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Site:	Land off Saint Mary's Street, Penistone
Client's Agent:	Reliant Building Contractors Ltd
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LAND OF SAINT MARY'S STREET, PENISTONE

REMEDIATION METHOD STATEMENT FOR RELIANT BUILDING CONTRACTORS

Project Ref:
P6793

Date:
February 2016

Prepared for:
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This report has been prepared in accordance with GRM's Accredited Quality Procedures.



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1 INTRODUCTION

1.1 PREAMBLE

GRM Development Solutions Ltd (GRM) was instructed by Reliant Building Contractors Ltd (Client) to produce a Remediation Method Statement for the development of the site with 15 new residential properties, one renovated residential property and six commercial units and associated infrastructure, including soft landscaping.

GRMs standard limitations of reporting are provided in Appendix A of this report.

The following reports have been used in the preparation of this document:

- GRM Phase II Site Appraisal Ref GRM/P6793/F.1 dated January 2015.
- GRM Gas Addendum Letter Ref: P7329/GAL dated 20th January 2016.

A Proposed Development Layout Plan presented in Appendix B.

1.2 OBJECTIVES OF THIS ASSESSMENT

The principal aims of the Remediation Method Statement are as follows:

- a) Assess the existing information relating to the soil and groundwater conditions within the area of the site.
- b) Determine a cost and time effective remedial strategy.
- c) Set out the remediation and validation processes to be followed on site to ensure the site development does not pose a risk to human health and controlled waters.

The risk assessment and recommendations contained within this document will need to be agreed with the Local Authority and other regulators / warranty providers.

2 SUMMARY DESK STUDY

The following is a summary of the site setting revealed by a desk based review and ground investigation works.

- The site is located in Penistone approximately 5km north west of Stocksbridge town centre. The National Grid Reference (NGR) for the approximate centre of the site is SE 244 034. Site Location and Site Boundary Plans are provided in Appendix C.
- The site covers an area of approximately 0.4ha and comprises an irregular shaped plot. The boundaries are formed by Station Road the east, residential properties and gardens to the south and west and a dismantled railway used as a footpath to the north. The site is generally flat with an area of raised ground along the northern site boundary, and a steep slope dropping down 2 to 3 metres from the southern site boundary.
- The site is currently used as open space with two existing buildings in the east of the site, and a concrete floor slab from a previous temporary structure in the central area of the site. The northern section of the site comprises a cycle path running east to west. At the eastern end of the site are a number of former coal drops with rail lines running over a number of stone arches. These were in poor condition with a number of the wooden beams supporting the rail lines having fallen down and some cracking noted in the stone work forming the arches.
- Historically the site has comprised a railway line and sidings since the map for 1891, with lines generally trending east to west across the site with sidings terminating on either St Mary's Street or at buildings to the south of the site. A gas works with two gasometers, ancillary buildings and mill race is present 40m to the north west. The map for 1903 shows the appearance of additional railway lines and sidings which now cover the majority of the site with a crane noted close to the southern boundary. Tanks are shown north of the railway lines 75m to the east. The map for 1929 shows no significant changes to the site, although the surrounding area has become more built up and the gas works now contains a third gasometer. The map for 1959 shows the site in more detail with slight alterations across the southern area, and the crane is no longer present. The gasworks to the north east is no longer shown. The map for 1987 shows the railways and sidings across the site have been dismantled and noted as disused, the map for 1993 shows all of the lines as dismantled with a row of residential properties along the northern boundary. The map for 2002 notes the appearance of another works building in the southern area of the site, and the refuse tips are no longer shown. The map for 2008 shows a cycle path along the northern section of the site.
- The geological mapping for the site shows no superficial deposits, with the underlying solid geology comprising Pennine Lower Coal Measures of mudstone and siltstone.
- The solid geology beneath the site is reported as a Secondary B Aquifer, and the site is not located within a Source Protection Zone. The BGS indicates that the site is at a low risk from groundwater flooding.
- The River Don is located 250m north of the site and flows to the east. Due to the distance the river is not considered a viable receptor

- The Environmental data report indicates that there have been five recorded pollution incidents within 250 metres of the site boundary, and these are all List 2 incidents. A pollution incident occurred in February 2002 and September 2003 some 66m and 234m to the south east and north respectively. The pollutants comprised commercial waste and crude sewage which had a minor land and minor water impact respectively. Three pollution incidents were noted on the same day in May 2003 all 110m to the north west with the pollutant comprising fumes and smoke which had a minor air impact. None of these incidents are considered to be significant.
- There is one recorded historic landfill area which is shown to encroach the south western corner of the site, the waste type is noted as inert industrial and the license was surrendered in 1985. There are also two Local Authority Landfill sites located 19 and 69 metres to the south.
- There are three potentially contaminative industrial land uses within 50m of the site, these comprise a works 4m south of the site, a Distribution and haulage site and a garage both 18m to the south. None of these are considered to be significant.
- The GroundSure Report states that radon protective measures are not required.

