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PHASE 1: DESK TOP STUDY REPORT AND COAL MINING RISK ASSESSMENT REPORT

MR STUART BROOK

PROPOSED RESIDENTIAL DEVELOPMENT

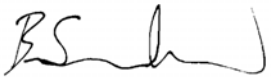
LAND OFF REDWOOD CLOSE/LONG LEE LANE

KEIGHLEY

WEST YORKSHIRE

Project No: 16-451

Prepared By:

Ben Smallwood 

Date: 05/07/2016

Approved By:

Kevin Moir 

Date: 05/07/2016

The information and/or advice contained in this Phase 1: Desk Top Study and Coal Mining Risk Assessment Report is based solely on, and is limited to, the boundaries of the site, the immediate area around the site, and the historical use(s) unless otherwise stated. This 'Report' has been prepared in order to collate information relating to the physical, environmental and industrial setting of the site, and to highlight, where possible, the likely problems that might be encountered when considering the future development of this site for the proposed end use. All comments, opinions, diagrams, cross sections and/or sketches contained within the report, and/or any configuration of the findings is conjectural and given for guidance only and confirmation of the anticipated ground conditions should be considered before development proceeds. Agreement for the use or copying of this report by any Third Party must be obtained in writing from Arc Environmental Limited (ARC). If a change in the proposed land use is envisaged, then a reassessment of the site should be carried out.

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1.0 Introduction July 2016

As requested by Heritage Design Planning, on behalf of Mr Stuart Brook, a Phase 1: Desk Top Study and Coal Mining Risk Assessment Report has been produced for a parcel of land off Redwood Close and Long Lee Lane, south-east of Keighley in West Yorkshire. There are currently proposed plans for the construction of no. 45 residential properties.

The primary objectives of the report are to assess the geological and land contamination conditions on and beneath the surface, and a preliminary Conceptual Site Model (CSM) has been developed to define the scope and extent of investigation works deemed necessary, prior to commencing with any future developments.

A site reconnaissance (walkover) survey was undertaken as part of this report which involved an inspection of the site and its vicinity. Site photographs were taken during the survey and these can be seen attached in Appendix I, with all relevant observations noted in Section 2.1.

2.0 Physical Setting

2.1 Site Details:-

Table 2.1 N = North, E = East, S = South, W = West

Site Name & Address:	Land off Redwood Close/Long Lee Lane, Keighley, West Yorkshire.
National Grid Reference:	407200, 440370 – representative of the centre of the site.
Description of Location:	The site is located immediately south of Redwood Close, south-east of Keighley in West Yorkshire.
Site Boundaries:	N = Redwood Close, S = Longlee Lane, E & W = Residential properties.
Site Shape & Area:	Irregular shaped site occupying an area of c.1.32Ha.
Proposed Development Details:	The current plans propose the demolition of the existing buildings and the construction of no. 45 residential properties with areas of hardstanding and soft landscaping.
General Topography:	There currently no topographical survey plans available. However, during the site reconnaissance survey it was noted that the site steeply slopes from the north to the south.
Site Surfacing:	The site surfacing comprises a large area of unmanaged grass as well as small areas of hardstanding in the southern portion of the site.
Above Ground Structures:	Several residential properties and derelict barns occupy the southern portion of the site.
Sub-surface Structures & Services:	Services associated with the existing buildings are anticipated, service plans should be obtained prior to any future works.
Summary of Recorded Historical Features:	Historically the majority of the site is recorded as undeveloped land, however several structures are noted occupying the southern portion of the site in c.1852. No further development is recorded over the next c.164 years. During the site reconnaissance (site walkover) survey there was no evidence of any further development to the site. The barns on site appear to be derelict with missing roof tiles, rubble materials and overgrown vegetation within the buildings. Several stockpiles of various materials i.e. pipes and sandstone blocks were noted in the southern portion of the site.

3.0 Environmental Setting

3.1 Site Geology:-

The geological assessment for this site has been based on records produced by the British Geological Survey (BGS) and the Coal Authority. The following documents have been reviewed:-

- BGS England and Wales Geological Sheet 69, Bradford, 1:50,000 Scale, Solid and Drift Edition.
- Non-Residential Coal Authority Mining Report, ref; 51001177479001.
- BGS Boreholes SE04SE198, 200, 343 & 344 located within c.100m north-east and east of the site.
- BGS Technical Report, A geological background for planning and development in the City of Bradford Metropolitan District, WA/96/01, 1996.

