

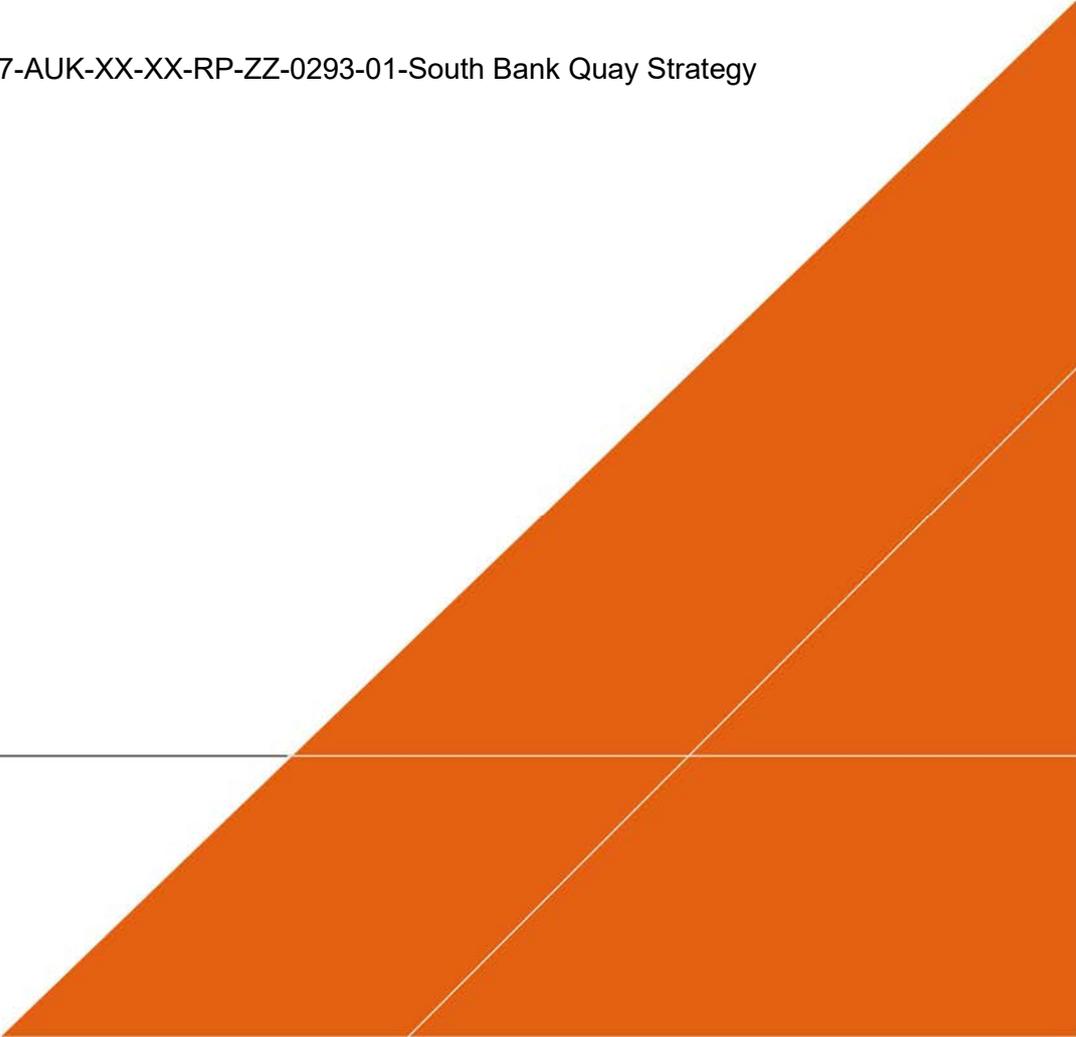
SOUTH BANK QUAY AREA, FORMER STEELWORKS, REDCAR

Enabling Earthworks and Remediation Strategy Report

South Tees Development Corporation

REPORT NO. 10035117-AUK-XX-XX-RP-ZZ-0293-01-South Bank Quay Strategy

MAY 2021

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VERSION CONTROL

Version	Date	Author	Changes
	May 2021	Adam Bethell	First Draft
Rev 1	May 2021	Adam Bethell	Incorporating comments

This report dated 30 April 2021 has been prepared for South Tees Site Company (the "Client") in accordance with the terms and conditions of appointment dated 17 April 2020 (the "Appointment") between the Client and **Arcadis (UK) Limited** ("Arcadis") for the purposes specified in the Appointment. For avoidance of doubt, no other person(s) may use or rely upon this report or its contents, and Arcadis accepts no responsibility for any such use or reliance thereon by any other third party.

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Study Limitations

1 INTRODUCTION

1.1 Project Aims and Objectives

The South Bank Quay (SBQ) Area (the site) is a land parcel situated at the Former Redcar Steelworks located within the Redcar, Lackenby, Grangetown and South Bank conurbations of the Borough of Redcar & Cleveland, within the industrial area generally known as ‘South Tees’.

The South Tees Regeneration Masterplan has been developed detailing the industrial-led regeneration of the Former Redcar Steelworks into a world class employment-generating zone and economic growth enabler for the Tees Valley.

The Masterplan has identified the SBQ area as being located within the Southern Industrial Zone. The site is a priority development area and Arcadis understands this report is to be used within a planning application scheduled for submission in May 2021.

The overarching aim of the works is to deliver a sustainable ground remediation strategy for the contract site which is compliant with regulatory needs (Local Authority and Environment Agency) and has their approval in principle. As technical consultant, the specific objective of this phase of works is to review the output of environmental and geotechnical risk assessments and identify an applicable remediation strategy for the site.

1.2 Contract Details

Arcadis (UK) Limited (Arcadis) were appointed by South Tees Development Corporation (STDC) to develop a remediation strategy to address environmental constraints relating to ground conditions identified by physical ground investigation works conducted at the South Bank Quay Area site.

The work was carried out in accordance with the proposal “South Bank Area B & C Ground Investigation - PM, PD and Technical Support Roles Proposal” dated 26th February 2021.

The Site area is presented in the below Figure 1 and included in Appendix A.

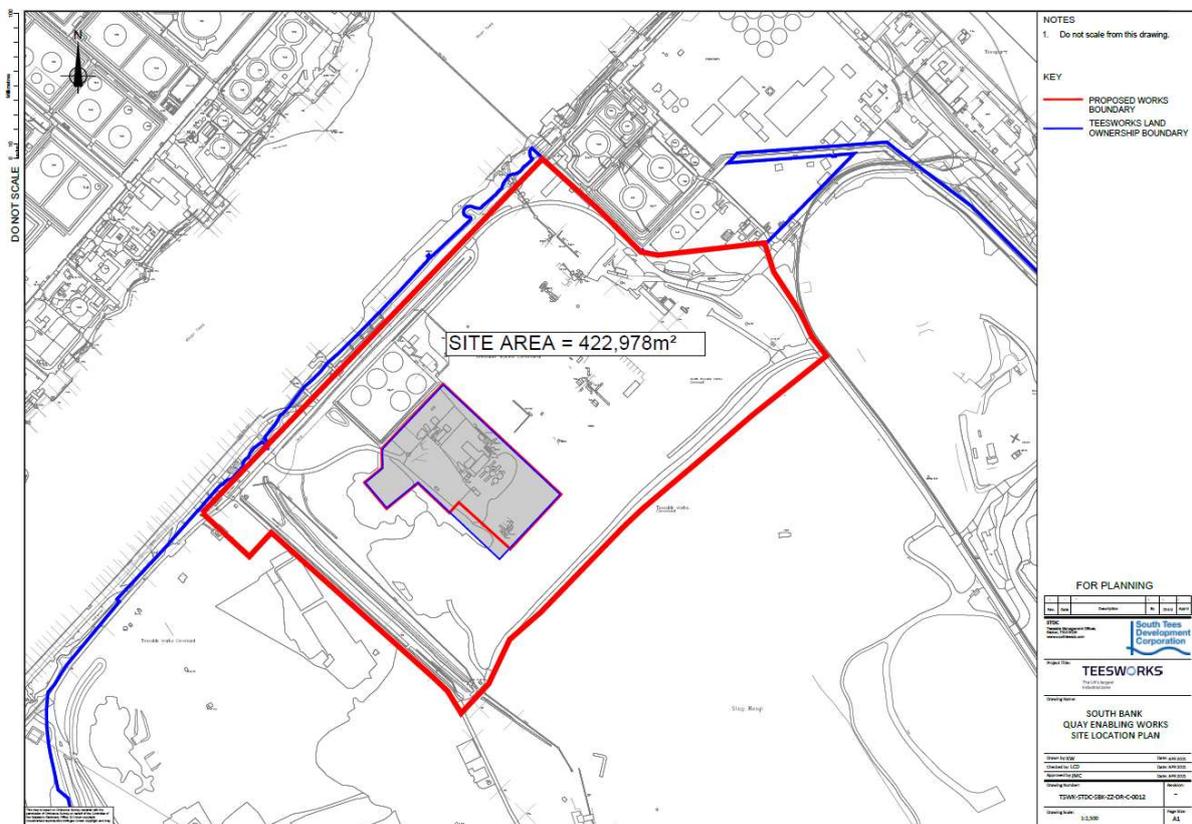


Figure 1- Site Area

1.3 Report Aims

The aim of this remediation strategy document is to use the available information to assess feasible remediation strategies to address the active source-pathway-receptor linkages identified. The remediation strategy has been formulated to support the planning process for the development of the South Bank Quay site.

1.4 Previous Information

The following reports have been prepared for or include the South Bank Quay Area:

- Soil and Groundwater Baseline Characterisation Study Teesside Works Summary Report and appendices, prepared by Enviro, June 2004;
- Design of a Site Protection and Monitoring Programme for Cleveland Works, Teesside, prepared by CORUS UK Ltd., October 2004;
- First Phase Reporting of the Site Protection and Monitoring Programme 31 prepared by CORUS UK Ltd., January 2008;
- TS4 South Bank – Phase 1 Geo-Environmental Desk Study, prepared by CH2M Hill for the Homes and Communities Agency, report ref. 678079_TS4_002 dated August 2017 and marked Final [CH2M 2017];
- Former Steelworks Land, South Tees Outline Remedial Strategy, Prepared for South Tees Development Corporation by Wood, ref 41825-wood-XX-XX-RP-OC-0001_S0_P01 dated 25th June 2019 [Wood 2019];
- South Industrial Zone ES - Vol 2 - Chapter H (Ground Conditions and Remediation), prepared by Arcadis for STDC and dated July 2020;
- South Bank Quay – Ground Investigation and Generic Quantitative Risk Assessment Report, dated 16th April 2021, Report Ref: PC1084-RHD-ZZ-XX-RP-Z-0001, [Royal Haskoning, 2021];
- South Bank Site Remediation, Ecological Impact Assessment Revision A Final, dated May 2021, Report ID: INCA 2021-29 [INCA]; and,
- South Bank Site Remediation - Shadow Habitats Regulations Assessment: Stage 1 Screening and Stage 2 Appropriate Assessment Revision A Final, dated May 2021, Report ID: INCA 2021-30 [INCA].

