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MARCH 2018

STRATEGY FOR REMEDIAL AND PREPARATORY WORKS

For land off
WAKEFIELD ROAD, MAPPLEWELL, BARNSLEY

prepared for
LIDL UK GMBH

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Drawing No.	Title	Scale
C7481/RS/01	Site Location Plan	1:50,000
1744/P401	Proposed Type 1300 Surfacing Plan	1:500
1744/P403	Proposed Type 1300 Levels Plan	1:500

APPENDIX B SIRIUS GENERIC ASSESSMENT CRITERIA

1. INTRODUCTION

Sirius Geotechnical Ltd (Sirius) was commissioned by Lidl UK GmbH Ltd (Lidl), to produce a Strategy for Remedial and Preparatory Works required to facilitate development of land off Wakefield Road, Mapplewell, Barnsley ("the site").

The site is currently disused, having previously been occupied by a rubber and plastics factory, and is occupied by the floor slab to the former factory, stockpiles of demolition rubble and areas of grass and dense scrub.

It is understood that Lidl is proposing to redevelop the site for a low-rise commercial end-use. Redevelopment proposals at the time of writing comprise a Lidl food store, along with access road, hard surfaced car parking and areas of peripheral landscaping. It is understood that as part of the redevelopment proposals that site levels will be raised by *c.* 1.3m across the footprint of the proposed store and adjacent car parks. Retaining walls of up to 2.5m in height will be required at the site boundaries. A proposed development layout plan (HTC Architects Drawing No. 1744-P401) is included in Appendix A.

It is understood that the type of foundations and floor slab to be used for the building have not been determined at the time of writing. Likely options for the foundations include:

- Spread foundations within natural strata (could include pier-type foundations cast within manhole rings);
- Full excavation of made ground and construction of a raft on engineered fill;
- Ground improvement with vibro-replacement stone columns following turnover of made ground, with shallow spread foundations or raft within the improved ground;
- Piled foundations.

The site has been subject to previous assessments and investigation as detailed below:

- Joynes Pike & Associates (JPA) Geo-environmental Investigation Report (Ref. NLM/DRS/120700197.20070986, dated 10th August 2007) prepared for Ben Bailey Homes Ltd.
- Sirius Preliminary Appraisal Report (Ref. C7481 Rev. A, dated June 2017) prepared for Lidl. This report was prepared for the same site area as assessed by the JPA investigation, which was a significantly larger site area than assessed by the subsequent Sirius Geoenvironmental Appraisal Report.

- Sirius Geoenvironmental Appraisal Report (Ref. C7481/GA, dated January 2018) prepared for Lidl. This report relates only to part of the southern area of the site assessed within the previous JPA report and Sirius Preliminary Appraisal Report.
- Sirius Supplementary Ground Gas Risk Assessment (Ref. C7413/AMG/8295, dated 1st March 2018) prepared for Lidl. Assesses the ground gas monitoring undertaken as part of the Sirius Geoenvironmental Appraisal, and issued subsequent to that report.

The documents above are the principal sources of information used in the preparation of this Strategy. These documents should be read in conjunction with this report. This document summarises the works undertaken to date and details the remedial and site preparatory works required to provide a site considered suitable for low-rise commercial development.

The main aims of this Strategy are summarised as follows:

- To discharge the relevant planning conditions pertaining to contaminated land;
- To enable the ground at the site to be prepared to a condition ready for development and which is suitable for the proposed end-use (low-rise commercial) whilst ensuring construction workers and environmental receptors are not put at an unacceptable short-term risk during the remediation, preparation and redevelopment of the site;
- To minimise the risk of future end users coming into contact with any contaminated soils; and
- In the interests of sustainability, to promote the use of site-won materials where possible, providing they are suitable for the proposed end-use.

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2. SITE DETAILS AND DESCRIPTION

2.1. Site Overview

Table 2.1 Current Site Overview

Location	The site is located off Wakefield Road, Mapplewell, Barnsley, South Yorkshire. A site location plan is included as Drawing No. C7481/RS/01 within Appendix A.
National Grid Reference	434050, 409825.
Topography and Features	The site is approximately 1 hectare in area and comprises mainly hard standing remaining from demolition of the former William Freeman rubber and plastics factory. There are stockpiles of demolition wastes across the hardstanding area. There are mature trees along the western boundary with Wakefield Road, and an area of scrubland at the eastern end of the site; this area comprises a historical landfill associated with the former factory.
Site Boundaries	The western site boundary is defined by a chain link fence with a large leylandii hedge; the remaining boundaries are not physically defined.
Current Land Use	Disused demolished former factory with surrounding scrubland to the south and east.
Adjacent Land Uses	Land to the north comprises the remainder of the demolished former factory. Land to the east comprises scrubland with residential housing beyond. To the south is an area of trees with commercial premises and a residential property beyond. West of the site is Wakefield Road with residential properties beyond.

2.2. Historical Development

Review of historical Ordnance Survey (OS) maps indicate the site to be undeveloped agricultural fields until the 1960s, when the William Freeman factory was constructed. The factory was subsequently demolished sometime in the 21st Century. By the latter half of the 19th Century, the Barnsley Coal Railway Extension, with associated cutting, was constructed in proximity to the site's eastern boundary.

2.3. Recorded Geology

Table 2.2 Geological Summary

Sources of Information	BGS 1:10,000 scale Sheet SE 30 NW. BGS 1:50,000 scale Sheet 87, Barnsley (Bedrock and Superficial Edition). Memoirs of the Geological Survey of Great Britain: Geology of the Country around Barnsley (Sheet 87). Envirocheck Report (Reference 127234884_1_1), dated 5th June 2017. Coal Authority Mining Report (Reference 51001477424001), dated 5th June 2017.
Made Ground	Made ground is indicated on the 1:10,000 scale geological map to underlie the eastern part of the site; this is assumed to be associated with historical landfilling activities in this area. Made ground may also be present within the area of the former factory associated with historical development and earthworks activity.
Superficial Geology	The southern part of the site is indicated to be underlain by Till of Mid Pleistocene age, typically described as being of *'variable lithology, usually sandy, silty clay with pebbles, but can contain gravel-rich, or laminated sand layers'.* The Geological Memoir indicates the Till to comprise *'stiff, blueish-grey clay giving rise to strong loams'.* Superficial deposits are recorded to be absent in the northern part of the site.
Solid Geology	Geological mapping identifies solid geology at the site to comprise strata of the Pennine Middle Coal Measures Formation (PMCMF) of Carboniferous age. The Newhill Coal is recorded to outcrop / subcrop within the site, dipping to the north. The Wooley Edge Rock, typically comprising medium-grained sandstone, is indicated to sub-crop approximately 65m south of the site, dipping north beneath the site.
Faults	No significant faults are shown to underlie the site.
Mining and Quarrying	**Coal Mining:** Geological mapping records the Newhill (aka Steam) Coal to outcrop / subcrop within the site, dipping to the north. The Newhill Coal is recorded to vary in thickness between 2.5m at Darton Lane Head, approximately 2km west of the site, and

		0.4m to 1.1m at Carlton, approximately 2.5km east of the site. This seam is reported to often contain several dirt partings which may be up to 0.45m thick and to have been worked a little at crop. There are no recorded shallow mine workings or mine entries within the site, although the site is within a Development High Risk area set by the Coal Authority (CA), due to the potential for unrecorded shallow mine workings within the Newhill Coal.
	Quarries:	A sandstone quarry is recorded on the 1854 historical OS mapping approximately 400m north of the site. The quarry appears to be disused on the OS map dated 1894. A BGS recorded mineral site, considered to relate to the above quarry, is recorded at Tipsey Lodge, for opencast extraction of sandstone.

2.4. Hydrology and Hydrogeology

The nearest surface water body is an unnamed watercourse approximately 240m west of the site.

Under the aquifer classification system developed by the EA, the Glacial Till superficial deposits (where present) are classified as a Secondary Undifferentiated Aquifer and the Coal Measures solid geology underlying the site are classified as Secondary A Aquifer.

The site is not located within a groundwater Source Protection Zone.

2.5. Landfilling and Waste Management

The land occupying the eastern part of the site is identified as a historical landfill, noted as, *'On waste land to rear of Subseal Works'.* The first input date was 1962 and the last date of input was 1994. Deposited wastes included inert, industrial, commercial and household waste.

2.6. Radon Risk

The site lies within an area where basic radon protective measures are required.

2.7. Proven Ground Conditions

A summary of the strata profile encountered by the Sirius site investigation is provided in Table 2.3.