3.1.1 Made Ground:-

In accordance with published BGS plans, significant thicknesses of made ground deposits are not recorded on site. Due to the lack of historical activity recorded on the majority of the site any made ground underlying the site is likely to be thin, i.e. less than 1m. However, made ground is anticipated below the southern portion of the site associated with areas of existing structures and areas of hardstanding.

3.1.2 Drift Deposits:-

In accordance with published BGS maps, the site lies within a part of Keighley where Glacial Till (Boulder Clay) deposits are present. These deposits generally consist of firm and stiff, sandy gravelly clay deposits. Based on historical BGS boreholes, within c.100m north-east and east of the site, natural drift deposits are recorded generally <c.4m, and similar ground conditions are anticipated below the site.

3.1.3 Solid Geology:-

The site lies in an area of complex geology with the site underlain by several Carboniferous rocks. Based on published BGS plans the Lower Coal Measures (mudstone, siltstone and sandstone), is shown underlying the southern portion of the site which is in turn underlain by both the Guiseley Grit (sandstone) and the Millstone Grit Group (sandstone and mudstone). The Guiseley Grit is shown subcropping below the northern and eastern portion of the site whereas the Millstone Grit Group is shown underlying the western portion of the site.

3.2 Coal Mining Risk Assessment:-

The bedrock deposits present below the site area are shown to consist of Carboniferous mudstone, siltstone and sandstone which are productive coal-bearing stratum. The Coal Authority (CA) Interactive Map for England and Wales and CA gazetteer identifies that this area falls within a coal mining reporting area, but does not lie within a Development High Risk Area.

Based on the published BGS plans the Thwaites Coal (TC) is the nearest recorded seam. It is shown c.500m north of the site, dipping in a northerly direction (away from the site). There are no shallow coal seams present below the site and therefore the site is not at risk from shallow coal mining.

For completeness a Non-Residential Coal Authority (CA) Mining Report, attached in Appendix II, was obtained to further assess the risks posed to the site from past coal mining activities near or on the site. The report concludes that the site is not in the likely zone of influence from workings.

3.0 Environmental Setting (Cont'd)

3.2 Coal Mining Risk Assessment (Cont'd):-

The Coal Authority is not aware of any evidence of damage arising due to geological faults or other lines of weakness affected by coal mining. There are no known coal mine entries i.e. shafts, adits etc. close or near to the site. The CA has not received a damage notice or claim from subsidence within c.50m of the site.

From the information obtained and reviewed, no further assessment or intrusive works are required with regards to historical coal mining activities and it can be seen that there is no significant risk to the site with respect to past shallow coal mining activities.

3.3 Site Hydrogeology:-

Table 3.1

GROUNDWATER	Aquifer / Soil Vulnerability Classification	Comments
Groundwater Vulnerability:	Soils of High Leaching Potential (H3).	Coarse textured or moderately shallow soils which readily transmit non-absorbed pollutants and liquid discharges but which have some ability to attenuate absorbed pollutants because of their large clay or organic matter contents.
Superficial Aquifer Designation: (Glacial Till)	Secondary Aquifer – Undifferentiated.	The glacial deposits have been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
Bedrock Aquifer Designation: (LCM / Guiseley Grit / Millstone Grit)	Secondary A Aquifer.	These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.
GROUNDWATER	**Presence/Location**	**Comments**
Depths:	Groundwater strikes are recorded at shallow depths.	Groundwater is anticipated at shallow depths within the glacial deposits. BGS boreholes SE04SE198 & 200 record groundwater at the base (c.2.00m).
Source Protection Zones:	None recorded within c.1km.	~
Water Abstractions:	Ten recorded within c.1km.	These water abstractions are located between c.749m and c.985m north, north-west and west of the site. The water abstraction are used for general industrial use, general use and general cooling.