This Strategy document should be read in conjunction with the aforementioned reports.

At the time of issue Arcadis are undertaking a ground investigation of the southern area of the site in order to inform current data gaps and to investigate the current geo-environmental conditions. The findings of the ground investigation works shall be reviewed once complete to confirm the accuracy of the conceptual site model, contaminant distribution and the requirements of the remediation strategy.

1.5 Reliability / Limitations of Information

A complete list of Arcadis' Study Limitations is presented in Appendix B.

It should be noted that ground conditions between exploratory holes may vary from those identified during the ground investigations that this report is based upon; any design should take this into consideration. It should also be noted that groundwater levels may be subject to diurnal, tidal, seasonal, climatic variations and those recorded in this report are solely dependent on the time the ground investigation were carried out and the weather before and during the investigation work.

2 Environmental Setting and Development Constraints

This section incorporates a review of the above reports listed in Section 1.4.

2.1 Site Description and Setting

The site is approximately 42 hectares in size and is irregular in shape. The site is bound to the north by the River Tees.

The central portion of the site contains land leased to Hanson and an area previously occupied by Heavy Fuel Oil Tanks (HFO). The HFO site is currently being decommissioned, and all above ground structures have recently been demolished. The site is relatively level with the exception of a lined valley running along the western boundary which formerly housed water pipes (now redundant) and a culverted stream (now rerouted).

The site is bound to the south by the Highfield Environmental and High Tip Landfills, to the west by the wider South Bank site including South Bank Priority Area site, South Bank Coke Ovens and By-products Plant (SBCO), and to the north by the River Tees. The eastern boundary is marked partially by land owned by STDC (former Metal Recovery Area) and land owned and operated by third parties including the Tees Renewable Energy Plant and PD Ports sites

The site and surrounding areas have a long and layered industrial history and largely comprise mudflat and marshland reclaimed by deposition of iron and steel slag and by-products which form the majority of the site surfacing.

Numerous services and utilities cross the site including the Heavy Fuel Oil line from the recently demolished HFO site.

The site setting and layout are shown on Figure 2 below and in Appendix A.

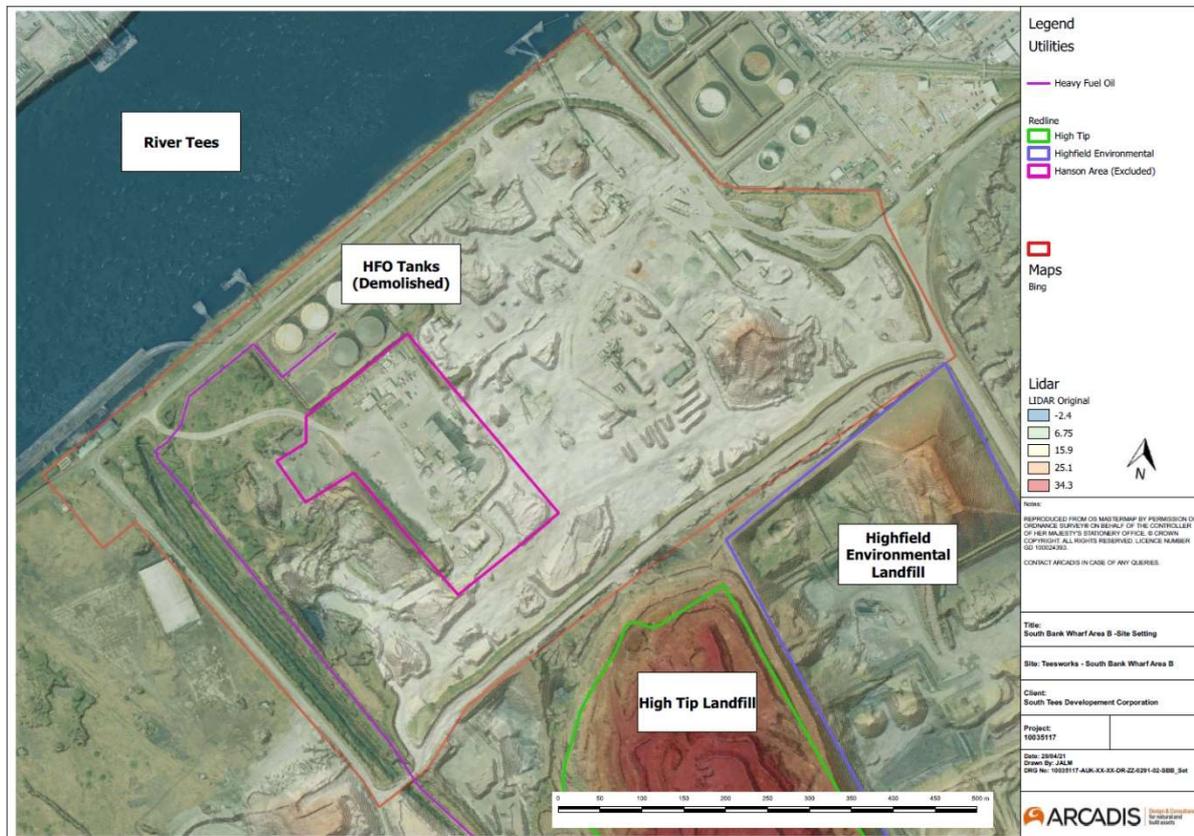


Figure 2 Site Setting

2.2 Geology

A review of historical ground investigation data indicates a substantial thickness of Made Ground underlies much of the site. Review of the British Geological Survey (BGS) data also suggests the presence of Made Ground at the site; the BGS maps indicate the Made Ground is underlain by Tidal Flat Deposits predominantly comprising sand, silt and clay. These deposits are likely to be underlain by Glaciolacustrine Deposits of laminated silts and clays and Glacial Till predominantly comprising slightly gravelly clay.

Bedrock beneath the site is anticipated to comprise the Mercia Mudstone Group comprising predominantly red mudstones and subordinate siltstones with thick halite-bearing units.

Unit	General description
Made Ground	<p>Site surfacing comprised a mix of soft standing of gravel, sand, or slag. In areas hardstanding is present associated with roadways, infrastructure and building structures.</p> <p>The Made Ground encountered during the investigations predominantly comprised granular material with a fine-grained component and medium to high cobble/boulder content which included slag, brick, concrete and occasionally clinker, coke, coal and/or metal. Rare to frequent refractory materials were identified in a number of trial pits across the site. Based on visual assessment slag was found to be the dominant component of Made Ground</p>
Tidal Flat Deposits (Secondary A Aquifer)	Generally comprised soft sandy silt (often shelly) frequently underlain by a silty sand. Identified to be widely distributed across the site below the Made Ground.
Glaciolacustrine Deposits (unproductive strata)	The deposits were generally described as a soft to firm brown laminated clay often with sand or silt partings along laminations.
Glacial Till (unproductive strata)	Glacial Till was described as a firm to very stiff red brown slightly sandy slightly gravelly clay, with gravel composed of mixed lithologies, including sandstone, mudstone, and limestone. Glacial till is distributed widely across the site overlying the bedrock.
Sand and Gravel	The Sand and Gravel was described as a clayey Sand and Gravel with gravel composed of mixed lithologies, including sandstone, limestone, flint and chert. This deposit was not present at all exploratory locations.
Mercia Mudstone (Secondary B Aquifer)	An extremely weak to weak red brown mudstone partially to highly weathered with numerous bands of white gypsum and locally green, grey glauconite. The Mercia Mudstone was noted to become interbedded mudstone, sandstone and siltstone in some locations at depth

Two predominant types of Made Ground were noted:

- **Slag-dominant material (>50% slag):** Generally ranging from gravel to cobble and occasional boulder size fragments. The slag material was generally vesicular and grey-green-white in colour.
- **Granular Made Ground:** Identified widely across the site of varying composition, most frequently a sandy gravel with varying cobble content. Gravel and cobbles include brick (including refractory), concrete, ash and clinker, slag was not the dominant constituent although often still present within the soil matrix.

2.3 Hydrogeology

The site was reclaimed from the Tees Estuary by the placement of by-products from the steel making process. As such the River Tees is likely in continuity with water within both the Made Ground and the Tidal Flat Deposits. The depth at which the Mercia Mudstone was encountered indicate it is unlikely to be in direct continuity with the River Tees however interaction cannot be ruled out without data on the deposits forming the base of the river channel.

Water was noted to be variably present in Made Ground. The Tidal Flat Deposits are present across the site but in locations are of limited thickness and as such, are not expected to represent a significant resource across the site. Although an Unproductive Strata, the site data indicates the potential for horizontal and vertical migration of groundwater within more permeable horizons of the Glaciolacustrine Deposits. The underlying bedrock is considered the most sensitive aquifer system at the site, with a groundwater flow direction towards the north-east inferred from site data. It should be noted the inferred flow directions within the bedrock and Superficial Deposits are based on elevations from a limited number of monitoring wells given the size of the site and may be influenced by local ground conditions.

Groundwater levels vary across the Site and are in part influenced by topography and the thickness of the underlying superficial deposits. Areas of the South Bank Quay are anticipated to be tidally influenced with the amplitude of the tidal variation decreasing with increasing distance from the River Tees (i.e. landward).

Geology	Aquifer Classification	Groundwater flow
Tidal Flat Deposits	Secondary (A) Aquifer	Not confirmed, aquifer of limited thickness
Glaciolacustrine Deposits	Non-aquifer	Flow dictated by localised preferential pathways
Glacial Till	Non-aquifer	
Mercia Mudstone	Secondary (undifferentiated) Aquifer	North to north-east

2.4 Hydrology

The closest surface water feature to the site is the River Tees on the northern boundary. The river is tidal at the point it passes the site. The former course of Holme Beck cuts through western extent of the site, the beck is however currently culverted remotely around the site.

2.5 Data Gap

At the time of issue Arcadis are undertaking a ground investigation of the southern area of the site in order to inform current data gaps and to investigate the current geo-environmental conditions. The findings of the ground investigation works shall be reviewed once complete to confirm the accuracy of the conceptual site model, contaminant distribution and the requirements of the remediation strategy.