Table 2.3 Strata Profile

Strata	Depth Range (Thickness Range)	Description and Comments
Made Ground	From Ground Level (0.3 – 2.2m)	In general, made ground increases in depth to the east. Asphalt and / or reinforced concrete surfacing was found in exploratory holes within the former factory area, to a maximum depth of 0.3m bgl. The made ground underlying the hard standing in the former factory area is generally granular, comprising clayey sandy gravel of brick and tile, or locally, limestone hardcore. Underlying the granular sub-base in the former factory area, cohesive made ground comprising re-worked residual Coal Measures soils are present, typically comprising slightly sandy slightly gravelly clay. In the eastern end of the site, exploratory holes WS01, TP04 and TP05 identified 0.1 – 0.3m of topsoil overlying landfilled waste, which included hot water bottles, plastic, steel drums, polystyrene and wood, in a matrix of clay. It should be noted that this landfilled area was also identified during the previous investigation undertaken by JPA.
Possible Reworked Clay	0.3 – 1.0m (0.25 – 1.6m)	Identified within WS01A, WS04-WS08, TP03 and TP05, underlying made ground and comprising variable cohesive soils, including greyish brown slightly sandy slightly gravelly clay, grey very silty clay with wood fragments and grass, orange-brown slightly gravelly clay, greenish-grey sandy silty clay, blueish grey gravelly clay, greyish green sandy clay and dark brown silty clay with organic odour.
Residual PMCMF Soils	0.3 – 2.2m (0.8 – >3.4m)	Generally comprises slightly sandy to sandy, slightly gravelly to gravelly clay, with the gravel comprising sandstone and mudstone.

Strata	Depth Range (Thickness Range)	Description and Comments
PMCMF Rock Strata	1.8 – 3.3m (NR)	Interbedded brown / light grey fine-grained sandstone and siltstone, recovered from trial pits as clayey tabular gravel.
Newhill Coal	13.5 – 18.7m (0.8 – 1.0m)	Identified within rotary boreholes only; described as black coal.

Glacial Till, shown to underlie the site on geological mapping, was not identified within any exploratory hole.

An intact shallow coal seam, 0.8m – 1.0m thick (most likely to represent the Newhill Coal) was identified within every rotary borehole, at depths ranging between 13.5m and 18.7m bgl.

No evidence of coal mine workings, e.g., loss of flush or rapid acceleration in drilling rate, was noted within any rotary boreholes.

2.8. Identified Contamination Considerations

The intrusive investigation undertaken by Sirius has highlighted the following contamination issues:

- Stockpiled demolition materials on the site were observed to contain visible asbestos containing materials (ACMs), in the form of fragments of asbestos cement corrugated roof panel and rainwater pipes. Laboratory analysis confirmed that the observed suspected ACMs contained chrysotile;
- A ground gas risk assessment has shown that ground gas protection measures are required within the construction of the new building to protect against ingress of carbon dioxide and radon gases;
- Low pH values in site soils, leading to a Design Sulphate Class of DS-1 and ACEC Class of AC-2z.

It should be noted that the low pH values do not have a direct or indirect risk to end-users of the proposed development but may have implications regarding the built environment i.e. foundations (adopting appropriate concrete specifications).

The intrusive investigations and subsequent assessments have not identified any significant risks to controlled waters.

2.9. Potential Contamination Considerations

In addition to the above identified contamination, given the former uses of the site and the presence of known historical sources of contamination on site i.e. former landfill site, there is the possibility that as yet undiscovered sources of contamination may be present which will require remediation. It is therefore considered that the following actions should be undertaken during reclamation and preparatory works.

A watching brief should be carried out during breaking out of existing concrete floors, and asphalt hardstanding.

The watching brief should be carried out by an experienced geoenvironmental engineer (GE) with particular attention to:

- Made ground differing significantly in nature from that previously identified during the previous investigation works;
- Evidence of asbestos containing materials (ACMs), which is further detailed in Section 8;
- Visual and/or olfactory evidence of hydrocarbons;
- Evidence of former relic structures.

If any other previously unidentified contamination is encountered during any of the proposed works by any site personnel, the GE shall be notified immediately and works in the vicinity of the suspected contamination should be temporarily suspended. Additional laboratory analysis of previously unidentified contamination sources will be required in order to determine the requirements for remediation, assessed against appropriate assessment criteria (as seen within Appendix B of this report).

2.10. Hazardous Ground Gas / Vapours

The site has been classified as Characteristic Situation (CS) 2 as defined in BS 8485:2015, and is also within an area where basic radon gas protective measures are required. This ground gas classification requires that specific gas protection measures are installed within the building in order to prevent the ingress of hazardous ground gases (carbon dioxide and radon).

No elevated concentrations of organic compounds which could potentially release hazardous vapours were detected during the laboratory testing undertaken as part of the Sirius geoenvironmental appraisal. Therefore, no specific hydrocarbon / vapour protection measures are considered to be necessary.

2.11. Invasive / Protected Plant Species

Invasive plant species were not observed on this site at the time of previous investigations; however, orchids were observed during the Sirius site walkover survey. It is therefore recommended that an ecological survey is carried out to confirm if any invasive / protected plant species are present. The treatment of any invasive plant species should take place in advance of the proposed construction works.

2.12. Asbestos Containing Materials (ACMs)

ACMs have been locally identified within stockpiles of demolition arisings located on the site. Further information of appropriate mitigation measures to deal with ACMs on site are provided within this Strategy.

3. REMEDIATION STRATEGY AND OBJECTIVES

The primary objective of the remediation works is to discharge the relevant planning conditions whilst mitigating the transient and long-term risks to receptors including human health from asbestos in site stockpiles and from hazardous ground gases. In brief, this will be achieved by the removal of ACMs from site and by the provision of gas protection measures to the new building, as described herein.

Review of existing and proposed ground levels shows that proposed site levels will be lifted by *c.* 1.3m across the footprint of the new building, and up to *c.*2m in other areas adjacent to the site boundaries, as shown on HTC Architects drawing 1744-P403, dated July 2017, included in Appendix A to this report.

If soils that would otherwise be classified as controlled waste are to be used or re-used on site, remediation works should be undertaken under a CL:AIRE Development Industry Code of Practice Materials Management Plan (MMP); the MMP must be declared to CL:AIRE prior to commencement of remediation works.

The main requirements of the remediation works are given below in the approximate sequence of works, which may need revising once the final foundation and floor slab solutions are confirmed. Pertinent elements of the works are discussed in greater detail in subsequent sections of this document.

- Production of a Materials Management Plan (MMP), to be agreed with CL:AIRE prior to development.
- Service location, disconnection and / or protection, including establishing stand-off area for high plant in vicinity of high voltage overhead cables.
- The presence or absence of invasive / protected plant species should be confirmed by a qualified consultant and their advice taken on appropriate treatment if necessary.
- Erection of temporary tree protection fencing for any retained trees.
- Removal of remaining existing vegetation (trees / bushes etc.) from the proposed development area necessary to facilitate the works.
- Removal of any remaining fly-tipped material from the site.

- Strip suitable topsoil and stockpile for assessment and potential re-use on site.

- Controlled removal of all asbestos containing materials (ACMs) from stockpiles by an approved licensed contractor.

- Safe demolition / breaking out of remnant slabs and areas of hardstanding within the proposed development area and inspect for ACMs.

- Dependent on the chosen foundation type and floor slab construction type for the building, it is recommended that existing made ground soils, and clays identified as 'possibly reworked' within the footprint of the building, are excavated and removed to expose the underlying natural strata, in particular the residual Coal Measures strata beneath, prior to earthworks commencing. Proof rolling of exposed natural material should be undertaken, with any soft spots, large obstructions or other deleterious materials removed and replaced with suitable material compacted in accordance with an agreed earthworks specification, where necessary.

- During the above process, all excavations should be inspected for evidence of mine entries / bell pits. If evidence of a mine entry or ground disturbance is suspected, advice regarding treatment / foundation precautions should be sought from a suitably qualified engineer.

- Excavation of waste material within former landfill in full where present beneath the site, disposal to a licenced landfill / waste management facility, and establishment of final site levels with suitable fill material compacted in accordance with an agreed earthworks specification.

- For made ground across the remainder of the site, outside of the building footprint / landfilled area, consideration could be given to excavating the upper 1m to 2m of fill (or down to residual Coal Measures strata if shallower) classifying and compacting to development subgrade levels, to facilitate the construction of a lightly reinforced hardstand.

