

**Transpennine Route Upgrade
Hillhouse Construction Compound-
s73 application**

**Appendix G1: Phase 2 Land
Contamination Risk Assessment**

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Network Rail



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EXECUTIVE SUMMARY

Project Background	This report presents the findings of a ground investigation and subsequent risk assessment to identify potential contamination constraints at the former Hillhouse Engine Shed and sidings at land off Alder Street, Fartown. The Development comprises a strategic construction compound with railway sidings, retaining wall, noise attenuation, utilities and temporary railway platform.
Ground Investigations	Three phases of ground investigation have been undertaken at the site to date, which comprised cable percussive, rotary cored and windowless sampler boreholes, dynamic sampler and trial pits. Soil and groundwater samples were collected scheduled for chemical analysis. Ground gas and groundwater monitoring was undertaken. Sampling of three stockpiles located on site was also undertaken by Alder and Allan in 2014.
Ground Conditions	<p>The stockpiles contained brick/concrete rubble, with some ash and coal. Made Ground was encountered to a maximum depth of 17.05 metres (m) below ground level (bgl) and was predominantly granular, with occasional clay layers. Superficial deposits, in the form of clay, were encountered in three exploratory holes with a maximum proven thickness of 3.50 m. The Pennine Lower Coal Measures, comprising predominantly of mudstones interbedded with sandstone and siltstones, were encountered in 16 locations with top depths ranging from 0.70 to 16.50 m bgl.</p> <p>Coal was also recorded within three boreholes with depths encountered ranging between 13.17 and 13.50 m bgl. Intermittent perched water has been recorded within Made Ground, generally at the base near the bedrock. Groundwater monitoring indicated groundwater levels in the bedrock varied from 13.0 to 14.5 m bgl.</p> <p>Visual and olfactory evidence of contamination comprised ash, colliery spoil, organic odours, rare hydrocarbon odours (and in one location sheens were noted).</p>
Human Health Risk Assessment	<p>A single exceedance of the human health generic assessment criteria (GAC) was recorded within BH5167 at 0.20 m bgl (for benzo(a)pyrene which marginally exceeded the GAC). The majority of samples recorded determinands below GAC or laboratory detection limits and are unlikely to pose an unacceptable risk to human health. Asbestos was recorded within two samples collected from across the site from Made Ground, both of which are located in the north-east of the site. Asbestos was also recorded within five samples collected from all three stockpiles located on site.</p> <p>During use the Development will comprise hardstanding, ballast/gravel or imported topsoil (in the few landscaped areas). This is likely to limit the exposure of site users to the underlying Made Ground. It is recommended that advice be sought from a specialist asbestos contractor on measures to mitigate the risks posed by asbestos to construction works during excavation works (e.g. utility/drainage/foundations).</p>
Controlled waters Risk Assessment	<p>Five inorganic determinands and benzo(a)pyrene were recorded above Drinking Water Standards (DWS) in less than half the soil-leachate samples analysed. Six metals and five polyaromatic hydrocarbons (PAHs) exceeded the DWS in the single groundwater sampled recovered from the site. Generally, the concentrations were marginally above the DWS and/or limit of detection (LOD) (within the same order of magnitude of the DWS). Concentrations are likely to reduce during migration through the unsaturated zone of the mudstone (which data indicates to be 10+ m thick) and then along the groundwater flow path via natural processes such as biodegradation, adsorption and dilution. Contaminants recorded to date on</p>

	<p>site are unlikely to pose an unacceptable risk to the groundwater aquifer or the abstraction. Further groundwater monitoring and sampling is proposed at this site and an updated groundwater risk assessment will be undertaken following completion of the monitoring.</p>
Gas Risk Assessment	<p>Peak maximum concentrations of 1.2 % volume per volume (v/v) methane and 8.2 % v/v carbon dioxide were recorded. Maximum steady state flow rate of 9.0 litres per hour (l/hr) recorded. Maximum recorded photo-ionisation detector (PID) concentrations was 126.2 part per million (ppm). No obvious sources of volatile contaminants were identified during the ground investigation or were identified during chemical analysis of soils and groundwater. The initial data indicates ground (and/or possibly mine gas) is present within the upper 5 m, which might pose a risk to workers involved in drainage/foundation excavations. Providing a gap is maintained beneath portacabins, it is likely ground/mine gas would pose a low risk to occupants.</p>
Preliminary Waste Classification	<p>CAT-WasteSOIL analysis on soil samples collected from the site indicates the majority of samples tested are likely to be classified as non-hazardous for off-site disposal (if such was required). Twelve samples were indicated to be potentially hazardous due to hydrocarbons, copper and/or zinc. Waste Acceptance Criteria (WAC) analysis was undertaken on soil samples collected from the three stockpiles located on site. Alder and Allan indicated that material from all three stockpiles failed the criteria for inert waste landfill. It is recommended that waste contractors are consulted prior to disposal to discuss these results and to confirm their requirements. Further sampling and analysis will be required prior/during construction by the contractor to enable them to classify the waste and ensure it is disposed of to an appropriately permitted facility.</p>
Land Contamination Constraints and recommended actions	<p>Table 10-1 in Section 10 of this report provides detail on the constraints posed by land contamination/ground gas to the redevelopment of the site and the recommended actions required before and/or during construction.</p>

1. INTRODUCTION

1.1 Background

- 1.1.1 Planning Permission was granted for a temporary strategic construction compound with retaining wall, environmental mitigation measures and a temporary railway platform to facilitate the construction works for the section of the Trans-Pennine Route Upgrade (TRU) between Huddersfield and Westtown (Dewsbury) (the Scheme) at a site off Alder Street, Huddersfield namely the Hillhouse Yard.
- 1.1.2 This report supports the submission under section 73 of the Town and County Planning Act 1990 made on behalf of Network Rail and seeks to vary details of the development set out under paragraph 1.1.1 and consented under planning reference 2021/94337 dated 30 March 2022.
- 1.1.3 It should be noted that certain elements of the proposed development fall under NR's Permitted Development privileges. These did not form part of the approved scheme and were supplied for information only; these include provision of the stabling sidings in the Yard for the train operating company, and the provision of a signing-on /mess facility to serve the sidings in question, along with associated internal access and car parking. It should also be noted that the existing GSM-R mast will remain in situ as part of this temporary works application. There is no change to these elements as part of this submission.

1.2 Purpose of the document

- 1.2.1 The purpose of this document is to present the findings and interpretation of the recent phases of ground investigation undertaken to inform the design and support the consenting requirements for the Development.
- 1.2.2 The excavation and re-use of site won materials will be undertaken in order to achieve the formation levels needed for new infrastructure to be built. As the site preparatory works will include land located both within the Development site as well as Network Rail owned land immediately adjacent to the south-west boundary of the Development site (works in this area will be undertaken utilising Network Rail's Permitted Development Rights) shown on the Site Layout drawing in Appendix A. Excavation and reuse will only take place within Network Rail owned land). In order to assess the potential risks posed to human and environmental receptors present during the construction and use of the Development from contaminants/gas, ground investigation data from within the Planning Application boundary and from the Network Rail owned land directly adjacent to the Site have been combined and used within this report.
- 1.2.3 The objectives of this report are to:
- Summarise key information from desk study sources;
 - Describe the recent phases of ground investigation and present the findings;
 - Production of a generic quantitative risk assessment (GQRA) to assess the potential risk to human health and controlled waters for the Development using the recent ground investigation data;
 - Preparation of a ground gas risk assessment following on from post-fieldwork monitoring;
 - Undertake preliminary waste characterisation;
 - Revision of the Conceptual Site Model (CSM);
 - Preparation of a geo-environmental assessment report detailing the ground investigation findings and assessment of the results; and

- Provide recommendations and suggestions for further works based on the collated ground and groundwater conditions.

2. THE DEVELOPMENT

2.1 Location of the Development

- 2.1.1 The Site is located at Hillhouse railway yard, Alder Street, Fartown at approximate National Grid Reference (NGR) 414838, 418129.
- 2.1.2 The Hillhouse Construction Compound site encompasses an area of approximately 5 hectares, which is entirely under the ownership of Network Rail. The Site is operational railway land within the meaning of Section 263 of the Town and Country Planning Act 1990.
- 2.1.3 The Site is bounded by residential properties to the north-west, the operational railway to the south-east and Alder Street to the west. The Site boundary (planning application boundary shown in the Site Layout plan in Appendix A) is located within 20m of residential properties on Abbey Road, Hammond Street and Abbey Place.
- 2.1.4 The construction site will be used by the civils and rail systems engineers and will include laydown areas for the receipt and storage of the overhead line equipment (OLE) and trackwork. The laydown area for OLE would be located in the northern part of the compound. A laydown area is also proposed for permanent way works including an area where the trackwork will be fabricated. The Site will also be used for storage of waste and excavated material. Active plant and machinery would be present on site.
- 2.1.5 Construction and project management activities to service the wider Scheme will also be undertaken from the Site. The Site will make provision for welfare cabins for construction staff.
- 2.1.6 Works associated with the Proposed Development will be undertaken in two stages, comprising a number of elements within each stage:
- Stage 1:
 - o Use of the Site for construction of Advanced Works to the Order;
 - o Construction of retaining wall (works complete);
 - o Construction of environmental mitigation measures (noise attenuation);
 - o Construction of railway sidings (works complete);
 - o Provision of welfare for civils and rail systems staff (works complete);
 - o Material Storage (works complete);
 - o Limited staff parking; and
 - o Associated utilities/drainage work (complete).

- Stage 2:
 - o Use of the Site as a strategic construction compound to facilitate the TRU works between Huddersfield and Westtown (Dewsbury);
 - o Material Storage; and
 - o Provision of welfare for civils and rail systems staff.

Information sources

The following sources of information have been used in this report:

- Hillhouse Construction Compound, Phase 1 Land Contamination Desk Study (Network Rail, 2021), which utilised the following sources:
 - Groundsure “Enviro+Geo Insight” reports (hereafter referred as “Groundsure report”), which includes historical maps and a range of environmental data (Groundsure, 2020);
 - Multi-Agency Geographic Information for the Countryside (MAGIC) Interactive map (Department for Environment, Food & Rural Affairs, 2021)
 - British Geological Survey (BGS) online data (British Geological Survey, 2021);
 - DEFRA Spatial Data Download which was utilised in the preparation of the Phase 1 Land Contamination Desk Study (DEFRA, 2019);
 - The Environment Agency Catchment Data Explorer website (Environment Agency, 2021);
 - Zetica, Unexploded Bombs online risk map (Zetica, 2021);
 - The Coal Authority (CA) “Interactive Map” website¹ and web map services data (Coal Authority, 2021);
- A detailed UXO assessment by 1st Line Defence (February 2018);
 - Information obtained from multiple phases of ground investigation (also included within Appendix B):

¹ <https://mapapps2.bgs.ac.uk/coalauthority/home.html> [accessed April 2022]

- BAM Ritchies (September 2018) SPO 14.1 Boreholes Ground Investigation Report – Factual Account (Bam Ritchies, 2018); and
- Bam Ritchies, Transpennine Route Upgrade GI, W3A Area 2 – Hillhouse Lane to Deighton (ATK Boreholes), Ground Investigation Report – Factual Account (Bam Ritchies, 2020);
- Structural Soils, Transpennine Route Upgrade; Factual Report on Ground Investigation; 151667-TSA-W3-MVL3-DM3-X-MF-701852 SSL-W3-MVL3-Alder Street (Structural Soils Limited, 2020);
- Bam Ritchies, Transpennine Route Upgrade GI; W3A (Section 2) - Hillhouse Sidings Boreholes & Plate Bearing Tests; Ground Investigation Report - Factual Account (Bam Ritchies, 2021). AGS data and the associated ground investigation draft factual report has been downloaded from the project database on 18 January 2022 and therefore only information contained within the factual report at this point in time (plus the final soil lab test report 21/13305 dated 10 January 2022 for BH5160) has been included within this report; and
- Adler and Allen, inspection and site report of stockpile material 12 November 2014 (Adler and Allan, 2014).

For a full list of all information sources please refer to the references list in Section 12.

2.3 Limitations

- 2.3.1 The report authors are responsible for selecting and summarising the data supplied by third parties but cannot be held responsible for any for any mistakes or inaccuracies or the completeness of third-party data on which it has relied. As with any point data, ground conditions can only be inferred between test locations and as such localised conditions on site may vary between point locations and groundwater/ground gas conditions may differ from those encountered during the monitoring periods. Therefore, this report cannot guarantee against unexpected ground conditions occurring between the sampling points.
- 2.3.2 This report presents the preliminary findings of a geo-environmental ground investigation and risk assessment to inform the client about potential contamination hazards and constraints relating to the Development. Constraints relating to geotechnical hazards, ecology, heritage, flooding/drainage, utilities, air quality and noise are beyond the remit of this report and have been considered elsewhere mistakes or inaccuracies or the completeness of third-party data on which it has relied. As with any point data, ground conditions can only be inferred between test locations and as such localised conditions on site may vary between point locations and groundwater/ground gas conditions may differ from those encountered during the monitoring periods. Therefore, this report cannot guarantee against unexpected ground conditions occurring between the sampling points in the information submitted to support the planning application.
- 2.3.3 Ground gas and groundwater conditions are based on observations made at the time of the ground investigations and monitoring programmes, and may be subject to variation due to atmospheric, seasonal or other effects.
- 2.3.4 The CSM developed and GQRA carried out for human health has been based on using screening criteria for a commercial land use scenario. Any changes to the Development from those indicated in Section 2.1 may require revision of the CSM and reassessment of the risk assessment findings if the final development differs substantially from these assumptions.
- 2.3.5 This report does not advise on measures to deal with asbestos. Detailed advice should be sought from a specialist contractor.

3. SITE CHARACTERISTICS

3.1 Site Characteristics

3.1.1 A summary of the historical and environmental setting of the site is presented in Table 3-1. This information has been summarised from the findings of the Phase 1 Land Contamination Desk Study (including a site walkover undertaken in November 2019) and from observations during the ground investigation works.

Table 3-1 Summary of Site's historical and environmental setting

Item	Description
Current site description and use	<p>The site encompasses an area of approximately five hectares (ha) and was recently occupied by a number of commercial and industrial units (including a vehicle repair facility, fuel distributors and suppliers (wood products only), stone quarrying and preparation, garages and a concrete producer and supplier who operated under short-term leases. Gas tanks, oil tanks and miscellaneous tanks were observed during the site walkover undertaken in 2019.</p> <p>The site is bound by residential properties to the north-east, the operational railway to the south-east and Alder Street to the north-west. Listed coal drops and a motorcycle training centre are also located adjacent to the south-west of the site. The northern site boundary is located within 20m of residential properties on Abbey Place and Hammond Street. Residential properties and playing fields are also located beyond the railway line approximately 300m and 200m, respectively, to south-east of the site.</p> <p>At the time of the walkover in 2019, approximately 30% of the site is occupied by vegetation, 60% by hardstanding (including concrete, asphalt and stone setts) and buildings and 10% is unsurfaced/ unvegetated ground. Three stockpiles of waste materials are present on site; Stockpile 1 (150 m³) is located in the north of the site, Stockpile 2 (300 m³) is located in the centre of the site and Stockpile 3 (600 m³) is located in the south of the site. All three stockpiles are noted to support vegetation. Approximate stockpile volumes have been obtained from the Alder and Allan report 2014.</p> <p>Fly tipping has been observed at the site, in particular adjacent to the railway line in the east.</p>
Key historical land uses	<p>The earliest mapping reviewed (1889) indicates that the site contained infrastructure associated with the nearby railway, including buildings, cuttings, railway sidings and an engine shed. Tanks, a wagon repairing shop and unspecified works occupied the site later.</p> <p>The surrounding land has also contained infrastructure associated with the railway, including cuttings (infilled), tramway and railway sidings, engine sheds and a depot. In addition, the surrounding land appears to have mainly used for industrial purposes, with unspecified commercial/industrial works, dye works, mills, brick works, chemical works, refuse heaps, wagon works, foundry, garages, sanitary depot and old coal shafts located within 250 m of the site.</p>
Geology	<p>Superficial Deposits: A small portion of the northern part of the site is described as Glaciofluvial deposits, of Mid Pleistocene age. The remainder of the site is recorded as being devoid of superficial deposits.</p> <p>Bedrock: Pennine Lower Coal Measures Formation.</p> <p>No geological faults are recorded on the site.</p>
Mining	<p>The site is located within a Surface Coal Resource Area and an area of probable shallow coal mine workings. Two mine entries are shown on</p>

Item	Description
	or directly adjacent to the site. The Coal Authority online interactive map shows a near surface coal seam aligned across the southern tip of the site (the BGS appears to show the same coal seam off-site to the west). The Groundsure Report indicates that underground mining of sandstone (Elland Flags) is known or considered likely to have occurred 45 m to the north of the site boundary. The Brit Pits layer contained within the Groundsure Report indicates that there are five Brit Pits located within 250 m of the site, all recorded as ceased. The closest Brit Pit, the Fartown Green Pit, is located 30 m north-west of the site.
Hydrogeology	<p>Superficial: Secondary A Aquifer Bedrock: Secondary A Aquifer</p> The site is not located within 250 m of a Source Protection Zone (SPZ). There are four groundwater abstraction licences recorded within 250 m of the site, but only one licence is registered as active. The active licence is located 130 m south west and is registered to the Huddersfield Dying Company and relates to the general use relating to secondary category (medium loss).
Hydrology	Blackhouse Dike, designated by the Environment Agency as a Main River, flows approximately 30 m north of the site boundary into the Huddersfield Broad Canal, which is approximately 100 m south-east of the Site boundary. The canal is not classified by the Environment Agency.
Landfills and Waste	There are four historical landfill sites located within 250 m of the site. The nearest site, Emerald Street Brick and Tile Landfill is located 30 m east of the site and accepted industrial, commercial and household waste. Licence issue/surrender date and input dates are unknown. There are nine licensed waste transfer sites within 250 m of the site, two of which were located on site. The on-site transfer sites were Truckline Services and Able Fuels, with licence issue dates of February 2010 and December 1994 respectively, with the licence associated to the latter site surrendered in 2000. Truckline Services Ltd was a vehicle depollution facility and Able Fuels was a household, commercial/industrial waste transfer station. Works ongoing to surrender the existing licence relating to the Truckline facility and as part of their relocation the super structure was removed from site. There is one Pollution Inventory Waste Transfer site located within 250 m of the site, this facility is located 150m east of the site and is known as the Suez Recycling and Recovery Kirklees Ltd (Vine Street), associated with the incineration of non-hazardous waste.
Discharge consents	There are no discharge consents to ground located within 250 m of the site boundary. There are two active consents relating to surface water recorded within 250 m of the site, the closest of which is located 150 m east. The consent is associated with trade discharges (process effluent) to Canker Dike.
Pollution Incidents	Three pollution incidents to controlled waters are recorded within the site boundary, with an additional two incidents recorded within 250 m of the site boundary. All three incidences that occurred on site relate to the discovery of asbestos at approximate NGR 414927 418195 in September 2005. The pollution types identified in this incident are specific waste materials (asbestos), general biodegradable materials and waste, and construction and demolition materials and waste, with impact to air and land identified as minor and significant respectively.

Item	Description
Pollution Controls	<p>Several historical and current pollution controls have been identified on-site and within 250 m of the site, including:</p> <ul style="list-style-type: none"> • eight Local Authority Pollution Prevention and Control (LAPPC) sites; • four Integrated Pollution Prevention and Control (IPPC) sites; • one Control of Major Accident Hazards (COMAH) site; • one Hazardous Substance Storage Site; • four List 1 and 2 Dangerous Substance Consents; and, • one Pollution Inventory Substance. <p>Only one of these activities was located on site: the historical LAPPC permit relating to the use of bulk cement, associated with Hi-Spec Concrete UK.</p>
Trade Directory Entries and Fuel Stations	<p>The Groundsure Report was reviewed in order to identify recent land uses that have the potential to represent key contamination sources on site and in the surrounding land, and there were 44 of these sites located on or within 250 m of the site boundary. Seven of these were located on site and relate to the following industrial land uses:</p> <ul style="list-style-type: none"> • container and storage; • vehicle repair, testing and servicing; • vehicle bodybuilders; • fuel distributors and suppliers; and, • stone quarrying and preparation. <p>One petrol station is located within 250 m of the site, which is operated by Texaco and is located approximately 154 m south-west of the Site on Bradford Road.</p>
Sensitive Land Uses	<p>The site is not located within 250 m of any statutory designated sites for nature conservation (for example, Sites of Special Scientific Interest, National/Local Nature Reserves, ancient woodland, etc.).</p> <p>The Huddersfield Broad Canal, which at the closest point, is located approximately 100m south-east of the Site boundary, is designated as a Local Wildlife Site (LWS).</p>
Radon	<p>The site is located within an area not affected by radon, with <1% of properties affected. No radon mitigation measures are therefore required.</p>
UXO Risk	<p>The Zetica website indicates the site is at a low risk of unexploded bombs.</p> <p>A detailed unexploded ordnance (UXO) assessment was undertaken by 1st Line Defence for the wider TRU Scheme using a 'buffer zone' forming a corridor either side of the existing railway. The UXO report concluded the railway was in a low-risk area and recommended site-specific UXO awareness briefings be given to all personnel conducting intrusive works. Further sub-surface assessments, including UXO and utility checks, on areas not covered by the initial assessment of the rail corridor, are implemented through Network Rail Health and Safety contractual requirements with its contractors.</p>

4. INITIAL CONCEPTUAL SITE MODEL

4.1 Introduction

4.1.1 Primary guidance for assessing and managing risks posed by land contamination is presented in Land Contamination: Risk Management (LCRM) published by the Environment Agency on 8 October 2020. LCRM provides a technical framework (and signposts other key guidance) for identifying and remediating contamination through the application of a risk management process. The question of whether a risk is unacceptable in any particular case involves not only scientific and technical assessments, but also appropriate criteria by which to judge the risk and conclude exactly what risk would be unacceptable.

