Combined Remediation Strategy, Drilling & Grouting Plan

Client: Lidl Great Britain Ltd

Lidl, Birstall

Report No: 1080.07.03

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REMADA GEO CONSULTANTS

TABLES

FIGURES

APPENDICES

Issue No	Date	Prepared By	Technical Review	Authorised
01	12.04.2024	S Taylor	P Dickinson	G Jones
02 (Revised Section 5.4)	14.05.2024	P Dickinson	P Dickinson	G Jones
03 (Revisions to S1, S4 & S6)	24.01.25	G Jones	P Dickinson	G Jones

1. INTRODUCTION

Remada Ltd was commissioned by Lidl Great Britain Ltd ('the Client') to prepare a Remediation Strategy for a proposed Lidl retail store on land off Bankwood Way, Birstall WF17 9TD. This report was prepared with regards to Kirklee Council's planning application ref: 2021/62/92528/E Conditions 18 and 19 relating to land quality and to present appropriate mitigation measures. This Remediation Strategy also sets out the works required to close out Condition 21, instability arising from coal mining legacy. The proposed site layout is presented on **Figure 1**.

This document has been updated and reissued on receipt of comments from Kirklees Council (Environmental Health) reference WK/202434387.

1.1 Proposed Development

Lidl proposes to develop a new retail store with 165 customer parking spaces. The new store footprint area will be 1,928m^2. A delivery bay will be located at the side of the store and the existing access from Bankwood Way will be retained to minimise adverse effects on traffic congestion. Some localised areas of soft landscaping will be present as part of the design.

1.2 Objectives

The objectives of this assessment are as follows:

- Summarise historic investigation reporting and recent ground investigation work;
- Define the works require to remediate the site to a suitable condition for a commercial/retail development;
- Detail the method of work to be adopted for the remediation of the site.

1.3 Scope of Work

The scope and layout of this document has been designed in mind of the Environment Agency's Land Contamination Risk Management guidance for land contamination reports.

The scope of the work comprised:

- An assessment of previous site investigation work on-site;
- A review of regulatory correspondence pertaining to the proposed development;
- An update of earlier Conceptual Site Model;
- Defining the extent of contamination requiring remediation;
- An appraisal of the appropriate remediation technology;
- Detailing the scope of environmental and geotechnical remediation works to be implemented; and
- Defining verification and reporting requirements.

1.4 Summary of Previous Investigations

A summary of the available reports is tabulated below:

2018	*Geo-Environmental Assessment, by Delta-Simons, issued in July 2018.*
2019	Project Completion Document: Asbestos Removal, Soft Stripping, Demolition of Building to Slab Level, Removal and Crushing of Slabs and Foundations, by Professional Remediation, issued in March 2019
2020	*Combined Phase 1 & 2 Ground Investigation Report, by Curtins, issued in December 2020.* *Supplementary Report, by G B Card & Partners, issued in December 2020*
2021	*CPT Report, by Lankelma, issued in January 2021.* *Detailed Coal Mining Risk Assessment, by Sirius (ref: C8781/GH/9715/Rev B), issued in October 2021.* *Coal Mining Risk Assessment, by G B Card & Partners (ref: GB/661), issued in October 2021.* *Ground Engineering & Contamination Mitigation Philosophy, by Beam Consulting (ref: 09-148-DOC003A), issued in October 2021.*
2022	*Supplementary Coal Mining Investigation, by Sirius (ref: C8781/AW/9824), issued in March 2022.* *Hazardous Ground Gas Risk Assessment, by Sirius (ref: C8781MB9853), issued in May 2022.* *Strategy for Remedial & Preparatory Works, by Sirius, issued in May 2022.* *Geotechnical Review, by SDS Design Engineers, issued in September 2022.* *Remediation Strategy, by Remada (ref: 1080.01.01/1080.01.02) issued in October 2022. Note: Appendices were revised in February 2023 (ref: 1080.01.03).* *Drill & Grout Specification, by Remada (ref: 1080.02.01) issued in October 2022.* *Settlement Estimates Letter Report, by Remada (ref: 1080.04.01), issued in October 2022.*
2024	*Factual Ground Investigation Report, by Remada (ref: 1080.06.01) issued in February 2024.*

1.5 Regulatory Consultations

1.5.1 Local Authority Environmental Health

Kirklees Council (Environmental Health) consultation reference WK/202434387 dated 17th December 2024 comments

'At this stage, we believe further clarification is necessary and that Condition 18 should remain. There appears to be turnover of landfill material proposed, and we require additional information regarding the proposals. Furthermore, we expect ground gas monitoring to be conducted post-grouting/earthworks. In addition, the gas protection proposals have not been confirmed, and we would expect ground gas alarm systems to be implemented on sites of this nature'.

This Remediation Strategy has not proposed turnover of the landfill but does state that obstructions to proposed foundations are to be removed.

1.5.2 Coal Authority

The Coal Authority's consultation response dated 14th November 2024 comments that the first part of Planning Condition 21 has been satisfactorily address but the remediation works have not been implemented.

1.6 Limitations

The comments given in this report and the opinions expressed are based on the information reviewed and observations during site work. However, there may be conditions pertaining to the site that have not been disclosed by this assessment and therefore could not be taken into account.

2. Background

2.1 Review of Previous Reports

A review of previous reports pertaining to the study site has been undertaken by Remada and is summarised in this section.

2.1.1 Geo-Environmental Assessment, by Delta-Simons (July 2018)

The site was found to be undeveloped until the 1960s when the southeast parts of the site comprised a landfill extending off-site to the southeast. The business park was developed in the early 1990s with the site layout generally unchanging to the present day, prior to the demolition of the business park.

The site was found to be underlain by variable thicknesses of Made Ground underlain by sandstone, siltstone, mudstone, and coal of the Lower Pennine Coal Measures. Possible voids or collapsed workings were identified. Water was rarely encountered during the course of the investigation and was considered to be perched above cohesive soils where it was.

It was recommended that Made Ground across the entire site be improved to mitigate against future unacceptable levels of settlement, for example by deep soil mixing to a specified CBR which would also enable the use of a piled foundation solution, which was recommended due to poor ground conditions. Consideration for the potential for negative skin friction associated with settlement of landfill materials was recommended.

It was recommended that all floor slabs be suspended.

It was also recommended that the extent of possible voids or collapsed workings be determined and treated prior to the redevelopment of the site.

A significant risk to controlled waters was not identified as part of the works, with the presence of buildings and hardstanding minimising infiltration and potential leaching.

The site was classified as a Characteristic Situation 2 with regards to ground gas, where basic ground gas protection measures are required.

Further ground investigation was recommended within the area of the recorded adit in the north-east of the site, to further assess the remediation cost.

However, Remada have identified that DeltaSimon's borehole log RT101 (E423789.20 N427455.68) located in the north-eastern area of the site contains evidence to suggest that the adit was encountered during their intrusive investigation. This exploratory borehole encountered MADE GROUND to 2.5m bgl, underlain by brown SANDSTONE to 3.8m bgl (145.12m AOD). The bedrock was underlain by MADE GROUND 'Loose Fill' to a depth of 5.7m bgl, with grey silt MUDSTONE thereafter. Remada considers it likely that the 1.9m thick 'loose fill' strata is actually the adit, and it would be prudent to undertake additional investigation to confirm this.

2.1.2 Project Completion Document, by Professional Remediation (March 2019)

The above document detailed the demolition of on-site buildings including asbestos removal, soft stripping, demolition, removal of slabs and foundations and crushing of all site-won material. Slabs and foundations were removed under existing building footprints to a depth of 1m bgl, and other areas of hardstanding were removed to ground level with no turnover of underlying material.

2.1.3 Combined Phase 1 & 2 Ground Investigation, by Curtins (December 2020)

The site was found to comprise agricultural fields and woodland since the early 1850s. Coal Authority Abandonment Plans indicated historical working in the northeast of the site extending off-site to the northeast until the 1911 mapping. A highwall was shown to run north to south in the center of the site on historical maps from 1883/4, extending to the northeast of the site by 1956. Historical landfill was indicated on-site across the majority of the site area and extending off-site to the southwest in 1970. Landfill operations were considered to have continued until the mid-1980s when the highwalls were no longer mapped. In 1992 the business centre was constructed on-site.

Extensive coal and mineral mining occurred within close proximity of the site from the 1870s onwards. These wider collieries were shown to be disused by 1956. A number of landfills were mapped in close proximity to the site.

Previous investigations of the site by Delta-Simons in 2018 recorded highly variable thicknesses of Made Ground underlain by sandstone, siltstone, mudstone and coal of the Pennine Lower Coal Measures. Possible voids or collapsed workings were encountered at shallow depths within the west and northeast of the site. A ground gas characteristic situation of CS-2 was applicable to the site.

Structural surveys of two of the business centre buildings noted external and internal structural defects associated with the settlement of landfill materials.

An intrusive investigation consisting of twelve rotary boreholes and the installation of ground gas/groundwater monitoring wells encountered highly variable thicknesses of Made Ground (average depth 1.75m bgl) comprising reworked natural clay. Within the footprint of the historical landfill refuse was encountered in the southern areas of the site to a maximum depth of 12.5m bgl, and where refuse was not encountered, Made Ground comprising reworked, natural clay was encountered to a maximum depth of 14.0m bgl. Made Ground was found to vary spatially, with thicker Made Ground in the east of the site, shallowing rapidly in the northeast, and with thinner deposits of Made Ground in the west and north of the site.

Weathered and solid bedrock was encountered at depths of less than 2.0m bgl outside the footprint of the historic landfill, and at a depth of 14.5m bgl within the footprint of the landfill. Solid geology typically comprised extremely weak to medium strong thinly laminated orange-brown mottled grey mudstone and siltstone with bands of medium-strong to strong grey fine-grained sandstone. Coal associated with the Flockton Thin coal seam was encountered between 2.8 and 8.4m bgl across the northeastern, northwestern, and western areas of the site. No other coal seams were encountered within 30.0m of the existing ground surface levels. Perched water was encountered locally and bubbling was noted within one of the boreholes where perched water was encountered.

No exceedances above the appropriate GAC of the determinants tested for within soil samples analysed were identified. A ground gas characteristic situation of CS-4 was considered applicable to the site.

2.1.4 Supplementary Report, by G B Card & Partners (December 2020)

The site was found to be undeveloped since the time of the earliest available historical mapping (1852), comprising fields and a small area of woodland in the east of the site. Numerous coal pits, quarries, and other mining features were identified in the vicinity of the site at this time, as near as 70m west of the site. By 1893 excavation of the southeast of the site was evident, with further excavation indicated

on the 1956 maps with an area of steeply sloping ground trending southeast to northwest across the northern margin of the site. Operations ceased between 1988 and 1990 at which time the site was infilled and the business centre was constructed by 1992. The business centre was demolished in 2018/19 as a result of ongoing settlement issues since 2001.

A Coal Mining Report obtained by Curtins Limited identified the Flockton Thin coal seam being 0.91m thick and outcropping on-site. The Top Fenton seam was recorded as being 0.60m in thickness, present on-site at a depth of 30m bgl. The seams are recorded as having last been worked in 1877 and 1911, respectively. Several further seams of present beneath the site, though these are at depths considered to be unlikely to affect the development of the site. An adit was recorded in the eastern corner of the site, apparently intercepted the Flockton Thin coal seam in a northeasterly direction. Further, unrecorded shallow workings and/or mine entries were indicated to be probable.

It was recommended that consideration be given to how the base of the columns will be installed without deflection and with sufficient penetration into competent natural material around the edge of the former opencast workings, where interacting with the highwall.

It was noted that the landfill waste was described as being within a clay matrix that would generally dominate the geotechnical engineering behaviour of the waste, though variation was predicted given the heterogeneity of the material. It was considered possible that any biodegradable putrescible materials in the waste are still degrading. Following improvement, the long-term residual degradation of landfill waste materials, resulting in potentially uneven loss of strength within the soil mass, should be considered. Where long-term settlement occurs within the waste mass, confirmation should be provided that any reduction of support and/or movement will not adversely affect the proposed solution, resulting in excessive movement or collapse of the stone columns.

It was recommended that the design considers the transition between differing foundation types (CMC's/BMC's) to minimise potential differential movements and to maintain transition gradients within acceptable tolerances. It was anticipated the use of the load transfer mat will mitigate the majority of these potential effects.

The potential for ground gas migration, particularly within the vibro stone column element of the BMC columns, should also be considered when designing the system. It may not be feasible to locate the base of the stone columns within the landfill waste material, encountered from depths as shallow as 0.8m bgl, which may mean varying the depth of the stone columns across the site.

It was understood that the identified shallow mine workings are to be treated by injection grouting prior to ground improvement works taking place. The interaction between the treated mine workings, including the adit recorded in the northeast of the site, but not identified, and the ground improvement works should be considered to ensure the performance of the ground treatment is not adversely affected.

It was recommended that excessive heave should be mitigated during the ground improvement works, as this will reduce the effectiveness of the improvement of soils surrounding the columns. It was assumed the surcharge loading from the addition of the load distribution mat will be minimal and supported by the columns and will therefore not significantly increase consolidation settlements.

GB Card and Partners were commissioned to undertake a geotechnical assessment of the proposed ground improvements at the site.

Based on the information provided by the previous ground investigations, controlled modulus columns (CMC) beneath the building footprints and service yard and bi modulus columns (BMC) comprising vibro stone columns (VSC) to depths between 1 and 2m and underlain by CMC, beneath pavement areas were recommended. It was recommended that all CMC were advanced into the underlying bedrock.

Potential issues with the ground improvement method included further deterioration of landfill materials resulting in reduced lateral support to columns, the potential for differential settlement (to be mitigated via a load transfer platform), and the potential for ground gas migration.

2.1.5 CPT Report, by Lankelma (January 2021)

Lankelma undertook a ground investigation comprising cone penetrations tests (CPT) across the site; eight were advanced in car park and landscaped areas, and fourteen were advanced under the building footprints.

2.1.6 Detailed Coal Mining Risk Assessment, by Sirius (October 2021)

The table below summarized the potential risks associated with coal mining legacy for the site.

Coal Mining Issue	Requires Further Consideration?		Comments
	Yes	No	
Underground Coal Mining	✓		The CA Mining Report notes that a number of seams are recorded to have been mined below the site, including the Flockton Thin at a depth of 10m bgl and an extraction thickness of 0.91m (last worked in 1877). The Top Fenton (or First Brown Metal) is recorded to have been mined at a depth of 30m bgl with an extraction thickness of 0.60m (last worked in 1911). The Middleton Main is recorded to have been mined at a depth of 74m bgl with an extraction thickness of 1.22m (last worked in 1875). The Top Beeston, Whinmoor and Black Bed coals are recorded to have been mined at depths of between 165m and 242m bgl. Mine abandonment plans have been obtained for the three shallowest recorded seams, copies of which are included within Attachment B. The site falls within the CA defined Development High Risk Area.
Unrecorded Shallow Coal Mining	✓		The CA Mining Report notes that there are probable unrecorded shallow workings below the site.
Mine Entries (shafts and adits)	✓		An adit is recorded to be located within the northeast of the site (CA ref. 423427-054), with a recorded bearing of 24°. The CA hold no details of any past treatment of the adit. The CA records five mine entries off-site, the closest located 50m to the west. The locations of the recorded mine entries are shown within the CA report, included within Attachment B.
Coal Mining Geology		✓	The CA's Mining Report states there are no faults, fissures or breaklines recorded.
Record of Past Mine Gas Emissions	✓		No mine gas emissions recorded by the CA within 500m of the site. It is acknowledged, however that where coal resources or coal mine features exist at shallow depth, there is the potential for mine gas to exist.
Recorded Coal Mining Surface Hazard		✓	No damage notice or claim associated with coal mining subsidence for the site or any property within 50m of the site have been received by the CA since October 1994.
Surface Mining (opencast workings)		✓	The CA's Mining Report indicates that the property is not affected by historic opencast mining. However, a review of historical OS Mapping indicates the presence of potential opencast workings on site.

Three (3 No.) coal mine abandonment plans were obtained from the Coal Authority relating to the 3 No. shallowest recorded seams to have been mined.

The Flockton Thin coal was recorded in 1878 to have been worked within the northwestern and western extents of the site and an adit was mapped off-site to the northwest. The southeastern area of the site was referenced as 'output of coal' located to the east a conjectured outcrop. The coal was indicated to be around 0.8m thick.

The Top Fenton/First Brown Metal abandonment plan (1913) showed working within the First and Second Brown Metal Coal to the east and north of the site. The site was located to the south of an area referenced as 'old workings' and a drift (assumed to be related to the recording mine adit ref: 423427-054) was mapped in the northeastern portion of the site, heading off-site in a northeasterly direction.

The Brown Metal Coal foot was indicated to be encountered at a depth of around 12.0m and a section of the First and Second Brown Metal Coal indicated the seam to have a thickness of around 0.6m.

Six recorded mineral sites were identified within 250m of the site.

Previous ground investigations encountered variable thicknesses of Made Ground that was generally noted to become thicker towards the east, and was encountered to a maximum depth of 12.5m. Made Ground was found to overlie weathered and competent deposits of the Pennine Lower Coal Measures which were generally encountered as mudstone or sandstone. Coal seams and/or evidence of mine workings were identified in a number of exploratory holes, as summarised in the table below.

Borehole	Depth to Rockhead (m bgl)	Invert Depth to Intact Coal (m bgl)	Invert Depth to Suspected Workings (m bgl)	Seam / Working Thickness (m)	Inferred Seam Name	Thickness of overlying Competent Rock (m)
DS112	NR	5.8	NR	0.2	FN	0
RT101	2.5	NR	*5.7*	1.9	FN	1.3
RT105	8.2	37.3	NR	0.2	1BM	28.9
RT106	7.5	37.6	NR	0.2	1BM	29.9
RT107	1.0	NR	*4.6*	1.4	FN	2.2
		38.3	NR	0.2	1BM	37.1
RT108	0.8	NR	*5.0*	2.8	FN	1.4
		38.7	NR	0.25	1BM	37.6
RT109	3.4	38.4	NR	0.3	1BM	34.7
RH201	1.8	4.9	NR	0.2	FN	2.9
RH204	1.3	NR	2.4	0.3	FN	0.8
		NR	*3.5*	0.6	FN	
RH205	0.4	NR	*4.5*	2.7	FN	1.4
RH206	0.6	6.8	NR	0.6	FN	5.6
RH207	3.0	NR	*8.0*	LOF	FN	0.0
RH208	3.0	8.6	NR	0.2	FN	5.6
TT201A	2.0	4.0	NR	0.6	FN	1.4
TT201E	5.0	NR	*5.0*	2.5	FN	0.0
TT204B	1.0	NR	*>3.0*	>1.5	FN	0.5
TT204C	2.1	3.2	NR	0.4	FN	0.7

* Flockton Thin (FN)
Top Fenton / First Brown Metal (1BM)
LOF - Loss of Flush (thickness of workings / seam not identified)
NR – Not recorded/encountered

Recorded mine workings within the Flockton Thin Coal Seam were encountered between depths of 3.5 and 8.0m. Where intact, the Flockton Thin Coal Seam was encountered at a thickness of up to 0.60m and suspected workings were identified due to a loss of flush or encountering loose fill, collapsed workings, voids and soft/broken ground at thicknesses of between 0.60 and 2.80m.

Evidence of seat earth was recorded underlying Made Ground within Curtin's trial hole TT204A.

The seam was recorded to have been worked in 1877 indicated a pillar and stall method would likely have been used. Intact coal encountered may represent areas of pillars left in-situ as support for workings.

Locally, the coal appears to have been extracted by opencast methods as identified by areas of earthworks and highwalls on historic OS maps. Excavations were backfilled with Made Ground soils.

It was noted that instability of bedrock resulting from the collapse of pillar and stall mine workings may exceptionally extent to 10 times the height of the original extraction. All boreholes where evidence

of mine workings was encountered within the Flockton Thin seam were found to have insufficient cover.

Sufficient competent cover was identified over the deeper Top Fenton/First Brown Metal seam to mitigate any risk from surface stability within any mine workings present below the site. No definitive evidence of mine workings within the seam were recorded on-site on the mine abandonment plan.

It was recommended that areas of the site underlain by the Flockton Thin and/or associated coal/seat earth workings be stabilised by drilling and pressure grouting to mitigate the risk of surface instability. The stabilisation works are proposed to allow historic workings within the Flockton Thin coal seam to be substantially filled as well as any voids or broken ground to prevent the development of crown holes at surface or formation level.

The adit in the northeast of the site had a recorded angle of 24° and a departure of 8m with an assumed diameter of 2m. Evidence of a drift was indicated on the abandonment plans for the Top Fenton seam.

Further investigations to determine the presence/absence of the adit and its dimensions, depth, and locality were strongly recommended as well as confirmatory probe holes to confirm the depth and dimensions of any backfill.

The adit is located within a proposed car parking area and any identified adits with the potential to affect the proposed development should be stabilised, e.g., by the drilling, grouting, and capping where necessary.

The possibility of encountering unrecorded mine entries on-site cannot be discounted, therefore it was recommended that areas beneath proposed buildings have overlying Made Ground removed where feasible to expose the natural ground to enable the inspection of the formation for any disturbed ground, which if encountered would require treatment.