- Break out all relic foundations, below ground obstructions and oversized / unsuitable materials encountered during the site wide strip / earthworks which would hinder subsequent foundation, utility / service and highway construction.

- Where possible and practical, on site crushing, screening and classification of all suitable materials won from the above works, to provide fills suitable for re-use on site in

accordance with an agreed specification for the works. Alternatively, such materials to be removed off-site for possible processing and re-use elsewhere.

- Where applicable, removal or relocation to suitable areas (i.e. non-structural), any material which fails to achieve the requirements set out within the agreed specification for re-use.

- Re-profile site to finished ground levels, re-engineering suitable fill materials (site-won and / or imported) back into place, in accordance with the requirements of the agreed specification, within the site area to form a suitable development plateau as agreed with Lidl. If a raft foundation, or a ground-bearing floor slab is proposed, the earthworks specification should be sufficiently robust to allow for their construction and use.

- As part of the above works, it is possible that the proposed retaining walls will require constructing in order to retain the fill materials to the proposed levels (c. 1.3m above existing ground level). Alternatively, the fill materials could potentially be left at a suitably stable angle towards the edge of the development plateau and the retaining walls constructed at a later date, with fill material placed up to these at that time, to the required earthworks specification.

- Carry out a watching brief, by the GE during all of the above, to identify any previously unidentified sources of contamination.

- On site treatment and / or removal (where required) from site if any unidentified hydrocarbon contaminated soils and groundwater is encountered with the potential to pose a significant risk to end-users and / or controlled waters.

- Undertake all geotechnical and chemical testing as required throughout the remedial earthworks.

- A validation report produced by a suitably qualified geoenvironmental engineer on completion of the works. This initial report will provide a record of the remediation works including the results of testing to demonstrate the integrity of the work and confirm the work has been carried out in accordance with the relevant legislation, the remediation specification and planning conditions.

It is understood, based on the proposed development layout that retaining walls are to be constructed to accommodate the variation in finished levels between the site and adjoining land. At the time of writing, gabion (mass) retaining walls up to approximately 2.5m high are proposed.

The extent of any proposed works pertaining to these retaining walls should be discussed with an experienced geotechnical engineer and works carried out under appropriate method statements and risk assessments.

Subsequent to the above works, additional phases of remedial works will be required to ensure that the site is suitable for re-use. These are:

- Provision of suitable gas protection measures to the new building, in line with the recommendations given within the Sirius Ground Gas Risk Assessment Report; and
- Validation of the gas protection measures by a suitably qualified consultant and production of a validation report to confirm correct installation and suitability.

The development will also include the provision of soft-landscaped areas to the periphery of the car parking areas. These will not be required to provide a 'clean cover' to the site; however, a suitable depth of clean soil will be required in order to provide a suitable plant growth medium.

4. CONSTRAINTS TO DEVELOPMENT

4.1. Ecology

Orchids were identified on site during the Sirius site walkover survey. Sirius are not aware of any other ecological restrictions associated with the site; however, it is recommended that recourse should be made to the client and/or Local Planning Authority (LPA) regarding any previous ecology reports prior to the works, and any recommendations / advice made should be strictly adhered too.

The site itself has numerous mature trees along the site's southern boundary. It is therefore recommended that prior to any works being undertaken a compressive tree survey should be undertaken and all trees to be retained clearly identified and protected on site.

4.2. Services

Statutory utility plans for the site record the presence of an electricity cable in the south of the site and a BT cable in the far west of the site. An underground utilities survey undertaken on the site was unable to locate these services however, therefore the presence / absence of these should be determined by hand-dug trenching.

Prior to any works, the location of all known services should be clearly marked on site (and on drawings) and discussed as part of the site induction. Any services which remain live as works progress should be protected and have a suitable easement / stand-off and works should be carried out under an approved method statement.

5. PREPARATORY WORKS

5.1. Invasive / Protected Plant Species

If required, any ecological precautions / measures recommended which are required for the site should be implemented.

The treatment of any invasive plant species should take place in advance of the proposed construction works.

5.2. Tree Protection

Trees to be retained should be identified prior to works commencing. The trees should be protected by means of a robust fence (Heras fencing) to avoid accidental impact damage and to prevent excavation within the root zone.

5.3. Site Clearance

Following the construction of the tree protection, all remaining vegetation shall be stripped / cleared and stockpiled on site for re-use (where applicable) or subsequent removal from site. Any general debris shall be cleared and placed in skips for off-site disposal.

During these works a suitably qualified CAT B asbestos operative using appropriate PPE will undertake an assessment of the area in order to identify any potential asbestos containing materials (ACMs) present at the surface. Any such fragments will be carefully picked, double bagged and placed into a lockable skip for subsequent disposal.

5.4. Topsoil Strip

The re-use of site won topsoil is subject to regulatory approval. If considered chemically and texturally suitable for re-use, such soils should be screened if necessary and carefully stockpiled at an agreed quarantined area, for future re-use. The topsoil should be suitably sheeted to avoid any potential future cross contamination.

6. EARTHWORKS

6.1. General Requirements

It is proposed to undertake engineering works within the made ground soils to form a suitable development platform. It is not the intention of this Strategy to provide a detailed specification for the earthworks elements of the proposed preparatory / enabling works as these will be dependant upon final foundation and/or floor slab details; however, some outline recommendations are discussed below.

All earthworks should be undertaken in accordance with an engineering specification which should be agreed between Lidl and the Earthworks Contractor prior to commencement of any works.

6.2. Asbestos Containing Materials

Prior to any earthworks being undertaken, existing stockpiles of demolition rubble will require removing from their current locations. It is proposed that these stockpiles could be processed (screened and crushed) in order to provide granular fill material for re-use during the earthworks.

These stockpiles were observed to contain visible ACMs, in the form of fragments of asbestos cement corrugated roof panel and cement pipes. Laboratory analysis confirmed that the observed suspected ACMs contained chrysotile. Therefore, as part of the processing of the stockpiles, visible ACMs will require removal from the stockpiles prior to any movement, crushing or sorting of the stockpiles, to avoid production of asbestos-contaminated granular fill material which would be unsuitable for re-use and / or release of asbestos fibres into the environment.

ACM removal should be undertaken under a watching brief by an asbestos CAT B trained operative. Any visible ACMs identified should be carefully picked by the CAT B trained operative, double bagged, which shall be sealed and clearly labelled as containing asbestos waste, and placed into a secure area for subsequent removal from site to a suitable disposal facility.

During processing of the stockpiles, reassurance asbestos air monitoring should be carried out in accordance with Control of Asbestos Regulations 2012 and HSG248 Asbestos: The Analysts' Guide for Sampling, Analysis and Clearance Procedures. This should include for the presence of an analyst on site to collate analytical data.

During all operations the risk of dust release will be continuously assessed and appropriate mitigation measures will be put in place. This is typically a bowser with hose attachment to wet

down working areas and suppress dust although other alternative techniques (i.e. atomisers) will be considered as necessary. Potential dust emissions from soils should be mitigated by the application of water or stabilizing agents and/or by covering with tarpaulin sheeting or other appropriate cover material. The materials must not be allowed to dry out throughout any of the above operations.

Following removal of ACMs and processing of the existing stockpiled material, the material will require laboratory testing to determine whether any asbestos fibres are present within the crushed material. If the material is not found to contain asbestos, it would be considered suitable for re-use as granular fill material, in line with the site MMP. If asbestos fibres are found to be present, this will require that the material is only used below site hardstanding, ideally below the floor slab to the new building or, if external to the building, outside of any underground utility corridors to ensure the material is not disturbed during future maintenance of the utilities.

6.3. Grubbing up of Slabs / Hardstands and Foundations

If it is proposed that a site-wide strip of made ground is to be undertaken, all remnant hardstanding, slabs, foundations, drainage runs and other relic structures, obstructions and oversized material encountered during the proposed works shall be broken out and removed to the agreed depth from across the entire site area.

All hard arisings / materials, where appropriate, should be stockpiled and crushed in an agreed location. Appropriate materials shall be crushed (125mm down) to generate a 6F2 graded material.

All unsuitable material, including, but not limited to, metal, steel reinforcement, rags, plastic, timber or degradable material shall be removed. The crushed product shall be inspected by the GE to confirm such materials have been removed as far as practicable.

Any asphalt hardstanding generated on site should be removed to an appropriately licensed landfill facility.

The Earthworks / Remediation Contractor shall undertake geotechnical testing in accordance with the agreed earthworks specification.