4.1.2 An initial CSM was presented within the Phase 1 Land Contamination Desk Study, this has formed the basis of the CSM presented in Table 4-1. A CSM describes the relationship between potential sources of contamination (resulting from both on- and off-site historical and recent activities) and receptors to the potential contamination. As part of the CSM development, three elements are identified and assessed:

- Source of contamination and associated contaminants;
- Receptors – human beings, controlled waters (surface water/groundwater), ecological systems and property, to that contamination; and
- Pathways between the sources and receptors.

4.1.3 Where all three elements are present or are likely to be present, they are described as potential contaminant linkages (PCLs), which can then be subjected to the risk assessment and risk management process.

4.2 Initial Conceptual Site Model

4.2.1 The preliminary risk categorisations presented are based on an assessment of the potential consequence of each PCL occurring along with the likelihood that each PCL will occur in accordance with the framework provided in Appendix C. Potential contamination that might be present has been identified through knowledge of historical land uses on or adjoining the site.

4.2.2 Under current health and safety legislation, construction and maintenance staff are required to carry out their own appropriate risk assessments and mitigation to protect their staff, other human receptors and the environment from potential contamination. Such risks must be adequately mitigated by law, specifically the Construction Design Management (CDM) Regulations (Health and Safety Statutory Executive, 2015), that require potential risks to human health and the environment from construction activities are appropriately identified and all necessary steps taken to eliminate/manage that risk. However, for completeness the workers involved in the construction of the Development (or maintenance workers involved in excavations) have been included as human receptors within the CSM.

4.2.3 Direct contact of contaminants in the soil or groundwater to new foundations/services has been excluded from the CSM as this is being addressed separately as part of the design process of the Development.

Table 4-1 Initial Conceptual Site Model and Risk Assessment (Use of the site as a strategic construction compound)

Source	Pathway	Receptor	Risk classification and justification
<p><u>Potential on-site contamination:</u></p> <p>Made Ground, stockpiles and historical/current activities (including sidings, garages, stone yard - see Phase 1 Land Contamination Desk Study for full list).</p> <p>Metals, PAHs, TPHs asbestos, sulphate VOC/SVOC² and high pH</p> <p>Ground gas associated with thick (~13m) Made Ground and shafts/shallow mine workings. Methane, carbon monoxide, carbon dioxide and hydrogen sulphide.</p> <p>Historically (1890 – 1993) there was a waste incinerator off-site to the east, so there is a possibility that contaminants from this off-site source are present within site soils/fill from historical aerial deposition (e.g. metals, PAHs and potentially dioxins/furans).</p>	<p>Ingestion of contaminated soils, soil-derived dust and groundwater</p> <p>Inhalation of soil and soil-derived dust, asbestos and soil and groundwater droplets</p> <p>Dermal contact with soil, soil derived dust and groundwater</p>	<p>On-site users (construction workers utilising the construction compound and members of the public using the temporary platform).</p> <p>Property (gas only)</p>	<p><u>Construction workers</u> (Medium/Likely) Moderate Risk</p> <p>There is the potential for contamination to exist within the Made Ground and stockpiles on-site. Construction workers are likely to be in contact with the underlying soils at the Site when undertaking excavations (e.g. for foundations of retaining walls, embankment works, utilities) for the construction compound. The Contractor has a duty under health and safety legislation to assess the risks posed to its workforce from contamination/asbestos and will implement the appropriate mitigation measures, which should minimise the potential risks.</p> <p><u>General public and TRU workforce</u> (Medium/unlikely) Low Risk</p> <p>Members of the public utilising the temporary platform are unlikely to come into contact with the underlying soils. The compound surface areas will be covered in hardstanding or ballast during the site preparation works, which would minimise the risk of contact with underlying Made Ground.</p>
	<p>Inhalation of ground/mine gas and vapours (e.g. from historical fuel spills)</p> <p>Migration along service trenches and build up within confined spaces (explosion or asphyxiation)</p>		<p>(Severe/unlikely) Moderate/Low Risk</p> <p>Installation of new services (e.g. drainage) have the potential to introduce new migration pathways to the welfare cabins. Providing the gap beneath the cabins is maintained, the ingress of gas is unlikely to be sufficient to pose an unacceptable risk to the cabin occupants.</p>
	<p>Ingestion of contaminated soils, soil-derived dust and groundwater</p> <p>Inhalation of soil and soil-derived dust, asbestos, soil and groundwater droplets</p> <p>Dermal contact with soil, soil derived dust and groundwater</p>	<p>Off-site residents, occupiers of commercial property and users of playing fields.</p> <p>Property (gas only)</p>	<p>(Medium/Unlikely) Low Risk</p> <p>If dust control measures are implemented correctly (in line with industry good practice and the mitigation measures specified in the planning application) when Made Ground is disturbed, the risk to these receptors should be negligible. Once the construction of the temporary compound has been completed, hardstanding, gravel or vegetation are likely to cover the Site minimising the risk of wind entrainment of dust.</p> <p>It is unlikely that occupiers of surrounding properties/users of playing fields would encounter groundwater, which is likely to be deeper than the depths gardeners would dig to.</p>
	<p>Inhalation of ground gases/mine gas and vapours.</p> <p>Ground gas migration and build up within confined spaces (explosion or asphyxiation)</p>		<p>(Medium/Low Likelihood) Moderate/Low Risk</p> <p>Installation of new services (e.g. drainage) has the potential to introduce new migration pathways to off-site buildings/occupiers via trench backfill. This risk should be considered during design. The piling technique currently proposed for the retaining wall is bored piles, which are unlikely to create preferential gas migration pathways as the concrete seals the boreholes as the auger is retracted.</p>
	<p>Leaching of contaminants and migration through permeable Made Ground</p> <p>Migration through the bedrock</p>	<p>Groundwater – Secondary A Superficial Aquifer (Glaciofluvial deposits)</p>	<p>(Medium/Low Likelihood) Moderate/Low Risk</p> <p>The glacio-fluvial deposits are predominately located beneath the adjacent off-site housing estate, and only just extend across the Site boundary into the northern part of the Site (the edge of these deposits is parallel to the Site boundary). The residential properties at Abbey Place and Hammond Street are at a higher topographical level than the Site and it is unlikely that contaminants on-site would migrate off-site to the north-west.</p>

² Volatile and semi-volatile organic compounds

Source	Pathway	Receptor	Risk classification and justification
	Migration via preferential pathways e.g. existing and historical pipes and services, or new foundations (e.g. piles)	Groundwater – Secondary A Bedrock aquifer (Pennine Lower Coal Measures) Groundwater abstraction (process water)	(Medium/Likely) Moderate Risk Significant deposits of Made Ground have been identified on-site and past/recent use might have resulted in hydrocarbons leaking into the ground. Therefore, there is potential for leaching of contaminants into groundwater within the bedrock Secondary A Aquifer. No superficial deposits are recorded underlying the majority of the Site therefore there is the potential for a direct pathway for contaminant migration from the Made Ground into the underlying bedrock aquifer.
	Contact/absorption of contaminants by flora/fauna in LWS.	Surface water – Blackhouse Dike (30m north of Site) and the Huddersfield Broad Canal (100m to the south-east at the closest point), which is designated as a Local Wildlife Site (LWS).	(Medium/Unlikely) Low Risk Groundwater flow beneath the Site is likely to be towards the south-east (towards the distant River Colne). Blackhouse Dike flows almost parallel to the Site boundary adjacent to Red Doles Road and as such it is unlikely that groundwater would flow from the Site towards Blackhouse Dike (which is also partially in culvert). The canal is likely to be sealed with puddle-clay, which would restrict the ingress of groundwater. It is unlikely that the use of the Site as a construction compound would pose an unacceptable risk to these surface water receptors and the LWS.
<u>Potential off-site contamination:</u> Historical landfills (closest 30m to the east)	Inhalation, ingestion and dermal contact with contaminants in soil derived dust	On-site users (e.g. construction workers, in the compound and general public utilising the temporary platform).	(Medium/Unlikely) Low Risk The majority of the surrounding area is covered in hardstanding or vegetated, therefore exposure to the underlying soils is limited and it is unlikely that contaminants would migrate onto Site through windblown dust.
Key land uses include incinerator (sanitary depot), chemical/dye works, foundry, abattoir and waste transfer sites. Contaminants as for on-site, plus ammonia (landfill and abattoir)	Inhalation of vapours/gas migrating through unsaturated zone and disassociating from migrating groundwater	As above, plus, for gas only, on-site property and off-site humans/property	(Severe/Unlikely) Moderate-Low Risk All of the major off-site contamination sources (chemical/dye works, landfills) are located to the east and south-east, down slope from the Site so it is unlikely that groundwater containing dissolved or free phase contamination that might produce vapours would migrate onto Site. A large landfill is located 30m east of the Site, so there is the possibility of landfill gas migration. The on-site welfare cabins (Portacabins or similar) are likely to have a void between the floor and ground and therefore it is unlikely landfill gas would pose an unacceptable risk. Installation of new services (e.g. drainage) has the potential to introduce new migration pathways that might re-direct landfill gas off-site towards the site. Although this particular PCL being present is relatively unlikely, it would be prudent to still considered this PCL during design.

5. GROUND INVESTIGATION

5.1 Introduction

- 5.1.1 To date, three phases of ground investigation have been undertaken at the site and on Network Rail owned land adjacent to the south-west, to inform the design of the Scheme, including:
- BAM Ritchies 2018 (Bam Ritchies, 2018);
 - BAM Ritchies 2020 (Bam Ritchies, 2020) and Structural Soils 2020 (Structural Soils Limited, 2020); and
 - BAM Ritchies 2021 (Bam Ritchies, 2021).
- 5.1.2 BAM Ritchies and Structural Soils, site investigation contractors, were commissioned to undertake the ground investigation works to obtain information on the geotechnical conditions at the site. The authors of this report contributed to the main investigation scope of the 2020 and 2021 investigations, with respect to the collection of contamination/gas data.
- 5.1.3 In addition to the three phases of ground investigation, three stockpiles were sampled by Alder and Allan in 2014 on behalf of Network Rail. Stockpile 1 (estimated volume 150 m³) is located in northern part of the site. Stockpile 2 (estimated volume 300 m³) is located in the centre of the site, aligned in a southwest-northeast direction. Stockpile 3 (estimated volume 600 m³) is located in the southern area. All three stockpiles were noted by Alder and Allan to have begun to support vegetation. Recent information from BAM Ritchies has indicated that Japanese knotweed is present on the stockpiles.
- 5.1.4 All factual ground investigation reports have been included within Appendix B of this report. The boreholes/data that do not relate to the Site and geotechnical test results (that are not relevant to the assessments undertaken herein) have been removed from the factual reports for ease of reference and to reduce the document file size.
- 5.1.5 The aims of the investigations, with respect to land contamination/gas were to:
- collect data on the ground conditions and groundwater depth;
 - collect soil and groundwater samples for laboratory analysis of potential contaminants of concern (identified from desk-based information); and
 - Undertake ground gas and groundwater monitoring from installed wells.
- 5.1.6 Following consideration of service plans from utility providers and drainage plans obtained from the Transpire Alliance, the proposed exploratory hole locations were cleared for buried services by a subcontractor hired by the site investigation contractor using ground penetrating radar (GPR) and by a Site Engineer using a cable avoidance tool (CAT).
- 5.1.7 It should be noted that the authors of this report were not present on site during the ground investigation works, and information provided within this report is based upon details provided within the Scheme-wide ground investigation specification and the factual reports provided by the ground investigation contractors.

5.2 Scope of works

- 5.2.1 The preliminary ground investigation was designed to target potential sources of contamination and to provide an overall summary of ground conditions. Wells were installed to enable collection of groundwater samples from within the Made Ground and bedrock and to target possible gas migration pathways from on- and off-site sources. The environmental

chemical testing suite was based on contaminants of concern identified during a review of desk-based information, including the historical uses of the site and on the Network Rail owned land adjacent to the south-west. Volatile head space testing using a PID was undertaken on site by either BAM or Structural Soils staff (hereafter referred to as the site engineer), on environmental samples to assess the risk posed by volatile contaminants within soil. Seventeen exploratory holes were completed with ground gas and/or groundwater monitoring installations. Installations targeted both Made Ground and bedrock. The installation details are shown in the logs presented in Appendix B and are summarised in Table 5-1.

- 5.2.2 The locations of the exploratory holes are presented on an exploratory hole location plan presented within Appendix A of this report and within the factual reports within Appendix B.

Table 5-1 Summary of exploratory holes undertaken across the site and on the Network Rail owned land adjacent to the south-west

GI	Exploratory Hole Type	Exploratory Hole Number	Termination Depth (m bgl)	BH Purpose/Comment*	Installation depth (m bgl)	Strata Screened
Bam Ritchies 2018	CP	BH4018	15.50	Confirm ground and groundwater conditions (primarily geotechnical).	1.50 to 10.50	Made Ground/Gravel (possible MG)
	CP + RC	BH4051	16.00		0.40 to 1.60	Made Ground
Bam Ritchies 2020	WLS	ATK BH5300	1.40	Approximate location of historical tanks (borehole terminated shallower than planned due to refusal on mudstone).	-	-
	RC	ATK BH5301	25.00	New buildings (part of TWAO) are proposed in the vicinity, a landfill is located off-site to the east and a possible worked seam at shallow depth. Shallow installation to collect gas data.	2.00 to 5.00	Mudstone
	WLS	ATK BH5302	6.45	Collect data from thick Made Ground and collect gas data.	2.00 to 6.00	Made Ground
	WLS + RC	ATK BH5303	25.00	Shallow workings possible and a shaft is located. Installation at depth to intercept any perched water at the base of the spoil and to monitor gas.	10.00 to 17.00	Made Ground and Mudstone
Structural Soils 2020	WS	WS5300	0.40	Able Fuels (boreholes terminated shallower than planned due to refusal on brickwork and mudstone).	-	-
	WS	WS5300A	1.45		-	-
	WS	WS5301	1.44	General light industrial/commercial use.	-	-
	WS	WS5302	2.35	General light industrial/commercial use. Installation in mudstone to target possible gas pathway from off-site landfill and shaft.	1.00 to 2.00	Possible Made Ground/Mudstone

GI	Exploratory Hole Type	Exploratory Hole Number	Termination Depth (m bgl)	BH Purpose/Comment*	Installation depth (m bgl)	Strata Screened
	WS	WS5303	3.45	General light industrial/commercial use. Install to collect gas data (thick Made Ground/mine gas).	1.50 to 3.00	Made Ground
	WS	WS5304	3.45		1.50 to 3.00	Made Ground
Bam Ritchies 2021	WS + RC	BH5154	15.00	Investigate ground conditions for new retaining wall.	6.00 to 7.00	Mudstone
	RC	BH5155	15.00		5.00 to 8.00	Mudstone
	RC	BH5156	25.00	Investigate ground conditions for new temporary station platform and installation in shallow bedrock to collect gas data.	2.00 to 5.00	Mudstone
	RC	BH5157	25.00	Investigate ground conditions for new retaining wall and general commercial/industrial use.	2.00 to 5.00	Mudstone
	RC	BH5158	25.00	Investigate ground conditions for new temporary station platform and installation to collect gas data.	16.50 to 19.00	Mudstone and Coal
	RC	BH5159	25.00	Investigate ground conditions for new temporary station platform and installation to collect gas data.	2.00 to 4.00	Mudstone
	RC	BH5160	20.20	Investigate ground conditions and identify extent of historical mine workings	12.50 to 14.00	Mudstone and Coal
	RC	BH5161	25.00	Installation to target coal seam and light industrial/commercial use.	22.00 to 24.00	Siltstone, mudstone and coal
	RC	BH5162	25.00	Investigate ground conditions and identify extent of historical mine workings. Light industrial/commercial use.	1.80 to 4.00	Mudstone
	WS + RC	BH5163	19.60		14.00 to 15.50	Mudstone and siltstone
	RC	BH5164	25.00	Obtain groundwater and gas data from deeper Made Ground.	9.00 to 12.90	Made Ground and Clay

GI	Exploratory Hole Type	Exploratory Hole Number	Termination Depth (m bgl)	BH Purpose/Comment*	Installation depth (m bgl)	Strata Screened
	RC	BH5165	34.00	Investigate ground conditions and identify extent of historical mine workings.	25.25 to 33.00	Mudstone, sandstone and siltstone
	WS	BH5166	3.21	Investigate ground conditions for new structures.	-	-
	WS	BH5167	1.50	Investigate ground conditions for new sidings (that will be constructed as part of site preparation works)	-	-
	WS	BH5168	3.95		1.50 to 3.50	Made Ground
	WS	BH5169	5.42		-	-
	WS	BH5170	6.40	Investigate ground conditions for new access road	-	-
	WS	BH5171	8.45		-	-
	WS	BH5172	8.45		-	-
	WS	BH5173	8.00		-	-
	TP	PL5174	0.30	Plate load test locations	-	-
	TP	PL5176	0.30		-	-
	TP	PL5178	0.30		-	-
	TP	PL5179	0.30		-	-
	TP	PL5180	0.30		-	-
	TP	PL5181	0.30		-	-
	TP	PL5182	0.30		-	-
	TP	PL5183	0.30	-	-	

Note:
 * Geotechnical and contamination sampling was undertaken at all locations.
 CP = Cable Percussive, RC = Rotary Cored, WS/WLS = Windowless Sampler, DS = Dynamic Sampler, TP = Trial Pit, BH = Borehole, PL = Plate Load

6. ENVIRONMENTAL SAMPLING

6.1 Soil sampling

6.1.1 Environmental soil samples were collected on site during the ground investigation by the site engineer and transported to Envirolab for chemical analysis. Envirolab is a United Kingdom Accreditation Service (UKAS) and Monitoring Certification Scheme (MCERTS) accredited laboratory.

6.1.2 Soil samples were collected by the site engineer and transported to the laboratory at the end of each working day under Envirolabs chain of custody delivery process.

6.2 PID testing

6.2.1 Environmental soil samples were screened on-site by a site engineer with a PID. This test provides an indication of the presence and concentration of Volatile Organic Compounds (VOCs) in soil vapour and informs the appropriate selection of laboratory analysis. In-situ testing results from each exploratory hole are presented on their respective logs.

6.3 Groundwater Sampling

6.3.1 One groundwater sample was taken from ATK BH5303 by the site engineer during a Site visit in 2020. The remaining wells were recorded to be dry during the sampling visit, with no samples collected. The sample was sent to the laboratory for chemical analysis indicated in Section 6.5.5. At the time of the January 2022 data download, no further groundwater sampling has been undertaken at the Site.

6.3.2 In-situ testing of the groundwater sample was also undertaken by a site engineer to monitor certain parameters to ensure that samples of groundwater representative of conditions within the ground were collected. The parameters recorded included pH, temperature, electrical conductivity, redox potential, dissolved oxygen and total dissolved solids. Full results of this testing are presented within the BAM Ritchies 2020 Factual Report.

6.4 Ground Gas and Groundwater Level Monitoring

6.4.1 Ground gas monitoring was carried out by a site engineer using a calibrated GA5000 over a 14-month period, between April 2020 and July 2021. The monitoring regime undertaken was disrupted by the COVID19 pandemic. It should also be noted that during multiple rounds monitoring wells (ATKBH5301 and ATKBH5302) were not accessible due to being located within land that was, until recently, leased by independent companies. Therefore, Table 6-1 shows that 14 rounds of monitoring have been undertaken, however, for any single exploratory hole the maximum number of visits undertaken ranges between five and 12 rounds.

