Remediation Strategy & Validation Proposal Sheets

To be approved by South Tyneside Council.

Project reference: 22-442

Site: Proposed Children's Centre, Grant Street, Jarrow, Tyne & Wear, NE32 5HY

Carried out by: Geoff Heron

Section A - Site Investigation Works

This Remediation Statement should be read in conjunction with the following reports produced for the site:

- Phase 1: Desk Top Study and Coal Mining Risk Assessment Report, Ref. 22-442, Arc Environmental Ltd., June 2022
- Phase 2: Ground Investigation Report, Ref. 22-442, Arc Environmental Ltd., Dec 2022
- Hazardous Ground Gas Risk Assessment Addendum Letter, Ref. 22-442.02L, Arc Environmental Ltd., January 2023

Section B - Summary of Site Investigation & Risk Assessments

Ground Conditions

From the investigation works completed, made ground deposits were encountered across all the boreholes and trial pits to depths of between c.0.50m and c.0.90m below current ground levels (bgcl). The deposits encountered typically comprised grass underlain by sandy gravelly clayey soil sandy gravel and stiff gravelly clay with fragments of ash, brick, coal, concrete and slate.

Natural deposits were recorded immediately beneath the made ground typically comprising stiff greyish brown sandy gravelly CLAY with occasional coal fragments to depths of between c.18.50m and c.19.00m bcgl.

From the investigation works undertaken, the site is not deemed to be at risk from unrecorded shallow workings and therefore, no further works or mitigation measures are required in this regard.

Ground Contamination Risk Assessment

From the results of the contamination screening and the risk assessments completed for the made ground encountered below this site, the results have recorded elevated levels of Lead (458mg/kg) and several PAHs, Benzo(a)pyrene (8.64mg/kg), Benzo(b)fluoranthene (10.22mg/kg) and Dibenz(ah)anthracene (1.67mg/kg) which represent a potential risk to future end users (residents).

Other metals, metalloids, in-organics and speciated PAH's screened do not pose a significant risk to Human Health.

Hazardous Ground Gas Risk Assessment

The results of the hazardous ground gas monitoring show the presence of hazardous ground gas does not exceed the GSV assessment value of 0.07 l/hr. (Characteristic Situation 1), indicating that no gas protection measures would be required for the proposed development.

However, since the maximum Carbon Dioxide concentration exceeds the action trigger level of 5%, the CIRIA 665 guidance recommends an increase in the characteristic situation by an order of 1 to take into account the gas concentrations recorded. It is understood the floor type is to be a ground bearing floor slab and as such, it is felt that an appropriate determination for this site would be to place the site within Characteristic Situation 2 (CS2) classification, Therefore, appropriate gas protection measures will need to be implemented within the building design to negate against any risks to future end users, in accordance with BS8485:2015 + A1:2019.

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Section C - Remediation Strategy

Options Appraisal

When considering the maximum recorded thickness of the made ground materials i.e. c.0.90m, it is recommended that as part of the initial site preparatory works, the made ground is carefully stripped and removed from all areas of proposed soft landscaping and gardens. A remediation mark up plan highlighting the areas where made ground is to be removed is attached.

Removal of Made Ground Materials

Where made ground is present, this should be fully removed from within areas of gardens / soft landscaping thus removing the contamination *sources* and future dermal contact, ingestion or migration *pathways*, and the risk posed to end users will in turn be negated. The excavated made ground will require either removal from site to an appropriate waste disposal facility or re-used as general fill below areas of permanent hardcover, provided this material meets any geotechnical requirements for reuse on the site.

Re-use of Site Won Materials

Where spoil comprising uncontaminated natural strata is generated from foundation / drainage excavations, etc., these materials can be considered suitable for use within any areas of soft landscaping, providing these materials are inspected and are free of any anthropogenic debris and visual & olfactory evidence of fuel, oils and ash. However, confirmatory contamination screening in accordance with the validation requirements detailed in the following sections will also be required to confirm the suitability of these materials prior to re-use.

