GROUNDTECH
CONSULTING

Job title:	Soothill Lane, Batley
Report type:	Remedial Specification
Prepared for:	Kirklees Council
Date:	October 2019

DOCUMENT CONTROL FORM		
PROJECT	SOOTHILL LANE, BATLEY	
REPORT NAME	REMEDIAL SPECIFICATION	
REPORT REFERENCE	18058/633	
STATUS	FINAL	
ISSUE DATE	26 FEBRUARY 2019	
REVISION	1.1	26 February 2019
	1.2	22 August 2019
	1.3	01 October 2019
CLIENT	*KIRKLEES COUNCIL*	
CLIENT CONTACT	ALISON BRUTON	

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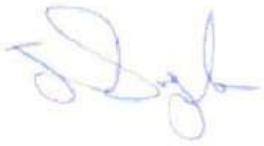
SIGNATURE	
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M4492 sk 01	A	Feasibility Layout 1

REMEDIAL SPECIFICATION
SOOTHILL LANE, BATLEY

1.0 INTRODUCTION

1.1 Objectives

This specification has been produced on behalf of Kirklees Council and relates to the remediation of a site at Soothill Lane, Batley.

This document and related appendices set out the requirements relating to disposal, appropriate and suitability testing to be used as part of the remediation works.

The following scope of remedial and enabling works is required to prepare the site for development and occupation post construction phase:

Remedial Works
- *Removal of topsoil in the southern area of the site*
- *Reuse of site won material on site*
- *Placement of cover layer in garden areas and POS (post construction)*

Enabling Works
- *Earthworks to achieve finished site levels*
- *Capping of the mine shaft in the southern site area*
- *Confirmatory drilling of plots where less than 10m of solid rock cover exist above mine workings*

1.2 Proposed Works

Remediation will be undertaken at the site to prepare it for development of the residential units as shown on the proposed site layout M4492 sk 01.

1.3 Sources of Information

A previous Preliminary Risk Assessment and desk based Coal Mining Risk Assessment was undertaken by Parsons Brinckerhoff in July 2015 (Ref 3514191A-3171).

Groundtech Consulting carried out a Ground Investigation in December 2018 to quantify the level of risk identified in the Phase I Desk Study discussed in the previous paragraph.

A summary of the findings of the investigation is outlined in Section 2.0.

2.0 CONCEPTUAL SITE MODEL

2.1 Background

Pertinent information from the Groundtech Consulting Geo-Environmental Appraisal and Coal Mining Risk Assessment Report is presented below.

The site is irregular in shape and covers an area of 12.73 hectares and is entirely undeveloped encompassing agricultural fields bordered by mature trees and hedgerows.

Geological records indicate that no superficial deposits are present. The site is underlain by the Horbury Rock Sandstone in the north and Pennine Middle Coal Measures in the south.

The Ground Investigation scope of works comprised the following:

- Geophysical Survey
- Utility Clearance
- 40 No. trial pits
- 21 No. rotary boreholes with water flush
- 18 No. window sample boreholes
- 9 No. Plate Load/CBR tests
- 8 No. trenches
- 4 No. soil percolation tests
- Surveying of locations

Made ground encountered at the site is generally associated with the former coal mining legacy including opencast, mine shaft and shallow workings. Made ground populations are detailed below:

Locations Encountered	Depth (min - max)	Thickness (min – max)	Description
TP15 to TP20, TP36 to TP39, WS05 to WS07	GL to 0.40m	0.10m to 0.40m	Dark brown slightly clayey slightly gravelly sandy topsoil with gravel of sandstone, coal and rare brick.
TP16 to TP20, WS05	0.10m to 4.10m	1.20m to 3.90m	Light brown and black sandy gravel with low cobble content. Gravel is of sandstone, coal and rare ash. Generally considered as colliery spoil.
TP15, WS05 to WS07	0.30m to 3.40m	0.40m to 2.10m	Soft to firm brown slightly sandy slightly gravelly clay with gravel of sandstone, coal and rare brick. Generally considered as colliery spoil.
TP16	1.90 to 2.20m	0.30m	Black sandy gravel of coal and ash with clayey lenses. Generally considered as colliery spoil.
Trench 5 to Trench 8, RO19	GL to 0.50m	0.25m to 0.50m	Grey slightly clayey slightly sandy gravel of mudstone and siltstone
Trench 6, RO19	0.30m to 19.50m	19.20m	Brown and grey slightly sandy gravelly clay with medium to high cobble content of sandstone blocks.

Topsoil was encountered across the entire site.

Bedrock was encountered in all locations with the exception of TP20, it typically comprised weathered sandstone in the northern area of the site and weathered mudstone in the southern area of the site. Intact coal seams were also encountered at several locations across the site.

Historic mine workings were encountered within two of the rotary boreholes (RO18 and RO20). Loss of flush was encountered in RO18 between 13.5m and 18.0m bgl which is attributed to historic working of the Top Haigh Coal at 17.0m to 18.0m bgl which has subsequently undergone collapse causing the bedrock above to bulk and subsequently fracture. Loss of flush was encountered within RO20 between 7.0m and 7.5m, then at 10.5m to 12.0m bgl implying that the Top Haigh Coal was worked between 11.0m and 12.0m bgl and the workings have again collapsed and the above bedrock has bulked preventing further upward migration.

A backfilled mine shaft (RO19) was identified in the south east of the site, the shaft is 19.50m deep with a diameter of approximately 1.50m.

Groundwater was encountered within TP32 at 1.40m bgl, rising to 0.70m bgl after 20 minutes and in WS11 at 1.20m bgl. No groundwater was recorded within the other exploratory hole locations.

Rare ash was noted within the colliery spoil in the vicinity of TP16 to TP20 and WS05 in the north eastern area of the site.

A slight hydrocarbon odour was noted within the mudstone and siltstone gravel in the vicinity of trench TP05 at 0.50m bgl.

2.2 Geo-Environmental Testing Results

The suite of testing scheduled included metals, metalloids, speciated PAHs, VOCs, TPH CWG, sulphate, pH and asbestos.

A summary of the geo-environmental testing results is presented below:

Metals			
Contaminant	Range of Results (mg/kg unless stated)	Number of Exceedances	Locations of Exceedances
Arsenic	1.8 – 38.2	3	TP35, TP38, TP39
Cadmium	<0.1 – 0.2	0	N/A
Chromium	25.7 – 71.7	0	N/A
Hexavalent Chromium	<0.3	0	N/A
Copper	<1 – 59	0	N/A
Lead	11 – 657	2	TP30, TP35
Mercury	<0.1 – 2.0	4	TP05, TP15, TP21, TP27
Nickel	16.7 – 43.8	0	N/A
Selenium	<1 - 2	0	N/A
Zinc	29 – 126	0	N/A
Polycyclic Aromatic Hydrocarbons (PAHs)			
Contaminant	Range of Results (mg/kg unless stated)	Number of Exceedances	Locations of Exceedances
Naphthalene	<0.04 – 17.50	2	TP30, TP37
Acenaphthylene	<0.03 – 3.06	0	N/A
Acenaphthene	<0.05 – 3.94	0	N/A
Fluorene	<0.04 – 5.35	0	N/A
Phenanthrene	<0.03 – 32.59	0	N/A
Anthracene	<0.04 – 7.52	0	N/A
Fluoranthene	0.07 – 34.38	0	N/A
Pyrene	0.06 – 29.11	0	N/A
Benzo(a)anthracene	<0.06 – 13.93	2	TP30, TP37
Chrysene	<0.02 – 14.21	0	N/A