In addition, crushed product should also be tested for the following suite of determinands at a frequency no less than one sample per 2000m^3:

- Standard metals/metalloids (should include as a minimum As, Cd, Cr, CrVI, Cu, Hg, Ni, Pb, Se, Zn).

- PAH (16 USEPA speciation).
- Asbestos.

The results of all the chemical testing should be reviewed by the GE who will advise on the suitability of the material for re-use on the site, which should be discussed / confirmed with the LPA as necessary.

6.4. General Excavations

As part of the remedial and preparatory works, it may be required that the full depth of made ground soils, and clays identified as 'possibly reworked', across the site footprint is to be excavated, processed / screened (as required) and re-engineered in order to achieve a suitable development platform (for the intended foundations type) or set earthworks specification (if required for raft or ground bearing floor slab). In addition, waste material within the former landfill is to be excavated in full, and disposed of to a licenced landfill / waste management facility.

During the above excavation works all excavations should be inspected for evidence of mine entries / bell pits. If evidence of a mine entry or ground disturbance is suspected, advice regarding treatment / foundation precautions should be sought from a suitably qualified engineer.

Any made ground excavated as part of the preparatory / enabling works, and which are to be re-used on site as engineered fill, should be processed / screened (as required) to remove oversized materials or any other unsuitable material. All suitable arisings, if re-used in the works, should have a maximum particle size of 125mm. Oversized hard material shall be crushed to generate a suitable granular material for re-use within the works. Materials which may be re-used on site as engineered fill should be classified in accordance with the Department of Transport's Manual of Contract Documents for Highways Works (MCHW): Series 600, Volume 1, dated November 2009.

If soils that would otherwise be classified as controlled waste are to be used or re-used on site, remediation works should be undertaken under a MMP; the MMP must be declared to CL:AIRE prior to commencement of remediation works.

Granular and cohesive soils should be safely stockpiled separately.

During the excavation works, the materials excavated should be inspected by the GE to ensure there are no areas of previously undetected contamination. Any soils exhibiting visual and / or olfactory evidence of gross contamination shall be placed in temporary stockpiles on hardstanding or heavy-duty Visqueen sheeting, suitably covered and bunded with appropriate signage and

identification. The GE shall advise the contractor of any testing requirements to adequately classify the materials for potential re-use or removal from site.

6.5. Control of Groundwater

The contractor shall ensure that potentially contaminated waters and leachate from excavations or stockpiling areas do not reach watercourses, surface water drains, etc. The contractor shall ensure contaminated waters or leachate do not discharge onto ground outside of the site or on the site.

All such waters will be treated on site as necessary for subsequent disposal to the foul sewer or alternatively removed from site by tanker to a suitable disposal facility.

The contractor will be responsible for obtaining all necessary permits, licences and consents for disposal to the foul sewer.

Contaminated waters pumped from excavations should be stored in a holding tank and be subject to appropriate chemical testing prior to disposal. Any discharges to foul sewer should be recorded in relation to date, time, quantity and quality. All records should be maintained at all times and be made available for inspection upon request.

6.6. Adoptable Highways

It is not currently known how far onto the site the highway boundary will extend; this will require confirmation prior to construction of the roads, car parking, etc.

With regards to adoptable highways, any in situ made ground found beneath proposed roads, car parking etc. will require excavation sorting, classifying and if suitable be re-used, compacting, in accordance with Series 600 (Earthworks) of the Department for Transport ‘Specification for Highway Works’ amended November 2009.

In light of the above, if highways are to be adopted as part of a Section 38 Agreement, it is recommended that the treatment of the soils below the proposed highway and any proposed highway design should be discussed with the LA Highways Department prior to construction.

Based on limited laboratory testing undertaken during the Sirius Geoenvironmental Appraisal, on remoulded cohesive soils (made ground and natural soils) a CBR value of <2.5% should be assumed for these materials at this stage.

However, in the eastern end of the site, where underlain by landfilled waste, it would be considered prudent to remove the landfilled waste in its entirety and establish final site levels with suitably compacted materials to facilitate the construction of a lightly reinforced hardstand.

Outside of the landfilled area, based on the anticipated CBRs, consideration could be given to excavation of the upper 1m to 2m of fill (or down to residual Coal Measures strata if shallower) classify and compact to development subgrade levels to facilitate the construction of a lightly reinforced hardstand.

Prior to development all sub grades should be proof rolled and visually inspected by the GE. Soft or loose materials should be removed and replaced with a compacted granular fill.

Notwithstanding the above, it is recommended, that in situ CBR testing is carried out by way of suitable plate load and TRL dynamic cone penetration testing on exposed sub grade at 25m spacings on adoptable roads and at 25m centres for car parks to confirm CBR values, when final site levels are known.

6.7. Re-profiling / In-Filling

Any areas requiring infilling shall be made level, by terracing if necessary with a nominal fall of 1 in 50. The base of all excavations shall be surveyed, prior to the placement of any engineered fill.

The base of any excavation or surface, prepared by the Earthworks Contractor, to accept fill material shall be proof-rolled using a vibratory roller and any soft spots encountered investigated, removed as necessary and replaced with suitable fill materials.

Once a clean working surface has been exposed, inspected and approved by the GE, suitable fill materials shall be placed to form the required development plateau.

Areas of fill shall be benched into adjacent areas in accordance with BS6031:1981 “Code of Practice for Earthworks”.

Any materials excavated not immediately placed in the deposition area shall be stored in stockpiles clearly identified. Surveys of any stockpiles shall be undertaken at regular intervals through the remediation works and provided to the GE, together with a description of their intended use.

Any stockpile of made ground soils shall be assumed to contain elevated concentrations of contaminants. It shall be ensured that such materials are not allowed to cross-contaminate any clean areas of the site, nor are they allowed to contaminate any off-site areas or controlled waters.

6.8. Compaction Requirements

Compaction works shall be undertaken in accordance with an approved engineering specification which should be agreed between Lidl and the Earthworks Contractor prior to commencement any works.

If the compaction criteria cannot be achieved by normal compaction methods on some of the made ground materials, then the GE should be consulted for further advice on alternatives.

6.9. Control Testing

All control testing shall be carried out in accordance with the relevant British Standard or other relevant guidance, except where the specification adopts alternative methodologies.

If the results of control / validation tests indicate that the fill is being placed and compacted in such a way that the desired level of compaction is not being achieved, the Earthworks Contractor shall further compact or, if necessary, shall excavate the affected work and replace with new fill, compacted to meet the specification requirements.

7. CONTAMINATION CONSIDERATIONS

As noted in Section 6.4, above, during the excavation works, the materials excavated should be inspected by the GE to ensure there are no areas of previously undetected contamination. Any soils exhibiting visual and / or olfactory evidence of gross contamination shall be placed in temporary stockpiles on hardstanding or heavy-duty Visqueen sheeting, suitably covered and bunded with appropriate signage and identification. The GE shall advise the contractor of any testing requirements to adequately classify the materials for potential re-use or removal from site.

Any groundwater or leachate arising from the site shall be considered to be contaminated until proven otherwise. The Earthworks Contractor shall ensure that potentially contaminated waters and leachate from excavations or stockpiling areas do not reach watercourses, surface water drains, etc. The Earthworks Contractor shall ensure contaminated waters or leachate do not discharge onto ground external to the site or on the site.

All such waters will be treated on site as necessary for subsequent disposal to the foul sewer or alternatively removed from site by tanker to a suitable disposal facility.

The Earthworks Contractor will be responsible for obtaining all necessary permits, licenses and consents for disposal to the foul sewer. Contaminated waters pumped from excavations should be stored in a holding tank and chemically tested prior to disposal. Any discharges to foul sewer should be recorded in relation to date, time, quantity and quality. All records should be maintained at all times and be made available to the GE upon request.

No asbestos contamination or ACMs were identified within made ground at the site. However, the presence of such contamination beneath existing floor slabs / hardstanding cannot be discounted. Should asbestos contamination or ACMs be identified during site clearance / excavation works then the impacted soils should be excavated and removed for disposal off-site by a suitably licenced contractor in accordance with a suitable method statement.

During the preparatory works it will be necessary to protect the health and safety of site personnel. General guidance on these matters is given in the Health and Safety Executive (HSE) document ‘Protection of Workers and the General Public during the Redevelopment of Contaminated Land (HS(G)66)’. In summary, (and subject to review based on site-specific conditions encountered, i.e. possible asbestos, hydrocarbons etc) of the following measures are suggested to provide a minimum level of protection:

- All ground workers should be issued with high visibility clothing, hard hats, protective footwear and impermeable heavy-duty gloves. Personnel should be instructed as to how they are to be used;
- Hand washing and boot cleaning facilities shall be provided;
- No smoking on site other than in designated areas (if any are present on site); and,
- Good practices relating to personal hygiene shall be adopted.