3.4 Site Hydrology:-

Table 3.2

SURFACE WATER FEATURE	Location	Comments
GQA Classified River:	One recorded within c.250m.	The Hog is recorded as a tertiary river which is located c.62m south-west of the site.
Unclassified Watercourse(s), Canals, Ponds & Lakes:	None recorded within c.250m.	~

3.0 Environmental Setting (Cont'd)

3.4 Site Hydrology (Cont'd):-

Table 3.2 (Cont'd)

SURFACE WATER FEATURE	Location	Comments
Flooding:	The site does not fall within the designated Flood Zone II & III.	Although the site does not fall within the designated Flood Zone II & III, it is recommended that further consultation with the LA and EA should be made with respect to the potential for flood events in this area and to establish local knowledge of periodic flooding problems.
Surface Water Flooding:	The maps published for the site area show a low risk (1000 year return) shading on the plans. The risks noted can be overcome by installing positive surface drainage.	The Environment Agency has recently published new maps which show the risk of surface water flooding, in addition to maps showing the risk of flooding from rivers and the sea, and reservoirs. Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead.
RAINFALL	**Measurements (mm)**	**Comments**
Annual:	1024.1	Data based from the nearest station Bingley SAMOS. Average taken from met office between 1981-2010.
Precipitation, Jan:	109.8	
Precipitation, July:	63.0	

3.5 Site Ecology:-

The site lies within an area of an Adopted Green Belt located c.13m south of the site.

At this stage, and from the site walkover survey undertaken, there is no evidence to suggest that the site is affected by the presence or invasive weed species (i.e. Japanese Knotweed). However a detailed Japanese Knotweed Survey has not been undertaken.

3.6 Estimated Soil Chemistry:-

Data provided by the BGS in relation to estimated soil chemistry for a number of key metals and metalloid elements are summarised in Table 3.3 below.

Table 3.3

Element	Location	Estimated Soil Concentrations (mg/kg)
Arsenic	On site	<15
Cadmium	On site	<1.8
Chromium (total)	On site	60-90
Lead	On site	<100
Nickel	On site	<15 to 30

3.7 Radon Assessment:-

The property is in an intermediate probability radon area, as between 1% and 5% of homes are above the action level. This corresponds with the BRE Digest, BR211 (2015) Radon: Guidance on protective measures for new buildings, the site is located within a lightly shaded grid square (1km), and therefore basic radon protection measures **are** required for the site, as confirmed in the Envirocheck Report.

4.0 Industrial Setting

4.1 Recent Site History:-

Copies of old survey plans covering this site area and adjacent land are included in Appendix III, and a summary of the site history based on these plans is given in Table 4.1 below.

Table 4.1 Significant features / potentially contaminative uses highlighted in **bold** text

Date	Site	Adjacent Areas
c.1852	Several **structures** are shown occupying the southern portion of the site. Whereas the rest of the site is recorded as undeveloped.	The adjacent land to the site is predominantly undeveloped, however a road and several residential properties are noted immediately south of the site. Several **sandstone quarries** are also recorded c.500m south-west of the site.
c.1894 to c.1895	Generally as c.1852.	The **sandstone quarries** have expanded further north and is now recorded c.75m south of the site. An **old quarry** is recorded c.325m south-east of the site.
c.1908 to c.1956	Generally as c.1894 to c.1895.	A **quarry** is noted c.175m south and an **old quarry** is located c.275m north-west of the site.
c.1961 to c.1969	Generally as c.1908 to c.1956.	Extensive residential development is recorded immediately east of the site.
c.1979	Generally as c.1961 to c.1969.	Widespread residential development has occurred west to north-east of the site.
c.1984 to c.1992	Generally as 1979.	The **old quarry** located north-west of the site is no longer recorded (assumed **infilled**).
c.1993 to c.2006	Generally as c.1984 to c.1992.	The **quarries** to the south are no longer recorded and are assumed to have been **infilled**.
c.2016 to Present Day	During the site reconnaissance (site walkover) survey there was no evidence of any further development to the site. The barns on site appear to be derelict with missing roof tiles, rubble materials and overgrown vegetation within the buildings. Several stockpiles of various materials were noted in the southern portion of the site.	Generally as c.1993 to c.2006.