Depending on the volume of soils to be reused on site, a Materials Management Plan (MMP) may be required to control the movement of any materials which are intended for re-use on site.

Unforeseen Contamination

If during the remediation / groundworks phase, visual and / or olfactory evidence of unidentified grossly contaminated materials or 'hot spots' are identified then site works in the affected area should cease and site should notify ARC and the Local Authority as soon as it is possible. A reassessment of the ground contamination risk assessment will need to be made, and the requirement for any further sampling and screening to be undertaken should be determined. Details of the appropriate course of action undertaken to deal with these materials should be provided to and agreed with the Local Authority prior to carrying out any remediation. Further remediation and validation works may then be necessary.

Provision of Gas Protection Measures

In accordance with BS8485:2015+A1:2019 'Code of Practice for the Design of Protective Measures for Methane and carbon Dioxide Ground Gases for New Buildings', the proposed development has been assessed as a Type B building (Table 3) and therefore the gas protection measures should meet a minimum gas protection score of **3.5 points** (Table 4).

Section D - Implementation of Remediation Strategy

Prior to the commencement of the site works and in conjunction with the Main Contractor, the appointed groundworks subcontractor should prepare and submit a suitable Methodology for implementation of all the remediation elements detailed in this RS. This should be submitted to ARC for approval before commencing with the remediation works to ensure that the methodology will meet the requirements of the RS and to allow for any amendments to be made that might be required.

Removal of Made Ground

- Where made ground materials are present below areas of soft landscaping / gardens, these should be fully removed down to the natural underlying sandy gravelly clay deposits and either placed onto plastic membrane to await removal from site to landfill or reused as general fill below areas of proposed hard-standing.
- Any imported soils brought on to site to bring up site levels following removal of the made ground should be suitably screened and tested for human health assessment prior to delivery with these results reviewed by ARC a minimum of 1 week before delivery to site (max. 2 months old).
- If any made ground is left in-situ below or subsequently placed within gardens or soft landscaping areas, a clean cover system would be required and a reassessment of this strategy would need to be undertaken.

Risk Assessment (Construction Workforce)

When considering the potential risks to the construction workforce, it will be necessary to ensure that the appropriate level of protection is provided and these should be detailed in the site health and safety management scheme (designed by the Main Contractor), during all construction activities. These measures should include appropriate PPE and good site practice, and the results of all the contamination screening undertaken (all results contained within all the site investigation reports) can be used when assessing the required level of protection (based on the acute exposure risk). For further guidance reference should be made to the Health and Safety Executive (HSE) document EH40/2005 (Second edition, published 2011) Workplace Exposure Limits.

Implementation of Gas Protection Measures:

To achieve the required gas protection score, a combination of protection elements taken from Tables 5, 6 & 7 (contained within BS8485) should be implemented.

Table 5 – Structural Barrier – Depending upon the foundation type, floor type and the quality of the design & construction, a number of points can be achieved, for example provision of an insitu cast reinforced concrete slab (ground bearing or suspended) will achieve between **0.5 & 1.5 points** and a raft can achieve **1.5 points**. It should be noted that a suspended block and beam floor will be achieve **0 points** and therefore alternative measures from Tables 6 & 7 will need to be adopted (see below).

Table 6 – Ventilation Protection Measures – Where sub-floor ventilation is provided this should comprise either a min. 150mm clear void, void former blanket or gas drains, with ventilation from the sub-floor ventilation through the internal wall to the external wall using telescopic swan neck vents with air bricks providing 1500mm^2/m run void ventilation spaced at maximum 2.0m centres will achieve **1.5 points**. In addition, cross ventilation will need to be incorporated into sleeper walls / party walls.