6.4.2 At the time of the factual report download in January 2022, only one round of ground gas monitoring data was available from the 2021 monitoring regime, which was undertaken in October 2021.

6.4.3 Methane, carbon dioxide, carbon monoxide, hydrogen sulphide, oxygen and gas flow rate were recorded along with groundwater levels. The monitoring dates and the atmospheric pressure trends in the days prior to the visits, together with the pressure measured during the visits are detailed in Table 6-1.

Table 6-1 Atmospheric pressure conditions during ground gas monitoring

	Monitoring Round	Date	Pressure	Trend*
Structural Soils 2020	One	26/08/2020	1004	Rising
	Two	14/09/2020	999	Rising
	Three	16/10/2020	990	Falling
	Four	16/12/2020	992	Fluctuating
	Five	22/01/2021	979	Falling
Bam Ritchies 2020	One	07/04/2020	1018	Rising
	Two	06/10/2020	983	Falling
	Three	04/11/2020	1020	Rising
	Four	01/12/2020	1018	Fluctuating
	Five	27/01/2021	1020	Rising
	Six	09/02/2021	1004	Rising
	Seven	23/02/2021	1000	Rising
	Eight	23/03/2021	1012	Falling
	Nine	07/04/2021	1018	Falling
	Ten	14/05/2021	996	Rising
	Eleven	04/06/2021	1019	Fluctuating
	Twelve	18/06/2021	1010	Fluctuating
	Thirteen	16/07/2021	1021	Rising
	Fourteen	27/07/2021	1003	Falling
Bam Ritchies 2021	One	21/10/2021	999	Falling

*Overall trend estimated from various online sources

6.5 Laboratory Chemical Analysis

- 6.5.1 Chemical analysis of environmental samples collected during 2020/2021 was scheduled by Atkins and carried out by Envirolab under the UKAS and the MCERTS accreditation schemes. Chemical analysis was based on contaminants of concern (CoC) identified in the initial CSM from consideration of historical and current land-uses, in-situ PID testing and ground conditions encountered on-site.

Soils

- 6.5.2 Selected soil samples from all three investigation phases were scheduled for soil analysis comprising the determinands in Table 6-2.

Table 6-2 Soil testing suite

Determinand	Number of samples tested
Metals (aluminium, antimony, arsenic, boron, cadmium, chromium (total), copper, lead, magnesium, mercury, nickel, potassium, zinc, selenium and vanadium)	46
pH	48
Total Organic Carbon (TOC)	48
Speciated polycyclic aromatic hydrocarbons (USEPA 16)	42
Cyanide (complex & free)	45
Cyanide (total)	47
Asbestos ID	48
Speciated total petroleum hydrocarbons (TPH) criteria working group (CWG) with aliphatic/aromatic separation and carbon banding	43
VOCs	7
SVOCs	7
Polychlorinated biphenyls (PCBs)	2
Dioxins and Furans	4
Asbestos quantification	2

- 6.5.3 Ten samples collected during the stockpile testing were submitted for waste acceptance criteria (WAC) analysis by Alder and Allan to Jones Environmental Laboratory. No further testing was undertaken on these samples.

Soil leachate

- 6.5.4 Selected soil samples collected during the 2020 and 2021 ground investigations were scheduled for leachate analysis by Atkins, comprising the determinands set out in Table 6-3. No soil leachate analysis was undertaken on soil samples collected during the 2018 ground investigations.

Table 6-3 Soil leachate testing suite

Determinand	Number of samples tested
Metals (aluminium, antimony, arsenic, boron, cadmium, chromium, copper, lead, magnesium, mercury, nickel, potassium, selenium, vanadium and zinc)	20
pH	20
Ammoniacal Nitrogen as N	17
Ammoniacal Nitrogen as NH ₃	3
Sulphate	20
Speciated polycyclic aromatic hydrocarbons (USEPA 16)	20

Determinand	Number of samples tested
Total PAH	20
Cyanide (total & free)	20

Groundwater

6.5.5 A single groundwater sample was collected from ATK BH5303 during April 2021 by the site engineer and was scheduled for a range of determinands by Atkins, comprising the determinands outlined in Table 6-4. The remaining monitoring wells were recorded to be dry at the time of the sampling round.

Table 6-4 Groundwater testing suite

Determinand	Number of samples tested
Metals (antimony, arsenic, beryllium, cadmium, calcium, chromium (total), copper, lead, magnesium, mercury, nickel, vanadium, zinc and selenium)	1
pH	1
Cyanide (total & free)	1
Ammoniacal Nitrogen as N	1
Dissolved organic carbon (DOC) and hardness	1
Sulphate and chloride	1
Speciated polyaromatic hydrocarbons (USEPA 16)	1
Speciated total petroleum hydrocarbons (TPH) criteria working group (CWG) with aliphatic/aromatic separation and carbon banding	1
VOCs	1
SVOCs	1

7. GROUND CONDITIONS

7.1 Summary of ground conditions

7.1.1 Ground conditions have been summarised using data gathered from the 2018, 2020 and 2021 ground investigations. Olfactory and visual signs of contamination along with PID results are discussed in Section 7.3.

Made Ground

7.1.2 Made Ground was encountered across the site to a maximum depth of 17.05 m bgl within ATK BH5301 in the form of worked ground, in the west of the site. Made Ground generally thickens from north to south, with the deeper Made Ground deposits likely to be partially associated with the creation of the railway embankment in the south of the site. It should be noted, that although not described as Topsoil, grass was recorded overlying Made Ground in a number of locations.

Hardstanding

7.1.3 A fractured concrete floor slab was encountered within BH5171 at ground level to a depth of 0.15 m bgl. It is noted that no rebar was encountered. Concrete was recorded at ground level to 0.20 m bgl within WS5300A. Tarmacadam was also encountered within PL5181 at ground level to 0.08 m bgl and within WS5303 and WS5304 to 0.10 m bgl.

Granular

7.1.4 Granular Made Ground was encountered in 36 exploratory holes across the site, to a maximum depth of 16.45 m bgl recorded within ATK BH5303. Granular Made Ground was generally encountered at surface and comprised silty gravelly SANDs and clayey sandy GRAVELs. Cobbles were also recorded within Granular Made Ground deposits.

7.1.5 Inclusions within Made Ground comprised sandstone, mudstone, brick, burnt shale, coal, concrete, clinker, ash and slag. Ash was widespread across the site and was generally found in the upper couple of metres of Made Ground. Rare inclusions of metal fragments and also very rare inclusions of plastic fragments have also been recorded. Colliery Spoil is noted within ATK BH5303 between 10.45 and 16.45 m bgl. Occasional organic material was noted within ATK BH5300 between ground level and 0.25 m bgl.

7.1.6 Within the PLS undertaken at the site, fragments plastic and glass refuse were also noted.

7.1.7 Within ATK BH5303 the colour of the gravel within the Made Ground was noted to change over depth, with colours ranging from grey/black/brown to orangish brown with reddish brown iron staining noted.

Cohesive

7.1.8 Cohesive Made Ground was encountered in 12 of the exploratory holes across the site to a maximum depth of 12.65 m bgl within BH5164. A maximum thickness of 9.0 m was recorded within BH5165. Cohesive Made Ground deposits were typically described as sandy gravelly CLAYs and was generally recorded to be interbedded within granular Made Ground deposits. Gravel included limestone, siltstone, mudstone, clinker and coal.

Superficial deposits

7.1.9 As outlined within Section 3, superficial deposits were not anticipated to be recorded across the majority of the site. The investigations undertaken only encountered cohesive CLAY

within three locations, BH5154, BH5164 and BH5165. The clay encountered at the site is described as firm to stiff orangish brown sandy gravelly CLAY, with inclusions of sandstone, siltstone and rare coal.

- 7.1.10 Clay was encountered between Made Ground and the underlying bedrock at depths of 1.10 m bgl (BH5154), 12.65 m bgl (BH5164) and 12.10 m bgl (BH5165). A maximum clay thickness of 3.50 m was recorded within BH5154, which is located within an area indicated to comprise Glaciofluvial Deposits by the BGS GeoIndex (in the north of the site at the top of a steep slope that has residential properties beyond it). BH5164 and BH5165 are located towards the south of the site, where the nearest recorded Alluvium and Glaciofluvial Deposits are recorded 150 m off-site to the south by the BGS GeoIndex. It is possible the clay recorded in the southern boreholes might be reworked natural deposits.

Bedrock

- 7.1.11 Bedrock of the Pennine Lower Coal Measures was encountered across the site within 16 exploratory holes, with top depths ranging from 0.70 m bgl to 16.50 m bgl. Bedrock was encountered at shallower depths within the north of the site than in the south. Bedrock comprised predominantly of mudstone with interbedded sandstone and siltstone. Sandstone layers were recorded within limited locations, mainly located in the Occasional clay horizons were noted within limited exploratory holes, with a maximum thickness of 0.60 m recorded within BH5173.
- 7.1.12 Coal was recorded within four locations BH5157, BH5158, BH5160 and BH5161. Depths encountered ranged between 12.92 m bgl and 23.50 m bgl, with a maximum thickness of 0.74 m recorded within BH5157. Suspected workings were also recorded within two locations by BAM Ritchies, ATK BH5301 and BH5158. Workings within ATK BH5301 were described as slightly clayey slightly sandy GRAVEL of mudstone with frequent orangish brown and pale yellow surface staining at 16.80 m bgl. Within BH5158, a possible anthropogenic timber mine working prop was encountered intact at 17.70 m bgl. No recovery was also recorded within BH5162 between 15.25 and 16.00 m bgl and within BH5165 between 25.35 and 26.05 m bgl. Within BH5165, the exploratory log indicates that the area of no recovery could be possible workings.

Stockpiles

- 7.1.13 The following descriptions are summarised from the works undertaken at the site by Alder and Allan in 2014 on behalf of Network Rail:
- Stockpile 1: The western and near surface parts of the stockpile mainly comprised stones and rubble, indicated by Alder and Allan to have been associated with the stone merchants which operated nearby. The eastern and deeper parts of the stockpile contained black ash and coal. The presence of a former platform was also recorded.
 - Stockpile 2: Material encountered within Stockpile 2 generally comprised a mixture of clayey sand and topsoil, stones and rubble. Plastic fragments were also recorded. It was concluded, by Alder and Allan, that this material was originated from the landscaping company that was located nearby and the clearance of topsoil from the site itself.
 - Stockpile 3: Stockpile 3 generally comprised stones, rubble, brick, concrete and fragments of plastic. It was noted by Alder and Allan that the northern half of the stockpile appeared to have been "screened" and contained larger blocks of concrete and stone.

Groundwater recorded during investigation

- 7.1.14 Groundwater was encountered during excavation/drilling as summarised in Table 7-1. No visual or olfactory signs of contamination were recorded during groundwater monitoring.

Table 7-1 Summary of groundwater strikes during the ground investigation

GI Phase	Exploratory hole	Depth of water strike (m bgl)	Deposit	Water level after 20 min (m bgl)
2018 Bam Ritchies	BH4051	16.00	Siltstone	16.00
2020 Bam Ritchies	ATK BH5300	0.85	Made Ground	0.85
2020 Structural Soils	WS5300A	0.80	Made Ground	n/a
2021 Bam Ritchies	BH5172	1.50	Made Ground	1.10

Groundwater levels

7.1.15 Groundwater levels have been monitored by the site engineer on five occasions during the monitoring undertaken in 2020, a maximum of 12 occasions in 2020 and on a single occasion in 2021 (from information available at the time of writing). The groundwater levels recorded are summarised in Table 7-2 to 7-4.

Table 7-2 Summary of groundwater levels during Structural Soils 2020 Monitoring Regime

Exploratory hole	Well screen range (m bgl)	Screened deposits	Water depth (m bgl)				
			Visit 1 – 26/08/2020	Visit 2 – 14/09/2020	Visit 3 – 16/10/2020	Visit 4 – 16/12/2020	Visit 5 – 22/01/2021
WS5302	1.00 to 2.00	Made Ground and Mudstone	Dry	Dry	Dry	1.70	1.76
WS5303	1.50 to 3.00	Made Ground	Dry	Dry	Dry	Dry	2.92
WS5304	1.50 to 3.00	Made Ground	Dry	Dry	Dry	Dry	Dry
WS5302	1.00 to 2.00	Made Ground and Mudstone	Dry	Dry	Dry	1.70	1.76

Table 7-3 Summary of groundwater levels during Bam Ritchies 2020 Monitoring Regime

Exploratory hole	Well screen range (m bgl)	Screened deposits	Water depth (m bgl)													
			07/04/2020	06/10/2020	04/11/2020	01/12/2020	27/01/2021	09/02/2021	23/02/2021	23/03/2021	07/04/2021	14/05/2021	04/06/2021	18/06/2021	16/07/2021	27/07/2021
ATK BH5301	2.00 to 5.00	Mudstone	4.50	4.30	Dry	Dry	Dry	NR	NR	NR	NR	1.10	4.30	NR	NR	NR
ATK BH5302	2.00 to 6.00	Made Ground	Dry	NR	NR	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
ATK BH5303	10.00 to 17.00	Made Ground and Mudstone	12.00	12.00	12.00	12.00	12.00	12.00	NR	12.00	12.00	12.00	12.00	12.20	12.10	12.05

NR = Not recorded (site engineers could not gain access to this part of the site)

Table 7-4 Summary of groundwater levels during Bam Ritchies 2021 Monitoring Regime

Exploratory hole	Well screen range (m bgl)	Screened deposits	Water depth (m bgl)
BH5157	2.00 to 5.00	Mudstone	3.1
BH5158	16.50 to 19.00	Mudstone and Coal (wood also noted by BAM Ritchies as a timber prop from mine workings)	Dry
BH5161	22.00 to 24.00	Siltstone, mudstone and coal	13.00
BH5163	14.00 to 15.50	Mudstone and siltstone	14.50
BH5164	9.00 to 12.90	Made Ground and Clay	11.80
BH5165	25.25 to 33.00	Mudstone, sandstone and siltstone (no recovery also noted, BAM Ritchies indicated possible workings)	13.20
BH5168	1.50 to 3.50	Made Ground	Dry

- 7.1.16 Based on water level data obtained during excavation/drilling and subsequent monitoring visits, the following hydrogeological regime is considered likely to be present:
- 7.1.17 Groundwater within Made Ground was intermittent and generally encountered perched above more cohesive layers within the predominantly granular material of above bedrock.
- 7.1.18 Monitoring undertaken within deep Made Ground and bedrock as part of the 2021 ground investigation (October) in was utilised to estimate an initial flow orientation. During this monitoring round groundwater levels ranged from 64.07 m AOD in BH5163 to 74.93 m AOD in BH5157. Preliminary data indicates that groundwater flow within bedrock is to the west-south-west of the site, whereas the topography slopes to the south-east towards the distant River Colne. An abstraction licence is located approximately 130 m south-west of the site (registered to the Huddersfield Dying Company for general use), which might be influencing the groundwater regime in the vicinity of the site.

7.2 Ground gas monitoring results

- 7.2.1 Between five and seven rounds of ground gas monitoring have been undertaken during 2020 and 2021 from the installed monitoring wells. At the time of writing only one round of gas monitoring data was available for the wells installed in 2021 (monitoring is ongoing). The results are summarised in Table 7-5, with maximum (or minimum for oxygen) peak and steady state gas concentration values and flow rates taken from across the whole monitoring period presented.

Table 7-5 Summary of ground gas monitoring undertaken at the site

Monitoring Regime	Exploratory hole	Well screen range (m bgl)	Screened Deposits	Flow (l/hr)		Methane (% v/v)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Max hydrogen sulphide (ppm)	Max Carbon monoxide (ppm)	Max PID (ppm)
				Max	Max Steady	Max	Max Steady	Max	Max Steady	Min	Min Steady			
Structural Soils 2020	WS5302	1.00 to 2.00	Made Ground & Mudstone	0.0	0.0	0.0	0.0	4.40	2.30	10.60	10.80	0	0	0.3
	WS5303	1.50 to 3.00	Made Ground	0.1	0.1	0.0	0.0	5.00	0.20	13.60	19.50	1	0	0.6
	WS5304	1.50 to 3.00	Made Ground	0.0	0.0	0.0	0.0	5.00	5.00	12.60	12.80	1	0	0.2
Bam Ritchies 2020	ATKBH5301	2.00 to 5.00	Mudstone (suspected workings at 16.8 m bgl)	0.4	0.4	0.3	0.3	3.6	3.2	9.4	9.5	2	3	2.8
	ATKBH5302	2.00 to 6.00	Made Ground	0.5	0.5	0.3	0.3	1.6	1.6	17.7	17.7	3	0	112
	ATK BH5303	10.00 to 17.00	Made Ground & Mudstone	0.4	0.4	0.3	0.2	4.9	3.8	14.2	15.1	4	5	110.3
Bam Ritchies 2021	BH5156	2.00 to 5.00	Mudstone	-1.3	-1.3	0.7	0.7	8.2	5.2	21.0	5.2	0	0	16
	BH5157	2.00 to 5.00	Mudstone	9.0	9.0	0.8	0.8	2.9	2.7	2.6	4	0	28	11.8
	BH5158	16.50 to 19.00	Mudstone, coal & a possible timber prop	0.2	0.2	0.6	0.6	0.4	0.4	20.3	20.3	0	0	56.6
	BH5161	22.00 to 24.00	Siltstone, mudstone and coal	0.1	0.1	0.9	0.9	2.4	2.1	19.7	19.7	0	0	6.5
	BH5163	14.00 to 15.50	Mudstone and siltstone	0.2	0.1	0.6	0.6	6.6	6.6	9.8	9.8	0	2	0
	BH5164	9.00 to 12.90	Made Ground and clay	0.2	0.2	1.2	1.2	0.9	0.9	20.1	20.2	0	0	6.8
	BH5165	25.25 to 33.00	Mudstone, sandstone, siltstone & possible workings	0.1	0.1	0.6	0.6	2.6	0.8	17.8	19.4	0	0	126.2
	BH5168	1.50 to 3.50	Made Ground	0.1	0.1	0.6	0.6	6.4	6.3	9.7	9.9	0	0	61.9

7.3 Olfactory and Visual Records of Contamination

Soils

- 7.3.1 The majority of exploratory holes across the site encountered Made Ground which included anthropogenic materials such as brick, clinker, ash, slag, burnt shale and rare inclusions of plastic and metal.
- 7.3.2 Details of olfactory/visual evidence of hydrocarbon/chemical contamination recorded on logs, within the Made Ground, are outlined in Table 7-6.

Table 7-6 Summary of visual/olfactory evidence of contamination

Exploratory Hole	Depth (m)	Strata	Comment
ATKBH5303	10.45 to 16.45	Made Ground	Colliery Spoil
BH5164	12.20 to 12.65	Made Ground	Slight organic odour
BH5165	0.05 to 1.20	Made Ground	Very strong hydrocarbon odour noted associated with large timber fragment
BH5169	Ground level to 0.80	Made Ground - Clinker and coal	Faint hydrocarbon odour noted (timber fragment noted on log).
PL5180	0.15 to 0.30	Made Ground	Hydrocarbon odour noted and two railway sleepers recorded.
PL5183	Ground level to 0.10	Made Ground	Tar planings noted.
WS5300A*	0.40 to 1.10	Made Ground	Hydrocarbon odour and sheen noted on gravel.

*BH5166 and BH5167 undertaken as part of the 2021 ground investigation were located within close vicinity of WS5300A (within 15 m). No hydrocarbon odours or sheens were noted within either exploratory hole.

- 7.3.3 No visual or olfactory evidence of contamination were recorded by during the sampling of the stockpiles on site.

Soil Vapour Headspace Results for Soils

- 7.3.4 PID screening for VOCs was conducted on environmental soil samples during the ground investigation. No visual/olfactory evidence of VOCs was observed during the investigations undertaken and the PID tests conducted in the field did not record VOC levels of concern, with concentrations consistently measured below the limit of detection (<0.1 ppm). A maximum value of 16.20 ppm was recorded within ATKBH5303 at 11.50 m bgl within deposits identified as colliery spoil.

Deviating samples

- 7.3.5 As part of their accreditation, laboratories are obliged to indicate where samples deviate from their testing protocols. The QA pages are provided by the contractor/laboratories separately and are appended at the end of Appendix B (at the time of writing, the QA pages for two reports are outstanding and have been requested from the laboratories).
- 7.3.6 Of the 47 soil samples collected during 2018, 2020 and 2021 investigations for soil and soil-leachate testing, 36 have deviated due to the samples not being extracted within the laboratory defined holding times. Based on dates provided on the test certificates, the time elapsed between sample collection and commencement of analysis varies between a few

weeks to six months. Much of the sampling and testing was undertaken in 2020 and 2021 when COVID-19 restrictions, staff absence due to illness/isolation and social distancing would have made working conditions challenging.