Benzo(b)fluoranthene	<0.07 – 23.79	6	TP30, TP33, TP36, TP37, TP38, TP39
Benzo(k)fluoranthene	<0.02 – 6.66	0	N/A
Benzo(a)pyrene	<0.04 – 12.48	7	TP28, TP30, TP36, TP37, TP38, TP39, TP40
Indeno(123cd)pyrene	<0.04 – 6.73	0	N/A
Dibenzo(ah)anthracene	<0.04 – 2.51	8	TP28, TP30, TP33, TP36, TP37, TP38, TP39, TP40
Benzo(ghi)perylene	<0.04 – 6.85	0	N/A
TPH CWG - Aliphatics			
Contaminant	Range of Results (mg/kg unless stated)	Number of Exceedances	Locations of Exceedances
>C5-C6	<0.10	0	N/A
>C6-C8	<0.10	0	N/A
>C8-C10	<0.10	0	N/A
>C10-C12	<0.20	0	N/A
>C12-C16	<4.00	0	N/A
>C16-C21	<7.00	0	N/A
>C21-C35	<7.00	0	N/A
Total aliphatics C5-35	<19.00	0	N/A
TPH CWG – Aromatics			
Contaminant	Range of Results (mg/kg unless stated)	Number of Exceedances	Locations of Exceedances
>C5-EC7	<0.10	0	N/A
>EC7-EC8	<0.10	0	N/A
>EC8-EC10	<0.10	0	N/A
>EC10-EC12	<0.20	0	N/A
>EC12-EC16	<4.00	0	N/A
>EC16-EC21	<7.00	0	N/A
>EC21-EC35	<7.00	0	N/A
Total aromatics C5-35	<19.00	0	N/A
Total aliphatics and aromatics(C5-35)	<38.00	0	N/A
MTBE	<5.00 ug/kg	0	N/A
Benzene	<5.00 ug/kg	0	N/A
Toluene	<5.00 ug/kg	0	N/A
Ethylbenzene	<5.00 ug/kg	0	N/A
m/p-Xylene	<5.00 ug/kg	0	N/A
o-Xylene	<5.00 ug/kg	0	N/A

Asbestos Screen		
Position	Depth (m bgl)	Result
TP01	0.10	None Detected
TP15	0.20	None Detected
TP16	0.50	None Detected
TP19	0.50	None Detected
TP20	0.10	None Detected
TP30	0.10	None Detected
TP33	0.10	None Detected
TP36	0.10	None Detected
TP37	0.10	None Detected
TP38	0.10	None Detected
TP39	0.10	None Detected
Trench T05	0.10	None Detected

Trench T06	0.50	None Detected

2.3 Permanent Ground Gases

Six ground gas monitoring visits have been carried out to between 03 January and 01 April 2019. In accordance with CIRIA 665 'Assessing risks posed by hazardous ground gases to buildings' the site falls within the NHBC green traffic light zone and is considered Characteristic Situation 1.

In accordance with BRE 211 'Radon Guidance on Protective Measures for New Buildings' 2015 and UKRadon the site falls in an area where 5% to 10% of homes are affected by radon gas, and basic radon precautions would be required.

2.4 Pollution Linkage Assessment Review

The risk to human health was generally considered to be low.

The risk from radon gas was considered to be moderate to high.

The geo-environmental testing indicates slightly elevated mercury concentrations in the northern site area likely related to agricultural activities on the site previously carried out to improve the quality of the topsoil. Significant mixing of the topsoil will take place during the initial site strip which will sufficiently dilute the concentrations. Furthermore statistical analysis carried out on the metals shows that the upper confidence limit is less than the critical concentration with an evidence level of 95% or above, meaning that the Null Hypothesis is rejected with a high degree of confidence. Therefore the topsoil in the northern site area is considered suitable for reuse.

The geo-environmental testing indicates elevated lead, arsenic and PAHs within the topsoil in the southern site area. Elevated metal concentrations are again likely to be a result of agricultural activities, while elevated PAH concentrations can be attributed to an increase in the quantity of coal within the topsoil since the Pennine Middle Coal Measures are at the surface. Based on discussions with the Kirklees Council Environmental Health Officer topsoil in the southern site area is not suitable for reuse.

3.0 REMEDIAL OPTIONS APPRAISAL

3.1 Remediation Options

The objective of this remediation specification is to identify any potential risk and reduce them to an acceptable level. This remedial specification is based on the site investigation undertaken across the site.

- No remedial action is required in the northern site area and topsoil is considered to be reusable.
- No specific remedial action is required in the southern site area, however topsoil is not considered reusable.
- No permanent ground gas precautions are required.
- Basic radon precautions are required within all buildings.
- Remediation of the historic mine shaft in the south east of the site is required, a concrete cap with ventilation is recommended.
- Remediation of shallow mine workings in the south of the site where less than 10m of solid rock cover exists above the workings is required, confirmatory boreholes in the footprints of proposed buildings in this area are recommended.
- Isolation of foundations and utilities from coal seams that are potential combustible.

Northern Site Area

No remedial action is required with respect to contaminated soils on the Northern Area, this approach is effective as no sources of contamination have been identified for the proposed end use.

Based on the statistical analysis carried out on the topsoil the marginally elevated concentrations are not considered to pose a risk to site end users and the topsoil is suitable for reuse. Topsoil in this area should be stripped and stockpiled separately from any other material for future reuse in garden and soft landscaped areas.

Southern Site Area

No remedial action is required with respect to contaminated soils on the Southern Area (excluding topsoil), this approach is effective as no sources of contamination have been identified for the proposed end use.

Elevated lead, arsenic and PAHs were detected within the topsoil across the Southern Area. After discussions with Kirklees Council CLO, the topsoil is not suitable for reuse. Remedial options for the topsoil are as follows:

1. Reuse on site in as part of landscaping with suitable thickness of cover above.
2. Transfer to another site under appropriate permits/exemptions.
3. Dispose to landfill.

Permanent Ground Gas

Permanent gas monitoring results indicate no permanent gas precautions are required.

Basic radon precautions are required to be incorporated within all buildings on the site.

Enabling Works

A backfilled mine shaft is present in the south east of the site with a diameter of approximately 1.50m. Treatment of the mine shaft is required and the most cost effective method is considered to be to cap at rockhead with ventilation.

Shallow mine workings were encountered in RO18 and RO20. Based on a seam thickness of 1.00m, remedial works are required for plots where less than 10m of solid cover exists above the mine workings as shown on

Groundtech Foundation Zone Plan 18058 05_1.1. Confirmatory drilling to determine the presence of workings should be undertaken and the options include:

1. Drill and grout beneath foot prints of buildings.
2. Revise development layout to position dwellings outside area at risk.

Combustible Soils

Shallow coal seams which are confirmed to be combustible may be encountered at within foundation and utility trenches across the site,

Furthermore potentially combustible colliery spoil is present in the north east of the site in the vicinity of the former Solway opencast mine. Remedial works are required where foundations or utilities (specifically heat generating utilities) come into contact with combustible or potentially combustible soils.

Current guidance states that isolation of foundations/ utilities from combustible soils is the most effective form of remediation.

4.0 IMPLEMENTATION OF SITE REMEDIATION PROCESSES

4.1 General

The following remedial works are required to break pollution linkages, to reduce risks to an acceptable level and make the site suitable for the proposed end-use.

4.2 Unsuitable Topsoil Southern Area – Source Removal

The most suitable remediation measure for the lead, arsenic and PAH contamination is considered to be removal of the affected soils, due to the widespread nature of the contamination across the southern site area all topsoil in this area should be stripped, stockpiled and removed from site. The affected area is shown on Groundtech Contamination Distribution Plan 18058 06.

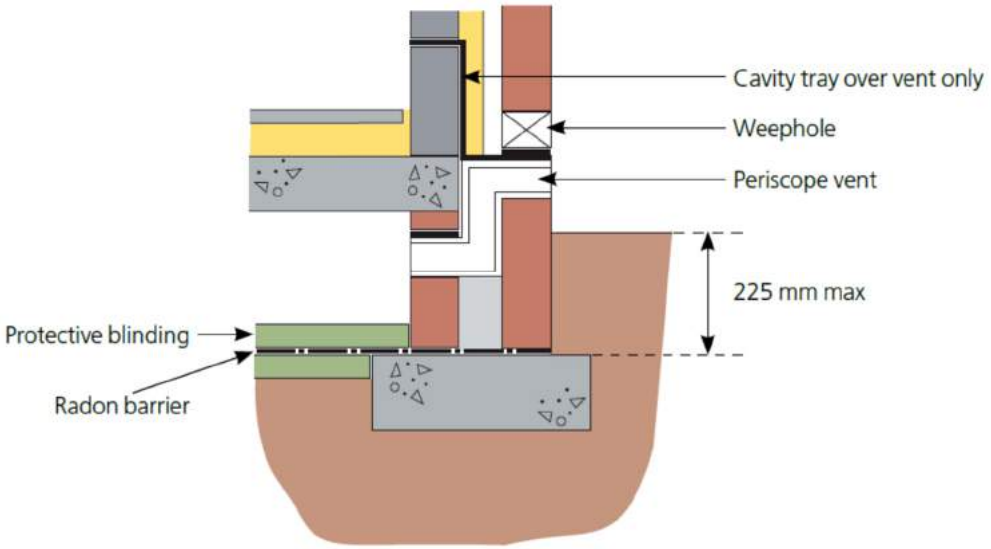
The stripping of the topsoil should be undertaken using suitable plant and the material should be stockpiled separately from the rest of the material on-site in a sealed area prior to being removed to a suitable off-site location.