Section D - Implementation of Remediation Strategy (Cont'd)

Implementation of Gas Protection Measures (cont'd):

Table 7 – Gas Resistant Membrane - The final element of the gas protection measures is the provision of a suitable gas resistant barrier membrane, which should comply with the criteria listed in Table 7. There is also the requirement for the verification of the gas barrier membrane installation, undertaken in accordance with CIRIA C735. The implementation of gas resistant barriers will achieve **2.0 points**. Notes on the installation of gas barrier membranes is given below:

- The performance of the gas barrier membrane is dependent on the quality and design of the installation, and therefore guidance suggests suitably qualified and experienced contractors (holding an NVQ Level 2 qualification in gas protection installation) should carry out the construction / installation of the gas barrier membrane.
- The gas barrier membrane will need to be installed in accordance with the manufacturer's details.
- Either, a blinding layer of soft sand should be applied to the floor construction, or the surface should be adequately cleaned, to prepare a smooth surface free from sharp debris, which may damage the laid membrane.
- The membrane should be installed in a logical sequence across the footprint of the building, to achieve a minimum number of joints. A minimum overlap of 150mm is recommended where membranes sections are joined together. A combination of thermal welding and butyl double-sided jointing tape can be used for joining gas barrier membranes together. Where the membrane has been jointed using double-sided jointing tape, it can be further protected by the application of gas resistant self-adhesive membrane, to prevent dirt and moisture ingress.
- Where steel stanchions and service entries / ducts penetrate the floor construction these should be suitably sealed, using a pre-formed top-hat or wrapped in gas resistant self-adhesive membrane. Where ducts are used to feed in services, the top of the duct and service should be appropriately sealed with closed cell foam inside the duct and / or appropriate gas resistant products (i.e. gastite tape or GR SAM) wrapped around the duct and service.
- Following validation of the gas barrier membrane, it is the responsibility of the main contractor / groundworks contractor to protect the gas barrier membrane from damage by follow-on trades or during the construction of subsequent final floor layers, in order to maintain the integrity of the gas barrier membrane.

The Design Team have provided detailed design drawings, showing the proposed installation / construction of the protection measures and indicated Visqueen products will be used. The design drawings and product specifications have been reviewed by Arc Environmental Ltd to ensure they meet the BS8485 guidance and this Remediation Strategy.

Section E - Validation of Remediation Strategy

To ensure that all elements of the RS are properly implemented, the following validation works should be undertaken and documented within a final Validation Report (VR), confirming that each element of the remediation works has been completed. The validation works will comprise the following:

Removal of Made Ground

The made ground materials will be removed from areas of proposed soft landscaping and gardens and this should be witnessed, where possible by a suitably qualified Geo-environmental Engineer. Following removal of these materials, they can then be either re-used as a general fill material, providing they remain below areas of proposed hard-standing (i.e. proposed access road, car-parking, building, etc.,), or alternatively they can be removed off-site and taken to an appropriate landfill. Where excavated made ground materials are to be moved around the site and placed below areas of hardstanding a materials management plan may be required.

Section E - Validation of Remediation Strategy (Cont'd)

Removal of Made Ground (Cont'd)

During these works, the removal of materials off-site will need to be observed and documented. In addition, photographic evidence of these works will be required. These works should be observed by a suitably qualified Geo-environmental Engineer, from Arc Environmental Limited, and recorded within a Validation Report.

To confirm that all the made ground has been fully removed and that no residual contamination is present, representative samples of the resultant formation should be recovered and tested for, and verified against, the determinands listed within Table 1 below. If any exceedances are recorded, then additional materials should be excavated, and additional samples recovered and tested. This process should be repeated until no exceedances are recorded. The frequency of testing will be dependant upon the resultant formation area and should be discussed and agreed with Arc Environmental Ltd and the Local Authority at the time.

Table 1 – (Assessment Criteria for Imported Soils)

Analyte	Target Conc. (C_T) mg/kg		
Metals/Metalloids			
Arsenic	37(1)		
Cadmium	11(1)		
Chromium III	910(1)		
Chromium VI	6(1)		
Copper	2400(1)		
Lead	200(2)		
Mercury	40(1)		
Nickel	180(1)		
Selenium	250(1)		
Zinc	3700(1)		
Cyanide	34(3)		
Asbestos	Presence of fibres		
Speciated PAH's	1% SOM	2.5% SOM	6% SOM
Acenaphthene	210(1)	510(1)	1100(1)
Acenaphthylene	170(1)	420(1)	920(1)
Anthracene	2400(1)	5400(1)	11000(1)
Benzo(a)anthracene	7.2(1)	11(1)	13(1)
Benzo(a)pyrene	2.2(1)	2.7(1)	3.0(1)
Benzo(b)fluoranthene	2.6(1)	3.3(1)	3.7(1)
Benzo(ghi)perylene	320(1)	340(1)	350(1)
Benzo(k)fluoranthene	77(1)	93(1)	100(1)
Chrysene	15(1)	22(1)	27(1)
Dibenz(ah)anthracene	0.24(1)	0.28(1)	0.30(1)

