



Leeds
CITY COUNCIL

A62 Longroyd Bridge Junction Corridor Improvements, Huddersfield

Phase 1 Desk Study Report

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Geotechnical Section



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1.0 INTRODUCTION

Leeds City Council (LCC) Geotechnical Section (GS) was requested by Kirklees Metropolitan Council (KMC) to carry out a desk study on land at the A62 Longroyd Bridge Junction. The site is approximately 200m long and covers almost 1ha in area. It is located approximately 1km southwest from Huddersfield City centre and centred on OS National Grid Reference E:413500 N:416150. See Figure 1.

It is understood that an enhanced highway is proposed for the length of the site, from Market Street and Paddock Foot (west) following along Longroyd Lane to intercept Manchester Road (east). Manchester Road will also be enhanced where it runs south from the junction with Longroyd Lane, over Longroyd Bridge from beyond Well Street (north), to the junction with St Thomas Street (south). An existing building at the junction with Longroyd Lane and Manchester Road will be demolished. The full proposed development is detailed in Figure 2.

1.1 Objectives

The objective of this report is to evaluate current and former uses of the site and the surrounding area, and the nature of any potential environmental or geotechnical hazards or physical constraints that may exist as a result.

In order to achieve the objective, the scope of this study consists of;

- Provision of general information on the site location, description and topography;
- Identification, discussion and summarisation of any historical development that has occurred at the site and in the surrounding area;
- Identification and discussion of the geology, hydrogeology and hydrology at, and in the vicinity of, the site;
- Provision of a summary of the environmental setting of the site; e.g. landfills, sensitive land uses, etc.;
- The development of an initial Conceptual Site Model (CSM) linking sources of potential contamination with pathways and receptors;
- The production of a preliminary risk assessment for the current and proposed end use of the site;
- Provision of Environmental and Geotechnical conclusions and recommendations for further works where necessary.

1.2 Limitations

The comments and recommendations given in this report are based on a review of available information, and observations made during a site walkover survey of the site, as well as the surrounding area where necessary. There may be other conditions prevailing on the site that have not been identified by the available information and therefore cannot be taken into account by this report. GS does not warrant the accuracy of information provided by third party sources or any conclusions expressed within this report that is based upon the information provided if it is subsequently found to be inaccurate.

2.0 THE SITE

The site comprises Longroyd Lane and land immediately to the north, and the traffic-light controlled junction with Manchester Road, with the site area extending north east towards Huddersfield city centre and south over the Huddersfield Narrow Canal and the River Colne.

The Longroyd Lane part of the site is generally flat and runs north of and parallel with a section of Huddersfield Narrow canal. South of the canal is a small industrial site. The the north of Longroyd Lane is an area of hard standing, with some grassed areas and is currently in use as a car wash and car park. To the west, Longroyd Lane runs under a railway viaduct, and becomes Market Street and Paddock Foot highways. At the junction of Longroyd Lane with Manchester Road are some buildings that are are fenced and proposed for demolition, and some that are currently in use as a takeaway and taxi rank. The Bridge pub is located opposite Longroyd Lane. The Manchester Road part of the site runs approximately 100m to the east and approximately 100m to the south over the Huddersfield Narrow Canal and the River Colne, and is bound by commercial and residential properties.

The approximate locations of features noted during the walkover survey are shown on Figure 3.

3.0 HISTORY

3.1 Review of Historical Maps & Plans

Historical OS (scale 1:10,560, 1:2,500 & 1:1,250) maps of the site and surrounding area have been obtained from Groundsure, with the relevant maps included as Appendix 5. An overview of the historical setting of the site is given in chronological order, in Table 1 below.