4.2 Landfill & Waste:-

The following information relating to Landfill and Waste has been obtained from Landmark Information Group, the Environment Agency and walkover survey completed;

- There are no BGS Recorded Landfill Sites noted within c.250m of the site.
- There are two Historical Landfill Site located c.221m north of the site.
- There are no Local Authority Recorded Landfill Sites located within c.250m of the site.
- There are two Registered Landfill Sites recorded within c.250m of the site.
- There are no Licensed Waste Management Facilities noted within c.250m of the site.
- Potential presence of hazardous ground gases associated with historical quarries located north-west and south of the site.

4.0 Industrial Setting (Cont'd)

4.2 Landfill & Waste (Cont'd):-

After reviewing the information on the previous page it is felt the site is potentially at risk, albeit a low risk from the potential of hazardous ground gassing associated with the nearby historical and registered landfill sites and historical quarries mentioned above. It is therefore recommended that a programme of gas monitoring in line with current guidance (CIRIA C665, 2007) is undertaken prior to commencing with any future development works.

4.3 Statutory Requirements / Authorisations:-

Table 4.2

Type	Location	Comments
Pollution Prevention and Controls	None recorded within c.250m.	~
Registered Radioactive Substances	None recorded within c.250m.	~
Prosecutions Relating to Authorised Processes	None recorded within c.250m.	~
Enforcement and Prohibition Notices	None recorded within c.250m.	~
Planning Hazardous Substances Consents / Enforcements	None recorded within c.250m.	~
COMAH / NIHHS Sites	None recorded within c.250m.	~
Contemporary Trade Entries	Six recorded within c.250m.	None of the trade entries are recorded as active, and do not represent a risk to the site.
Fuel Station Entries	None recorded within c.250m.	~

4.4 Pollution Incidents and Discharge Consents:-

Table 4.3

Type	Location	Comments
Discharge Consents	None recorded within c.250m.	~
Water Industry Act Referrals	None recorded within c.250m.	~
Prosecutions Relating to Controlled Waters	None recorded within c.250m.	~
Pollution Incidents to Controlled Waters	Three recorded within c.250m.	
Substantiated Pollution Incident Register	None recorded within c.250m.	~

5.0 Preliminary Risk Assessment Summary

5.1 Preliminary Conceptual Site Model (CSM):-

The Conceptual Site Model (CSM) is one of the primary planning tools that can be used to support the decision making process of managing contaminated land and groundwater on any given site, and allows a better understanding of what needs to be done to achieve risk management, and from this appropriate remediation techniques, if required for those risk management goals can be chosen.

5.0 Preliminary Risk Assessment Summary (Cont'd)

5.1 Preliminary Conceptual Site Model (CSM) (Cont'd):-

This can be done by undertaking a *source-pathway-receptor* analysis of the site. The anticipated sources, pathways and receptors for this site are summarised in Table 5.1 below, and a graphical representation of the preliminary CSM has been produced for this site and this can be seen attached in Appendix IV.

Table 5.1

	Sources (S)		***Pathways (P)***		***Receptors (R)***
S1	Potential presence of made ground below the southern portion of the site.	P1	Ingestion & Dermal Contact	R1	Human health (Future Residents)
S2	Potential presence of hazardous ground gases associated with off-site sources i.e. historical & registered landfill sites and historical quarries.	P2	Inhalation of indoor / outdoor air	R2	Groundwater within both drift (Secondary Undifferentiated) and solid geology (Secondary A Aquifer)
		P3	Plant Uptake		
		P4	Migration through existing services	R3	Adjacent sites
		P5	Direct contact with building materials	R4	Building materials*
		P6	Surface runoff & Infiltration	R5	Flora and fauna*

* = Not included in the Human Health & Controlled Waters Risk Assessment

5.2 Geotechnical Considerations:-

The following potential geotechnical issues and hazards have been identified for this site, and these issues should be considered before future development of the site is to take place;

- Steep topography over large portions of the site, may require significant retaining structures or slope stability mitigation.
- Type and thickness of made ground / fill deposits (if present).
- Geotechnical parameters of initial natural drift deposits (Glacial Till).
- Control of surface drainage – suitability of natural drift deposits for utilising sustainable urban drainage systems (SUDS).
- The possible presence of active / current services which may pass below the site area.