The foundation designs should consider the presence of shallow treated/consolidated mine workings. As an alternative to a piled foundation solution, ground improvement utilising controlled modulus columns beneath building footprints and the service yard, and bi-modulus columns beneath the pavement areas is being considered, with the base of the columns at least 0.5m within the Pennine Lower Coal Measures.

2.1.7 Coal Mining Risk Assessment, by G B Card & Partners (October 2021)

A letter report was produced by G B Card & Partners in response to the above Detailed Coal Mining Risk Assessment produced by Sirius. G B Card & Partners largely agrees with the site characterization and setting as described but made the following comments:

It was recommended that the proposed building development be founded on soil cement columns penetrating a minimum of 0.5m into the underlying Pennine Lower Coal Measures Formation (below the Flockton Thin and First Brown Metal coal seams). G B Card & Partners stated that there was no need to pressure grout loose or fissured round as the process of installing soil cement columns would fill any loose or voided ground. The same process would be undertaken beneath roads and drainage infrastructure, and a reinforced granular mattress should be placed beneath buildings, roads, and hardstanding to further spread load from the structure or pavement onto the improved, treated ground as well as to span any loose or voided ground that may migrate to shallow depths.

It was considered that the previous application of a ground gas characteristic situation of CS4 to the site was conservative. It was considered that the age of the Made Ground and waste deposits (30 to 50 years) would mean the majority of the degradable waste within the fill will have reduced, reducing the potential for significant ground gas generation, therefore it was not considered that further ground gas monitoring would be necessary unless intended to reduce the characteristic situation applicable to the site and the scope of ground gas protection measures.

2.1.8 Ground Engineering & Contamination Mitigation Philosophy, by Beam Consulting (October 2021)

Beam Consulting produced this document to enable the successful remediation of the site. Beam identified contamination, coal mining legacy, ground gas and the essential requirement to improve the bearing capacity of the existing ground as the key issues affecting the site.

A holistic ground engineering approach was recommended to establish the extent of coal mining legacy on-site, grout up the appropriate extent of coal mining workings, retain a significant portion of Made Ground in-situ, improve the ground without the use of traditional piling by adopting controlled and/or bi-modulus columns with a load transfer mat above to eliminate the risk up any upwardly migrating voids. The culvert in the east of the site was noted, and it was stated that the proposed ground treatment would be designed not to negatively impact the culvert.

Organic contamination was considered to be low risk due to the age of the organic fill. Inorganic contamination was considered to be adequately encapsulated by the 15m or so of proposed ground improvement measures. The previous ground gas characteristic situation of CS4 was considered to be a conservative evaluation which could be revised with additional ground gas monitoring, however the cost of additional monitoring was estimated to exceed the potential cost reduction of reducing the site from CS4 to CS3, therefore the application of a CS4 characteristic situation to the site was recommended.

It was recommended that the ground engineering scheme specified by G B Card & Partners in their December 2020 letter report (detailed above) should be adopted.

2.1.9 Supplementary Coal Mining Investigation, by Sirius (March 2022)

In February 2022, Sirius drilled forty rotary probe holes along 3 No perpendicular transects of the recorded adit to a maximum depth of 25m bgl. Additionally, 3 No trial pits/trenches were excavated to a maximum depth of 5.5mbgl to determine the nature of the underlying coal seam and associated mine workings, and 5 No rotary probe holes and 2 No cable percussion boreholes were drilled to install ground gas/groundwater monitoring wells (detailed in subsequent hazardous ground gas risk assessment).

No evidence of the adit was identified along its conjectured length and allowing for an 8m departure from its recorded location. Should the adit exist at a depth greater than 25m, it was considered that significant cover exists within the eastern part of the site to mitigate against any risk from surface stability of the adit which has a conjectured height of 2m.

Soft ground was identified within several probe holes with confirmatory trial pitting identifying extremely weak intact coal at depths of 3.7 and 4.0m bgl, with a thickness of around 1.1m, indicated that the Flockton Thin Coal seam does not appear to have been subjected to pillar and stall working

within this area. The presence of deep Made Ground associated within historic earthworks has resulted in the local extraction of coal by opencast methods.

The risk posed by pillar and stall workings within the eastern part of the site was considered to be low, removing the requirement for remedial works in the form of drill and pressure grouting within the northeastern area of the site.

Risks to surface stability do exist in the northern and western portions of the site which were recommended to by stabilised by drilling and pressure grouting to mitigate the risk of surface instability.

2.1.10 Hazardous Ground Gas Risk Assessment, by Sirius (May 2022)

The site was a registered landfill from March 1982, and was authorized to accept household, commercial, and industrial waste from 1989. The was detailed as dormant in 1996. Two other historical landfills are located within 250m of the site.

The site is located within a lower probability radon area.

Organic matter contents of the on-site Made Ground were found to vary from 0.5 to 4.6%, though one sample did exhibit an organic matter content of 20%. Laboratory analysis of the landfill material noted organic matter contents to range from 4.4 to 9.9%.

Elevated concentrations of PAHs were identified within one sample recovered from the landfill material.

Ambisense Gasflux real-time data monitors were installed within 3 No selected gas wells and continuous monitoring was undertaken from 11th March to 4th April 2022. Spot monitoring of ground gases was also carried out on 5 No occasions between 24th February and 14th April 2022.

During continuous monitoring within the landfill material, methane concentrations ranged from non-detectable to 82.79% v/v, although typically remained high (69.5 to 82.8% v/v). Carbon dioxide concentrations ranged between 0.03 and 27.86% v/v though typically ranged from 19.4 to 27.9%. Oxygen levels were generally <1% v/v. A relationship between flow rates and atmospheric pressure was noted, with flow rates generally between -3.57 and -13.2l/hr. Carbon monoxide concentrations were generally <10ppm though maximum concentrations of 62.2ppm were noted. Hydrogen sulphide and VOC concentrations were non-detectable to <3ppm.

Within the lower coal measures, methane levels ranged from non-detectable to <1% v/v, with flow rates not exceeding 0.09 l/hr. Oxygen levels were recorded to range from 18.22 to 20.41% v/v, and carbon monoxide and hydrogen sulphide concentrations were <3ppm and <1ppm, respectively. VOC concentrations were noted to <3ppm during the monitoring period.

Spot sampling data was generally consistent with the findings of the continuous monitoring.

Worst case values indicated a GSV of 11.2 l/hr for methane, 3.7 l/hr for carbon dioxide, indicative of a high hazard potential for methane and carbon dioxide, classifying the site as Characteristic Situation 4 (CS4). It was considered that gas protection measures designed for a CS4 site would be adequate to mitigate the migration of carbon monoxide at the recorded concentrations. Low oxygen concentrations were detected on several occasions which may present a significant risk to construction and maintenance workers operating in excavations and in below ground confined spaces. Appropriate

risk assessment and mitigation measures will be required during construction of below-ground structures.

It was recommended that all existing monitoring wells should be fully decommissioned prior to development commencing.

2.1.11 Strategy for Remedial & Preparatory Works, by Sirius (May 2022)

A previously obtained Coal Authority (CA) Mining Report states that the site is located within a "High Risk Development Area" with the shallowest recorded worked coal seams underlying the site being the Flockton Thin and the Top Fenton (or First Brown Metal) coal seams, recorded to have been mined at depths of 10.0 and 30.0m bgl, respectively. An adit was recorded with a bearing of 24°, located in the northeast quadrant of the site. There was no record of treatment of the adit.

Previous mining investigations identified the Flockton Thin and deeper Top Fenton coal seams and/or evidence of associated mine workings within a number of rotary boreholes and trial pits. The Flockton Thin coal seam was absent in the southern, eastern, and central parts of the site and was assumed to have been removed during historic excavations of the site.

A risk to surface stability exists in the northern and western parts of site which are underlain by the Flockton Thin and/or associated coal or seat earth workings. It was recommended that these be stabilised by drilling and pressure grouting to mitigate the risk of surface instability. Confirmatory probe holes were recommended within areas of the former opencast workings (south of the conjectured Flockton Thin outcrop) to prove the absence of the coal seam.

No evidence of the adit was identified, and it was concluded that the adit may have been removed during historical on-site earthworks.

The site was found to be underlain by variable thicknesses of Made Ground, ranging from 0.3 to 14.0m. Made Ground deposits were noted to be generally thicker in the east of the site. The Made Ground generally comprised cohesive fill and occasionally mixed granular fill. Landfill waste was encountered to a maximum depth of 12.5m bgl in the southeast of the site.

Made Ground was found to overly weathered and competent mudstone of the Pennine Lower Coal Measures.

Chemical testing of soil samples identified elevated concentrations of PAHs within one sample of landfill waste. All other determinants tested for within all other samples analysed were below the appropriate GAC for a commercial development. Testing of groundwater quality was not undertaken as the risk to controlled waters by contaminants was concluded to be very low by Curtins Limited, requiring no further consideration.

A ground gas characteristic situation of CS-4 was recommended. Radon protection measures were not required as part of the proposed development. Prior to undertaking construction on-site, the proposed design of gas protection measures and strategy for verification must be agreed with the Local Authority, and all existing monitoring wells should be fully decommissioned prior to commencement of the proposed development.

2.1.12 Geotechnical Review, by SDS (September 2022)

SDS were appointed by Lidl Great Britain Ltd to carry out a preliminary geotechnical review of the site. The report calculated estimated settlements underneath the proposed buildings based on the results of the Lankelma CPT investigation, and concluded that VSC ground improvement would be suitable under proposed buildings when combined with a raft foundation. However, it was considered overly conservative to undertake GI in car park areas; an alternative solution of 300mm of Type 1 material, underlain by 600mm of 6F2 or similar was recommended.

2.1.13 Remediation Strategy, by Remada (October 2022)

Superseded by this document.

2.1.14 Drill & Grout Specification, by Remada (October 2022)

Superseded by this document.

2.1.15 Settlement Estimates Letter Report, by Remada (October 2022)

Settlement estimates were interpreted from Lankelma's CPT Report, and the following assumptions were made:

- The first metre of material is to be excavated and recompacted;
- A 600mm thick layer of capping and 300mm layer of subbase are to be placed beneath the building footprints;
- A 600mm thick layer of capping and 300mm layer of subbase are to be placed beneath the proposed car park;
- To alllow for regrading we have assummed an additional 1m layer of fill is be placed across the site;
- Applied pressure beneath a raft downstand of 1.5m square is assumed at 125kPa from foundation plus an additional 40kPa due to self weight of fill;
- Applied pressure of the car parking area is assumed at 30kPa plus an additional 40kPa due to self weight of fill;
- Settlement was calculated to the base of the foundation zone of influence; and
- Where an exact reading was uncertain, a conservative value was estimated.

Lidl Store

The highest m_v values were recorded at CPT11, where a worse case settlement of 27mm was estimated.

Retail Unit (Disposal Land)

The highest m_v values were recorded at CPT15, where a worse case settlement of 46mm was estimated.

Car Park

The highest m_v values were recorded at CPT18, where a worse case settlement of 17mm was estimated.

2.1.16 Factual Ground Investigation Report, by Remada (February 2024)

7 No plate load tests were performed on-site, with 4 within the footprint of the proposed Lidl store and 3 No within the proposed retail unit within the disposal land. 8 No trial pits were excavated to a maximum depth of 4.0m bgl to assess the ground conditions in the plate load testing locations and to delineate the extent of the shallow landfill material.

Ground conditions encountered consisted of Made Ground comprising reworked natural clay which overlay landfill waste within exploratory holes TP04 and TP05 at depths of 1.70 and 2.40m bgl, respectively.

Plate load testing confirmed CBRs of around 21 to 52% in the footprint of the proposed Lidl store, and around 10 to 43% in the footprint of the proposed retail unit within the disposal land.

2.2 Regulatory Correspondence

There are conflicting reports from different consultants, for example Sirius recommend grouting of mine seams (voids) but Card who was appointed by Beam proposed to pile through the mine seams and voids.

In correspondence dated 29th July 2021 the Coal Authority states that it does not consider that Curtins' report "*adequately addresses the impact of coal mining legacy on the proposed development*"'. The Coal Authority also "*welcomes the recommendation that past shallow mine workings will require treatment, however, the precise method as to how this is to be achieved is unclear. We therefore consider that the applicant should provide further information regarding their proposed approach to the treatment of shallow coal mining legacy affecting the site*". In addition, the Coal Authority *"does not consider that the submitted report adequately assesses the risk of instability posed by the adit roadway*"'.

Similarly, the EHO in correspondence reference WK/202122895 has read three GI reports (DeltaSimons, Sirius & Card) but all have different classifications of ground gas risk and the EHO requires more gas monitoring in accordance with the CIRIA C665 guidance (minimum of 12 No visits over six months). The EHO noted that Curtins ground gas monitoring programme falls far short of these recommendations. This additional gas data is to be used to provide a revised ground gas risk assessment which considers horizontal migration of ground gas due to the presence of extensive hardstanding. A detailed quantitative risk assessment of any proposed ground gas protection measures was also required.

Given that the most recently available correspondence from the EHO is dated 2021, and given that these documents were not available on the planning portal, it is understood that the EHO and Coal Authority have not received or reviewed the Hazardous Ground Gas Risk Assessment and/or Supplementary Coal Mining Investigation Sirius in 2022.

2.3 Pre-Remediation Conceptual Site Model

A Pre-Remediation Conceptual Model is tabulated below in **Table 1**.

Potential Source Areas	Potential Contaminant of Concern	Pathways	Potential Receptor	Exposure Route (Human unless otherwise stated)	Potential Identified Linkage (unmitigated)	Findings of Ground investigation	Risk (Un-mitigated)	Proposed Remediation (Mitigation) Measures	Residual Risk Estimation
On-site Sources **Elevated concentrations of PAHs within landfill waste** **Unidentified contaminants within landfill waste** **Hazardous ground gases generated from landfill waste and, to a lesser extent, worked coal measures** ***Off-site Sources*** **Migrating contaminants and ground gases from numerous landfill sites and mine workings within 250m of the site**	Asbestos / Metals As, Be, Cd, Cu, Cr (VI), Cr (III) Hg, Ni, Se, Va, Zn, *Boron, TPH /PAH/PCBs.* *Methane & Carbon Dioxide.*	Disturbance due to construction plant causing direct contact, dusts, vapours. Direct Contact with occupants of the proposed development (retail & off-site residential) Inhalation of fibres / vapours / gases by occupants of proposed development Permeation of water supply pipework Leachate	Occupants of the development / building fabric Ground workers during construction Adjacent residents during construction Secondary A Aquifer	Direct Soil Ingestion	Yes	PAH exceedances	Low	Hardstanding to cover retail site minimising direct contact.	Negligible
				Indoor Dust ingestion	Yes	As above	Low	As above	Negligible
				Skin Contact with Soils	Yes	As above	Low	As above	Negligible
				Skin Contact with Dust	Yes	As above	Low	As above	Negligible
				Inhalation of Outdoor Dust	Yes	As above	Low	As above	Negligible
				Inhalation of Outdoor Vapours	Yes	As above	Low	As above	Negligible
				Inhalation of Indoor Vapours	Yes	As above	Low	As above	Negligible
				Ingestion via permeated water supply pipework	Yes	As above	Low	As above	Negligible
				Inhalation of ground gas	Yes	CS4	Medium	Ground gas protection measures	Negligible
				Inhalation of radon gas	Yes	Lower Probability Radon Area	Negligible	None required	Negligible
				Leaching to Secondary A Aquifer in Bedrock	Yes	PAH exceedances	Low	Hardstanding to prevent precipitation infiltration and leaching	Negligible

Table 1: Pre-Remediation Conceptual Model

Direct contact with subsurface soil and/or groundwater during redevelopment works are not assessed as part of the CSM. It is considered that risks to workers will be managed as part of any the redevelopment works at the site through the application of health and safety procedures, where required.

3. REMEDIATION OPTIONS & OBJECTIVES

3.1 Objectives

3.1.1 Environmental Remediation Objectives

The principal environmental remediation objectives are to:

- Identify, manage and assess previously identified and unforeseen contamination;
- Assess the chemical suitability of on-site stockpiles for re-use in the proposed development;
- Provide clean cover of fill to the proposed landscaped areas; and
- Install ground gas protection measures protective of a CS4 classification.

3.1.2 Geotechnical Remediation Objectives

The principal geotechnical remediation objectives are to:

- Remove existing relic foundations and obstructions to 1.5m bgl across the site area, and in entirety underneath proposed buildings;
- Excavate, screen, classify and replace existing made ground material and existing demolition rubble as engineered fill across the site;
- Grout former mineworkings/voids underneath proposed buildings and adoptable roadways; and
- Enable foundation or ground improvement solutions for the proposed buildings and car park.

3.2 Reuse of Excavated Soils – General Notes for Guidance

3.2.1 Achieving Non-Waste Status

While clean uncontaminated natural soils can be reused directly on the site of origin, where soils have the potential to be contaminated it is necessary to prove that the materials are not considered a waste on completion of the works. Excavated soils can be reused at the site of origin or another site as long as the following four factors can be demonstrated (via appropriate permitting etc.):

- Factor 1: Protection of human health and protection of the environment;
- Factor 2: Suitability for use, without further treatment;
- Factor 3: Certainty of use; and
- Factor 4: Quantity of material.

It is important that materials that moved around the site or imported onto site are not classified as a waste (as defined by Waste Framework Directive) on completion of the works. There are several different waste regulatory options available, the suitability of which is dependent upon the complexity of the site and the quantity/composition of the material to be reused. These include:

- Quality Protocols – Allows for inert aggregate waste to be recovered and used subject to meeting set conditions.
- Waste Exemption – suitable for small volumes of non-hazardous waste;

- Standard Rules Environmental Permit – Suitable for non-hazardous waste with limits on the quantity. Can take several months to obtain from the Environment Agency;
- Bespoke Environmental Permit – Suitable for greater volumes of waste and includes hazardous waste. Can take several months to obtain from the Environment Agency;
- Application in accordance with CL:AIRE guidance 'Definition of Waste: Development Industry Code of Practice' (DoWCoP).

The following sections describe the procedures to be undertaken and testing requirements to ensure that materials reused at the site are suitable for use and on completion of the scheme are not classified as a waste.

3.2.2 Quality Protocols

Quality Protocols for converting waste into non-waste products in England have been jointly developed by the Environment Agency and the Waste and Resources Action Programme (WRAP). The main aim is to determine when specified wastes can be considered to have been fully recovered and no longer waste for the purposes of the WFD. Protocols are available for the following products, amongst others:

- Aggregates from inert waste; and
- Quality compost from source-segregated biodegradable waste.

Any recycled aggregate or manufactured topsoil should be produced in accordance with the Quality Protocols and evidence will be required to demonstrate that this is the case.

3.2.3 Waste Exemption

The purpose of the waste exemptions is to allow the use of suitable wastes for small scale construction instead of using virgin raw materials. There are very strict limits placed on the quantities and types of waste that can be reused. With respect to soil and stones it is possible to use up to 1,000 tonnes (approximately 500m^3) with a U1 exemption. The soil and stones must be either inert or non-hazardous (no hazardous waste) and can either be directly reused or from a permitted remediation process.

3.2.4 Standard Rules and Bespoke Environmental Permits

Standard Rules Environmental Permits are available for a number of relatively low risk activities. There are application, transfer, surrender and subsistence fees associated with each of the standard rule permits payable to the EA. There are also restrictions placed on the operations that fall within the standard rule permits. For example, with respect to the use of waste in construction the waste must be either inert or non-hazardous (no hazardous waste). The activities must not be carried out within 500 metres of a European Site, Ramsar site or a Site of Special Scientific Interest (SSSI). The activities shall also not be within:

- Groundwater Source Protection Zones 1 or 2;
- 50 metres of any spring or well, or of any borehole not used to supply water for domestic or food production purposes; and
- 250 metres of any borehole used to supply water for domestic or food production.

It is therefore feasible that reuse of excavated materials could be undertaken under a standard rules permit. However, a potentially easier route is to carry out the work following the Definition of Waste: Development Industry Code of Practice.

3.2.5 Definition of Waste: Development Industry Code of Practice (DoWCoP)

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

If materials are dealt within in accordance with the DoWCoP then the materials are unlikely to be waste. This is either due to the fact that the materials were never discarded in the first place or because they have been submitted to a recovery operation and have been completely recovered so that they have ceased to be waste.

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

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

In addition to the risk assessment and remediation strategy, a materials management plan (MMP) will be required detailing where soils will be moved to and how they will be tracked. Approvals may need to be sought from the Local Authority and the Environment Agency (groundwater team) with respect to the remediation strategy. In addition, the Environment Agency (waste team) need to acknowledge that they have no objections to the use of the DoWCoP for the scheme. Planning permission is normally required.

The Materials Management and accompanying documentation will have to be reviewed by a Qualified Person prior to submitting a formal declaration to the Environment Agency (waste team), via CL:AIRE (the scheme administrators). On completion of the work a verification report will need to be completed. If a verification report is not prepared there is the potential that the materials reused will be viewed as a waste.

