

This report supplements the planning application for planning permission for a Strategic Housing Development (SHD) and has been prepared alongside the Construction Environmental Management Plan (CEMP) (267365-ARUP-XX-XX-RP-YE-0004).

1.1 Purpose

In the CEMP it was highlighted that contaminated soils are present on site. This Remedial Strategy provides a method statement for their management and remediation as part of the proposed application.

This remedial strategy considers impacts on human health, groundwater, the nearby drainage channels and the River Lee.

1.2 Structure

A summary of the proposed development, ground conditions and contamination found are presented in the CEMP. These are reproduced in Sections 2 and 3 of this Remedial Strategy so that the reader has all the information in one document. The contaminated soil remedial strategy is presented in Section 4 of this report and a short conclusion in Section 5.

No ground investigation or detailed assessment of the contamination are presented in this report.

2 Proposed Development

The Developer intends to apply to An Bord Pleanála (the Board) for consent for a Strategic Housing Development (SHD) with a total application area of c. 1.06 ha on lands located on the Former Cork Warehouse Company Site at Centre Park Road, in Cork City. The area is considered to be a brownfield site with a number of pre-existing structures on the site which have been partially demolished.

A detailed description of the proposed development and construction strategy is presented in the CEMP and planning applications documents. A summary is presented below of the earthworks that could interact with potential contamination.

2.1 Construction Phase

The proposed development is anticipated to be constructed in four sequential phases, three main construction phases preceded and Mobilisation and Enabling Works Phase

During the Mobilisation and Enabling Works site level shall be lowered to approximately -1.30mOD. This will require the excavation of approximately 26,188m^3 soil and approximately 356m^3 of asphalt. Excavation will remove made ground, some silts and potentially some sand/gravels (a summary of the ground conditions is presented in Section 3.). The excavation will require a temporary dewatering strategy.

Once the foundations are constructed fill materials will be required to build up the site to the required levels, in addition further fill will be required for under hard and soft landscaping areas.

2.2 Operational Phase

The development will consist of:

- The construction of a strategic housing development of 190 no. apartments in a building ranging in height from single to 12 storeys.
- The proposed development makes provision for 3 no. café/restaurant units, 2 no. retail units, a creche and supporting tenant amenity facilities at ground floor level and includes 64 no. 1 bedroom apartments, 106 no. 2 bedroom apartments and 20 no. 3 bedroom apartment on the upper levels.
- The proposed development also provides for outdoor amenity areas, landscaping, public realm works on Marquee Road and Centre Park Road, car parking, bicycle stores and shelters, bin stores, ESB substation, plant rooms and all ancillary site development works.
- Vehicular access to the proposed development will be provided via Marquee Road.

3 Ground Investigation

A geo-environmental ground investigation (GI) was carried out between September to October 2021 across a series of properties in the Cork Docklands under the ownership of the applicant. This included the site the Former Cork Warehouse Company Site, the subject of this report (Figure 1). The ground investigation was carried out in accordance Irish and International good practice.

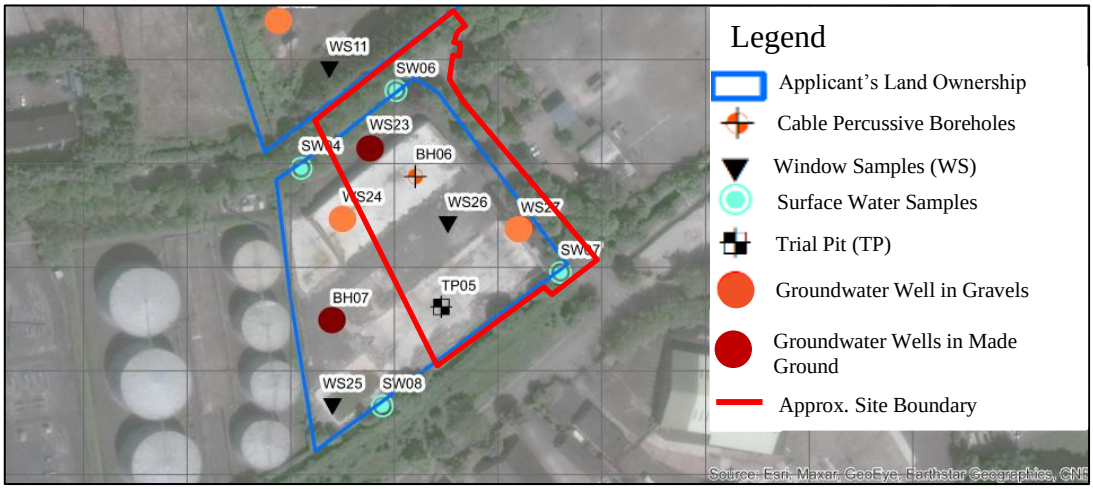


Figure 1: Ground Investigation with the Former Cork Warehouse Company Site highlighted in Red.