2.6 Conceptual Site Model

2.6.1 Environmental

The ESA (Environmental Site Assessment) for South Bank Area A and the South Bank Quay Ground Investigation and Generic Quantitative Risk Assessment Report (Royal Haskoning, 2021) (which forms part of the South Bank Quay Area) developed a conceptual site model (CSM) based on ground investigation findings. The CSM identified a number of potentially active source-pathway-receptor (SPR) linkages the significance of which was assessed by comparison to appropriate generic screening criteria. The identified SPR linkages were:

- Human Health - Risk to commercial workers via inhalation of asbestos fibres, originating from shallow Made Ground across the site.

- Human Health - Risk to commercial workers via dust inhalation and direct contact with soils for arsenic and Polycyclic Aromatic Hydrocarbons (PAHs), originating from shallow soils across the site.
- Water Resources – A Detailed Quantitative Risk Assessment is currently being prepared by Arcadis. Based on the currently available data, the DQRA indicates that the current site condition does not pose a significant risk to water resources and therefore no remediation is required. At present, data gaps exist in the south of the site in the vicinity of potential source areas (on and off site). As further data is collected from across the site, including addressing these data gaps, update of the risk assessment may be required in order that it remains valid.

The identified SPR linkages for the site are shown within the CSM presented below as Figure 3.

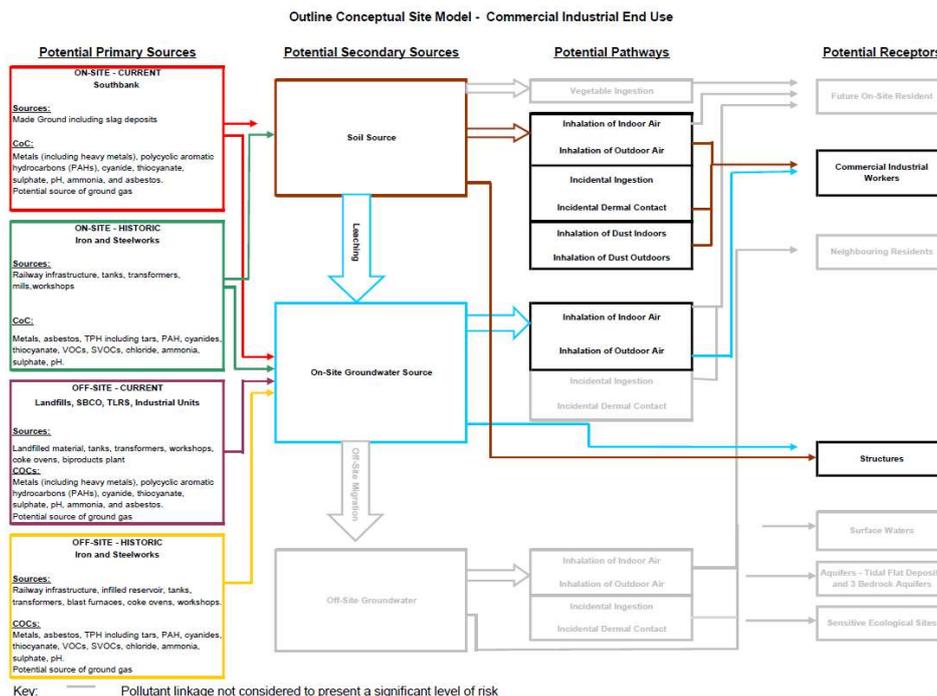


Figure 3 - Conceptual Site Model

2.6.2 Ground Gas

The ESA for South Bank Area A and the 2021 Royal Haskoning report, did not identify an unacceptable risk to human health or built receptors from the accumulation of ground gas. However, as the ground investigation was not designed with a particular redevelopment scenario in mind, the gas monitoring data was limited and may not be representative of the entire extent of the site under a particular redevelopment. Ground gas monitoring is included within the scope of the additional ground investigation works currently underway within the wider South Bank Quay Area. Following completion of the scope the results of the ground gas assessment shall be reviewed and where required the Remediation Strategy amended.

Additional ground gas monitoring may be required prior to any specific redevelopment to determine the risk from ground gases on the site, the scope of this investigation and any subsequent remedial requirements would depend on the proposed redevelopment scenario. Arcadis understand from STDC that it is expected this would be the responsibility of the developer.

2.6.3 Geotechnical

It is not the specific intention of this Remediation Strategy to address geotechnical risks, however these works have identified the following which may present significant development constraints at the site:

- Expansive slag deposits and refractory bricks may lead to disruption and damage of structures, hardstanding etc.;
- Due to long term creep settlement, the Made Ground and underlying Tidal Flat Deposits may possess inadequate bearing capacity to support proposed structures;
- Lateral and vertical changes in ground conditions;
- Anticipated total and differential settlement / heave in excess of the tolerable limits may occur due to changes in loading or groundwater regime;
- Sulphate attack on subsurface concrete; and,
- Obstructions within the made ground (boulder size fragments of slag and buried underground structures);

2.7 Contaminant Distribution

The contamination is summarised below based on the findings of a number of historical ground investigation phases, however there are data gaps discussed in Section 2.5 which are currently being addressed in an ongoing ground investigation. The contaminant profile and distribution are anticipated to be broadly in line with previous findings, however once the ground investigation and Generic Qualitative Risk Assessment (GQRA) have been completed the findings of this Remediation Strategy will be reviewed and refined where required.

During the implementation of any remediation approach additional testing is likely to be required to refine the contaminant distribution and maximise the efficiency of remediation implementation.

2.7.1 Human Health

Asbestos in Soils

To date limited detections of asbestos containing materials have been recorded within the South Bank Quay area, it should be noted that historical ground investigation did not routinely analyse for asbestos. Asbestos containing materials however may be present on site within the Made Ground materials in line with the findings of ground investigations within other landholdings within the Redcar Steelworks. Typically, these are not hotspots of Asbestos Containing Materials but are low level identification of fibres, which are sporadic in distribution.

Organic and Inorganic Contaminants

A review of the previously conducted ground investigations identified concentrations of arsenic and PAHs in excess of the Generic Assessment Criteria (GAC) in soil, driven by direct contact exposure and dust inhalation. These will need to be considered in the remedial strategy for the site.

2.7.2 Materials Impacted with Non-Aqueous Phase Liquids

NAPL and Tar have locally been identified primarily within the Made Ground and associated with subsurface or former above ground structures and plant. Further consideration of the NAPL with respect to the risk to human health will be needed as part of the remedial strategy.

Materials impacted with NAPL and tar should not be reinstated due to being a primary source of contamination. Where encountered, impacted materials will need to be consigned to a treatment process to remove the NAPL element or disposed of at an appropriate waste facility under duty of care.

2.8 Unexploded Ordnance and Magnetic Anomalies

A desktop Unexploded Ordnance (UXO) assessment has been completed for the STDC boundary. The outcome of the assessment indicates a Medium risk from UXO for borehole and excavation activities.

In addition, magnetic anomalies have been encountered elsewhere on STDC landholdings which may represent potential UXO risk. Should redevelopment require the installation of piled foundations or deep ground improvement, clearance of locations for potential UXO is recommended.

2.9 Archaeology

Archaeological surveys and assessment have not been made available to Arcadis at the time of writing this document. These documents should be reviewed when available to develop an appropriate mitigation and management strategy.

2.10 Ecology

The South Bank Quay Area site directly adjoins the Teesmouth and Cleveland Coast SPA and SSSI site. The Teesmouth and Cleveland Coast Ramsar is approximately 400m to the west of the site.

A Shadow Habitat Risk Assessment (HRA) has been completed on the site and is reported within South Bank Site Remediation, Shadow Habitats Regulations Assessment: Stage 1 Screening and Stage 2 Appropriate Assessment Revision A Final [INCA 2021] and Ecological Impact Assessment Revision A Final, dated May 2021, Report ID: INCA 2021-29 [INCA]; concluded that;

“The proposed development will not cause adverse effect to the integrity of the Teesmouth and Cleveland Coast SPA and Ramsar sites, either alone or in combination with other plans or projects.”

Further recommendations and requirements have been highlighted within the document such as

- *“Removal of vegetation that may support nesting birds should be undertaken outside of nesting season (March to August inclusive), unless the habitats are first checked by a suitably qualified ecologist, who confirms in writing to the LPA that no nesting birds are present, and the work is undertaken within 48 hours. This is a legal requirement of the WCA 1981.”*
- *“Measures will be implemented to prevent the spread of invasive non-native plant species, as listed under either Schedule 9 of the WCA 1981 or the Invasive Alien Species (Enforcement and Permitting) Order 2019 (this is a legal requirement).”*
- Compensation is required to offset residual losses after the mitigation through the preparation of a Environment and Biodiversity Strategy, which *“will provide options and opportunities for Teesworks, and those developing within the Teesworks area, to meet any biodiversity value deficit arising from development.”*

All recommendations and requirements of the HRA should be incorporated into the working methodology to execute this Remediation Strategy. Where required working practices, restrictions, exclusion zones and the like should be implemented in line with the HRA recommendations.

2.11 Invasive Species

Japanese knotweed stands (*Fallopia japonica*) have been identified within the wider South Bank site with locations immediately to the south and west of the SBQ site.

It is a requirement to prevent Japanese knotweed on your land from spreading into the wild and causing a nuisance including contaminated soil or plant material from any waste you transfer to spread into the wild.

2.12 Flood Risk

The risk of flooding from rivers and the sea has been assessed by reviewing Environment Agency flood maps for the area which indicate the risk of flooding is “Very Low” with a less than 0.1% chance of flooding in any year.

The Wood “Flood Risk Assessment and Drainage Strategy Flood Risk Assessment and Drainage Strategy” (Ref. 41825-WOOD-XX-XX-RP-OW-0001_A_P01) concluded that the potential import of up to 500mm mudstone onto the site did not increase the surface water flood risk.

The proposed remedial strategy comprises the excavation and crushing of hardstanding (where present) and other impermeable obstructions within the Made Ground and their backfill within the excavation. As such, Arcadis considers that excavation and replacement of the Made Ground combined with removal of hardstanding (where present) is not likely to decrease surface water infiltration rates and therefore the risk of surface water flooding will be no higher than identified by Wood.

2.13 Proposed Redevelopment and Enabling Works

Arcadis understand STDC are to complete enabling works to create an environmentally suitable development platform for future redevelopment, which will include construction of a new Quay wall. Permission for the construction of the Quay Wall and associated dredging operations was granted by Redcar and Cleveland Borough Council on 19th March 2021 (Planning Ref R/2020/0684/ESM). Note this strategy document has been prepared to inform the enabling works only.