3 SUMMARY GROUND INVESTIGATION AND RISK ASSESSMENT

3.1 PHASE II REPORT

The following is a summary of the ground investigations undertaken by GRM to date.

- GRM has undertaken a ground investigation at the site, on 17th November 2014, as described in our Phase II Site Appraisal Report. The investigation comprised a combined total of 7 window sample holes and 3 hand-dug pits.
- The investigation confirmed made ground up to 0.7m in association with former railway sidings running east/west through the site. The made ground generally comprised sand of ash with varying amounts of brick, concrete and clinker. No visual or olfactory evidence of hydrocarbon contamination was observed in any of the exploratory holes undertaken by GRM.
- The investigation confirmed made ground up to 3.3m in association with the material used to form the railway embankment, with this material thought to be sourced from railway related excavations elsewhere comprised sand with varying amounts of sandstone. No visual or olfactory evidence of hydrocarbon contamination was observed in any of the exploratory holes undertaken by GRM.
- No superficial deposits were encountered during the investigation.
- A solid geology of Weathered Pennine Lower Coal Measures / Pennine Lower Coal Measures deposits were encountered to a maximum depth of 4.0m begl, and generally comprised gravelly silty gravelly clay / siltstone / mudstone.
- Six gas and groundwater monitoring standpipes (WS01, WS02, WS03, WS04, WS06 and WS07) were installed by GRM during the window sampling investigation on the 17th November 2014.
- Groundwater was not observed in any of the exploratory holes during the ground investigations; however, during subsequent monitoring visits, standing water was recorded at depths of 0.5m begl to in excess of 3.0m begl.

Risk Assessment (Human Health – Ground Gas)

- The gas monitoring undertaken at the site recorded no methane and concentrations of carbon dioxide of up to 5.7%v/v. Flow recorded during the monitoring programme was at a maximum of 0.1l/h. A GSV of 0.0057l/hr has been calculated and the site should be considered as potentially falling within Characteristic Situation 2 however as the maximum concentration of carbon dioxide is only slightly over 5%v/v the site has been classified as Characteristic Situation 1 as outlined in table 8.5 of CIRIA C665. **Accordingly, no gas protection measures will be required for the proposed development.**

Risk Assessment (Human Health)

- Chemical analysis comprised:
 - Six samples for a general suite of contaminants (metals, inorganics and speciated PAH).
 - Two samples for PCBs (WHO12).

- Three samples for banded aliphatic and aromatic hydrocarbons (TPHCWG).
 - Three samples for total petroleum hydrocarbons (TPH).
 - Three leachate samples for a general suite of contaminants.
 - Six samples have been screened for the presence of asbestos.
- Statistical analysis of the made ground indicated that samples exceeded the current GRM TAC threshold for lead, and the 95% UCL was calculated at 205.8mg/kg, which exceeds the current TAC of 200mg/kg. Benzo(a)pyrene was found to exceed the current TAC of 5mg/kg with a calculated 95% UCL of 15.9mg/kg, however this is considered to be due to a hotspot around WS04 of 17.6mg/kg. Napthalene was also found to exceed the current TAC of 3.5mg/kg with a calculated 95% UCL of 6.6mg/kg. A copy of the current GRM TACs can be found in Appendix D. The remainder of the chemical testing yielded no values in excess of current TACs. Therefore **remedial measures will be required** to mitigate the risks posed to human health by elevated concentrations of lead, napthalene and benzo(a)pyrene.
 - No evidence of asbestos was observed during the fieldworks. **None of the samples reported the presence of asbestos. Accordingly, the risk posed to end users from asbestos is assessed as negligible and no remediation is considered to be required.**

Risk Assessment (Controlled Waters)

- Chemical testing of soil leachate and groundwater was undertaken on samples obtained by GRM, in summary, recorded concentrations of all contaminants were below the relevant thresholds. In addition, the site is underlain by impervious cohesive deposits, which are considered to inhibit the pathway to the identified receptor.
- **Accordingly, the risk to controlled waters is assessed as negligible and no remediation is considered to be required.**

Risk Assessment (Water Pipes)

- The recorded concentrations of organic contaminants **do** (C21-C40) exceed the acceptable levels listed in the UKWIR documentation. The contaminant concentrations recorded are such that standard metal copper or copper sheathed pipes placed in clean backfill will be suitable for the development.
- The local utility should be contacted to determine its exact requirements in respect of the levels of contamination encountered.

