PARRS WOOD LANE
EAST DIDSBURY
MANCHESTER



DANDARA LIVING DEVELOPMENTS LTD

REMEDIATION STRATEGY & VERIFICATION PLAN

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Document Verification

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Executive Summary

The Site	The site forms a roughly triangular shaped parcel of brownfield land approximately 0.22 ha (2,200m^2) in area. This site is currently part of a Tesco Superstore car park, located to the north of Parrs Wood Lane, East Didsbury, Manchester. The site is centred near OS grid reference 385466, 3906486. The nearest postcode is M20 5NP. The site has an asphalt surface with some soft landscaping lining the boundaries. The site is accessible to vehicles via the north and west from the Tesco car park and access road, which branches from Parrs Wood Lane. The site and surrounding area history is summarised as; • The site was used as part of the Parrs Wood Bus Depot from circa 1934 to 1989. • An above ground tank is shown around 100m north of the site, associated with the Bus Depot. • A Garage/Petrol Station was formerly located around 75m to the southwest of the site. • The surrounding area road network and general layout has been established since the 1930s. A railway line has been located around 25m from the western boundary since circa 1911. Planning permission has been granted to develop the site with the erection of a 6-storey residential building (Use Class C3) comprising 75 new homes together with ground floor flexible community space, car parking, cycle parking as well as landscaping, highways and other associated works.
Previous Work	A Phase 1 Desk Study, Phase 2 Ground Investigations (GI), and a human health and controlled waters Detailed Quantitative Risk Assessment (DQRA) have already been completed for this site. Contamination risks are concluded to be low to moderate without mitigation measures. A Construction & Environmental Management Plan (CEMP) has also been prepared for the site, by Dandara Living.
Remediation Objectives & Verification	The recommendations of this Remediation Strategy should be adopted to manage the risks so that they are acceptably low. The following Remediation Objectives have therefore been set to manage potential risks: 1. Maintenance of a watching brief during the development process. 2. Management of Made Ground and waste arisings. 3. Design of below ground concrete. 4. Installation of piled foundation 5. Gas Protection Measures including a Low Permeability Hydrocarbon Vapour Membrane 6. Validation of imported topsoil/subsoil for landscaped areas. 7. Liaison with the public water supplier regarding potable water supply piping. The Principal Contractor is responsible for ensuring that the above objectives are actioned

	during the construction works, including submission of information to MMC, as outlined in this document. An independent consultant, such as Westlakes, should be engaged by the Principal Contractor to verify that the works have been completed in accordance with this Remediation Strategy. All parties should be suitably qualified and experienced relevant to their remediation and verification roles. Validation records should be passed to the Local Authority to enable the discharge of related planning conditions.
Conclusion	The above objectives are discussed in greater detail within this report. Each objective should be validated, and the records passed onto the Environmental Protection Department of the Local Authority (Manchester City Council).

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1. Site Location Plan
2. Proposed Ground Floor Plan Including Landscaping
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1 Introduction

Westlakes Environmental, as a division of Westlakes Engineering Limited, has been commissioned by Dandara Living Developments Limited to produce a Remediation Strategy for a site at Parrs Wood Lane, East Didsbury in Manchester.

Planning permission has been granted for the erection of a 6-storey residential building (Use Class C3) comprising 75 new homes together with ground floor flexible community space, car parking, cycle parking as well as landscaping, highways and other associated works.

1.1 Supporting Documents

The following documents have been produced for the site:

- An initial Factual GI Report (ref. CCG-C-20-11474 dated July 2020) and Phase I Geoenvironmental Report (ref. CCG-C-21-1661-A dated October 2021) by CCG Ltd.
- Phase 2 Ground Investigation Report – Parrs Wood Lane, East Didsbury. Westlakes report ref. 2333-002-002 dated 23/05/2024.
- Additional Contamination Investigation Report – Parrs Wood Lane, East Didsbury. Westlakes report ref. 2333-003-001 dated 09/10/2025.
- Construction & Environmental Management Plan (CEMP) - Parrs Wood Lane, East Didsbury, Manchester M20 5NP Dandara Living Application Ref: APP/B4215/W/23/3314646 Rev 1 dated November 2025.
- Parrs Wood Lane, Didsbury – Planning Application 133746/FO/2022, Planning Condition 8 – Contaminated Land. Westlakes Letter Report 2333/JT/L002 dated 09/01/2026.
- Parrs Wood Lane, Didsbury - Human Health and Controlled Waters Risk Assessment: LNAPL Sources. Geosyntec Consultants Ltd report ref. GCU0400001 dated May 2026.

This Remediation Strategy should be read in conjunction with these reports to obtain a fuller understanding of the site. The reports provide commentary on the site history, potential contamination risks and encountered ground conditions and assess the potential contamination risks at the site.

An initial conceptual site model (CSM) was developed during the Desk Study. This was refined following the phases of Westlakes intrusive GI, the Westlakes generic quantitative risk assessment and the Geosyntec detailed human health and controlled waters risk assessment (DQRA). The latest CSM is presented in Section 2, and takes into account the proposed site end-use, site-specific information, the findings of the Desk Study and all stages of GI, and the human health and controlled waters DQRA.

Remediation Strategy objectives are considered in Section 3 and Verification requirements are discussed individually in each subsection within Section 3 and overall in Section 4.

1.2 Site Description

The Dandara site has until recently formed part of a car park serving the Tesco East Didsbury superstore, and has been acquired by Dandara for development. The site forms a roughly triangular shaped parcel of brownfield land approximately 0.22 ha (2,200m^2) in area. This site is part of a Tesco Superstore car park, located to the north of Parrs Wood Lane, East Didsbury, Manchester. The site is centred near OS grid reference 385466, 3906486. The nearest postcode is M20 5NP.

A Site Location Plan is presented in Appendix 1.

The site is used as part of a Tesco car park and has an asphalt surface with some semi-mature and mature trees lining the southern and northern boundaries, along with smaller shrubs. The site is accessible to vehicles via the north and west from the Tesco car park and access road, which branches from Parrs Wood

Lane. The site is relatively level at around 38.25m to 38.50m AOD, with the car parking areas set to fall gently towards the surrounding drainage channels.

The site surroundings are summarised as follows:

North	Tesco Superstore car park and the main Tesco building is located approximately 75m to the north with a Metrolink line running west-east further north, approximately 175m north of the site.
East	Kingsway main road (A34) with Metrolink park and ride car parking beyond and residential streets and housing further east.
South	Parrs Wood Lane (A5145) is located immediately to the south and then an area of landscaping. Slightly farther to the southeast is the A34 with a cinema and commercial units to the southeast. East Didsbury rail station is located approximately 175m to the southwest.
West	The main access route into the Tesco car park is located immediately to the west. A railway runs north-south approximately 25m west of the site boundary, with housing and some commercial units further west.

1.3 Intended Future Use

Planning permission has been granted to develop the site with the erection of a 6-storey residential building (Use Class C3) comprising 75 new homes together with ground floor flexible community space, car parking, cycle parking as well as landscaping, highways and other associated works.

The plan in Appendix 2 shows the ground floor and landscaping arrangement of the proposed development.

There is no existing topsoil on site suitable for reuse, and topsoil/subsoil will need to be imported for landscaped areas.

Groundworks would be associated with development including installation of piled foundations, which would be required to support the new buildings and would need to be founded within the underlying sandstone bedrock. A piling mat would also be required across the site to facilitate operation of a piling rig.

1.4 Historical Context

The Desk Study discusses the site and surrounding area history; and the following is noted here.

- The site was used as part of the Parrs Wood Bus Depot from circa 1934 to 1989.
- An above ground tank is shown on historic maps around 100m north of the site, associated with the Bus Depot.
- A Garage/Petrol Station was formerly located around 75m to the southwest of the site.
- The surrounding area road network and general layout has been established since the 1930s. A railway line has been located around 25m from the western boundary since circa 1911.

Figure 1 shows an OS mapping extract from 1958 recording the above historical uses.