4. REMEDIATION OUTLINE METHOD STATEMENT

4.1 General

A summary of remediation activities with cognisance to the proposed site layout is shown in **Figure 1**.

4.1.1 Public Access

No public access is required to or through the site. However, the site requires full perimeter security fencing to be maintained throughout the remediation works to prevent public access.

4.1.2 Materials Management Plan (MMP)

A Materials Management Plan (MMP) should be prepared and declared as necessary to enable the re-use of existing Made Ground and demolition materials.

4.1.3 Utilities

Statutory service bodies should be consulted at an early stage with respect to the ground conditions within which the developer will install buried services in order to enable them to assess at an early stage any potential abnormal costs. It is possible that special water supply protective measures will be necessary but this should be confirmed with United Utilities at the earliest opportunity. Further advice is contained in UKWIR Report 10/WM/03/21 – 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'.

4.1.4 Removal of Relict Floor Slabs

All brick and concrete rubble, ground floor concrete slabs and building foundations are to be excavated and crushed to produce 6F2 material to be used to achieve formation levels or stockpiled for later use in construction by Lidl.

4.1.5 Groundwater in Excavations

Any perched or shallow groundwater water that may collect in excavations is to be pumped out and either disposed of at a suitably permitted facility, or treated on-site and discharged to the public sewer system under licence / consent from the owner / operator of the public sewer system.

4.1.6 Drainage

All abandoned drainage runs encountered on-site during development works including those below the proposed footprint of the new store must be chased out, excavated and removed from site. Water and sludges are to be pumped from the drainage system where necessary and disposed at a suitably licensed facility. United Utilities and / or the appropriate utility owner should be consulted with regards to any modifications to existing site drainage.

4.1.7 Ground Obstructions

Further advice should also be sought if ground obstructions such as foundations, further basements etc associated with the former buildings and other structures on-site are encountered during the preparatory works; such obstructions might necessitate revised foundation design. Any grubbed-out ground obstructions will need to be replaced with suitably compacted fill material such as 6F2 to an engineered specification.

4.1.8 Stockpile Management

It should be ensured that the groundworker understands the need for good materials management. Most notably the importance of not mixing different materials within a given stockpile; i.e. there should be separate marked stockpiles of: Topsoil; made ground; demolition crush, excess clean, natural soil arisings; general construction waste etc.

4.2 Remediation Formation Level

Formation levels for the remediation works are to be advised by the structural engineer in order to produce the development finished levels for the proposed site layout as per **Figure 1.** Based on the SDS Cut Fill Analysis (drawing ref 22349 3015 T1), included as **Appendix A**), it is understood that in general site levels are to be raised between in the east of the site and cut within the western area.

4.3 Earthworks Surplus & Waste Removal

According to the Cut Fill Analysis (**Appendix A**), there is c. 1,800m^3 of excess material on-site. It is anticipated that this surplus will comprise made ground which will require off-site disposal at a suitably permitted off-site facility.

4.4 Existing Stockpiles

The Centara Utility and Topographical Survey (drawing ref. 105879, included as **Appendix B**) records seven stockpiles with an estimated volume of 3,600m^3 (to be confirmed). It is understood that the material has been produced from the previous demolition and is suitable for use as a 6F2 capping layer. However, this requires confirmation prior to works.

4.5 Treatment of Shallow Mine Seams

Refer to Section 5 below.

4.6 Foundations and Ground Improvement

Ground improvement will be undertaken in accordance with SDS Ground Improvement Plan (drawing ref. 22254-3010-T1, included as **Appendix C**). The works are summarised below:

- Vibro stone columns underneath building footprints to achieve the minimum bearing capacity specified by the engineer, currently 150kPa; and
- Construction of the capping layer will be undertaken as indicated on the SDS Ground Improvement Plan (**Appendix C**) as a 450mm layer across the site. The piling mat will be constructed as per the contractor's requirements, which are to be confirmed.

The construction of reinforced raft foundations would provide protection against potential differential settlement.

The construction of reinforced raft foundations would also provide 1.5 points of ground gas protection in accordance with Table 5 of BS8485:2019 and further measures of ground gas protection are discussed in Section 4.6.

4.7 Car Park & Road Construction

Construction of car park and road areas will be undertaken as per SDS Ground Improvement Plan (**Appendix C**). The works are summarised below:

- 100mm of asphalt underlain by a 100mm base in HGV routes, and 90mm of asphalt in car parking areas; and

- Car park and HGV route asphalt and base to be underlain by 300mm of Type 1 granular material, underlain in turn by 450mm of 6F2 granular material.

The HGV routes and external capping layer will comprise 6F2 material to the minimum thickness required by Lidl's standard detail (drawing ref. LD(14)-SP-04).

The placement of compacted Type 1 and 6F2 material under car parking should mitigate the majority of potential settlement. However, settlement cannot be ruled out entirely and provision should be made for minor car park repairs in the long term.

4.8 Landscape Cover Thickness

Unless specified elsewhere the minimum thickness of topsoil shall not be less than 150mm and the minimum thickness of subsoil not less than 150mm to provide a minimum overall thickness of 300mm over existing natural soils.

4.9 Soil Acceptance Criteria

4.9.1 General Fill Geotechnical Requirements

Site won soils shall conform to either Class 1, Class 2 or Class 3 fill as appropriate and be placed and compacted in layers in accordance with the Specification for Highway Works 600 series. No general fill should be placed beneath structures. The designer will provide further details on which materials are deemed to be geotechnically suitable for reuse and testing requirements to demonstrate compliance.

4.9.2 Engineered Fill Geotechnical Requirements

Any on-site produced 6F2 material will be used as a engineered fill beneath proposed buildings and structures. The designer will provide further details on testing requirements to demonstrate compliance. However, as a minimum this will include the following:

- Particle size distribution testing.
- Plate bearing tests.

4.9.3 Reuse of Soil

The upper limits for general and engineering fill material being produced from the site shall not exceed the LQM/CIEH S4ULs for Commercial Land Use presented in **Table 2** below.

4.9.4 Re-use of Landscape Soils

The upper limits for landscape soils being produced from the site shall not exceed the LQM/CIEH S4ULs for Commercial Land Use presented in **Table 2** below. Topsoil shall comply with the requirements of BS3882.

4.10 Post Remediation Constraints

For a commercial building of this type (Type C) at a site classified as Characteristic Situation 4, the required minimum gas protection score in accordance with BS 8485:2015+A1:2019 (Table 4) is **4.5**. Appropriate forms of floor and substructure designs are listed in Table 5 of BS 8485:2015+A1:2019; it is likely that structural barriers, ventilation and a ground gas membrane would comprise suitable mitigation measures.

The gas protection system should consist of at least 2 separate elements including a structural barrier, ventilation measures and/or a gas resistant membrane for example:

- Passive sub-floor dispersal layer to achieve good performance with media such as no-fines gravel layer **Score 1.5**.
- Cast in-situ monolithic reinforced ground bearing raft or reinforced cast in-situ slab to control cracking have minimal penetrations **Score 1.5**.
- Gas resistant membrane (**Score 2.0**) meeting all of the following criteria:
  - Sufficiently impervious, both in the sheet material and in the sealing of sheets and sealing around sheet penetrations, to prevent any significant passage of methane and/or carbon dioxide through the membrane.
  - Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions.
  - Sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools etc); and to withstand in-service stresses (e.g. settlement if placed below a floor slab.
  - Capable after installation, of providing a complete barrier to the entry of the relevant gas; and
  - Verified in accordance with CIRIA C735.

4.11 Passive Sub-floor Dispersal Layer

Details of the Passive Sub-floor Dispersal Layer are presented in the Structural Engineer's Drawing 24185-SDS-00-FP-DR-S-3400-T4 at **Appendix D.** The drawing specifies a Cordon EPS Total Gas Barrier with Cordon Vent and Pipe Box beneath the foundation. Cordon Product details are presented at **Appendix E**.

4.12 Membrane Installation

Details of the membrane installation beneath the raft foundation are presented in the Structural Engineer's Drawings 24185-SDS-00-FP-DR-S-3401-T3, 3402-T2 and 3403-T3 at **Appendix D.**

In general, the membrane should be installed in accordance with the manufacturer's instructions and as per the Engineer's detail and construction drawings:

- Capable after installation, of providing a complete barrier to the entry of the relevant gas; and
- Gas Barrier to be installed in accordance with the manufacturer's instructions and Engineer's drawings,
- Underlying damp membrane or formation to be free of detritus prior to laying the gas barrier
- Barrier sheets to overlap by not less than the width of the joint tape.
- Double sided joint tape to be used.
- All tears and punctures to be repaired using double sided joint tape and off-cut membrane.
- All service entries to be sealed as 'top-hat' details to prevent gas ingress.

- Membrane installation to be inspected by a Verification Consultant following placement of rebar to ensure that may punctures have been repaired.
- Concrete to be placed as soon as possible after inspection.

4.13 Post Remediation Ground Gas Monitoring

The Local Authority requires a ground gas monitoring to be implemented on completion of remediation and grouting works as described in **Section 5 Monitoring and Verification Plan.**

4.14 Building Gas Alarms

The Local Authority requires a gas alarm system to be incorporated within the buildings on site. Details are of an appropriate system are to be proposed by a fire and gas alarm specialist and separately submitted the Local Authority for approval .

CLEA Category	Commercial			
Contaminant	mg/kg 1% SOM	mg/kg 2.5% SOM	mg/kg 6% SOM	Reference
Asbestos	<0.0001%*	<0.0001%*	<0.0001%*	JIWG CAR 2012
Antimony	7500	7500	7500	*EIC/AGS/CL:AIRE*
Arsenic	640	640	640	*LQM/CIEH S4UL*
Barium	22000	22000	22000	*EIC/AGS/CL:AIRE*
Beryllium	12	12	12	*LQM/CIEH S4UL*
Boron	240000	240000	240000	*LQM/CIEH S4UL*
Cadmium	190	190	190	*LQM/CIEH S4UL*
Chromium III	8600	8600	8600	*LQM/CIEH S4UL*
Chromium VI	33	33	33	*LQM/CIEH S4UL*
Copper	68000	68000	68000	*LQM/CIEH S4UL*
Mercury (Elemental	58[sol] (26.8)	58[sol] (26.8)	58[sol] (26.8)	*LQM/CIEH S4UL*
Mercury (Inorganic	1100	1100	1100	*LQM/CIEH S4UL*
Mercury (Methyl 4")	320	320	320	*LQM/CIEH S4UL*
Molybdenum	18000	18000	18000	*EIC/AGS/CL:AIRE*
Nickel	980	980	980	*LQM/CIEH S4UL*
Lead	NC	NC	2300	*DEFRA C4SL*
Selenium	12000	12000	12000	*LQM/CIEH S4UL*
Vanadium	9000	9000	9000	*LQM/CIEH S4UL*
Zinc	730000	730000	730000	*LQM/CIEH S4UL*
BTEX				
Benzene	27	47	90	*LQM/CIEH S4UL*
Toluene	56000[sol] (869)	110000[sol] (1820)	180000[sol] (4360)	*LQM/CIEH S4UL*
Ethylbenzene	5700[sol] (518)	13600[sol] (1220)	27000[sol] (2840)	*LQM/CIEH S4UL*
O-Xylene	6600[sol] (478)	16000[sol] (1120)	33000[sol] (2620)	*LQM/CIEH S4UL*
M-Xylene	6200[sol] (825)	14800[sol] (1470)	31000[sol] (3480)	*LQM/CIEH S4UL*
P-Xylene	5900[sol] (576)	14000[sol] (1390)	30000[sol] (3170)	*LQM/CIEH S4UL*
TPH Aliphatics				
>EC5-EC6	3200[sol] (304)	5900[sol] (558)	12000[sol] (1150)	*LQM/CIEH S4UL*
>EC6-EC8	7800[sol] (744)	17000[sol] (322)	40000[sol] (735)	*LQM/CIEH S4UL*
>EC8-EC10	2090[sol] (78)	4800[sol] (199)	11000[sol] (451)	*LQM/CIEH S4UL*
>EC10-EC12	9730[sol] (48)	23000[sol] (118)	47000[sol] (283)	*LQM/CIEH S4UL*
>EC12-EC16	59000[sol] (24)	82000[sol] (59)	90000[sol] (142)	*LQM/CIEH S4UL*
>EC16-EC35	1900000	1700000	1900000	*LQM/CIEH S4UL*
>EC35-EC44	1900000	1700000	1900000	*LQM/CIEH S4UL*
>EC44-EC70 (aHaro)	28000	28000	28000	*LQM/CIEH S4UL*
TPH Aromatics				
>EC5-EC7 (Benzene)	26000[sol] (1220)	46000[sol] (2260)	86000[sol] (4710)	*LQM/CIEH S4UL*
>EC7-EC8 (Toluene)	56000[sol] (869)	110000[sol] (1820)	180000[sol] (4360)	*LQM/CIEH S4UL*
>EC8-EC10	3500[sol] (813)	8100[sol] (1500)	17000[sol] (3580)	*LQM/CIEH S4UL*
>EC10-EC12	16000[sol] (364)	28000[sol] (859)	34000[sol] (2130)	*LQM/CIEH S4UL*
>EC12-EC16	36000[sol] (169)	32000	18000	*LQM/CIEH S4UL*
>EC16-EC21	28000	28000	28000	*LQM/CIEH S4UL*
>EC21-EC35	28000	28000	28000	*LQM/CIEH S4UL*
>EC35-EC44	28000	28000	28000	*LQM/CIEH S4UL*
>EC44-EC70 (aHaro)	28000	28000	28000	*LQM/CIEH S4UL*
PAH				*LQM/CIEH S4UL*
Naphthalene	190[sol] (78.4)	460[sol] (183)	1100[sol] (432)	*LQM/CIEH S4UL*
Acenaphthylene	83000[sol] (66.1)	97000[sol] (212)	100000	*LQM/CIEH S4UL*
Acenaphthene	84000[sol] (57)	97000[sol] (141)	100000	*LQM/CIEH S4UL*
Fluorene	63000[sol] (30.9)	86000	71000	*LQM/CIEH S4UL*
Phenanthrene	22000	22000	22000	*LQM/CIEH S4UL*
Anthracene	520000	540000	540000	*LQM/CIEH S4UL*
Fluoranthene	23000	23000	23000	*LQM/CIEH S4UL*
Pyrene	54000	54000	54000	*LQM/CIEH S4UL*
Benzo(a)anthracene	170	170	180	*LQM/CIEH S4UL*
Chrysene	350	350	350	*LQM/CIEH S4UL*
Benzo(b)fluoranthene	44	45	45	*LQM/CIEH S4UL*
Benzo(k)fluoranthene	1200	1200	1200	*LQM/CIEH S4UL*
Benzo(a)pyrene[1]	35	35	36	*LQM/CIEH S4UL*
Indeno(1,2,3-	500	510	510	*LQM/CIEH S4UL*
Dibenzo(a,h)anthrace	3.5	3.6	3.6	*LQM/CIEH S4UL*
Benzo(g,h,i)perylene	3900	4000	4000	*LQM/CIEH S4UL*
Coal Tar[1]	15	15	15	*LQM/CIEH S4UL*
Chloroalkanes &				*LQM/CIEH S4UL*
1,2-Dichloroethane	0.67	0.97	1.7	*LQM/CIEH S4UL*
1,1,1-Trichloroethane	659	1300	3000	*LQM/CIEH S4UL*
1,1,2,2-	279	559	1100	*LQM/CIEH S4UL*
1,1,1,2-	116	258	569	*LQM/CIEH S4UL*
Tetrachloroethane	19	42	95	*LQM/CIEH S4UL*
Tetrachloromethane	2.8	6.3	14	*LQM/CIEH S4UL*
Trichloroethene (TCE)	1.2	2.6	6.7	*LQM/CIEH S4UL*
Trichloromethane	99	170	350	*LQM/CIEH S4UL*
Chloroethene (Vinyl	0.059	0.077	0.12	*LQM/CIEH S4UL*
Explosives				*LQM/CIEH S4UL*
2,4,6-Trinitrotoluene	1000	1000	1000	*LQM/CIEH S4UL*
RDX	210000	210000	210000	*LQM/CIEH S4UL*
HMX	110000	110000	110000	*LQM/CIEH S4UL*
Pesticides				*LQM/CIEH S4UL*
Aldrin	170	170	170	*LQM/CIEH S4UL*
Dieldrin	170	170	170	*LQM/CIEH S4UL*
Atrazine	9300	9400	9400	*LQM/CIEH S4UL*
Dichlorvos	140	140	140	*LQM/CIEH S4UL*
alpha-Endosulfan	9600[sol] (0.003)	7400[sol] (0.007)	8400[sol] (0.016)	*LQM/CIEH S4UL*
beta-Endosulfan	6300[sol] (0.00007)	7800[sol] (0.0002)	8700	*LQM/CIEH S4UL*
alpha-	170	180	180	*LQM/CIEH S4UL*
beta-	65	65	65	*LQM/CIEH S4UL*
gamma-	67	69	70	*LQM/CIEH S4UL*
Chlorobenzenes				*LQM/CIEH S4UL*
Chlorobenzene	56	130	290	*LQM/CIEH S4UL*
1,2-Dichlorobenzene	2000[sol] (571)	4600[sol] (1370)	11000[sol] (3240)	*LQM/CIEH S4UL*
1,3-Dichlorobenzene	30	73	170	*LQM/CIEH S4UL*
1,4-Dichlorobenzene	4400[sol] (224)	10000[sol] (540)	25000[sol] (1250)	*LQM/CIEH S4UL*
1,2,3-	100	250	600	*LQM/CIEH S4UL*
1,2,4-	220	530	1300	*LQM/CIEH S4UL*
1,3,5-	23	55	130	*LQM/CIEH S4UL*
1,2,3,4-	1700[sol] (122)	3980[sol] (304)	4400[sol] (728)	*LQM/CIEH S4UL*
1,2,3,5-	49[sol] (39.4)	120[sol] (98.1)	240[sol] (235)	*LQM/CIEH S4UL*
1,2,4,5-	42[sol] (19.7)	72[sol] (48.1)	96	*LQM/CIEH S4UL*
Pentachlorobenzene	640[sol] (43.0)	770[sol] (107)	830	*LQM/CIEH S4UL*
Hexachlorobenzene	110[sol] (0.20)	120	120	*LQM/CIEH S4UL*
Phenols &				*LQM/CIEH S4UL*
Phenols	440[dir] 28000)	690[dir] (30000)	1300[dir] (34000)	*LQM/CIEH S4UL*
Chlorophenols	3500	4000	4300	*LQM/CIEH S4UL*
Pentachlorophenol	400	400	400	*LQM/CIEH S4UL*
Other				*LQM/CIEH S4UL*
Carbon Disulphide	11	22	47	*LQM/CIEH S4UL*
Hexachlorobutadiene	31	66	120	*LQM/CIEH S4UL*
dieldrin	7000	13000	24000	*EIC/AGS/CL:AIRE*

NC: No published criteria
vap: Screening criteria presented exceed the vapour saturation limit, which is presented in brackets.
sol: Screening criteria presented exceed the solubility saturation limit, which is presented in brackets.
dir: Screening criteria based on threshold protective of direct skin contact (guideline in brackets based on health effects following long term exposure provided for illustration only).
(1): For assessment based on the use of the surrogate marker approach the GAC for Coal Tar must be used instead of benzo(a)pyrene.
* Asbestos trace level

Updated with LQM/CIEH errata/erratum to March 2016.

Table 2: Imported Fill Acceptance Criteria

5 Mine Workings

5.1 Review of Borehole Records

Information on possible mineworkings and coal seams has been reproduced from the Delta-Simons and Curtins report in Tables 3 and 4 below.

Exploratory Hole Location	Depth to top of stratum (m bgl)	Thickness (m)	Coal Description
RH201	4.7	0.2	Recovered as drilling fines within the water flush
RH206	6.2	0.6	Recovered as drilling fines within the water flush
RH208	8.4	0.2	Recovered as drilling fines within the water flush
TT201A	3.4	0.6	Intact
TT204C	2.8	0.4*	Intact - trial pit terminated within the coal
*Base not proven			

Table 3: Depths and Descriptions of Coal Recovered

Exploratory Hole Location	Depth to top of stratum (m bgl)	Void or Workings Thickness (m)	Evidence of Historical Mine Workings and Voids
RH202	4.6	*	Complete (100%) loss of flush and no drilling returns yet hard competent ground to 7.0mbgl - potential broken ground suggestive of a coal seam.
RH204	2.1	2.4	Complete (100%) loss of flush and no drilling returns - potential broken ground suggestive of historical mine workings.
	2.4	2.9	Stiff dark brown clay with frequent fragments of coal – potential coal tailings/backfill suggestive of historical mine workings.
	2.9	3.5	Complete (100%) loss of flush and no drilling returns - potential void suggestive of historical mine workings.
RH205	1.8	3.5	Partial (60%) loss of flush – potential broken ground.
	3.5	4.5	Complete (100%) loss of flush and no drilling returns – potential void/soft ground suggestive of historical mine workings.
	4.5	*	Complete (100%) loss of flush and no drilling returns yet hard competent ground to 8.0mbgl.
RH207	3.0	*	Complete (100%) loss of flush and no drilling returns yet hard competent ground to 8.0mbgl - potential broken ground suggestive of a coal seam.
TT201E	2.5	5.0	Loose black angular gravel of coal (non-intact) – potential fill / coal mine tailings.
TT204B	1.5	>3.0*	Large void encountered in the northern face of the trench.
*Base not proven			

Table 4: Depths and Descriptions of Potential Mineworkings and Voids

Based on the information collected to date and cross-sections provided by Delta-Simons, the mineworkings of the former Flockton Thin coal seam are considered to dip to the north-east at approximately 2°.