Table 1: Site History

Date	On-Site Features	Surrounding Area
1854	A railway viaduct (Paddock Viaduct) trending NE-SW, crosses the west end of Longroyd Lane. There are numerous small properties within the centre-north part of the site. The eastern part of the site is Manchester Road that extends southwards over Longroyd Bridge which crosses the canal and river.	The site is surrounded by extensive development and infrastructure with less developed areas shown further to the north and south. Huddersfield City Centre is to the north east.
1888-91	There is a new building parallel to the canal that extends into the south section of the site.	St Thomas Road is to the south east of the site and links to the southern boundary. There is a railway to the north west of the site trending east to west.
1890	Longroyd Lane has a tramway. There is a row of buildings along the northern part of the site.	Mills and railways are located north of the defined site area. The west end of the land strip is shown to be soft ground. A silk mill and gas works are located within 50m southwest of the site boundary.
1893	No significant changes.	Buildings extending from the east site boundary are now shown to be woollen mills.
1905		There is a new residential estate to the south of the site.
1907	The junction at the southern end of the site has been widened and improved.	There is a tramway depot shown just south east of the site.
1918	Tramway networks running through the site have been improved.	No significant changes.
1930-31	No significant changes.	There has been extensive development of the areas to the south west, south and south east of the site.
1932		A coal depot is labelled to the north of the site. There are numerous new buildings to the south and south west both residential and industrial.
1938		A couple of buildings to the south west of the site are no longer shown
1948		More buildings have been built to the south west of the site.
1956		No significant changes.
1959-60	The buildings along the north boundary of the site are no longer shown.	
1966-69	No significant changes.	
1972-73		
1975		
1983-86		
1990-93	An electricity sub-station is located within south site area of Longroyd Bridge.	Buildings along the land strip to the east of the site are no longer shown.
2002	No significant changes.	Land strip to the east of the site has been removed
2010		No significant changes.
2014	Buildings are no longer shown to enter the northern site boundary.	

3.2 Summary of Historical Land Use

In 1854 the site is a road junction between Longroyd Lane and Manchester Road with part of Manchester Road being Longroyd Bridge which makes up the south part of the site. A viaduct crosses the western part of the site and there are numerous buildings along the north site boundary. In 1890 a tramway is shown to run east to west across the site through Longroyd Lane and Manchester Road. In 1907 the junction at the south end of the site has been widened and improved and in 1918 the tramway is shown to have been widened. The site remains unchanged until 1960 when the junction at the southern end of the site is now a roundabout and the tramways are no longer shown. By 1990 a substation is shown to enter the south eastern site boundary and by 2014 buildings within the northern part of the site are no longer shown.

Outside the site, the land is developed with a mix of commercial, industrial and residential buildings, as well as a river, a canal and a railway on viaduct. It has remained essentially unchanged since the earliest maps

4.0 PREVIOUS INVESTIGATION INFORMATION

One BGS borehole, located in the eastern part of the site and carried out in 1986 for a Longroyd Bridge scheme recorded fill to 2.50m depth which included sandstone, bitmac, brick, ash, clinker and coal, above alluvium, encountered as silty fine to coarse gravelly sand and cobbles to 3.25m, over ferruginous sandstone interpreted to be the Rough Rock which continued to the base of the hole at 5.75m.

No coal seams or groundwater were recorded.

5.0 GEOLOGICAL SETTING

5.1 Sources of Information

The geology has been reviewed from the Groundsure Geo Insight Report, survey maps of the area, and the Geological map SE11NW. See Figure 4.

5.2 Superficial and Artificial Deposits

Superficial deposits of river alluvium comprising clay, sand and gravel cover the southern part of the site along Longroyd Lane and the south extension of the site along Manchester Road. One borehole located north of the bridge encountered superficial deposits to 3.25m but was notably able to penetrate rockhead to 5.75m suggesting that this would behave geotechnically as a soil.

The geological maps record the site as surrounded by localised deposits of undivided made ground. This comes to within 26m north at its nearest point and while not mapped below the site, made ground can be expected below the canal and engineered river channels of the site. The north site area may be associated with historically filled cellars.

The Groundsure Geo Insight Report records a moderate classification for compressible deposits in the south of the site and this clearly follows the defined area of superficial alluvium deposits that would not be suited to any significant building foundations. A negligible risk for compressibility exists for the remainder of the site.

A moderate to Low risk of landslides exists for land north of the defined site area and this area looks to enter the north boundary of Longroyd Lane. The line of this classification looks to correspond with the change in strata. This is not interpreted to affect the proposals however, site levels should be examined by the site walkover.

5.3 Solid Geology

The solid geology below the site belongs to the undifferentiated strata of the Lower Coal Measures Formation (east) and the Rough Rock Sandstone (west). A fossil horizon is shown to cross the site which is shown to be free of faulting. The nearest coal seam outcrops beyond 140m north of the site. The Longroyd Bridge section of Manchester Road may well straddle both geology types.