The enabling works will include turnover of the Made Ground within the subsurface to a defined depth based on the location in relation to the proposed new quay wall.



Figure 4 - Indicative Maximum Dig Depths

Area	Indicative Dig Depth m bgl	Dig Elevation	Rationale
River side of the proposed Quay wall	Up to 4m bgl	+ 8.64m Chart Datum (m CD)	Works are planned to install a new quay wall as part of site development works.

			Surface materials will be removed to +8.64m CD as part of enabling works Future works (not included within this Strategy) to remove materials shall be undertaken to a prosed depth of - 15.60mCD
From proposed Quay wall to 100m landside	Up to 5.5m bgl	+ 8.64m CD	Excavation and removal of materials above development platform
		+6.14m CD	Turnover and replacement of materials 2.5m below finished level including removal and crushing of relic structures and obstructions, removal and treatment of environmental contamination as required and replacement of treated material to formation levels for development.
From 100m landside of Quay wall, covering remaining site area	2.5m below current ground level		Turnover and replacement of materials 2.5m below current ground level including removal and crushing of relic structures and obstructions, removal and treatment of environmental contamination as required and replacement of treated material to formation levels for development.

Table 1 Dig Depth Rationale

In some areas of the Site large relic structures are anticipated to be present and where these are identified or if environmental contamination is found to extend below the depths identified in Table 1, further excavation works may be required. Any requirement for deeper excavation works will be assessed on a case specific basis following consultation with stakeholders.

It is not STDC's intention to remove piles to depth below those identified in Table 1 or to address the potential for future slag expansion. If deemed necessary, specific engineering controls will be installed by a future developer.

This strategy has been produced on the assumption that any redevelopment of the site will be for a generic commercial industrial end use. Remediation technologies have been selected based on Arcadis' professional judgement and experience of large-scale redevelopments of brownfield sites. The site is part of a wider STSC landholding and Arcadis recommends the remediation approach is considered holistically with the wider redevelopment of the Redcar Steelworks Site.

2.14 Materials Management

Given that remediation measures involve the movement of materials around the South Bank Area of the site and the wider STDC site it is important that they are not classified as a waste (as defined by Waste Framework Directive) on completion of the works.

2.14.1 Achieving Non-Waste Status

There are several different waste regulatory options available, the suitability of which is dependent upon the complexity of the site and the quantity/composition of the material to be reused. Based on the complexity of the site Arcadis recommend the most suitable option is via an application in accordance with CL:AIRE guidance 'Definition of Waste: Development Industry Code of Practice' (DoWCoP).

2.14.2 Definition of Waste: Development Industry Code of Practice

The Environment Agency (EA) has worked with industry through CL:AIRE to prepare the DoWCoP (Definition of Waste: Development Industry Code of Practice). The purpose of the DoWCoP is to allow industry to regulate itself with respect to determining whether excavated materials have achieved non-waste status. The EA states that 'When a signed Declaration is sent to us (the EA) by a Qualified Person (QP) showing that excavated materials are to be dealt with as set out in the DoWCoP, we (the EA) will take the view that the materials on the site where they are to be used will not be waste.'

If materials are dealt with in accordance with the DoWCoP then the materials are unlikely to be waste. This is either due to the fact that 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.

In order to demonstrate that the four factors have been fulfilled will require preparation of various reports including:

- Site investigation reports (Site Condition Report / Environmental Site Assessment).
- Quantitative Risk Assessment (QRA);
- Remediation Strategy or Design Statement;
- Materials Management Plan (MMP); and,
- Verification report (on completion of the works).

In addition to the risk assessment, an MMP will be required detailing where soils will be moved to and how they will be tracked. Approvals will also need to be sought from the Local Authority and the Environment Agency (groundwater team) with respect to this remediation strategy. Planning permission may also be necessary to ensure QP approval of the DoWCoP.

Once this documentation is in place a QP will review the overall strategy and ensure that everything is in place prior to submitting a formal declaration to the Environment Agency (waste team), via CL:AIRE (the scheme administrators). On completion of the work a verification report will need to be completed.

2.14.3 Materials Management Plan

An MMP shall be prepared in accordance with CL:AIRE DoWCoP and authorised by a QP registered with CL:AIRE. Excavated materials will be segregated and sorted into the following categories:

- Materials suitable for re-use on site (without needing additional treatment);
- Materials that require treatment in order to be suitable for re-use on site;
- Soils that require off-site disposal/treatment (not treatable);
- Refractory bricks and potentially expansive slag materials;
- Soils containing asbestos for treatment and reuse or for off-site disposal;
- Excavated hard materials (such as concrete and brick) that may be crushed to produce suitable material for use as infill in the Work; and
- Other materials that require off-site disposal (household waste, electrical goods, vegetation etc).

Where appropriate, existing concrete, brick and other suitable building materials will be crushed to a 6F2 or other suitable material classification as specified by the Highways Specification to allow for reuse on-site. Materials destined for re-use must meet the criteria proposed within the MMP.

For site-based contaminants the Re-use Criteria and Assessment Criteria should be reviewed and where necessary amended following the current ground investigation works and if required Quantitative Risk Assessment.

2.14.3.1 Records to be made

The contractor will be required to maintain records of material excavation and movement in support of the MMP, these shall include but not be limited to

Records whilst excavating	Records whilst backfilling
Date	Date
Grid square of origin	Excavation area or stockpile of origin
Depth of origin	Volume (uncompacted and compacted)

South Bank Quay Area; Former Steelworks, Redcar.
Enabling Earthworks and Remediation Strategy - 10035117

Type of material (Made Ground, Concrete, slag etc.)	Placement grid square(s)
Volume excavated	Depth placed
Material destination (if direct to processing and backfill the backfill area, stockpile, or treatment area)	Material type
Evidence of contamination	

Table 2 Records to support the MMP

3 Remediation and Excavation Objectives

The aim of the remediation works at the site is to address the identified development constraints pertaining to environmental ground conditions and to facilitate redevelopment for a future commercial / industrial end use.

The remediation works will be undertaken at the same time as enabling earthworks (detailed in Section 2.133), and therefore should be considered holistically with these works.

3.1 Remediation Objectives

The remediation objectives will be achieved by controlling or breaking the identified SPR linkage in order to mitigate identified risks to the identified environmental receptors. The remediation objectives are to:

- Manage the contamination in excess of screening levels and that are likely to be present following completion of ongoing ground investigation, including NAPL containing soils.
- Manage the identified pollutant linkage between potential asbestos containing materials that are anticipated to be within shallow Made Ground such that that exposure pathway for on-site commercial workers is inactive.
- Maximise the reuse of excavated soils by making them suitable for use under DoWCoP.
- To develop an unexpected contamination strategy in order to manage and mitigate the risks due to encountering additional materials as is common place during the preparation and reclamation of historical brownfield land.

3.2 Excavation Objectives

As the enabling earthworks are to be conducted alongside the environmental remediation it is considered prudent to incorporate the objective of the earthworks into the remediation strategy. The enabling earthworks objectives are to:

- Remove sub-surface obstructions within the Made Ground to a depth identified in Table 1. Where obstructions extend below this depth their removal will be conducted on a case by case basis following consultation with stakeholders;
- Creation of a formation layer suitable for a commercial / industrial redevelopment;
- Manage groundwater (including tidally influenced, perched and confined) within the Made Ground encountered during excavations;
- Maintain a continuous flood defence line, using the existing, revised or a combined defence line such that a continued standard of protection will be provided throughout construction that is comparable with the existing;
- Management of risk to external hardstanding, culverted waterways and utilities; and,
- Identify the requirement for a UXO mitigation strategy.

Arcadis recommends the following excavation objectives are considered as part of the earthworks strategy and therefore require consideration as part of the Earthworks Specification and development plans:

- Consideration of the management and placement of potentially expansive refractory materials excavated as part of the enabling earthworks; and,
- Protection of sub surface structures and utilities from attack due to aggressive ground conditions;

It is not the intention of this Remediation Strategy to fully address geotechnical development constraints at the site as these are the responsibility of the developer and dependent on a specific redevelopment scenario. It is anticipated that appropriate engineering controls will be developed by future site users at detailed design stage.

4 Enabling Earthworks and Remediation Strategy

The strategy for the enabling earthworks and remediation of the South Bank Quay Area site should be considered within the wider context of the Redcar Steelworks reclamation and remediation. The excavated materials identified as not suitable for direct reuse will be consigned to a remedial process in order to meet the criteria for reuse after treatment. The exact technology is dependent on the volume and availability of the material and the timescale required to complete the remediation. It is currently envisaged that the treatment of materials could be undertaken on the South Bank Quay Area site as a single location or potentially as part of a hub and cluster arrangement should one be established for the wider Redcar Steelworks site.

4.1 Aim

The aim of the works is to:

- Remove underground relic structures and foundations;
- Processing Made Ground materials in order to make them suitable for use as backfill materials,
- Provide a backfilled development platform to approved site levels;
- Make the site suitable for future commercial / industrial end-use through SPR linkage breaks from materials impacted with arsenic, asbestos and PAHs; and,
- Reduce the geotechnical risks from slags and refractory materials removed as a consequence of the excavation works.

4.2 Overview of Required Works

In overview the enabling earthworks and remediation will comprise the following activities.

Enabling Earthworks

- Removal and processing of relic underground structures and foundations for reuse, to a depth identified in Table 1. The requirement to remove areas of deeper structures or foundations, if encountered, will be assessed on a case-by-case basis.
- Screening and crushing of Made Ground materials in order to make them suitable for reuse.
- Treatment of soils impacted with NAPL in order to make them suitable for reuse.
- Segregation of soils with ACM for treatment and reuse.
- Segregation and processing of refractory materials for reuse as far as practicable.
- Retaining a continuous flood defence line, using the existing, revised or a combined defence line such that a continued standard of protection will be provided throughout construction that is comparable with the existing
- Temporary works to facilitate the excavation of materials adjacent to manmade structures and the River Tees;
- Dewatering of below ground structures and excavations with management, treatment and disposal of water; and,
- Backfill of excavations to leave the site safe and to an approved level, with validated made ground, certified demolition arising, crushed concrete or imported fill.

Remediation

- Remediation of soils impacted with contaminants above target levels through capping of materials to manage SPR linkages.