Detailed records including photographic evidence should be kept to validate where topsoil has been removed. Records should also incorporate details of any topsoil being taken off site, including waste transfer notes appropriate for the receiving location.

4.3 Permanent Grounds Gas

No ground gas precautions are required.

Basic radon precautions are required in accordance with BRE 211 'Radon Guidance on Protective Measures for New Buildings'. Basic radon precautions include but are not limited to the provision of a 1200 gauge damp-proof barrier to the floor sealed to a DPC/cavity tray through the walls as demonstrated on the extract below.



Sealing of joints in the barrier and sealing around service penetrations are also required. It is important that attention is paid to detailing and workmanship in jointing of the barrier.

It is important to use a strong membrane material (possibly a reinforced material) and to ensure that it is well protected with sand or lean mix concrete before advancing construction. Protection is essential since there is a risk of damage by subsequent trades dropping concrete beams or blocks onto the barrier when installing the floor structure. The radon barrier should provide adequate radon protection provided that it is no more than 225 mm below ground level.

The barrier should be visually inspected for completeness prior to it being covered by later construction. Any imperfections found should be appropriately repaired.

4.4 Reuse of Topsoil Northern Area – Cover System

There is not considered to be a risk from the re use of topsoil from the northern site area. Based on the laboratory testing results there is no risk of contamination from the underlying natural soils, therefore no cover system is required. However an adequate thickness of topsoil should be provided in all gardens and soft landscaped areas to act as a growing medium. Topsoil suitable for reuse is indicated by the unshaded area on the Contamination Distribution Plan 18058 06.

4.5 Mine Shaft – Reinforced Concrete Cap

The mine shaft is indicated to be at least 134 years old with a diameter of approximately 1.50m. The construction of a reinforced concrete cap at the surface of bedrock is a suitable remedial technique, and should be designed by an experienced structural engineer and constructed in accordance with CIRIA SP32. Competent mudstone bedrock is at c.1.8m to construct the cap. The cap should be a minimum twice the diameter of the shaft. The cap will prevent potential for future settlement at the surface of the site.

It is recommended an easement of 3m is implemented based on a ϕ' value of 20°, the development layout should be revised accordingly. The mine shaft location is shown on the Coal Mining Features Plan 18058 04.

The mine shaft is a preferential pathway for any mine gas being generated. Therefore it is recommended the cap design includes suitable ventilation to allow mine gas to disperse into the atmosphere.

Confirmation of the design and permissions from the Coal Authority should be acquired prior to the treatment of the mine shaft.

Upon completion the cap should be surveyed in and validated to ensure it has been constructed in accordance to the design for future records. Records of the completed cap should be communicated to the Coal Authority.

4.6 Shallow Mine Workings – Confirmatory Drilling or Specialist Foundation Design

Mine workings are present beneath the area of the site to the south of the bridleway. Mine workings are already indicated to have collapsed and material above bulked – no further movement is anticipated. This area is shown on Plan 18058 05_1.1.

Where less than 10 times the thickness of the Top Haigh Coal Seam of cover exists as shown on Plan 18058 05_1.1, confirmatory rotary holes should be drilled within footprints of proposed dwellings. Based on the existing masterplan four proposed plots are indicated to be situated in the zone where less than 10m of rock cover exists above the Top Haigh Coal.

If mine workings are encountered during the confirmatory drilling of these plots a drill and grout specification is required. All drilling works should be carried out under the supervision of the Clients Representative in

accordance with the specification. Coal Authority permissions will be required prior to any drilling works taking place.

Alternatively the development layout can be revised based upon the findings of the confirmatory boreholes to locate dwellings outside the area of workings and less than 10m over rock cover. There is potential for the development layout to change and the above remedial recommendations should be revisited in this instance.

Foundations should be reinforced where more than 10m of rock cover exists above the former coal seam to mitigate against the risk of any minor movement at surface level of the site.

4.7 Combustible Soils – Isolation of foundations and Utilities

Combustible coal seams may be encountered at shallow depths within foundation and utility trenches across the site. In addition, potentially combustible colliery spoil is present in the vicinity of the former Solway opencast mine in the north east of the site from 0.10m (min) to 4.10m (max) bgl.

In accordance with ICRCL Guidance Note 61/84 'Notes on the Fire Hazards of Contaminated Land' where foundations are progressed through potentially combustible colliery spoil and coal seams, the combustible material should be isolated from the foundations with non combustible material to mitigate against structural damage to the proposed buildings. Furthermore, utilities (specifically utilities generating heat) should be completely isolated from these soils with non-combustible material, a utilities connections company should provide appropriate design and justification. The guidance states 1000mm of clay material should be placed to isolate the combustible/potentially combustible material, the guidance is over 35 years old and if can be proven to be appropriate, a more advanced method of isolation may be proposed.

The specification of the isolating material used around foundations and utilities should be discussed and confirmed with Building Control and the utility connections consultants, and approval obtained prior to construction.

Garden bonfires and barbeques will be a potential source of ignition at the surface for the longevity of the development, therefore remediation regarding combustibility will be necessary. A 1000mm of cohesive cover should be placed or an alternative method proposed as discussed above.

4.8 Watching Brief

A watching brief should be maintained during the soil strip, groundworks, and construction of any retaining structures/ cut and fill exercises across the central strip of the site for evidence of adits/day eyes. If any evidence of coal mining as described within this report are identified, work in that area should cease and the Clients Representative contacted for further guidance and recommendations. The area requiring a watching brief for potential adits is highlighted on the Coal Mining Features Plan 18058 04.

The watching brief during groundworks should also be maintained for any contamination previously unseen as part of this investigation. If any contamination is identified, work should cease and the Clients Representative should be consulted immediately.

In the event that remediation is unable to proceed in accordance with the approved Remediation Strategy or contamination not previously considered in either the Preliminary Risk Assessment or the Phase II Intrusive Site Investigation Report is identified or encountered on site, all works on site shall cease immediately and the local planning authority shall be notified in writing within 2 working days. Works shall not recommence until proposed revisions to the Remediation Strategy have been submitted to and approved in writing by the local planning

authority. Remediation of the site shall thereafter be carried out in accordance with the approved revised Remediation Strategy.'.

5.0 EARTHWORKS

5.1 General

The topography of the site is variable and in order to create level platforms for development, an earthworks programme in the form of a cut and fill exercise will need to be undertaken.

The most economical solution will be to balance the cut and fill from the site so that there is no net import and no excess material. A cut and fill balance plan would be beneficial to determine if there is a surplus or a deficit of material.

The design and construction of retaining walls will also be necessary in the central area of the site as indicated on Groundtech Foundation Zone Plan 18058 05_1.1. Detailed design of these structures should be carried out once site layout and finished site levels have been confirmed.

The area of the former Solway opencast mine in the north of the site is circa 1.50m higher in elevation than the agricultural field immediately to the south, therefore earthworks will be required in this area to grade the areas together.

5.2 Site Won Material and Suitability Testing

The material generated from the cutting exercise would predominantly comprise natural sandstone and mudstone bedrock, made ground is highly localised on site. Different material types should be stockpiled separately.

Any surplus topsoil should be exported from site to a suitable receiver.

Initially the materials generated should be classified using the Specification for Highways works. Earthworks testing should be scheduled on representative samples to classify the material, and determine the:

- Strength/Density.
- Actual Water Content.
- Optimum Moisture Content.

Actual moisture content values should be within the allowable range of 95% MDD and less than 5% air voids to be suitable for compaction.

In addition, the Moisture Condition Value provides a numerical value for the least amount of compactive effort to achieve near full compaction at a given moisture content. This enables a comparison with the actual moisture content during the earthworks process and can be used for determination of the moisture content in the field.

The earthworks specification should be an end-product or performance specification.

5.3 Validation Testing

Prior to placing down any of the fill the existing subgrade should be proof rolled using suitable methods outlined in the HASHW Series 600. Proof rolling will identify any soft spots present which should be dealt with using good site practice and procedures outlined in the specification.