From the investigation works completed, the following Phase II Conceptual Model has been produced:

Phase II Conceptual Model (pre-remediation)

HUMAN HEALTH			
Source	Pathway	Receptor	Solution
Elevated levels of lead and locally PAH and hydrocarbons.	Indoor and outdoor inhalation of ground gas and soil vapours, the ingestion of contaminated soil and soil dust, ingestion of vegetables which have taken up contamination, and dermal contact with contaminated soil and soil dust.	End users and construction workers.	Soil capping or removal of contaminated soils.
Elevated levels of carbon dioxide.	Inhalation.	End users.	Gas protection measures.
Potential asbestos containing materials associated with buildings.	Inhalation.	Construction workers.	Survey and removal by specialist contractor.
CONTROLLED WATERS			
Localised elevated levels of hydrocarbons.	Leaching of contaminants and vertical migration to the groundwater.	Secondary B Aquifer.	None required.
CONSTRUCTION MATERIALS			
Elevated levels of hydrocarbons.	Migration of contamination through leaks and joints, degradation of pipe materials.	Water pipes.	Upgraded water pipes laid in clean backfill material
Elevated levels of sulphate and/or acidic ground conditions.	Direct contact.	Buried concrete.	Appropriate concrete specification.

4 REMEDIAL STRATEGY

The works outlined below are those considered necessary to commence the development of the site in accordance with the requirements of the Local Authority. The Local Authority should approve the recommendations given, and the risk assessment on which they have been based.

4.1 REMEDIATION

4.1.1 Remedial Strategy for Human Health (Soil Contamination)

Based on the recorded levels of contamination across the site, remediation will be required to protect end users of the proposed residential development. Recommended remedial measures include soil capping in areas of soft landscaping and hotspot removal.

It is considered that the use of a soil capping system in soft landscaped areas to break the source-pathway-receptor linkage would represent a suitable form of remediation. No capping would be required below areas of hard standing, such as roads, drives and houses as the hard cover will remove the possibility of a plausible linkage being present by removing the pathway.

For this site a clean capping layer 600mm in thickness is recommended for the proposed garden and landscaped areas. The capping layer should comprise 600mm of subsoil/topsoil.

If current ground levels are to be maintained then sufficient material should be removed to facilitate the capping layer. Any material removed to facilitate the capping layer can be placed under areas of hardstanding or removed from site if surplus to requirement.

The elevated amount of benzo(a)pyrene found in the area of WS04 is beneath proposed plots 10 and 11. It is also very shallow and will almost certainly be removed during construction works therefore no specific remedial works on this hot spot are required. The material will be either removed from site, placed beneath hardstanding or below the capping layer and this will not pose a risk to human health.

Should any material suspected of being significantly contaminated be encountered during the redevelopment of the site, GRM shall be contacted to undertake additional investigation if necessary. The local Environmental Health Officer should be contacted and informed of any additional remedial work required.

4.1.2 Remedial Strategy for Human Health (Ground Gas)

None required.

4.1.3 Remedial Strategy for Controlled Waters

None required.

4.1.4 Remedial Strategy for Construction Materials

Following consultation with the relevant water supply company, remedial measures to protect underground plastic water pipes will be required. This may take the form of an alternative pipe material and/or backfilling of service trenches with clean inert material.

There is no risk to buried concrete, and accordingly no specific protection is required. The appropriate concrete specification deemed for the site is DS-1, AC-1.

4.2 SOIL VALIDATION AND REPORTING

4.2.1 Validation of Imported Soils

Imported soils will be required for use in garden and soft landscaped areas. A minimum of three samples per source and type of imported material (e.g. topsoil and subsoil), with further samples being taken at the rate of one sample per 250m³ for soils from a confirmed Greenfield source and one sample per 50m³ for generated soils will be required. Confirmation of the location of greenfield sources, including a location plan and address, will be required by the Local Authority.

Imported soils should be tested in-situ in stockpiles or once placed in soft landscaped areas. A copy of GRMs Contaminant Screening Values is presented in Appendix D.

The chemical analysis results and test certificate, if provided, should be assessed against the relevant Tier 1 Assessment Criteria (TAC) presented in Appendix A (ii), plus asbestos. Any material that fails the assessment criteria will need to be removed from site.

Additionally, validation is required to confirm that sufficient material has been laid to the recommended thickness. This can be achieved with the excavation of hand-dug trial pits and a visual assessment of the materials for each plot and area of soft landscaping.

Details of the validation testing of the imported material and verification of the capping layer thickness will be required by the local Environmental Health Officer and the warranty provider.

4.2.2 Reporting

A Validation Completion Report will be required by the Local Authority to confirm that the necessary validation has been undertaken. The report should include the following:

- Details of the source and chemical composition of the soils imported to form the capping layer.
- Validation of capping layer thickness with supporting photographic evidence.
- Additionally, copies of haulage notes confirming the import / export of any soils will also be required.

5 FURTHER WORKS

Further works are required as per Section 11 of the Phase II report (GRM/P6793/F.1) – i.e. inspection beneath floor slabs of buildings which are to be demolished as well as beneath the slab in the area of WS4.

6 CONCLUSIONS

In summary, remedial measures are limited to the emplacement of a capping layer and gas protection measures. Following the above will remove any remnant risk to end-users of the proposed development and as such, no further work is required provided the additional investigation detailed above does not identify any other significant risks. Following the results of the additional investigation, this RMS may need to be revised.