Bands of coal were also identified at depth, which were interpreted as the Top Fenton seam. No evidence of mineworkings were identified associated with this seam.

An adit (Coal Authority reference 423427-054) is recorded at an angle of 24° in the north-east of the site. The Coal Authority does not hold any record of treatment of the adit.

5.2 General Requirements of CIRIA 758

With regard to the treatment of seams CIRIA 758 states:

> *'For reasons of economy, grouting layouts have often been limited to the approximate loading footprint of a building.....For other than light loads it is recommended to treat a greater area within a load dispersal of 2V:1 H, struck from the foundation edge....*
>
> *For level or shallow-dipping workings up to 20m depth the treatment grid should extend 3.0 to 4.5m outside the foundation footprint.*
>
> *For level or shallow-dipping workings up to 50m depth the treatment grid should extend to 6m outside the foundation footprint'.*

With regard to hole spacing CIRIA 758 states general guidance on borehole spacing is a follows:

> *Large development site beneath proposed structures – primary grid 6m x 6m, secondary grid overlapping 6m x 6m (i.e. effectively a 4.24m grid) and a subsequent tertiary grid based on 3m grout takes.*
>
> *Open areas such as car parks – 12m grid breaking down to a 6m grid subject to grout takes*

Perimeter walls are generally formed by grouting through holes drilled at 1.5 to 3.0m centres.

CIRIA 758 defines shallow dipping seams as <25°.

5.3 Permits

The Contractor is to apply to the Coal Authority for a permit to carry out the works.

For the Coal Authority permit application, the following applies:

- The Principal Contractor will confirm landownership with their client Lidl Great Britain Ltd.
- The Client's / Principal Contractor's Consultant is Remada Ltd.

The Drilling & Grouting Contractor has not been appointed.

5.4 Drill & Grout Plan

There are two proposed building footprints within the overall site area as indicated on the attached **Figure 2.** Beneath the proposed building footprints shallow mine seams are to be grouted to a depth of 30m bgl. Grouting is to be set out on a grid measured from the centre lines of the proposed buildings (horizontal & vertical on plan).

Proposed Lidl Store

- Primary grouting of probeholes on a 6m x 6m grid to a depth of 30m bgl.
- Secondary grouting of probeholes where necessary to form a 3m x 3m grid.

Proposed B&M Store / Garden Centre

- Primary grouting of probeholes on a 6m x 6m grid to a depth of 30m.
- Secondary grouting of probeholes where necessary to form a 3m x 3m grid.

Due to the potentially lighter loading of the (B&M) garden centre area, the requirement for grouting this area is dependent on the requirements of the client.

5.5 Drill & Grout Specification

The contractor shall comply with the following guidance as appropriate to the works:

- *Coal Seams with a History of Spontaneous Combustion. www.gov.uk/government/publications*
- *Guidance on Managing the Risk of Hazardous Gases when Drilling or Piling Near Coal: The Coal Authority, Health and Safety Executive, British Drilling Association, Federation of Piling Specialists and the Association of Geotechnical and Geoenvironmental Specialists. Published 2012.*
- *Parry, D and Chiverrell, C (eds) 2019 Abandoned Mine Workings Manual, C758, CIRIA, London, UK*

5.5.1 Constituent Materials for Grouting

Water shall be from the mains supply or other source approved by the Principal Contractor, supplied by the Main Contractor. Cement shall be Portland cement complying with BS EN 197-1. PFA shall be conditioned hopper ash, or dry powder ash, or a type suitable as a constituent for grout and obtained from an approved supplier. Sand shall generally comply with BS EN 12620:2002+A1:2008 and be of a grading suitable for use in the Contractor's plant. Pea gravel shall comply with BS EN 12620 and be of a suitable grading.

Thixotropic admixtures shall be bentonite or another suitable admixture.

5.5.2 Storage and Use of Materials

Storage of materials shall be such as to prevent contamination and deterioration. Cement shall be kept in a dry location, and the sequence of deliveries recorded so that cement can be used in rotation.

PFA shall be delivered to site and stockpiled, if required it may be stored under impermeable covers which shall be weighted down to prevent dust nuisance and to retain moisture.

5.5.3 Grouting Plant

Grout will be mixed by loading hopper conditioned PFA and bagged OPC directly into a rotary paddle mixer. Water supplied from a nearby source will then be added to the mix to produce grout of the correct consistency.

The grout will be mixed and injected under hydrostatic head using a 50mm diaphragm pump operating at around 100 psi (6.9 bar) and will be pumped via 50mm reinforced grout hoses into the boreholes.

The grout mixer will be capable of producing a homogenous mix, with all particles being thoroughly wetted and without segregation occurring.

5.5.4 Grout Mixes

With consideration to the future use of the area, the filling material shall generally consist of a PFA:cement grout which should be mixed in the proportions of up to 12:1 where water is present, but which may range up to 20:1 in dry conditions.

It is anticipated that a 12:1 mix will be utilised although the exact proportion of the mix to be used at any one time shall be proposed by the grouting contractor.

Where excessive lateral flow of grout is anticipated or when voids greater than 500mm are encountered, the addition of sand or pea gravel to the mix in accordance with CIRIA 758 may be utilised. The specified grout mix shall have the minimum water content consistent with effective pumping.

The actual proportions to be used initially for the various grouts shall be agreed with the Principal Contractor paying due regard of the conditions met in drilling and the results of any trial grouting carried out before work commences.

5.5.5 Grout Properties and Testing

With water / (cement and PFA) ratios generally in the range of 0.4 to 0.45 (including the moisture in the aggregates), the mixes proposed should produce pumpable grout with flowability readings of between 300 to 600mm, when measured in a meter of the "Colcrete" type.

The sample for the flowability test shall be obtained by the grouting Contractor at the point of injection i.e. from the end of the tremie pipe. A minimum of two flowability tests per week shall be performed by the Contractor.

High-bleed grouts shall be avoided. Bleed capacity should be limited to 5% maximum unless agreed otherwise.

A minimum of two bleed capacity tests shall be performed by the Contractor per shift. The sample of grout for the test shall be taken from the point of injection, i.e. the end of the tremie pipe.

Bleed capacity shall be measured in a clear plastic or glass graduated cylinder which has an internal diameter not less than 50mm and with a volume of approximately 1000ml. After placing the grout, a cover shall be placed over the cylinder to avoid evaporation. Bleed capacity shall be read at hourly intervals for neat cement grout, and readings should continue for not less than 3 hours. For PFA:cement grouts readings should continue for not less than 6 hours.

The Contractor shall prepare two sets of test cubes of grout from one batch of grout per week.

Each cube shall be of 100mm side, and shall be taken from the grout at the point of injection i.e. the end of the tremie pipe.

At the instruction of the Principal Contractor, the Contractor shall arrange for them to be tested by crushing at 7 and 28 days in accordance with BS1881. The testing shall be carried out by an independent laboratory.

The mixes shall produce cubes with crushing strengths of not less than 0.7MN/m^2 at 28 days (Note: the 7 day test is performed to indicate that the 28 day strength is achievable i.e. a 7 day value of about 0.4MN/m^2 would probably be considered on target).

If the Principal Contractor considers the results of the test indicate that a change of mix proportions is required, the Contractor shall make such modifications as the Principal Contractor or Principal Contractor's Consultant may direct.

5.5.6 Drilling Procedures for Treatment of Shallow Mineworkings

All boreholes to be used for the injection of grout, including those which strike coal pillars, shall be drilled by rotary or rotary percussive techniques down to between 0.5m and 1.0m beyond the base of the old workings in the seams to be treated. The drilling system and flushing medium to be used shall be as instructed on the Coal Authority permit.

The minimum diameter of the holes shall be 50mm. When it is impracticable to drill at the minimum diameter for the full depth, the diameter of the boreholes shall be increased in the upper lengths.

The boreholes shall be kept open until grout injection into the workings and rock is complete.

Where a borehole proves abortive because it becomes obstructed, it shall be re-drilled in a suitable position. Boreholes shall be formed in general accordance with the locations shown on **Figure 2.** The plan is provisional only, subject to change with any alterations to proposed layout. Any deviation from the final layout including the drilling of additional secondary and tertiary holes shall be recorded by the contractor and a revised borehole location plan provided to the client.

During the course of the works, an on-going review of the data generated will be undertaken to assess the potential for the treatment zone extending beyond the considered areas.

5.5.7 Grouting Procedures for Shallow Mineworkings

The Contractor shall fill all abandoned mineworkings and voids encountered in the boreholes in the manner specified. Grout shall be introduced into all boreholes drilled.

Perimeter grout walls, if required, shall be formed by filling boreholes with a viscous grout composed of appropriate proportions of cement, PFA, sand or pea gravel and water.

Unless specified otherwise, the section of the perimeter wall at the deepest part of the seam shall be constructed first. Immediately prior to grouting each borehole, the Contractor shall check that it is unobstructed to the required depth to receive the tubing or tremie pipes for grout injection. Obstructions shall be dealt with as described in 'drilling procedures' above.

Grout shall be injected into position down each hole via an approved flexible grouting tube, placed to the base of the hole or to such other depth to receive the tubing or pipes for grout.

Grouting shall proceed upwards from the base of each borehole to the base of the surface deposits. It is not intended that, as a general rule, significant quantities of grout shall be injected into the surface deposits unless specified otherwise.

The grout shall be injected at the approved rates until grout appears near the point of injection, when the borehole shall be deemed complete. If this criterion is reached quickly, the grout tubes shall be lifted to check that a local obstruction is not preventing flow of the grout into the strata.

Hydrostatic pressure shall be applied to the grout in every borehole. If grout has not appeared at the point of injection after 5 tonnes of grouting materials have been introduced, then sand and/or pea gravel (gravel which passes through a 6.33mm sieve and is retained on a 2.36mm sieve) may be added to the mix or placed down the borehole.

5.5.8 Stabilisation Procedures for the Treatment of Mine Entries (if required)

If any unrecorded mine shafts are encountered on-site, they shall be stabilised in accordance with the recommendations given in CIRIA 758. All work on or about old mine shafts must be carried out from a safety platform of adequate dimensions that will span the potential collapse zone and support the crew and equipment should a catastrophic failure of the shaft occur.

Prior to work commencing the area will be inspected to ensure that the safe movement of heavy equipment can proceed. This will be carried out by a competent, experienced person who will be securely fastened to the surface by means of a full body harness anchored some 5.0 metres away from the shaft perimeter. If the shaft is found to be open from the surface, then it shall be backfilled with graded material.

Any such material will be introduced directly into the shaft from the surface utilising equipment such as a 360 excavator or conveyor. If the shaft is backfilled then reversed stage pressure grouting of the infill material will be undertaken. Such treatment is achieved by a combination of permeation grouting and low-pressure compaction grouting of the infill material which forms an enhanced bond between the infill and the shaft lining / bedrock. Treatment will therefore be undertaken in the following manner.

A rigid steel and wooden shaft frame will be then mounted over the shaft mouth to ensure that any slumping of the shaft infill will not jeopardise the stability of the drilling rig and the safety of the crew.

Once the safety frame is in place, the drill rig will be positioned over the shaft to allow the sinking of a centrally located borehole through fill material. Treatment will involve the drilling of a single borehole to the base of the shaft and at least three metres into natural strata. This is to ensure that no "staging" is present within the shaft and that the actual shaft base has been reached. Shaft staging would typically be encountered within the first 50m below ground within shafts, although no hard or fast rules can be applied to this. Staging can be a problem if, over time, it deteriorates to such an extent that catastrophic failure of the infill material occurs

On completion of the first borehole temporary steel casing will then be inserted into the borehole. This casing forms the basis of the reversed stage pressure grouting technique. The grouting operation will commence on completion of the borehole and will involve direct injection down the borehole under pressure through the drill rods or casing in ascending 3m stages.

The grout will possess water: solids ratio of no more than 40% giving an approximate compressive strength of 0.9N/mm^2 after 28 days.

Grout will be mixed by loading hopper conditioned PFA and bagged OPC directly into the mixer as per the grouting procedure above.

The grout will be mixed and injected using a 50mm diaphragm pump operating at around 100 psi and will be pumped via 50mm reinforced grout hoses into borehole. This will continue until either a maximum pressure is reached or refusal of grout occurs. A length of casing will then be extracted, and the process repeated until the complete length of the shaft has been treated.

Should any significant thickness of permeable / granular fill be present on site, grouting may need to be terminated at the level of the base of such material.

If any significant voids are encountered during the operation, a grout \ pea gravel mix will be introduced into the borehole to restrict excessive movement of grout. However, should any major mining feature such as roadways running off the shaft are suspected these will require investigation and treating separately from the shaft.

If required, a reinforced concrete shaft cap (to be designed and installed by others) should be constructed at rockhead level over each treated shaft.

6 MONITORING & VERIFICATION PLAN

6.1 Main Remediation Works - General

A photographic record of all excavations and backfill operations will be maintained and compiled within a Verification Report. A photographic will be prepared by the Main Contractor for use by Remada in preparation of the Verification Report.

6.2 Engineered Ground & Imported Fill

Any engineered ground and imported fill will require testing to confirm it been correctly placed and suitably compacted in accordance with the Engineer's Specification. General and structural fill materials shall be tested at rate of 1 /500m^3 but not less than one sample per source and not less than three samples in total. Records are to be provided to Remada for compilation in the Verification Report.

Engineered fill placed beneath the proposed store car park should be inspected to ensure that it is of the correct layer and total thickness and has been correctly placed and suitably compacted. CBR or Plate load tests will be necessary on the compacted fill immediately after placement and this should be directed / supervised by a geotechnical engineer.

Imported fill material and site-won material shall not contain concentrations of contaminants greater than the suitability for reuse criteria detailed in **Table 3.** Provided that it is placed at depths greater than 600mm or below buildings / hardstanding, these materials should be tested at a rate of one per 1000m^3 with a minimum of four tests on any individual source material and at an ongoing frequency to ensure the assessment of representative contaminant concentrations.

Records are to be provided to Remada for compilation in the Verification Report.

6.3 Mine Drilling & Verification

On a daily basis, the drilling and grouting contractor is to issue the following records to the Principal Contractor and Remada:

- Job title and area location (building, garden centre or roadway)
- Borehole reference number
- Date
- Contractor's name
- Plant in use, crew members and hours worked
- Details of type of injection grout-line dimensions and length of standpipes inserted
- Type of grout mix and volumetric quantity injected including total quantity by weight by each type of grouting material introduced
- Grout pressures recorded, with the corresponding depths
- Grout quantity to demonstrate borehole backfill or greater volume
- The results of all flow and bleed tests
- Details of grouting materials delivered to the site and a running total of each of the materials delivered
- The nature, frequency and results of all inspections of services to check for grout penetration
- Details of all stoppages or delays and any other relevant information
- The daily records of materials and plant received shall show in particular that day's quantities by weight of each type of material and cumulative quantities. With the daily records, the

Contractor shall submit to the RE copies of receipts or invoices for all materials delivered and he shall keep them on site until the Works are complete.

6.4 Soft Landscaping Areas & Cover System

Topsoil imported for landscape shall not contain concentration of contaminants greater than **Table 2.** The thickness of topsoil and subsoil in the landscape area should be checked ensure that the minimum required thickness has been achieved. The following sampling frequency for assessing site-won and imported soils located within soft landscaping / areas is required:

- For material from a greenfield source, testing should be undertaken at a rate of one sample per 250m^3, with a minimum of four tests on any individual source material and at an ongoing frequency to ensure the assessment of representative contaminant concentrations.
- For material from a brownfield, recycled or unverified source, testing should be undertaken at a rate of one sample per 100m^3, with a minimum of four tests on any individual source material and at an ongoing frequency to ensure the assessment of representative contaminant concentrations.

Records are to be provided to Remada for compilation in the Verification Report.

6.5 Engineered Capping Material

Site won and imported engineering capping material (6F2/6F5 etc) shall not contain concentration of contaminants greater than **Table 2** shall be tested at rate of one per 1000m^3. Records are to be provided to Remada for compilation in the Verification Report.

6.6 Sampling & Analysis

All verification sampling will be conducted by suitably qualified and experienced geoenvironmental engineer. Samples are to be tested at a UKAS and MCERTS accredited laboratory.

6.7 Unforeseen Contamination

In the event that unforeseen contamination is encountered during the works, samples of the suspected soil or groundwater contamination shall be taken and submitted for laboratory analysis. The results will be assessed by Remada.

6.8 Waste Disposal Records

Any contaminated materials (including unforeseen contaminated soils) requiring removal from the site must be recorded and copies of Consignment notes or Duty of Care transfer notes must be retained by the Main Contractor for incorporation in the Verification Report.

6.9 Post Remediation Ground Gas Monitoring

A minimum of three 3 No. ground gas monitoring wells are to be installed within each proposed building footprint to a depth of 5m below the proposed formation level. The concentrations of methane, carbon dioxide, oxygen and the gas flow rate are to be measured at each well for a minimum of four (4 No.) monitoring events over a four week period during periods of low and high atmospheric pressure.

The results of the ground gas monitoring will form an updated Ground Gas Risk Assessment and to confirm the extent of ground gas protection measure prior to construction of the buildings.

6.10 Ground Gas & Membrane

Ground gas protection measures should be installed & verified in accordance with CIRIA C735 Good Practice on the Testing & Verification of Protection Systems for Buildings / Against Hazardous Ground Gases (2014) which sets out current industry good practice.

6.10.1 Protection Measures

Grading results of the material used for the no fines gravel layer should be supplied to Remada for incorporation into the final Verification Report.

Similarly, photographs of the raft prior and/or floor slab should confirm the extent of reinforcement as per the designer's drawings and be supplied to Remada for incorporation into the final Verification Report.

6.10.2 Gas Membrane

Installation of any gas resistant membrane shall be inspected and verified by a geo-environmental engineer or suitably qualified verifier prior to placing of the screed. The verification consultant will ensure that:

- Record the membrane batch number (if available).
- Record details of the double sided joint tape.
- Inspect that all laps and joints are sealed;
- Inspect that all service entries have been lapped to surround as a 'top hat' detail.
- Inspect the membrane for punctures and check that repairs have been carried out using double sided joint tape and off-cut membrane.
- Take photos of the membrane prior to installation of the screed.
- Complete an inspection record.

Photographic records and technical details relating to the chosen protection measures must be taken and retained.

6.11 Final Verification Report

On completion of the works a Verification Report will be compiled by Remada and submitted to the local authority to demonstrate that the remediation criteria have been met and to discharge relevant planning conditions. The report will as a minimum include the following:

- Description of the works that have taken place.
- Present photographic records of the work undertaken.
- Provide material tracking forms.
- Provide results of laboratory analysis undertaken during earthworks.
- Geotechnical test results.
- Provide records of off-site disposal of soil and groundwater.
- Document variations due to unforeseen contamination; and
- Provide details and results of laboratory analysis for imported materials.

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STUDY LIMITATIONS

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

1. This report has been prepared by Remada, Ltd with all reasonable skill, care and diligence within the terms of the Appointment and with the resources and manpower agreed with (the 'Client'). Remada does not accept responsibility for any matters outside the agreed scope.

2. This report has been prepared for the sole benefit of the Client unless agreed otherwise in writing.

3. Unless stated otherwise, no consultations with authorities or funders or other interested third parties have been carried out. Remada is unable to give categorical assurance that the findings will be accepted by these third parties as such bodies may have published, more stringent objectives. Further work may be required by these parties.

4. All work carried out in preparing this report has used, and is based on, Remada' professional knowledge and understanding of current relevant legislation. Changes in legislation or regulatory guidance may cause the opinion or advice contained in this report to become inappropriate or incorrect. In giving opinions and advice pending changes in legislation, of which Remada is aware, have been considered. Following delivery of the report Remada has no obligation to advise the Client or any other party of such changes or their repercussions.

5. This report is only valid when used in its entirety. Any information or advice included in the report should not be relied upon until considered in the context of the whole report.

6. Whilst this report and the opinions made are to the best of Remada' belief, Remada cannot guarantee the accuracy or completeness of any information provided by third parties.

7. This report has been prepared based on the information reasonably available during the project programme. All information relevant to the scope may not have received

8. This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of changes in the condition of the site since the time of the investigation.

9. The content of this report represents the professional opinion of experienced environmental consultants. Remada does not provide specialist legal or other professional advice. The advice of other professionals may be required.