4.3 Works Approach

4.3.1 Enabling works

Prior to mobilisation and commencing the enabling earthworks and remediation the following documentation, notifications, permits and approvals shall where required be obtained and in place:

- Approved Schedule;
- Construction Phase Health and Safety Plan;
- Method Statements and Risk Assessments;
- Occupational Health Plan;
- Biodiversity Assessment
- Invasive Non-Native Species (INNS) Management Plan
- Construction Traffic Management Plan (CTMP)
- Construction Phase Waste Management Plan (CWMP)
- Construction Phase Flood Risk Emergency Plan (FREP)
- Written Scheme of Investigation (WSI) for archaeological work
- Environmental Permit for Land and Groundwater Remediation;
- Environmental Permit for Flood Risk Activities;
- Marine Management Organisation – Marine Licence
- Trade Effluent Discharge Consent / Water Discharge Activity Environmental Permit;
- Temporary Works Design;
- Traffic Management Plan;
- Construction Phase Environmental Management Plan;
- Materials Management Plan;
- Emergency Response Plan; and,
- Surface water management and maintenance plan.

A site compound, including welfare facilities and parking will be required to be established in a suitable area on Site, the location shall be detailed within the CPEMP. Temporary buildings, structures, equipment and facilities shall be properly maintained for so long as it is in use, and the compound, welfare and parking facilities cleared away on completion. Appropriate site fencing, signage and security shall be implemented to protect the works.

4.3.2 Environmental Permit for Land and Groundwater Remediation

An Environmental Permit (EP) Mobile Treatment Licence is likely to be required in order to conduct works comprising the treatment and reuse of site won material identified as requiring remediation and the treatment of any contaminated waters recovered during the works. This is typically held and deployed by the party responsible for designing and managing the execution of the remediation who are responsible and accountable for compliance with regulatory requirements.

An EP deployment form will need to be submitted to and approved by the EA (Environmental Permit Team) detailing the remedial approach and associated engineering controls, prior to treatment being undertaken.

The excavation of site won materials which do not require treatment for environmental purposes does not need to be conducted under an EP. If uncontaminated made ground is to be processed and an EP for mobile plant is not in place, then an EA Standard Rules Permit for the low risk crushing and screening of materials will also be required.

4.3.3 Environmental Permit for Flood Risk Activities

Where excavation work is undertaken within 16 metres of a main river, flood defence (including a remote defence) or culvert a Bespoke Flood Risk Activity Permit may be required to be applied for. However, it is our understanding that the Environment Agency have indicated that due to the minimal flood risk associated with the proposed works they will not request an Environmental Permit in addition to Marine Licence

4.3.4 Marine Management Organisation – Marine Licence

The Marine and Coastal Access Act 2009 provides that a marine licence is required for certain activities carried out within the UK marine area. A marine licence application in relation to the construction of the new quay wall and associated dredging activities has been submitted on behalf of STDC which is currently under consideration with statutory consultees

Results of the ongoing site investigation works and subsequent DQRA will be reviewed and the Remediation Strategy updated to reflect any changes required to ensure protection of the marine works from potential contaminants mobilisation.

Following the MMO consultation process and granting of the marine licence any further requirements or obligations placed upon the remediation works as part of the consent will be reviewed and incorporated into this Remediation Strategy.

4.3.5 Discharge Consent / Water Discharge Activity Environmental Permit

All encountered accumulated, perched or ground water encountered within the Made Ground shall be collected in a holding tank or lined lagoon prior to any treatment and subsequent discharge. The incidental water shall either be:

- a) discharged to foul sewer under a trade effluent consent agreed with the local sewerage undertaker and/or;
- b) discharged to surface water under a Water Discharge Activity Environmental Permit (“WDA-EP”) from the EA.

The Contractor shall make arrangements to identify the most sustainable, compliant and cost-effective discharge method and ensure that relevant permissions and consents are received prior to discharging.

4.3.6 Materials Management

Remediation measures will involve the movement of materials. It is important that they are not classified as a waste (as defined by Waste Framework Directive) on completion of the works.

4.3.6.1 Achieving Non-Waste Status

As discussed in Section 2.14.3, there are several different waste regulatory options available, the suitability of which is dependent upon the complexity of the site and the quantity/composition of the material to be reused. It has been concluded the most suitable option is via an application in accordance with CL:AIRE guidance ‘Definition of Waste: Development Industry Code of Practice’ (DoWCoP). Please refer to section 2.14.3 for further details on this use of the DoWCoP.

4.3.6.2 Use of slag under the DoWCoP

Engagement with the Environment Agency was undertaken on the proposal to re-use iron & steel slag rich made ground under CL:AIRE Definition of Waste: Development Industry Code of Practice (DoWCoP) on the Site of Origin at the Metals Recovery Area, South Bank.

The Environment Agency’s position following this engagement is that the steel and iron slag that makes up the made ground located outside of designated former and current landfills is not waste and can be re-used under CL: AIRE Definition of Waste: Development Industry Code of Practice (DoW CoP) based on the following parameters

- *the developer/operator can demonstrate that the steel and iron slag was used for an intended purpose, i.e. to heighten and extend the marshy low-lying ground for the purpose to use and develop that land.*
- *the developer/operator can demonstrate that the steel and iron slag was deposited pre-Control of Pollution Act (1974). This is in line with our approach not to bring areas of land no longer regulated back into regulation unless not doing so would undermine our existing legislative regime.*
- *re-development area incorporates areas of land that have clearly been designated 'landfill' (both under current permit and historical prior to waste legislation) if this waste is excavated at any point, current waste regulations will apply for the treatment and/or disposal, recovery and re-deposit of the waste.*

4.3.6.3 Materials Management Plan

An MMP shall be prepared in accordance with CL:AIRE Code of Practice (Definition of Waste) and authorised by a Qualified Person registered with CL:AIRE. Excavated materials will be segregated and sorted into categories as defined in Section 2.14.3.3

4.3.7 Soil Sampling

Soil sampling will be undertaken by an STDC appointed representative and at the frequency proposed Section 4.3.10 and in line with the requirement set out in the Earthworks Specification.

Where samples are required to be taken from the excavation (representative of materials left in-situ or materials reused as backfill) locations shall be machine scraped across the validation sample location and a representative soil sample collected for analysis. Sample locations shall be defined on a predefined grid basis to ensure appropriate coverage and frequency.

Where samples are required to be taken from stockpiles of materials composite sampling from stockpiles will be undertaken in order to collect a representative sample. Stockpiles will be subdivided into representative sections, each section will be sub divided to 6 sub-sections, soils shall be collected from each subsection and homogenised in order to create the representative sample.

Further information on the proposed sampling strategy, including sampling frequency and testing schedule will be provided within the Earthworks Specification and the Materials Management Plan.

4.3.8 Excavations

4.3.8.1 General Excavations

The scope of the excavation works is outlined in Section 2.133. Where practicable obstructions will be removed and crushed for re-use on site. Materials which are impacted with contaminants to levels above the defined reuse criteria shall be treated using the remediation strategy or if treatment is not considered possible disposed of offsite under full duty of care.

Made Ground materials will require size screening and crushing to enable reuse. Any deleterious materials not suitable for incorporation into the fill material, such as rebar, wood, plastic, putrescible materials etc will be segregated and stored separately on site. Such materials will then be disposed offsite under full duty of care.

4.3.8.2 Slags and Refractory Materials

Ground conditions at the site present a number of potential geotechnical constraints. It is anticipated that the majority of these can be dealt with by adopting appropriate engineering controls at the development phase.

However, Arcadis recommend where potentially expansive refractory materials are excavated as part of the enabling excavations these be managed (as far as practicable) by Excavation, Separation, and Reuse in low risk areas of the site, as defined by STDC. Treatment may also be undertaken if this is identified as feasible for the materials in the given timescale.

The above is intended to reduce rather than eliminate the risks from these materials. Additional management through the use of engineering controls are likely to be required depending on the final redevelopment, these are to be the responsibility of the developer.

4.3.8.3 Segregation and Stockpiling

Excavated materials identified by laboratory analysis as chemically unsuitable for direct reuse will be stockpiled for treatment. Stockpile and treatment areas will be required to be placed on impermeable surfaces with covers and suitable drainage to collect and dispose of waters. Validation testing of these areas will be undertaken to prove the land quality pre- and post-remediation.

4.3.8.4 Temporary Works

Where required the contractor shall undertake Temporary Works design to manage general excavation, working around manmade structure / assets and for working in close proximity of the River Tees.

4.3.8.5 Surveying

All excavations shall be surveyed by the appointed Remediation Contractor to allow for accurate measurement of excavation extents, cut and fill balances, volumes and to establish remedial verification sample locations.

4.3.8.6 Relic Underground Structures and Services

The following shall be implemented with respect to relic structures, foundations and obstructions:

Area	Structure and Services Removal	Rationale
River side of the proposed Quay wall	+ 8.64m Chart Datum (m CD)	Where relic structures are encountered above 8.64m CD but continue below 8.64m CD a record of the residual foundation shall be made recording the topographical coordinates, size and type.
From proposed Quay wall to 100m landside (approx.)	+6.14m CD	<p>Relic structures shall be removed where encountered to +6.14m CD in the Made Ground. Where relic structures continue below 6.14m CD confirmation on the requirement to remove them below this depth shall be required from the STDC. If removal is not required a record of the residual foundation or obstructions shall be made recording the topographical coordinates, size and type.</p> <p>Where encountered, piled foundations shall be removed to a maximum extent of +6.14m CD. A record of the residual foundation shall be made recording the topographical coordinates, size and type.</p> <p>Redundant pipework is likely to be encountered within the excavations which may be preferential pathways for the migration of contamination. Where encountered redundant pipe work will be removed from the excavations. Should complete removal not be possible or feasible then residual pipework will be sealed at the edges of excavations and the location recorded on an as-built survey.</p>
From 100m landside of proposed quay wall, covering remaining site area	2.5m below current ground level	<p>Relic structures shall be removed where encountered within 2.5m Below Existing Ground Level (begl) in the Made Ground. Where relic structures or obstructions are encountered within 2.5m begl but continue below 2.5m begl confirmation on the requirement to remove them below this depth shall be required from the STDC. If removal is not required a record of the residual foundation shall be made recording the topographical coordinates, size and type.</p> <p>Where encountered, piled foundations shall be removed to a maximum extent of 2.5m begl. A record of the residual foundation shall be made recording the topographical coordinates, size and type.</p> <p>Redundant pipework is likely to be encountered within the excavations which may be preferential pathways for the migration of contamination. Where encountered redundant pipe work will be removed from the excavations. Should complete removal not be possible or feasible then residual pipework will be sealed at the edges</p>

		of excavations and the location recorded on an as-built survey.
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Table 3 Relic Underground Structure and Services Removal

No specific development plans have been made available at the time of writing this remediation strategy and any future development plans may need to account for structures remaining *in-situ* or partially removed following these works depending on the specific redevelopment.