A P P E N D I X A

GRM Development Solutions provides multi-disciplinary consultancy services, UK-wide:

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- Structural Engineering Services
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GENERAL APPRAISAL COMMENTS
i INFORMATION SOURCES

Where available the following sources have been used for the identification and assessment of potential ground hazards:

- Relevant British Standards
- British Geological Survey (BGS) Geology Map Scale 1:10,000 for local area
- British Geological Survey (BGS) Geology Map Scale 1:50,000/1:63,320
- BGS Memoir
- BGS Borehole Records
- Environment Agency Groundwater Vulnerability Maps
- Historical Ordnance Survey (OS) Maps
- Environmental Data Report
- Environment Agency Website: <http://www.environment-agency.gov.uk/>
- Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites, UKWIR, 2010.
- Coal Authority Records / Coal Mining Report
- DEFRA/Environment Agency Contaminated Land publications and DoE Industry Profiles
- BRE Guide BR211 (2007), 'Radon: Guidance on protective measures for new buildings'
- HPA-RPD-033 (2007), 'Indicative Atlas of Radon in England and Wales'
- NRPB Publication W26 (2002), 'Radon Atlas of England and Wales'
- CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings'
- Other technical references used throughout this document are detailed in the text.

ii CONTAMINANTS OF CONCERN

The DoE Industry Profiles are normally used to assess likely contaminants from past land use and potential nearby industrial sources. For land uses where no profile is available, likely contaminants of concern are selected by GRM based on past experience of similar sites, a general screening suite of contaminants covered by CLEA and common contaminants from the Industry Profiles.

- | | | |
|------------|-------------------|--|
| • Arsenic | • Copper | • Water soluble sulphate |
| • Cadmium | • Nickel | • PAH (polycyclic aromatic hydrocarbons) |
| • Chromium | • Zinc | |
| • Lead | • Phenols | |
| • Mercury | • cyanide (total) | |
| • Selenium | • pH | |

Asbestos and PCBs are listed in the vast majority of profiles. PCBs are listed as the profiles expect electricity substations and switch boxes on all industrial sites. There is the potential for asbestos containing material to be mixed up with made ground, following any demolition works.

iii CONCEPTUAL MODEL METHODOLOGY

The consideration of contamination is based upon the principles of risk assessment, using the 'source-pathway-receptor' model in order to establish the presence, or potential presence, of a pollutant linkage.

To create a risk, contamination must have the potential to cause harm to susceptible targets or receptors such as humans, the water environment or the built environment. The potential for harm to occur requires three conditions to be satisfied to form a pollutant linkage:

- The presence of substances that may cause harm (SOURCE).
- The presence of a target which may be harmed (RECEPTOR).
- The existence of a plausible migration route between the source and the receptor (PATHWAY).

In the absence of a plausible pollutant linkage there is no risk. Where a potential linkage is identified in order for it not to pose a risk to the identified receptor it must be broken.

iv INTRUSIVE INVESTIGATION SAMPLING METHODOLOGY

The ground investigation (including fieldwork, sampling, monitoring and laboratory analyses) has been designed to identify and assess potential ground related problems and to allow cost effective solutions to be advised. It has been planned on the basis of the desk study, site inspection and the proposed development layout (where available). All fieldwork and soil descriptions were carried out in general accordance with relevant British Standards.

The exploratory holes have been positioned and advanced to depths to determine the general ground/groundwater/gas conditions below the site. A general grid pattern has been adopted, where possible, to provide sufficient information based on the current proposed layout scheme. Some holes have been targeted at particular hazards identified in the Phase I assessment. The resultant exploratory hole density is considered to be commensurate with the complexity of the site conditions and detail of information required for this phase of the investigation.

v GROUND GAS RISK ASSESSMENT METHODOLOGY

Gas monitoring programmes undertaken by GRM are designed to broadly comply with the recommendations outlined in CIRIA Report C665 'Assessing risks posed by hazardous ground gas to buildings' (2007).

To assess the risks posed by ground gases such as radon, carbon dioxide and methane, the relevant current guidance has been used. For radon the site has been assessed following the guidelines in 'Radon: guidance on protective measures for new dwellings (BR211: 2007)'. For methane and carbon dioxide the primary guidance document used to determine if protection measures are required is CIRIA Report C665 'Assessing risks posed by hazardous ground gases to buildings' (2007). This uses Gas Screening Values (GSVs), which are gas concentrations multiplied by borehole flow rate, along with additional limiting factors (such as maximum methane concentrations) to classify the gas regime of a site.

The guidance document includes two methods of characterising a site. The main method 'Situation A' is based on work by Wilson and Card and is used for all types of development except low rise housing that meets the assumptions of 'Situation B'. The 'Situation B' method proposed by Boyle and Witherington for the NHBC assumes all properties have pre-cast suspended floors (beam and block) with ventilated underfloor voids.