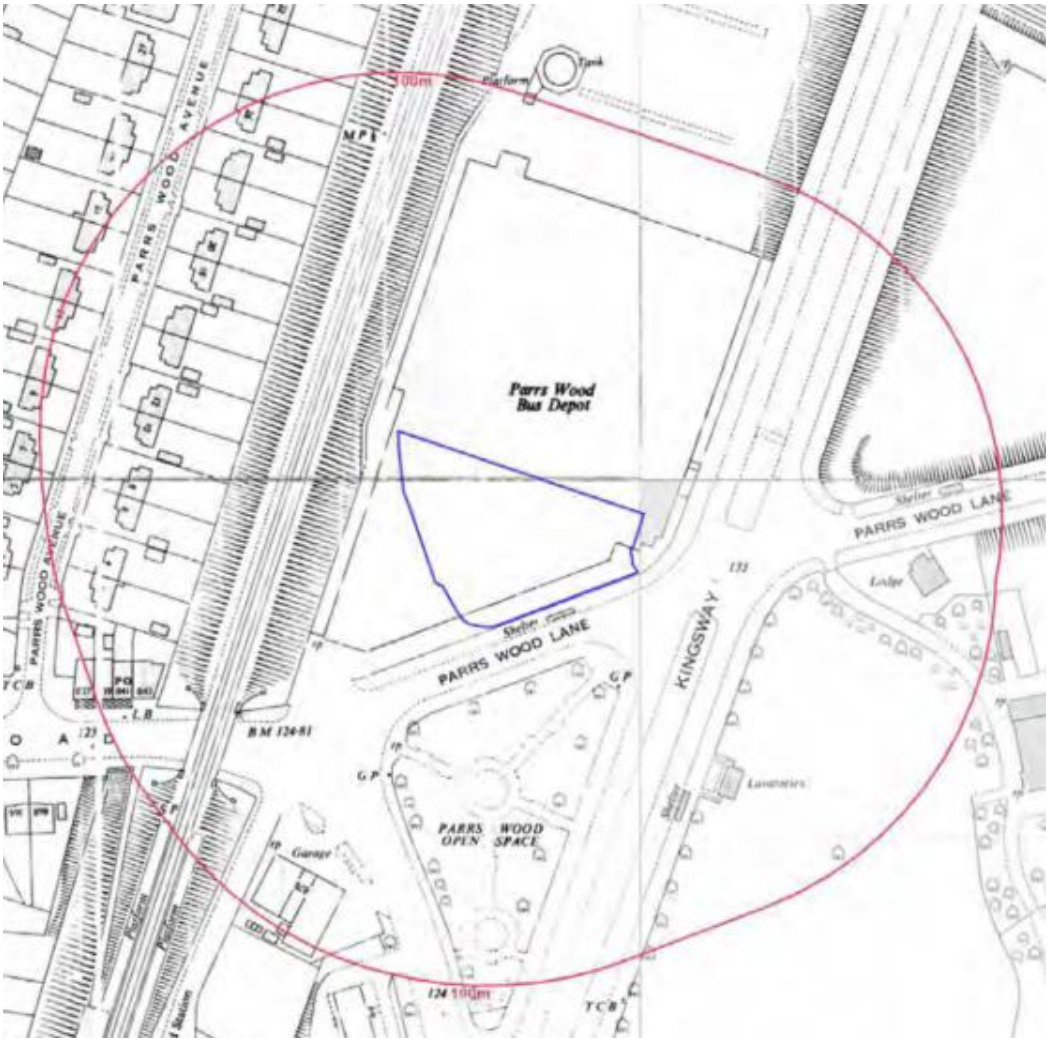


Figure 1: OS Mapping Extract – 1958

Historically (from 1934 to 1989), the entire Tesco East Didsbury site was the location of the Parrs Wood Bus Depot.

The bus depot was therefore much larger than the extent of the Dandara site, and would presumably have had on-site refuelling facilities, most probably using diesel fuel. In December 2023, after the initial discovery of contamination during GI, the GMFRS Petroleum Officer was contacted by Westlakes but they stated that they held no records of historic tank locations for the site.

1.5 Ground Investigation Summary

An initial phase of GI was undertaken in June 2020 by CC Geotechnical Limited (CCG) which was discussed within their Factual GI Report (ref CCG-C-20-11474 dated July 2020). A Phase 1 Geo-Environmental Desk Study report (ref CCG-C-21-1661-A dated October 2021) was subsequently produced by CCG. These documents were submitted in support of the planning application for the proposed development.

Following the award of planning consent, Westlakes were commissioned by Dandara to undertake further Phase 2 GI to gather data for foundation design as well as to supplement the geo-environmental data gathered previously. GI was commenced in November 2023 but was aborted on finding evidence of unexpected hydrocarbon contamination. Limited data was obtained during the GI as a result and the extent of contamination on site was not determined. As such, additional GI was arranged to supplement the existing chemical data, to explore whether hydrocarbon contamination was site-wide or localised, and to complete

the collection of geotechnical data for foundation design. This included mitigation measures, including aquifer protection, to prevent mobilisation of any contamination encountered, cross contamination, or exposure for site workers and users.

The additional GI was undertaken by Westlakes in February 2024, the findings of which were presented in a Phase 2 GI Report (2333-002-002 dated 23/05/2024). Hydrocarbon contamination was recorded in soil leachate results and within superficial aquifer groundwater, and to a limited extent in the bedrock aquifer groundwater collected from across the site. Dandara notified Tesco of the discovery of hydrocarbon contamination on their site and provided them with a copy of the Westlakes Phase 2 GI Report.

Following consultation with Tesco, permission was requested by Dandara to undertake additional GI on the wider superstore car park, which was granted by Tesco. This resulted in a further 2025 Additional GI (BH301 to BH303), including further groundwater monitoring and contamination testing, the purpose of which was to assist understanding of the wider ground conditions and the likely source of the identified contamination. The findings of this GI were presented in a subsequent report (ref. 2333-003-001 dated 09/10/2025).

An extract of the GI Plan is included here.



Figure 2: Extract of GI Plan

1.6 Ground Conditions

The encountered ground conditions recorded during the Westlakes GI on the development site are summarised here.

Stratum	Upper Surface From (m bgl)	Lower Extent To (m bgl)	Thickness (m)
Asphalt	Ground Level	0.10 to 0.15	0.10 to 0.15
Made Ground	0.10 to 0.15	0.80 to 3.90[1]	0.80 to 3.90[1]
Superficial Clay	0.80 to 3.90	8.20 to 12.60	0.30 to 4.70
Superficial Sand or Gravel	1.10 to 6.50	10.80 to 12.80	0.20 to 3.80
Weathered Sandstone	10.80 to 12.80	11.30 to 13.80[2]	0.50[2] to 1.50[2]
Groundwater – Superficial	1.60 to 4.00	N/A	N/A
Groundwater – Bedrock	9.00 to 10.50	N/A	N/A

1 Where base of Made Ground was encountered.

2 Base of weathered sandstone not proven.

1.6.1 Surface Hardstanding

A surface covering of asphalt was encountered across the site. Asphalt thicknesses varied from 0.10m to 0.15m.

1.6.2 Made Ground

Made Ground was encountered beneath the asphalt surfacing and extended to between 0.80m and 3.90m bgl. The Made Ground was encountered as broadly five types:

- Subbase was found directly below the asphalt surfacing across the site. The subbase was generally between 0.33m to 0.40m in thickness, however in the area of WS202 and BH202 it was found up to 2.85m thick (WS202 and BH202). The subbase comprised whitish cream, slightly clayey very sandy gravel. Sand was fine to medium. Gravel was fine to coarse, subangular limestone and quartzite.
- Buried reinforced concrete with thin rebar was encountered across most of the site from around 0.50m bgl (BH201 to BH205, SA201, WS201, WS202, WS203, WS204, WS205, WS206). This often hindered the progression of the window sampling boreholes. In the trial pit (SA201), the concrete was broken out and found to be approximately 0.30m thick, extending from 0.50m to 0.80m bgl. This may be indicative of an historical floor slab relating to the previous bus depot on the site.
- A brick and concrete structure, recovered as cobbles of brick and concrete was recovered locally in BH201 from 0.50m bgl up to 1.50m bgl. Deeper buried concrete was encountered in BH202 only from 3.0m to 3.50m bgl. This may indicate the presence of historical foundations, which could relate to the historic bus station building which was formerly present on the site.
- Granular Made Ground was found underlying the buried concrete in all cable percussive boreholes (BH201 to BH205) from 0.70 m to 3.90m bgl. Between 0.70m and 2.80m this comprised fine to coarse gravelly sand or very sandy gravel, underlain by sand and gravel from 2.80m to 3.90m bgl. Gravel was fine to coarse, subangular brick, ash, sandstone and quartzite. Black hydrocarbon

staining and a strong odour was recorded in the granular Made Ground in BH201 from 3.00m 3.50m bgl.

- Cohesive Made Ground was locally (WS201 and BH205) encountered from 0.70m to 1.40m bgl and comprised sandy gravelly clay. Sand was fine to coarse. Gravel was fine to coarse, subangular brick, concrete, cinder, sandstone and quartzite. Ash content was noted.

1.6.3 Superficial Deposits – Glaciofluvial Deposits

Superficial deposits were encountered in 7 of the exploratory hole locations, SA201, WS201 and BH201 to BH205, as the other positions did not progress beyond the Made Ground due to concrete obstructions and refusals in the overlying Made Ground.

The upper surface of the superficial deposits was exposed at depths from between 0.80m (WS201) to 3.90m (BH201) and were encountered to a maximum depth of 12.80m bgl (BH202), where the base of the superficial soils was encountered. British Geological Survey (BGS) 1:10,000 scale mapping shows the site to be underlain by superficial 'drift' deposits of Glaciofluvial Sheet Deposits.

The encountered superficial deposits comprised both cohesive material and granular material. These were generally encountered as interbedded strata to the base of the superficial deposits. The following subsections characterise these two types of deposits in terms of physical properties.

1.6.4 Cohesive Glaciofluvial Sheet Deposits

The cohesive Glacial Till comprised firm to stiff sandy gravelly clay with variable silt and cobble content generally becoming very stiff from 5.0m bgl. Locally in BH202, laminated silty sandy clay was encountered from 12.0m to 12.60m bgl.

In BH201, natural ground was not encountered until 3.9m bgl, where mainly cohesive soils were encountered with thin sand lenses of up to 200mm recorded within the clay below 6.50m bgl to 8.45m bgl, where the borehole was terminated. In BH202 and BH205 more granular material was encountered as discussed in the next section.

1.6.5 Granular Glaciofluvial Sheet Deposits

Granular Glaciofluvial Sheet deposits were recorded across the site in four exploratory hole locations (BH202 to BH205) as well as the thin sand lenses recorded within BH201 from 6.50m bgl to 8.45m bgl.