5.4 Hydrogeology & Hydrology

All of the bedrock and the superficial deposits are shown to be classified as a Secondary A Aquifers. These are Permeable layers capable of supporting water supplies at a local rather than strategic scale. These soils are predicted to have a high leaching potential.

The detailed groundwater regime of the site is unknown, however most of the south site boundary is formed by the Huddersfield Narrow Canal which includes sets of locks. This is recorded as a catchment for the Rivers Aire and Calder.

The middle section of the site south extends over Longroyd Bridge which crosses the canal, a central strip of land and the River Colne. Gledholt Beck is shown as a culverted water course, crossing the site northwest to the River Colne.

Four minor surface water features are listed within the site area and a further five within 250m are beyond 37m. These are ponds, land drains or historical features not recorded on mapping.

The site is not in a Groundwater Source Protection Zone (SPZ). No Groundwater or surface water abstractions are listed onsite, however two groundwater abstractions are located at 148m and 169m southeast of the site. These records are for process water boreholes at SKA Textiles Ltd and are not considered to affect the proposals.

One recorded discharge consent is located within the site at Springdale Avenue CSO (NGR: 413567, 416072). This is inside the southernmost point of the site, for a storm water overflow sewage discharge. Two further listings at 2.0m south exist for the same feature. Two further CSO storm water overflows for sewage discharges are located at 6m east and 7m southwest of the location.

Other undefined discharge locations are recorded: three times at 10m south, for (NGR: 413580, 416060), four times at 12m south, for (NGR: 413560, 416060), four times 22m south at (NGR: 413560, 416050) and four times 22m west at (NGR: 413530, 416090).

Two further records exist for CSO storm water overflows for sewage discharges at 36m and 41m west. These are recorded by Groundsure as west of Longroyd Lane and they discharge to the Huddersfield Narrow Canal.

Six pollution events have been recorded in close proximity to the site boundary. The closest locations were at 4m north west; 4m south; 8m north west; 13m north west and 40m south of the site. These and two further records beyond 160m occurred before December 2003 and were of category 3 minor or category 4 no impact.

Both the Huddersfield Narrow Canal and the River Colne run east to west through the site. These are in association with another culverted water course and highly developed site drainage. The Groundsure report shows the majority of the surrounding site area to be within an Environment Agency Zone 2 and Zone 3 Flood Plane. The Environment Agency Risk of Flooding from Rivers and Sea (RoFRaS) rating for the area of the river at the south of the site is High. The rating is medium or low for the majority of the associated north site area. Only the northwest corner of the site remains without classification.

5.5 Mining & Quarrying

A Coal Authority Consultants Coal Mining Report was obtained on the 8th August 2019 (see appendix 2). which states that the site is in an area that is not affected by past, present or future underground coal mining.

No mine entries have been identified within 20m of the site.

The Groundsure Geo Insight Report (appendix 3) records areas of Historical Surface Ground Working. These include the delineated areas of both the Huddersfield Narrow Canal (Site North) and the River Colne (Site South). The report also shows historical underground working for a railway tunnel located 150m to the north. The Rough Rock Sandstone which exists below the south and west site areas is associated with non-coal mining typically in the form of sandstone quarries or mineral veins, however at the site location, at the edge of the outcrop, it would be considered highly unlikely.

No quarrying has been identified within 250m of the site.

In general accordance with Local Authority Development Plan Documents, consideration has to be given to the extraction of any identified mineral resources prior to permanent redevelopment. Given the small site area being considered and the urbanised nature of the surrounding area, it is not considered feasible to extract any potential shallow depth mineral resources prior to redevelopment of the site.

6.0 ENVIRONMENTAL SEARCHES

6.1 Sources of Information

To determine the presence of any recorded sources of potential contamination a Groundsure Enviro Insight Report (see Appendix 4). In addition, a search of in-house LCC landfill and environmental data was carried out.

6.2 Current Land Use

A substation is recorded within the south of the study site area and twelve industrial sites are recorded from 4m to 50m of the site boundary. In record order, these include vehicle repair, testing and servicing, scrap metal merchants, unspecified works or factories, new vehicle parts or accessories, industrial coating, blacksmiths and metal working.

A further forty four are within two hundred fifty metres and include substations, motoring, warehouses, depots and numerous unspecified industrial uses. The Huddersfield Narrow Canal is listed twelve times as an onsite historical ground working. An obsolete fuel garage is located at 60m north west of the site area.