Where flow is not recorded during the monitoring a default flow rate of 0.1l/hr will be used in the assessment to produce a positive result.

vi HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

Guidance contained in the Environment Agency's CLEA Report has been used to assess the risks posed to human health.

For residential developments that include domestic gardens the default Tier 1 Assessment Criteria (TAC) for 'residential land with plant uptake' are used, i.e. a female with a start age class of one and an end age class of six. All pathways are considered including the consumption of home-grown vegetables.

For residential developments that do not include domestic gardens the default Tier 1 Assessment Criteria (TAC) for 'residential land without plant uptake' are used, i.e. a female with a start age class of

one and an end age class of six. All pathways are considered except the consumption of home-grown vegetables.

For commercial/industrial developments the default Tier 1 Assessment Criteria (TAC) for 'commercial/industrial' are used, i.e. a female with a start age class of sixteen and an end age class of eighteen. All pathways are considered except the consumption of home-grown vegetables.

The TAC used by GRM include Soil Guideline Values (SGV) published by the EA, values calculated by GRM using the CLEA v1.06 risk assessment and values and chemical data developed by LQM/CIEH. The TAC used in the assessment are selected based on the lowest site specific SOM values returned as part of the chemical analysis.

Where soil chemical analysis results are found to exceed the TAC, Site-Specific Risk Assessments may be undertaken using the CLEA v1.06 risk assessment software using the age classes and pathways described above.

vii RISK TO SITE WORKERS – GENERAL COMMENTS

The risks to site workers are similar to those posed to site end users, although likely to be less severe due to the site workers' shorter exposure to the identified contamination. However, site workers (particularly groundworkers) are more likely to come into direct contact with contaminated soils due to the nature of their work. On this basis ground and construction workers should be provided with basic Personal Protective Equipment based on the site's general health and safety risk assessment, but including as a minimum safety footwear, gloves and overalls.

A site specific risk assessment should be carried out for all hazards identified within the ground investigation in accordance with current health and safety legislation. This assessment should identify any measures required to further reduce risks i.e. providing further Personal Protective Equipment, welfare facilities and if necessary preventing access to certain areas.

Demolition and dismantling of existing structures on the site must be carried out to a safe and acceptable standard, in accordance with current UK guidance and best practice. Whilst not ground related, asbestos and hazardous substances surveys should be conducted prior to any demolition.

Any unusual colours, odours and suspicious ground should be reported immediately to site management and then GRM.

Whilst this appraisal has considered the long-term effects of contamination, GRM can also help during the formulation of Health and Safety documentation, if required.

viii CONTROLLED WATERS RISK ASSESSMENT METHODOLOGY

Where the desk study and fieldwork do not reveal a potential source of contamination no leachate or groundwater testing will be performed. Where a potential source is identified the testing will comprise leachate testing on the material considered most likely to pose a risk, groundwater testing will be undertaken if water is present at shallow depth.

The UK Drinking Water Standards (UKDWS) or Environmental Quality Standards (EQS) are usually adopted for comparison with the leachate/groundwater test results. When the most sensitive receptor is considered to be the an aquifer (groundwater) UKDWS will be adopted as the Initial Tier 1 screening values. Where the most sensitive receptor is a surface water feature the EQS values will be used as Initial Tier I Screening values.

ix CONSTRUCTION MATERIALS RISK ASSESSMENT METHODOLOGY

The 'screening levels' adopted for the assessment of risk to construction materials are taken from the following documents:

- UK Water Industry Research (UKWIR) Contamination thresholds for sub-surface water pipes, for the protection of buried pipes.
- Building Research Establishment (BRE) Special Digest SD1 (2005), 'Concrete in Aggressive Ground', for the protection of buried concrete.

WASTE DISPOSAL AND SITE WASTE MANAGEMENT PLANS

Under current Waste Management Regulations, waste soil materials produced from the site will require characterisation to enable it to be disposed of correctly.

The chemical analysis results included in this report should be provided to the relevant landfill operators to establish the characterisation of the waste, confirm its suitability for landfill disposal and provide estimated costings. If material is classified as hazardous, then the site will need to be registered with the Environment Agency prior to the movement of the waste. Depending on the receiving landfill's current permit, further chemical analysis, incorporating Waste Acceptance Criteria (WAC) leachate analysis, may be required.

All materials removed from the site will be classified as 'waste' and therefore must be removed by a suitably licensed carrier of waste. This applies whether or not the waste is contaminated. All waste removed to landfill will attract Landfill Tax.

The developer/builder is likely to be classed as the waste producer and therefore, has a duty of care to ensure that all waste is disposed of appropriately. This includes ensuring the waste carrier is licensed and disposes of the waste to a suitably licensed landfill site. They are also required to keep a paper trail from 'cradle to grave' including copies of the waste disposal tickets.