Analyte	Target Conc. (C_T) mg/kg		
Speciated PAH's (Cont'd)	1% SOM	2.5% SOM	6% SOM
Fluoranthene	280(1)	560(1)	890(1)
Fluorene	170(1)	400(1)	860(1)
Indeno(123cd)pyrene	27(1)	36(1)	41(1)
Naphthalene	2.3(1)	5.6(1)	13(1)
Phenanthrene	95(1)	220(1)	440(1)
Pyrene	620(1)	1200(1)	2000(1)
Speciated TPH	1% SOM	2.5% SOM	6% SOM
TPH Aliphatic (EC5-EC6)	42(1)	78(1)	160(1)
TPH Aliphatic (EC6-EC8)	100(1)	230(1)	530(1)
TPH Aliphatic (EC8-EC10)	27(1)	65(1)	150(1)
TPH Aliphatic (EC10-EC12)	130(1)	330(1)	760(1)
TPH Aliphatic (EC12-EC16)	1100(1)	2400(1)	4300(1)
TPH Aliphatic (EC16-EC35)	65000(1)	92000(1)	110000(1)
TPH Aliphatic (EC35-EC44)	65000(1)	92000(1)	110000(1)
TPH Aromatic (EC5-EC7)	70(1)	140(1)	300(1)
TPH Aromatic (EC7-EC8)	130(1)	290(1)	660(1)
TPH Aromatic (EC8-EC10)	34(1)	83(1)	190(1)
TPH Aromatic (EC10-EC12)	74(1)	180(1)	380(1)
TPH Aromatic (EC12-EC16)	140(1)	330(1)	660(1)
TPH Aromatic (EC16-EC21)	260(1)	540(1)	930(1)
TPH Aromatic (EC21-EC35)	1100(1)	1500(1)	1700(1)
TPH Aromatic (EC35-EC44)	1100(1)	1500(1)	1700(1)

(1) = LQM S4UL's (2014 & 2015) – *Residential with home-grown produce*, (2) = CL:AIRE C4SL's – *Residential with home-grown produce,* (3) = ATRISK^{SOIL} SSV,

Any topsoil and subsoil (either site-won and / or imported), for use in gardens and areas of soft landscaping should be suitably screened and tested for human health assessment prior to re-use / delivery, with these results sent to Arc Environmental, a minimum of 1 week before delivery to site. To confirm the suitability of these materials, validation testing will be required following emplacement and / or importation onto site in accordance with the YALPAG guidance with the volume of screening dependant on the source of material as highlighted on the following page.

Section E - Validation of Remediation Strategy (Cont'd

Virgin Quarried Material – The suite of screening will include standard metals and metalloids. Sampling numbers 1 or 2 to confirm the inert nature of the material.
Crushed Hardcore, Stone, Brick – The suite of screening will include standard metals and metalloids, Speciated PAH's, asbestos and leachate analysis. Sampling numbers minimum of 1 per 500m^3.
Greenfield Soils – The suite of screening will include heavy metals, speciated PAH's and asbestos. Sampling numbers - minimum 3 or between 1 per 50m^3 and 1 per 250m^3 (whichever is the greater).
Brownfield Source – The suite of screening will include heavy metals, speciated TPH's, speciated PAH's and asbestos and any additional analysis depending on history of donor site. Sampling numbers minimum 6 or between 1 per 50m^3 and 1 per 100m^3 (whichever is the greater).