Before site operations are commenced the necessary COSHH Assessment, Method Statements and Health and Safety Plans should be completed and issued by the Earthworks Contractor in accordance with current CDM Regulations.

All site personnel shall undergo a site-specific health and safety induction prior to commencement of work on site.

8. SOILS IN SOFT LANDSCAPED AREAS

8.1. General

A clean cover system, with respect to protection of future end-users, is not required to be installed at the site. However, landscaped areas are proposed for the new development as shown on HTC Architects drawing no. 1744/P401 included in Appendix A. The landscaped areas will require the provision of soil to provide a suitable growth medium for plants; in line with the HTC Architects drawing this should be provided in accordance with the Lidl specification.

This work will be carried out after the site remedial works, forming part of the subsequent site development works.

8.2. Use of Site-Won Soils

Any site-won soils (topsoil and subsoil) proposed for use in the landscaped areas shall be confirmed to be suitable for use, as per the Lidl specification.

The use of site-won natural soils within the landscaped areas will require careful control of excavation arisings and soil management during the development. Excavated soils that are not immediately placed in the cover system should be stored in stockpiles at agreed locations and sealed, by 'blading', to reduce water ingress and softening.

8.3. Imported Soils

Any imported soils (topsoil and subsoil) proposed for use in the landscaped areas shall be confirmed to be suitable for use, as per the Lidl specification.

9. VALIDATION AND REPORTING

The GE and / or site manager will maintain records of the works to include the following:

- Daily record sheets to include a summary of the day's activities;
- Weather conditions;
- Plant, personnel and visitors present;
- Aspects relating to Health and Safety, environmental control or non-compliance with the General Specification or the contractors Method Statement; and,
- Test results;
- Waste Transfer Notes (for any soils disposed of off-site);
- Materials Conveyance Notes (for soils which are imported).

The GE shall ensure that the requirements of this strategy are complied with. On satisfactory completion of all the remediation works, the GE will provide an initial validation report, comprising relevant site records and act as certification that the remedial and ground preparation works have been carried out in accordance with this specification.

The validation report shall include the following:

- A description of the works undertaken;
- Records of the works, including measures taken to deal with any previously undetected contaminated soil and relict structures (if encountered);
- Progress photographs;
- Waste transfer notes;
- Materials Conveyance Notes (for soils which are imported)
- Chemical and geotechnical validation test results, including results of the asbestos removal from existing site stockpiles;

- As built surveys, including base of excavation and final level survey, base and top of made ground; and,

- A statement that the works have been undertaken in accordance with the agreed specification.

Subsequent validation reports will be required following the final provision of gas protection measures to the building (by others) post remediation works, in order to confirm the suitability and integrity of the measures provided, see Section 10, below.

10. POST REMEDIATION REQUIREMENTS

Lidl and their sub-contractors shall be responsible for all construction works following handover of the works. Elements that need to be included in any subsequent method statements shall include:

- Compliance with environmental issues;
- Construction of foundations;
- Construction / provision and validation of gas protection measures for the new building;
- Placement of growth media in soft landscaped areas (in line with Lidl specification, as per HTC Architects drawing no. 1744/P401);
- Health and Safety;
- Appropriate protection of underground services; and,
- Disposal of any contaminated arisings.

11. REGULATORY APPROVAL

A copy of this specification shall be forwarded to the Local Planning Authority (LPA), and other regulators as appropriate for their approval prior to the works.

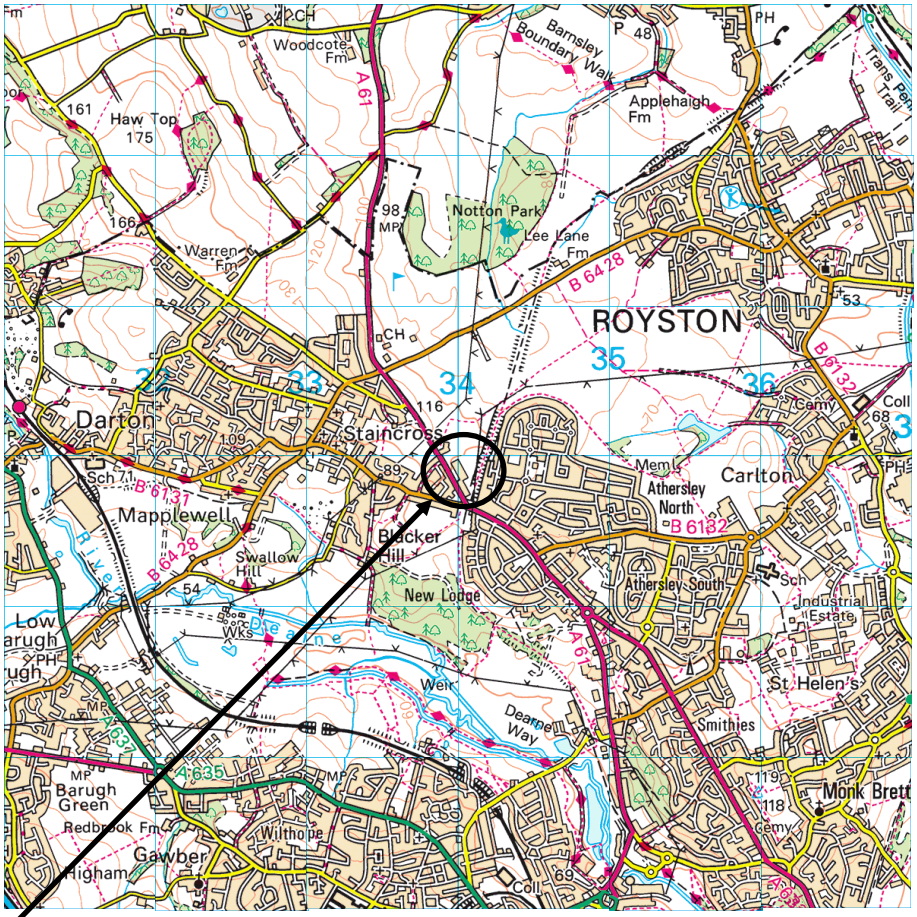
Detailed method statements from the Earthworks Contractor and any nominated sub-contractors may also be required to be submitted and approved in writing by the LPA prior to commencement of these works. Sufficient time should be allowed for regulatory approval to be obtained during the redevelopment programme.

APPENDIX A

FIGURES AND DRAWINGS

Site Location Plan

Contract Number	**C7481**
Contract	**Wakefield Road, Mapplewell**
Client	**Lidl UK GmbH**



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Sirius Geotechnical & Environmental Ltd, Suite 2, Russel House, Mill Road, Langley Moor, Durham DH7 8HJ.
Licence No. 100042005

Scale	**1:50,000**		
Drawn by	**AMG**	**Approved**	**AMG**
Drawing Number	**C7481/RS/01**		

Surfacing Treatment Key

- SMA (Stone Mastic Asphalt) to new car park circulation areas with white and yellow thermoplastic paint to denote car parking spaces in accordance with Lidl spec.
- PMB (Poly-modified Bitumen) to the HGV route, in accordance with Lidl specification
- 200x100mm dark grey/anthracite concrete block paving with pencil edge in Herringbone bond to front of store and paths in accordance with Lidl specification
- Reinforced concrete delivery ramp in accordance with Lidl specification
- Soft landscaping in accordance with Lidl specification

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DO NOT SCALE!
ALL DIMENSIONS SHOULD BE CHECKED ON SITE BEFORE WORK COMMENCES

SUBJECT TO HGV TRACKING CHECK

INLINE WITH TOPOGRAPHICAL SURVEY, LANDFORM SURVEY DATED 03.07.15 DRAWING NUMBER 001.

SUBJECT TO REVIEW OF LEVELS AND FALLS

SUBJECT TO CONFIRMATION OF CAR CHARGING POINT REQUIREMENT

SUBJECT TO LIGHTING PLAN

BASED ON LIDL SPEC DRAWING LD(13)-GF-01 - Ground Floor - Setting Out Plan

SUBJECT TO HIGHWAYS CONSULTED DESIGN

N

Residual Hazard Register:
HGV Tracking
Vehicular movements within car park
Pedestrian movements within car park.