- 7.3.7 The majority of inorganic soil parameters were largely unaffected, with only cyanide (free, total and complex) being reported as deviating. At least one organic compound was indicated to deviate in 35 of the samples (the 2018 sample only showed a deviation for cyanide), with over half the samples reporting deviations in TOC, TPH-CWG, PAHs and/or BTEX. Most samples scheduled for VOC and SVOC were also reported as deviations.
- 7.3.8 The delay between sampling and extraction/analysis might have resulted in concentrations being under reported (i.e. concentrations might have been higher when the samples were collected). However, following consideration of the following it is unlikely the reported deviations would significantly affect the conclusions of the risk assessments:
- Although ash was reported in the Made Ground, there were no significant visual, olfactory or PID evidence of major organic contamination reported on the borehole logs (except for WS5300A) and as such there was an expectation that the laboratory test results for organic compounds would likely be below human health GAC and less than or marginally in excess of DWS. As indicated in Section 8, the majority of chemical concentrations are considerably lower than the human health GAC and soil-leachate concentrations were generally less than detection limits/DWS, with only a few contaminants in excess of DWS, which broadly corroborates the expectations and site-based observations. (DWS were selected as GAC due to the topography of the wider area and initial data indicating groundwater flow beneath the site is likely to be towards the south/south-west, away from surface water receptors.)
 - Hydrocarbon odour and sheen were recorded on the WS5300A log and the associated sample recorded some of the higher PAHs and TPH concentrations (but not the maximums).
 - It is intended that the near-surface Made Ground across the site will be excavated and replaced prior to the Development, with materials stockpiled, sorted and tested in accordance with earthworks specification and/or materials management plan (that will be prepared) to determine suitability for reuse. This excavation work therefore allows a discovery strategy to be implemented and additional testing to confirm the material meets the reuse criteria during the future remediation works.
 - The site surface will be covered in hardstanding, ballast or imported soils and so it is unlikely that end-users will come into contact with underlying fill materials.
 - Groundwater level data indicates an unsaturated zone of approximately 10+m is present beneath the site. The concentrations of organic compounds would decline during migration through the unsaturated zone due to natural processes such as adsorption and biodegradation.

8. GENERIC QUANTITATIVE RISK ASSESSMENT

8.1 Human Health Risk Assessment

Introduction

- 8.1.1 A generic quantitative risk assessment (GQRA) has been carried out to assess the potential long-term risks to human health receptors in relation to the Development at the site and the identified key contaminants of concern. Given the potential pathways identified in the initial CSM, soils have been screened against generic assessment criteria (GAC) based on a future commercial end use. The commercial GAC are considered appropriate due to the use of the site as a construction compound and temporary platform. Construction workers will either be located within portacabins or outdoors, while members of the public utilising the temporary platform will be outdoors (there is no indoor air PCL for members of the public). The GAC are derived following consideration of inhalation, ingestion and dermal contact with the soil/dust and inhalation of vapours originating from soils and groundwater.
- 8.1.2 Data collected from the 2018, 2020 and 2021 ground investigations have been utilised as part of the human health risk assessment. The results of the asbestos sampling within the stockpiles undertaken in 2014 have also been considered within this assessment, as it is not currently known whether the stockpiled materials are to be re-used on site or removed for disposal.

Methodology

- 8.1.3 In order to identify potential contaminants of concern (CoCs), the soil analytical data has been screened against Atkins' soil screening values (SSVs) or Category 4 Screening Levels (C4SLs) derived to be protective of chronic risks to human health.
- 8.1.4 SSVs are based on minimal toxicological risk for a variety of standard land uses at 1% soil organic matter (SOM) (sand soil type) and 6% SOM (sandy loam soil type) using CLEA v1.071 in accordance with Environment Agency guidance (Environment Agency 2009b).
- 8.1.5 Based on the ratio of genotoxic PAHs to benzo(a)pyrene, the surrogate marker approach for genotoxic PAHs as set out in the C4SL Project Methodology (Contaminated Land: Application in Real Environments, 2014) has been adopted.
- 8.1.6 Samples were analysed for total organic carbon and have therefore been converted to Soil Organic Matter (SOM) ($SOM = TOC \times 1.72$). The laboratory data of the soil collected from the site indicates a geometric mean SOM of 9.73. Samples where visual and/or olfactory evidence of hydrocarbon contamination was noted were excluded from the SOM calculation. The GAC for 6% SOM was selected for use within the GQRA.
- 8.1.7 For compounds arsenic, benzene, benzo(a)pyrene, cadmium and lead, the C4SL (based on a low level of toxicological concern) for the commercial land use at 1% SOM has been selected as the assessment criterion. C4SLs have also been published for vinyl chloride, trichloroethylene (TCE) and tetrachloroethylene (PCE).
- 8.1.8 Due to the nature of acute risk from cyanide, the SSV for cyanide has been based on the potential for an adult to ingest a bolus of soil contaminated with free cyanide.
- 8.1.9 Due to the nature of risk from asbestos an SSV cannot be derived using CLEA. Therefore, for generic quantitative risk assessment the limit of detection at the laboratory has been selected as the assessment criterion.

Comparison of Soil Concentration Data with Generic Assessment Criteria

- 8.1.10 Forty-eight soil samples have been retrieved from across the site during the ground investigations and analysed for a range of contaminants. A full set of analytical results are included in Appendix B and the screening sheets are within Appendix D. These results have been compared against the GAC outlined above and the majority of contaminants were recorded below the GAC, with the single GAC exceedance detailed in Table 8-1.

Table 8-1 Human Health Exceedances Summary

Determinand	Unit	LOD	GAC	No. of samples	No. of exceedances	Max value	Location of exceedance
Benzo(a)pyrene	mg/kg	0.04	76.3	43	1	82.1	BH5167 at 0.20 m bgl

- 8.1.11 Asbestos was identified within two exploratory holes and within five samples collected from the three stockpiles located across the site. Details are summarised in Table 8-2.

Table 8-2 Summary of Asbestos Results

Exploratory Hole	Depth (m bgl)	Asbestos ID	Asbestos Quantification (%)
ATKBH5300	0.20	Chrysotile – loose fibres	<0.001
BH5158	0.20	Chrysotile – loose fibres	<0.001
Site 3 Stockpile 2	1.00 to 1.50	Amosite & Chrysotile – free fibres	Quantifiable
Site 3 Stockpile 3	1.00 to 1.50	Chrysotile – free fibres	Quantifiable
Site 2 Stockpile 1	1.00 to 1.50	Chrysotile – free fibres	Trace
Site 2 Stockpile 2	1.00 to 1.50	Chrysotile – free fibres	Trace
Site 1 Stockpile 2	1.00 to 1.50	Amosite & Chrysotile – free fibres	Quantifiable

- 8.1.12 Concentrations of determinands where GACs are not available but exceed the limit of detection (LOD) are outlined in Table 8-3.

Table 8-3 Summary of determinands where GAC is not available, but concentrations recorded >LOD

Determinand	Unit	LOD	No. of samples	No. of samples above LOD	Max value	Location of maximum concentration	No. of samples
Cyanide (Complex)	mg/kg	1	43	9	15	BH5158 at 1.0 m bgl	Cyanide (Complex)
Cyanide (total)	mg/kg	1	45	9	15	BH5158 at 1.0 m bgl	Cyanide (total)
Dibenzofuran	mg/kg	100	7	1	492	BH5165 at 0.50 m bgl	Dibenzofuran
Phenanthrene	mg/kg	0.03	44	42	596	BH5165 at 0.50 m bgl	Phenanthrene
Methylnaphthalene	mg/kg	100	7	1	625	BH5165 at 0.50 m bgl	Methylnaphthalene
m & p-xylene	mg/kg	0.01	47	1	0.14	WS5302 at 0.50 m bgl	m & p-xylene

- 8.1.13 The elevated organic concentrations recorded within BH5165 above coincide with the identification of a very strong hydrocarbon odour associated with a larger timber fragment. It is possible that this is the source of these organic compounds within this location.
- 8.1.14 The maximum concentrations recorded for total and complex cyanide are considerably lower than the GAC for free cyanide (373 mg/kg). Benzo(a)pyrene has been used as a surrogate marker for PAHs and as the majority of benzo(a)pyrene concentrations were below the GAC, it is unlikely that acenaphthylene and phenanthrene would pose an unacceptable risk to site users. The combine concentration of m & p-xylene is considerably lower than the GAC (37,400 mg/kg) for p-xylene.
- 8.1.15 Furan and dioxin analysis was also undertaken on four soil samples collected from BH5154 at 0.20 m bgl, BH5164 at 1.50 m bgl, BH5159 at 0.30 m bgl and BH5160 at 0.2m bgl. Concentrations were generally recorded within one or the same order of magnitude of the detection value. Those with concentrations greater than one order of magnitude of the detection value have been summarised below. Concentrations are low and it is unlikely they would pose an unacceptable risk to occupiers of the compound or the public.

Table 8-4 Furan and dioxins recorded in soil samples

Determinand	Unit	LOD	No. of samples*	Maximum value
Furan 1234678-HpCDF	ng/kg	0.16 1	2	67.4
Dioxin 1234678-HpCDD	ng/kg	0.23 3	1	30.00
Furan OCDF	ng/kg	0.94 5	1	27.2
Dioxin OCDD	ng/kg	0.24	2	44.1
PCB-118	ng/kg	0.25 9/0.1 74	2	21.3

* concentrations greater than one order of magnitude of the detection value

Human Health Risk Assessment Conclusions

- 8.1.16 A single exceedance of the human health assessment criteria was recorded within BH5167 at 0.20 m bgl. The benzo(a)pyrene exceedance recorded is considered to be marginal and is unlikely to pose an unacceptable risk to human health. Asbestos was recorded within two samples collected from Made Ground, both of which are located in the north-east of the site. Asbestos was also identified within five samples collected from the stockpiles located on site. Asbestos recorded within Stockpile 2 might be associated with the historical asbestos pollution incident which has been indicated to have taken place in the centre of the site.
- 8.1.17 Made Ground is present across the site and although it was only recorded in two samples, the potential presence of asbestos elsewhere cannot be completely dismissed, and advice should be sought from a specialist asbestos contractor to ensure appropriate mitigation measures are in place for the Development’s workers (i.e. those involved in construction of the retaining wall and utilities).
- 8.1.18 The Development is likely to comprise hardstanding, gravel/ballast and topsoil (which will need to be imported to support plant growth) at surface. This is likely to sever the exposure pathway to the underlying Made Ground for the majority of site users. The short-term risks that might be posed to construction workers excavating utility/drainage trenches, etc will be considered by their employers within health and safety risk assessments.

8.2 Controlled Waters Risk Assessment

Introduction

- 8.2.1 The controlled waters GQRA has been undertaken to assess the potential risks posed to the identified controlled waters receptors from the migration of contaminants from potential on site sources. To assess the potential risks to the identified receptors, a comparison of soil leachate and groundwater concentrations against pertinent Water Quality Standards (WQS) has been undertaken.

Methodology

- 8.2.2 The preliminary ground investigation identified that the majority of the site is not underlain by superficial deposits, with Made Ground underlain directly by the Pennine Lower Coal Measures (Secondary A Aquifer). Cohesive clay was occasionally recorded within the north and south of the site. The site is not located within 250 m of a groundwater source protection zone, however a groundwater abstraction utilised for general use is located 130 m south-west of the site and preliminary data suggests groundwater flow might be towards the south-west. Blackhouse Dike is located approximately 30 m north of the site and the Huddersfield Canal 100 m south-east (both in relation to the north-east tip of the site). Due to the topography of the site and the surrounding area and initial data indicating groundwater flow direction may be towards the south-west, groundwater is not anticipated to flow towards Blackhouse Dike. Groundwater and any potential contamination is likely to flow to the south/south-west away from surface water receptors. Also, the Huddersfield Canal is likely to have been lined with impermeable material during its construction, minimising the ingress of groundwater.
- 8.2.3 The WQS for the controlled waters assessment are dependent on the nature of the receptors (as identified above). Due to the absence of viable pathways to surface water receptors and Made Ground being in direct contact with the underlying Secondary A Aquifer within the Pennine Lower Coal Measures, groundwater is considered to be the risk driver for this assessment. Therefore, soil leachate and groundwater results will be screened against Drinking Water Standards (DWS), which is considered to be a relatively conservative approach given the site is not located within 250m of a potable water abstraction or SPZ.
- 8.2.4 Soil-derived leachate tests give an indication of the concentrations at which contaminants might leach from soil into soil pore-water and thereby migrate to groundwater. Groundwater samples provide an indication of the groundwater quality and the contaminants that could migrate within the aquifers underlying the site.
- 8.2.5 The laboratory results are presented in Appendix B and the screening results in Appendix D.

Results

- 8.2.6 Results for potential contaminants of concern (i.e. those that exceed the screening value) are presented in Tables 8-5 and 8-6. A full set of screening results are presented within Appendix D.

Soil Leachate

- 8.2.7 Twenty soil samples ranging in depth from 0.20 m to 11.50 m bgl from Made Ground deposits were scheduled for soil-leachate analysis during the 2020 and 2021 ground investigations. The Made Ground analysed is noted to include ash, clinker, burnt shale and coal fragments.
- 8.2.8 A GQRA screening of sample results has identified contaminants above DWS within soil-

derived leachate.

Table 8-5 Summary of Soil Leachate DWS Exceedances

Determinand	Number of samples	Number of exceedances	Comment
Cyanide (total)	20	1	A single cyanide (total) exceedance of 0.063 mg/l was recorded above the DWS of 0.05 mg/l within BH5161 at 1.00 m bgl.
Sulphate	20	7	Seven sulphate concentrations ranging from 256.19 mg/l to 1620 mg/l were recorded above the DWS of 250 mg/l.
pH	20	2	Two pH concentrations of 5.74 and 2.91 were recorded outside of the DWS range of 6.5 to 9.5 within ATK BH5302 at 1.00 m bgl and BH5164 at 1.50 m bgl respectively.
Antimony	20	1	A single antimony exceedance of 0.006 mg/l was recorded above the DWS of 0.005 mg/l within ATK BH5303 at 0.30 m bgl.
Lead	20	2	Two lead concentrations, 0.011 mg/l and 0.019 mg/l were recorded above the DWS of 0.01 mg/l within ATK BH5301 and BH5165 respectively.
Nickel	20	3	Three nickel concentrations ranging from 0.048 mg/l to 0.169 mg/l were recorded above the DWS of 0.02 mg/l.
Benzo(a)pyrene	20	3	Three benzo(a)pyrene exceedances ranging from 0.00004 mg/l to 0.0002 mg/l were recorded above the DWS of 0.00001mg/l.

Groundwater

- 8.2.9 A single groundwater sample was collected from the site on 4th April 2020 by the site engineer and scheduled for chemical analysis by Atkins. The groundwater sample was collected from ATK BH5303 in the south-east of the site, which screens Made Ground just above rockhead. GQRA screening of sample results has identified contaminants above DWS within groundwater samples.

Table 8-6 Summary of Groundwater DWS Exceedances

Determinand	Number of EQS exceedances	Comment
Beryllium	1	0.015 mg/l was recorded above the DWS of 0.012 mg/l.
Cadmium	1	0.0081 mg/l was recorded above the DWS of 0.005 mg/l.
Lead	1	0.047 mg/l was recorded above the DWS of 0.01 mg/l.
Manganese	1	28.1 mg/l was recorded above the DWS of 0.05 mg/l.
Nickel	1	0.462 mg/l was recorded above the DWS of 0.02 mg/l.

Determinand	Number of EQS exceedances	Comment
Zinc	1	3.87 mg/l was recorded above the DWS of 3.0 mg/l
Benzo(a)pyrene	1	0.00047 mg/l was recorded above the DWS of 0.00001 mg/l.
Benzo(b)fluoranthene*	1	0.00059 mg/l was recorded above the DWS of 0.0001 mg/l.
Benzo(ghi)perylene*	1	0.00033 mg/l was recorded above the DWS of 0.0001 mg/l.
Benzo(k)fluoranthene*	1	0.00022 mg/l was recorded above the DWS of 0.0001 mg/l.
Indeno(123-cd)pyrene*	1	0.00033 mg/l was recorded above the DWS of 0.0001 mg/l.

* DWS of 0.0001 mg/l relates the sum of these PAHs

Controlled Waters Discussion

- 8.2.10 The concentrations of those determinands that exceed DWS in soil leachate are generally only marginally above the DWS and/or limit of detection (LOD) (within the same order of magnitude of the DWS). With the exception of the manganese exceedance, exceedances with groundwater outlined above are marginally above DWSs.
- 8.2.11 All the samples that underwent leachate analysis were collected from within the Made Ground. Exceedances were all recorded within the upper 1 m of the exploratory hole with no exceedances recorded at depth (four samples were collected from >1 m bgl).
- 8.2.12 The recorded soil leachate PAH exceedances occur within Made Ground deposits which include gravels of mudstone, sandstone, coal and clinker. Exceedances ranged in depth from 0.30 to 0.80 m bgl, with Made Ground directly overlying bedrock in all three locations. All three PAH exceedances are located in the northern half of the site. One of the locations of the exceedances, WS5300A, recorded evidence of hydrocarbon odours and sheens during drilling. This exceedance coincides with the evidence of hydrocarbon contamination.
- 8.2.13 The sulphate exceedances were recorded within soil samples collected during the 2021 and 2020 investigations. All exceedances were recorded within the centre/northern half of the site.
- 8.2.14 The manganese exceedance is likely to be due to elevated background concentration levels within the groundwater contained within the bedrock aquifer due to weathering of iron and manganese bearing rocks.
- 8.2.15 It has not been possible to collect a groundwater sample from the vicinity of the hydrocarbon contamination noted around WS5300A, as the window sampler borehole refused on mudstone. Further sampling will be required prior to construction. During earthworks, delineation of the potential hydrocarbon contamination will be required.
- 8.2.16 Groundwater flow is likely to be off site to the south-west of the site. A groundwater abstraction is located 130 m south-west of the site. Concentrations are likely to reduce during migration through the unsaturated zone of the mudstone (which data indicates to be 10+ m thick) and along the groundwater flow path via natural processes such as biodegradation, adsorption and dilution. Contaminants recorded to date on site are unlikely to pose an unacceptable risk to the groundwater aquifer or the abstraction. Furthermore, the abstraction is listed for "general use" at a dye works and is not indicated to be a potable water supply.

- 8.2.17 Further groundwater monitoring and sampling is proposed at this site. However, the initial assessment undertaken indicates that contaminants are leaching from Made Ground at insignificant levels and perched water located within the Made Ground contains insignificant concentrations of contaminants (ATK BH5303). An updated groundwater risk assessment will be undertaken following completion of the monitoring.

8.3 Ground Gas Risk Assessment

Methodology

- 8.3.1 The CL:AIRE guidance “Good Practice for Risk Assessment for Coal Mine Gas Emissions” (CL:AIRE, 2021) indicates the site is at high risk from mine gas because there are shallow mine workings recorded at less than 20 m bgl beneath the site (that initial monitoring data indicate might be unflooded), mine entries recorded within the site boundary and a general absence of low permeability superficial deposits. The guidance states that a detailed mine gas risk assessment is required to establish whether gas protection measures need to be incorporated into the new development. However, the temporary platform will have open “bus shelter” like canopies and the Development does not include any new buildings, as office/welfare facilities will be accommodated within Portacabins. Such temporary structures are usually placed on hardstanding or compacted gravel and have a gap in between the base of the structure and the ground with service penetrations between the ground and cabins unlikely, which would reduce the risk of ground gas entering the portacabins. A detailed gas risk assessment has not been undertaken for portacabins, as this would be disproportionate to the likely level of risk posed to portacabins.
- 8.3.2 British Standard BS8485:2019 code of practice for design of protective measures for methane and carbon dioxide ground gases for buildings (British Standards Institute, 2019) is the primary guidance used for ground gas risk assessments. However, this guidance relates to permanent buildings and it would be disproportionate to use the approach therein to assess risks to temporary portacabins, which are placed onto the ground and likely to have gaps beneath their bases.
- 8.3.3 In order to inform the revised CSM in Section 9, the key findings of the initial gas monitoring data have been presented as follows.

Ground/mine gas discussion

Hydrogen Sulphide and Carbon Monoxide

- 8.3.4 Hydrogen sulphide was predominantly measured at or below the limit of detection of 1 ppm. However, concentrations above the LOD ranged from 2 to 4 ppm in ATKBH5301, ATKBH5302 and ATKBH5303. The highest concentration of 4 ppm was recorded within ATKBH5303 with a response zone located within the Made Ground and underlying Mudstone.
- 8.3.5 Carbon Monoxide concentrations were consistently measured below the limit of detection of 1 ppm. However, a peak reading of 28 ppm was recorded within BH5157 on the single monitoring visit undertaken at this location. BH5157 is installed within the Mudstone.