Efficient materials management on site is recommended as it can lead to significant cost savings when compared to the traditional side casting or single stockpile of arisings. Likewise making the site as volume neutral as possible will reduce the costs of development.

Site Waste Management Plans allow better waste management practices, help to reduce the amount of waste produced and identify best environmental disposal options. Implementing a Site Waste Management Plan (SWMP) can reduce costs (increasing business profits) and maximise resource efficiency.

SWMPs are a legal requirement for all projects with an overall development cost of over £300k. GRM can assist in the production of SWMPs which comply with the Code of Practice and identify best environmental disposal options when dealing with waste.

GEOTECHNICAL ASSESSMENT GENERAL COMMENTS

Where finished floor levels of proposed structures have not been provided by the Client, then for the purposes of initial assessment, GRM will assume that finished levels will not vary appreciably from the existing ground levels. If the depths of any underground engineering works (i.e. sewers, pumping stations etc.) are unknown they will not be taken in to account in the assessment and it will be assumed that any such works will not compromise foundation or ground stability.

Should the development proposals or finished levels be different from these assumptions then the comments/recommendations in the Geotechnical Assessment may require revising.

It should be noted that the results of window sampling and/or cable percussive boreholes may not give a true indication of a soils actual engineering properties (i.e. stability, mass structure etc). GRM consider that that prior to development trial pitting should be undertaken to confirm the recommendations in the Geotechnical Assessment.

GEOTECHNICAL ASSESSMENT – ENGINEERING GROUND TREATMENT

Near surface soils have the potential to be disturbed by weathering and site traffic. Precautions should always be taken to avoid this, as excessive disturbance may leads to more onerous floor slab designs, road cap thickness and increased amounts of off site disposal etc.

Near surface soils may need treatment or reinforcing to allow safe movement of construction plant and labour. An assessment by the contractor should be undertaken once the type of machinery/plant needed to complete the development is known.

GEOTECHNICAL ASSESSMENT – EXCAVATIONS

Excavation instability (over-break) can result in damage to existing services or structures (e.g. foundations, roads or boundary walls/fences) both on and off-site, as well as increased foundation concrete costs. In order to minimise this, all excavations deeper than 1.2m deep (or any excavation within 1.5m of any existing structure or service) should be supported. Full support should be provided to the full depth of all near vertically sided excavations in made ground, soft and very soft clays and granular soils. A reduction to intermediate support should be acceptable within firm and stiffer natural clays.

Wherever possible, man entry into excavations should be prevented; however, where this is not possible, entry to, and time spent in, excavations should be kept to a minimum.

The build program should be tailored to reflect the impact that deep excavations through potentially unstable strata can have on adjacent properties, so that they are not undermined.

All excavations on site should be in accordance with HSE guidelines and stability should be practically maintained at all times. Reference should be made to HSE construction information sheet No. 8 (Revision 1) 'Safety in Excavations'.

Care should be taken to ensure that falls from excavation faces do not adversely affect the integrity of foundation concrete.

If contaminated water enters excavations it should be removed and transported to an appropriate treatment facility by a suitably licensed carrier before construction begins.

GEOTECHNICAL ASSESSMENT – SUBSTRUCTURES

Where practicable, existing buried construction should be fully removed; however, if this is not practicable all new foundations should be carried down to fully penetrate it and it should be broken well away from all new structures.

There may be existing structures and/or infrastructure in close proximity to the proposed development. New build foundations may be constructed next to pavements with existing underground services beneath them, or excavations may be required near existing footings associated with adjacent properties. These potential hazards need to be taken into consideration when designing foundations and the groundworker needs to be made aware of their potential impact during the redevelopment works. Foundations close to existing underground services or buildings may require alternative foundation techniques (such as piling) to protect the integrity of these structures.

The contractor for the works should carry them out in such a fashion so as to not cause excessive overbreak, concrete usage or undermine existing buildings/roads/ services that are to be retained.

GEOTECHNICAL ASSESSMENT – SOAKAWAYS

Soakaway testing in trial pits by GRM is broadly carried out in accordance with BRE 365 (1991). The testing comprises the excavation of a test pit to a suitable depth, and the placement of water into the pit. The level of water present is then monitored over time. For borehole installations, the permeability testing (falling head/rising head) is undertaken in accordance with BS5930.

If it is decided to proceed with the use of soakaway drainage, then the following general points should be noted:

- Soakaways should not be placed so that water can be discharged through potentially contaminated made ground.
- The Environment Agency may require soakaways to be sealed systems such that only roof run off falls to soakaway.
- Interceptors are likely to be required for soakaways for highway drainage. The adopting authority for the highways should be consulted at the earliest opportunity regarding the use of soakaways for highways drainage.
- Consideration of site levels and slopes should be taken into account during the design.