Rev.	Date	Description	Drawn

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client
Lidl UK GmbH

project
New Store
Wakefield Road,
Mapplewell

drawing title
Proposed Type 1300
Surfacing Plan

date	July 2017		
status	Planning Issue		
scale	1:500 @ A3		
drawn	AB	checked	LS
job no.	1744	dwg no.	P401 rev. -

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DO NOT SCALE!
ALL DIMENSIONS SHOULD BE CHECKED ON SITE BEFORE WORK COMMENCES

SUBJECT TO HGV TRACKING CHECK

INLINE WITH TOPOGRAPHICAL SURVEY, LANDFORM SURVEY DATED 03.07.15 DRAWING NUMBER 001.

SUBJECT TO REVIEW OF LEVELS AND FALLS

SUBJECT TO CONFIRMATION OF CAR CHARGING POINT REQUIREMENT

SUBJECT TO LIGHTING PLAN

BASED ON LIDL SPEC DRAWING LD(13)-GF-01 - Ground Floor - Setting Out Plan

SUBJECT TO HIGHWAYS CONSULTED DESIGN

EXISTING LEVELS SHOWN IN PINK

PROPOSED LEVELS AND FALLS SHOWN IN GREEN

Residual Hazard Register:
HGV Tracking
Vehicular movements within car park
Pedestrian movements within car park.

Rev.	Date	Description	Drawn

htcarchitects
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client
Lidl UK GmbH

project
New Store
Wakefield Road,
Mapplewell

drawing title
Proposed Type 1300 Levels Plan

date	July 2017		
status	Planning Issue		
scale	1:500 @ A3		
drawn	AB	checked	LS
job no.	1744	dwg no.	P403 rev. -

Sales Area
+98.6m FFL

139 PARKING SPACES
Including 3 disabled / 6 P&C / 3 Staff

WAKEFIELD ROAD

Dismantled Railway

LOCATION OF GULLIES/ HIGHWAY BOUNDARY SUBJECT TO FURTHER DISCUSSION

97.9m

Nursery School

Heavily Overgrown
No Access

Building Rubble

Brick Path

Tarmac

Bush

Pipe

Elec. Pylon

Delapidated

Post

Open Board Fen

Conifers

LF6 96.515
LF7 94.768
LF9 94.704
LF10 94.846
LF11 95.606
LF12 95.992
LF13 96.245

APPENDIX B

SIRIUS GENERIC ASSESSMENT CRITERIA

SIRIUS GENERIC ASSESSMENT CRITERIA

Context

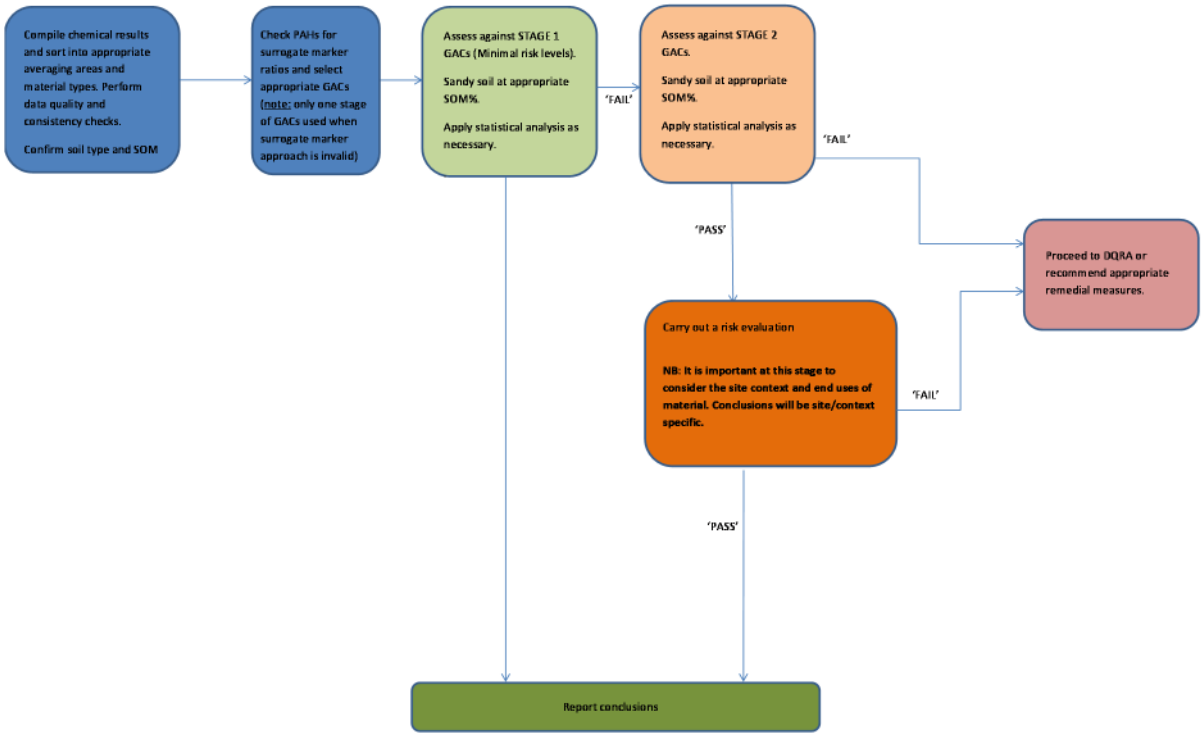
The framework for conducting site investigations, risk assessments and undertaking any necessary remedial works in the UK is provided by Environment Agency report CLR11 "Model Procedures for the Management of Contaminated Land". This presents a phased approach to risk assessment, involving: identification and qualitative assessment of potential pollutant linkages (source-pathway-receptor relationships) by means of a Conceptual Site Model; Generic Quantitative Risk Assessment (GQRA) of potentially significant pollutant links by comparing contaminant concentrations with appropriate Generic Assessment Criteria (GAC) values; and, if required, a Detailed Quantitative Risk Assessment (DQRA) based on site-specific conditions.

Assessment of Risk to Human Health

Introduction

A staged approach to GQRA has been adopted by Sirius for the evaluation of soil concentration data, as shown schematically in Figure 1.

Figure 1. GQRA Process.



The first stage of GQRA comprises assessment of the data against GAC values derived using toxicological parameter values based on "minimum risk". Any contaminants exceeding their GACs at this stage are further assessed against Stage 2 GACs, which have been derived using Low Level of Toxicological Concern (LLTC) criteria, where these are available.

With appropriate justification, a contaminant concentration that does not exceed the relevant Stage 2 GAC value may be considered to indicate that the land is "suitable for use". The appropriate use of LLTC-based criteria within the planning regime is considered reasonable by government agencies, as most recently highlighted in the letter (dated 3rd September 2014) to all local authorities from Lord de Mauley, Parliamentary Under Secretary at DEFRA.

A narrative "risk evaluation" must therefore accompany any Stage 2 assessment to justify the conclusions drawn. Where appropriate, this may provide a basis for eliminating from further consideration those contaminants whose concentrations do not exceed the applicable Stage 2 GAC value.

For the specific case of lead, the Category 4 Screening Level criteria given in CL:AIRE (2014)[1] have been adopted directly as GACs, as these are considered to be based on expert interpretation of current toxicological evidence.

In some areas, background concentrations of lead, other metals and metalloids, and/or individual PAHs may exceed their respective GACs and it may be appropriate to consider relative site and background concentration data as part of a more detailed assessment of the data.

Derivation of GACs

Except where otherwise stated, GACs have been derived by Sirius using CLEA version 1.071.

The GAC values have been derived for a sandy soil type, which will be conservative for the majority of soils (including made ground) encountered on historically contaminated sites. For organic contaminants of concern, criteria have been derived for a number of Soil Organic Matter (SOM) contents.

Genotoxic PAHs are assessed by the "Surrogate Method" using benzo(a)pyrene. Further information on this approach is given below.

Unless specifically stated, chemical properties and Health Criteria Values (HCVs) were obtained from:

- Environment Agency Science Report SC050021 series;
- Nathanail *et al*. (2009) "The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment", 2nd edition, Land Quality Press, Nottingham;
- CL:AIRE - AGS - EIC (2010) "Soil Generic Assessment Criteria for Human Health Risk Assessment". CL:AIRE, London.

GACs for arsenic, benzene, benzo(a)pyrene, cadmium and chromium (VI) have been derived using the

[1] CL:AIRE (2014) "Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination", Report SP1010, rev. 2.