From the Groundsure Report no authorized activities are recorded within five hundred metres of the site boundary. These include IPC Authorisations, Part A (1) and IPPC Authorised Activities, Red list Discharge Consents, List 1 and 2 Dangerous Inventory Sites, Part (A) and Part (B) Activities and Enforcements, Category 3 or 4 Radioactive Substances, Water Industry Referrals, Planning Hazardous Substance Consents or Enforcements, COMAH or NIHHS Sites or Sites Determined as Contaminated Land under part 2A of the Environmental Protection Act 1990.

6.3 Historical Land Use

One substation and one sewerage overflow are recorded within the defined site boundary, however numerous other drainage records are located in the south site area and before any site work, and these should be more fully understood.

Throughout history the site has comprised the towing path, wharves and banks of the Huddersfield Narrow Canal (north) and industry along the River Colne (south). The associated land has been recorded twelve times as potentially infilled from historical mapping comparison. A railway viaduct has always crossed the west site area.

The review of archives has shown the site to have been used as a series of roadways since before Ordnance Survey information. The review has also shown that at least six unspecified mills, works, and depots, have entered the site area. Historically a Tramway Depot came within 15m east of the site and at least four sites within 50m have been recorded multiple times either as historical garages or motor vehicle repair.

6.4 Landfill and Waste Sites

The Groundsure Report does not show any landfill records within 900m of the site. Three records for a Scrap Yard are however located inside the defined north west tip of the site area. An Environment Agency Licenced Waste Site for metal recycling is recorded at 4m north of this location. The address is The Triangle, Paddock Foot, Huddersfield, HD1 4RY. This is for vehicle dismantling under Licence Number ISL001 61032. A similar record exists at 96m north west but is not considered to affect the study site.

6.5 Infilled Ground

The Huddersfield Narrow Canal and associated waterways are listed twelve times under potentially infilled ground. A historical railway crosses the west site area and filled cellars could exist in the north site area, along the north side of Longroyd Lane.

6.6 Radon

The site is not shown to be in a Radon Affected Area as defined by the Health Protection Agency (HPA), as less than 1% of properties are above the Action Level. No radon protective measures would be considered necessary for new buildings.

7.0 PRELIMINARY CONCEPTUAL SITE MODEL

7.1 Introduction

The preliminary Conceptual Site Model (CSM) highlights the possible linkages between potential contaminants, potential migration pathways and the identified future receptors, using the source – pathway – receptor model. Definitions of the three elements of the model are given in Table 2.

Table 2: Source – Pathway – Receptor Definitions

Source	A substance that is above, on or under land and could pose potential harm or adversely affect an identified receptor, or cause pollution to controlled waters.
Pathway	The physical means by which contaminants may reach the receptor.
Receptor	The identified element (can be animate or inanimate) that could be adversely affected by the contaminant.

It should be noted that all three of the elements are required in order for there to be a potential risk. Where all three elements are deemed to be present, the risk is a function of the probability of the event occurring and the potential consequence should the event occur. A risk matrix for the CSM is provided in Appendix 6.

The CSM has identified the most sensitive receptor for each potential source of contamination and the most likely critical pathway between the source and receptor.

A preliminary conceptual model of the source-pathway-receptor linkages has been developed based on the information derived from the desk study for the site, and is also included as Appendix 6.

7.2 Plausible Migration Pathways

Where a series of potential migration pathways may exist between a potential source and identified receptor (see Table 3), the conceptual model has highlighted the most likely migration pathway between the source and receptor.

Table 3: Summary of Potential Pollution Linkages.

Potential Source	Plausible Pathways	Possible Receptors
Made Ground and Soils (metals and PAH). Mineral oil and fuel spillages.	Inhalation of dust, vapours and migration off site.	Site users Construction workers
	Dermal contact Ingestion of soil and indoor dust Inhalation of vapours (indoor and outdoor)	Construction workers (to be assessed as part of the CDM Regulations)
	Leaching to groundwater. Migration through any remain granular deposits.	Groundwater surrounding land.
	Surface water run-off	Surface waters (Canal/ River Colne)
	Direct contact with substructures	Buildings / structures (Sulphate attack)
Made ground, organic matter.	Migration of ground gases through soil void spaces.	Construction workers in confined spaces any proposed bus shelters.

7.3 Critical Receptors

It is considered that a Public Open Space and Parks Land Use is the most appropriate for the site. Based on this, the most critical receptor would be a site user.