At each layer testing should be carried out to confirm the properties of the filled soils including whether specified maximum dry density has been achieved. Testing should include sand replacement tests and plate load testing.

These tests should be carried out varying depths as the fill materials are placed to ensure they have been compacted sufficiently.

A comprehensive surveying programme should be in place during the earthworks so levels of tests and finished levels are accurate. The earthworks specification will also need to include for sufficient testing to ensure the bearing capacity and settlement criteria have been satisfied, consideration of the long term performance will be required.

All earthworks should be undertaken in accordance with the criteria set out in Appendix 1 to 4.

6.0 REMEDIATION CONTRACTORS DUTIES

6.1 General

The following regulations, guidance and legislation relating to the works shall be complied with:

- Health and Safety Executive "Protection of Workers and the General Public during the Redevelopment of Contaminated Land", HS(G)66, HMSO 1991.
- The Construction, Design and Management Regulations 2015.
- The Control of Substances Hazardous to Health Regulations.
- Environmental Protection Act 1990.
- Environment Act 1995.
- Duty of Care Regulations 1991.
- Hazardous Waste Regulations.
- Water Resources Act 1991.
- Water Industry Act 1991.
- DoW CL:AIRE Code of Practice.

6.2 Site Supervision

Adequate supervision for all the site works should be in place.

6.3 Records

The contract is intended to allow the maximum re-use of site won materials. To allow this and demonstrate compliance with Waste Management Licensing Regulations the Remediation Contractor shall maintain an accurate materials management plan. These shall show the source, description, classification and placement location of all fill used on the site. The plans shall be revised regularly with archive versions maintained for future reporting purposes.

The materials management plan shall also show the extent of any excavations undertaken on site.

The remediation contractor shall also keep detailed records, including weather, to demonstrate the works have been undertaken in favourable conditions.

Records of changes to the MMP should be kept and provided to the Clients Representative along with progress reports. The reuse and movement of soils should be done in accordance with the CL:AIRE "Development Industry Code of Practice for the Definition of Waste" (CL:AIRE CoP).

6.4 Health and Safety

The works will be subject to the Construction (Design and Management) Regulations. The Client will appoint a Principal Designer and a Principal Contractor.

All works shall be carried out in a manner that will safeguard all site employees. This shall include but not be limited to; site induction for all staff and visitors, training/safety awareness training, issue of Personal Protective Equipment (PPE) and the provision of suitable welfare facilities.

The works shall be carried out in a manner to protect against damage to property or nuisance to property or persons on the site or within its immediate vicinity.

Members of the public will be excluded from the works and the site will be suitably secure to ensure unauthorised persons cannot access the works.

Appropriate temporary protection and warning signs shall be erected to warn of hazards that may result as a consequence of the works.

6.5 Testing

The preferred Laboratories should hold UKAS and MCERTS accreditations (as appropriate). The Clients Representative will approve the laboratories subject to them holding the relevant certifications.

Physical properties of any imported or processed material to be used in the cut and fill exercise to achieve finished site levels requires testing to confirm the material is appropriate for its proposed use as set out in Section 5.0.

Contaminated material for disposal should be tested to define the most economical disposal route.

In addition, any material to be imported to the site shall be tested by the contractor and its suitability demonstrated prior to it being brought to the site. Chemical criteria for imported material is presented in Appendix 5.

7.0 CLIENTS REPRESENTATIVE AND DUTIES

The client's representative will oversee the works, and will be responsible for:

- Providing an appropriate level of supervision of the remedial works.
- Monitoring the works to ensure compliance with this specification and the Contractor's method statements.
- Audit testing of the suitability/acceptability of materials.
- Approval of test results.
- Validation and verification of the works.

Records of the works to include the following will be maintained:

- Site record sheets to include a summary of the activities undertaken.
- Date and weather conditions.
- Aspects relating to the Health and Safety, Environmental Control or non-compliance with the Specification or the Remediation Contractors Method Statement.
- Test Results.

Liaison will be carried out with relevant regulators prior to commencing on site. The design of the remedial specification can be adapted to avoid unnecessary delays at a later date.

8.0 VALIDATION AND VERIFICATION

8.1 Verification Report

The Remediation Contractors are responsible for maintaining all records in connection with the works.

On completion, the Remediation Contractor will collate all the records into a Factual Report and submit to the Clients Representative, and will form part of the verification report to be issued to regulators and where required to satisfy CL:AIRE CoP conditions. The report will include relevant site records and stand as certification that the remedial works have been carried out in accordance with the specification and an acceptable level of risk now exists.

The content of the report will include details of:

- Volume, source and chemical composition of all the material imported to the site.
- Volume, source and chemical composition of all the material exported from the site.
- The accurate dimensions of the remedial excavations including on a plan.
- Any treatment undertaken.
- Details of the Remediation Contractor's waste exemption licence if material is being brought onto site.
- Discharge of any groundwater.