Low Level of Toxicological Concern (LLTC) criteria given in CL:AIRE (2013). These criteria are considered a reasonable basis for assessment as they are still highly precautionary and definitely do not approach an intake level that could be defined as approaching Significant Possibility of Significant Harm to human health in the context of Part 2A of the Environmental Protection Act 1990. It must be further understood that the GACs derived will still incorporate a residual level of conservatism resulting from the exposure parameters used and the assumptions inherent in the model algorithms.

GACs for Genotoxic PAHs

Our approach to the assessment of genotoxic PAHs retains the use of benzo(a)pyrene as a surrogate marker. This approach for genotoxic PAHs is recommended by the HPA (2010)[2], which we consider to be the authoritative current guidance produced by a UK expert body and note that it was retained in the DEFRA Category 4 Screening Levels project (CL:AIRE, 2014).

The surrogate marker approach allows the assessment of the combined carcinogenic risk associated with all genotoxic PAHs[3] present as a mixture within soil, even though detailed toxicological information for many of the individual compounds may be lacking. The approach is based on determining the risk posed by the genotoxic PAH mixture using the concentration of benzo(a)pyrene present as an indicator.

To use the GAC for benzo(a)pyrene as a surrogate marker, a number of requirements must be met (HPA, 2010):

- Benzo(a)pyrene must be present in all soil samples containing genotoxic PAHs for which this method of assessment is being used;
- A similar profile of the genotoxic PAHs relative to benzo(a)pyrene should be present in all of the samples being assessed;
- The PAH profile of PAHs in the soil samples should be similar to that present in the pivotal toxicity study on which toxicological criterion for benzo(a)pyrene was based (Culp et al., 1998[4]). Table 1 provides the basis for defining the acceptable range.

Data indicate that contaminated soils in the UK generally meet these criteria[5] but the assessor must review their dataset before adopting this approach. If the above criteria are not met, then the surrogate marker approach must not be adopted and individual GAC or SSAC values are to be applied.

[2] HPA (2010) "Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)", version 5.

[3] The genotoxic PAHs included in the USEPA PAH 16 analysis reported by analytical labs are: benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, benzo(a)pyrene, chrysene, dibenz[a,h]anthracene and indeno[1,2,3-c,d]pyrene.

[4] Culp, S. *et al*. (1998) Carcinogenesis, 19, 117-124.

[5] Bull, S. & Collins, C. (2013) Environ. Geochem. Health, 31, 101-109.

Table 1. Profile of Genotoxic PAHs Relative to Benzo(a)pyrene that are Considered Acceptable for Application of Benzo(a)pyrene as a Surrogate Marker.

PAH	Acceptable Ratio of PAH Concentration to Benzo(a)pyrene for Application of Surrogate Marker Assessment	
	Lower Limit	Upper Limit
Benz[a]anthracene	0.12	12.43
Benzo[b]fluoranthene	0.11	10.85
Benzo[k]fluoranthene	0.04	3.72
Benzo[g,h,i]perylene	0.08	8.22
Chrysene	0.12	11.61
Dibenz[a,h]anthracene	0.01	1.38
Indeno[1,2,3-c,d]pyrene	0.07	7.27

For further information see: HPA (2010).

Soil Criteria Set for Purposes Other Than Human Health Protection

The Sirius GACs for sulphate, total organic carbon (TOC) and calorific value are set on basis of risks other than human health and their exceedance does not indicate a potential risk to future site users:

- The GAC for sulphate content is based on potential detrimental effects on buried concrete[6] and must be assessed with reference to the soil pH;
- The GAC for TOC content is provided for indicative assessment of disposal options if off-site landfill of soil were to be considered. This GAC is set at the 'Inert' waste threshold and should be considered as being applied for information purposes only;
- The GAC for calorific value is set to assist in an initial assessment of the potential fire risk posed by made ground or natural soils containing elevated concentrations of potentially combustible organic matter.

Assessment criteria more stringent than those for human health may be set for specific purposes, for example, elimination of nuisance odours or ensuring that potentially mobile free-phase organic products are not present.

Controlled Waters

The Environment Agency's "Remedial Targets Methodology" (2006) provides a framework for assessing the potential for pollution of controlled waters and for deriving remedial target concentrations in soil and groundwater.

There are no generic groundwater or surface water quality standards that are applicable to all sites. Drinking Water Standards and Environmental Quality Standards (EQS) are used by Sirius as assessment criteria where they are appropriate to the contaminant linkages under consideration. Given that these standards apply at the receptor point, this is a conservative approach for samples collected at a source or along a transport pathway.

[6] BRE (2005) "Concrete in Aggressive Ground", Special Digest No. 1; 3rd Edition.

Soil Leachability

Sirius specifies that the analytical laboratory undertakes leachate preparation by BS EN 12475-2:2002. Where specific circumstances require a different method to be used, then this will be explained and justified within the report body text.

The results of leachate analysis are compared to the relevant GAC values for controlled waters.

The Sirius Group
Stage 1 Generic Assessment Criteria for Soils

Revision: 17th February 2015

Parameter	Residential (mg/kg, unless otherwise stated)						Commercial / Industrial (mg/kg, unless otherwise stated)			Note
	With Homegrown Produce			Without Homegrown Produce						
	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	
Metals/Metalloids										
Arsenic (inorganic)	37			40			630			[1]
Cadmium	11			85			190			[2]
Chromium (III)	910			4000			8600			
Chromium (VI)	6.0			6.1			33			[3]
Copper	200			7100			68000			[4]
Lead	200			310			2300			[5]
Mercury (inorganic)	40			56			1100			[6]
Nickel	180			180			980			[7]
Selenium	250			430			12000			
Vanadium	410			1200			9000			
Zinc	450			40000			750000			[4]
Other Inorganics										
pH	<5 or >9			<5 or >9			<5 or >9			
Total Sulphate	2400			2400			2400			[8]
Water-Soluble Sulphate	0.5 g/l			0.5 g/l			0.5 g/l			[8]
Free Cyanide	34			34			1400			[9]
Organics										
PAHs										
Acenaphthene	200	490	920	2000	3600	4900	75000	92000	100000	
Acenaphthylene	170	400	760	2000	3600	4900	76000	93000	100000	
Anthracene	2300	5300	9400	30000	34000	36000	520000	540000	540000	[10]
Benzo(a)anthracene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Benzo(a)pyrene	2.1	2.1	2.2	2.3	2.3	2.3	27	27	27	[11]
Benzo(b)fluoranthene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Benzo(k)fluoranthene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Benzo(g,h,i)perylene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Chrysene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Dibenzo(a,h)anthracene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Fluoranthene	280	560	820	1500	1600	1600	23000	23000	23000	
Fluorene	170	390	730	2200	3400	4000	60000	67000	70000	
Indeno(1,2,3-c,d)pyrene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Naphthalene	1.0	2.3	4.6	1.0	2.4	4.7	110	260	510	
Phenanthrene	95	220	380	1300	1400	1500	22000	22000	23000	
Pyrene	620	1200	1900	3700	3800	3800	54000	54000	54000	
BTEX and related										
Benzene	0.063	0.13	0.24	0.16	0.30	0.38	15	28	49	
Toluene	100	240	460	370	830	1100	33000	68000	110000	
Ethylbenzene	26	62	120	34	81	110	3200	7400	14000	
Xylenes (total)	28	67	130	33	78	110	3200	7700	15000	[12]
1,2,4-trimethylbenzene	0.22	0.53	1.1	0.24	0.58	1.2	39	93	170	
Iso-propylbenzene	6.6	16	32	6.8	17	33	1300	3100	6100	
Propylbenzene	21	51	100	23	57	110	3800	9100	17000	
Styrene	6.9	16	32	21	49	93	3100	6100	9500	
TPH										
Aliphatic EC 5-6	24	41	68	24	41	48	2400	4100	6900	
Aliphatic EC >6-8	53	110	210	53	110	150	5300	11000	21000	
Aliphatic EC >8-10	13	31	61	13	31	43	1300	3100	6000	
Aliphatic EC >10-12	62	150	300	62	150	220	6100	15000	28000	
Aliphatic EC >12-16	510	1200	2300	510	1200	1700	43000	72000	85000	
Aliphatic EC >16-35	41000	70000	90000	42000	70000	80000	>1E6	>1E6	>1E6	[13]
Aromatic EC >5-7	53	110	200	150	300	380	15000	28000	48000	
Aromatic EC >7-8	100	240	460	370	820	1100	33000	68000	110000	
Aromatic EC >8-10	20	48	94	22	54	75	2200	5200	9800	
Aromatic EC >10-12	63	150	290	120	290	400	11000	22000	30000	
Aromatic EC >12-16	140	320	570	1100	1900	2100	35000	37000	37000	
Aromatic EC >16-21	260	540	840	1800	1900	1900	28000	28000	28000	
Aromatic EC >21-35	1100	1500	1700	1900	1900	1900	28000	28000	28000	