4.3.8.7 Boreholes

There are existing borehole installations across the South Bank Quay Area site. Where possible boreholes within defined excavation areas should be protected, however if this is not practicable, they are required to be decommissioned in accordance with the relevant British Standards and EA guidance.

4.3.8.8 UXO

A desktop UXO assessment has been completed for the STDC boundary. The outcome of the assessment indicates a Medium risk from UXO for borehole and excavation activities. Further mitigation activities such as detailed risk assessment or site mitigations are considered essential to reduce the UXO risk on the site to As Low As is Reasonably Practicable (ALARP). These additional mitigating factors should be defined within the Remediation Implementation Plan (RIP).

4.3.8.9 Health and Safety

A Construction Phase Plan (CPP) will be required to be prepared for the works. The CPP shall include detailed risk assessments and method statements for all activities. It shall also provide safe working methods that will be required to be adopted to minimise risks to site workers, visitors and the general public.

The following non-exhaustive listed pertinent hazards shall be considered:

- Works will be undertaken in close proximity to a tidal river and the tidal influence is likely to extend to influence of groundwater levels within excavations;
- Deep excavations will be required with a high potential of groundwater ingress and associated ground stability issues;
- Known below-ground live services are present and unrecorded services may be present within the remediation areas;
- The Site has been subject to incidents of trespass, vandalism and theft in the past; and
- Contaminated materials including hydrocarbons, tars, Asbestos Containing Materials are expected to be encountered.

4.3.8.10 Utilities and Services

A review of the available data sources provided to Arcadis has highlighted a number of live services and utilities that cross and bound the site: These services include;

- Overhead and below ground electric;
- Communication infrastructure;
- Heavy Fuel Oil line;
- Natural Gas Line;
- Industrial Water Supply;
- Storm Drains both active and abandoned; and
- BOC pipelines to the East.

There is the potential for other utilities to be crossing the site including redundant gas pipes, water pipes and electrical cables as well as live 3rd party utilities.

At the time of writing a constraints plan is not available which would identify which site services and 3rd party utilities are required to remain and be protected during the remediation and reclamation works. The constraints plan will be reviewed and accounted for within the Remediation Contractors Remediation Implementation Plan.

4.3.9 Groundwater Management

Groundwater and accumulated water are anticipated to be encountered within excavations and subsurface structures, this will require removal to facilitate excavation and backfilling works. In areas in close proximity to the River Tees the groundwater level is anticipated to be tidally influenced.

The Contractor shall undertake excavation planning and sequencing to account for the tidal variation within the groundwater level to enable safe excavation and backfilling according with the requirements of the Remediation Strategy and the Earthworks specification

The Contractor shall minimise the quantity of water requiring to be pumped, through backfilling excavations as soon as practicable and avoiding the potential for accumulation of rainwater in open excavations.

The Contractor shall ensure that recovered groundwater is sampled and classified to allow appropriate disposal, either via direct disposal to site foul drainage under discharge consent, *via* on site treatment and discharge to foul drainage under consent, or by tankerage and disposal from site.

Any temporary storage of groundwater or accumulated water shall be within storage vessels, which are to be bunded and equipped with drain-down and sampling valves.

4.3.9.1 Removal of NAPL on Groundwater

If free phase NAPL is encountered on the groundwater during excavation works, the Contractor shall undertake recovery prior to groundwater discharge. The Contractor shall continue the NAPL recovery process until no visible NAPL is observed or further recovery is not reasonably practicable (evidenced by diminishing recovery quantities i.e. base of asymptotic curve).

Where there is evidence of the presence of NAPL in the unsaturated zone, excavations will be extended (by trial pits or boreholes) to expose the groundwater table and identify if it is impacted by the above material and if groundwater treatment is required.

4.3.10 Remediation Criteria

The following Remediation Criteria have been developed for Human Health receptors at the Site (in order of priority):

- LQM/CIEH Suitable for Use Levels (S4UL) (LQM / CIEH, 2015),
- Department of Environment Food and Rural Affairs (DEFRA) Category 4 Screening Levels (C4SL) (DEFRA, 2012),
- Arcadis derived generic assessment criteria based on CLEA v1.07,
- United States Environmental Protection Agency (U.S. EPA) Regional Screening Levels (RSLs)

Wood derived GAC based on CLEA v1.07 were presented in the Wood 2019 report for benzo(a)pyrene and naphthalene. It is understood that these values and the use of the LQM S4UIs were acceptable to the regulator for this site.

4.3.10.1 Compliance Sampling Frequency

Remediation Criteria Point	Remediation Objective	Compliance Criteria ¹
Excavation Extents in areas without NAPL	Ensure that concentrations of asbestos within soils within the uppermost 0.1m of materials do not exceed the defined risk-based thresholds	Composite soil samples do not exceed the Remediation Criteria. Samples collected at the following frequency <ul style="list-style-type: none"> • One sample per 50 linear metres of excavation from within the top 0.6m
	Ensure that soils remaining in-situ do not contain contaminant concentrations in excess of the remediation and reclamation criteria	Composite soil samples do not exceed the Remediation Criteria. Samples collected at the following frequency <ul style="list-style-type: none"> • One sample per 50 linear metres of excavation; and, • One sample per stratum or at 1.0m vertical intervals (whichever is the greater) • One sample per 100x100m extent of excavation base • One sample per 2,000m³ of stockpiled excavated Made Ground. • One sample per 2,000m³ of stockpiled crushed site aggregate
Excavation Extents in areas with NAPL	Ensure that concentrations of asbestos within soils within the uppermost 0.1m of materials do not have asbestos concentrations that exceed the defined risk-based thresholds	Composite soil samples do not exceed the Remediation Criteria. Samples collected at the following frequency <ul style="list-style-type: none"> • One sample per 25 linear metres of excavation from within the top 0.6m
	Ensure that soils remaining in-situ do not contain contaminant concentrations in excess of the remediation and reclamation criteria	Composite soil samples do not exceed the Remediation Criteria. Samples collected at the following frequency

¹ Sampling frequency to be formalised and agreed as part of Remediation and Reclamation Implementation Plan and MMP

South Bank Quay Area; Former Steelworks, Redcar.
 Enabling Earthworks and Remediation Strategy - 10035117

		<ul style="list-style-type: none"> • One sample per 25 linear metres of excavation; and, • One sample per stratum or at 1.0m vertical intervals (whichever is the greater) • One sample per 50x50m extent of excavation base • One sample per 625m³ of stockpiled excavated Made Ground • One sample per 625m³ of stockpiled crushed site aggregate
Imported Materials	Ensure that materials imported and used at the site do not introduce environmental or human health risks	Soil samples collected at a frequency of one sample per 2,000 m ³ of imported material (with a minimum of three samples per source) do not exceed the Remediation Criteria.
Accumulated NAPL	Ensure that no NAPL is present on groundwater as far as is reasonably practicable	No visible NAPL to be recorded on groundwater or accumulated water as far as reasonably practicable ²

² To consider that further free phase recovery is not reasonably practicable, it should be demonstrated that free phase recovery rates have diminished to asymptotic conditions.

4.3.10.2 Suitability for Use Criteria

For excavated materials the following reuse criteria will apply:

Reuse Criteria Point	Objective	Compliance Criteria ³
Reuse below capping layer	To ensure that concentrations of asbestos and presence of NAPL within materials proposed for reuse do not exceed agreed reuse criteria.	Composite soil samples collected at a frequency of one sample per 2,000 m ³ of material proposed for re-use. Human Health - Laboratory analysis confirms concentrations of contaminants are below the criteria set out in Wood 2019 (LQM S4UL and Wood GAC).
Reuse as capping materials	To ensure that concentrations of contaminants within materials proposed for reuse do not exceed agreed reuse criteria.	Water Resources – Reuse criteria to be confirmed by the DQRA Geotechnical – Backfill in line with Highways Specification. Exact specification to be confirmed in Earthworks Specification

4.3.11 Management of Contaminated Soils

In order to address the identified pollutant linkage in section 2.6.1 it is proposed that remediation should be undertaken to break the pathway between the contaminants and the receptor.

This should comprise placement of protective cover layers in areas where contaminants in soils are identified above the reuse criteria. A temporary cap is to be installed to provide risk reduction prior to redevelopment when the final capping solution shall be required to be engineered into the design requirements

4.3.11.1 Temporary Cover System

In order to facilitate development a temporary cover system should be installed across the footprint of the site; this temporary cover system should comprise 200mm of site won or certified imported materials (which may include the Mudstone currently being brought onto site from an off-site source) which meet the reuse criteria defined in Section 5.3.9. The presence of the cover system should be considered when the final construction phase planning and design are finalised

4.3.11.2 Developer Led remedial requirements

As part of the future developer led re-development works, a permanent cover system should be incorporated into the design and construction works. Areas of hardstanding will act as a suitable cover system however in areas of soft standing and landscaping the following permanent cover system should be incorporated into the design and installed:

- Geotextile marker layer over soils containing exceedance of the reuse criteria; and
- 450-600 mm thickness of suitable imported materials.
- Suitable Engineering controls in structures as required (e.g. ground gas and vapour, concrete design).

³ Sampling frequency to be formalised and agreed as part of Remediation and Reclamation Implementation Plan and MMP

4.3.11.3 NAPL Impacted Materials

Materials impacted with NAPL are likely to be excavated as part of the enabling earthworks. The most sustainable use of these materials is to facilitate their reuse on site and as such treatment is required to make them suitable for use such that they do not represent a potential ongoing source of contamination. The volumes of materials for treatment have been estimated at between 5-10% of the predicted soil arisings, however due to the discrete nature of these impacts, materials will potentially be generated throughout the works and in variable amounts.

The exact approach to treatment of materials impacted with NAPL will be influenced by a number of variables including volume of material, contaminant loading, contaminant properties and timescales. A number of remediation technologies are available that could technically, operationally and commercially be employed to meet the remediation objectives and make the NAPL impacted soils suitable for re use at the site, these include;

- Ex situ bioremediation;
- Stabilisation;
- Soil Washing;
- Ex situ thermal remediation (smouldering combustion or thermopile); and,
- Excavation and disposal.

Where soils are visibly impacted with NAPL or onsite screening / testing indicates the presence of NAPL they shall be consigned for treatment either on site or within a wider project treatment hub

4.3.11.4 Management of Asbestos Containing Materials

It is anticipated that there is a potential for asbestos fibres to be identified within materials excavated from the South Bank Quay Area, however only a limited number of the historical ground investigation works have scheduled asbestos analysis and therefore it cannot be determined at this point how frequently materials are expected to contain asbestos containing materials.