- The construction of all soakaways should be in accordance with the current building regulations.
- Soakaways should not be placed within 5m of a proposed building.
- Placement of soakaways needs to be considered so as to avoid ponding of water down slope.
- The base of a soakaway should not be below the highest recorded water level.
- The Environment Agency prefer 1m of dry soil to be present between the base of a soakaway and the water table to provide attenuation for contamination.

xvi GEOTECHNICAL ASSESSMENT – FOUNDATIONS

If soft or hard spots are encountered during foundation excavation then they should be replaced with suitably compacted material or the footings deepened to suitable strata, to avoid differential settlement.

If strata of differing bearing character (e.g. sand and clay) are encountered at foundation levels within the excavations for a single plot then the excavation depths should be altered as appropriate to ensure the foundations rest on a single stratum, or strata that will not induce differential settlement. Where this is impractical then GRM should be contacted to assess a reinforced concrete detail or an alternative foundation solution (e.g. piles or vibro-replacement).



General

GRM Development Solutions Limited has prepared this report solely for the use of the Client and those parties with whom a warranty agreement had been executed, or with whom an assignment had been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from GRM Development Solutions Limited; a charge may be levied against such approval.

GRM Development Solutions Limited accepts no responsibility or liability for:

- a) the consequences of this document being used for any purpose or project other than for which it was commissioned, and
- b) the consequences of this document being used by any third party with whom an agreement has not been executed.

Phase I Environmental Audits/ Desk Studies

The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the site and meetings and discussions with relevant authorities and other interested parties. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, GRM Development Solutions Limited reserves the right to review such information and as considered necessary and appropriate to modify the opinions accordingly. It should be noted that any risks identified in a Phase 1 report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

Phase II Environmental Audits (Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, ground and groundwater conditions to allow a reasonable risk assessment to be made. The objectives of the investigation have been limited to establishing the risks associated with potential human targets, building materials, and controlled waters.

The amount of exploratory work and chemical testing undertaken has necessarily been restricted by the short timescale available, and the locations of exploratory holes have been restricted to the areas unoccupied by the building(s) on the site and by buried services. A more comprehensive investigation may be required if the site is to be redeveloped as, in addition to risk assessment, a number of important engineering and environmental issues need to be resolved.

For these reasons if costs have been included in relation to site remediation these must be considered as provisional only and must, in any event, be confirmed by a commercial adviser.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. Whilst exploratory testing is intended to gain an accurate representation of the site, the very nature of sampling and testing is such that it cannot ensure that all localised conditions are detected.

The risk assessment and opinions provided take in to consideration, inter alia, currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

Phase II Geo-environmental Investigations (Combined Geotechnical and Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, geotechnical characteristics, and ground and groundwater conditions to provide a reasonable assessment of the environment risks together with engineering and development implications. If costs have been included in relation to site development a commercial adviser must confirm these.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions apparent at the site for each of the exploratory holes. There may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.

The comments made on groundwater conditions are based on observations made at the time the site work was conducted. It should be noted that groundwater levels will vary owing to seasonal, tidal and weather related effects. The scope of the investigation was selected on the basis of the specific development proposed by the Client and may be inappropriate to another form of development or scheme.

The risk assessment and opinions provided take in to consideration, inter alia, currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.



A P P E N D I X B

GRM Development Solutions provides multi-disciplinary consultancy services, UK-wide:

- Geotechnical and Geo-environmental Services
- Civil and Infrastructure Services
- Structural Engineering Services
- Construction Management
- Site Services

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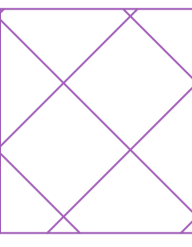
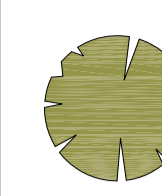
LANDSCAPE KEY

SUDS Resin Bonded Aggregate such as addagrip by Addastone or equivalent. Areas to be separated by Granite setts on shared surfaces.

Green roof areas (see green roof details)

Garden areas to be high quality amenity turf consisting of Rolawn Medallion or equivalent.
Bin collection points to be Grasscrete

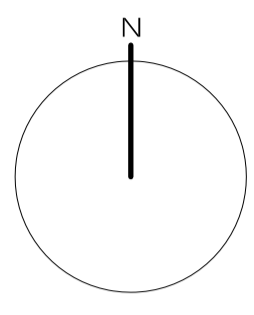
Proposed tree planting within the application site will consist of Specimens 12-14cm standard root-balled trees. Variety mix to be confirmed by Arboricultural Consultant.