The Sirius Group
Stage 1 Generic Assessment Criteria for Soils

Parameter	Residential (mg/kg, unless otherwise stated)						Commercial / Industrial (mg/kg, unless otherwise stated)			Note
	With Homegrown Produce			Without Homegrown Produce						
	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	
Chlorinated Organics										
Chlorobenzene	0.19	0.44	0.86	0.19	0.45	0.87	31	71	140	
Dichloromethane (DCM)	0.47	0.78	1.2	1.2	1.7	2.4	250	340	470	
1,1-dichloroethane (DCA)	1.4	2.4	4.0	1.4	2.4	4.1	260	420	690	
1,2-dichloroethane (DCA)	0.0031	0.0048	0.0076	0.0035	0.0053	0.0084	0.34	0.51	0.81	
1,1-dichloroethene (DCE)	0.15	0.26	0.45	0.15	0.26	0.46	24	43	74	
cis-1,2-dichloroethene (DCE)	0.066	0.12	0.20	0.069	0.12	0.21	14	23	38	
trans-1,2-dichloroethene (DCE)	0.11	0.21	0.38	0.12	0.22	0.39	21	37	65	
Pentachlorophenol	0.21	0.52	1.0	27	30	31	400	400	400	
1,1,1,2-tetrachloroethane	0.56	1.3	2.6	0.63	1.5	2.9	59	140	270	
1,1,2,2-tetrachloroethane	0.98	2.1	4.0	1.6	3.4	6.3	150	310	570	
Tetrachloroethene (PCE)	0.074	0.17	0.32	0.07	0.17	0.33	10	23	45	
Tetrachloromethane (CT)	0.011	0.024	0.046	0.011	0.024	0.046	1.6	3.6	6.9	
1,1,1-trichloroethane (TCA)	3.7	7.8	15	3.8	7.9	15	370	770	1400	
1,1,2-trichloroethane (TCA)	0.39	0.85	1.6	0.51	1.1	2.0	89	180	320	
Trichloroethene (TCE)	0.0070	0.015	0.028	0.0071	0.015	0.68	1.5	2.8	44	
Trichloromethane (CF)	0.43	0.80	1.4	0.48	0.89	53	98	170	300	
Vinyl Chloride	0.00034	0.00045	0.00062	0.00037	0.00048	0.00066	0.038	0.049	0.068	
Miscellaneous Organics										
Carbon disulphide	0.066	0.13	0.25	0.066	0.13	0.25	6.7	14	25	
Di-(2-ethylhexyl)-phthalate	290	660	1100	3900	4000	4100	85000	85000	8600	
MTBE	31	55	94	39	68	120	7400	12000	19000	
Phenol	110	190	330	420	440	440	440			[14]
Methylphenols (cresols), total	78	170	330	5600	8200	9900	160000	170000	18000	[15]
2,4-dimethylphenol (m-xylenol)	18	43	82	200	430	720	15000	23000	28000	
Other Parameters										
TOC	3% w/w			3% w/w			3% w/w			[16]
Calorific Value	2 MJ/kg			2 MJ/kg			2 MJ/kg			[17]
Asbestos	Fibres present			Fibres present			Fibres present			

All concentration-based criteria are rounded to 2 significant figures.

The criteria assume a sandy soil type, which will be conservative for the great majority of soils (including made ground) encountered on historically contaminated sites.

Except where otherwise stated, criteria have been derived by Sirius using CLEA version 1.06. Parameters for the land use cases are consistent with those given in Environment Agency (2009) "Updated Technical Background to the CLEA Model", report SC050021/SR3 but updated (where relevant) for respiration rate, exposure frequency for dermal contact outdoors, soil adherence factors for children, and plant uptake concentration factors given in CL:AIRE (2014) and Nathanail et al., (2015). No correction has been made for the "Top Two" crop types in the Residential with Homegrown Produce land use and the criteria will therefore be conservative in this regard.

Health Criteria Values (HCVs) and (except where specifically noted) chemical property data were obtained from:
- Environment Agency Science Report SC050021 Series;
- Nathanail et al. (2015);
- CL:AIRE-AGS-EIC (2010).

Footnotes

[1] Based on oral GAC as this is the lower GAC and reflects a cancer risk many orders of magnitude greater than for inhalation.

[2] Determined for lifetime exposure. Plant uptake concentration factors applied were as given in CL:AIRE (2014). The GAC values are based on data for soils having a pH value in the range 6-8; caution should be applied in applying them at pH values outside this range, especially at pH values <5.

[3] Both oral and inhalation HCVs are based on local toxicological effects and therefore the lowest (oral) GAC value is adopted.

[4] For the Residential with Homegrown Produce land use, the GAC values for Cu and Zn are based on potential phytotoxic effects and have been set at the maximum allowable concentrations for sewage sludge-amended soils presented in the "Sludge (Use in Agriculture) Regulations" (SI 1263/1989); these criteria may also be applied in any land use where plants are to be grown. The equivalent GAC values for human health protection in the Residential with Homegrown Produce land use are around an order of magnitude greater.

[5] The Category 4 Screening Levels for lead defined in CL:AIRE (2013) have been adopted directly to provide an acceptable basis for initial assessment of data. Where background concentrations of lead exceed the GAC value, then site-specific evaluation will be required.

[6] The SGV for mercury is based on inorganic mercury which represents the most common form encountered within the environment. This is considered appropriate for most sites as: "…the SGV for inorganic mercury can normally be compared with chemical analysis for total mercury content because the equilibrium concentrations of elemental and methylmercury compounds are likely to be very low" (Environment Agency report SC050021/Mercury SGV). Analysis and specific assessment for elemental or methylated forms of mercury will need to be considered if historical land use or site-specific factors indicate that these forms of mercury are likely to be present.

[7] Toxicological effects by inhalation are localised, therefore the lower of the GAC values for oral and inhalation HCVs have been adopted.

Parameter	Residential (mg/kg, unless otherwise stated)						Commercial / Industrial (mg/kg, unless otherwise stated)			Note
	With Homegrown Produce			Without Homegrown Produce						
	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	

[8] BRE (2005). Sulphate is not considered to pose a potential risk to human health under normal circumstances – this GAC applies to construction cases only and is set at the upper limit for DS-1 Design Sulphate Class concrete.

[9] GAC calculated for acute risk. Further information can be provided upon request.

[10] The genotoxic PAHs (benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene) are routinely assessed using benzo(a)pyrene as a surrogate (HPA (2010) "Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)", version 5). Separate information on this approach is provided.

[11] Calculated using a 'minimum risk' oral index dose derived from the application of a 10,000x safety factor to the BMD10 presented in CL:AIRE (2014) for benzo(a)pyrene as a surrogate marker and the inhalation index dose specified in CL:ARE (2014) and Nathanail *et al*. (2015). As a conservative measure, the GAC is based on combined exposure pathways to account for systemic carcinogenic effects. Further information on the derivation can be provided upon request.

[12] For screening purposes, a single GAC has been set for total xylene. This is the lowest of the values calculated for the three individual xylene isomers.

[13] "No GAC" indicates that no value has been specified for this land use as the TDSI cannot be exceeded at achievable soil concentrations.

[14] 440mg/kg is the minimum concentration that is protective for direct skin contact with phenol (See Environment Agency SR050021/Phenol SGV) and is adopted where GACs for chronic exposure are higher.

[15] For screening purposes, a single GAC has been set for total methylphenol. This is the lowest of the values calculated for the three individual methylphenol isomers.

[16] The Hazardous Waste (England and Wales) Regulations 2005. TOC content in itself does not represent a potential risk to human health. This GAC is provided for indicative assessment of disposal options, in the case that off-site landfill of soil is undertaken. This GAC is specified at the 'Inert' waste threshold and should be considered as for information purposes only.

[17] ICRCL (1986) Guidance Note 61/84, 2nd Edition, Notes on the Fire Hazards of Contaminated Land. Calorific value is not an indication of direct human health risk but may be useful in assessment of the potential fire risk posed by made ground or natural soils containing elevated concentrations of potentially combustible organic matter.