Validation of Gas Protection Measures

For this site, the implementation of CS2 gas protection measures must be witnessed, photographed and validated by an experienced and suitably qualified Engineer to ensure that all works are being completed in strict accordance with this Remediation Strategy, the proposed design details, BS8485 & CIRIA C735.

Each site visit should validate the construction and emplacement of each element of the gas protection measures within the proposed building and confirm that all installation requirements have been met. Typical inspection should follow the criteria set out in CIRIA C735, and the procedure for inspection / validation of the gas protection measures is outlined below.

- The verification of the gas protection measures inspected on each visit will be recorded visually using the proforma outlined in Appendix A5 of CIRIA C735 to verify that the works have been carried out in full accordance to the submitted design drawing and product specifications.
- The visual inspection will be accompanied by a full photographic record. The inspected / photographic record will include (as a minimum) the verification of the following construction details:-

    - Construction of structural barrier: confirmation of the construction of any insitu cast reinforced slabs / rafts.
    - The underside of the gas barrier membrane: to assess that no uneven / rough surfaces are present.
    - Gas barrier membrane type: full product / manufacturers specification, gauge, colour, batch/roll number.
    - Gas barrier membrane condition: assess for no punctures, tears, rips or other defects to the membrane.
    - Joining tape: to assess product type, brand, thickness, material, width and colour
    - Lapping design: to assess whether joints are lapped and sealed in accordance with the manufacturer's specifications (including double taping and correct overlapping)
    - Laps and sealed joints: to assess double sided tape has been used and welds are undertaken correctly
    - Service entries: to assess whether service entries have been appropriately sealed i.e. assessing top hat arrangements with the use of Jubilee clips, GR SAM and sealing of service feed ducts using a closed cell foam such as FiloSeal or FiloForm.

- The completed inspection record sheets will be submitted to the LA within the final Validation Report, as well as a record of the approved contractors' qualifications, which should include as a minimum an NVQ Level 2 in gas protection installation and product specification / datasheets.

Section F - Action Items & Persons Responsible

- Completion of Site wide 'Watching Brief' – Main Contractor
- Additional sampling, screening and risk assessment of any unknown / unrecorded ground contamination (if required) – Arc Environmental Ltd
- Provision of pre-delivery imported soil screening results – Main Contractor
- Validation of imported soils. All validation screening will be assessed against the Level 1 Target Concentration Values in Table 1 above – Arc Environmental Ltd.
- Construction & installation of gas protection measures – Main Contractor.
- Validation of installation of gas protection measures – Arc Environmental Ltd.
- Completion of final Validation Report incorporating all of the above – Arc Environmental Ltd.
- Collection and provision of all documentation relating to waste disposal: - as a minimum, provision of total volumes excavated and removed to tip, waste consignment / transfer notes, landfill tip receipts – Main Contractor.
- Completion of final Validation Report incorporating all the above – Arc Environmental Ltd.

This document has been completed by Geoff Heron, for and on behalf of Surgo Construction Ltd.

[redacted]