At shallow depths above 5.0m bgl these granular deposits typically comprised very sandy gravel or sand and gravel with variable silt and clay content. The gravels included sandstone, mudstone and granite. Locally, cobbles were encountered of sandstone and granite in some granular material. Below 5.0m bgl, granular material generally comprised clayey silty sand with variable gravel content. Locally, BH202 and BH205 recorded coarse granular material comprising sandy gravel or sand and gravel with silt and clay content at depths between 10.30m and 12.80m bgl. It is also noted that the cohesive material commonly included thin bands of silty sand or sandy silt (50-200mm thick) within the clay from depths of 6.50m bgl up to 12.00m bgl across the site.

1.6.6 Chester Formation

Weathered deposits of the Chester Formation comprising sandstone bedrock were encountered during the GI at depths from 10.80m up to 13.80m bgl. Generally, the completely weathered sandstone was recovered as clayey gravelly sand including gravels of subangular sandstone, and with depth angular cobbles of sandstone were recovered below 12.20m bgl.

During drilling, recovered material from the weathered deposits of the Chester Formation in BH202 to BH205 were not recorded to exhibit a hydrocarbon odour.

1.6.7 Groundwater

Groundwater monitoring has been undertaken in the installed groundwater monitoring wells since 2023 (see GI reports and Geosyntec risk assessment for details).

Wells installed in the superficial soils have recorded groundwater levels ranging between 1.53m to 4.18m bgl (34.19m to 36.98m AOD).

Wells installed within the bedrock have recorded groundwater levels ranging between 6.00m to 7.64m bgl (30.88m to 31.83m AOD). Based on the depth to bedrock (10.80m up to 13.80m bgl), these levels may indicate semi-artesian conditions within the deeper aquifer.

1.7 Historic Contamination Observations

During the Westlakes initial GI on the Dandara site in late 2023, no signs of significant contamination were observed during the drilling of the shallow window sampling boreholes or during excavation of the shallow trial pit for infiltration testing. However, the maximum depth of these shallow exploratory positions was 3.0m bgl.

The Westlakes initial GI had originally anticipated the progression of 2 deep cable percussive boreholes to 20m bgl or rockhead, whichever was shallower, to facilitate collection of deeper geotechnical data for pile foundation design. However, a notable hydrocarbon odour and staining was observed during drilling the first borehole (BH201) and works were therefore stopped, to avoid potential mobilisation of contamination, until results of contamination analysis had been received.

Following confirmation of the presence of contamination, the original proposal of 2 deep boreholes was revised to include more data points for chemical sampling and monitoring across the Dandara site to determine if contamination was site wide. The subsequent Phase 2 Intrusive GI in 2024 therefore comprised 4 cable percussive boreholes, completed using contamination mitigation measures. The boreholes were all progressed through the Made Ground and Superficial Deposits and into the top of the underlying Bedrock.

Observations of hydrocarbon contamination were noted whilst drilling all cable percussive boreholes across the site (BH201 to BH205), as follows:

- In BH201, black hydrocarbon staining and a strong hydrocarbon odour was noted in Made Ground between 3.00m and 3.50m bgl.
- In BH202, hydrocarbon odour was noted on recovered concrete cobbles from Made Ground from 3.00m to 3.50m bgl.
- In BH202 to BH205, hydrocarbon odour was noted in natural soils (sand, gravel and clay) recovered below 3.50m and generally becoming stronger with depth up to 10.00m bgl.
- In all cable percussive boreholes (BH201 to BH205), the most notable hydrocarbon staining, odour and sheen was observed at depths of recorded water strikes, and where water was recovered from the boreholes during the drilling process.
- In BH202 to BH205, the hydrocarbon odour became weaker generally below 10.00m bgl, but was still noticable.
- In BH202 to BH205, no visual or olfactory evidence of contamination was noted in the weathered sandstone of the Chester Formation, recovered below 10.80m bgl.

During the drilling of BH202 to BH205, a photoionisation detector (PID) was used to measure VOC concentrations from recovered soil at regular depth intervals from 1.00m bgl (Made Ground) to 13.00m bgl (Weathered bedrock). The highest VOC concentrations (149ppm to 338ppm) recorded were from recovered soil between 5.50m and 9.00m bgl. The highest recorded VOC concentration was 338ppm in BH204 at 7.50m bgl.

Similar observations were also noted on groundwater during the development, purging and sampling of a number of the historic boreholes.

Elevated PID readings were recorded in a number of the historic boreholes, during VOCs monitoring (see GI reports for details).

Possible free product was detected by oil-water interface probe measurements in historic boreholes BH01 and BHC.

Additionally, during the 2025 GI and monitoring of the 3 boreholes to the north of the Dandara site on the Tesco car park, hydrocarbon odours, sheens and discolouration was observed and elevated PID readings of VOCs were recorded.

Hydrocarbon odours and reducing odours were noted from a number of monitoring wells during the 2026 Geosyntec groundwater monitoring and sampling visit.

The Geosyntec DQRA conclusions noted that area upgradient of the site is also impacted by hydrocarbons and data from this area has been used in that report to inform the evaluation of risk. There were no clear distinctions in the data from off and on-site wells, albeit the PAH exceedances were in an off-site well (BH303) The wider area is similarly impacted to that within the site boundary. The offsite chemical impacts are of a similar nature and also not likely to be mobile.

Figure 2 above shows the exploratory hole locations.

1.8 Gas Risk

On-site Made Ground was identified as a potential source of ground gas, along with the potential for migration of ground gases from Made Ground within the surrounding area. In addition, hydrocarbon vapours were also identified as a potential gas risk, based on the ground conditions and contamination observations encountered.

A programme of 7 ground gas monitoring visits were undertaken in accordance with CIRIA Guide C665. The monitoring visits were completed between 30th November 2023 and 22nd April 2024.

During each monitoring visit, the atmospheric pressure, flow rate, methane, carbon dioxide and oxygen concentrations were recorded, along with the groundwater level. Additionally, due to the observed evidence of hydrocarbon contamination, a Photoionisation Detector (PID) monitor was used to measure VOC concentrations from all the boreholes and an oil interface probe was used to check if any free hydrocarbon product was present within the groundwater column.

Additionally, on Visit 7 (22/04/2024), a VOC filter was added to the gas monitor to mitigate potential interference arising from the VOC fluxes in some of the boreholes with the gas analyser, which it was suspected was leading to anomalously high results for methane from the data collected during Visits 4, 5 and 6.

The full gas monitoring results are enclosed in Appendix 8 of the 2024 Westlakes GI report (ref. 2333-002-002).

The proposals are for the ground floor to consist of vehicle parking, a substation and sprinkler tank rooms, which are anticipated to be well vented. Residential accommodation will commence on the first floor. Enclosed public space on the ground floor will comprise the entrance/amenity space only (shaded in brown on the proposed ground floor drawing in Appendix 2).

To meet the requirements of the CS2 classification for both methane and carbon dioxide, gas protection designed in accordance with BS8485:2015+A1:2019, will be required in the entance/amenity area (shaded brown on the plan in Appendix 2) and residential areas. It is not expected to be required in the ventilated areas noted above, It is also recommended that the gas protection should include for a hydrocarbon/VOC membrane.

Details of gas and VOC protection measures are to be produced at detailed design stage, and submitted to MCC for approval prior to construction. Once approved, these are to be installed by a suitably qualified and experienced contractor, and verified independently by a suitably qualified and experienced third party as outlined in Section 3.5. Records of installation and verification will be included in the Verification Report (see Section 3.5).

The site is not in a radon affected area as less than 1% of properties are above the action level. Therefore, radon protective measures are not considered to be required. This is based on assessments by the Health Protection Agency. This should be confirmed with the Local Authority as part of the development process.

1.9 Contamination Findings & Preliminary Risk Assessment

1.9.1 Soils – Human Health Assessment

As detailed in the Westlakes GI reports, soil chemical test results were compared to GAC for a proposed residential end use with no plant uptake using a conservative organic matter content of 1% for Made Ground and 1% for natural soils.

The soil results were generally below the GACs. However, within the Made Ground and natural soils there were some exceedances in some fractions of TPH and one PAH compound, namely naphthalene. All other contaminants tested were below the GAC for human health.

No BTEX fractions recorded exceedances when compared to the relevant GACs.

Most VOCs results were below the Limit of Detection (LOD), therefore having very low concentrations. However, seven samples of natural soils recorded BTEX above the LOD, but were below the GAC and are therefore not considered to be of risk to human health. It is also noted that some VOC fractions were also recorded above the LOD, but have no available GAC. The concentrations are low and therefore the risk to human health is also considered to be low.

SVOCs were also generally below or only slightly above the LOD. Nine samples of natural soils recorded some species of SVOC above the LOD which were typically Polycyclic Aromatic Hydrocarbons (PAH), such as naphthalene, as previously mentioned. A PAH compound without a published GAC, 2-Methylnapthalene recorded the highest concentrations in the 9 samples. The risk from this is considered to be enveloped within the assessment of naphthalene and is therefore not considered further.

Asbestos was not detected within any of the samples.

Based on the data available, risks to human health for future site users appear to be generally low, but there are elevations of hydrocarbons and naphthalene which present more of a moderate risk and therefore the following is noted.