The Former Cork Warehouse Company Site is the eastern side of a plot of land located along Marquee Road, shown in Figure 1 by the red line boundary. During the GI a number of Trial Pits (TP), Window Samples (WS), Boreholes (BH) and groundwater well installations were carried out across the site (Figure 1). The investigation was undertake to examine the ground conditions and take geo-environmental samples of the soil to determine their waste classification and any risk to human health and the environment.

The existing topography of the site is relatively flat with levels generally decreasing in elevation from approximately +1.70mOD at the southern boundary to +1.00mOD at the northern boundary.

3.1 Stratigraphy

The ground investigation for the site has found in general that the site stratigraphy is as follows:

- Made Ground (comprising of sandy, gravelly, silt / silty, sandy, gravel with cobbles and boulders and typically 10% to 20% anthropogenic materials including brick, concrete blocks, pieces of glass and ceramics) from approximately 1.2 metres above Ordnance Datum, (mOD) up to -0.7mOD,
- Silt (reclaimed and natural) from approximately 0.5mOD up to a depth of -2.3mOD.

- Sand/gravel from -0.33mOD and extending for several 10's of metres under the site.

3.2 Sample strategy

During the Ground Investigation, soil samples were collected from the trial pits and window samples. The soil samples were taken at 50m spacing, as required for an exploratory investigation according to BS 10175:2011+A2:2017, 'Investigation of potentially contaminated sites'.

The soil samples were taken at varying depths between the surface and 0.5 meter Below Ground Level (mBGL). Subsequent samples were taken at approximately 1.0m intervals and where colour, odour or consistency indicate a change in the nature of the soil.

Groundwater samples were taken from wells with a response zone in the made ground and a response zone in the gravels. Surface water samples were taken from drainage ditches near the site and the River Lee, approximately 0.5km northeast of the site.

3.3 Contamination Assessment

The soil samples were compared against Generic Assessment Criteria (GAC) for human health relevant to a '*public open space with residential land use*', based on the English Environment Agency CLEA model. This is equivalent to the most conservative proposed use of the site which includes communal spaces. The soil samples exceeded the GAC for the following:

- The polycyclic aromatic hydrocarbon (PAH) dibenz(a,h)anthracene in TP05 at 1mBGL and WS27 at 0.5mBGL.
- The PAH benzo(b)fluoranthene in WS27 at 0.5mBGL.
- Trichloroethene in TP05 at 1mBGL.
- Asbestos in soil (AiS) as fibres and clumps between 0.001% to 0.007% in TP05 at 1mBGL, WS23 at 0.8mBGL and WS27 at 0.5mBGL.

Groundwater samples from the made ground, gravel under the site and the drainage channels were compared with Environmental Quality Standards (EQS).

Some elevations in the groundwater quality from the made ground and gravel were noted, such as:

- WS23 and WS24 had elevated levels of sodium;
- WS23, WS24 and WS27 had elevated levels of chloride;
- WS23, WS24 and WS27 had elevated levels of ammoniacal nitrogen;
- WS23, WS24 and WS27 had elevated levels of manganese;
- WS23, WS24 and WS27 had elevated levels of metals such as barium and chromium.

- WS27 had an elevated level of zinc in the third round of sampling.
- WS23 had elevated Aliphatic Total Petroleum Hydrocarbons (TPH) >C16 – C21 in the third round of sampling.

Some elevated concentrations, such as sodium and chloride could be attributable to brackish water from the River Lee. Elevated chromium could be attributable to background concentrations from the River Lee. The elevated concentration of TPH is likely to be attributable to an offsite up-hydraulic gradient source. Elevated barium is likely to be attributable to background concentrations.

The manganese concentrations were observed to be high in WS27. Manganese is usually linked to the breakdown of hydrocarbons. There were no high levels of hydrocarbons observed in the soil on the site. Hence, the concentrations are likely to be linked to an off-site source or a small localised hotspot.

The water quality in the surface water channels was found to vary between moderate to poor. Some concentrations of contamination were observed in the surface water channels but are most likely attributed to an up-stream and an off-site source(s).