Depleted Oxygen

- 8.3.6 Oxygen was recorded at concentrations below 19 % v/v in all of the shallow wells installed in both Made Ground and mudstone, with concentrations less than 15 % v/v regularly recorded in six shallow wells. The minimum oxygen concentration recorded within the upper 5m was 3.3 % oxygen in BH5157. The response zones of these wells were not flooded. Such low concentrations of oxygen pose a high risk to construction or maintenance workers involved

in foundation and utility installation/repair. Design should try to minimise the need for workers to access trenches, etc, and if this cannot be avoided air quality monitoring with alarms should be implemented as a minimum to protect the workforce.

Methane and Carbon Dioxide

- 8.3.7 A summary of the maximum gas concentrations and steady state flow rates for each well is presented in Table 8-7.

Table 8-7 Summary of methane, carbon dioxide and oxygen data

Exploratory Hole	Maximum peak Carbon Dioxide (% v/v)	Maximum peak Methane (% v/v)	Minimum Oxygen (% v/v)	Maximum steady state flow rate (l/hr)	Deposit/Strata screened by well response zone (RZ)	Response zone flooded
WS5302	4.40	0.1**	10.6	0.1**	Shallow Made Ground/Mudstone	No
WS5303	5.00	0.1**	13.6	0.1	Shallow Made Ground	No
WS5304	5.00	0.1**	12.6	0.1**	Shallow Made Ground	No
ATKBH530 (in vicinity of portacabins)	3.6	0.3	9.4	0.4	Shallow mudstone in RZ (suspected workings at 16.8 m bgl)	Yes (1/7)
ATKBH5302	1.6	0.3	17.7	0.50	Shallow Made Ground	No
ATK BH5303	4.9	0.3	14.2	0.4	Deep Made Ground (colliery spoil) and Mudstone	No
BH5156 (in vicinity of portacabins)	8.2	0.7	5.2	-1.3	Shallow Mudstone	No
BH5157 (in vicinity of portacabins and new drainage)	2.9	0.8	3.3	9.0	Shallow mudstone in RZ	No
BH5158 (in vicinity of portacabins)	0.40	0.6	20.3	0.2	Deep mudstone, wood prop (possible workings) and coal	No
BH5161	2.4	0.9	19.7	0.1	Deep siltstone, mudstone and coal	Yes (1/1)
BH5163	6.6	0.6	9.8	0.1	Deep mudstone and siltstone	No
BH5164	0.9	1.2	20.1	0.2	Deep Made Ground and Clay	No
BH5165	2.6	0.6	17.8	0.1	Deep mudstone, possible workings , sandstone and siltstone	Yes (1/1)
BH5168	6.4	0.6	9.7	0.1	Shallow Made Ground	No

*Maximum gas concentration combined within maximum steady state flow rate, recorded on any visit. Note that for the un-shaded rows, data from those visits in which the response well was completely flooded have not been used within this assessment.

**These concentrations/flow rates were recorded as not detected in the field, therefore the LOD of the gas monitor has been used in the calculations.

- 8.3.8 Four visits were undertaken during a fall in atmospheric pressure (and where pressure fell to below 1000mb). However, the pressure data viewed online does not show the necessary frequency (i.e. hourly) to be able to confirm whether either of these constitute “worst case” conditions as described in CL:AIRE TB17: Ground Gas Monitoring and Worst Case Conditions August 2018.
- 8.3.9 As indicated in the table above, response zones were flooded in three exploratory hole locations during the monitoring regimes. Data recorded within these boreholes may not be representative of the ground gas regime within unsaturated soils and therefore have not been included within the below assessment.
- 8.3.10 Concentrations of methane were consistently measured below the LOD in all boreholes across all monitoring visits in 2020. Peak methane concentrations during the 2020 monitoring were all recorded at 0.3 % v/v. Peak methane concentrations during the initial 2021 monitoring visit ranged from 0.6 % v/v to 1.2 % v/v.
- 8.3.11 Peak carbon dioxide concentrations ranged from 0.4 % v/v to 8.2 % v/v in wells with response zone located within bedrock. Sources of ground gas have been identified across the site including thick Made Ground deposits, carbonaceous mudstone, coal seams, suspected mine workings and the olfactory hydrocarbon odours. In addition, a historical landfill site is located off-site to the east. Concentrations of carbon dioxide appear to be similar for response zones that screen Made Ground and those that screen bedrock. Concentrations within Made Ground ranged from 1.60 % v/v to 6.40 % v/v while in bedrock (including possible workings) they ranged from 0.40 to 8.20 % v/v.
- 8.3.12 Maximum steady state flow rates ranged from <0.1 l/hr to 9.0 l/hr. The higher steady state flow rates recorded on site were from boreholes with response zones located within Mudstone bedrock with no evidence of coal workings recorded within the hole. Steady state flow rates within Made Ground ranged from <0.1 l/hr to 0.50 l/hr.
- 8.3.13 Maximum recorded PID concentrations ranged from 0.0 to 126.2 ppm (BH5156), with the highest reading recorded on 21/10/2021. PID concentrations above 50 ppm were also recorded at the following locations:
- 112 ppm at ATKBH5302;
 - 110.3 ppm at ATKBH5303;
 - 56.6 ppm at BH5158; and
 - 61.9 ppm at BH5168.
- 8.3.14 Whilst multiple visits have taken place to ATKBH5302 and ATKBH5303, elevated PID readings were only recorded once. No obvious sources of volatile contaminants were identified in the desk study, on borehole logs, PID results done on soils, or were identified during chemical analysis of soils and groundwater.
- 8.3.15 Maximum concentrations of carbon dioxide (8.2 % v/v) and carbon monoxide (28 ppm) were recorded in wells that screened shallow mudstone (within 5 m of ground surface), with the maximum steady state gas flow also recorded in shallow mudstone (9 l/hr). Methane was generally recorded less than 0.8 % v/v in the upper 5 m. The initial data indicates ground and/or possibly mine gas is present at shallow depth, which might pose a risk to workers involved in drainage/foundation excavations. Providing a gap is maintained beneath Portacabins and any service entry points (through the base of the cabins) are sealed, it is likely ground/mine gas would pose a low risk to occupants.
- 8.3.16 A surface water attenuation tank and associated drainage is included within the Development. The CL:AIRE guidance indicates that an attenuation tank has the potential to

form a secondary storage of significant volumes of mine gas and new drainage might create new pathways for the lateral migration of mine gas. Following completion of the gas/groundwater monitoring, it is recommended that a mine gas risk assessment is undertaken, which includes details of the design available at that time.

9. REVISED CONCEPTUAL SITE MODEL

- 9.1.1 The findings of the recent ground investigation and GQRA have been used to update the Initial CSM presented in Section 3.
- 9.1.2 As with the Initial CSM, future construction and ground maintenance workers are included within the revised CSM for completeness. However, it should be noted that risks to construction workers will be assessed by their employers via health/safety risk assessments to establish safe systems of work and to ensure appropriate mitigation procedures are in place.
- 9.1.3 The revised CSM has been developed assuming completion of the Development works with no mitigation measures having been applied. The preliminary risk categorisations presented are based on an assessment of the potential consequence of each PCL occurring along with the likelihood that each PCL will occur in accordance with the framework provided in Appendix C. The revised CSM is shown in Table 9-1, together with updated risk levels.
- 9.1.4 Chemical attack to buried structures as a pathway has not been included within the CSM as it will be considered as part of the geotechnical assessment, which is being prepared separately.

Table 9-1 Revised Conceptual Site Model and Risk Assessment (Use of the Site as a strategic construction compound)

Source	Pathway	Receptor	Risk classification and justification
<p><u>Potential on-site contamination:</u></p> <p>Made Ground, stockpiles and historical/current activities (including sidings, garages, stone yard)</p> <p>Ground gas associated with thick Made Ground, shafts/shallow mine workings and coal.</p> <p>Historically (1890 – 1993) there was a waste incinerator off-site to the east, so there is a possibility that contaminants from this off-site source are present within site soils/fill from historical aerial deposition (e.g. metals, PAHs, dioxins/furans). Dioxins and furans recorded at very low concentrations.</p> <p><u>Potential off-site contamination:</u></p> <p>Historical landfills (closest 30m to the east).</p> <p>Key land uses include incinerator (sanitary depot), chemical/dye works, foundry, abattoir, waste transfer sites.</p> <p><u>Key Findings of GQRA:</u></p> <p>Human Health: Benzo(a)pyrene and asbestos</p> <p>Controlled Waters: beryllium, cadmium, cyanide, sulphate, pH, antimony, lead, manganese, nickel, zinc & PAHs.</p> <p>Ground Gas: Methane, carbon dioxide, carbon monoxide and occasionally hydrogen sulphide have been recorded. Depleted oxygen levels recorded at shallow depth.</p>	<p>Ingestion of contaminated soils, soil-derived dust and groundwater</p> <p>Inhalation of soil and soil-derived dust, asbestos and soil and groundwater droplets</p> <p>Dermal contact with soil, soil derived dust and groundwater</p>	<p>On-site users (construction workers involved in excavations, Scheme workforce utilising the construction compound and members of the public using the temporary platform).</p> <p>Property (gas only)</p>	<p><u>Construction workers involved in excavations (Medium/Likely) Moderate Risk</u></p> <p>Workers are likely to be in contact with the underlying soils at the site when undertaking excavations (e.g. for foundations of retaining walls, embankment works, utilities) for the construction compound. The Contractor has a duty under health and safety legislation to assess the risks posed to its workforce from contamination/asbestos and to implement the appropriate mitigation measures to protect their workers and adjacent land occupiers.</p> <p><u>General public and TRU workforce (Medium/Unlikely) Low Risk</u></p> <p>Minimal exceedances were recorded during the ground investigation undertaken across the site. Members of the public utilising the temporary platform are unlikely to come into contact with the underlying soils. The compound surface areas will be covered in hardstanding, ballast/gravel or topsoil imported for landscaped areas during the site preparation works, which would minimise the risk of the Scheme workforce coming into contact with underlying Made Ground.</p>
	<p>Inhalation of ground/mine gas and vapours (e.g. from historical fuel spills)</p> <p>Migration along service trenches and build up within confined spaces (explosion or asphyxiation)</p>	<p>Off-site residents, occupiers of commercial property and users of playing fields.</p> <p>Property (gas only)</p>	<p><u>Drainage workers & drainage infrastructure (Severe/Likely) High Risk</u></p> <p>A surface water attenuation tank, interceptor chamber and new drainage (including behind the retaining wall) are proposed. There is a potential for ground/mine gas to migrate into and build up when the tank is empty. Based on the CL:AIRE mine gas guidance (2021) the site is in a high risk zone with respect to mine gas and risks posed to the drainage infrastructure and construction/maintenance works must be considered during detailed design. Following completion of the gas monitoring, the data should be used to update the CSM and undertake a mine gas risk assessment as described within CL:AIRE guidance (October 2021) to inform the drainage design.</p> <p><u>General public and TRU workforce (Severe/Unlikely) Moderate/Low Risk</u></p> <p>Installation of new services (e.g. drainage) have the potential to introduce new migration pathways to the welfare portacabins. However, providing the gap beneath the cabins and ground surface is maintained and all service entry points through the base of the Portacabins are sealed, the ingress of gas is unlikely to be sufficient to pose an unacceptable risk to the cabin occupants. Users of the temporary station will be outside (the shelters are open to the air).</p>
	<p>Ingestion of contaminated soils, soil-derived dust and groundwater</p> <p>Inhalation of soil and soil-derived dust, asbestos, soil and groundwater droplets</p> <p>Dermal contact with soil, soil derived dust and groundwater</p>		<p>(Medium/Unlikely) Low Risk</p> <p>There are a number of residential and commercial properties surrounding the Site. Playing fields are also located within 250m of the site. However, if dust control measures are implemented correctly (in line with industry good practice) when Made Ground is disturbed, the risk to these receptors should be negligible. Once the construction of the Development has been completed, hardstanding, gravel and vegetation are likely to cover the site minimising the risk of wind entrainment of dust.</p> <p>It is unlikely that occupiers of surrounding properties/users of playing fields would encounter groundwater, which is likely to be deeper than the depths gardeners would dig to.</p>
	<p>Inhalation of ground gases/mine gas and vapours.</p> <p>Ground gas migration through ground and via service trenches and build up within confined spaces (explosion or asphyxiation)</p>	<p>Groundwater – Secondary A Superficial Aquifer (Glaciofluvial deposits)</p>	<p>(Medium/Low Likelihood) Moderate/Low Risk</p> <p>Installation of new services (e.g. drainage and attenuation tank) has the potential to introduce new migration pathways to off-site buildings/occupiers via trench backfill potentially forming a new pathway to existing off-site utility corridors. This risk should be considered during design. Areas of proposed hard standing broadly coincide with areas of pre-existing hardstanding, therefore the Development is unlikely to alter the impermeable surface across the site and is unlikely to promote the lateral movement of ground gas off site. The pile design for the retaining walls is the installation of bored piles, which are unlikely to create preferential gas migration pathways as the concrete seals the boreholes as the auger is retracted.</p>
<p>Leaching of contaminants and migration.</p> <p>Migration through permeable Made Ground and the bedrock.</p>	<p>(Medium/Unlikely) Low Risk</p> <p>The glacio-fluvial deposits are predominately located beneath the adjacent off-site housing estate, and only just extend across the site boundary into the northern part of the site (the edge of these deposits is parallel to the site boundary along the top of the embankment). The residential properties at Abbey Place and Hammond Street at a higher topographical level than the Site and it is unlikely that contaminants on-site would migrate off-site to the north-west. Exceedances</p>		

Source	Pathway	Receptor	Risk classification and justification
	Migration via preferential pathways e.g. existing and historical pipes and services, or new foundations (e.g. piles).		recorded within soil leachate and groundwater are considered to be marginal and are unlikely to pose to an unacceptable risk.
	Contact/absorption of contaminants by flora/fauna in LWS.	Groundwater – Secondary A Bedrock aquifer (Pennine Lower Coal Measures) Groundwater abstraction (process water)	<p>(Medium/Low Likelihood) Moderate/Low Risk</p> <p>Significant deposits of Made Ground have been identified on-site. Localised evidence of hydrocarbon odours was noted during the investigations undertaken, mainly associated with timber fragments. In WS5300A (located in the north-west corner of the site where the attenuation tank is proposed) water perched above mudstone encountered at 1.1 m bgl had oily sheen and strong hydrocarbon odour. The ground investigation confirmed the BGS information, with superficial deposits absent across the majority of the site, apart from localised clay and one thin sand layer overlying bedrock. There is a direct pathway for contaminant migration from the Made Ground into the underlying bedrock aquifer. However, initial groundwater level data indicates groundwater within the bedrock is approximately 13.0 – 14.5 m bgl and contaminant concentrations would be reduced during vertical migration through this unsaturated zone by natural processes, such as biodegradation and adsorption. Chemical analysis of Made Ground and the single groundwater test (from water perched within the base of thick Made Ground) has not identified evidence of significant contamination.</p> <p>Monitoring is still underway on the site and once completed, a revised controlled waters risk assessment will be undertaken.</p>
		Surface water – Blackhouse Dike (30m north of Site) and the Huddersfield Broad Canal (100m to the south-east at the closest point) designated as a Local Wildlife Site (LWS).	<p>(Medium/Unlikely) Low Risk</p> <p>Groundwater flow beneath the site is likely to be towards the west-south-west. Blackhouse Dike flows almost parallel to the site boundary adjacent to Red Doles Road and as such it is unlikely that groundwater would flow from the site towards Blackhouse Dike (which is also partially in culvert).</p> <p>The canal is likely to be sealed with puddle-clay, which would restrict the ingress of groundwater. It is unlikely that the use of the site as a construction compound would pose an unacceptable risk to these surface water receptors and the LWS.</p>

10. PRELIMINARY WASTE CHARACTERISATION

10.1 Results of CAT-WasteSOIL

- 10.1.1 A preliminary waste assessment has been undertaken using the Atkins/McArdle online waste characterisation tool CAT-Waste^{SOIL} (Atkins, 2022). This provides an indication of whether waste might be Hazardous in accordance with the current guidance within the Environment Agency’s Technical Guidance WM3: Waste Classification – Guidance on the Classification and Assessment of Waste (Environment Agency, 2018). Analytical results from the forty on-site soil samples were uploaded into CAT-Waste^{SOIL}.
- 10.1.2 Twelve samples were classified by the CAT-Waste^{SOIL} tool as potentially hazardous waste as detailed in Table 10-1. The remaining samples were classified as non-hazardous waste.

Table 10-1 CAT-Waste^{SOIL} results summary

Exploratory Location	Depth (m)	Strata	Hazardous Property
ATK BH5301	0.30	Made Ground	Hydrocarbon Oil with marker compound
ATKBH5303	0.30	Made Ground	Hydrocarbon Oil with marker compound
BH5160	0.20m	Made Ground	Hydrocarbon Oil with marker compound
BH5161	0.25	Made Ground	Hydrocarbon Oil with marker compound
BH5165	0.50	Made Ground	Hydrocarbon Oil with marker compound
BH5167	0.20	Made Ground	Hydrocarbon Oil with marker compound
	0.50	Made Ground	Hydrocarbon Oil with marker compound
BH5170	1.20	Made Ground	Hydrocarbon Oil with marker compound
BH5173	0.20	Made Ground	Copper Zinc
WS5300A	0.80	Made Ground	Hydrocarbon Oil with marker compound
WS5303	0.60	Made Ground	Hydrocarbon Oil with marker compound Zinc
WS5304	0.30	Made Ground	Hydrocarbon Oil with marker compound

- 10.1.3 It is the duty of the waste producer to ensure that waste materials have been appropriately tested and classified to allow disposal to suitably licensed waste management facilities.

10.2 Waste Acceptance Criteria (WAC)

- 10.2.1 Adler and Allan undertook sampling of the three stockpiles on site and submitted samples for waste acceptance criteria testing to determine the type of landfill that might be able to accept the stockpiled materials. No general testing was undertaken on the samples collected from the stockpiles so further testing of the fines (e.g. soil, ash) to allow waste classification is proposed and will be undertaken in May 2022.
- 10.2.2 Samples of stockpiled material were submitted for WAC testing, with a summary of the results provided by Adler and Allan as follows:
- Stockpile 1: The chemical testing undertaken indicates that the stockpiled material contains elevated levels of PAH contaminants, with a total PAH concentrations ranging from 105 to 167 mg/kg. The WAC test results on the solid phase indicate that the samples fail the Inert WAC limits for PAH. Sample 3 taken from the black coaly material presents a high Total Organic Content (TOC) which also represents a failure for the Inert WAC. Asbestos fibres, in the form of amosite and chrysotile, were also recorded within

Sample 2. For the purpose of waste disposal, the bulk of the material would therefore classify as stable non-reactive hazardous waste.

- Stockpile 2: The chemical testing undertaken on Stockpile indicated that elevated PAHs (135 mg/kg) were recorded within Sample 3. The WAC test results indicate that this sample fails the Inert WAC limits for PAH and TOC. Chrysotile was identified within two samples.
- Stockpile 3: The chemical testing undertaken indicates that Samples 1 and 4 contain elevated levels of mineral oil C10-C40, with concentrations of 631 and 527 mg/kg respectively. The WAC test results indicate that these samples fail the Inert WAC limits for mineral oil. Sample 1 also fails the Inert WAC limit for PAH, and Sample 4 for TOC. Three of the four samples also present high levels of sulphates. Asbestos was identified within samples 2 and 3 in the form of amosite and chrysotile.

10.2.3 It is recommended that the waste producer should contact potential landfill operators to confirm their additional testing requirements prior to the off-site disposal of material to ensure the waste materials are transported to an appropriately licensed facility. It is the waste producer's responsibility to agree with the landfill operators the appropriate testing regime.

11. LAND CONTAMINATION CONSTRAINTS

- 11.1.1 This section along with the Revised Conceptual Site Model (RCSM) presented in Section 9 comprise the decision record for this stage of risk assessment. The Land Contamination Risk Management (LCRM) guidance (Environment Agency, 2019) states that confirmed pollutant linkages become Relevant Pollutant Linkages (RPLs). For the purposes of this report, RPLs are considered those where the risk level in the RCM is higher than Moderate/Low and some form of mitigation before or during construction is considered likely to be required. RPLs have been identified (see below) and the further works/mitigation procedures required have been included within Table 11-1.
- Moderate Risk: construction workers involved in excavations below ground (exposure to contaminants and asbestos); and
 - High Risk: drainage infrastructure and the workers installing or maintaining it (ground/mine gas).
- 11.1.2 The following is a summary of the key findings and interpretation of the ground investigation data with respect to land contamination and ground gas. Table 11-1 includes the key findings of the RCSM/GQRA and contamination constraints.
- 11.1.3 The risk assessment presented in previous sections and the conclusions/recommendations presented in Table 11-1 are based on the site layout/design plans shown on Drawing 151667-TSA-31-MVL3-DRG-T-LP-162881 (revision A01 dated 12 November 2021 contained in Appendix A) and outlined in Section 2 of this report. If the design/layout subsequently changes then the RCSM, risk assessment and Table 11-1 must be reviewed and if necessary revised by a contamination and ground/mine gas specialist.