Elevated hydrocarbons were recorded within natural soils exceeding the GACs for human health. The recorded exceedances of hydrocarbon fractions were within samples of natural soil at 7.50m bgl, and as such these are unlikely to mobilise upwards to surface, and consequently there would be no pathway to the receptor and therefore the pollutant linkage would be broken. However construction activities forming piled foundations may bring these soils to the surface, which could become intermixed with residual soils remaining on site.

PAHs in the form of naphthalene were elevated in some of the Made Ground and natural ground. The PAH contamination recorded in the Made Ground presents an elevated risk when considering possible contact of site soils with future site users, and it would therefore be prudent to increase the risk to human health from site soils to moderate.

1.9.2 Soils – Potable Water Supply Assessment

The soil sample results have been compared to the UKWIR assessment values for PVC and PE potable water supply pipes.

Some Made Ground samples exceeded the GAC for SVOC for both PVC and PE piping.

Samples of natural soil from four locations exceeded the GAC for VOC, particularly relating to BTEX compounds.

The mineral oil GAC for C11-C20 was also exceeded in some samples of Made Ground and natural soils.

Additionally, most Made Ground and natural soil samples recorded pH values >8 and positive redox potentials, indicating ground conditions could be corrosive to copper pipes.

It is considered that PVC and PE pipes may not be suitable for use at this site due to the presence of hydrocarbons and therefore barrier piping is recommended. This should be confirmed with the local water supplier, United Utilities, and a copy of this report provided for their records.

1.9.3 Soils – Plant Health Assessment

Concentrations of copper, nickel and zinc, which can be particularly phytotoxic, were compared to plant health GAC. No samples of Made Ground or natural soils exceeded the plant GAC. Risk to plant health from the soils on site is considered to be very low. However, there is no suitable topsoil on site for reuse for plant growth. Topsoil/subsoil will need to be imported to form landscaped areas.

1.9.4 Controlled Waters Assessment

The site is underlain by superficial Glaciofluvial Sheet Deposits, recorded as a Secondary A Aquifer. The underlying bedrock is sandstone of the Chester Formation, which is recorded as a Principal Aquifer. The groundwater body catchment relating to the site under the Water Framework Directive is identified as the Manchester and East Cheshire Permo-Triassic Sandstone Aquifers.

The site is not within a Source Protection Zone. There are no groundwater or surface water abstraction licenses within at least 1km of the site. There is no potable groundwater abstraction recorded within at least 2km of the site. There are no surface water features or main rivers within 250m of the site.

The nearest main river is identified as the River Mersey which is located approximately 600m to the south. A small stream is located around 400m to the south, which is likely a tributary to the River Mersey. It is considered that the groundwater flow direction within the superficial aquifer would be towards the direction of the river (south/south-east/south-west) and this is consistent with the groundwater monitoring results from the shallow installations.

The primary receptors when considering the risk to controlled waters at this site are the underlying aquifers.

Concentrations of cadmium, copper, chromium, lead and zinc are elevated in the shallow groundwater beneath both the Tesco car park and the Dandara site.

The GAC for copper is considered to be very conservative and copper can be naturally occurring. Additionally, cadmium, chromium, lead and zinc may be naturally occurring, and elevated leachable concentrations of metals were detected in natural superficial soil samples.

The site is a substantial distance from surface watercourses and the concentrations of metals in the groundwater, although elevated, are not considered to be of significant risk to controlled waters.

Elevated concentrations of PAH and TPH contamination were found to be present in the groundwater in all boreholes screened within the superficial deposits, with the exception of BH204s. These concentrations of hydrocarbons were significantly elevated, often by several orders of magnitude.

BH301s, BH302s and BH303s recorded significantly elevated hydrocarbon concentrations, indicating significant contamination in the shallow groundwater beneath the Tesco car park, north of the Dandara site. BH303s also recorded the highest VOC monitoring results by PID during the 2025 monitoring programme.

The groundwater sample recovered from BH201d at 2.67m bgl recorded significantly elevated concentrations of TPH fractions. However, given the depth of the groundwater in this well that the sample

was retrieved from, and the depth range of the deeper response zone (4.00 – 7.00m bgl) it is likely that this installation is in hydraulic continuity with the shallow perched groundwater, and not the deeper aquifer.

Hydrocarbon contamination was significantly elevated in BH01 and BH201 (correlating with the 2023 and 2024 results), and BH205 (correlating with the 2024 results). Free product may also have been detected in BH01 during the 2025 monitoring programme.

The exceedances, within the boreholes installed in the superficial strata, are up to 5 orders of magnitude greater than the UK Drinking Water Standard (DWS) GACs (and where available, the EQS GACs). Even considering the use of overly conservative UK DWS GACs, this is still evidence of a potential risk to controlled water receptors. This is also supported by the exceedances of TPH Total Aliphatic and Aromatic Hydrocarbons, which are up to several orders of magnitude greater than the UK DWS, indicating that the groundwater is contaminated.

Elevated concentrations of metals were detected in the sample from BH303d, albeit at similar levels to those recorded in the shallow installations. Elevated copper was also detected in BH205d. Elevated concentrations of zinc were recorded in 4 of the deeper samples, which may indicate it is naturally occurring.

Although to a lesser degree than the shallow installations, 6 of the 7 boreholes screened within the bedrock stratum recorded some elevated concentrations of PAH or TPH, with the exception being BH202.

The exceedances within the boreholes installed in the weathered bedrock strata are generally 1 order of magnitude higher than the UK Drinking Water Standard (DWS) GACs or EQS where available). It is therefore concluded that the contamination previously encountered in the deep aquifer on the Dandara site is also present on the Tesco land to the immediate north.

1.10 Sulphate Precautions

The site is classified as brownfield, water is assumed to be mobile and soil pH was found to be >6.5 in all of the 38 samples tested. The results showed the following:

Stratum	Water Soluble SO_4 2:1 Extract (mg/l)	Total Potential Sulphate (TPS) (%)	Classification
Made Ground (13 samples)	7.6 to 197	0.023 to 0.207	DS1:AC1
Glaciofluvial Deposits (22 samples)	6.5 to 61.20	0.015 to 0.237	DS1:AC1
Weathered Sandstone (3 samples)	9.21 to 16.80	0.015 to 0.017	DS1:AC1

Oxidisable sulphides were less than 0.3%, consequently oxidisable sulphides are unlikely to be present.

The sulphate classification has been assigned considering the number of samples tested and BRE Special Digest 1 guidance.

However, based on the hydrocarbon contamination detected, the below ground concrete classification should be increased, especially if in contact with groundwater, such as the proposed piled foundation solution. Additional protective measures may also need to be considered, and this should be assessed by a suitably qualified person.

1.11 Contamination Summary

Observations of hydrocarbon contamination were noted whilst drilling all cable percussive boreholes across the Dandara site. This included strong hydrocarbon odours, grey discolouration and sheens, and elevated PID measurements of VOCs. Possible free product was detected in historic borehole BH01 by interface probe.

Groundwater was encountered within the superficial soils and also within the deeper bedrock. Samples of groundwater taken from the superficial aquifer at between 2.65m to 4.18m bgl were found to be considerably contaminated with hydrocarbons, specifically PAH and some TPH fractions.

Samples of groundwater taken from the deeper bedrock aquifer at around 6.00m to 7.64m bgl, following the later installation of deeper wells, were found to be similarly contaminated, although to a lesser degree.

Soil samples taken from within the Dandara site recorded elevated leachable concentrations of the same contaminants.

Groundwater samples taken from the 2025 shallow installations to the north recorded significantly elevated hydrocarbon concentrations, indicating contamination in the shallow groundwater beneath the Tesco car park. It appears that the contamination previously encountered in the shallow aquifer on the Dandara site is also present on the Tesco land to the immediate north. Again, samples taken from the deeper aquifer were found to be similarly contaminated, although to a lesser degree.

Contamination is therefore not considered to be within a localised area, and appears to be widespread. The findings of the 2025 GI have also been shared by Dandara with Tesco.

Following review of all data collected from the site, it is considered that the superficial aquifer underlying the site is contaminated. Groundwater samples from the bedrock aquifer have recorded elevated metal and hydrocarbon concentrations but to a much lesser degree.

The contaminants detected in groundwater samples from the 2025 GI are broadly the same as those detected in previous stages of GI, although the elevations of hydrocarbon contaminants are often lower than those recorded in 2023 and 2024. However, it can be seen from the 2025 results that contaminant levels at the site remain considerably elevated, with some of the highest concentrations recorded in BH301 to BH303 on the Tesco car park.

The risk to controlled waters was initially considered to be moderate to high, due to the presence of elevated hydrocarbon contamination recorded in soil leachate results and within superficial groundwater, and to a limited extent in the bedrock groundwater collected from across the site.

The source of contamination is unknown but it is considered to be likely associated with the historical land use as a bus depot. The level of contamination was considered to warrant the undertaking of a DQRA.

1.12 Geosyntec Human Health and Controlled Waters Risk Assessment

Geosyntec were commissioned to undertake a Human Health and Controlled Waters Risk Assessment (report ref. GCU0400001 dated May 2026). The DQRA considers the residual risk to human health and controlled waters by considering the properties of the contamination, the age of the contamination, and the evidence for natural attenuation occurring, and should be read in conjunction with this Remediation Strategy to fully understand the residual risks. The report concluded:

The site is impacted by Light Non Aqueous Phase Liquids (LNAPL). However, it does not pose a risk to the wider environment or to end users. The LNAPL is immobile and the dissolved hydrocarbons are degrading. The geology and hydrogeology are such that there is no likely viable pathway to reach viable off-site receptors. Therefore, the LNAPL does not pose an unacceptable environmental risk to end users. It should be noted that area upgradient of the site is also impacted by hydrocarbons and data from this area has been used in this report to inform the evaluation of risk. There were no clear distinctions in the data from off and on-site wells, albeit the PAH exceedances were in an off-site well (BH303) The wider area is similarly

impacted to that within the site boundary. The offsite chemical impacts are of a similar nature and also not likely to be mobile. A construction-specific environmental management plan may however be needed to control the risks to site workers during the development. A plan for further unidentified contaminated materials management for off-site disposal or on-site reuse is required. This risk assessment has shown that there is an absence of risk to controlled water and human health end users.