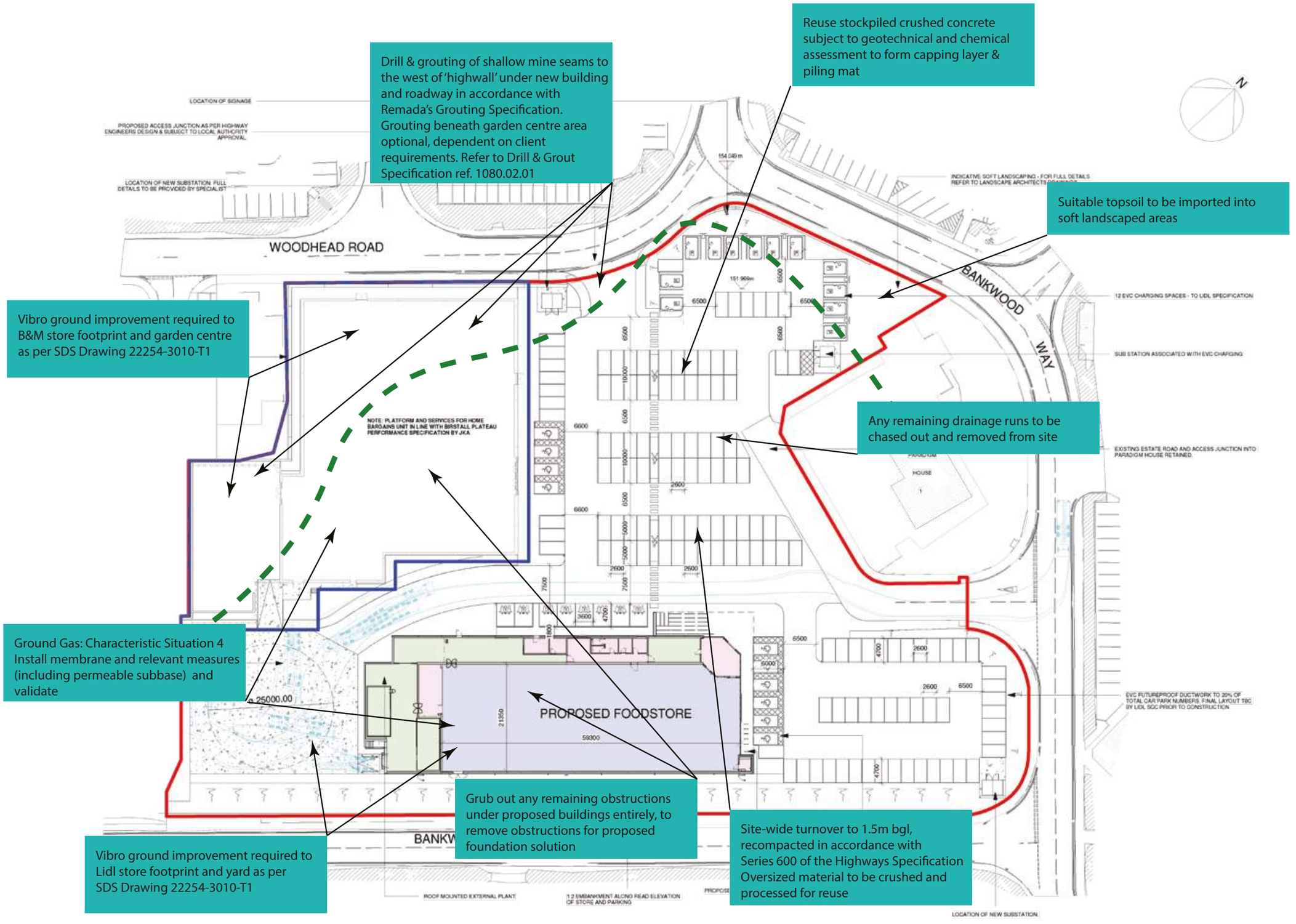
10. Where intrusive investigation techniques have been employed they have been designed to provide a reasonable level of assurance on the conditions. Given the discrete nature of sampling, no investigation technique is capable of identifying all conditions present in all areas. In some cases the investigation is further limited by site operations, underground obstructions and above ground structures. Unless otherwise stated, areas beyond the boundary of the site have not been investigated.

11. If below ground intrusive investigations have been conducted as part of the scope, service tracing for safe location of exploratory holes has been carried out. The location of underground services shown on any drawing in this report has been determined by visual observations and electromagnetic techniques. No guarantee can be given that all services have been identified. Additional services, structures or other below ground obstructions, not indicated on the drawing, may be present on site.

12. Unless otherwise stated the report provides no comment on the nature of building materials, operational integrity of the facility or on any regulatory compliance issues.

13. Unless otherwise stated, samples from the site (soil, groundwater, building fabric or other samples) have NOT been analysed or assessed for waste classification purposes.

FIGURES



Legend

Approximate location of opencast 'highwall'

Notes

Proposed Layout SMR-7404-00-ZZ-DR-8027-S3-P6

Earthworks cut/fill in accordance with MP Cut Fill Analysis 4665-MP-00-ZZ-DR-S-0100-S2-P01

Disposal of surplus soil/made ground to a suitably permitted facility

Thickness of capping and car park construction as per Lidl Drawing LD(14)-SP-04

Issue	Approved	Date
-	AH	18.10.22
A	AH	21.10.22
B	GJ	11.04.24

Project Title: Lidl Birstall

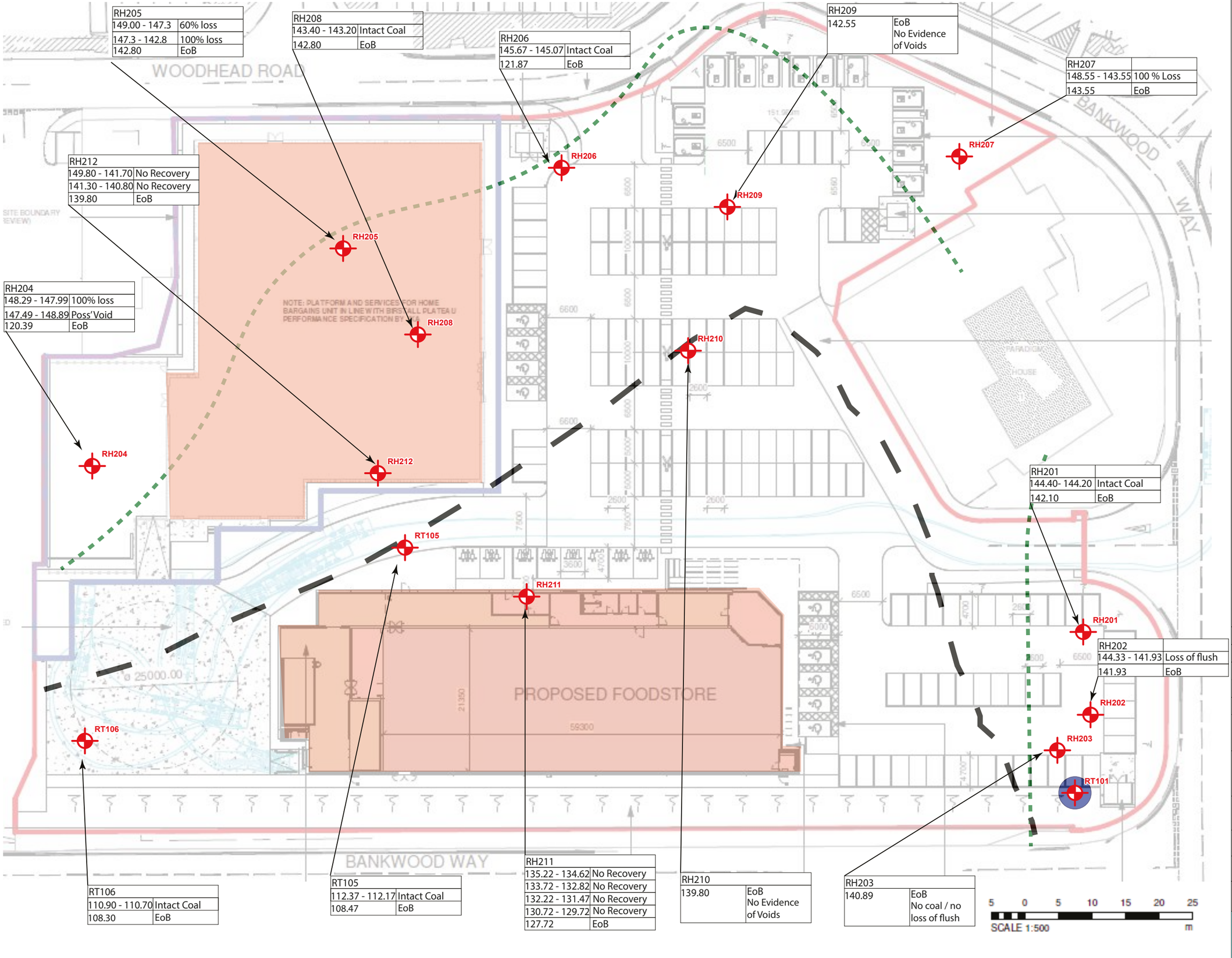
Drawing Title: Remediation Activities

Client: Lidl Great Britain Ltd

Scale	Drawn	Size
as shown	GJ	A4
Date	Job No.	Figure No.
11.04.24	1080.07	01

Drawing Reference: 1080.07 Fig1

REMADA GEO CONSULTANTS



RH205	
149.00 - 147.3	60% loss
147.3 - 142.8	100% loss
142.80	EoB

RH208	
143.40 - 143.20	Intact Coal
142.80	EoB

RH206	
145.67 - 145.07	Intact Coal
121.87	EoB

RH209	
142.55	EoB No Evidence of Voids

RH207	
148.55 - 143.55	100 % Loss
143.55	EoB

RH212	
149.80 - 141.70	No Recovery
141.30 - 140.80	No Recovery
139.80	EoB

RH204	
148.29 - 147.99	100% loss
147.49 - 148.89	Poss'Void
120.39	EoB

RH201	
144.40- 144.20	Intact Coal
142.10	EoB

RH202	
144.33 - 141.93	Loss of flush
141.93	EoB

RT106	
110.90 - 110.70	Intact Coal
108.30	EoB

RT105	
112.37 - 112.17	Intact Coal
108.47	EoB

RH211	
135.22 - 134.62	No Recovery
133.72 - 132.82	No Recovery
132.22 - 131.47	No Recovery
130.72 - 129.72	No Recovery
127.72	EoB

RH210	
139.80	EoB No Evidence of Voids

RH203	
140.89	EoB No coal / no loss of flush

Legend

Extent of Grouting
Primary grouting holes to 30.0m depth on a 6.0m grid.

Secondary holes to 30.0m depth grouted on a 3.0m grid as neccessary

RBH01 Rotary Boreholes

Approximate location of opencast 'highwall'

Conjectured Outcrop

Inferred location of the conjectured on-site adit. Delta-Simons' borehole RT101 encountered adit at 3.80 to 5.70mbgl but did not identify the feature.

Notes

Highwall location reproduced from Curtins' drawing 076893-CUR-00-XX-DR-GE-001-V01.

All primary holes to be set out on a 6.0m grid to a depth of 30mbgl.

Secondary holes to be set out on a 3.0m grid to 30mbgl as necessary to define voids.

The grouting targets former working of the Flockton Thin seam. The Top Fenton seam has been identified at depth, however no evidence of workings within this seam were encountered.

Proposed site layout reproduced from SMR Architects' Site Plan Sketch Option - Reduced Retaining Layout, dated 24.08.2022 (ref: 7404-SMR-00-ZZ-DR-A-8027-S3-P6).

Overlay of Sirius Drawing C8781/02 including conjectured position of high wall

Issue	Approved	Date

Project Title
Lidl, Birstall

Drawing Title
Drill & Grout Plan

Client
Lidl Great Britain Ltd

Scale	Drawn	Size
as shown	GJ	A4
Date	Job No.	Figure No.
12.04.24	1080.07	02

Drawing Reference
1080.07 - Figure 02

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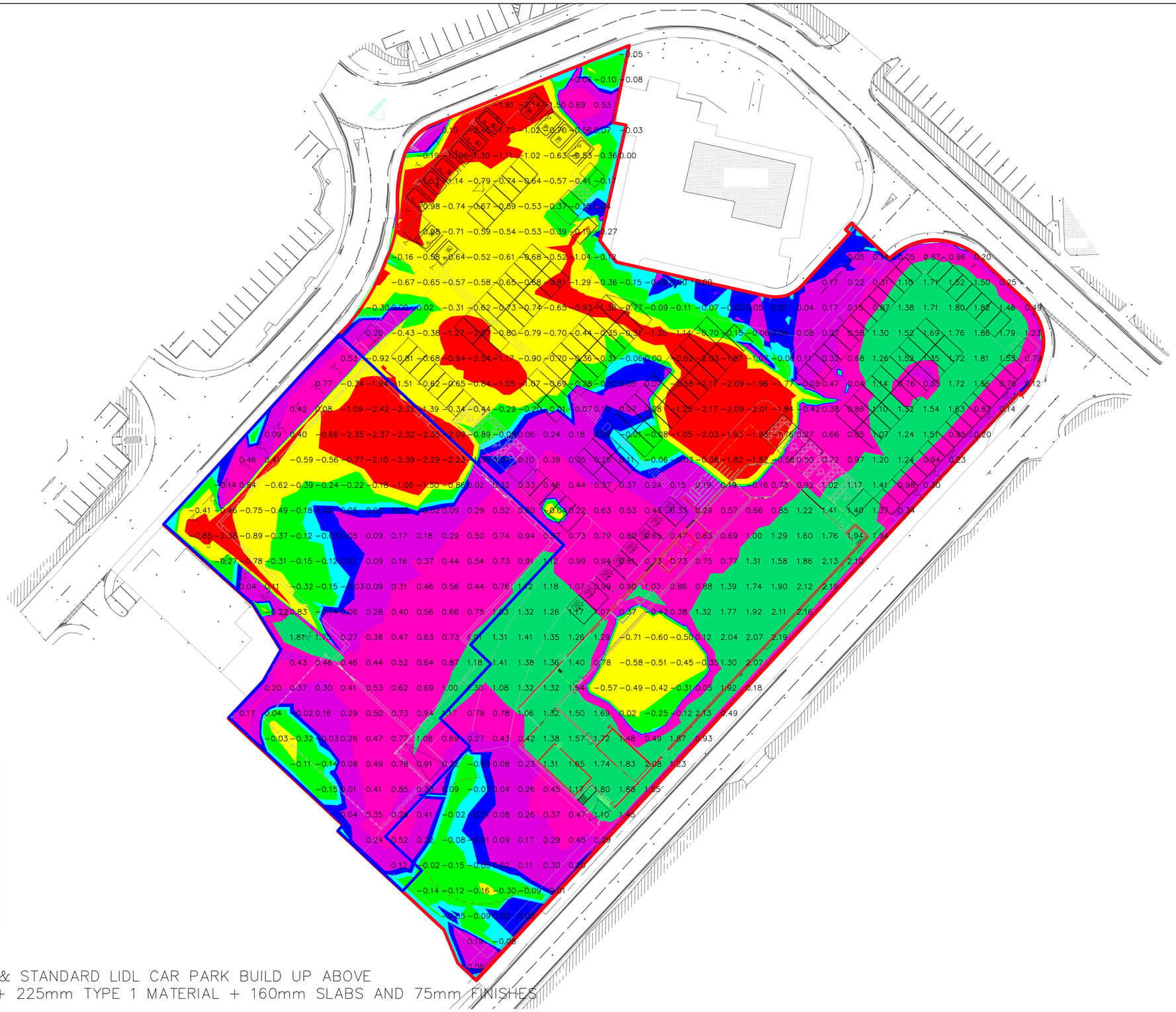
APPENDIX A
SDS Cut Fill Analysis

A1



TOTAL FILL = 7038 m3
TOTAL CUT= 4450 m3
NET FILL=2587m3

Elevations Table					
Number	Minimum Elevation	Maximum Elevation	Area	Color	VOLUME m3
1	−3.01	−0.93	1618.36		1261.68
2	−0.93	−0.28	2552.61		1817.55
3	−0.28	−0.05	1368.08		1077.25
4	−0.05	0.00	580.94		300.86
5	0.00	0.06	773.72		545.75
6	0.06	0.37	2269.41		2167.92
7	0.37	1.07	3361.11		3001.74
8	1.07	2.39	2768.01		1316.10

TABLE REFER TO FORMATION LEVELS
BUILD UPS NOT INCLUDED:
1. CAR PARK= 450mm 6F2 MATERIAL & STANDARD LIDL CAR PARK BUILD UP ABOVE
2. BUILDINGS= 225mm 6F2 MATERIAL + 225mm TYPE 1 MATERIAL + 160mm SLABS AND 75mm FINISHES

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DRAWING NOTES:
1. This Drawing is to be read in conjunction with the relevant Specifications & other Architectural & Engineering Drawings. Engineers to be informed immediately of any discrepancies before work proceeds.
2. Do Not Scale from this Drawing; -Metric Figured Dimension only are to be used.
3. It is •••• ••••••••••• responsibility to ensure that all works are carried out in accordance with the requirements of the current Building Regulations and all other statutory documents relevant to this project including the grant of planning permission, Fire Safety Certificate and Disability Access Certificate.
4. SDS (Structural Design Solutions) Ltd./ SDS-UK (Structural Design Solutions) Ltd. bear no liability for unilateral changes/modifications made during the course of construction based on the drawing prepared, without prior consultation and confirmation of acceptance of the revision by SDS (Structural Design Solutions) Ltd./ SDS-UK (Structural Design Solutions) Ltd.

REV..	DATE:	BY:	DESCRIPTION:
T1	07.10.2022	AM	ISSUED FOR INFORMATION

Client: LIDL GB
Project Title: LIDL BIRSTALL, BANKWOOD WAY
BIRSTALL, UK

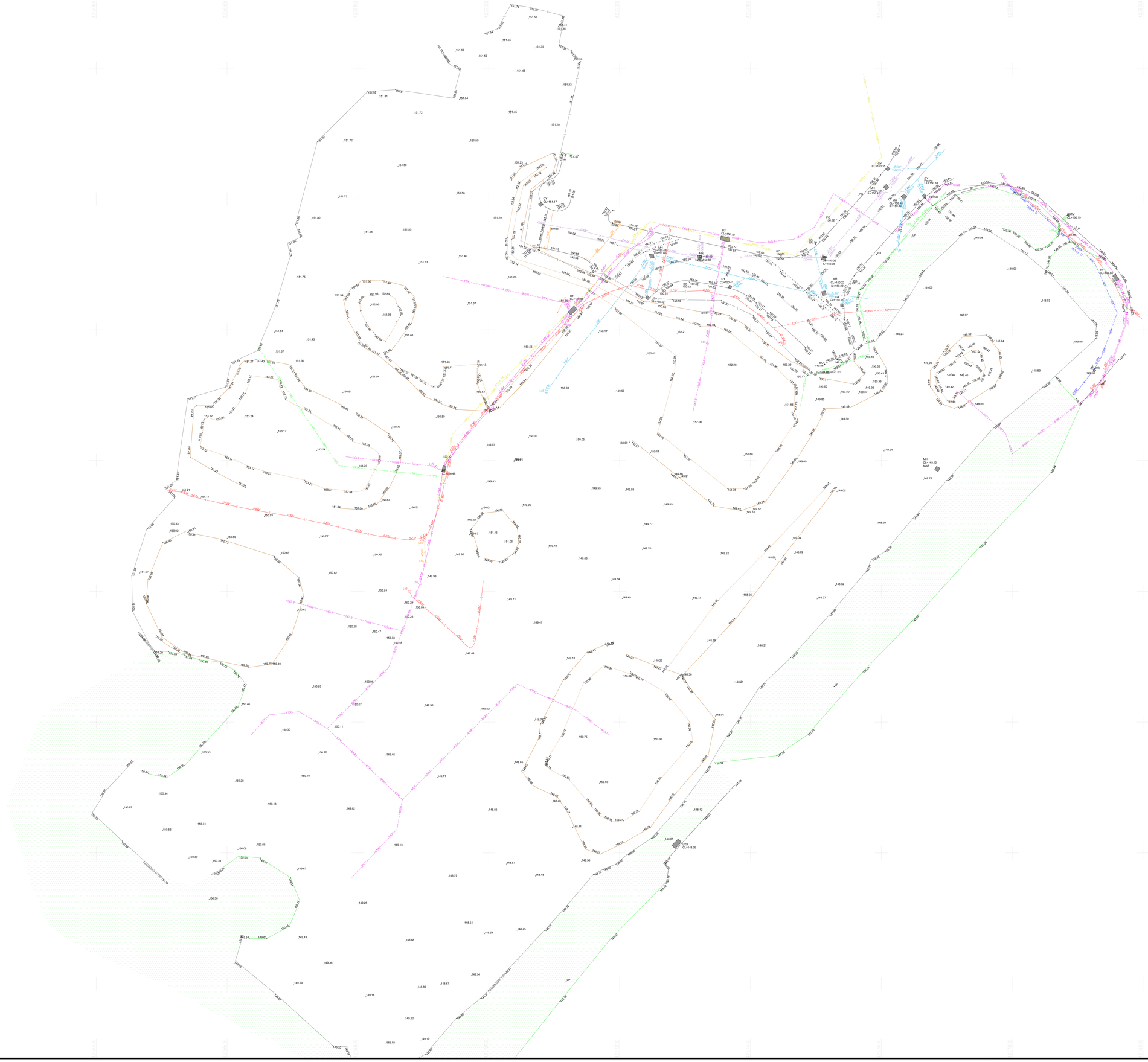
Drawing Title: CUT AND FILL LAYOUT

Scales	Paper Size:	Status
1:250	A1	TENDER
Drawn by	Date	Checked
JPM	OCT 2022	AM

C:\Users\Alvare\Desktop\New Folder\22349- CUT AND FILL.dwg

Project No.	Drawing No.	Revision
22349	3015	T1

APPENDIX B
Centara: Utility & Topographical Survey



N

GRID: OS NATIONAL GRID

Using the OS GPS Network and applying OSTN15 Transformation and then removing the scale factor for true distances with a one-step transformation centered on: DH01

DATUM: OS LEVEL DATUM

Using the OS GPS Network and applying OSGM15 National Geoid Model to obtain local area corrections.