APPENDIX 1 - Plans

NOTES

THE SITE

Rev	Details	Date

Status	
Preliminary	
Draft	
Issued	●
For Comment	
Approved	

GROUNDTECH CONSULTING

CLIENT

KIRKLEES COUNCIL

PROJECT TITLE

SOOTHILL LANE, BATLEY

DRAWING TITLE

PROJECT LOCATION PLAN

DRAWN	SF	CHECKED	JD
DATE	January 2019	SCALE	NTS

DRAWING NUMBER 18058 01

N

POSTULATED EXTENT OF THE WARREN HOUSE COAL SEAM EXTRACTED FROM THE SOLWAY OPENCAST PIT

APPROXIMATE FAULT LINE AS INDICATED BY POSTULATED COAL SEAM OUTCROPS CUTTING UP TOPOGRAPHY

SOLWAY OPENCAST DEEPENS TO THE NORTH

SOME EARTHWORKS REQUIRED IN THIS AREA TO ACHIEVE FINISHED SITE OR NO BUILD ZONE IS PRESENT LEVELS, HOWEVER NO HIGH WALL

SOLWAY OPENCAST LOW WALL

HORBURY ROCK

BECK BOTTOM STONE COAL

WATCHING BRIEF IN PLACE FOR POSSIBLE ADITS INTO EMBANKMENT

GAWBER COAL

SOOTHILL COLLIERY

TOP HAIGH COAL

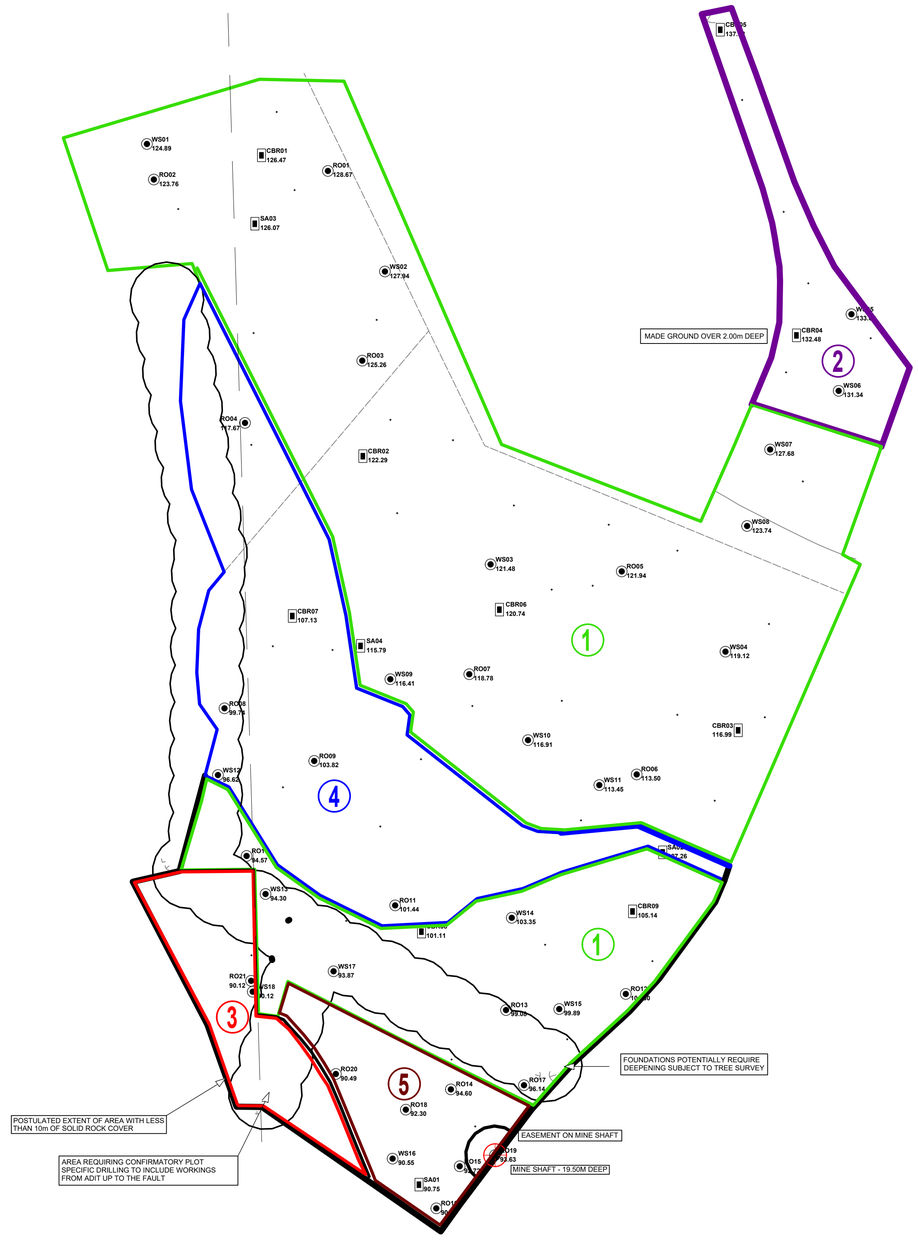
27 YARD COAL

MINE SHAFT - 19.50M DEEP

TP02 127.31
WS01 124.89
CBR01 126.47
RO01 128.67
RO02 123.76
TP01 127.55
TP03 123.20
SA03 126.07
WS02 127.94
TP05 126.48
TP04 123.72
RO03 125.26
TP06 123.83
TP21 116.48
TP07 124.55
CBR02 122.29
TP08 121.18
TP09 122.85
TP12 123.38
WS08 123.74
TP13 122.77
WS03 121.48
RO05 121.94
TP10 121.56
TP11 121.66
CBR06 120.74
TP14 120.32
TP32 105.41
TP31 110.19
SA04 115.79
WS04 119.12
WS09 116.41
RO07 118.78
RO08 99.74
TP27 117.71
TP26 118.36
TP24 116.94
TP22 117.63
CBR03 116.99
WS10 116.91
RO09 103.82
TP35 114.29
WS12 96.62
TP33 100.00
RO06 113.50
WS11 113.45
TP23 113.62
TP34 105.78
SA02 107.26
RO10 94.57
WS13 94.30
RO11 101.44
CBR09 105.14
TP40 97.32
WS14 103.35
CBR08 101.11
TP29 102.20
TP30 103.74
WS17 93.87
RO21 90.12
WS18 90.12
RO12 101.50
RO13 99.08
WS15 99.89
TP28 99.23
TP37 95.74
TP38 89.51
RO20 90.49
RO14 94.60
RO17 96.14
RO18 92.30
TP36 94.04
RO19 92.63
WS16 90.55
RO15 92.72
SA01 90.75
RO16 90.96
CBR05 137.92
TP20 136.86
TP19 134.75
TP18 133.53
WS05 133.05
CBR04 132.48
TP17 132.66
WS06 131.34
WS07 127.68
TP15 126.34

GROUNDTECH CONSULTING	CLIENT: KIRKLEES COUNCIL	DATE: JANUARY 2019			Status: Preliminary ; Draft ; Issued ● ; For Comment ; Approved
	PROJECT TITLE: SOOTHILL LANE, BATLEY	SCALE: 1:1000 @ A1			
	PLAN TITLE: COAL MINING FEATURES PLAN	PLAN NUMBER: 18058 04	Rev.	Details / Date	

Notes
- Opencast Mining Area
- Horbury Sandstone
- Possible Adits into Embankment
- Coal Seams
- Approximate Fault Line

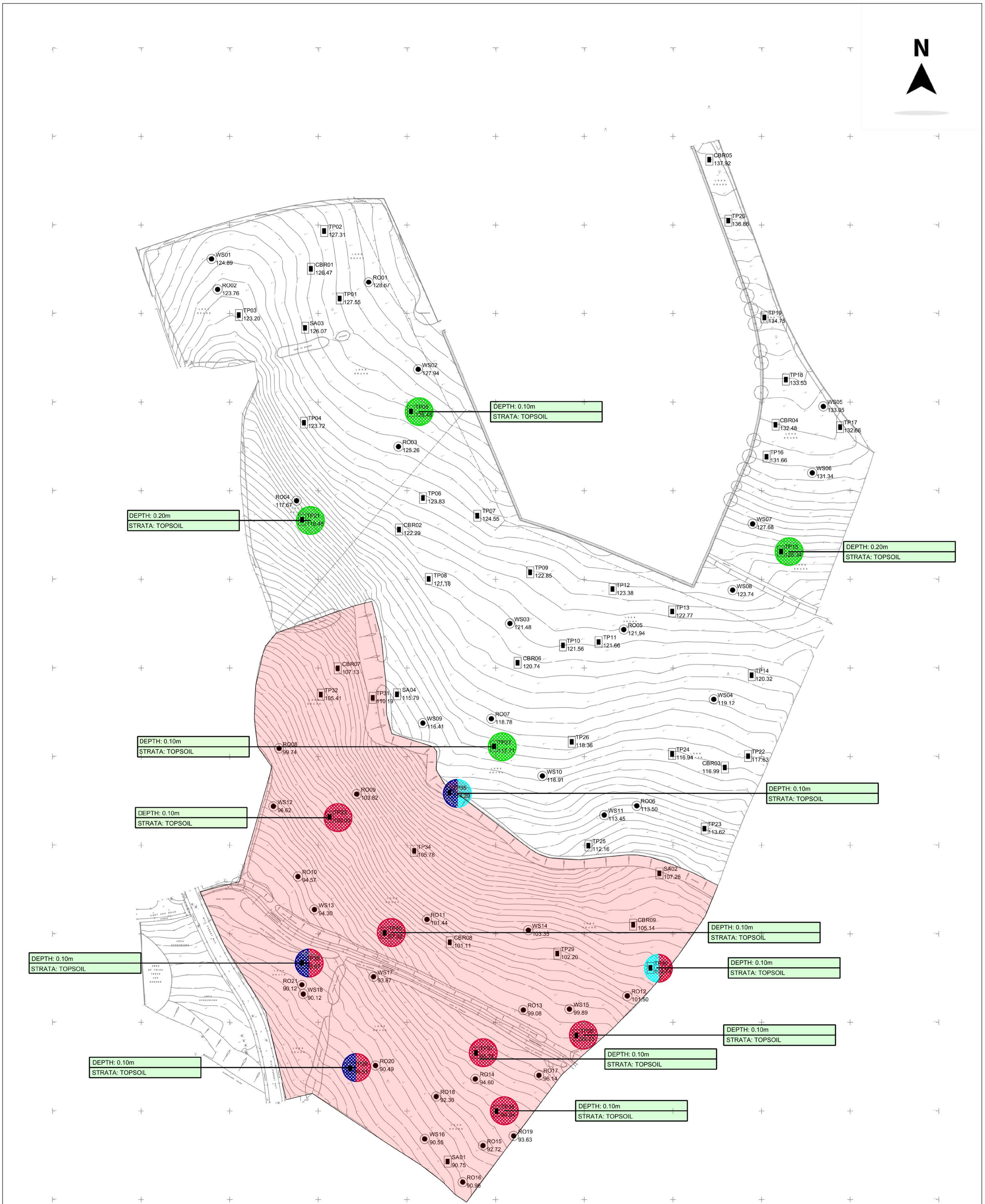


GROUNDTECH CONSULTING

CLIENT	DATE				Status	
KIRKLEES COUNCIL	JANUARY 2019				Preliminary	
PROJECT TITLE	SCALE				Draft	
SOOTHILL LANE, BATLEY	1:1500 @ A1	1.2	Revise extent of Area 5	August 2019	Issued	●
PLAN TITLE	PLAN NUMBER	1.1	Additional details added.	February 2019	For Comment	
FOUNDATION ZONE PLAN	18058 05	Rev.	Details	Date	Approved	

Notes

1. Area where traditional strip foundations are suitable
2. Area where trench foundations are required
3. Postulated area requiring drill and grout of mine workings prior to development
4. Area requiring earthworks and possible retaining structures or slope design. This area should be revisited once finished site levels are available.
5. Area where mine workings were encountered with more than 10m of solid rock cover over the former coal seam. Foundations will require reinforcing in this area.