It is therefore considered that the ground conditions and contamination status of the site currently present no potential risk to end users (future residents or visitors) or controlled waters (the underlying aquifers and surface water, ie. the River Mersey).

However, there may be a risk to construction workers or site users during the development process, and also to potable water supply pipes.

The Remediation Strategy therefore sets out measures to manage the residual risks.

2 Risk Assessment

The site's refined CSM is presented below, showing source-pathway-receptor 'pollutant linkages' potentially present at the site, along with a quantitative assessment of each pollutant linkage. Contamination risks potentially range from low to high, depending on the pollutant linkage. Mitigation measures and resulting residual risk are then considered to be acceptably low provided the Remediation Strategy recommendations are followed.

Potential Hazard	Potential Receptor	Probability	Consequence	Risk Rating	Mitigation and Resulting Residual Risk (RR)
Potential for unforeseen contamination in areas of site not investigated	Humans: construction workers	Likely	Medium	Moderate	Risk lowered by appropriate PPE and good hygiene and working practices. **(RR = Low)**
	Humans: future site users and visitors	Low	Medium	Moderate/ Low	Risk lowered by findings of DQRA. Risk to future site users and visitors removed by introduction of new buildings/ hardstanding and use of a capping layer in landscaped areas. **(RR = Low)**
	Underlying aquifers and nearby River Mersey	Likely	Medium	Moderate	Risk lowered by findings of DQRA. Some Made Ground removed during construction. Risk reduced by building footprint/hardstand limiting infiltration and percolation. Risk reduced by selection of appropriate piling technique, completion of piling risk assessment, piling contractor RAMS adhered to during construction works and continuation of groundwater monitoring during piling operations. **(RR = Low)**
	Vegetation	Likely	Medium	Moderate	Some Made Ground removed during construction. Introduction of a capping layer within landscaped areas. **(RR = Low)**

Potential Hazard	Potential Receptor	Probability	Consequence	Risk Rating	Mitigation and Resulting Residual Risk (RR)
Contamination in Made Ground and superficial soils including leachable heavy metals and hydrocarbons	Humans: construction workers	Likely	Medium	Moderate	Risk lowered by appropriate PPE and good hygiene and working practices. **(RR = Low)**
	Humans: future site users and visitors	Low	Medium	Moderate/ Low	Risk lowered by findings of DQRA. Risk to future site users and visitors removed by introduction of new buildings/ hardstanding and use of a capping layer in landscaped areas. Risks to construction workers reduced/removed by appropriate working practices and PPE. **(RR = Low)**
	Underlying aquifers and nearby River Mersey	Likely	Medium	Moderate	Risk lowered by findings of DQRA. Some Made Ground removed during construction. Risk reduced by building footprint/hardstand limiting infiltration and percolation. Risk reduced by selection of appropriate piling technique, completion of piling risk assessment, piling contractor RAMS adhered to during construction works and continuation of groundwater monitoring during piling operations. **(RR = Low)**
	Vegetation	Likely	Medium	Moderate	Some Made Ground removed during construction. Introduction of a capping layer within landscaped areas. **(RR = Low)**

Potential Hazard	Potential Receptor	Probability	Consequence	Risk Rating	Mitigation and Resulting Residual Risk (RR)
Contamination in Made Ground and superficial soils including leachable heavy metals and hydrocarbons	Below ground concrete	Likely	Medium	Moderate	Risk to below ground concrete lowered by appropriate design classification and consideration of additional protective measures. **(RR = Low)**
Contamination in groundwater including heavy metals and hydrocarbons	Humans: construction workers	Likely	Medium	Moderate	Risk lowered by appropriate PPE and good hygiene and working practices. **(RR = Low)**
	Humans: future site users and visitors	Low	Medium	Moderate/ Low	Risk lowered by findings of DQRA. Risk to future site users and visitors removed by introduction of new buildings/ hardstanding and use of a capping layer in landscaped areas. Risks to construction workers reduced/removed by appropriate working practices and PPE. **(RR = Low)**
	Underlying aquifers and nearby River Mersey	Likely	Medium	Moderate	Risk lowered by findings of DQRA. Some Made Ground removed during construction. Risk reduced by building footprint/hardstand limiting infiltration and percolation. Risk reduced by selection of appropriate piling technique, completion of piling risk assessment, piling contractor RAMS adhered to during construction works and continuation of groundwater monitoring during piling operations. **(RR = Low)**

Potential Hazard	Potential Receptor	Probability	Consequence	Risk Rating	Mitigation and Resulting Residual Risk (RR)
Contamination in groundwater including heavy metals and hydrocarbons	Below ground concrete	Likely	Medium	Moderate	Risk to below ground concrete lowered by appropriate design classification and consideration of additional protective measures. **(RR = Low)**
Elevated VOC vapours from contaminated Made Ground, superficial soils and shallow groundwater	Humans: construction workers	Likely	Medium	Moderate	Risk lowered by appropriate PPE and good hygiene and working practices. **(RR = Low)**
	Humans: future site users and visitors	Likely	Medium	Moderate	Risk lowered by findings of DQRA. Risk to future site users and visitors lowered by installation of gas protection measures and hydrocarbon/VOC membrane in new buildings. **(RR = Low)**
	Future structures	Likely	Medium	Moderate	Risk to future structures lowered by installation of gas protection measures and hydrocarbon/VOC membrane in new buildings. **(RR = Low)**

Potential Hazard	Potential Receptor	Probability	Consequence	Risk Rating	Mitigation and Resulting Residual Risk (RR)
Ground gas within Made Ground	Humans: construction workers	Likely	Medium	Moderate	Risk lowered by appropriate PPE and good hygiene and working practices. **(RR = Low)**
	Humans: future site users and visitors	Likely	Medium	Moderate	Risk to future site users and visitors lowered by installation of gas protection measures and hydrocarbon/VOC membrane in new buildings. **(RR = Low)**
	Future structures	Likely	Medium	Moderate	Risk to future structures lowered by installation of gas protection measures and hydrocarbon/VOC membrane in new buildings. **(RR = Low)**
Elevated VOCs, SVOCs and TPH within Made Ground and natural soils samples, when compared to UKWIR GAC for potable PVC and PE drinking water pipes.	Humans: PE and PVC potable water supply pipes	Likely	Medium	Moderate	Risk removed by appropriate water supply pipe selection **(RR = Low)**

Potential Hazard	Potential Receptor	Probability	Consequence	Risk Rating	Mitigation and Resulting Residual Risk (RR)
pH >8 and positive Eh in Made Ground and natural soils samples, compared to UKWIR GAC for potable copper drinking water pipes	Humans: Corrosion of copper potable water supply pipes	Likely	Medium	Moderate	Risk removed by appropriate water supply pipe selection **(RR = Low)**

3 Remediation Objectives

Based on the findings of the DQRA, it is considered that the risk to both to human health and controlled waters is sufficiently low to enable development of the site. However, the remediation objectives below set out the steps to be undertaken to ensure safe development.

Purpose: To address the potential pollutant linkages and to facilitate successful site development where human health (future site users, members of the public and construction workers, and potable water supply users), controlled waters (underlying aquifers/River Mersey), the general environment/ecology and plant health (plants within landscaped areas) are protected from possible residual contamination risks.

The following remediation objectives have therefore been identified:

1. Maintenance of a watching brief during the development process.
2. Management of Made Ground and waste arisings.
3. Design of below ground concrete.
4. Installation of piled foundations.
5. Gas Protection Measures including a Low Permeability Hydrocarbon Vapour Membrane
6. Validation of imported topsoil/subsoil for landscaped areas.
7. Liaison with the public water supplier regarding potable water supply piping.

Each remediation objective is discussed in detail in the following subsections.

The Principal Contractor is responsible for ensuring that the above objectives are actioned during the construction works. An independent geo-environmental consultant should be engaged by the Principal Contractor to verify that the works have been completed in accordance with this Remediation Strategy.

3.1 Maintenance Of A Watching Brief During The Development Process

Reasoning: To protect human health and controlled waters.

Operation: Due to the unpredictable nature of ground and groundwater conditions, it is possible that localised zones of other contaminated material not previously identified may be found on-site in areas that were not covered by the ground investigation.

This watching brief working method has been developed to assist management of the residual risks.

- All site workers should keep a watching brief to look out for possible signs of contamination during the construction process. The Principal Contractor should inform site workers that localised zones of contaminated material may be found on-site, and if so, the precautions to be taken. This should be addressed as part of each Contractor's Risk Assessment Method Statements (RAMS), and during site inductions and toolbox talks.
- Asbestos awareness training should be provided as a minimum to ground workers and a management system put in place to evaluate asbestos risk and potentially escalate precautions to control any exposure to asbestos in line with the Control of Asbestos Regulations.
- Construction workers should be protected from exposure to asbestos fibres and unforeseen contamination risks. Appropriate working practices should be adhered to, including use of appropriate personal protective equipment (PPE), including P3 category face masks where asbestos is suspected, and adopt good hygiene practices to prevent unnecessary exposure to made or potentially contaminated ground. This should be considered as part of each relevant contractors' risk assessments and method statements, and emphasised at the Sie Specific Induction stage.