Denotes area of applicants right of way

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20m @ 1:200

Inset of Plot 1 and remaining site area Scale 1:200



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interiors architecture landscape

Client:
RELIANT BUILDING CONTRACTORS

Project:
PENSTONE FORMER COAL DROPS

Drawing:
PROPOSED SITE LAYOUT

Date: 19/02/2014	Scale: 1:200	Drawn: SS
Job Number:	Drawing Number:	Reason:

RBC02 25 **K**

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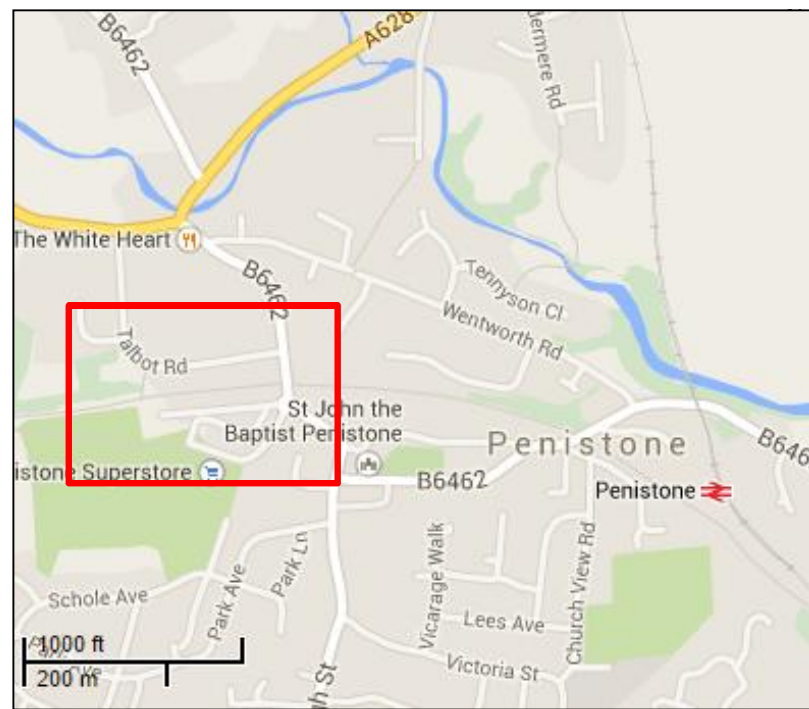
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CLIENT:
Reliant Building Contractors Ltd

PROJECT:
Land off St Mary's Street, Penistone, Sheffield.

TITLE:
Site Location Maps

SCALE@SIZE: NTS	ISSUE: FINAL
DESIGN/DRAWN: CBC	DATE: 11/2014
PROJECT No: P6793	DRAWING No: 2

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	GRM TIER 1 ASSESSMENT CRITERIA		
LAND USE	Residential with Plant Uptake		
CONTAMINANT	1%	2.50%	6%
^e Arsenic	37	37	37
^e Cadmium	26	26	26
^b Chromium III	2590	2590	2590
^e Chromium VI	21	21	21
^e Lead	200	200	200
^c Mercury	170	170	170
^a Selenium	350	350	350
^a Nickel	130	130	130
^b Phenols	240	471	951
^b Copper	2300	2300	2300
^b Zinc	4590	4590	4590
^d Cyanide	34	34	34
^e Benzene	0.20	0.36	0.87
^b Toluene	118	267	609
^b Ethylbenzene	64	151	349
^b <i>o</i> - xylene	43	101	235
^b <i>m</i> - xylene	41	98	228
^b <i>p</i> - xylene	40	93	217
Non Genotoxic PAHs			
^b Acenaphthene	333	746	1450
^b Acenaphthylene	170	407	906
^b Anthracene	3770	7890	13700
^b Fluoranthene	391	690	981
^b Fluorene	166	939	849
^b Naphthalene	1.5	3.5	8.2
^b Phenanthrene	149	316	558
^b Pyrene	867	1560	2270
Genotoxic PAHs			
^{ef} Benzo(a)pyrene	5	5	5
ALIPHATIC HYDROCARBONS			
^b C5-C6	28	51	105
^b C6-C8	68	152	347
^b C8-C10	18	43	102
^b C10-C12	87	215	509
^b C12-C16	709	1680	3400
^b C16-35	128000	128000	128000
AROMATIC HYDROCARBONS			
^b C5-7 (benzene)	64	128	271
^b C7-8 (toluene)	118	267	609
^b C8-C10	26	63	146
^b C10-C12	69	165	364
^b C12-C16	141	325	662
^b C16-C21	264	547	938
^b C21-C35	1120	1490	1720

Notes

- a SGV (2009)
 - b LQM/CIEH values or derived using CLEAv1.06 with LQM/CIEH Data.
 - c SGV for inorganic Hg used (ref.2009 SGV, Pg5, Para.4)
 - d Atkins ATRISKsoil Value
 - e C4SL - SP1010 (2014)
 - f Benzo(a)pyrene is a surrogate marker for the 8 genotoxic PAHs (Benzo(a)pyrene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(ghi)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(ah)anthracene, Ideno(1,2,3-cd)pyrene)
- NB Where C4SLs/SGVs have not been produced, all TACs have been revised in line with report SP1010 (2014), however, the default consumption rates in the CLEAv1.06 model have been retained.

GRM.TAC.08.14