Signed: Date: 1st August 2023

For and on behalf of Arc Environmental Ltd.
Geoff Heron
Senior Technician

Remediation Strategy & Validation Proposal Sheets

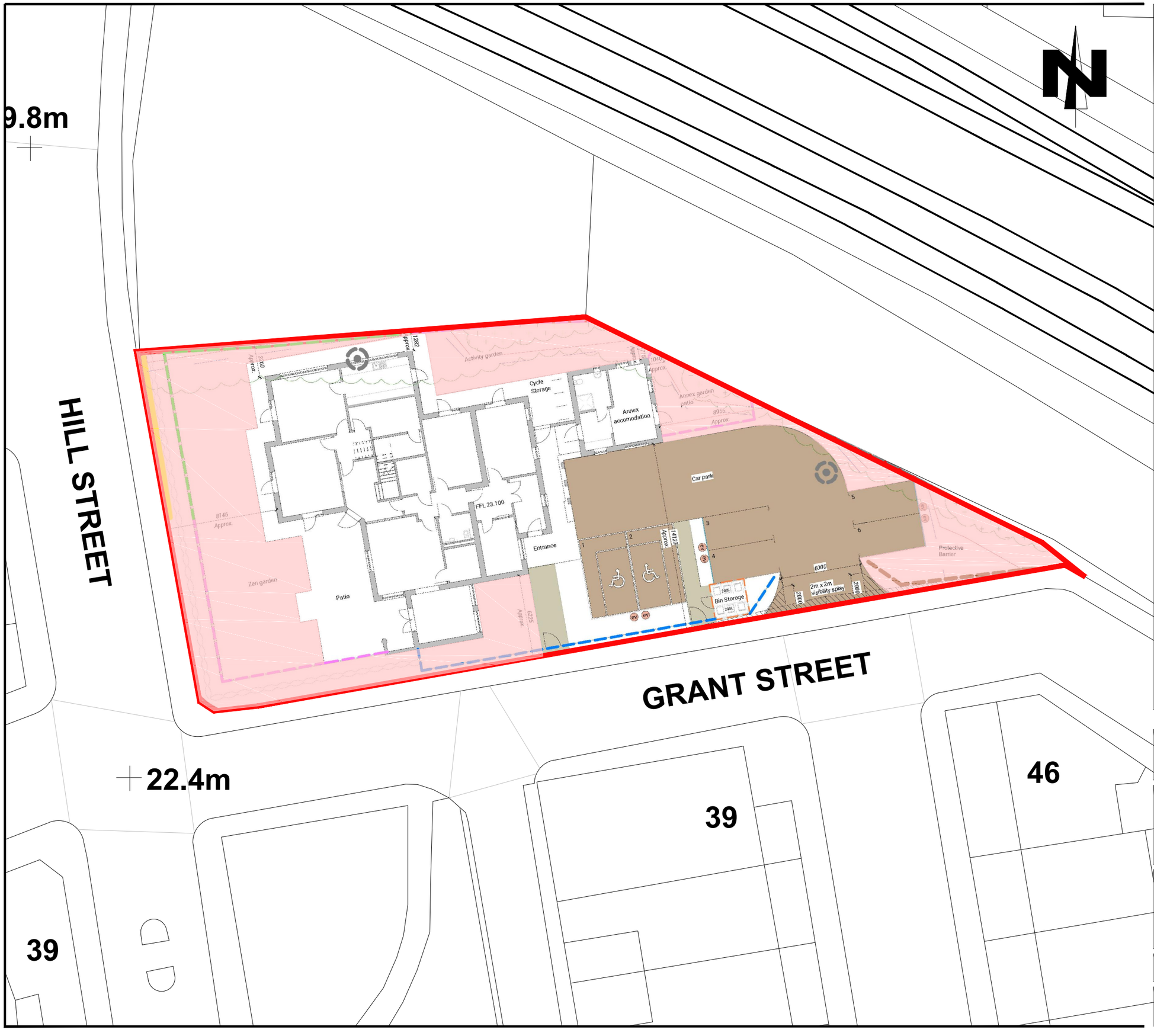
To be approved by South Tyneside Council.

Project reference: 22-442

Site: Proposed Children's Centre, Grant Street, Jarrow, Tyne & Wear, NE32 5HY

Carried out by: Geoff Heron

Plan Highlighting Areas Requiring Removal of Made Ground



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The contractor shall check all dimensions on site before commencement of any works. No dimensions to be scaled off this drawing.
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LEGEND	
	APPROXIMATE SITE BOUNDARY
	AREAS OF PROPOSED SOFT LANDSCAPING REQUIRING REMOVAL OF MADE GROUND MATERIALS

rev.	date	amendments	drawn	chckd

Client:
JDDK ARCHITECTS LTD

Project Title:
Proposed Children's Centre
Grant Street, Jarrow
Newcastle upon Tyne, NE32 5HY

Drawing Title:
Made Ground Removal Plan

Scale at A3:	Date:	Drawn by:	Approved by:
NTS @ A3	01.08.23	P.D	G.H

Job Ref:	Drg no:	Rev:
22-442	–	–