- If contamination is suspected, then the Discovery Strategy below should be followed.

Discovery Strategy:

- If oily, ashy, odorous or apparently contaminated material (including discovery of suspected Asbestos Containing Materials) is found, then the Environmental Protection Department of Manchester City Council (MCC) should be informed. A geo-environmental consultant should also be informed immediately by the Principal Contractor, and a suitably qualified and experienced person should attend site and determine what action is required. Samples of the material should be tested under geo-environmental direction to assess if the material is 'contaminated'. The testing regime should be selected depending on the suspected source of possible contamination, and the number of samples determined by the area of contamination. As a minimum two soil samples should be taken and tested.
- Results of the testing should be compared with GAC, like those listed in Appendix 3, which are for a residential without plant uptake end use. If the results are below these values, then no further action is required.
- If the results are above the GAC, then further risk assessment or testing may be required to understand the risk. This work should be undertaken by an appropriately qualified and experience person. If the material is found to be 'contaminated' and therefore unsuitable to remain in its present circumstance, after consultation with the Environmental Protection Department of MCC, then the material should be removed, treated or capped as appropriate.

Verification:

- If unexpected contamination is encountered then this should be documented as discussed above. The Principal Contractor should confirm to the independent verification consultant via email the outcome of the Watching Brief. These records should be passed to MCC as part of a Verification Report.

3.2 Management of Made Ground and Waste Arisings

Reasoning: To protect human health and controlled waters

ACMs and asbestos fibres have not been detected at the site. However, the presence of undetected areas of asbestos cannot be discounted. TPH and PAH concentrations within some Made Ground and natural soils samples were elevated when compared to soil human health GAC, residential without plant uptake end use.

Residual hydrocarbon contamination and some metal exceedances have been detected within the Made Ground, superficial Glaciofluvial Deposits, the shallow groundwater, and to a lesser extent the deeper aquifer beneath the site.

The metal exceedances may be naturally occurring, and are not considered to present a risk to human health end users or controlled waters.

The DQRA concludes that the hydrocarbon contamination, in the form of LNAPLs, does not present a risk to the underlying aquifers or the nearby River Mersey. The residual hydrocarbon contamination is considered likely to be sourced from the previous site land use as a bus depot.

The following is noted regarding the management of Made Ground and soil arisings:

- During any excavations, below ground obstructions should be anticipated, as detailed in Section 1.6.2.
- If during the course of the construction works, significantly hydrocarbon impacted soils are encountered, then these should still be removed from site as this provides a benefit to the site condition, and subsequently lessens residual risks overall. Following completion of the excavation,

validation samples should be collected from each side and the base of each respective excavation to demonstrate the removal of impacted surrounding soils.

- Any other Made Ground (except for that already mentioned above) can remain on site however, it should not be placed within landscaping areas and formation of landscaped areas is considered in Section 5.
- Remaining Made Ground will be sealed beneath the building footprint, hard surface or imported topsoil, separating it from future site users, and limiting infiltration, percolation and leaching potential.
- Asbestos has not been detected at the site, however the presence of asbestos/asbestos containing materials (ACMs) cannot be discounted. The contractor's risk assessment and method statement and subsequent working practices should account for this possibility and that of other unforeseen contamination, including following the Watching Brief and discovery strategy set out in Section 3.1.
- Asbestos awareness training should be provided as a minimum to ground workers and a management system put in place to evaluate asbestos risk and potentially escalate precautions to control any exposure to asbestos in line with the Control of Asbestos Regulations.
- The public should also be protected as part of the contractors' safe working practices which should include dampening down during the disturbance of Made Ground to mitigate the generation of dust and (if present) airborne release of asbestos fibres, as outlined in the CEMP.
- Excess arisings should be appropriately classified and removed from site by a registered waste carrier in accordance with the waste "Duty of Care requirements" and associated legislation. Any soil to be removed should be stockpiled according to material type and kept separately from all other materials prior to removal. Testing frequency will depend on the quantity and the homogenous or heterogeneous nature of the waste.
- Excavations below the groundwater table (except for piling) are unlikely, due to its depth. However, consideration should be given to the design of lift pits or tower crane bases, which may be deeper. Any perched water encountered within the Made Ground or natural soils is expected to be manageable via pumping from sumps. Excavation below the groundwater table would encounter groundwater. It is likely that collected water may contain contamination. Disposal of groundwater will need to be considered by the contractor with agreement to discharge into the sewerage network obtained from the approving bodies, which may require treatment prior to discharge, or alternatively the waters could be removed by a registered waste carrier and disposed of off-site. Any dewatering and discharge of waste waters should be undertaken in accordance with the water quality measures set out in the CEMP.
- All excavations and removal of waste materials from site should be undertaken in accordance with the excavation, waste management and dust mitigation measures set out in the CEMP.
- A piling mat would likely be required, which would result in removal of some of the existing Made Ground and import of aggregates. Any aggregate, particularly recycled aggregate, brought to site should be from a source that is expected to be uncontaminated and from an asbestos-free source.

Verification:

- Verification visits, testing of remaining soils, and reporting on these visits will be required to document the suitable removal of any discovered contamination. Any areas where soils are removed due to encountering contamination will also need to be appropriately verified to document the management of contamination. A Verification Report(s) should be produced by an independent third party and submitted to MCC.

- Prior to the start of construction works, the contractor's risk assessment(s) and method statement(s) (stating how asbestos within Made Ground is to be managed during the construction works, and how residual hydrocarbon is to be managed) should be provided by the Principal Contractor to the Environmental Protection Department of MCC.
- Records should be kept showing the volume and former location of any material (including soils and groundwater) removed from site, including Waste Transfer and Consignment Notes, and testing certificates. Records should also be kept showing the amount and location of any imported aggregate, including confirmation that the material has been tested to confirm its chemical suitability. These records need not be provided within the Verification Report(s) but should be available for inspection by the local authority as required.

3.3 Design of Below Ground Concrete

Reasoning: To protect building integrity.

Oxidisable sulphides were calculated to be less than 0.3%, consequently oxidisable sulphides are unlikely to be present.

An initial sulphate classification of DS1:AC1 was derived considering the number of samples tested and BRE Special Digest 1 guidance.

However, based on the hydrocarbon contamination detected, the below ground concrete classification should be increased, especially if in contact with groundwater, such as the proposed piled foundation solution. Additional protective measures may also need to be considered, and this should be assessed by a suitably qualified person.

Verification: Confirmation of the design classification and any additional protective measures incorporated into below ground concrete should be provided as part of the Verification report.

3.4 Installation of Piled Foundations

Reasoning: To protect controlled waters.

Residual hydrocarbon contamination remains within the Made Ground, superficial Glaciofluvial Deposits and shallow groundwater beneath the site, and to a lesser extent the deeper groundwater. It will be necessary to install piled foundations in an appropriate manner to protect controlled waters receptors from the potential risk that contamination may migrate via the piled foundations into the underlying Principal Aquifer of the Chester Formation bedrock. A piling risk assessment will need to be carried out as part of the process of managing this risk. A reputable piling contractor will also need to be engaged by the developer and safe and appropriate working methods employed during pile installation. Groundwater monitoring is also advised during and after piling installation to confirm that the piling works have not negatively impacted the underlying aquifer.

The following should be noted regarding the design and installation of the piled foundations:

- The selection of the most appropriate piling technique will need to consider the environmental risks alongside the structural performance and buildability constraints.
- It is recommended that a specialist piling contractor is engaged to carry out the pile design and piling works.
- It is essential that Quality Assurance (QA) and Quality Control (QC) procedures are identified prior to the start of construction. These measures should be agreed in advance with the regulatory authorities, and form part of the verification requirements for the management of residual contamination at the site.

- As a minimum it is expected that the Piling Contractors RAMS will need to be agreed with the regulatory authorities to confirm acceptance of the preferred piling technique and any associated monitoring requirements.

Verification:

- A piling risk assessment report will need to be produced to consider the safe installation of piled foundations at this site, and to determine what mitigation and/or monitoring measures may be needed. A copy of this report should be provided to MCC prior to the start of construction.

- Prior to the start of construction works, the contractor's risk assessment(s) and method statement(s) (stating how the piling design and method has been selected in order to protect the underlying aquifers) should be provided by the Principal Contractor to MCC. Additionally, a programme for groundwater monitoring should be presented at this stage to MCC. This should document the frequency of proposed monitoring during and after completion of the piling works to provide reassurance that the works are to be completed in accordance with best practice procedures and to manage the potential residual risk to the aquifer.

3.5 Gas Protection Measures including a Low Permeability Hydrocarbon Vapour Membrane

Reasoning: To protect human health

Operation: The site is classified as Characteristic Situation 2 with regard to methane and carbon dioxide. The gas protection measures should also include a membrane that is hydrocarbon/VOC resistant.

When designing gas protection measures for new buildings, reference should be made to BS 8485:2015+A1:2019 Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings. Consideration should also be given to hydrocarbon and VOC risks by following best practice guidance such as C682 The VOC Handbook and C716 Remediating and Mitigating Risks from VOC Vapours.