During excavation works to remove underground structures there is the potential for ACM to be encountered. In the event that suspected ACM materials are observed associated with excavations, sampling will be undertaken to confirm the asbestos type and quantification. Where ACM has to be removed to facilitate removal of structures it shall be separately stockpiled and covered to control potential dust generation.

Soils containing asbestos in excess of the reuse criteria will not be subject to mechanical screening where free fibres have been detected or are suspected. All soils containing asbestos will be managed by maintaining mist sprays to keep the soils wet whilst handled and covered when stockpiled.

Soils which have been identified as containing asbestos (or suspected to) will be stockpiled separately from all other excavated materials. These materials will be characterised by sampling and laboratory analysis.

In the event that materials are impacted with visible fragments of ACM, the ACM materials shall be handpicked by a suitably licenced asbestos contractor with additional control measures implemented based on the sampling results.

Where soils containing CoC in excess of the reuse criteria and, due to the presence of asbestos cannot be safely handled or successfully treated, they will be disposed of offsite.

4.3.11.5 Management of Potentially Expansive Refractory Materials

If these materials are excavated as part of the enabling earthworks and are not comingled with other materials, they should be separated from other materials as far as practicable and stockpiled. Material

should be crushed to 6f2 or similar suitable material class and reused in areas identified by STDC as low risk from the effects of expansive properties.

The above is intended to reduce rather than eliminate the risks from these materials. Additional management through the use of engineering controls are likely to be required depending on the final redevelopment, these are to be the responsibility of the developer.

4.3.11.6 Invasive Species

Treatment of Japanese Knotweed can be achieved through;

- Herbicide treatment;
- Burying plants under an Environmental Permit or Remediation Position Statement; or
- Disposing of plants off site as controlled waste.

Materials contaminated by Japanese Knotweed, its crown and rhizome shall be remediated using one or a combination of the above treatments. The specific treatment shall be defined as part of an invasive species treatment plan.

4.3.12 Unexpected Contamination

At present, data gaps exist in the south of the site in the vicinity of the potential source area and no detailed characterisation has been undertaken in this area of the site. Further data is currently being collected from across the site, including addressing these data gaps and the Remediation Strategy shall be reviewed based on the finding of these works and where required updated to ensure that the strategy remains valid and comprehensive.

Additionally, changes to the remediation strategy may be required during the remediation works, as a result of encountering unexpected contamination⁴. Should unexpected contamination be encountered, then further characterisation and risk assessment will be undertaken as required. In this situation an addendum to the strategy will be prepared detailing how this contamination will be dealt with. Written agreement with the regulators will be required prior to implementation of any amendments to the agreed strategy. Any such amendments shall be required to be fully documented within the Verification Report.

4.3.13 Anticipated Enabling Earthworks and Remediation Extents and Quantities

The extent and quantities of the enabling earthworks and remediation shall be estimated following the completion of the ongoing ground investigation site assessment works.

Prior to commencement of the remediation works an earthworks cut and fill balance shall be completed and the remediation strategy reviewed to ensure that the anticipated material volumes are reflective of the results of the cut and fill assessment. Should a surplus of material be identified this will be designated for reuse within the wider redevelopment of the former steelworks site under appropriate MMP.

4.3.14 Verification of Excavations and Materials for Reuse

Materials identified for reuse will be required to be tested prior to placement to demonstrate compliance with the reuse criteria. Testing will be undertaken on a proposed frequency identified in 4.3.10

4.3.15 Backfill

All Made Ground will be excavated and screened to remove oversize or deleterious material. Oversize material will be crushed for reuse, while deleterious material will be removed from site. All remaining material will be placed into stockpiles and subjected to testing and grading to ensure suitability as defined in series 600 of the Specification for Highways. Where the material does not meet the suitability criteria, it will be subjected to physical treatment, modification or stabilisation as required to achieve the necessary degree of compaction.

⁴ This is defined as any contamination source which is distinct in its chemical or physical composition from the type of source material considered within the conceptual site model.

No detailed redevelopment design is currently available for the site and therefore no groundworks model with cut and fill levels is available. In addition, the geotechnical specification for backfilling is not provided as a development ready platform but to provide a level access to and around the site.

At the time of writing the Earthworks Specification is yet to be completed. Following the completion of the Earthworks Specification, the excavation, processing and backfilling specifications of this document will be required to be updated to reflect the changes.

Where backfilling in areas that have tidally influenced groundwater, backfilling should be undertaken in line with the tidal cycles to ensure it is placed and compacted in dry conditions, where this is not practicable it is likely that use of Class 6A – Selected well graded granular material will be required – however this shall be defined within the Earthworks Specification.

Where required imported materials from the wider Redcar Steelworks shall be used to fulfil any materials deficit. Imported material must be certified free of asbestos and other deleterious material. For each source of imported material for backfill, a material statement shall be provided detailing the chemical testing results, geotechnical testing material classification, destination of material deposition on site and proposed method of compaction. Site won materials that are re-used on site must be demonstrated as suitable for use in accordance with the MMP. Prior to backfill, excavations will be dewatered. Excavations will be backfilled in layers in accordance with the Highway Specifications.

4.3.16 Environmental Controls and Management

As set out in Section 4.3.1 the Contractor shall prepare and submit a Construction Phase Environmental Management Plan (CPEMP) for the Works. As a minimum this shall consider the following environmental aspects.

4.3.16.1 Groundwater / Surface Water Management

The Contractor shall develop and implement a ground and surface water management plan as a component of the CPEMP to provide temporary drainage facilities and protection measures (such as silt fences) as necessary to ensure the site, the Remediation Works, the adjacent land and existing facilities are adequately drained and run-off managed during the course of the Work.

The Contractor shall ensure that ground, surface and other water generated as part of the Works shall be monitored and treated via an appropriate water treatment system in order to meet the requirements of the Environmental Permit or Trade Effluent Discharge Consent.

This may include;

- Settlement tanks, lamella filters, sand filters or similar, to remove solids and fines from water;
- Granular Activated Carbon filtration;
- pH adjustment; and
- Any further treatment necessary to effect compliance with the consent limits.

4.3.16.2 Dust, Noise and Vibration

Air Quality and Dust Management Plan

An Air Quality and Dust Management Plan (AQDMP) will be prepared as a component of the CPEMP. Baseline data will be collected as part of this plan to allow the impact of the works on the surrounding environment to be determined and allow the success of control measures undertaken to protect the site workforce and neighbouring receptors to be assessed. Trigger levels for remedial action will be defined within this plan.

Dust control measures will be implemented through the works including the use of damping down, sealing of stockpiles and vehicle wash facilities to prevent the transport of mud and debris from the site onto public roads.

Asbestos

A reassurance monitoring plan and program shall be developed and implemented for asbestos air monitoring will be prepared as a component of the CPEMP Baseline data will be collected as part of this plan to allow the impact of the works on the surrounding environment to be determined and allow

the success of control measures undertaken to protect the site workforce and neighbouring receptors to be assessed.

Noise

Prior to commencement on site noise data will be taken to establish baseline conditions. Trigger levels to prevent unacceptable impacts to receptors shall be identified within the CPEMP and agreed with the Regulators. Noise monitoring stations will be implemented to monitor the impact of the Works against background levels and allow measures to be implemented to ensure noise levels remain below these limits.

Vibration

Prior to commencement on site vibration levels will be taken to establish baseline conditions. Trigger levels to prevent unacceptable impacts to receptors shall be identified within the CPEMP and agreed with the regulators. The Contractor shall implement vibration monitoring stations to monitor the impact of the Works against background level and these limits.

4.3.16.3 Ecology

As discussed in Section 2.1 following the completion of the ecological surveys and review of the findings of the HRA, any control and mitigation measures identified within it shall be adopted in relations to the remediation and restoration works and future development.

5 Reporting

5.1 Pre-commencement

5.1.1 Enabling Earthworks Remediation Implementation Plan

The specific objective of the Remediation Implementation Plan (RIP) is to produce a site-specific plan detailing the design and methodology of the selected remediation approach to be applied at the site. This will incorporate remediation programme and the monitoring and validation requirements.

The RIP will be undertaken in accordance with the requirements of LCRM guidance and will include the following tasks:

- Review of the site characteristics – in particular any variation from currently known conditions;
- Development of remediation technical specification;
- Development of implementation methodology;
- Discussion of any additional regulatory requirement; and,
- Details on methodology for verification of remedial works.

5.1.2 Materials Management Plans

An MMP shall be prepared by the appointed Contractor in accordance with CL:AIRE DoWCoP and authorised by a Qualified Person registered with CL:AIRE.

5.1.3 Construction Phase Environmental Management Plan

The appointed Contractor will prepare a construction phase environmental management plan (CPEMP) for the works. This will consider the potential impacts that the works will have on the environment and include any monitoring and control measures required.

The plan will set out the monitoring and recording process for the management and minimisation of waste, including the storage and transport of waste on-site. This will include a recording mechanism for required waste documentation such as Waste Transfer or Consignment Notes (dependent on the waste stream) in order to confirm the assessment of the waste impact and to implement embedded mitigation measures.

The CPEMP will include their methodologies for controlling and monitoring the following aspects of the works:

- Waste Management Procedures
- Noise and vibration
- Air quality and dust management
- Any ecological mitigations required
- Ground and surface water drainage plans
- Spills and environmental releases
- Monitoring and measuring procedures
- Relevant policies, legal requirements and key stakeholders

5.2 Implementation

During remediation implementation, regular meetings will be held and minuted by the remediation contractor to provide robust control of the work. Meetings are proposed to include:

- Pre-start Meeting
- Daily Site Briefings
- Weekly Site Progress Meetings

- Fortnightly Contract Review meetings
- Risk Reduction/Change Management Meetings
- Project Close Out Meeting

Data types to be collected and reviewed during the remediation implementation period are described in Section 5.3 below. Records will be produced to detail progress of the works. Should site conditions vary from those currently known, resulting in a change to the proposed remediation strategy, this will be communicated to relevant stakeholders at the earliest opportunity to allow for an amended approach to be developed and approved.

5.3 Remediation Works Verification Report

Verification of remediation will be based on a number of lines of evidence collected during the works and tracked through the implementation phase. These will be documented within the final Verification Report as follows:

5.3.1 Field records

Field records to verify the works may include the following;

- Excavation extents and depths supported by topographic survey data;
- Volumetric measures of materials excavated and removed from site;
- Field screening / onsite analysis of soil samples;
- Records of required backfilling and compaction processes;
- In situ Geotechnical testing of reinstated material to ensure compliance with Earthworks Specification in line with relevant British Standards or European Standards;
- Volumetric records of water and free phase hydrocarbons recovered from excavations; and,
- Photographic records.