Table 11-1 Contamination Constraints and Recommended Actions Before/During Construction

Item	Findings of Initial Assessments	Implications to redevelopment
Exposure of workforce to contaminants in soils/water/air	Asbestos recorded by lab tests within Made Ground/Stockpiles. Metals, organics and polyaromatic hydrocarbons (PAHs) recorded within soil and a single groundwater sample.	Due to the presence of Made Ground across the site there is the potential for further asbestos to be encountered. Vigilance should be maintained during earthworks by appropriately experienced/trained staff. An asbestos specialist should be contacted for advice on what mitigation measures are required to protect the workforce and public.
Exposure of workforce and maintenance workers to ground/mine gas within trenches/excavations, attenuation tank inspection chambers; and the drainage infrastructure design	The site is within a high risk zone for mine gas due to presence of shallow workings <20 m bgl that might not be flooded (CL:AIRE, 2021). Carbon dioxide, carbon monoxide and methane have been recorded, with occasional hydrogen sulphide. Depleted levels of oxygen have been regularly recorded in the upper 5m of Made Ground/bedrock.	Gas mitigation measures might need to be incorporated into the drainage infrastructure design. Design should aim to minimise the need for workers to access trenches, tank excavations and inspection chambers. If this cannot be avoided then air quality monitoring and implementation of alarm/evacuation procedures should be included within work method statements and risk assessments to protect the construction/maintenance workers. Following completion of the gas monitoring the RSCM should be revised (with consideration to the design current at that time) and a mine gas risk assessment undertaken as recommended in CL:AIRE guidance.
Materials/waste management and potential risk to plastic pipes, etc in vicinity of the surface water attenuation tank	Strong hydrocarbon odour and oily sheen noted within Made Ground and bedrock.	Further soil and possibly water sampling will be required prior to and during construction to delineate the presence of the hydrocarbon contamination to inform material/ waste management options and to inform selection of materials for the tank/pipes, etc. Any visual/olfactory evidence of hydrocarbon contaminated material should be segregated from other arisings upon concrete/asphalt hardstanding or plastic sheeting until test results are received and an assessment undertaken to decide upon re-use/disposal option.
Aggressive ground conditions and buried concrete and pipes (water supply and sewage pipes)	Petroleum hydrocarbons and sulphate recorded within soil samples. An assessment has not been undertaken as this is beyond the scope of this report.	Risk assessments should be undertaken to confirm the concrete class and the requirements for water supply and drainage/sewer pipes.
Re-use of site won arisings (current in-situ Made Ground and natural deposits) within the site boundary	Risk assessment indicated site-won arisings could be re-used across the site as they are unlikely to pose an unacceptable risk to human health or controlled waters.	It is anticipated that arisings could be re-used across the site, subject to re-use complying with requirements of a materials management plan or environmental permit. Verification that re-use complied with the MMP/permit would be required, accordingly materials should be tested and compared to re-use criteria (to be developed for the site). It is recommended this

Item	Findings of Initial Assessments	Implications to redevelopment
		<p>approach is agreed with the contaminated land officers at the Council and Environment Agency <u>prior</u> to submission of the MMP/permit.</p>
<p>Use of stockpiled material on site.</p>	<p>Only WAC testing completed. Asbestos recorded in 2014 sampling.</p>	<p>Before the stockpiled material can be used on site the Contractor would need to establish whether such use is acceptable under the waste and environmental regulations. Early engagement with the Environment Agency is recommended to discuss options.</p>
<p>Asphalt (former road surfacing)</p>	<p>No risk assessment undertaken to date.</p>	<p>There is the potential for coal tar to be present in the asphalt surfacing. This is considered a hazardous waste and may require a specialist disposal route. It is recommended that samples are collected from the asphalt for analysis as per current guidance to confirm presence/absence of coal tar.</p>
<p>Piling/foundations and drainage – risks to groundwater</p>	<p>Leachate and groundwater recorded cyanide, sulphate, pH, antimony, beryllium, cadmium, lead, manganese, nickel, zinc and benzo(a)pyrene exceedances. Intermittent water within Made Ground, perched upon bedrock. Groundwater is likely to be over 10 m bgl within the bedrock. Risk assessment indicated unlikely to pose an unacceptable risk to controlled waters.</p>	<p>The pile design for the retaining wall currently proposes bored piles, which are unlikely to create preferential migration pathways as the concrete seals the boreholes as the auger is retracted. A piling risk assessment undertaken, in accordance with Environment Agency guidance should be undertaken. No soakaways are proposed on site. It is unlikely the drainage would create new migration pathways that would pose an unacceptable risk to controlled waters.</p>
<p>Disposal of waste soils and Made Ground.</p>	<p>Preliminary results indicate that 10 samples collected from across the site might be considered as hazardous waste. The remaining samples analysed would be considered as non-hazardous waste. WAC criteria for inert landfill was exceeded by samples collected from the stockpiles located on site.</p>	<p>These are the findings of a preliminary waste characterisation undertaken on samples collected from in-situ Made Ground. It is the responsibility of the waste producer to ensure that adequate sampling/ analysis is undertaken to allow waste classification in accordance with waste regulations/guidance. Further sampling is likely to be required to achieve this. It is recommended that the contractor discusses lab results and soil descriptions with a variety of landfill operators/soil recycling operators to confirm options.</p>
<p>Ground/mine gas</p>	<p>Methane, carbon dioxide, carbon monoxide and, to a lesser extent, hydrogen sulphide have been recorded at shallow depths.</p>	<p>Providing a gap is maintained beneath the Portacabins and the ground and service entry points through the base are sealed (or use entry points through the cabin sides), the ingress of gas is unlikely to be sufficient to pose an unacceptable risk to the portacabin occupants.</p>
<p>Unexpected Contamination</p>	<p>N/A</p>	<p>As with any development there is always the possibility of finding ground/gas/contamination conditions that vary from those recorded in the</p>

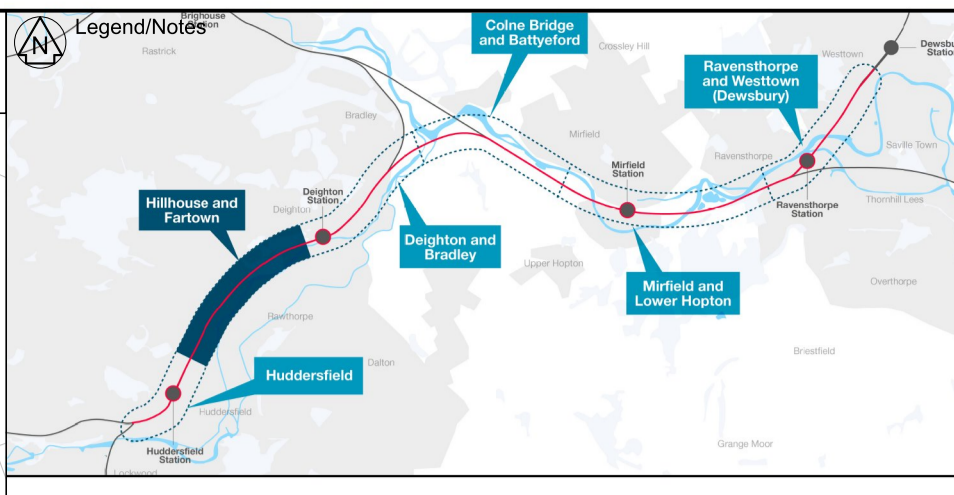
Item	Findings of Initial Assessments	Implications to redevelopment
		ground investigation. Construction team should be vigilant and if such is encountered, to stop work in that area and seek advice from contamination specialists and inform the planning authority. Further sampling and assessment might be required to evaluate the risk.
Decommissioning monitoring wells	N/A	Prior to construction, all monitoring wells should be decommissioned in accordance with the Environment Agency's guidance "Good Practice for Decommissioning Redundant Boreholes and Wells" dated October 2012. This is to prevent the wells from becoming damaged during construction and inadvertently becoming pollution or gas migration pathways.

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APPENDIX A – DRAWINGS



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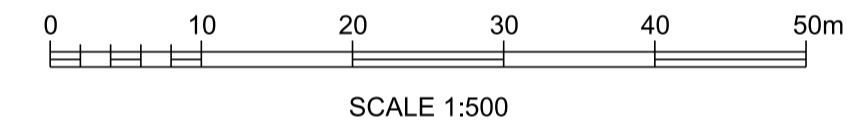
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- Notes
- All dimensions are in millimetres unless stated otherwise.
 - Do not scale from this drawing.
 - This drawing is to be read in conjunction with drawings:
151667-TSA-31-MVL3-DRG-T-LP-162881
151667-TSA-31-MVL3-DRG-T-LP-162882
151667-TSA-31-MVL3-DRG-T-LP-162883
151667-TSA-31-MVL3-DRG-T-LP-162884
151667-TSA-31-MVL3-DRG-T-LP-162885
151667-TSA-31-MVL3-DRG-T-LP-162886
151667-TSA-31-MVL3-DRG-T-LP-162887.
 - Railway sidings and reception rails to be provided under Part 8 of the General Permitted Development Order, and are shown here for information only.



P01	12/11/21	For Planning Application	SM	DM	JH
A01	01/04/25	For Planning Application	SM	DM	JH
P02	27/06/25	Planning Issue	JB	RG	RG
Rev	Date	Description of Revisions	Drawn	Chkd	Appr
Status					Suitability
					S2



Authorised _____ Signed _____ Date _____

Contractor(s)
TRU West Alliance

Location
STALYBRIDGE STN - HEATON LODGE JN (HUDD-MANC LINE)

Type
CAD Drawing

Role
Town and Country Planner

Phasing
Proposed

Project
Transpennine Route Upgrade

Contract No.
151667

Contract Title
TRU - West of Leeds

Drawing Title
Planning Drawing

Hillhouse Construction

Facility

Site Plan 1

Designed
J.Bacinski

Drawn
J.Bacinski

Checked
R.Gee

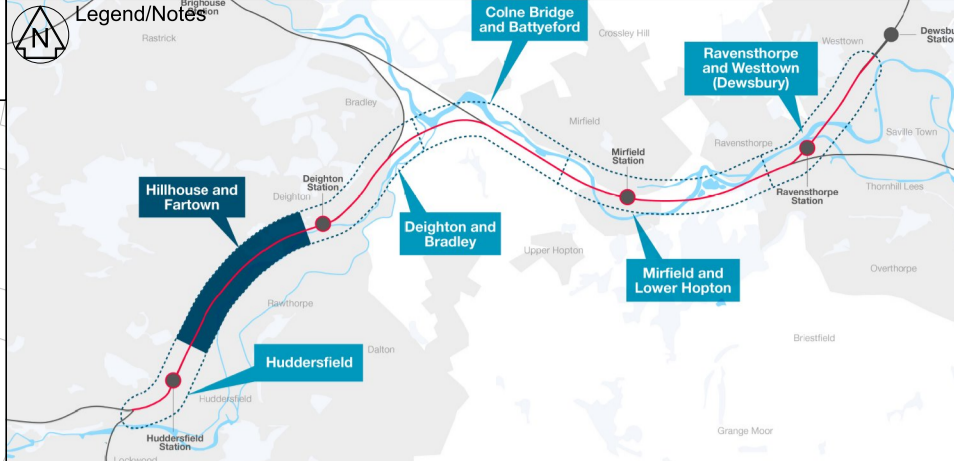
Approved
R.Gee

Scale(s)
1:500

Alternative Reference
151667-TSA-31-MVL3-DRG-T-LP-162880

Sheet
1 of **3**

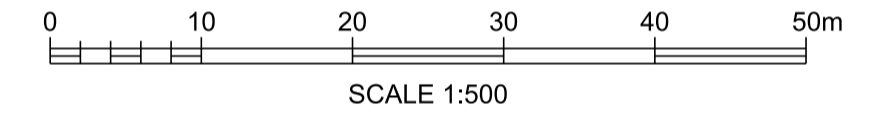
Revision
P02



Legend

- Existing Network Rail Boundary
- Planning Application Boundary
- Proposed Infrastructure
- Visibility Splay

- Notes**
- All dimensions are in millimetres unless stated otherwise.
 - Do not scale from this drawing.
 - This drawing is to be read in conjunction with drawings:
151667-TSA-31-MVL3-DRG-T-LP-162880
151667-TSA-31-MVL3-DRG-T-LP-162882
151667-TSA-31-MVL3-DRG-T-LP-162883
151667-TSA-31-MVL3-DRG-T-LP-162884
151667-TSA-31-MVL3-DRG-T-LP-162885
151667-TSA-31-MVL3-DRG-T-LP-162886
151667-TSA-31-MVL3-DRG-T-LP-162887.
 - Railway sidings and reception rails are to be provided under Part 8 of the General Permitted Development Order, and are shown here for information only.
 - Welfare Building to be delivered under Part 8 of the General Permitted Development Order, and is shown here for information only.



P01	12/11/21	For Planning Application	SM	DM	JH
A01	01/04/25	For Planning Application	SM	DM	JH
P02	27/06/25	Planning Issue	JB	RG	RG
Rev	Date	Description of Revisions	Drawn	Chkd	Appr
Status					Suitability
					S2



Authorised _____ Signed _____ Date _____

Contractor(s)
TRU West Alliance

Location	STALYBRIDGE STN - HEATON LODGE JN (HUDD-MANC LINE)	
Type	CAD Drawing	Sub-type General Arrangement
Role	Town and Country Planner	Sub-Role General
Zone	Hillhouse and Fartown	
Phasing	Proposed	Project Stage GRIP 5

Project
Transpennine Route Upgrade

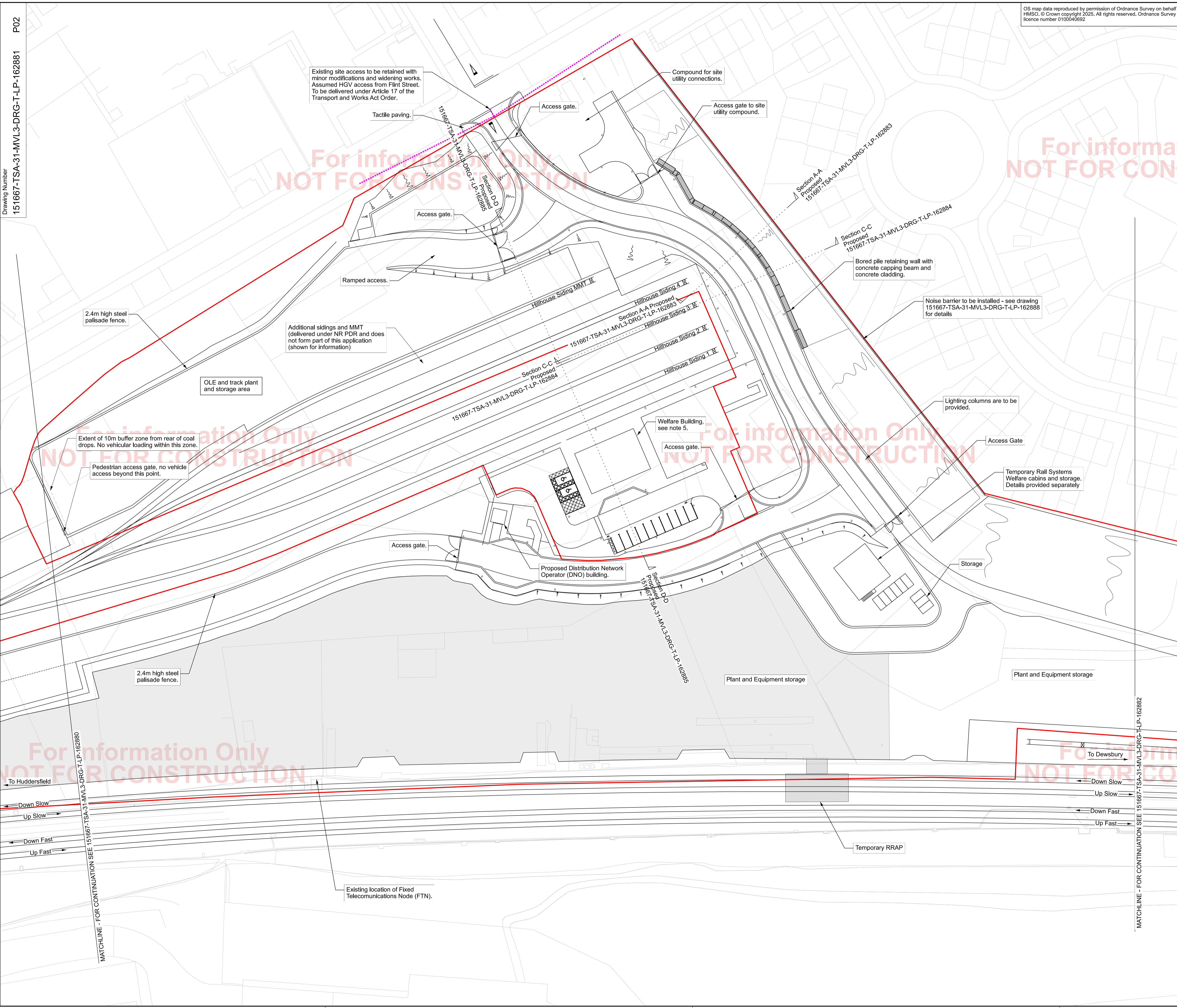
Contract No.
151667

Contract Title
TRU - West of Leeds

Drawing Title
**Planning Drawing
Hillhouse Construction
Facility
Site Plan 2**

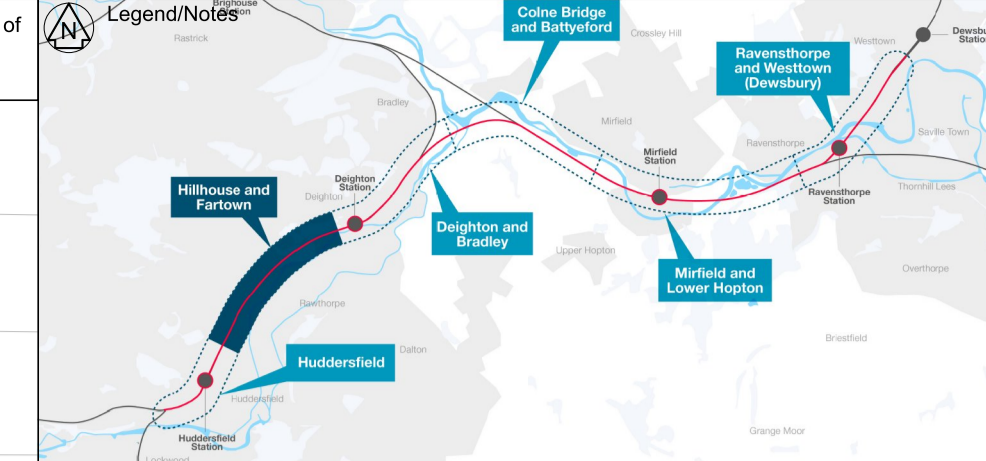
Designed	J.Bacinski	Signed	Electronically Signed	Date	27/06/25
Drawn	J.Bacinski	Signed	Electronically Signed	Date	27/06/25
Checked	R.Gee	Signed	Electronically Signed	Date	27/06/25
Approved	R.Gee	Signed	Electronically Signed	Date	27/06/25

Scale(s)	1:500	ELR & Mileage	026.0500 to 026.1484
Alternative Reference		Sheet	2 of 3
Drawing Number	151667-TSA-31-MVL3-DRG-T-LP-162881	Revision	P02



NOT FOR CONSTRUCTION

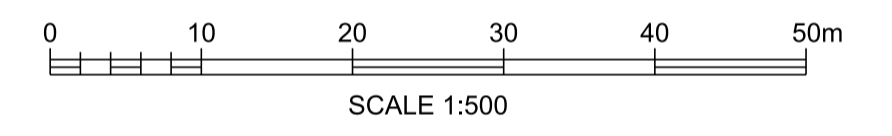
For information Only



Legend

- Existing Network Rail Boundary
- Planning Application Boundary
- Proposed Rail Infrastructure

- Notes**
- All dimensions are in millimetres unless stated otherwise.
 - Do not scale from this drawing.
 - This drawing is to be read in conjunction with drawings:
 - 151667-TSA-31-MVL3-DRG-T-LP-162880
 - 151667-TSA-31-MVL3-DRG-T-LP-162881
 - 151667-TSA-31-MVL3-DRG-T-LP-162883
 - 151667-TSA-31-MVL3-DRG-T-LP-162884
 - 151667-TSA-31-MVL3-DRG-T-LP-162885
 - 151667-TSA-31-MVL3-DRG-T-LP-162886
 - 151667-TSA-31-MVL3-DRG-T-LP-162887.