GROUNDTECH CONSULTING	CLIENT: KIRKLEES COUNCIL	DATE: JANUARY 2019				Status	
	PROJECT TITLE: SOOTHILL LANE, BATLEY	SCALE: 1:1000 @ A1				Preliminary	
						Draft	
						Issued	●
	PLAN TITLE: CONTAMINATION DISTRIBUTION PLAN	PLAN NUMBER: 18058 06				For Comment	
			Rev.	Details	Date	Approved	

Notes

- Arsenic Contaminated Soils
- Lead Contaminated Soils
- Mercury Contaminated Soils
- PAH Contaminated Soils
- Area where topsoil is to be stripped, stockpiled seperately and removed off site

Proposed residential development at Soothill Lane Batley

Proposed site layout
scale 1:1000
schedule of accommodation
extra care scheme
60no. 1 and 2 bedroom apartments with common facilities
car parking: 50%
housing
309 total no. 2, 3,4 and 5 bedroom houses
car parking: generally 200%
total site accommodation 369no. units
70 bed extra care scheme
new access road 1
north
playing field
Lydgate Lodge Residential Care Home
Lydgate Junior & Infant school
Soothill Lane
Lydgate Road
green corridor
proposed attenuation pond
existing watercourse
road 2
road 3
road 12
road 15
road 13
road 14
new access road 11
Mill Forest Way
proposed attenuation pond and swale
Heath Grove
retained public amenity space
Fort Ann Road
Oaklands Drive
Manor Road
nicol thomas

Revision	Date	Details
A	November 18	amendments to scheme accommodation

nicol thomas

architects project managers construction cost consultants principal designers

Registered in England and Wales. Reg No. 2140639

Quality Assured to BS EN ISO 9001:1994 Certificate Number GB 4723

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Also at Birmingham (Registered office)

Client: Kirklees MBC				
Job: Soothill Lane/Mill Forest Way, Batley				
Drawing title: Feasibility Layout 1				
Drawing Number: (Job number)	M4492	sk	01	**Revision:** A
Scale: 1:1000 at A1				
Date: October 2018				
Drawn by/ checked by: GRF				

APPENDIX 2 – 1/5 Goods, Material, Sampling and Testing

APPENDIX 1/5
GOODS, MATERIALS, SAMPLING AND TESTING

Clause	Work, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
Series 600						
	Acceptable Material					
	Class	General Description				
	1	General Granular fill	Grading	3 per source and twice per week		
			Moisture Content	1 per 500 tonnes		
			Dry Density/mc relationship (2.5kg rammer)	3 per source and 1 per week		
	2	General Cohesive fill	Grading	3 per source and twice per week		
			MCV	1 per 500 tonnes		
			PI	3 per source		
			Dry Density/mc relationship (2.5kg rammer)	3 per source and 1 per week		
			Undrained shear strength of re-moulded materials	3 per source		
	4	Landscape fill	Grading	1 per source		
			Moisture Content	1 per source		
	5A	Topsoil	Not required			
	6F2	Selected granular material (coarse grading)	Grading	1 per 500 tonnes		At least 1 test per 2 days
			Optimum Moisture Content	1 per 500 tonnes		
			10% fines value	3 per source		
			Dry density/mc relationship (vibrating hammer)	3 per source		

Earthwork Compaction Monitoring

Test	Frequency	Compliance Criteria
CBR's under road platform	2 per 50m road length, undertaken at 1m below finished contract levels and at finished contract levels	CBR Value min 5%

APPENDIX 3 – 6/1 Requirements for Acceptability and Testing of Earthworks Materials

APPENDIX 6/1
REQUIREMENTS FOR ACCEPTABILITY AND TESTING ETC OF EARTHWORKS MATERIALS.

1. The following classes of material may be used for incorporation into the work:

Class 1	General Granular Fill
Class 2	General Cohesive Fill
Class 4	Landscape Fill
Class 6F2	Selected granular material (coarse grading)

2. The use and distribution of these materials will be determined by the Clients Representative prior to the commencement of the site works.

3. The classification of compaction and testing requirements for acceptable earthworks shall be in accordance with this Appendix and Table 6/1.

4. The classification and confirmation of acceptability of the earthworks materials shall be carried out by the Remediation Contractor at the point of excavation for on-site materials. Locations for classification purposes shall be agreed with the Clients Representative in advance.

5. If in the opinion of the Clients Representative the material has altered its classification or become unacceptable for whatever reason, the Remediation Contractor may be required to repeat the classification and acceptability tests given in Table 6/1 at the rate of testing given in Appendix 1/5

6. The Remediation Contractor shall submit copies of all test results to the Clients Representative within one working day of the completion of the test. The copies shall be signed by the Remediation Contractor's responsible engineer/technician. Notwithstanding the testing schedule given in Appendix 1/5 the Remediation Contractor shall be responsible for ensuring the acceptability of all materials used on site.

7. At this stage, it is not anticipated any material will require importing for the earthworks.

8. In this document the upper and lower MCV and moisture content limits set for Class 1 and Class 6 material should be considered indicative only. These will be formally assigned by the Clients Representative for the selected material upon receipt of appropriate testing details supplied by the Remediation Contractor. Where this is site won material a "source" will constitute material with similar composition when assessed visually and described in accordance with BS5930: 1999.

Acceptability Criteria

9. Fill materials for use in the permanent works shall comply with the acceptability criteria set out in below (supplementing Table 6/1). Permitted constituents shall be as set out in Table 6/1 and Clause 601. Fill materials shall exclude materials classifying as Class U1B and Class U2 as defined in Clause 601.

Determination of Earthworks Acceptability

10. The Remediation Contractor shall be responsible for classifying earthworks materials and for ensuring that all materials incorporated in the permanent works are acceptable. Contract-specific Classification and Acceptability Criteria are as given in Table 6/1. It is currently anticipated that all non-contaminated material arising from the site will conform to one or other of the classes once sorting crushing and screening has taken place. However should materials excavated not conform to the classification and acceptability Criteria given in the tables it should be classified as Class U1A material. Class U1A material shall be dealt with in accordance with Appendix 6/1 below. Any contaminated material: Class U1B and U2 shall be dealt with in accordance with Appendix 6/2. The Remediation Contractor shall carry out testing at the frequencies set out in Appendix 1/5, and supply the results to the Client's representative.

Processing of Unacceptable Material (Class U1A)

11. Unacceptable material Class U1A arising from excavations on site shall as far as practicable be processed to render it acceptable for use as General Fill of Classes 1A, 1B, 2A, 2B, 2C, 4 or 6F2 as appropriate to the grading of the material being treated.

12. Processing shall include one or more of the following treatments as appropriate to the material being treated and the prevailing site conditions:

- Improvement of moisture content and/or plasticity by the addition of quicklime or hydrated lime;
- Drying by stockpiling or spreading;
- Removal of oversized material by screening;
- Removal of deleterious constituents (i.e. those constituents listed in Clause 601. 2(i)(b);
- Addition of water.