Topographic Legend

- Bottom of Bank
- Top of Banking
- Building
- Building Canopy
- Concrete Base
- Contour Major
- Contour Minor
- Fences
- General
- Kerb Bottom
- Kerb Drop
- Kerb Top
- OH Comms
- OH Electric
- Railway Line
- Road Centre
- Road Markings
- SC Hard:Hard
- SC Hard:Soft
- SC Soft:Soft
- Steps
- Tree Canopy
- Vegetation
- Visible Trench
- Walls
- Water Edge

Topographic Abbreviations

AV	Air Valve	PB	Pedestrian Beacon
BH	Borehole	PBox	Post Box
BO(IL)	Bollard (Illuminated)	PGR	Pedestrian Guard Rail
BS	Bus Stop	PM	Parking Meter
Cab	Cabinet	PO	Post
CL=	Cover Level	RE	Rodding Eye
COL	Column	RS(IL)	Road Sign (Illuminated)
Conc	Concrete	RWP	Rain Water Pipe
DC	Drainage Channel	SP(IL)	Sign Post (Illuminated)
DFBin	Dog Foul Bin	SPCam	Speed Camera
DP	Down Pipe	ST	Stop Tap
EP	Electricity Pole	SV	Sluice Valve
ER	Earth Rod	SVP	Soil Vent Pipe
FFL=	Finished Floor Level	TBox	Telephone Box
FH	Fire Hydrant	TL	Traffic Light
FP	Flag Pole	TOF=	Top of Fence Level
GP	Gate Post	TOW=	Top of Wall Level
GV	Gas Valve	TP	Telecoms Pole
GY	Gully	VP	Vent Pipe
IC	Inspection Cover	WB	Waste Bin
KO	Kerb Outlet	WB=	Window Bottom Level
LP	Lamp Post	WM	Water Meter
MH	Manhole	WO	Wash Out
Mkr	Marker	WT=	Window Top Level
MP	Marker Post	WV	Water Valve
	MW Monitoring Well		

Utility Legend

- Air Line
- Alarm Cable
- BT Cable
- CATV Cable
- Chamber Extent
- Comms Cable
- CWD Sewer
- Earth Wire/Tape
- Electric Cable
- Fibre Optic Cable
- Fuel Line
- FWD Sewer
- Gas Pipe
- Band of Cables
- Empty Service Duct
- SWD Sewer
- Survey Extents
- Heating Pipe
- HV Electric Cable
- Kingston Comms
- Oil Pipe
- Rising Main
- Traffic Control
- Unknown Utility
- Vent Pipe
- Water
- GPR Detection
- Assumed Route
- Records Route
- Drainage Backdrop /Cable Riser

Utility Abbreviations

CP	Cathodic Protection	LoS	Loss of Signal
Cut	Disconnected Utility	MDPE	Middle Density PE
DI	Ductile Iron	SI	Spun Iron
DoB	Depth of Bottom	TLC	Traffic Light Control
DoC	Depth of Cover	UDI	Unreliable Depth Info
ED	Empty Duct	uPVC	Unplasticised Polyvinyl Chloride
EoT	End of Trace	UTR	Unable to Raise
PE	Polyethylene	UTT	Unable to Trace
HDPE	High Density PE	VC	Vitrified Clay

Manufacturer Stated Depths

Detected Using Electromagnetic Location Methods e.g. Any metallic pipe/cable. Accuracy ± 2.5% of depth reading.

Detected Using Electromagnetic Location Methods eg. Using a Sonde to locate drainage pipework Accuracy ± 2.5% of depth reading.

Detected Using Ground Penetrating Radar e.g. A plastic pipe or service not located by other means. Accuracy depends on ground conditions.

CAUTION LIVE SERVICES PRESENT - EXTREME CARE SHOULD BE TAKEN WHEN EXCAVATING

Centara Ltd., and their agents or partners, are not responsible for any situation, incident or loss resulting from actions or planning resulting from total reliance upon this drawing or accompanying information. The completeness of the underground network information cannot be wholly guaranteed and as such no guarantees or warranties are provided or implied.The location and/or identification of a service will not positively indicate whether it is live or dead. A service indicated from records that has not been located or identified on site does not necessarily imply that it does not exist or is dead, however, its presence should be anticipated. The results of Electro Magnetic and GPR detection techniques are not infallible and ground proofing for the actual position and depth of services should be established.

If this drawing and any associated drawings should be used in relation to works, we advise that the users of this information follow the principles detailed by the Health and Safety Executive guidance directive HS(G) 47, "Avoiding Danger from Underground Services". Further details of this directive are available at www.hse.gov.uk <http://www.hse.gov.uk/>

Notes

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ALL DIMENSIONS SHOULD BE VERIFIED ON SITE PRIOR TO CONSTRUCTION.

ALL HATCHING IS FOR PRESENTATIONAL PURPOSES ONLY.

Client	LIDL
Site Location:	CENTRE 27 BUSINESS PARK, WOODHEAD RD, BIRSTALL, BATLEY, WF17 9TD.
Purpose of Drawing	UTILITY AND TOPOGRAPHICAL SURVEY

Surveyed:	BC GC DH	Drawn:	BM
Checked:	SH	Authorised:	KB
Date:	03/08/2020	Scale:	1:200@A0

Scale 1:200

0 5 10 15

centara

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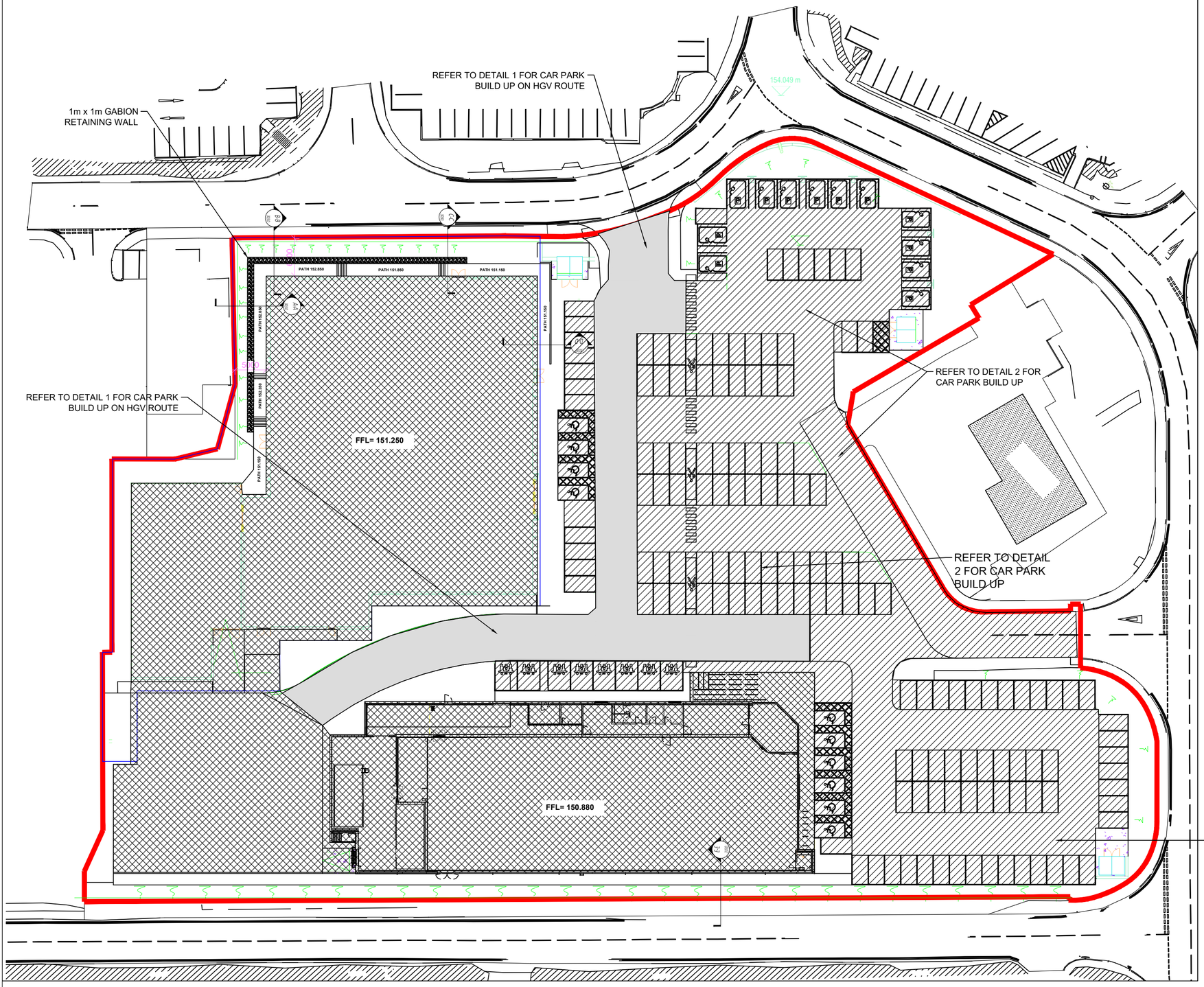
Normanton Business Park,
Wakefield,
WF6 1QT.
info@centara-ltd.com

Project Number:	105879
Sheet Number:	Layout 1 of 1

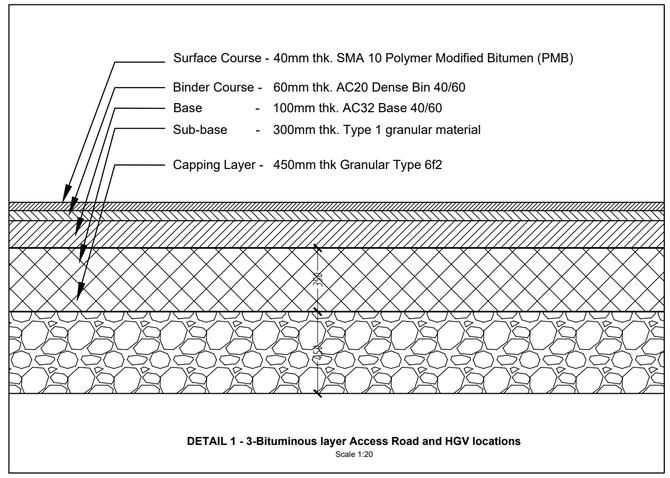
APPENDIX C
SDS Ground Improvement Plan

A2



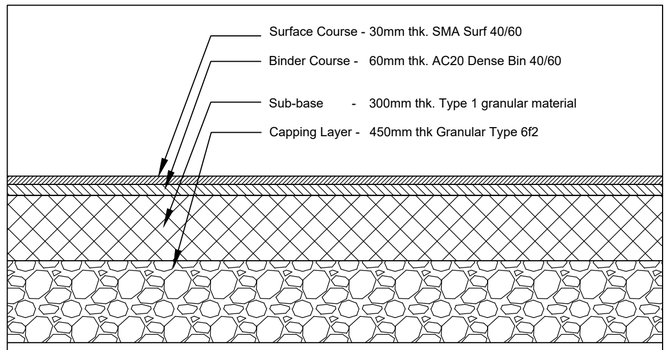
PROPOSED SITE LAYOUT

SCALE 1:250



DETAIL 1 - 3-Bituminous layer Access Road and HGV locations

Scale 1:20



DETAIL 2- 2 Bituminous layer Car and Light Vehicle Car Park locations

Scale 1:20

LEGEND -PROPOSED GROUND IMPROVEMENT PLAN		APPROX AREA
	SITE BOUNDARY	
	EXTENT OF VIBRO STONE COLUMNS GROUND IMPROVEMENT TO ACHIEVE A MINIMUM BEARING CAPACITY OF 150 kPa	6500sqm
	HGV ROUTE	2000sqm
	LIGHT VEHICLE CAR PARKING AREAS & NON-HGV ROUTE	5000sqm

IMPORTANT NOTE:

1. THE PRINCIPLE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS DESIGN , INSTALLATION, MAINTENANCE AND REMOVAL. TEMPORARY WORKS DESIGN SHOULD BE SUBSTANTIATED WITH ENGINEERING CALCULATIONS AND DRAWINGS THAT FULL DESCRIBE THE PHILOSOPHY OF THE PROPOSAL. SDS RECOMMEND THAT THE DESIGNS ARE PREPARED BY A REGISTERED DESIGN CERTIFIER WITH ADEQUATE INSURANCE TO DESIGN SUCH WORKS.
2. TEMPORARY WORKS DESIGNS, CALCULATIONS AND METHOD STATEMENTS MUST BE SUBMITTED BY THE MAIN CONTRACTOR TO THE APPOINTED HEALTH AND SAFETY CONSULTANT. A SUBMISSION TO THE DESIGN ENGINEERS FOR TECHNICAL EXAMINATION AND APPROVAL IS A REQUIREMENT PRIOR TO COMMENCEMENT OF ANY WORKS
3. IT IS THE MAIN CONTRACTORS RESPONSIBILITY TO ENSURE ANY SUPPORTING STRUCTURES FROM WHICH TEMPORARY WORKS ARE SUPPORTED FROM BE INCLUDED IN THE DESIGN AND CALCULATIONS PROVIDED AND ARE ALSO THE RESPONSIBILITY OF THE MAIN CONTRACTOR.
4. ALL STEEL MANUFACTURE MUST BE CE CERTIFIED IN ACCORDANCE WITH BS EN 1090-1. IT IS THE PRINCIPLE CONTRACTORS RESPONSIBILITY TO ENSURE THAT THEIR SELECTED STEEL FABRICATION SPECIALIST CAN PRODUCE STEELWORK IN COMPLIANCE, (INCLUDING SUBMISSION OF ALL RELEVANT SUPPORTING DOCUMENTATION) WITH THIS STANDARD
5. CLIENTS OR MAIN CONTRACTORS WHO ENGAGE A STEELWORK CONTRACTOR SHOULD CARRY OUT DUE DILIGENCE AND SHOULD ONLY APPOINT A STEELWORK CONTRACTOR CERTIFIED WITH AN EXECUTION CLASS EQUAL TO THAT FOR THE PROJECT AS DETERMINED BY THE DESIGNER THROUGH IS EN 1090-2.

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SDS design engineers

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REV.	DATE:	BY:	DESCRIPTION:
T1	07.10.2022	AM	ISSUED FOR INFORMATION

Client: LIDL GB

Project Title: LIDL BIRSTALL, BANKWOOD WAY, UK

Drawing Title: GROUND IMPROVEMENT PLAN

Scales	Paper Size	Status
1:250	A2	TENDER
Drawn by: AM	Date: OCT 2022	Checked: MM

P:\2022\22269 - Lidl GB - Birstall Board Approval Drawings\22254-3010.dwg

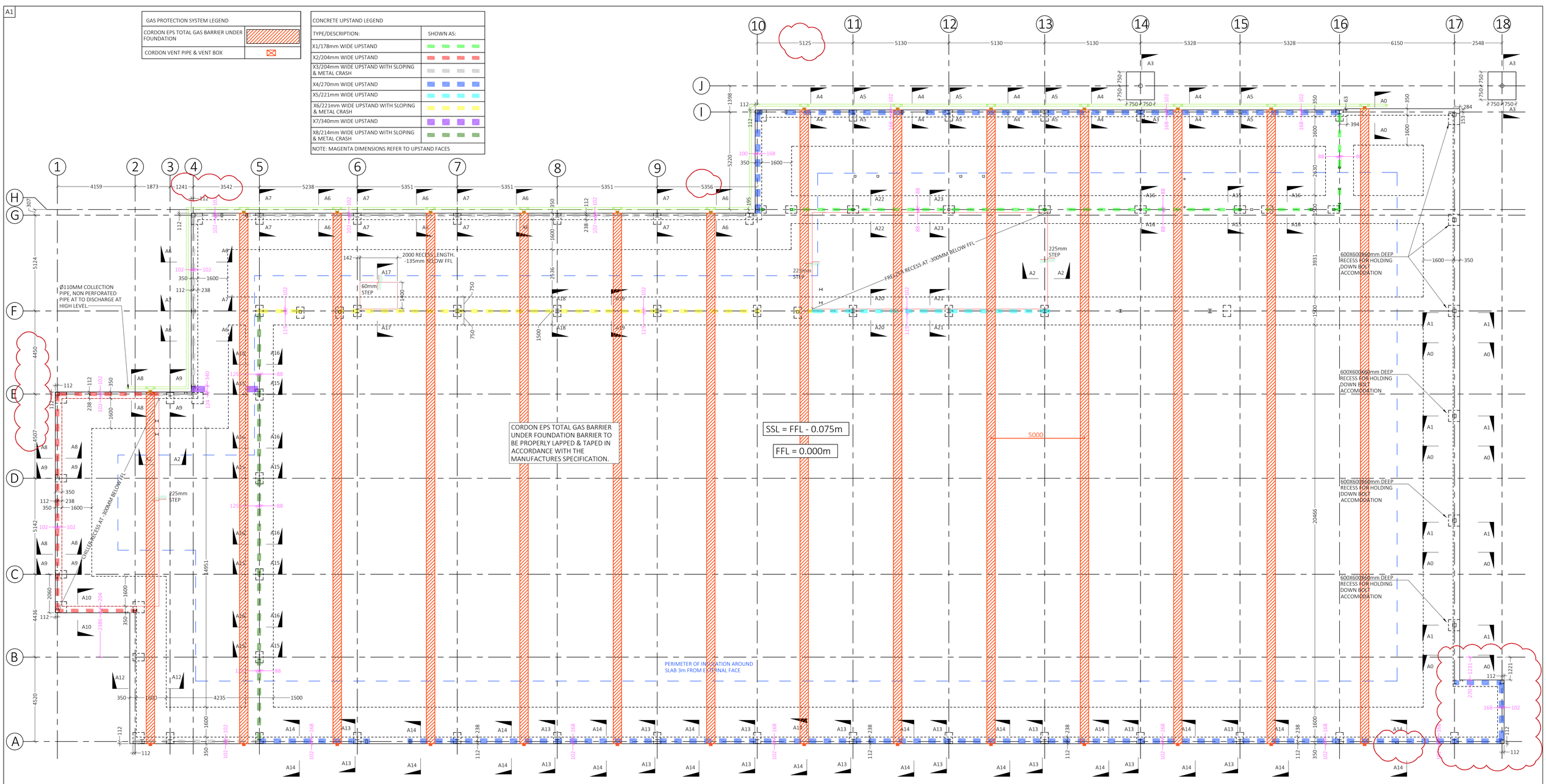
Project No.	Drawing No.	Revision
22254	3010	T1

APPENDIX D
SDS Gas Venting & Membrane Details

A1

GAS PROTECTION SYSTEM LEGEND	
CORDON EPS TOTAL GAS BARRIER UNDER FOUNDATION	
CORDON VENT PIPE & VENT BOX	

CONCRETE UPSTAND LEGEND	
TYPE/DESCRIPTION:	SHOWN AS:
X1/178mm WIDE UPSTAND	
X2/204mm WIDE UPSTAND	
X3/204mm WIDE UPSTAND WITH SLOPING & METAL CRASH	
X4/270mm WIDE UPSTAND	
X5/221mm WIDE UPSTAND	
X6/221mm WIDE UPSTAND WITH SLOPING & METAL CRASH	
X7/340mm WIDE UPSTAND	
X8/214mm WIDE UPSTAND WITH SLOPING & METAL CRASH	
NOTE: MAGENTA DIMENSIONS REFER TO UPSTAND FACES	



FOUNDATION LAYOUT PLAN

SCALE 1:100

GAS MEMBRANE NEEDS TO BE CS4 AND THAT WILL REQUIRE A MEMBRANE TO ACHIEVE CS4 AND SUB FLOOR VENTILATION IN ACCORDANCE WITH BS8485:2019. WE NEED THE GAS MEMBRANE, NO FINES GRAVEL SUBBASE AND PERFORATED PIPEWORK. BASIC RADON PROTECTION MEASURES REQUIRED. DUE TO THE PRESENCE OF SULPHATES IN THE SOIL, IT IS RECOMMENDED TO USE SULPHATE-RESISTANT CONCRETE. SPECIFICALLY, CONCRETE SHOULD BE CLASSIFIED AS SULPHATE CLASS DS-2 AND ACEC CLASS AC-2. REFER TO GROUND INVESTIGATION REPORTS

IMPORTANT NOTE:
PLEASE READ THESE DRAWINGS IN CONJUNCTION WITH CURRENT LIDL CORPORATE SPECIFICATION. CORPORATE SPECIFICATION TO TAKE PRECEDENCE AT ALL TIMES, ANOMALIES TO BE NOTED IN WRITING IMMEDIATELY TO THE ENGINEER.