There is also a lesser potential for construction workers to come into contact with any contamination through pathways such as dermal contact, ingestion of soil or inhalation of vapours.

At this stage, the preliminary CSM has determined whether a potentially significant risk exists to the critical receptor that would warrant further investigation or assessment. Tabulated summaries of both the CSM and risk matrix are presented in Appendix 6.

8.0 CONTAMINATED LAND RISK ASSESSMENT

8.1 Introduction

The proposed layout is appended to this Phase I Desk Study assessment as part of Figure 2. No permanent buildings are proposed and it is recommended that a Public Open Space and Parks Land end use should be adopted as part of any Generic Quantitative Risk Assessment (GQRA).

8.2 On-site Contamination

From the current and previous use of the majority of the site as roads within engineered canals and industrial surrounding, there is expected to be thicknesses of made ground present. This could include historically filled cellars, areas of fill on a thin strip of land between the canal (north) and river (south) or reworked ground below the canal and channelled sections of the river.

An intrusive investigation and associated chemical analysis will be required to refine the potential risks to critical receptors and should include testing for materials such as asbestos and chemicals

such as heavy metals and PAH. Based on the historic setting of the site, without specific targeted chemical testing data for the proposed development, the risk to future site users is considered to be Medium to Low.

8.3 Off-site Contamination

Several recorded areas of potential deep made and infilled ground have been identified within potential influencing distance of the site. The type and depth of fill material deposited below the site is currently unknown. The risk from off-site contamination is considered to be Low at this stage.

8.4 Controlled Waters

The underlying geological sequence is classified as a Secondary A aquifer and no water abstractions directly influenced by the proposals have been identified in the vicinity of the site.

The risk to controlled waters is considered to be Low at this stage. In line with good practice the proposed site works should be isolated from the neighbouring water courses. Any ground investigation should include ground water sampling from any seepages encountered within made ground materials that will be at or slightly below workable depths. In addition, an assessment of the leachability of contaminants from on-site soils that will be mobilised by the development should be carried out.

8.5 Waste Disposal

In light of the current development proposals, any excess site soils will need to be disposed off-site in accordance with current regulations. To inform any subsequent materials management at the site, it is recommended to carry out Waste Acceptance Criteria (WAC) testing of existing soils as part of any ground investigation.

8.6 Ground Gases

Presently it is understood no structures are proposed for the site, however if this changes an additional intrusive investigation and post-investigation ground gas monitoring will be required to confirm the risk classification and assess the nature and extent of any necessary gas protection measures. Potential sources for ground gas generation have been identified from deep made ground. The current risk from these potential sources is considered to be Low.

9.0 ENVIRONMENTAL CONSIDERATIONS

9.1 Overview

The initial CSM has shown there is potential for contamination from any made ground present on the site. An intrusive ground investigation is recommended to confirm the potential risk to identified critical receptors. On completion of the ground investigation the CSM should be refined and the scope of precautionary measures amended accordingly.

9.2 Soft Landscaped Areas

Depending on the chemical suitability of the existing on-site soils and the detailed development proposals, remedial measures may be required for any areas of soft landscaping. On completion of an intrusive ground investigation and GQRA, the requirement for and extent of remedial measures should be reassessed.

9.3 Construction Workers

Construction workers should take standard precautions to protect against any contaminants in the underlying soils, including maintaining good standards of personal hygiene whilst working on site. If worker access is required into any deep excavations in made ground; monitoring should be carried out for ground gases as a precautionary measure.

9.4 Controlled Waters

Based on the historical and geological setting of the site, the risk to controlled waters is currently regarded as low. This will need to be revised on completion of an intrusive ground investigation that should include sampling of shallow groundwater encountered within and slightly below the proposed future works.

9.5 Ground Gases

It is understood that no buildings are proposed at this time, however if this changes it will be necessary to carry out some ground gas monitoring. A site specific, ground gas risk assessment should then be undertaken.

10.0 GEOTECHNICAL CONSIDERATIONS

10.1 General

For feasibility purposes, the general geotechnical considerations given below are based on the anticipated ground conditions from the available published geological maps and the limited borehole

information of previous investigations. To confirm the actual ground conditions across the particular study site an intrusive ground investigation should be carried out prior to any further design work.

10.2 Mining & Quarrying

The local area is not recorded as having been mined for coal or non-coal minerals. No further investigation with respect to mining or quarrying is required as part of this risk assessment.