In accordance with Table 3 of BS 8485:2015+A1:2019, it is considered that the proposed building would be classed as either a 'Type B' or 'Type C' however in order to be conservative the Class B designation has been assigned as the scheme includes managed apartments.

In accordance with Table 4, a Type B building with CS2 classification is assigned a total point score of 3.5 for the minimum required gas protection measures. Points are assigned to different types of structural barrier (essentially the floor slab), ventilation protection measures and gas resistant membranes. The point score assigned by the type of building and CS classification should be achieved by an appropriate combination of these measures.

A ground-bearing floor slab will be utilised for the entrance/amenity area of the new building. In accordance with Table 5 (structural barrier), this would be assigned a point score of 0.5.

To achieve a point score of 1.5 (good performance) for passive sub-floor ventilation, in accordance with Table 6, one of the following should also be utilised:

- Clear void
- Polystyrene void former blanket
- Geo-composite void former blanket
- No-fines gravel layer with gas drains

Alternatively, active ventilation could be considered.

A proprietary gas resistant membrane, meeting the requirements of Table 7, achieves a point score of 2. A low permeability vapour membrane (resistance to hydrocarbon/VOC vapour and CH4/CO2) should be

provided within the new building to mitigate residual risks to human health. The membrane should be installed in accordance with the manufacturer's instructions.

The above gas protection measures collectively achieve a point score of at least 3.5.

The detailed design of the gas protection measures are to be finalised at detailed design stage with a gas protection measures specialist, and submitted to MCC with foundation section drawings.

Verification: Datasheets for the proposed membrane and installation/construction details should be provided in advance of installation to MCC. The membrane should be installed by a specialist company and independently verified by a suitably qualified and experienced third party, to confirm the membrane is installed correctly. Copies of this verification process should be passed to MCC for their records.

3.6 Validation of Imported Topsoil/Subsoil

Reasoning: To protect human health and plant health.

The near surface soils are classed as Made Ground and extend up to 3.90m bgl (and possibly slightly deeper) in some locations across the site. The upper surface of the natural Glaciofluvial Deposits was encountered from 0.80m to 3.90m bgl.

The soil chemical testing results were generally below human health GAC for a residential without plant uptake end use. However, within the Made Ground and natural soils there were some exceedances in some fractions of TPH and one PAH compound, namely naphthalene. All other contaminants tested were below human health GAC for a residential without plant uptake end use.

Asbestos was not detected within any of the samples.

The site does not require remediation or a formal capping layer, however soils are needed to form a suitable medium for plant grown within the future landscaped areas.

No samples of Made Ground or natural soils exceeded the plant GAC. Risk to plant health from the soils on site is considered to be very low. However, there is no suitable topsoil on site for reuse for plant growth. Topsoil/subsoil will need to be imported to form the proposed landscaped areas.

The landscaped areas are expected to include tree/hedge planting, rain garden, and some planted beds. Areas would not be planted with food produce. No areas of planted public open space are proposed, and would therefore not be used for recreation.

Topsoil/subsoil should be from a source that is expected to be uncontaminated. To comply with this the soils should be from a source which has not had a past industrial or obviously contaminating use. Natural or manufactured topsoil/subsoil may be used provided it meets the requirement of BS3882:2007 and BS8601:2013 respectively ('Specification for topsoil/subsoil and requirements for use').

Testing

To confirm that imported soils do not pose significant risks to plant health or human health:

- Imported topsoil/subsoil should be sourced from an approved supplier. The soil supplier should provide chemical test certificates for the soils which should be passed to the validating engineer to confirm the soil is expected to be uncontaminated before it is brought to site.
- Suitability should also be confirmed once the soils have been brought to site via an independent third party completing a validation visit. The validating engineer should complete a visual inspection (confirming that the soils appear free of deleterious materials such as glass, plastic or demolition rubble) and also collect soil samples for subsequent chemical validation testing. If samples of site won topsoil are to suitable for reuse, then these should also be tested to confirm. Soil samples should be tested at the frequency and for the determinands stated in the following table:

Source	Testing Frequency	Testing Schedule
Greenfield/ Manufactured Soils	Minimum of 3 samples or 1 sample per 200m^3 (whichever is greater)	Metals/metalloids (to include arsenic, cadmium, total chromium, hexavalent chromium, copper, mercury, nickel, lead, selenium and zinc) Speciated PAH – USEPA 16 Asbestos pH, SOM Total TPH
Brownfield/ Screened Soils	Minimum of 6 samples or 1 sample per 150m^3 (whichever is greater)	As above, and: Speciated TPH – CWG Banding Additional analysis dependant on the source history.
Crushed hardcore, stone, brick (if present within installed cover system)	Minimum of 1 sample per 200m^3	As Greenfield, but without SOM and: Additional analysis dependant on the source history.

Imported soils should be validated in accordance with Manchester City Council document 'Planning & Contaminated Land Technical Guidance, dated February 2021'.

Representative samples should be obtained in general accordance with BS10175.

The chemical test results should be mainly compared to the human health GAC for a residential without plant uptake end use in Appendix 4.

The soil is considered acceptable if all the test results are below the GAC. If the material is found to be unacceptable, further testing and risk assessment could be carried out to try to demonstrate its suitability, otherwise it should not be placed within landscaped areas, and instead it should be removed from site. The results of any further risk assessment must be agreed with the Local Authority.

Depth

In accordance with MCC guidance, it is considered that a 450mmm thick layer of imported topsoil and subsoil would be the ordinary requirement for soft landscaping at the site. Topsoil and subsoil thicknesses may need to be deepened around root bowls at tree planting locations. The required thicknesses and quantities of topsoil/subsoil should also be guided by advice from a landscape architect.

It is recommended that a 450mm thickness of soils (comprising a minimum of 150mm of imported topsoil over underlying imported subsoil) should be installed within landscaped areas to prevent exposure to the underlying Made Ground and to enable successful plant growth. It is recommended that the depth is checked in a minimum of 3 locations.

If, during regrading work, any evidence of significant contamination is encountered it should be treated as discussed in the Watching Brief.

If the landscaped area includes raised planters, then the same depth and testing requirements apply.

Validation:

- It is recommended that the depth of placed topsoil is checked in a minimum of 3 locations, around the new building in the landscaped areas to confirm a minimum depth of 150mm has been placed.
- If, during regrading work, any evidence of significant contamination is encountered it should be treated as discussed in the Watching Brief.
- If the landscaped area includes raised planters, then the same depth and testing requirements apply.

Stockpiles

Stockpiles of topsoil/subsoil should be placed in clearly identified demarcated zones on hard surfacing or on a geomembrane to avoid cross contamination with the underlying soils. Each stockpile should have a marker clearly showing its testing status. Material marked as untested is not to be used.

If it is not possible to stockpile imported material on-site because of lack of space or other operational reason, then the soils may be tested at source for the possible contaminants given in the table above. If the soils meet these criteria, they may be transported to site for use in the landscaped areas. A record of this transport should be kept for use as part of the verification reporting.

Validation:

- Independent Validation visit(s) and chemical testing of imported topsoil/subsoil is required to confirm the suitability of soils placed within the landscaped areas. Test results should be compared to the GAC provided in Appendix 3 and the depth of soils confirmed. The Principal Contractor should notify Westlakes to coordinate the timing of visit(s) with the construction activities. Verification report(s) to be produced and submitted to the Local Authority.

3.7 Potable Water Supply Pipes Liaison

Reason: To protect human health.

Considering the concentrations of VOCs, SVOCs, PAH and TPH identified within the Made Ground and natural soils, it is considered that PE and PVC potable water pipes would be unsuitable for use at this site. Below ground copper water supply pipes may also be unsuitable due to positive redox potentials and associated pH values. Consideration should be given to the use of barrier piping for potable water supply pipes at this site.

The Principal Contractor should liaise with the local public water supplier (United Utilities) to confirm the selection of potable water pipes. A copy of the Westlakes GI report should be provided for their information. Following this consultation, a separate risk assessment may need to be completed by a competent person.

Verification: Copies of relevant correspondence and (if required) the separate risk assessment should be provided to the Environmental Protection Department of MCC for their records.

4 Verification

The timetable for completion of each of these remediation objectives is dependent on the sequence of construction works. Objectives should be validated once the work has been undertaken.