450mm GEOVENT AT 5M CENTRES WITH CORDEN EPS GAS BARRIER
& GAS TAPE TO ALL JOINTS IN STRICT ACCORDANCE WITH MANUFACTURES DETAILS AND SPECIFICATIONS

PLEASE NOTE THAT LOCATIONS, DETAILS AND SYSTEM SPECIFICATIONS
FOR GAS PROTECTION SYSTEM SHOULD BE READ IN CONJUNCTION WITH CORDONS TECHNICAL DEPARTMENTS REPORT & DETAILS.

FOUNDATION STANDARD BUILD UP UNLESS OTHERWISE SPECIFIED:
1. 50mm BLINDING
2. 300mm (MIN.) SUB BASE TYPE 1 GRANULAR MATERIAL ROLLED IN LAYERS NOT EXCEEDING 200mm AND FULLY COMPACTED WITH A SUITABLE MECHANICAL ROLLER
3. COMPACTION & SUBGRADE MODULUS TO BE ESTABLISHED BY APPROPRIATE INSITU TESTING. (PLATE BEARING TESTS WITH A PLATE DIA ≥ 600MM, MINIMUM 6 No.TESTS TO BE CARRIED OUT PLATE BEARING TESTS TO CARRIED OUT AT EXCAVATION LEVEL PRIOR TO INSTALLATION OF CAPPING LAYER. LOCATIONS OF TEST TO BE AGREED WITH ENGINEER PRIOR TO TESTING. RESULTS TO BE FORWARDED TO ENGINEER FOR REVIEW PRIOR TO CAPPING LAYER CONSTRUCTION.

FOUNDATION MEMBRANE SPECIFICATION
DPM TO BE CS2 GAS PROTECTION IN ACCORDANCE WITH BS 8485-2019,LAPPED AND SEALED

IMPORTANT NOTE:
1. THE PRINCIPLE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS DESIGN , INSTALLATION, MAINTENANCE AND REMOVAL. TEMPORARY WORKS DESIGN SHOULD BE SUBSTANTIATED WITH ENGINEERING CALCULATIONS AND DRAWINGS THAT FULL DESCRIBE THE PHILOSOPHY OF THE PROPOSAL. SDS RECOMMEND THAT THE DESIGNS ARE PREPARED BY A REGISTERED DESIGN CERTIFIER WITH ADEQUATE INSURANCE TO DESIGN SUCH WORKS.
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- DIMENSIONS AS PER ARCHITECTS LAYOUT PLAN - PLEASE REFER TO ARCHITECTS DRAWINGS FOR ALL DIMENSIONS & LEVELS.
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IMPORTANT NOTES:
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CONCRETE NOTES:
2.1 CONCRETE GRADE TO BE C30/37 WITH 20mm MAX. AGGREGATE. NOMINAL COVER TO MAIN REINFORCEMENT. TOP 35mm, BOTTOM 40mm, SIDES 35mm
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ABBREVIATIONS
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ABR - ALTERNATE BARS REVERSED
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L - DENOTES L-BAR
STR - DENOTES A STRAIGHT BAR
U - DENOTES A U-BAR
UNO - UNLESS NOTED OTHERWISE

LAYERING CONVENTION
CN1 (N1)
T2 (N2)
B2 (F2)
B1 (F1)

BAR LAP TABLE

BAR TYPE	BAR LAPS
H12	480
H16	640
H20	800
H25	1000
H32	1280

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Spain: Calle Virgen de Guadalupe, 44. Ubeda, 23400, Jaen.
info@structuraldesign.ie Web: www.structuraldesign.ie
SDS design engineers

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REV.	DATE:	BY:	DESCRIPTION:
T4	26.07.2024	JAR	ISSUED FOR TENDER
T3	24.07.2024	JAR	UPSTAND X7 MOVED AS PER FIRE WALL LOCATION
T2	22.07.2024	JAR	ISSUED FOR TENDER
T1	17.07.2024	JPM	ISSUED FOR TENDER

Client: LIDL GB

Project Title: PROPOSED NEW LIDL BIRSTALL, BANKWOOD WAY BIRSTALL, UK

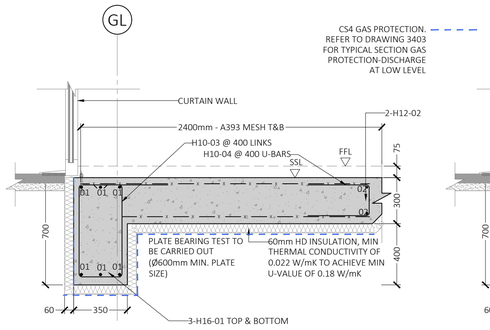
Drawing Title: FOUNDATION PLAN GENERAL ARRANGEMENT

Scales	Paper Size	Status
1:100	A1	TENDER
Drawn by	Date	Checked
JPM	JULY 2024	AM

Drawing No. 24185-SDS-00-FP-DR-S-3400

Revision T4

A1



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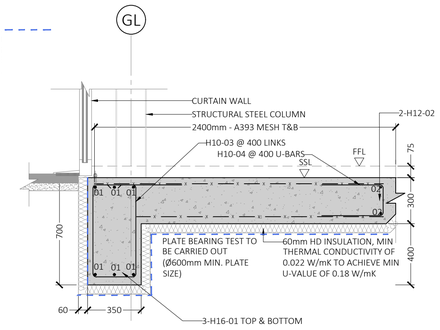

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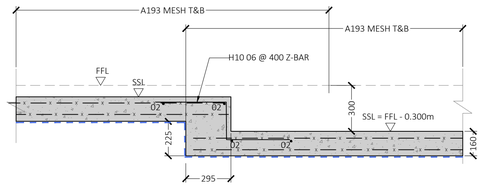

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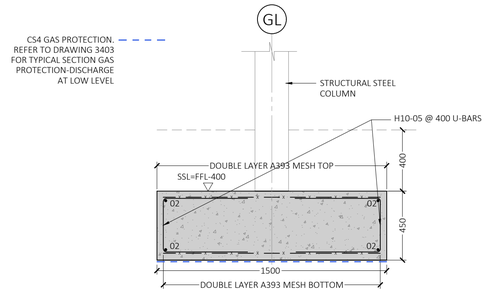

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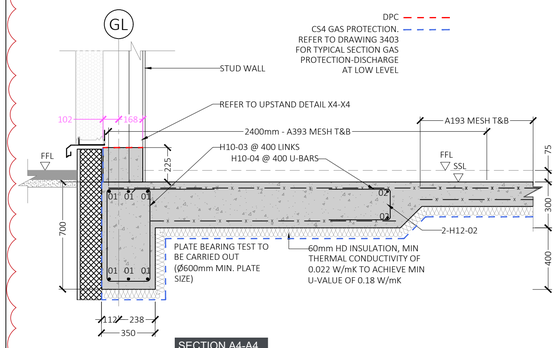

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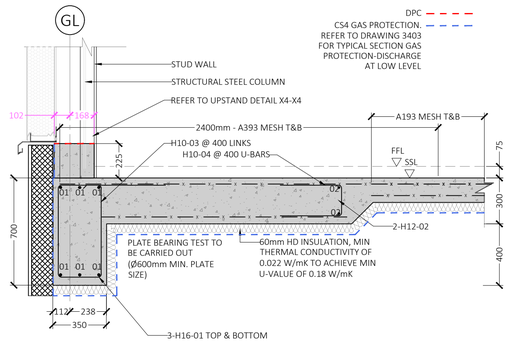

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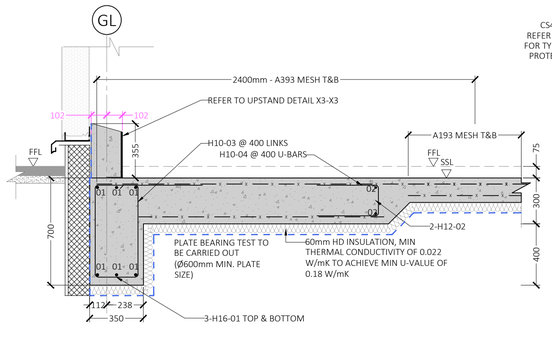

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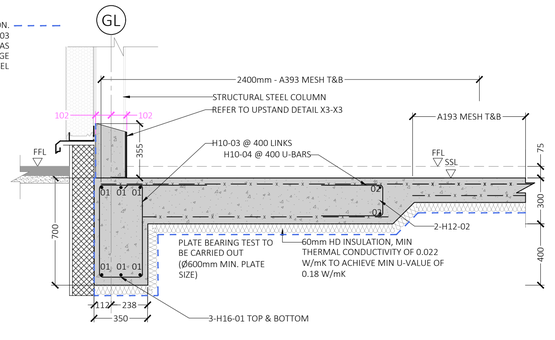

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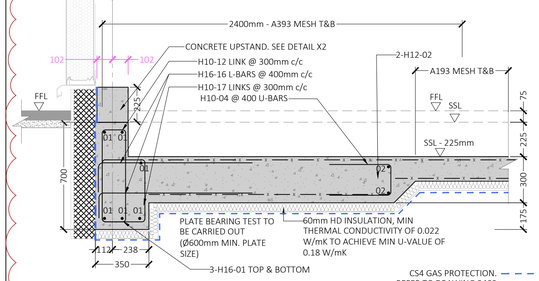

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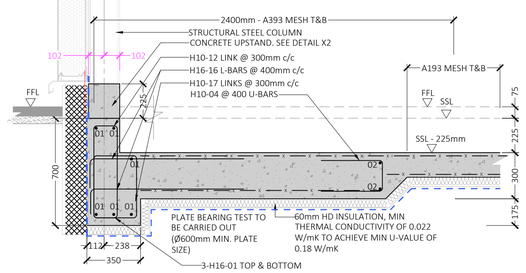

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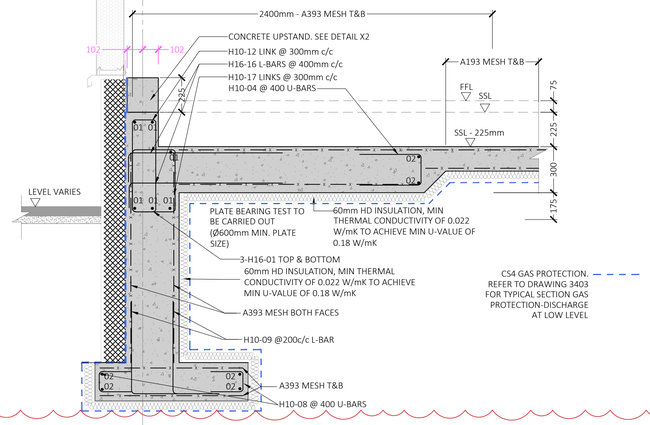

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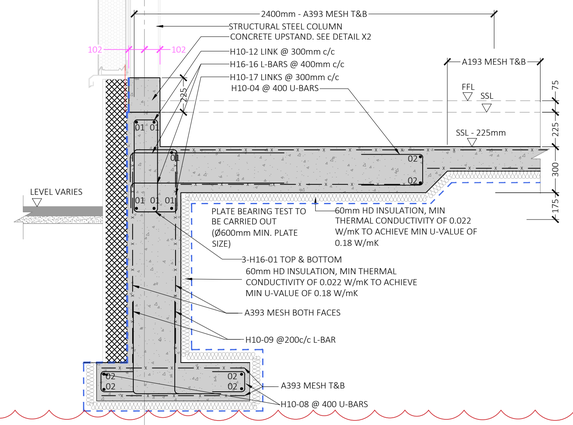

SECTION A11-A11
SCALE 1:20

FOUNDATION STANDARD BUILD UP UNLESS OTHERWISE SPECIFIED:
1. 50mm BLINDING
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FOUNDATION MEMBRANE SPECIFICATION
DPM TO BE CS2 GAS PROTECTION IN ACCORDANCE WITH BS 8485-2019,LAPPED AND SEALED

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2. TEMPORARY WORKS DESIGNS, CALCULATIONS AND METHOD STATEMENTS MUST BE SUBMITTED BY THE MAIN CONTRACTOR TO THE APPOINTED HEALTH AND SAFETY CONSULTANT. A SUBMISSION TO THE DESIGN ENGINEERS FOR TECHNICAL EXAMINATION AND APPROVAL IS A REQUIREMENT PRIOR TO COMMENCEMENT OF ANY WORKS
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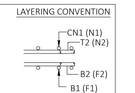
LAYERING CONVENTION



BAR LAP TABLE

BAR TYPE	BAR LAPS
H12	480
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REV.	DATE:	BY:	DESCRIPTION:
T3	26.07.2024	JPM	ISSUED FOR TENDER
T2	22.07.2024	JAR	ISSUED FOR TENDER
T1	17.07.2024	JPM	ISSUED FOR TENDER

Client: LIDL GB

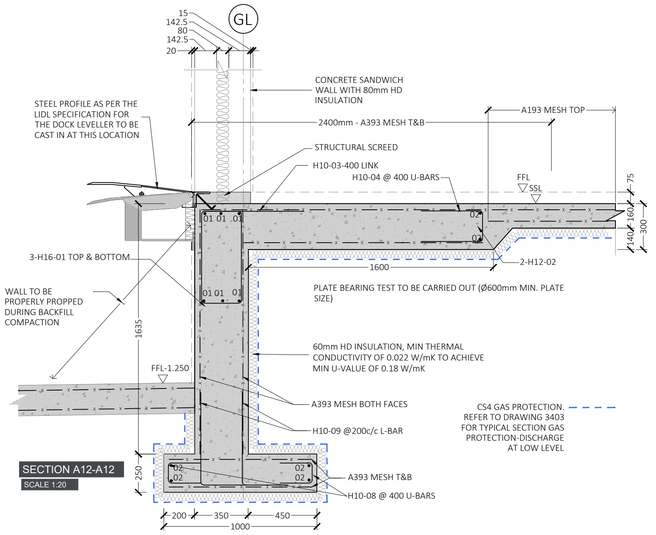
Project Title: PROPOSED NEW LIDL BIRSTALL, BANKWOOD WAY BIRSTALL, UK

Drawing Title: FOUNDATION DETAILS - SHEET 1 OF 3

Scales	Paper Size	Status
AS SHOWN	A1	TENDER
Drawn by	Date	Checked
JPM	JULY 2024	AM

Drawing No.: 24185-SDS-00-FP-DR-S-3401
Revision: T3

A1



SECTION A12-A12
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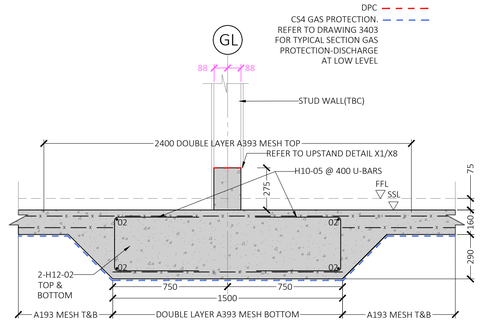

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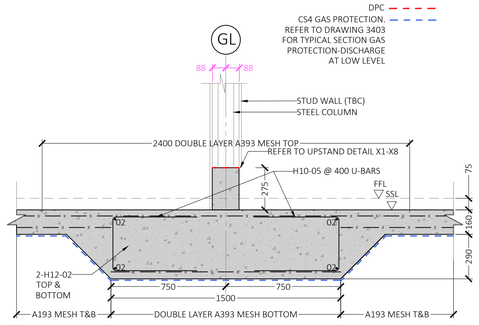

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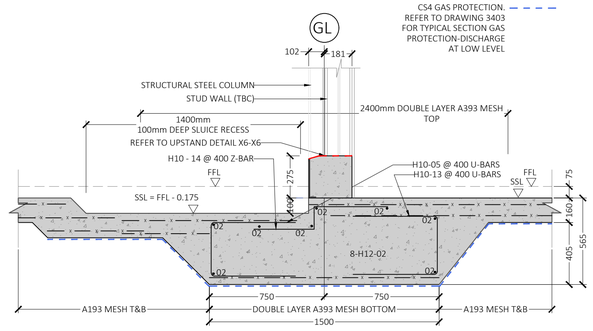

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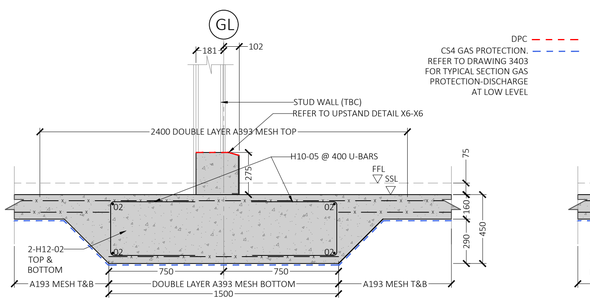

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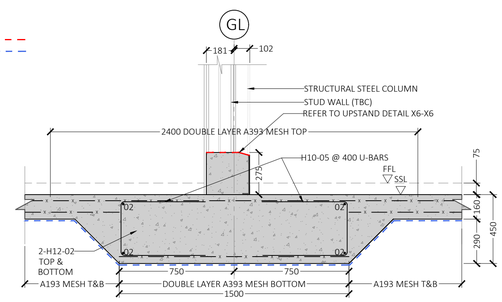

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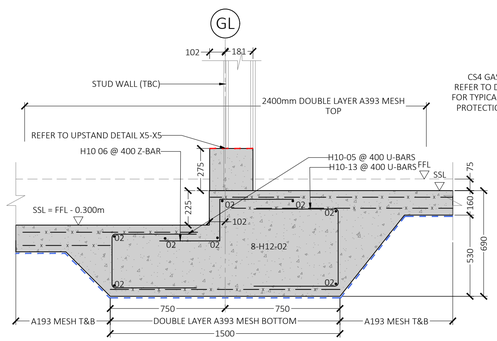

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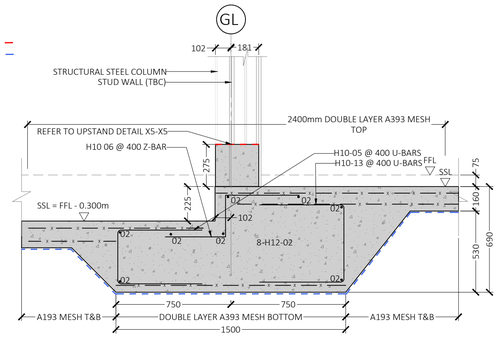

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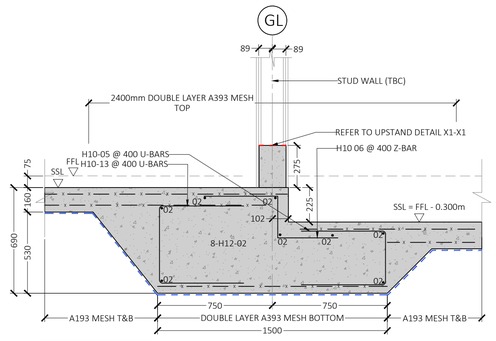

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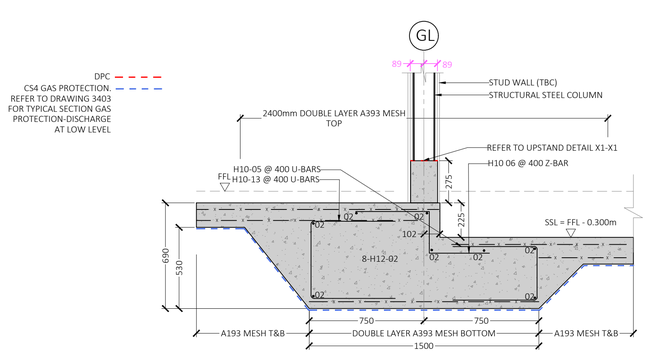

SECTION A23-A23
SCALE 1:20

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FOUNDATION MEMBRANE SPECIFICATION
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CONCRETE NOTES:

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ABBREVIATIONS

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ABS - ALTERNATE BARS STAGGERED
L - DENOTES L-BAR
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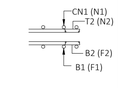
LAYERING CONVENTION



BAR LAP TABLE

BAR TYPE	BAR LAPS
H12	480
H16	640
H20	800
H25	1000
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info@structuraldesign.ie Web: www.structuraldesign.ie

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REV.	DATE	BY.	DESCRIPTION
T2	22.07.2024	JAR	ISSUED FOR TENDER
T1	17.07.2024	JPM	ISSUED FOR TENDER

Client: LIDL GB

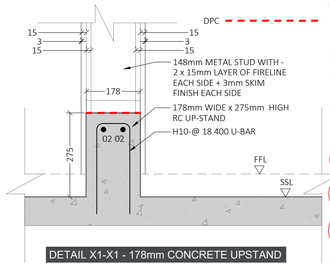
Project Title: PROPOSED NEW LIDL BIRSTALL, BANKWOOD WAY BIRSTALL, UK