Should it be necessary to dewater the gravel during construction, and dependant on the proposed discharge location, treatment is likely to be required.

3.4 Preliminary Waste Assessment

Soil to be disposed off-site has been classified as 17 05 04 and has been preliminarily assessed according to the Guidance of the Classification and Assessment of Waste. Further testing will be required at a rate determined by the waste receiver and the results from that will provide information on the final waste classification of the soil will be based. The waste soil classification was carried out using the Hazwaste Online (HWO) Tool and the leachate results have been compared to Waste Acceptance Criteria (WAC), ISBN 978-1-84095-880-5.

The soils samples were classified as Non-Hazardous based on the HWO tool, have inert leachate but laboratory results show that 3 of 7 soil samples had asbestos in soil (AiS) present hence the waste classification for these samples is non-hazardous with trace asbestos.

There was no pattern in the spacing or depth of the AiS therefore it is quite probable that asbestos is present throughout the made ground (see the Figure 2). Consequently, as a preliminary worst case assessment all made ground samples in the Former Cork Warehouse Company Site are classified as Non-Hazardous with trace asbestos. This is only an initial analysis and further testing could confirm a different pattern.

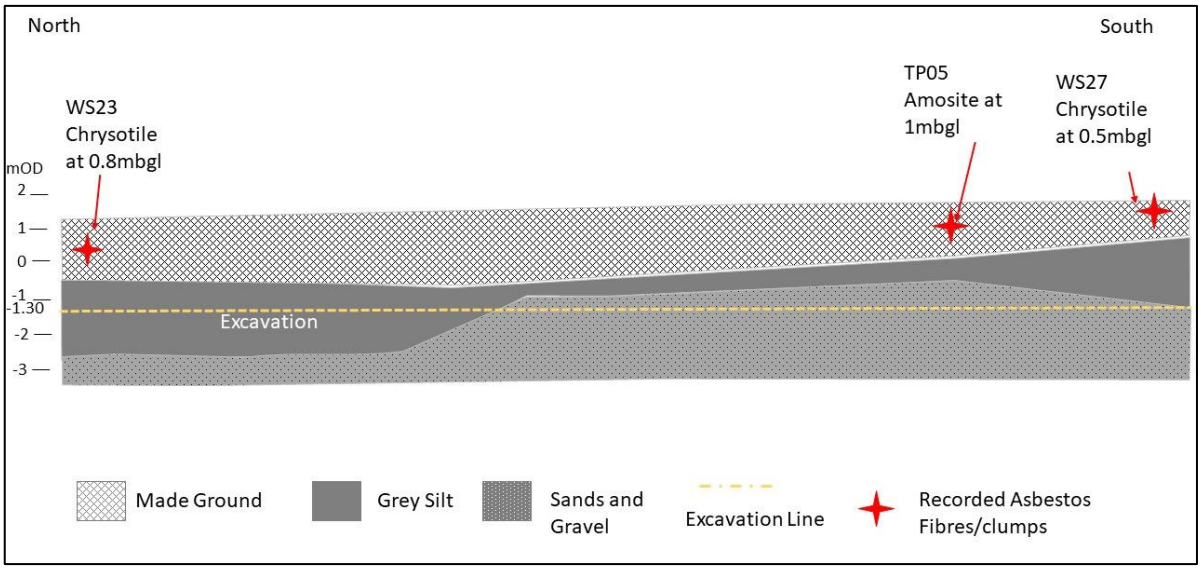


Figure 2: Ground conditions and indicative excavation line.

The natural soil under the made ground was seen to be free of contamination and can be classed as suitable for disposal to an inert landfill.

3.5 Contaminants of Concern

Based on the ground investigation carried out to date, the principal contaminants of concern are considered to comprise the lead and AiS which are assumed to be present throughout the made ground, and the PAH's which are present in localised areas.

The main pathways for these contaminants to reach site users (construction workers and future residents) are though dermal contact with the soil or consuming produce grown in the soil (lead and PAH's) or inhalation of dust generated by the soil (AiS).

Exposure to lead and PAH's in the soil are considered to be a long term issue and short term exposure is not envisaged to have any significant impacts on health of those exposed to them. However, there is no safe limit for asbestos hence even short-term exposure is considered potentially harmful.

As AiS presents the greatest risk to receptors, if soil exposure is minimised to reduce the impact of AiS then this will manage the risks from lead and PAH's. Consequently, remedial measures presented in the following section are considered in relation to the risk principally from AiS.