P01	12/11/21	For Planning Application	SM	DM	JH
A01	01/04/25	For Planning Application	SM	DM	JH
P02	27/06/25	Planning Issue	JB	RG	RG
Rev	Date	Description of Revisions	Drawn	Chkd	Appr
Status					Suitability
					S2



Authorised	Signed	Date
Contractor(s) TRU West Alliance		
Location	STALYBRIDGE STN - HEATON LODGE JN (HUDD-MANC LINE)	
Type	CAD Drawing	Sub-type General Arrangement
Role	Town and Country Planner	Sub-Role General
Zone	Hillhouse and Fartown	
Phasing	Proposed	Project Stage GRIP 5
Project	Transpennine Route Upgrade	

Contract No.	151667		
Contract Title	TRU - West of Leeds		
Drawing Title	Planning Issue/Planning Drawing Hillhouse Construction Facility Site Plan (3)		
Designed	J.Bacinski	Signed Electronically Signed	Date 27/06/25
Drawn	J.Bacinski	Signed Electronically Signed	Date 27/06/25
Checked	R.Gee	Signed Electronically Signed	Date 27/06/25
Approved	R.Gee	Signed Electronically Signed	Date 27/06/25
Scale(s)	1:500	ELR & Mileage 026.0500 to 026.1484	
Alternative Reference			Sheet 3 of 3
Drawing Number	151667-TSA-31-MVL3-DRG-T-LP-162882		Revision P02

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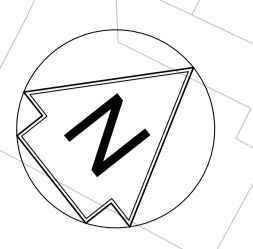
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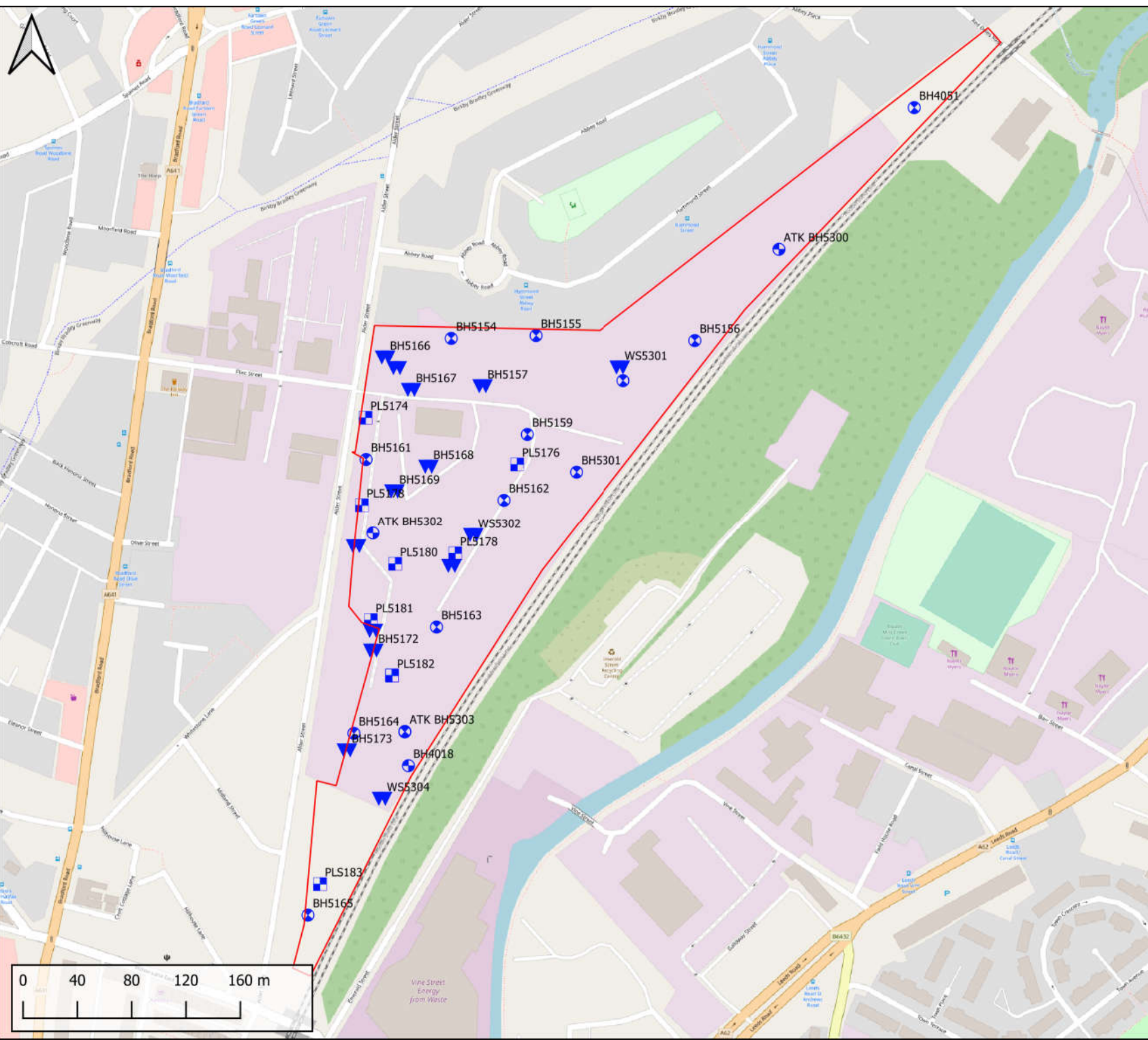
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Drawing Number
151667-TSA-31-MVL3-DRG-T-LP-162882 P02





Notes

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LEGEND

- CP
- TP
- CP+RC
- WS
- WLS
- RC

ATKINS

Member of the SNC-Lavalin Group

Office Information

Client

Network Rail

Project Title

Transpennine Route Upgrade

Drawing Title

BH Location Plan

Scale	Designed	Drawn	Checked	Authorised
1:4K	JB	AS	JB	JB
Original Size	Date	Date	Date	Date
A4	21/07/22	05/05/2022	05/05/2022	05/05/2022
Drawing Number				Revision
151667-TSA-00-TRU-REP-W-EN-001191				02

APPENDIX B – GROUND INVESTIGATION FACTUAL REPORTS

Submitted under separate cover

APPENDIX C – DEFINITIONS OF RISK PROBABILITY AND CONSEQUENCE

The assessment of risks related to the identified potential contamination linkages is based on the methodology presented in the National House Building Council/Environment Agency report R&D66³ (that follows the principles presented in CIRIA's C552⁴), which provide guidance on the development and application of a consequence and probability matrix for land contamination risk assessment. Definitions of probability, consequence and the risk classification matrix adopted for this assessment are provided in the tables below.

Although R&D66 was produced to inform residential developments, the methodology and criteria for assessing contamination risks is applicable to other types of developments and provides more detailed classification descriptions than C552.

Classification of probability

Classification	Definition of the probability of harm/pollution occurring
High Likelihood	The pollutant linkage exists, and it is very likely to result in harm/pollution in the short term, and/or will almost inevitably result in harm/pollution in the long term, and/or there is current evidence of harm/pollution. Likelihood is defined as more likely than not and meets the definition of 'significant possibility' under Part 2A of the Environmental Protection Act (EPA)1990.
Likely	The source, pathway and receptor exist for the pollutant linkage and it is probable that harm/pollution will occur. Circumstances are such that harm/pollution is not inevitable, but possible in the short term and likely over the long term. Likelihood is defined as reasonably possible and meets the definition of 'significant possibility' under Part 2A of EPA 1990.
Low Likelihood	The source, pathway and receptor exist, and it is possible that harm/pollution could occur. Circumstances are such that harm/pollution is by no means certain in the long term and less likely in the short term.
Unlikely	The source, pathway and receptor exist for the pollutant linkage, but it is improbable that harm/pollution will occur even in the long term.

Definition of consequence

Classification	Definition of consequence
Human health receptors – site end use or other more sensitive receptor	
Severe	Acute damage to human health based on the effects on the critical human health receptor. Concentrations of contaminants above appropriate site-specific assessment criteria. Harm meets definition of 'significant harm' under Part 2A of EPA 1990.
Medium	Chronic damage to human health based on the effects on the critical human health receptor. Concentrations of contaminants above appropriate site-specific assessment criteria. Harm meets definition of 'significant harm' under Part 2A of EPA 1990.
Mild	No appreciable impact on human health based on the potential effects on the critical human health receptor. Concentrations of contaminants above generic assessment criteria but below appropriate site-specific assessment criteria.
Minor	No appreciable impact on human health based on the effects on the critical human health receptor. Concentrations of contaminants below appropriate generic assessment criteria.

³ National House Building Council (NHBC) and EA report R&D66 – guidance for the safe development of housing on land effected by contamination, 2008

⁴ Construction Industry Research and Information Association (CIRIA) C552 – Contaminated Land Risk Assessment – A Guide to Good Practice 2001

Classification	Definition of consequence
Controlled water receptors	
Severe	Pollution of a Principal aquifer within a source protection zone or potable supply characterised by a breach of drinking water standards. Pollution of a surface water course characterised by a breach of an Environmental Quality Standards (EQS) at a statutory monitoring location or resulting in a change in General Quality Assessment (GQA) grade of river reach. Discharge of a List I or List II substance to groundwater. Pollution meets Part 2A definition.
Medium	Pollution of a Principal aquifer outside a source protection zone or a Secondary A aquifer characterised by a breach of drinking water standards. Pollution of an industrial groundwater abstraction or irrigation supply that impairs its function. Substantial pollution but insufficient to result in a change in the GQA grade of river reach. Pollution meets Part 2A definition.
Mild	Low levels of pollution of a Principal aquifer outside a source protection zone or an industrial abstraction, or pollution of a Secondary aquifer. Low levels of pollution insufficient to result in a change in the GQA grade of river reach, pollution of a surface water course without a quality classification.
Minor	No appreciable pollution, or pollution of a low sensitivity receptor such as a non-aquifer or a surface water course without a quality classification.
Property receptors – buildings, foundations and services	
Severe	Catastrophic damage to buildings, such as explosion. Catastrophic failure of foundations and services. Substantial damage to a Scheduled Monument significantly impairing the by reason of which the monument is scheduled. Harm meets definition of 'significant harm' under Part 2A of EPA 1990.
Medium	Substantial damage to buildings and foundations rendering the structures unsafe. Substantial damage to services impairing their function. Significant damage to a Scheduled Monument significantly impairing the reason of which the monument is scheduled. Harm meets definition of 'significant harm' under Part 2A of EPA 1990.
Mild	Significant damage to buildings and foundations but not resulting in them being unsafe for occupation. Damage to services but not sufficient to impair their function. Damage to a Scheduled Monument but no significant impairment to the reason of which the monument is scheduled.
Minor	Easily repairable damage to buildings, foundations and services.

Classification of consequence

Classification	Definition of risk
Very High Risk	There is a high probability that severe harm may arise to a designated receptor or there is evidence that severe harm to a designated receptor is currently happening. This risk is likely to result in a substantial liability. Urgent investigation (if not already undertaken) and remediation are likely to be required.
High Risk	Harm is likely to arise to a designated receptor. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not already undertaken) is required, and remedial works may be necessary in the short term and are likely over the longer term.
Moderate Risk	It is possible that harm may arise to a designated receptor. It is either relatively unlikely that any such harm will be severe, or if any harm were to occur, it is more likely that the harm will be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.

Classification	Definition of risk
Low Risk	It is possible that harm will arise to a designated receptor, but it is likely that this harm will be mild. Further investigation is not necessarily required and should be considered to confirm that there is no unanticipated contamination present.
Very Low Risk	The possibility of harm to the designated receptor is either not plausible or, if the possibility of harm is plausible, risk is considered to be very unlikely with attenuation along the exposure pathway. Further investigation is not necessarily required and may be considered to confirm that there is no unanticipated contamination present.

The following table provides the qualitative risk matrix, based on CIRIA guidance, in which the likelihood or probability of each contaminant linkage being realised is ranked against the severity of the consequences. The result is the relative risk classification, the results of which can inform the due diligence process and allow prioritisation of any further assessments or the implementation of risk management measures.

Qualitative Risk Matrix

Risk Matrix	Severity of Consequence			
	Severe	Medium	Mild	Minor
High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
Low Likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

Assessment Criteria :		Commercial - 6% SOM Sandy Loam										
<input type="checkbox"/> Use MRL Values?												
		Limit of Detection	Generic Assessment Criteria	Number of Samples	Minimum Value	Maximum Value	Number of Exceedances	Location		Strata		
								Sample ID	Depth			
								Sample ID	Depth	Date		
								Sample ID	Depth	Date		
% Stones >10mm	% w/w	0.1	No SSV	2	9.3	15.8	0				15.8	9.3
pH	pH	0.01	No SSV	2	6.83	7.35	0				7.35	6.83
Cyanide (total)	mg/kg	1	No SSV	2	<1	<1	0				<1	<1
Phenols - Total by HPLC	mg/kg	0.2	No SSV	2	<0.2	<0.2	0				<0.2	<0.2
Total Organic Carbon	% w/w	0.03	No SSV	2	4.59	18.2	0				18.2	4.59
Antimony	mg/kg	5	4650	2	<5	7	0				7	<5
Arsenic	mg/kg	1	635	2	14	38	0				38	14
Beryllium	mg/kg	0.5	14	2	1.3	1.8	0				1.8	1.3
Boron (water soluble)	mg/kg	1	No SSV	2	<1	<1	0				<1	<1
Cadmium	mg/kg	0.5	410	2	3.2	3.7	0				3.7	3.2
Copper	mg/kg	1	106000	2	65	184	0				184	65
Chromium	mg/kg	1	208000	2	21	56	0				56	21
Lead	mg/kg	1	2310	2	34	97	0				97	34
Mercury	mg/kg	0.17		2	0.41	4.83	0				0.41	4.83
Nickel	mg/kg	1	1770	2	40	42	0				40	42
Selenium	mg/kg	1	13000	2	<1	2	0				2	<1
Vanadium	mg/kg	1	7490	2	23	44	0				44	23
Zinc	mg/kg	5	1100000	2	112	135	0				112	135
TPH CWG	mg/kg		No SSV	0	-	-	0					
TPH Aliphatic C5-C6	mg/kg	0.01	29400	1	<0.01	<0.01	0				<0.01	-
TPH Aliphatic C6-C8	mg/kg	0.01	98200	1	<0.01	<0.01	0				<0.01	-
TPH Aliphatic C8-C10	mg/kg	1	14800	1	<0.01	<0.01	0				<0.01	-
TPH Aliphatic C10-C12	mg/kg	1	69500	1	1	1	0				1	-
TPH Aliphatic C12-C16	mg/kg	1	139000	1	1.4	1.4	0				1.4	-
TPH Aliphatic C16-C21	mg/kg	1	3620000	1	7.2	7.2	0				7.2	-
TPH Aliphatic C21-C35	mg/kg	1	3620000	1	86.9	86.9	0				86.9	-
TPH Aliphatic C35-C44	mg/kg	1	No SSV	1	18.2	18.2	0				18.2	-
Total Aliphatics	mg/kg	1	No SSV	1	115	115	0				115	-
TPH aromatic C5-C7	mg/kg	0.01	98	1	<0.01	<0.01	0				<0.01	-
TPH aromatic C7-C8	mg/kg	0.01	183000	1	<0.01	<0.01	0				<0.01	-
TPH aromatic C8-C9	mg/kg		No SSV	1	<0.01	<0.01	0				<0.01	-
TPH aromatic C9-C10	mg/kg		No SSV	1	<0.01	<0.01	0				<0.01	-
TPH aromatic C10-C12	mg/kg	1	53800	1	1.3	1.3	0				1.3	-
TPH aromatic C12-C16	mg/kg	1	65400	1	6.1	6.1	0				6.1	-
TPH aromatic C16-C21	mg/kg	1	28400	1	23.7	23.7	0				23.7	-
TPH aromatic C21-C35	mg/kg	1	28400	1	121	121	0				121	-
TPH aromatic C35-C44	mg/kg	1	No SSV	1	27.9	27.9	0				27.9	-
Total Aromatics	mg/kg	1	No SSV	1	180	180	0				180	-
TPH (Ali & Aro)	mg/kg	1	No SSV	1	295	295	0				295	-
Asbestos in Soil (inc. matrix) ^	mg/kg		No SSV	0	-	-	0					
Asbestos in soil	mg/kg		No SSV	2	-	-	0				NAD	NAD
Asbestos Matrix	mg/kg		No SSV	2	-	-	0				N/A	N/A
BTEX	mg/kg		No SSV	0	-	-	0					
Benzene	mg/kg	0.01	98	1	<0.01	<0.01	0				<0.01	-
Toluene	mg/kg	0.01	183000	1	<0.01	<0.01	0				<0.01	-
Ethyl Benzene	mg/kg	0.01	63100	1	<0.01	<0.01	0				<0.01	-
m & p Xylene	mg/kg	0.01	No SSV	1	<0.01	<0.01	0				<0.01	-
o Xylene	mg/kg	0.01	32700	1	<0.01	<0.01	0				<0.01	-
PAH-16MS	mg/kg		No SSV	0	-	-	0					
Acenaphthene	mg/kg	0.01	106000	1	0.34	0.34	0				0.34	-
Acenaphthylene	mg/kg	0.01	No SSV	1	0.08	0.08	0				0.08	-
Anthracene	mg/kg	0.02	544000	1	0.83	0.83	0				0.83	-
Benzo(a)anthracene	mg/kg	0.04	BaP Surrogate	1	4.5	4.5	0				4.5	-
Benzo(a)pyrene	mg/kg	0.04	76.3	1	5.06	5.06	0				5.06	-
Benzo(b)fluoranthene	mg/kg	0.05	BaP Surrogate	1	6.03	6.03	0				6.03	-
Benzo(ghi)perylene	mg/kg	0.05	BaP Surrogate	1	3.51	3.51	0				3.51	-
Benzo(k)fluoranthene	mg/kg	0.07	BaP Surrogate	1	2.46	2.46	0				2.46	-
Chrysene	mg/kg	0.06	BaP Surrogate	1	4.54	4.54	0				4.54	-
Dibenzo(ah)anthracene	mg/kg	0.04	BaP Surrogate	1	0.74	0.74	0				0.74	-
Fluoranthene	mg/kg	0.08	72600	1	7.77	7.77	0				7.77	-
Fluorene	mg/kg	0.01	72000	1	0.21	0.21	0				0.21	-
Indeno(123-cd)pyrene	mg/kg	0.03	BaP Surrogate	1	4.03	4.03	0				4.03	-
Naphthalene	mg/kg	0.03	1050	1	0.41	0.41	0				0.41	-
Phenanthrene	mg/kg	0.03	No SSV	1	3.63	3.63	0				3.63	-
Pyrene	mg/kg	0.07	54400	1	7.15	7.15	0				7.15	-
Total PAH-16MS	mg/kg	0.01	No SSV	1	51.3	51.3	0				51.3	-
Cyanide (free)	mg/kg	1	373	0	-	-	0					
Chromium (hexavalent)	mg/kg	1	49.1	0	-	-	0					
TPH aromatic C8-C10	mg/kg	1	20800	1	<0.01	<0.01	0				<0.01	-
MTBE	mg/kg	0.1	22400	0	-	-	0					
Thiocyanate	mg/kg	5	No SSV	0	-	-	0					