Drawing Title: FOUNDATION DETAILS - SHEET 2 OF 3

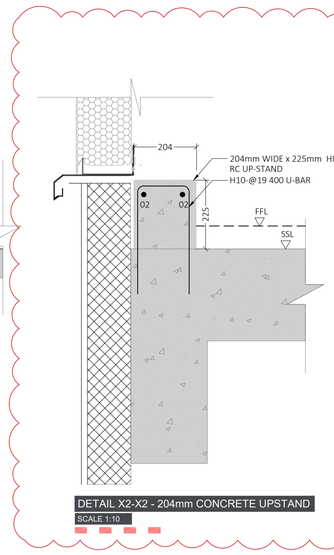
Scales	Paper Size	Status
AS SHOWN	A1	TENDER
Drawn by	Date	Checked
JPM	JULY 2024	AM

Drawing No: 24185-SDS-00-FP-DR-S-3402
Revision: T2

A1

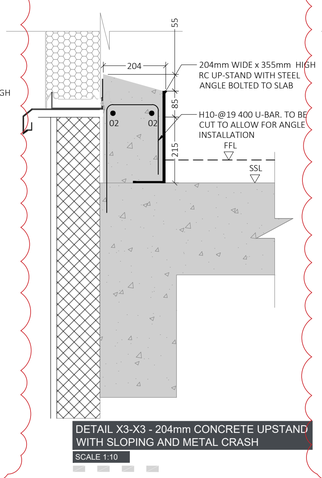


DETAIL X1-X1 - 178mm CONCRETE UPSTAND



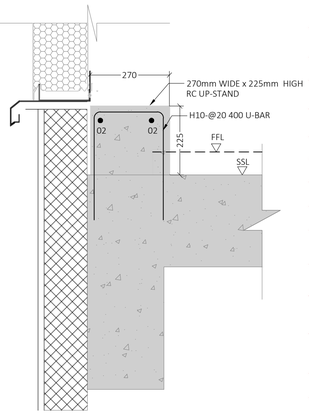
DETAIL X2-X2 - 204mm CONCRETE UPSTAND

SCALE 1:10



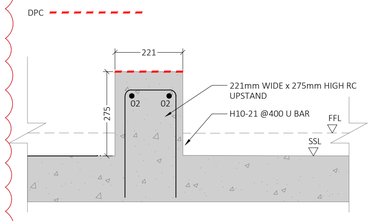
DETAIL X3-X3 - 204mm CONCRETE UPSTAND WITH SLOPING AND METAL CRASH

SCALE 1:10



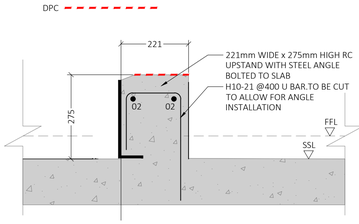
DETAIL X4-X4 - 270mm CONCRETE UPSTAND

SCALE 1:10



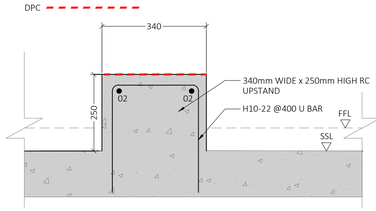
DETAIL X5-X5 - 221mm CONCRETE UPSTAND

SCALE 1:10



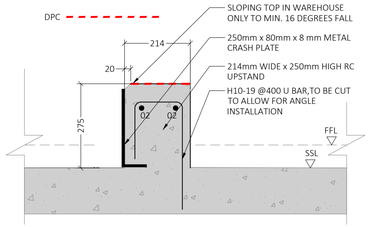
DETAIL X6-X6 - 221mm CONCRETE UPSTAND WITH SLOPING AND METAL CRASH

SCALE 1:10



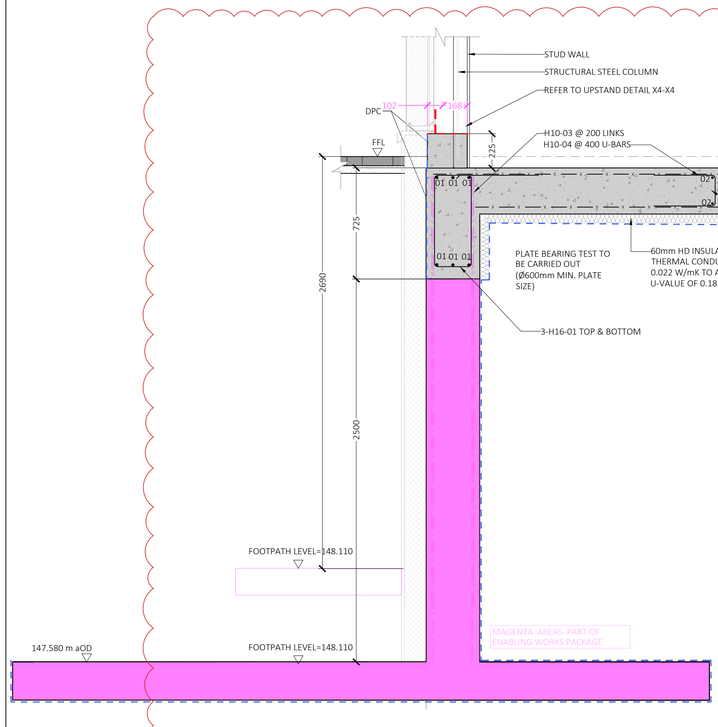
DETAIL X7-X7 - 340mm CONCRETE UPSTAND

SCALE 1:10



DETAIL X8-X8 - 214mm CONCRETE UPSTAND WITH SLOPING AND METAL CRASH

SCALE 1:10

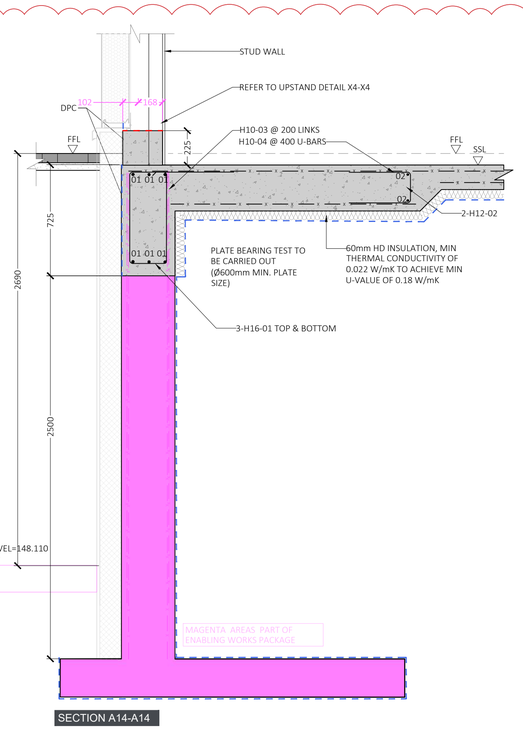


SECTION A13-A13

SCALE 1:20

DPC

CS4 GAS PROTECTION. REFER TO DRAWING 3403 FOR TYPICAL SECTION GAS PROTECTION-DISCHARGE AT LOW LEVEL

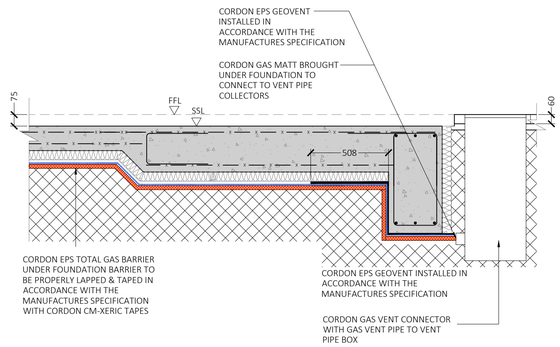


SECTION A14-A14

SCALE 1:20

450mm GEOVENT AT 5M CENTRES WITH CORDEN EPS GAS BARRIER & GAS TAPE TO ALL JOINTS IN STRICT ACCORDANCE WITH MANUFACTURES DETAILS AND SPECIFICATIONS

PLEASE NOTE THAT LOCATIONS, DETAILS AND SYSTEM SPECIFICATIONS FOR GAS PROTECTION SYSTEM SHOULD BE READ IN CONJUNCTION WITH CORDONS TECHNICAL DEPARTMENTS REPORT & DETAILS.



TYPICAL SECTION GAS PROTECTION-DISCHARGE AT LOW LEVEL

SCALE 1:20

FOUNDATION STANDARD BUILD UP UNLESS OTHERWISE SPECIFIED:

1. 50mm BLINDING
2. 300mm (MIN.) SUB BASE TYPE 1 GRANULAR MATERIAL ROLLED IN LAYERS NOT EXCEEDING 200mm AND FULLY COMPACTED WITH A SUITABLE MECHANICAL ROLLER
3. COMPACTION & SUBGRADE MODULUS TO BE ESTABLISHED BY APPROPRIATE INSITU TESTING. (PLATE BEARING TESTS WITH A PLATE DIA ≥ 600MM, MINIMUM 6 No.TESTS TO BE CARRIED OUT PLATE BEARING TESTS TO CARRIED OUT AT EXCAVATION LEVEL PRIOR TO INSTALLATION OF CAPPING LAYER. LOCATIONS OF TEST TO BE AGREED WITH ENGINEER PRIOR TO TESTING. RESULTS TO BE FORWARDED TO ENGINEER FOR REVIEW PRIOR TO CAPPING LAYER CONSTRUCTION.

FOUNDATION MEMBRANE SPECIFICATION
DPM TO BE CS2 GAS PROTECTION IN ACCORDANCE WITH BS 8485-2019,LAPPED AND SEALED

NOTE:

- GRID SETTING OUT AS PER ARCHITECTS DETAIL & DESIGN.
- DIMENSIONS AS PER ARCHITECTS LAYOUT PLAN - PLEASE REFER TO ARCHITECTS DRAWINGS FOR ALL DIMENSIONS & LEVELS.
- REFER TO ARCHITECTS DRAWINGS FOR ALL SERVICES, SIZES, SETTING OUT AND ARRANGEMENT.
- ARCHITECTS DRAWINGS TO TAKE PRECEDENCE.

IMPORTANT NOTES:

PLEASE READ THESE DRAWINGS IN CONJUNCTION WITH CURRENT LIDL CORPORATE SPECIFICATION. CORPORATE SPECIFICATION TO TAKE PRECEDENCE AT ALL TIMES, ANOMALIES TO BE NOTED IN WRITING IMMEDIATELY TO THE ENGINEER.

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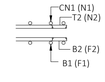

BAR LAP TABLE

BAR TYPE	BAR LAPS
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H16	640
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REV.	DATE:	BY:	DESCRIPTION:
T3	26.07.2024	JPM	ISSUED FOR TENDER
T2	22.07.2024	JAR	ISSUED FOR TENDER
T1	17.07.2024	JPM	ISSUED FOR TENDER

Client: LIDL GB

Project Title: PROPOSED NEW LIDL BIRSTALL, BANKWOOD WAY BIRSTALL, UK

Drawing Title: FOUNDATION DETAILS - SHEET 3 OF 3

Scales	Paper Size:	Status
AS SHOWN	A1	TENDER
Drawn by	Date	Checked
JPM	JULY 2024	AM

Drawing No: 24185-SDS-00-FP-DR-S-3403

Revision: T3

APPENDIX E
Cordon Product Data

Corden EPS Total Gas Barrier

BS 8485:2015+A1:2019 Compliant Gas Barrier

CORDEN EPS TOTAL GAS BARRIER

Corden EPS Total Gas Barrier is a multi-layer, low-density polyethylene membrane, reinforced with a polypropylene reinforcing grid with an integral aluminium foil.

Corden EPS Total Gas Barrier is specifically designed and manufactured to perform as a methane, carbon dioxide, radon ground gas, volatile organic compound and air & moisture protection system.

Corden EPS Total Gas Barrier complies with the latest codes of practice as published by BRE, CIRIA and BSI (BS 8485:2015+A1:2019)

Suitable for use as gas protection for NHBC GREEN, AMBER 1, and AMBER 2 site characterisations.

Corden EPS Total Gas Barrier			
Characteristic	**Test Method**	**Unit**	**Corden EPS TGB**
Physical Properties			
Thickness	EN 1849-2	mm	0.6
Thickness – Between Scrim	BS EN ISO 9863-1:2016	Mm	0.4
Width	EN 1849-2	M	Various
Length	EN 1849-2	M	Various
Weight	EN 1849-2	g/m2	370
Hydraulic Properties			
Water Column	EN 20811	-	>300
Resistance to water penetration	EN 13967, EN 1928	-	PASS
Water tightness	EN 1296, EN 1367, EN 1928	-	PASS
Mechanical Properties			
Resistance to Static Load	EN 12730 - B	Kg	20
Tensile Strength (MD)	EN 12311 -1	N/50mm	600
Tensile Strength (CMD)	EN 12311 -1	N/50mm	480
Tensile Elongation (MD)	EN 12311	-1 %	20
Tensile Elongation (CMD)	EN 12311	-1 %	20
Puncture Resistance	EN 12236	kN	1.25
Resistance to tearing (nail shank) MD	EN 12310	- 1 N	330
Resistance to tearing (nail shank) CMD	EN 12310	- 1 N	400
Durability and Chemical Resistance			
Transmission rate of volatile liquids - Diesel	ISO 6179:2010 (B)	g/m2/h	0.246
Transmission rate of volatile liquids - Xylene	ISO 6179:2010 (B)	g/m2/h	0.571
Transmission rate of volatile liquids - Toluene	ISO 6179:2010 (B)	g/m2/h	0.583
Transmission rate of volatile liquids - Petrol	ISO 6179:2010 (B)	g/m2/h	0.135
Gas Permeability			
Methane Permeability	BS EN ISO 15105 - 1	ml/m2/day/atm	<0.09
Carbon Dioxide Permeability	BS EN ISO 15105 - 1	ml/m2/day/atm	<0.09
Radon Permeability	K124/02/95	m2/s	8.0 x 10-15
Compliance and Certification			
CE Mark - EN13967:2012			
NHBC Standards Compliant			
BS 8485:2015+A1:2019 Accordant			

Corden EPS
www.cordeneps.co.uk
sales@corden-bssp.co.uk
44 (0)800 917 6565

Corden EPS Total Gas Barrier

BS 8485:2015+A1:2019 Compliant Gas Barrier

INSTALLATION

Corden EPS Total Gas Barrier should be installed in accordance with the product installation guidelines, and in accordance with BS 8485:2015+A1:2019.

JOINTING AND SEALING

It is recommended Corden EPS Total Gas Barrier be heat welded where possible, with welding carried out by competent personnel with suitable qualifications in accordance with best practice, and guidance contained within BS 8485:2015+A1:2019.

Corden EPS Total Gas Barrier should be overlapped by at least 100mm. If taping joints, only suitable tape must be used, ensuring application with a silicone roller to remove trapped air.

Corden EPS pre-formed details, or Self-Adhesive Gas Membrane are available for sealing around protuberances.

ACCESSORY PRODUCTS

A wide range of accessories are available for use with the Corden EPS Total Gas Barrier, including:

- EPS GAS TAPE
- EPS GRM SELF ADHESIVE MEMBRANE
- EPS PRIME
- EPS TOP HATS AND PREFORMED CORNERS CLOAKS
- EPS PROTECTION FLEECE
- EPS GEO-VENT VOID FORMER (25/40mm)

HANDLING

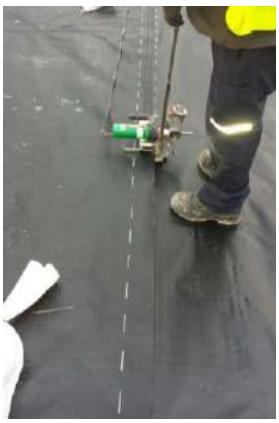
Roll weights can be in excess of 20kg and hence appropriate care and equipment is required for unloading and handling.

STORAGE

Rolls of Corden EPS Total Gas Barrier should be stored on stable/level ground and stacked not more than five rolls high, with no other material stacked on top. The rolls can be stored outdoors when packaged, but should be protected from exposure to UV.

ADDITIONAL INFORMATION

For additional information or assistance, please contact Corden EPS directly.



Corden EPS
www.cordeneps.co.uk
sales@corden-bssp.co.uk
44 (0)800 917 6565

Corden EPS Geo-Vent
Void forming geo-composite

Corden EPS Geo-Vent products include a cuspated high density polyethylene (HDPE) drainage core with a non-woven polypropylene (PP) geotextile separator/filter bonded to one side.

Mean Value (applied tolerance*)				
	Test Method	Unit	Void Vent 25	Void Vent 40
Mechanical Properties				
CBR Puncture Resistance	EN ISO 12236	kN	1.4 (-0.14)	1.4 (-0.14)
Tensile Strength (MD/CMD)	EN ISO 10319	kN/m	20/15 (-2.0/-1.5)	10/10 (-1.0/-1.0)
Compressive Strength	EN ISO 25619-2	kPa	300	200
Hydraulic Properties				
Pore Size (O90) [geotextile]	EN ISO 12956	µm	80 (±20)	80 (±20)
Permeability (H50) [geotextile]	EN ISO 11058	l/m2/s	100 (-20)	100 (-20)
Water Flow Capacity [Composite] (200kPa, (i) =1)	EN ISO 12958	l/m/s	5	>5
Gas Flow Capacity [Composite]	calculated (a)	m3/s	0.024	0.033
Physical Properties (nominal)				
Thickness	EN ISO 9863-1	mm	27.00	42.00
Material Dimensions				
Roll Width		m	0.9	0.97
Roll Length		m	50	25
Gross roll weight		kg	60	50
Product Information				
Polymer		High Density Polyethylene		
Biological Resistance		HDPE does not support bacterial growth		
Chemical Resistance		HDPE is highly resistant to acids and alkalis		

Description
Corden EPS Geo-Vent is a cuspated HDPE core with a geotextile filter/separator bonded to a single side, in either 25mm or 40mm depth. The intended use of the Corden EPS Geo-Vent is to provide a means of ventilation when used in conjunction with an approved Gas Protection Barrier, in accordance with the recommendation(s) contained within NHBC Guidance and BS8485:2015.

Features and benefits
Optimised for maximum strength and performance, providing high levels of air/gas flow. Complies with the latest codes of practice as published by BRE, CIRIA and NHBC. Corden EPS Geo-Vent is independently tested and verified by UKAS accredited bodies.



Storage and Handling
Corden EPS Geo-Vent is supplied in packaging designed to protect the product from damage during handling and storage, and degradation as a result of UV exposure. Geo-Vent should be kept in the supplied packaging until such time as it is required for installation.

Roll weights can be between 50kg and 100kg and hence appropriate equipment is required for unloading and handling.

Corden EPS
www.cordeneps.co.uk
sales@corden-bssp.co.uk
44 (0)800 917 6565

Corden EPS
Ground Level Vent Box Types

Ground Level Flood Defence Vent Box

Dimensions	500mm long x 150 wide x 275 Deep
Lid -Materials	Stainless or Galvanised Steel
Open Air	Slotted (8mm slots)-19,200mm² Perforated (6mm holes)-5994mm²
Screws	Secured using 4No. S/Steel Counter Sunk Screws
Vent Box	4mm HDPE Sheet (Extrusion Welded) HDPE Twinwall Pipe inlet/outlet.
Features	• Side Connection into vent box prevents surface water from entering the gas inlet • 110mm diameter gas inlet and water outlet connections • Base connection to storm water collection, land drainage or soakaway system • Removable mesh over drain outlet to prevent blockage by debris • Suitable for foot traffic only

Rectangular Gully Vent

Dimensions	Height 720mm (Can Be manufactured to bespoke heights) x 420mm wide x 210mm deep
Lid Materials	1.6mm 304 Grade Stainless steel.
Open Air	Slotted- 18139.88mm² Perforated (6mm holes)- 6841.34mm²
Screws	4mm HDPE Sheet (Extrusion Welded). HDPE Twinwall Pipe Spacer PVC Base (Extrusion Welded)
Features	110mm diameter gas inlet and 175mm water outlet Base connection to storm water collection, land drainage or soakaway system Load tested up to 190Kg (Suitable for foot traffic only)

EPS Vent Boxes used in conjunction with EPS Geo-Vent and EPS Geo-Vent components.
Correct installation / specification should be sought from the Specifier, Ground Engineers or the structural engineers to ensure this unit is suitable for the intended installation location.

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Corden EPS
Venting Components

Corden EPS Smooth Carrier Duct –
3m x 110mm Ø

Corden EPS straight coupler - 110mm Ø

Corden EPS Geo-Vent Connector - 110mm Ø
c/w 950mm x 30mm slot

Corden EPS Geo-Vent Connector (side vent)
c/w 200mm x 110mm Ø duct

Corden EPS Tee Coupler - 110mm Ø
Corden EPS 90° Coupler - 110mm Ø
Corden EPS Stop End - 110mm Ø

Corden EPS Geo-Vent Carrier Pipe - 1.5m
c/w 950mm x 30mm slot

Corden EPS Adjustable Periscope Vent
Corden EPS Adjustable Periscope Vent Adaptor

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