Groundwater contamination in the made ground is not considered to be significant and does not warrant special measures beyond standard good practice.

4 Management of Contaminated Soils

The final design of any remediation will be subject of the detailed design. This will include a detailed Soil Management Plan that will include a volumetric assessment of what soil will be reused, where and all necessary conditions required to allow it to be reused. In this section the framework required to prepare this Soil Management Plan is highlighted.

4.1 Construction Phase

During the excavation the soil can either excavated and disposed of to a suitable landfill or, subject to regulatory approval, it can be excavated and retained for potential reuse or reused elsewhere. There is a requirement for non-engineered fill around the foundations once constructed which could take a large portion of the excavated soil. In addition, there is potential to re-use soil during the development of adjacent sites under the ownership of the developer. The onsite reuse could include the contaminated soils (with or without treatment). Reuse offsite could include the inert natural soils under the made ground. This would be carried out under an Article 27.

Considering the AiS content of the made ground if the soil is retained on site for potential reuse then there are potentially legal requirements such as environmental licensing/permitting that will need to be agreed with the local waste regulator Cork City Council and or the Environmental Protection Agency.

Key to retaining soil onsite and demonstrating that it can be re-used will be understanding the risk of respirable asbestos becoming airborne. This shall be determined by risk assessment and review of additional testing of the soil such as dustiness testing. If the risk is significant then the designer shall need to incorporate measures during construction and operation to mitigate against any risk.

Standard mitigation measures for the construction phase, including excavation, stockpiling, and disposal of the soil are outlined in the CIRIA C733 Asbestos in Soil and Made Ground: A guide to understanding and managing risks (hereafter referred to as CIRIA C733). These include measures such as:

- Maintaining an exclusion zone around the area of the dig;
- Use of personal protection equipment (PPE) such as respiratory protection and full body disposable suits;
- Controlling surface water run-off from contaminated soil;
- Spraying soil to minimise dust generation; and
- Covering exposed soils.

Figure 3 summarises the different risks involved dealing with AiS and how these can be managed by standard mitigation measures.

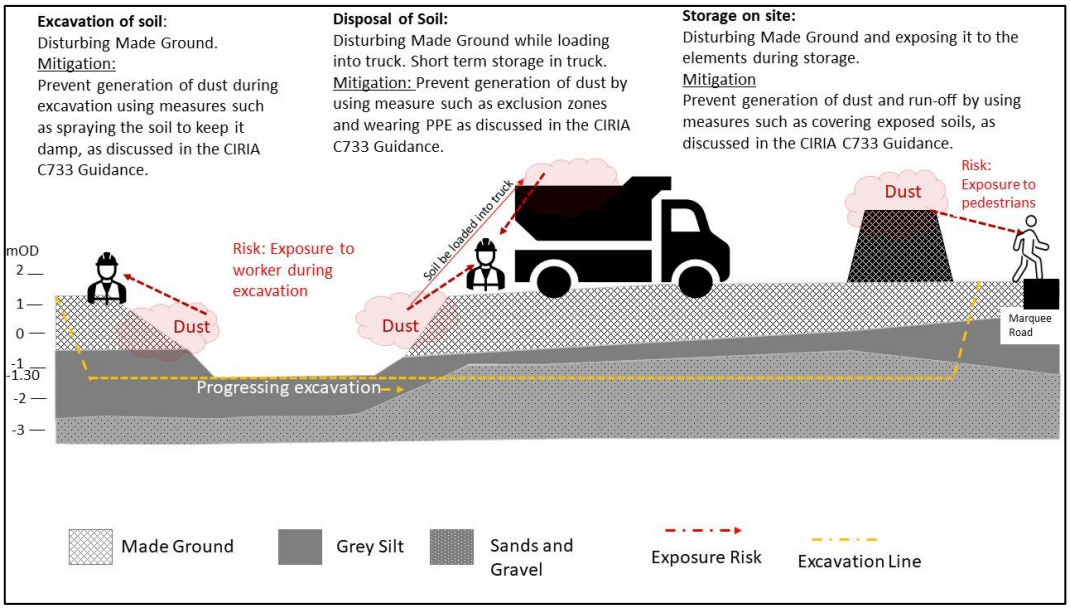


Figure 3: Different risks involved dealing with asbestos in soil and standard mitigation measures.