10.3 Foundations

The most suitable founding option for any proposed structure or building will be dependent on the type and loading of the proposed structure and the ground conditions present.

GS understand that at this stage only areas of potential highway or vehicle parking are considered for which a mix of construction methods may be considered. It is also presumed that improvements could be proposed for the Longroyd Bridge which looks to have existed since before ordnance survey information.

Investigation for improvements to roads need only consider depths to just below likely subgrade and/or any localized areas of deep fill. Where deep fill such as historically infilled cellars are encountered, these should be investigated in order to propose an appropriate site specific ground improvement before construction. This is most important where excavation and recompaction are likely to be used. Excavation will typically require to be to depths in excess of 2.00m below the finished site levels. Deeper potential made ground, voids and/or resulting high walls should be defined and mitigated within the design.

With respect to areas of the bridge, any ground investigation phase or the following improvements should be preceded by a thorough interpretation of the associated site services, most especially the substation in proximity to the south side of the bridge and also the multiple historical drainage records in this part of the site. Historical drainage features below any new road could have a similar detrimental effect to backfilled cellars or voids.

Deeper foundation solutions, e.g. piles, will be required where any load bearing structures are proposed and deep made ground is present.

The canal and river bridges may be founded on alluvial deposits, which have been assessed to be at moderate risk of compressibility. These would be discounted by constructing any new foundations on competent rock below. One borehole, located north of the bridge encountered superficial deposits

to 3.25m but was notably able to penetrate rockhead to 5.75m suggesting that any piling would require to be at greater depths. Alluvial deposits would also be expected deeper south of this location.

It is proposed to demolish an existing building at the junction of Longroyd Lane with Manchester Road. The historical building foundation should particularly be inspected for the presence of any historically backfilled cellars, most especially where the building is shown to be directly below the proposals.

10.4 Highways and Hard Standing

Without detailed knowledge of the ground conditions across any areas of proposed development, full construction thickness for a founding stratum with <2.5% CBR should be provided at this stage for any proposed highways or pavement areas.

10.5 Excavations

Temporary support is likely to be required in any made ground and also granular deposits. Any cohesive residual soils would be expected to remain stable in the short term. Historical records have shown the south site area to be covered by superficial deposits (River Alluvium) that have a high flooding potential. Historical site drainage features are currently not understood.

10.6 Drainage & Soakaways

Soakways are unlikely given the geology, proximity to watercourses and the urbanised nature of the site and surrounding area.

Any drainage measures should be in accordance with Sustainable Urban Drainage Systems (SUDS) strategy requirements. Following the design of suitable additional site catchment, it may be acceptable to regulators to permit the use of the current watercourses for use as a discharge system. For this reason any near surface ground water encountered from soils onsite at or slightly below depths of the proposals should be sampled and tested.

11.0 RECOMMENDATIONS

Intrusive ground investigation is recommended to confirm the ground conditions under the site and assess the engineering properties of any filled ground for foundation requirements.

A series of contemporary cable percussive boreholes, window samples and trial pits would be recommended across the site, to depths appropriate to the development proposals. As part of the

cable percussive boreholes, Standard Penetration Tests (SPTs) should be undertaken at regular intervals to provide relative strength / density information. To confirm that bedrock has been reached, chiselling should be undertaken for a minimum of one hour following a refusal SPT, followed by a confirmatory SPT. Representative samples of the made ground and natural soils would be collected from each trial pit and cable percussive borehole carried out, for subsequent geotechnical testing.

The scope of laboratory testing required will depend on the ground conditions encountered, but should include sufficient information to assess the engineering parameters of the natural soil for carriageway and foundation design, and the properties of any made ground if it is being considered for potential reuse as sub-base. Soil screening for a basic range of contaminants should be undertaken on any soils likely to be reworked or disposed of. Waste acceptance criteria (WAC) testing should be undertaken to inform any materials management.

Any chemical testing carried out to determine the presence of contamination across the site should include analysis for heavy and semi-heavy metals, spectated polycyclic aromatic hydrocarbons (PAH USEPA 16) and if deemed necessary, spectated total petroleum hydrocarbon (TPH CWG), where any visual or olfactory evidence of such contaminants is identified.

Monitoring wells should be installed in boreholes across the site and a programme of groundwater monitoring undertaken.