5.3.2 Laboratory Results

Soil and water sampling and accredited laboratory analysis data will be provided to confirm that:

- On completion of excavations contaminant concentrations within remaining in situ soil meets the reuse criteria, as far as is reasonably practicable (laboratory results).
- Contaminant concentrations within excavated soil that may be re-used onsite as infill to excavations, meet the reuse criteria.
- Laboratory analysis of recovered groundwater / treated groundwater to support off-site disposal, re-infiltration or disposal under consent to foul drainage network.
- Laboratory analysis results of material imported onto site as backfill will be obtained to demonstrate material meets the reuse criteria.
- Geotechnical testing of reinstated material to ensure compliance with Earthworks Specification. Laboratory analysis will be undertaken by a UKAS accredited laboratory.

5.3.3 Topographic Survey Records and Drawings

Site drawings and topographic plans will be developed to demonstrate that:

- Source areas have been removed (if identified) and provide records of excavation extents during the Works;
- Records of below ground obstructions left in-situ following the works;
- Site levels have been restored to the agreed formation levels;
- Thickness and extent of capping layer placed on the site; and,

- Re-used materials have been located in the correct place through as-built drawings showing locations of remedial works and records of residual hazards.

5.3.4 Materials Audit Trail Records & Environmental Monitoring

The results of the monitoring and testing set out in the CPEMP, including details of any spills or emergency response measures employed, will be included together with evidence to demonstrate that:

- Re-used material has been deposited in the correct location in compliance with the materials management plan;
- Waste materials have been properly quantified and have been accepted by an appropriately licenced facility include completed waste transfer documentation; and that
- Imported materials are of correct quality and volume for use on site and free of asbestos.

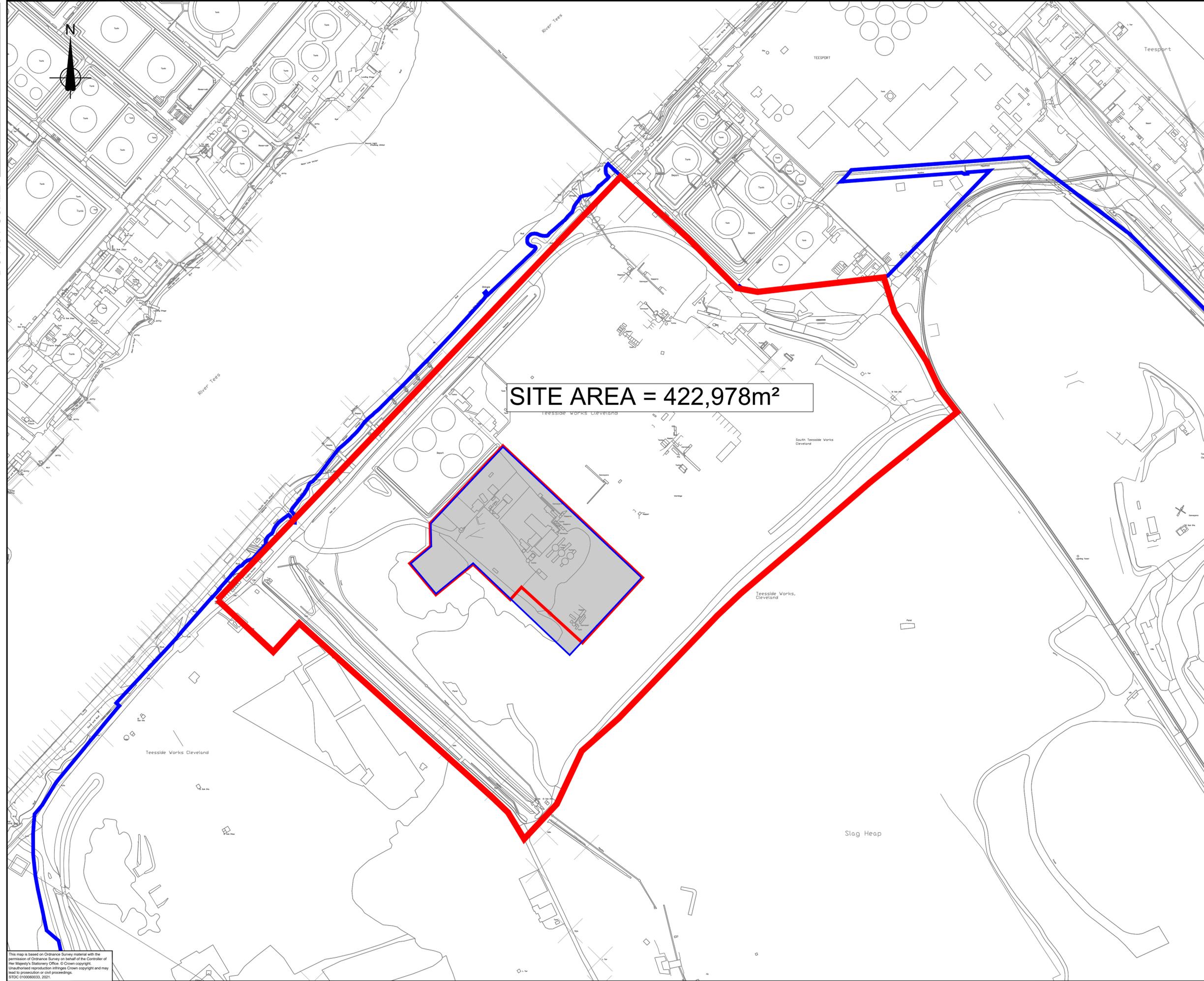
APPENDIX A

Figures

DO NOT SCALE

Millimetres

0 10 100



NOTES

- 1. Do not scale from this drawing.

KEY

- PROPOSED WORKS BOUNDARY
- TEESWORKS LAND OWNERSHIP BOUNDARY

SITE AREA = 422,978m²

FOR PLANNING

Rev.	Date	Description	By	Chk'd	App'd

STDC
 Teeside Management Offices,
 Redcar, TS10 5QW
 www.southteesdc.com



Project Title: **TEESWORKS**
 The UK's largest industrial zone

Drawing Name:
SOUTH BANK QUAY ENABLING WORKS SITE LOCATION PLAN

Drawn by: KW Date: APR 2021
 Checked by: LCD Date: APR 2021
 Approved by: JMC Date: APR 2021

Drawing Number: TSWK-STDC-SBK-ZZ-DR-C-0012 Revision: -

Drawing Scale: 1:2,500 Page Size: A1

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River Tees

**HFO Tanks
(Demolished)**

**Highfield
Environmental
Landfill**

**High Tip
Landfill**

Legend
Utilities

Heavy Fuel Oil

Redline

- High Tip
- Highfield Environmental
- Hanson Area (Excluded)



Maps

Bing

Lidar

LIDAR Original

- 2.4
- 6.75
- 15.9
- 25.1
- 34.3



Notes:
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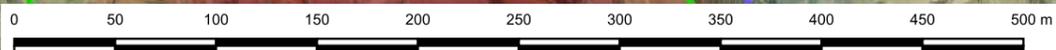
Title:
South Bank Wharf Area B -Site Setting

Site: Teesworks - South Bank Wharf Area B

Client:
South Tees Development Corporation

Project:
10035117

Date: 28/04/21
Drawn By: JALM
DRG No: 10035117-AUK-XX-XX-DR-ZZ-0291-02-SBB_Set





Legend
Remediation
Maximum Dig Depths
 (mbgl)

- 2.5
- 4m
- 5.5m

Red Line Boundary

Maps
 Bing

Notes:
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 GD 100024393.
 CONTACT ARCADIS IN CASE OF ANY QUERIES.



Title:
 South Bank Wharf Area B -Maximum Remedial
 Excavation Depths

Site: Teesworks - South Bank Wharf Area B

Client:
 South Tees Development Company

Project:
 10035117

Date: 26/04/21
Drawn By: JALM
DRG No: 10035117-AUK-XX-DR-ZZ-0273-01-
 SBB_Rem_Ex DRAFT



APPENDIX B

Study Limitations

IMPORTANT: This section should be read before reliance is placed on any of the information, opinions, advice, recommendations or conclusions contained in this report.

1. This report has been prepared by Arcadis UK Ltd (Arcadis), with all reasonable skill, care and diligence within the terms of the Appointment and with the resources and manpower agreed with **STDC** (the 'Client'). Arcadis does not accept responsibility for any matters outside the agreed scope.
2. This report has been prepared for the sole benefit of the Client unless agreed otherwise in writing.
3. Unless stated otherwise, no consultations with authorities or funders or other interested third parties have been carried out. Arcadis are unable to give categorical assurance that the findings will be accepted by these third parties as such bodies may have unpublished, more stringent objectives. Further work may be required by these parties.
4. All work carried out in preparing this report has used, and is based on, Arcadis' professional knowledge and understanding of current relevant legislation. Changes in legislation or regulatory guidance may cause the opinion or advice contained in this report to become inappropriate or incorrect. In giving opinions and advice, pending changes in legislation, of which Arcadis is aware, have been considered. Following delivery of the report, Arcadis have no obligation to advise the Client or any other party of such changes or their repercussions.
5. This report is only valid when used in its entirety. Any information or advice included in the report should not be relied upon until considered in the context of the whole report.
6. Whilst this report and the opinions made are correct to the best of Arcadis' belief, Arcadis cannot guarantee the accuracy or completeness of any information provided by third parties.
7. This report has been prepared based on the information reasonably available during the project programme. All information relevant to the scope may not have been received.
8. This report refers, within the limitations stated, to the condition of the Site at the time of the inspections. No warranty is given as to the possibility of changes in the condition of the Site since the time of the investigation.
9. The content of this report represents the professional opinion of experienced environmental consultants. Arcadis does not provide specialist legal or other professional advice. The advice of other professionals may be required.
10. Where intrusive investigation techniques have been employed they have been designed to provide a reasonable level of assurance on the conditions. Given the discrete nature of sampling, no investigation technique is capable of identifying all conditions present in all areas. In some cases the investigation is further limited by site operations, underground obstructions and above ground structures. Unless otherwise stated, areas beyond the boundary of the site have not been investigated.
11. If below ground intrusive investigations have been conducted as part of the scope, service tracing for safe location of exploratory holes has been carried out. The location of underground services shown on any drawing in this report has been determined by visual observations and electromagnetic techniques. No guarantee can be given that all services have been identified. Additional services, structures or other below ground obstructions, not indicated on the drawing, may be present on Site.
12. Unless otherwise stated the report provides no comment on the nature of building materials, operational integrity of the facility or on any regulatory compliance issue

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