It is recommended that in order to determine the geotechnical considerations above with more certainty that intrusive investigation works with associated geotechnical testing are carried out on this site, to aid in assessing the extent of any potential issues prior to commencing with any development in the future. Following this work detailed foundation proposals for the proposed residential development can then be prepared.

The information reviewed indicates that the site can be considered as being located within a **LOW-MODERATE** geotechnical risk setting.

5.0 Preliminary Risk Assessment Summary (Cont'd)

5.3 Sources of Contamination and Probable Contaminants:-

The historical Ordnance Survey maps, the Landmark Envirocheck Report and other environmental information has revealed that historically from as early as c.1852 the majority of the site is recorded as undeveloped land, however several structures are noted occupying the southern portion of the site. During the next c.164 years there was no further development recorded on site. Throughout the site reconnaissance survey there was no evidence of any further development to the site. The barns on site appear to be derelict with missing roof tiles, rubble materials and overgrown vegetation within the buildings. Several stockpiles of various materials i.e. metal pipe and sandstone blocks were noted in the southern portion of the site.

In conclusion, several contaminative issues have been highlighted for this development site and these have been listed below;

- Potential presence of made ground below the southern portion of the site.
- Potential presence of hazardous ground gases associated with off-site sources i.e. historical & registered landfill sites and historical quarries.

It is therefore concluded that ground contamination screening will need to be incorporated into the design of any future intrusive investigation works to confirm the risks posed towards Human Health (future end users).

Laboratory testing should also be undertaken on representative samples taken from site for naturally aggressive chemicals which could have a detrimental effect on building materials (i.e. pH value and soluble sulphate, etc.).

Soils – Human Health:-

In consideration of the above and when taking into account the guidance contained in Contaminated Land Report 8 and the appropriate DEFRA industry profiles, for completeness it would be prudent to test selected samples of soil from this site for a range of contaminants, typically as listed below;

Generic contamination, typically comprising; Arsenic, Cadmium, Chromium (III & VI), Copper, Lead, Mercury, Nickel, Selenium, Zinc, Cyanide, Total Organic Carbon (TOC) and asbestos.

In addition, contamination testing for Polycyclic Aromatic Hydrocarbons (PAH's) and Total Petroleum Hydrocarbons (TPH's) should be undertaken if "ashy" materials are encountered or there is any visual or olfactory evidence of fuels/oils or other wastes present in the ground.

Consideration may need to be given to the protection of service pipes for the proposed development from the made ground deposits present, and therefore a supplementary suite of contamination testing may be required in order to meet the requirements of the local utilities service provider for their 'pipe selection risk assessment' (PSRA), once the location and depth of future services have been determined.

The information reviewed indicates that the site can be considered as being located within a **LOW** ground contamination risk setting for Human Health.

5.0 Preliminary Risk Assessment Summary (Cont'd)

5.3 Sources of Contamination and Probable Contaminants (Cont'd):-

Groundwater / Leachate – Controlled Waters:-

The following factors have been taken into consideration when assessing the risks posed towards Controlled Waters;

- Groundwater within the solid geology below the site has been classified as a Secondary A Aquifer.
- There are no Source Protection Zones (SPZ) within c.1km of the site.
- There are ten Water Abstractions within c.1km of the site.

Depending on the results of any soil contamination screening, leachate / groundwater screening may be required on samples of made ground if present on site to determine the risk to Controlled Waters. Similarly, this work should be incorporated within the design of any intrusive ground investigation works which ideally should take place prior to commencing with any redevelopment works.

The information reviewed indicates that the site can be considered as being located within a **LOW** ground contamination risk setting for Controlled Waters.

5.4 Preliminary Risk Assessment Summary:-

Human Health:– When taking into consideration the history of the site, there could be a potential risk to human health from the presence of localised areas of made ground in southern part of the site. As such these issues should be investigated in more detail in order to determine the risks to human health more accurately, and these risks can be reassessed after the completion of any fieldworks.

Hazardous Ground Gases:– In accordance with CIRIA C665 this development would be considered as high sensitivity, it is felt the risk from potential areas of made ground associated with historical activities below the site and a nearby off-site sources i.e. landfill sites and historical quarries are deemed to be low. Nonetheless, for completeness ground gas monitoring standpipes should to be installed on site and monitored frequently for the presence of hazardous ground gases (Methane and Carbon Dioxide) in accordance with CIRIA C665.