Assessment Criteria		Manual SSAC																				
Use MRL Value?		Location																				
Sample ID	Depth	DHW	Location																			
			ATKBS100	ATKBS101	ATKBS102	ATKBS103	ATKBS104	ATKBS105	ATKBS106	ATKBS107	ATKBS108	ATKBS109	ATKBS110	ATKBS111	ATKBS112	ATKBS113	ATKBS114	ATKBS115	ATKBS116	ATKBS117	ATKBS118	
Asbestos in soil	%	No SSV	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Asbestos in soil % composition	%	No SSV	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Asbestos Matrix		No SSV	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
% Stones >10mm	%	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Organic Carbon	mg/kg	No SSV	44	<0.15	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cyanide (total)	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cyanide (free)	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Thiocyanate	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
pH	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Arsonic	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Arsenic	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Beryllium	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Boron (water soluble)	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Calcium	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Chromium	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Chromium (hexavalent)	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Copper	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Lead	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Mercury	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Nickel	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Selenium	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Zinc	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1,4-Methylphenol	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Phenol	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Phenyl	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Phenyls - Total by HPLC	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Propionitrile	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Acetophenone	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Acenaphthylene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Acenaphthylene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Anthracene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Benzo(a)anthracene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Benzo(a)anthracene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Benzo(a)anthracene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Benzo(b)fluoranthene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Benzo(b)fluoranthene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Benzo(b)fluoranthene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Benzo(k)fluoranthene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Benzo(k)fluoranthene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Benzo(k)fluoranthene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Chrysene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Chrysene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dibenz(a,h)anthracene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dibenz(a,h)anthracene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Dibenz(a,h)anthracene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Fluorene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Fluorene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Indeno(1,2,3-cd)pyrene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Indeno(1,2,3-cd)pyrene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Naphthalene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Naphthalene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Naphthalene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Phenanthrene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Phenanthrene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Phenanthrene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pyrene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pyrene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pyrene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total PAHs	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Benzene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ethylbenzene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Benzene & Xylene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Xylene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Benzene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Ethylbenzene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Benzene & Xylene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Xylene	mg/kg	No SSV	44	<0.1	31.4	0	0	0	0													

Assessment Criteria : Drinking Water Standard England and Wales/WHO										
CaCO (mg/l):	0.00	pH	0.00	Catchment area: Drinking Water Standard						Location
Calcium (mg/l):	0.00	DOC (mg/l)	0.00	Unit	Limit of Detection	Generic Assessment Criteria	Number of Samples	Minimum Value	Maximum Value	Number of Exceedences
Constituents	Unit	Limit of Detection	Generic Assessment Criteria	Number of Samples	Minimum Value	Maximum Value	Number of Exceedences	Locations of Exceedences	Strata	Zone
DOC	mg/l	0.2	No WSV	1	2.6	2.6	0			2.6
Hardness Total	mg/l CaCO3	2	No WSV	1	1251	1251	0			1251
Ammoniacal nitrogen as N	mg/l	0.02	0.39	1	0.19	0.19	0			0.19
Chloride	mg/l	1	250	1	22	22	0			22
Cyanide (total)	mg/l	0.01	0.05	1	<0.005	<0.005	0			<0.005
Sulphate BRE	mg/l	0.01	No WSV	1	239	239	0			239
pH	pH	0.01	6.5-9.5	1	7.37	7.37	0			7.37
Antimony	mg/l	0.001	0.005	1	<0.002	<0.002	0			<0.002
Arsenic	mg/l	0.001	0.01	1	0.009	0.009	0			0.009
Beryllium	mg/l	0.001	0.012	1	0.015	0.015	1	ATK BH5303, 12m		0.015
Cadmium	mg/l	0.002	0.005	1	0.001	0.001	1	ATK BH5303, 12m		0.001
Calcium	mg/l	1	N/A	1	317	317	0			317
Chromium	mg/l	0.001	0.05	1	0.028	0.028	0			0.028
Copper	mg/l	0.001	2	1	0.132	0.132	0			0.132
Lead	mg/l	0.001	0.01	1	0.047	0.047	1	ATK BH5303, 12m		0.047
Manganese	mg/l	0.001	0.05	1	28.1	28.1	1	ATK BH5303, 12m		28.1
Mercury	mg/l	0.0001	0.001	1	<0.0002	<0.0002	0			<0.0002
Nickel	mg/l	0.001	0.02	1	0.462	0.462	1	ATK BH5303, 12m		0.462
Selenium	mg/l	0.001	0.01	1	0.005	0.005	0			0.005
Vanadium	mg/l	0.001	N/A	1	0.208	0.208	0			0.208
Zinc	mg/l	0.001	3	1	3.87	3.87	1	ATK BH5303, 12m		3.87
3+4-Methylphenol	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
Phenol	mg/l	0.001	0.05	1	<0.001	<0.001	0			<0.001
Phenols - Total by HPLC	mg/l	0.01	No WSV	1	<0.01	<0.01	0			<0.01
Acenaphthene	mg/l	0.0001	See BaP	1	<0.001	<0.001	0			<0.001
Acenaphthylene	mg/l	0.0001	See BaP	1	0.00006	0.00006	0			0.00006
Acenaphthylene	mg/l	0.0001	See BaP	1	<0.001	<0.001	0			<0.001
Acenaphthylene	mg/l	0.00001	See BaP	1	0.00002	0.00002	0			0.00002
Anthracene	mg/l	0.0001	See BaP	1	<0.001	<0.001	0			<0.001
Anthracene	mg/l	0.00001	See BaP	1	0.0001	0.0001	0			0.0001
Benzo(a)anthracene	mg/l	0.0001	See BaP	1	<0.001	<0.001	0			<0.001
Benzo(a)anthracene	mg/l	0.00001	See BaP	1	0.0004	0.0004	0			0.0004
Benzo(a)pyrene	mg/l	0.0001	0.0001	1	<0.001	<0.001	0			<0.001
Benzo(a)pyrene	mg/l	0.00001	0.0001	1	0.00047	0.00047	1	ATK BH5303, 12m		0.00047
Benzo(b)fluoranthene	mg/l	0.001	See PAH Sum of 4	1	<0.001	<0.001	0			<0.001
Benzo(b)fluoranthene	mg/l	0.00001	See PAH Sum of 4	1	0.00059	0.00059	0			0.00059
Benzo(g)herylene	mg/l	0.001	See PAH Sum of 4	1	<0.001	<0.001	0			<0.001
Benzo(g)herylene	mg/l	0.00001	See PAH Sum of 4	1	0.00033	0.00033	0			0.00033
Benzo(k)fluoranthene	mg/l	0.001	See PAH Sum of 4	1	<0.001	<0.001	0			<0.001
Benzo(k)fluoranthene	mg/l	0.00001	See PAH Sum of 4	1	0.00022	0.00022	0			0.00022
Chrysene	mg/l	0.001	See BaP	1	<0.001	<0.001	0			<0.001
Chrysene	mg/l	0.00001	See BaP	1	0.00057	0.00057	0			0.00057
Dibenz(a,h)anthracene	mg/l	0.0001	No WSV	1	<0.001	<0.001	0			<0.001
Dibenz(a,h)anthracene	mg/l	0.00001	No WSV	1	0.00007	0.00007	0			0.00007
Fluoranthene	mg/l	0.001	See BaP	1	<0.001	<0.001	0			<0.001
Fluoranthene	mg/l	0.00001	See BaP	1	0.00066	0.00066	0			0.00066
Fluorene	mg/l	0.001	See BaP	1	<0.001	<0.001	0			<0.001
Fluorene	mg/l	0.00001	See BaP	1	0.00019	0.00019	0			0.00019
Indeno(1,2,3-cd)pyrene	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
Indeno(1,2,3-cd)pyrene	mg/l	0.00001	See PAH Sum of 4	1	0.00033	0.00033	0			0.00033
Naphthalene	mg/l	0.001	See BaP	1	<0.001	<0.001	0			<0.001
Naphthalene	mg/l	0.00001	See BaP	1	0.00013	0.00013	0			0.00013
Perylene	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
Phenanthrene	mg/l	0.001	See BaP	1	<0.001	<0.001	0			<0.001
Phenanthrene	mg/l	0.00001	See BaP	1	0.00094	0.00094	0			0.00094
Pyrene	mg/l	0.001	See BaP	1	<0.001	<0.001	0			<0.001
Pyrene	mg/l	0.00001	See BaP	1	0.00076	0.00076	0			0.00076
Total PAH 16MS	mg/l	0.00001	No WSV	1	0.00584	0.00584	0			0.00584
Benzene	mg/l	0.001	0.001	1	<0.001	<0.001	0			<0.001
Ethyl Benzene	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
Toluene	mg/l	0.001	0.7	1	<0.001	<0.001	0			<0.001
m & p Xylene	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
o Xylene	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
Benzene	mg/l	0.001	0.001	1	<0.001	<0.001	0			<0.001
Ethylbenzene	mg/l	0.001	0.3	1	<0.001	<0.001	0			<0.001
MTBE	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
Toluene	mg/l	0.001	0.7	1	<0.001	<0.001	0			<0.001
m & p Xylene	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
o-Xylene	mg/l	0.001	See Xylenes (total)	1	<0.001	<0.001	0			<0.001
Aliphatic TPH >C10-C12	mg/l	0.005	0.3	1	<0.005	<0.005	0			<0.005
Aliphatic TPH >C12-C16	mg/l	0.005	0.3	1	<0.005	<0.005	0			<0.005
Aliphatic TPH >C16-C21	mg/l	0.005	N/A	1	<0.005	<0.005	0			<0.005
Aliphatic TPH >C21-C35	mg/l	0.005	N/A	1	<0.005	<0.005	0			<0.005
Aliphatic TPH >C35-C44	mg/l	0.005	N/A	1	<0.005	<0.005	0			<0.005
Aliphatic TPH >C5-C6	mg/l	0.001	15	1	<0.001	<0.001	0			<0.001
Aliphatic TPH >C6-C8	mg/l	0.001	15	1	<0.001	<0.001	0			<0.001
Aliphatic TPH >C8-C10	mg/l	0.005	0.3	1	<0.005	<0.005	0			<0.005
Aromatic TPH >C10-C12	mg/l	0.005	0.09	1	<0.005	<0.005	0			<0.005
Aromatic TPH >C12-C16	mg/l	0.005	0.09	1	<0.005	<0.005	0			<0.005
Aromatic TPH >C16-C21	mg/l	0.005	0.09	1	<0.005	<0.005	0			<0.005
Aromatic TPH >C21-C35	mg/l	0.01	0.09	1	<0.01	<0.01	0			<0.01
Aromatic TPH >C35-C44	mg/l	0.005	N/A	1	<0.005	<0.005	0			<0.005
Aromatic TPH >C5-C7	mg/l	0.001	0.01	1	<0.001	<0.001	0			<0.001
Aromatic TPH >C7-C8	mg/l	0.001	0.7	1	<0.001	<0.001	0			<0.001
Aromatic TPH >C8-C10	mg/l	0.005	0.3	1	<0.005	<0.005	0			<0.005
TPH (Alk & Aro >C5-C44)	mg/l	0.01	No WSV	1	<0.01	<0.01	0			<0.01
Total Aliphatics	mg/l	0.005	No WSV	1	<0.005	<0.005	0			<0.005
Total Aromatics	mg/l	0.01	No WSV	1	<0.01	<0.01	0			<0.01
1,1,1,2-Tetrachloroethane	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
1,1,1-Trichloroethane	mg/l	0.001	N/A	1	<0.001	<0.001	0			<0.001
1,1,2,2-Tetrachloroethane	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
1,1,2-Trichloroethane	mg/l	0.001	N/A	1	<0.001	<0.001	0			<0.001
1,1-Dichloroethane	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
1,1-Dichloroethane	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
1,1-Dichloroethane	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
1,2-Dichloroethane	mg/l	0.002	0.003	1	<0.002	<0.002	0			<0.002
1,2-Dichloroethane	mg/l	0.001	0.04	1	<0.001	<0.001	0			<0.001
1,3,5-Trimethylbenzene	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
1,3-Dichlorobenzene	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
1,3-Dichlorobenzene	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
1,4-Dichlorobenzene	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
1,4-Dichlorobenzene	mg/l	0.001	0.3	1	<0.001	<0.001	0			<0.001
2,2-Dichloropropane	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
2-Chlorotoluene	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
4-Chlorotoluene	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
4-Isopropyltoluene	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
Bromobenzene	mg/l	0.001	No WSV	1	<0.001	<0.001	0			<0.001
Bromochloromethane	mg/l	0.005	No WSV	1	<0.005	<0.005	0			<0.005
Bromodichloromethane	mg									

Hillhouse Depot
GQRA
Ground Gas

Project:	TRU Hillhouse Depot
Project Number:	5186546
Client:	Network Rail

Borehole	Oxygen %v/v		Methane %v/v		Carbon Dioxide %v/v		Flow l/hr		H2S ppm	CO ppm	Hazardous Gas Values (calculated using max conc. and max steady state flow)	
	Min Min	Min Steady	Max Max	Max Steady	Max Max	Max Steady	Max Max	Max Steady	Max	Max	CH4	CO2
WS5302	10.60	10.80	<0.1	<0.1	4.40	3.00	0	0			0.0001	0.0044
WS5303	13.60	19.50	<0.1	<0.1	5.00	0.20	0.1	0.1	1		0.0001	0.005
WS5304	12.60	12.70	<0.1	<0.1	5.00	5.00	0	0	1		0.0001	0.005
ATKBH5301	9.40	9.50	0.30	0.30	3.60	3.20	0.4	0.4	2	1	0.0012	0.0144
ATKBH5301	20.20	20.20	0.20	0.20	0.30	0.30	0.3	0.3		3	0.0006	0.0009
ATKBH5302	17.70	17.70	0.30	0.30	1.50	1.50	0.3	0.3	3		0.0009	0.0045
ATKBH5302	18.10	18.10	0.20	0.20	1.60	1.60	0.5	0.5			0.001	0.008
ATKBH5303	14.20	15.10	0.30	0.30	4.90	4.90	0.3	0.3	4	5	0.0009	0.0147
ATKBH5303	15.90	15.90	0.20	0.20	2.60	2.60	0.4	0.4			0.0008	0.0104
BH5156	5.20	5.20	0.70	0.70	8.20	8.20	4.6	1.3			0.0091	0.1066
BH5157	3.30	4.00	0.80	0.80	2.90	2.70	9	9		28	0.072	0.261
BH5158	20.30	20.30	0.60	0.60	0.40	0.40	0.2	0.2			0.0012	0.0008
BH5161	19.70	19.70	0.90	0.90	2.40	2.10	0.1	0.1			0.0009	0.0024
BH5163	9.80	9.80	0.60	0.60	6.60	6.60	0.2	0.1		2	0.0006	0.0066
BH5164	20.10	20.20	1.20	1.20	0.90	0.90	0.2	0.2			0.0024	0.0018
BH5165	17.80	19.40	0.60	0.60	2.60	0.80	0.1	0.1			0.0006	0.0026
BH5168	9.70	9.90	0.60	0.60	6.40	6.30	0.1	0.1			0.0006	0.0064

Site Name	Transpennine Route Upgrade
Location	Hillhouse Depot
Site ID	
Job Number	5146546
Date	5/6/2022
User Name	Anuj.Singh@atkinsglobal.com
Company Name	Atkins

Hole ID	Sample Depth	Hazardous Waste Y/N	HP1	HP2	HP3	HP4	HP5	HP6	HP7	HP8	HP9	HP10	HP11	HP12	HP13	HP14	HP15	HP16
ATKBH5300	0.2m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
ATKBH5301	0.3m	Y	No	No	No	No	No	No	Yes	No	No	No	Yes	No	No	No	No	No
ATKBH5301	0.5m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
ATKBH5302	1m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
ATKBH5303	0.3m	Y	No	No	No	No	No	No	Yes	No	No	No	Yes	No	No	No	No	No
ATKBH5303	1.1m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
ATKBH5303	6m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
ATKBH5303	11.5m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5156	0.2m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5156	0.5m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5158	0.2m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5158	1m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5159	0.3m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5161	0.25m	Y	No	No	No	No	No	No	Yes	No	No	No	Yes	No	No	No	No	No
BH5161	1m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5163	0.25m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5164	1.5m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5164	5.5m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5164	12.5m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5164	0.25m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5165	0.5m	Y	No	No	No	No	No	No	Yes	No	No	No	Yes	No	No	No	No	No
BH5165	1.5m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5165	3.5m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5166	2.7m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5166	0.2m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5167	0.2m	Y	No	No	No	No	No	No	Yes	No	No	No	Yes	No	No	No	No	No
BH5167	0.5m	Y	No	No	No	No	No	No	Yes	No	No	No	Yes	No	No	No	No	No
BH5168	0.2m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5168	0.5m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5169	1.6m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5169	0.5m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5170	0.2m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5170	1.2m	Y	No	No	No	No	No	No	Yes	No	No	No	Yes	No	No	No	No	No
BH5171	1.2m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5171	0.5m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5171	1.5m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5172	0.5m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5173	0.2m	Y	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No
BH5173	1.4m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
WS5300A	0.8m	Y	No	No	No	No	No	No	Yes	No	No	No	Yes	No	No	No	No	No
WS5301	0.5m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
WS5302	0.5m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
WS5303	0.6m	Y	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No
WS5303	1.9m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
WS5304	0.3m	Y	No	No	No	No	No	No	Yes	No	No	No	Yes	No	No	No	No	No
BH4018	0.3m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH4018	1m	N	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
BH5160	0.2m	Y	No	No	No	No	No	No	Yes	No	No	No	Yes	No	No	No	No	No

APPENDIX E – ADDENDUM TO PHASE 2 LCRA TO ADDRESS KIRKLEES COUNCIL COMMENTS

Hillhouse Compound Phase 2 LCRA

Addendum to Phase 2 LCRA responses issued to consultation response issued by Kirklees Council July 22 Ref - WK/202217843

Document	section	Kirklees Council comments	Network Rail (applicant) response
Phase 2	(1)	Further investigation work is scheduled. With that in mind, it is unclear how we can accept a report when the site characterisation remains incomplete.	<p>The applicant considers that sufficient GI/sampling has been done to characterise the site for the development covered by the planning permission.</p> <p>The further investigation works recommended in the Phase 2 report related to the following:</p> <ul style="list-style-type: none"> • Completion of the gas monitoring and ground water sampling, if wells have sufficient water. These activities were part of the 2021 GI, but had not been completed/data not available at the time the report was written. This information is not critical to the CSM for the development covered by this planning permission. The remaining gas and groundwater data is required to refine the CSM / inform the design of new buildings that will be built on the site under NR's permitted development rights. • Additional sampling to investigate extent of strong hydrocarbon odour and oily sheen noted at one location. The remediation strategy that is to be submitted will span the permitted development works, the development covered by this planning permission and the TWAO works. • Sampling/analysis of stockpiled materials: trial pitting has been undertaken in the three stockpiles and samples analysed. We have produced a technical note that presents the findings of this sampling and a GQRA (see attached). This material is to be removed from site for appropriate treatment/disposal and the sampling will inform this process.
Phase 2	(2)	The borehole plan presented in the appendix suggests it is a draft location plan. We require the applicant to confirm the final	This was an error, an updated plan is attached to this response

		location of the boreholes discussed in the main report.	
Phase 2	(3)	The investigation included the 2014 Adler and Allan sampling of three stockpiles of waste materials present on site; Stockpile 1 (150 m3) is located in the north of the site, Stockpile 2 (300 m3) is located in the centre of the site and Stockpile 3 (600 m3) is located in the south of the site. Since 2014, no further testing was undertaken on these samples. We require the applicant to confirm the current locations of the stockpiles and provide a new contaminant analysis.	A technical note has been produced that presents the findings of trial pitting into the stockpiles, which includes a plan showing the approx. locations of the TPs in the stockpiles. A copy of the technical note is appended to this response.
Phase 2	(4)	Deviating samples are reported. In addition to the information provided in Section 7.3.5 through to Section 7.3.8 of the report, we also require detailed information about the sample containers and sample handling protocol from site to the laboratory which must include details about the storage of these samples.	<p><u>The below sets out the information pertaining to the sampling methodology;</u></p> <p><u>Sample containers</u> Soil sample containers used for each environmental sample are as below. These have been confirmed by the labs as being suitable and appropriate for the specified suites of testing.</p> <ul style="list-style-type: none"> • 1x 1 litre air tight plastic tub • 1x 250ml amber glass jar • 1x 60ml glass vial <p><u>Sample handling protocols on site</u> Sample are taken by experienced geotechnical engineers, generally this is by hand using disposable nitrile gloves with a fresh pair of gloves used for each sample. Any environmental samples taken on site are put into a cool box In addition subsamples are obtained from sealed liner samples, these are taken the very next working day from the liner sample being obtained, and are also placed into cool boxes. Collections</p>

			<p>by the labs courier are daily (generally around 3pm) so all samples are either taken to the labs on the same day or the following day. Once a sample is collected by the courier it is delivered straight to the laboratory without delay.</p> <p><u>Storage at laboratories</u> Samples received with instructions are unpacked when received, scheduled into the Laboratory Information Management System (LIMS), and placed in cold store while analysis is under way. Samples received without instructions are placed on hold and stored in a cold store until instructions are received.</p>
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APPENDIX F – STOCKPILE TECHNICAL NOTE

Submitted under separate cover

Network Rail
Waterloo General Offices
London
SE1 8SW
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