Validation records should be passed onto the Environmental Protection Department of MCC to facilitate discharge of related planning conditions. These records are likely to include:

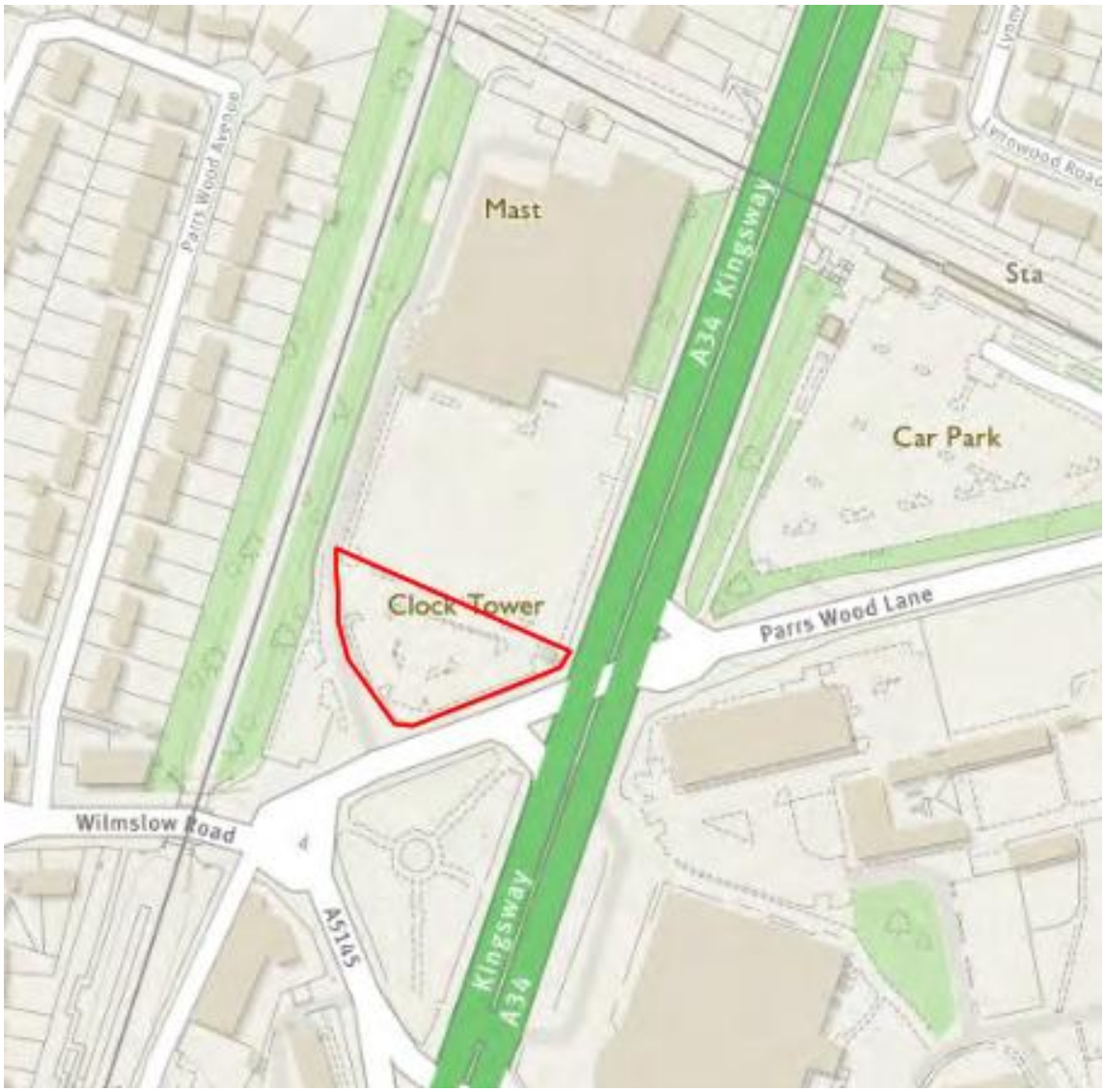
- A description of the works carried out.
- All chemical laboratory test certificates (as appropriate).
- Confirmation that all identified remediation objectives have been met.
- Details and justification of any changes from the agreed remediation strategy. Necessary variations to the agreed Validation Plan, arising during the course of the works, should also be notified to and agreed with the Local Authority within a period of two weeks.
- Confirmation of whether further works are required.

All parties undertaking remediation and verification works should be competent for their role, having previously undertaken similar work and employing suitably qualified and experienced personnel (SQEP).

The Principal Contractor should be experienced in carrying out the works as described within this Remediation Strategy and where required employ specialist subcontractors with SQEP for specialist tasks.

The Verification Consultant should also be competent in their role, being able to demonstrate previous verification experience with verification sign-off by a Chartered or Accredited member of a relevant body, such as the Geological Society of London, Society of Brownfield Risk Assessment, or similar institutions.

Appendix 1 – Site Location Plan



Approximate Dandara site boundary shown in red.

Modified extract from site development plan. Westlakes OS Licence. North is to top of page.

Appendix 2 - Proposed Ground Floor Plan Including Landscaping



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DO NOT SCALE
Work to annotated dimensions only.
Read drawing in conjunction with relevant specification, Structural Engineers' and Services Engineers' drawings. Confirm all dimensions before commencement of any work on site or fabrication.

revisions + notes:

REV. P1 10032022 PLANNING ISSUE

- Community
- Plant/Bins/Bikes
- 1B1P
- 2B3P

client: Dandara

date: NOVEMBER 2021

project: Didsbury, Parrs Wood

scale: 1:125 at A1

drawn by: NW

title: GROUND FLOOR PLAN

drawing number: L(—)000

status: PLANNING

job number: 0629

revision: P1

hodder+partners

Appendix 3 - Generic Assessment Criteria

Watching Brief & Landscaped Area GAC (as applicable)

Notes

Human Health GAC: LQM/CIEH Suitable 4 Use Levels (S4ULs) & Category 4 Screening Levels (C4SLs).

GAC given for human health and plant health is based on the more conservative receptor.

Concentrations below GAC are unlikely to pose a risk and therefore further assessment is not needed.

Concentrations above GAC require further risk assessment to determine is any further action is needed.

Human Health GAC for Residential Without Home-Grown Produce		
Contaminant	**Maximum Acceptable Concentration (mg/kg unless stated otherwise)**	**Source of GAC**
Arsenic	40	CIEH/LQM/C4SL
Cadmium	85 (150)	CIEH/LQM (C4SL)
Chromium (total) Cr VI	910 6 (21)	CIEH/LQM CIEH/LQM (C4SL)
Copper	200 (for pH>7)	MAFF
Lead	310	C4SL
Mercury (based on methyl GAC)	15	CIEH/LQM
Nickel	110 (for pH>7)	MAFF
Selenium	430	CIEH/LQM
Zinc	300 (for pH>7)	MAFF

Asbestos/General	
Asbestos	None Identified
pH	Range of 6.0 to 9.0 typical
Soil Organic Matter (SOM)	Range of 1% to 6% typical

Residential Land Use Value (CIEH/LQM) – S4UL (RWO = without plant uptake) (mg/kg)				
Polyaromatic Hydrocarbons		**1% RWO**	**2.5% RWO**	**6% RWO**
Acenaphthene		3,000	4,700	6,000
Acenaphthylene		2,900	4,600	6,000
Anthracene		31,000	35,000	37,000
Benz(a)anthracene		11	14	15
Benzo(a)pyrene (only)		3.2	3.2	3.2
Benzo(b)fluoranthene		3.9	4.0	4.0
Benzo(ghi)perylene		360	360	360
Benzo(k)fluoranthene		110	110	110
Chrysene		30	31	32
Dibenz(ah)anthracene		0.31	0.32	0.32
Fluoranthene		1,500	1,600	1,600
Fluorene		2,800	3,800	4,500
Indeno(123-cd)pyrene		45	46	46
Naphthalene		2.3	5.6	13
Phenanthrene		1,300	1,500	1,500
Pyrene		3,700	3,800	3,800
Coal Tar (Bap as surrogate marker)		1.2	1.2	1.2
Generic assessment criteria (GAC) taken from the 'Chartered Institute of Environmental Health / Land Quality Management 'The LQM/CIEH S4ULs for Human Health Risk Assessment'.				

C4SL RWO (mg/kg)

benzo(a)pyrene	5.3 (for SOM of 6%).	C4SL

Residential Land Use Value (CIEH/LQM) – S4UL (RWO = without plant uptake) (mg/kg)						
Petroleum Hydrocarbons		**1% RWO**		**2.5% RWO**		**6% RWO**
Aliphatic EC 5-6		42		78		160
Aliphatic EC >6-8		100		230		530
Aliphatic EC >8-10		27		65		150
Aliphatic EC >10-12		130		330		770
Aliphatic EC >12-16		1,100		2,400		4,400
Aliphatic EC >16-35		65,000		92,000		110,000
Aliphatic EC >35-44		65,000		92,000		110,000
Aromatic EC 5-7 (benzene)		370		690		1,400
Aromatic EC >7-8 (toluene)		860		1,800		3,900
Aromatic EC >8-10		47		110		270
Aromatic EC >10-12		250		590		1,200
Aromatic EC >12-16		1,800		2,300		2,500
Aromatic EC >16-21		1,900		1,900		1,900
Aromatic EC >21-35		1,900		1,900		1,900
Aromatic EC >35-44		1,900		1,900		1,900
Aliphatic+Aromatic EC >44-70		1,900		1,900		1,900
Benzene		0.38		0.70		1.4
Ethylbenzene		83		190		440
Toluene		880		1,900		3,900
O-xylene		88		210		480
M-xylene		82		190		450
P-xylene		79		180		430
Generic assessment criteria (GAC) taken from the ‘Chartered Institute of Environmental Health / Land Quality Management ‘The LQM/CIEH S4ULs for Human Health Risk Assessment’.						

Plant Health Assessment Value				
	pH 5-5.5	pH 5.5-6	pH6-7	pH ≥7
Zinc	200	200	200	300
Copper	80	100	135	200
Nickel	50	60	75	110

GAC for plant health are taken from 'The Soil Code' MAFF 1998, BS3882 Specification for Topsoil and Guidance 'Sewerage Sludge on Farmland' DEFRA 2017. Plant sensitivity will depend on the plant species used within landscaped areas. The GAC are pH dependant. A soil pH of >7 typically applies however if the pH is <7, then it is permissible to use the other values as appropriate. (mg/kg unless stated otherwise)