4.1.1 Disposal

It is likely that the construction will involve some soil to be disposed of off-site. Following the 2013 HSA Asbestos Guidance Document entitled Asbestos-containing Materials (ACMs) in Workplaces Practical Guidelines on ACM Management and Abatement, collection, transport, and disposal of asbestos waste should only be undertaken by an authorised waste collection permit holders under the Waste Management (Collection Permit) Regulations, 2007, (S.I.No.820 of 2007) and waste sent to an appropriately authorised facility for disposal.

4.1.2 Notification

A risk assessment shall be carried out by a competent person and in line with Section 6 of the 2013 HSA Asbestos Guidance Document. Where the risk assessment indicated that an asbestos work activity is high risk, then it is required to submit a notification in writing to the HSA. Section 16 of the 2013 HSA Asbestos Guidance details the requirements on notification to the HSA.

An exemption to notification to the HSA is when the risk assessment indicates lower risk asbestos work activities where exposure is low and sporadic. Discussion with the Cork City Council will help advise weather Notification to the HAS will be required.

4.1.3 The Safety, Health and Welfare at Work (Asbestos) Regulations

The Safety, Health and Welfare at Work (Asbestos) Regulations 2006-2010 apply to all work activities which expose people to risks arising from the inhalation of dust from asbestos or asbestos containing materials.

The main risk relates to dry soils and generating dust during excavation or by vehicular activity. The likely airborne fibre concentrations released from AiS will depend on the types of activities involved (hand digging or mechanic digging etc), the amount and the types of Asbestos being disturbed. During the construction phase the generation of dust must be managed by measures such as PPE, exclusions zones, good site awareness, site management, asbestos specific mitigation measures and appropriate training of staff. Part 2 of the CIRIA C733 details the management of risks associated with asbestos in soil and made ground.

4.1.4 Monitoring

The contractor who carries the earthworks shall be required to demonstrate that the control measures do not release airborne asbestos fibres. It is a mandatory requirement, as stated in the 2013 HSA Asbestos Guidance Document to implement an air monitoring program by an independent analyst during the removal of the asbestos in soil.

In addition, the contractor shall keep a watching brief to manage any unforeseen hotspots that may be encountered during the dig.

4.1.5 Storage of soil on site

Waste soil can be temporality stored on site during the construction phase. Storage of the waste soil should follow Section 17 of the 2013 HSA Asbestos Guidance Document, which states that the waste soil '*must be placed in a dedicated lockable skip or suitable controlled compound'*. There needs to be clear agreement on who is responsible for the waste soils stored on site. Care and diligence should be exercised when looking at both storage and disposal.

The main risk to storing soils on site relates to dry soils and generating dust allowing fibres to become airborne. The soil can be stored as stockpiles on site but good site management of these shall be implemented to prevent the generation dust and prevent any potential runoff from the stockpile. The CIRIA C733 outlines good management measures relevant to any soils with AiS stored on site.

4.2 Operational Phase

The soil containing asbestos may have suitable engineering properties that could make it useful as a fill material. Subject to the necessary regulatory approval during the detailed design analysis shall be undertaken to consider the potential options for reuse of the soil. Suitable potential re-use options include between pile caps, under hard and soft landscaping under areas such as communal spaces. The detailed design shall consider the necessary control measures to prevent site users being exposed to the AiS where contaminated soil is reused.

The CIRIA C733 states that AiS should be at a suitable depth below the ground level dependant on the risk of site users being exposed to the soil. In areas where soil is uncovered and in communal spaces, a significant thickness of clean materials are required to act as barrier material.

When soil is covered by infrastructure such as roads and buildings, the thickness of the barrier is can be reduced.

5 Conclusion

Based on the investigation and assessments carried out to date the biggest risk to human health or the environment during the development of the Former Cork Warehouse Company Site the presence of asbestos in soil (AiS). Other soil contaminants exist but will be dealt with by the same measures that shall be employed for the AiS.

During construction and the operation of the development there is the potential for asbestos fibres to become airborne. The likely airborne fibre concentrations released from AiS will depend on the types of activities involved (hand digging or mechanic digging etc), the amount and the types of asbestos being disturbed.

Suitable standard measures such as continued dampening of soil during excavation, disposal or stockpiling will help prevent generation of dust. The CIRIA C733 provides suitable guidelines on how to reduce the risks from the presence of AiS during construction and operation of the proposed development.

In line with best practice and subject to regulatory approval during the detailed design options to reduce disposal of soil will be followed. The re-use of soil containing asbestos shall be subject of a risk assessment and discussed and agreed with Local Authorities or the EPA, as necessary. Where disposal of waste is unavoidable this shall be done in accordance the necessary waste regulations.