Table 6/1
Acceptable Earthworks Materials: Classification

Class	General Material Description	Material Properties Required for Acceptability			
		Property	Defined & Tested in accordance with:	Acceptable Limits	
				Lower	Upper
1A	Well graded granular material	Grading	BS1377:part 2	Table 6/2	Table 6/2
		Uniformity coefficient	Table 6/1 Note 5	10	-
		Moisture content	BS1377:part 2	Optimum mc -2%	Optimum mc+2%
		Optimum mc	BS1377: Pt 4 Vibrating hammer method	-	-
1B	Uniformly graded granular material	Grading	BS1377:part 2	Table 6/2	Table 6/2
		Uniformity coefficient	Table 6/1 Note 5	-	10
		Moisture content	BS1377:part 2	Optimum mc -2%	Optimum mc+2%
		Optimum mc	BS1377: Pt 4 Vibrating hammer method	-	-
2A	Wet cohesive material	Grading	BS1377:part 2	Table 6/2	Table 6/2
		MCV	Clause 632	8	11
		Undrained shear strength of remoulded material	Clause 633	50kN/m^2	-
2B	Dry cohesive material	Grading	BS1377:part 2	Table 6/2	Table 6/2
		MCV	Clause 632	11	13
		Undrained shear strength of remoulded material	Clause 633	50kN/m^2	-
2C	Stony cohesive material	Grading	BS1377:part 2	Table 6/2	Table 6/2
		MCV	Clause 632	8	13
		Undrained shear strength of remoulded material	Clause 633	50kN/m^2	-
4	Fill to landscape areas	To be stockpiled			
6F2	Selected granular material (coarse grading)	Grading	BS1377; part 2 (on site)	Table 6/2	Table 6/2
		CBR value		5%	-
		optimum mc	Clause 613		
		Moisture Content	BS1377:part 2	Optimum mc -2%	Optimum mc+2%

APPENDIX 4 - 6/2 Requirements for Dealing with Class U1B and U2 Unacceptable Material

APPENDIX 6/2
REQUIREMENTS FOR DEALING WITH CLASS U1B AND U2 UNACCEPTABLE MATERIAL

1. This Appendix addresses the management issues associated with the assessment, classification, excavation, stockpiling and off site disposal of potentially contaminated soils encountered on site.

2. The classification of the contamination status of the soils shall be conducted in conjunction with the general classification as detailed in Table 6/1.

General Instructions Regarding Material Classification

3. The Remediation Contractor shall be responsible for keeping records of the location, volumes, extent, nature and test results for all Class U1B and U2 materials encountered. The Remediation Contractor shall keep the Clients Representative informed of the Class U1B and U2 materials encountered on a daily basis. The Remediation Contractor shall not classify material as Class U2 except with the agreement of the Clients Representative.

4. It is not anticipated material will require importing for the earthworks.

5. Testing of the clean excavation face to determine the extent of Class U1A material and/or U2 material will take place at a frequency of 1 test per 20m^2 on the side of the excavation with a minimum of 3 tests and 1 test per 50m^2 on the base with a minimum of 1 test.

Processing of Class U1B

6. Processing of Class U1B shall include one or more of the following treatments as appropriate to the material being treated and the prevailing site conditions:

   - careful excavation and sorting of arisings to avoid mixing of contaminated material with clean material;
   - bioremediation of selected excavated and screened materials;

7. Once processing is complete the processed material shall be classified in accordance with Appendix 6/1 for incorporation into the works.

Treatment of Class U2

8. Class U2 Material will be disposed off site.

APPENDIX 5 - Table 6/4 Series 600 Method Compaction for Earthworks Materials

TABLE 6/4: Method Compaction for Earthworks Materials: Plant and Methods (Method 1 to Method 6)
(This Table is to be read in conjunction with sub-Clause 612.10)

Type of Compaction Plant	Ref No.	Category	Method 1		Method 2		Method 3		Method 4		Method 5		Method 6		
			D	N#	D	N#	D	N#	D	N	D	N	N for D = 110 mm	N for D = 150 mm	N for D = 250 mm
Smoothed wheeled roller (or vibratory roller operating without vibration)		Mass per metre width of roll:													
	1	over 2100 kg up to 2700 kg	125	8	125	10	125	10*	175	4	unsuitable		unsuitable	unsuitable	unsuitable
	2	over 2700 kg up to 5400 kg	125	6	125	8	125	8*	200	4	unsuitable		16	unsuitable	unsuitable
	3	over 5400 kg	150	4	150	8	unsuitable		300	4	unsuitable		8	16	unsuitable
Grid roller		Mass per metre width of roll:													
	1	over 2700 kg up to 5400 kg	150	10	unsuitable		150	10	250	4	unsuitable		unsuitable	unsuitable	unsuitable
	2	over 5400 kg up to 8000 kg	150	8	125	12	unsuitable		325	4	unsuitable		20	unsuitable	unsuitable
	3	over 8000 kg	150	4	150	12	unsuitable		400	4	unsuitable		12	20	unsuitable
Deadweight tamping roller		Mass per metre width of roll:													
	1	over 4000 kg up to 6000 kg	225	4	150	12	250	4	350	4	unsuitable		12	20	unsuitable
	2	over 6000 kg	300	5	200	12	300	3	400	4	unsuitable		8	12	20
Pneumatic-tyred roller		Mass per wheel:													
	1	over 1000 kg up to 1500 kg	125	6	unsuitable		150	10*	240	4	unsuitable		unsuitable	unsuitable	unsuitable
	2	over 1500 kg up to 2000 kg	150	5	unsuitable		unsuitable		300	4	unsuitable		unsuitable	unsuitable	unsuitable
	3	over 2000 kg up to 2500 kg	175	4	125	12	unsuitable		350	4	unsuitable		unsuitable	unsuitable	unsuitable
	4	over 2500 kg up to 4000 kg	225	4	125	10	unsuitable		400	4	unsuitable		unsuitable	unsuitable	unsuitable
	5	over 4000 kg up to 6000 kg	300	4	125	10	unsuitable		unsuitable		unsuitable		12	unsuitable	unsuitable
	6	over 6000 kg up to 8000 kg	350	4	150	8	unsuitable		unsuitable		unsuitable		12	unsuitable	unsuitable
	7	over 8000 kg up to 12000 kg	400	4	150	8	unsuitable		unsuitable		unsuitable		10	16	unsuitable
	8	over 12000 kg	450	4	175	6	unsuitable		unsuitable		unsuitable		8	12	unsuitable
Vibratory tamping roller		Mass per metre width of a vibrating roll:													
	1	over 700 kg up to 1300 kg	100	12	100	12	150	12	100	10	unsuitable		unsuitable	unsuitable	unsuitable
	2	over 1300 kg up to 1800 kg	125	12	125	12	175	12*	175	8	unsuitable		12	unsuitable	unsuitable
	3	over 1800 kg up to 2300 kg	150	12	150	12	200	12*	unsuitable		unsuitable		8	12	unsuitable
	4	over 2300 kg up to 2900 kg	150	9	150	9	250	12*	unsuitable		400	5	6	10	unsuitable
	5	over 2900 kg up to 3600 kg	200	9	200	9	275	12*	unsuitable		500	6	6	10	unsuitable
	6	over 3600 kg up to 4300 kg	225	9	225	9	300	12*	unsuitable		600	6	4	8	unsuitable
	7	over 4300 kg up to 5000 kg	250	9	250	9	300	9*	unsuitable		700	6	3	7	12
	8	over 5000 kg	275	9	275	9	300	7*	unsuitable		800	6	3	6	10

TABLE 6/4: Method Compaction for Earthworks Materials: plant and Methods (Method 1 to Method 6)
(This Table is to be read in conjunction with sub-Clause 612.10)