Controlled Waters:– Following an assessment of the hydrological and hydrogeological conditions, the site is recorded to be underlain by Secondary A Aquifer. Based on the information reviewed it is felt that the site represents a potential low risk to Controlled Waters.

6.0 Recommendations for Phase 2 Intrusive Investigation Works

Taking into account the above, it is recommended that a Phase 2: Ground Investigation (intrusive investigation) is completed for this site to determine if any ground contamination is present on the site which could pose a risk towards the proposed end users and / or the environment. This investigation should be completed prior to commencing with any future development works and should include for the following or similar investigation work;

- A series of mechanically excavated trial pits and windowless sampling boreholes, including insitu geotechnical testing (SPT's, shear strength testing, etc.) and sampling to help aid with future foundation design and to collect samples from shallow depth for subsequent laboratory testing.

6.0 Recommendations for Phase 2 Intrusive Investigation Works (Cont'd)

- Install a minimum of 3 no. combined ground gas and groundwater monitoring wells to allow for a programme of ground gas monitoring in accordance with current guidance (CIRIA C665, 2007) to be completed.
- Appropriate laboratory geotechnical testing on both the natural drift and bedrock deposits. The samples of soil collected should be forwarded to UKAS and MCERTS accredited laboratory.
- Contamination screening on selected samples of made ground if present to assess the risks to Human Health and Controlled Waters.
- Site supervision and production of factual and interpretive Phase 2: Ground Investigation Report, including a Level 1 Ground Contamination Risk Assessment for Human Health and Controlled Waters.

End of Report

GENERAL REFERENCES

- British Geological Survey: Maps, Reports, Memoirs, etc.

  1. BGS England and Wales Geological Sheet 69, Bradford, 1:50,000 Scale, Solid and Drift Edition.
  2. BGS Boreholes SE04SE198, 200, 343 & 344 located within c.100m north-east and east of the site.
  3. BGS Technical Report, A geological background for planning and development in the City of Bradford Metropolitan District, WA/96/01, 1996.

- Landmark Information Group, Envirocheck Report, ref: 87826445_1_1
- Non-Residential Coal Authority Mining Report, reference; 51001177479001
- DoE, DEFRA & EA - Contaminated Land Reports

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  CLR 2: Guidance on preliminary site inspection of contaminated land. Report by Applied Environmental Research Centre Ltd. Volume 1. DOE, 1994
  CLR 3: Documentary research on industrial sites. Report by RPS Group plc. DoE, 1994
  CLR 4: Sampling strategies for contaminated land. Report by The Centre for Research into the Built Environment, The Nottingham Trent University. DoE, 1994
  CLR 5: Information systems for land contamination. Report by Meta Generics Ltd. DoE, 1994.
  CLR 6: Prioritisation & categorisation procedure for sites which may be contaminated. Report by M J Carter Associates. DoE, 1995
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  Science Report Final SC50021/SR3: Updated Technical Background to the CLEA Model, 2009
  Science Report SC050021/SR4: CLEA software (version 1.06) handbook, 2009

- BS10175: 2011 + A1:2013: Investigation of Potentially Contaminated Sites – Code of practice
- BS5930: 2015: Code of Practice for Site Investigations.
- Guidance on Investigation and Assessment for Contaminated Sites (CIRIA SP:103)
- BRE Digest BR211(2015): Radon: Guidance on Protective Measures for New Buildings
- Methane and Associated Hazards to Construction - CIRIA Reports 149,150,151 & 152
- Assessing Risks Posed by Hazardous Ground Gases to Buildings, CIRIA C665, 2007
- BS8485: 2015: Code of Practise for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings
- BS8576: 2013: Guidance on investigation from ground gas – Permanent gases and Volatile Organic Compounds (VOC's)
- National Planning Policy Framework (March 2012) supplemented with Planning Policy Statement 25 (PPS25)
- CIRIA Report C624 'Development and flood risk – guidance for the construction industry'
- CIRIA Report C733 'Asbestos in Soil and Made Ground: a guide to understanding and managing risks'