Type of Compaction Plant	Ref No.	Category	Method 1		Method 2		Method 3		Method 4		Method 5		Method 6		
			D	N#	D	N#	D	N#	D	N	D	N	N for D = 110 mm	N for D = 150 mm	N for D = 250 mm
Vibratory roller		Mass per metre width of a vibratory roll:													
	1	over 270 kg up to 450 kg	unsuitable		75	16	150	16	unsuitable		unsuitable		unsuitable	unsuitable	unsuitable
	2	over 450 kg up to 700 kg	unsuitable		75	12	150	12	unsuitable		unsuitable		unsuitable	unsuitable	unsuitable
	3	over 700 kg up to 1300 kg	100	12	125	10	150	6	125	10	unsuitable		16	unsuitable	unsuitable
	4	over 1300 kg up to 1800 kg	125	8	150	8	200	10*	175	4	unsuitable		6	16	unsuitable
	5	over 1800 kg up to 2300 kg	150	4	150	4	225	12*	unsuitable		unsuitable		4	6	12
	6	over 2300 kg up to 2900 kg	175	4	175	4	250	10*	unsuitable		400	5	3	5	11
	7	over 2900 kg up to 3600 kg	200	4	200	4	275	8*	unsuitable		500	5	3	5	10
	8	over 3600 kg up to 4300 kg	225	4	225	4	300	8*	unsuitable		600	5	2	4	8
	9	over 4300 kg up to 5000 kg	250	4	250	4	300	6*	unsuitable		700	5	2	4	7
	10	over 5000 kg	275	4	275	4	300	4*	unsuitable		800	5	2	3	6
Vibrating plate compactor		Mass per m^2 of base plate:													
	1	over 880 kg up to 1100 kg	unsuitable		unsuitable		75	6	unsuitable		unsuitable		unsuitable	unsuitable	unsuitable
	2	over 1100 kg up to 1200 kg	unsuitable		75	10	100	6	75	10	unsuitable		unsuitable	unsuitable	unsuitable
	3	over 1200 kg up to 1400 kg	unsuitable		75	6	150	6	150	8	unsuitable		unsuitable	unsuitable	unsuitable
	4	over 1400 kg up to 1800 kg	100	6	125	6	150	4	unsuitable		unsuitable		8	unsuitable	unsuitable
	5	over 1800 kg up to 2100 kg	150	6	150	5	200	4	unsuitable		unsuitable		5	8	unsuitable
	6	over 2100 kg	200	6	200	5	250	4	unsuitable		unsuitable		3	6	12
Vibro-tamper		Mass:													
	1	over 50 kg up to 65 kg	100	3	100	3	150	3	125	3	unsuitable		4	8	unsuitable
	2	over 65 kg up to 75 kg	125	3	125	3	200	3	150	3	unsuitable		3	6	12
	3	over 75 kg up to 100 kg	150	3	150	3	225	3	175	3	unsuitable		2	4	10
	4	over 100 kg	225	3	200	3	225	3	250	3	unsuitable		2	4	10
Power rammer		Mass:													
	1	100 kg up to 500 kg	150	4	150	6	unsuitable		200	4	unsuitable		5	8	unsuitable
	2	over 500 kg	275	8	275	12	unsuitable		400	4	unsuitable		5	8	14
Dropping-weight compactor		Mass of rammer over 500 kg weight drop:													
	1	over 1 m up to 2 m	600	4	600	8	450	8	unsuitable		unsuitable		unsuitable	unsuitable	unsuitable
	2	over 2 m	600	2	600	8	unsuitable		unsuitable		unsuitable		unsuitable	unsuitable	unsuitable

APPENDIX 6 - Imported Material Testing Criteria

Generic Tier I Generic Assessment Criteria (GAC)

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Proposed End Use	Unit	Residential with Plant Uptake		
SOM	%	1	2.5	6
Arsenic	mg/kg	32	32	32
Beryllium	mg/kg	1.7	1.7	1.7
Boron (water soluble)	mg/kg	290	290	290
Cadmium	mg/kg	10	10	10
Chromium (Total)	mg/kg	910	910	910
Chromium (VI)	mg/kg	21	21	21
Copper	mg/kg	2400	2400	2400
Lead	mg/kg	200	200	200
Organic Mercury	mg/kg	1.2	1.2	1.2
Nickel	mg/kg	130	130	130
Selenium	mg/kg	350	350	350
Vanadium	mg/kg	410	410	410
Zinc	mg/kg	3700	3700	3700
Aliphatic EC 5 - 6	mg/kg	42	78	160
Aliphatic EC 6 - 8	mg/kg	100	230	530
Aliphatic EC 8 - 10	mg/kg	27	65	150
Aliphatic EC 10 - 12	mg/kg	130 (48) [vap]	330 (118) [vap]	760 (283) [vap]
Aliphatic EC 12 - 16	mg/kg	1100 (24) [sol]	2400 (59) [sol]	4300 (142) [sol]
Aliphatic EC 16 - 35	mg/kg	65000 (8.48) [f,sol]	92000 (21) [f,sol]	110000 [f]
Aliphatic EC 35 - 44	mg/kg	65000 (8.48) [f,sol]	92000 (21) [f,sol]	110000 [f]
Aromatic EC 5 - 7	mg/kg	70	140	300
Aromatic EC 7 - 8	mg/kg	130	290	660
Aromatic EC 8 - 10	mg/kg	34	83	190
Aromatic EC 10 - 12	mg/kg	74	180	380
Aromatic EC 12 -16	mg/kg	140	330	660
Aromatic EC 16 - 21	mg/kg	260 [f]	540 [f]	930 [f]
Aromatic EC 21 - 35	mg/kg	1100 [f]	1500 [f]	1700 [f]
Aromatic EC 35 - 44	mg/kg	1100 [f]	1500 [f]	1700 [f]
Benzene	mg/kg	0.33	0.33	0.33
Toluene	mg/kg	610	610	610
Ethyl Benzene	mg/kg	350	350	350
Xylene - o	mg/kg	250	250	250
Xylene - m	mg/kg	240	240	240
Xylene - p	mg/kg	230	230	230
MTBE (methyl tert-butyl	mg/kg	49	84	160
Acenaphthene	mg/kg	210	510	1100
Acenaphthylene	mg/kg	170	420	920
Anthracene	mg/kg	2400	5400	11000
Benz(a)anthracene	mg/kg	7.2	11	13
Benzo(a)pyrene	mg/kg	2.2	2.7	5*
Benzo(b)fluoranthene	mg/kg	2.6	3.3	3.7
Benzo(ghi)perylene	mg/kg	320	340	350
Benzo(k)fluoranthene	mg/kg	77	93	100
Chrysene	mg/kg	15	22	27
Dibenz(ah)anthracene	mg/kg	0.24	0.28	0.3
Fluoranthene	mg/kg	280	560	890
Fluorene	mg/kg	170	400	860
Indeno(123-cd)pyrene	mg/kg	27	36	41
Naphthalene	mg/kg	2.3 f	5.6 f	13 f
Phenanthrene	mg/kg	95	220	440
Pyrene	mg/kg	620	1200	2000

APPENDIX 7 - Limitations

Limitations

This contract was completed by Groundtech Consulting on the basis of a defined programme and scope of works and terms and conditions agreed with the client. This report was compiled with due skill and care, taking into consideration the project brief provided, project objectives, agreed scope of works, prevailing site conditions and budget allocation.

Other than that defined in the paragraph above, Groundtech Consulting provides no other accountability or warranty whether express or implied, is made in relation to the services. Unless otherwise agreed this report has been prepared exclusively for the use and reliance of the client in accordance with generally accepted industry practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon, or transferred to, by any other party without the written agreement of a Director of Groundtech Consulting. A third party who relies on this report, does so at their own and sole risk and no liability to such parties is provided by Groundtech Consulting.

It is the understanding of Groundtech Consulting that this report is to be used for the intended purpose as set out in the introduction. The purpose was instrumental in determining the scope and level of the services provided. Should the purpose of the report or the proposed end use of the site change, this report will no longer be directly applicable, and its validity readdressed. No reliance upon the report in the revised situation should be assumed by the client without the permission of Groundtech Consulting.

The report was written in 2018, later changes in legislation, statutory requirements and industry best practices have not been considered and this should be allowed for. Ground conditions can also change and should be investigated if there is any significant delay in acting on the findings of this report. The period of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions in this report should not be relied upon in the future without the written confirmation from Groundtech Consulting that it is safe to do so.

The observations and conclusions outlined in this report are based exclusively on the services that were provided as set out in the agreement between the client and Groundtech Consulting.

Groundtech Consulting are not liable for the existence of any condition, the discovery of which would require additional investigation outside the agreed scope of works or core competency. The services provided are based upon Groundtech Consulting observations of existing physical conditions at the site gained from site reconnaissance together with interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The findings and recommendations contained in this report are based in part upon information provided by third parties, and Groundtech Consulting assume the information to be correct.

No responsibility can be accepted for errors for third party information presented in this report. Groundtech Consulting were not authorised to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the services. Groundtech Consulting are not liable for any inaccurate information, misrepresentation of data or conclusions, which may inform the scope of investigation undertaken by Groundtech Consulting and forms the contract with the client.

Where field investigations have been carried out these have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions can also be variable due to its heterogeneous properties and as investigation exploratory locations only allow examination of the ground at discrete locations. The potential exists for ground conditions to be encountered which are different to those

considered in this report, particularly between exploratory holes. The extent of the limited area depends on the soil and groundwater conditions, together with other constraints such as the position of any existing structures and underground utilities. Geo-Environmental testing was carried out for a limited number of parameters [as stipulated in the contract] based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

The groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The groundwater level often has not had time to reach equilibrium and a monitoring period is required. Furthermore, groundwater levels are subject to seasonal variation or changes in local drainage conditions and higher groundwater levels may occur at other times of the year than were recorded during this investigation.

Any site drawings provided in this report are not meant to be an accurate base plan, but are preliminary and used to present the general relative locations of features on, and surrounding, the site.

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