



NHS Property Services Ltd
The Former Clitheroe Hospital,
Chatburn Road, Clitheroe

Phase 1 Geo-Environmental Desk Top
Study

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1.0 EXECUTIVE SUMMARY

Current Site Status	The site is the former Clitheroe Hospital located on Chatburn Road, Clitheroe (centred at grid reference 375458, 443007). The site is a roughly rectangular area of land of approximately 2ha, and features the former hospital buildings, driveways, hardstanding and gardens, now disused.
Site and Surrounding History	The earliest historical maps show the site to be occupied by fields. The 1886 map shows the site developed as the Clitheroe Union Workhouse, with the site layout similar to that present today. Historical maps show that a number of quarries were present and some of which were later infilled. In recent years, much development of the surrounding area has occurred, including the Tarmac works to the north-west, an unnamed works to the west, a further works and conveyors to the north, and Salthill industrial estate to the south.
Environmental	The environmental database has not highlighted any significant issues which may affect the site. In the surrounding area there are a number of former quarries some of which have been later landfilled. There is one active upper tier COMAH site located 625m west of the site.
Geology	Made Ground may exist at the site associated with previous development. The superficial deposits underlying the site comprise Devensian Till, in turn, underlain by solid geology of the Clitheroe Limestone Formation and Hodder Mudstone Formation. The Peach Quarry Limestone Member is shown to be present on the southern part of the site. The site is shown to be stable with respect to ground movement relating to underground geological features.
Radon	There are conflicting views on the requirement for radon protection measures at the site. This requires further investigation.
Hydrogeology	The superficial Devensian Till deposits are classified as Unproductive Strata. The Limestone is designated as a Secondary A Aquifer. The site is not situated in a Source Protection Zone.
Hydrology	The nearest surface water feature is a pond located 75m south-east of the site. The Mearley Brook, which is a classified watercourse is located approximately 100m north-west of the site.
Preliminary Contamination Assessment (PRA)	The contamination risk posed by off site and on site sources to all receptors are considered to be generally low . Exceptions to this include the risk posed by the fuel tanks to controlled waters and ground gas originating from the Made Ground deposits which is considered to pose a low to moderate risk. The risk from natural ground sources is considered to pose a moderate risk to human health.
Conclusions and Recommendations	Based on the desk based information, it is not considered that further intrusive site investigations are required to refine the PRA at outline planning stage. In order to refine the PRA during detailed planning it is likely that ground investigation will be required to formulate a Refined Risk Assessment (RRA). It is recommended that ground investigation is undertaken during the detailed planning stage in particular to determine gas risk posed site users with mitigation design (as required), a targeted assessment to determine if the fuel tanks have caused any localised impact and a geotechnical investigation to aid foundation design. A bespoke radon report should be obtained from the British Geological Survey (BGS) for the site to determine the risk posed to future site users.



2.0 INTRODUCTION

2.1 Instruction

WYG Environment Planning Transport Ltd (WYG) has been commissioned by NHS Property Services Ltd to undertake a Phase 1 geo-environmental desk top study for a development site located on land at the former Clitheroe Hospital, Chatburn Road, Clitheroe. The site location is shown on Figure 1.

2.2 Objectives

The principal objective of the study is to provide and interpret information on ground conditions in relation to the proposed clinical and residential development for submission with the outline planning application for the site.

2.3 Scope of Services

In order to achieve the above objective, the following scope of works has been determined:

- A discussion of the current site status and key associated environmental influences observable around the site, including a site walkover;
- Review and discussion of environmental database information (Envirocheck™ report);
- An historical site and area review, referring to past editions of Ordnance Survey maps;
- A discussion of the expected ground and groundwater conditions by reference to geological and hydro-geological mapping;
- A qualitative Preliminary Land Contamination (PRA) risk assessment for a proposed future residential and clinical land use; and,
- Production of a report capturing the above information.

2.4 Proposed Development

The proposed development includes the construction of up to 50 dwellings, with associated access and car parking.





2.5 Report Conditions

Attention is drawn to the report conditions included in Appendix A.





3.0 SITE SETTING

3.1 Location & Size

Key details for the site are provided in Table 3.1 below.

Table 3.1 Site Address and Size

Address	Land at the former Clitheroe Hospital, Chatburn Road, Clitheroe, Lancashire, BB7 4JX (nearest postcode).
Grid Reference	375458, 443007
Site Area	Roughly rectangular area of land of approximately 2 ha

3.2 Site Description

The site is currently the disused former Clitheroe Hospital located on Chatburn Road, approximately 1.5km north- east of Clitheroe town centre. The site coverage is approximately 50% soft landscaping, 25% building cover and 25% hardstanding (asphalt). No evidence of surface staining to the hard standing was noted during the WYG site walkover. A surface water drainage system is still present on site. Three bunded fuel oil tanks are present adjacent to the former boiler room on the eastern boundary of the site; however, no evidence of spillages or leaks was visible, and the bunds appear to be in good condition. An orchard and growing areas are present to the south-east of the main buildings.

Surrounding the site, commercial properties lie to the south-east, beyond which is Clitheroe Auction Market. Immediately to the east and north-east is the new Clitheroe Community Hospital, to the north is Chatburn Road with agricultural land beyond. Agricultural land is also located to the west.



4.0 ENVIRONMENTAL SETTING

Regulatory authority information relevant to the site’s surroundings has been obtained from the undertaking of an environmental database search for the site. The information is summarised below and the environmental database records are enclosed in Appendix B. Distances stated are approximate and are taken from the boundary of the site to the database recorded entries.

4.1 Waste

There are no BGS recorded landfill sites, historical landfill sites, registered landfill sites, licensed waste management facilities, waste treatment sites, local authority recorded landfill sites and registered waste transfer stations sites at the site.

Recorded waste sites within 500m of the site are shown in Table 4.1 below.

Table 4.1 Waste Sites within approximately 500m of the site boundary

Site Type	Name and/or Location	Approximate Distance from Site (m)	Remarks
Historic Landfill	Salt Hills Quarry	370m south-east	Deposited waste/unknown material
Licensed Waste Management Facility Registered Landfill Site	Castle Hill Cement Coplow Quarry	165m north-west	Non-biodegradeable waste & Industrial Waste Landfill
Licensed Waste Management Facility	Ribble Valley Borough Council, Salthill Ind. Est	275m south	Household, commercial & industrial waste transfer station
Licensed Waste Management Facility	Miles Fox Haulage	325m south	Household, commercial & industrial waste transfer station
Registered Waste Treatment Site	S. Turner (Autoparts)	420m south	Scrapyard - Closed

4.2 Industrial Processes

There are no contaminated land register entries and notices (CLREN), Local Authority Pollution Prevention and Controls (LAPPC), Integrated Pollution Control (IPC), Integrated Pollution Prevention Control (IPPC), Local Authority Pollution Prevention or Control Enforcements (LAPPCE) relating to authorised processes at the site.



LAPPCs are recorded within 500m of the site boundary. These are detailed in Table 4.2 below.

Table 4.2 Industrial Processes within approximately 500m of the site boundary

Site Type	Name and/or Location	Approximate Distance from Site (m)	Remarks
LAPPC	Ribble Valley Borough Council	275m south	Waste oil burners
	Tarmac, Bankfield Quarry	355m north	Bitumen and tar processes; Mineral drying and roadstone coating processes; Quarry processes, including crushing
	Dugdale Nutrition	460m south-east	Animal feed compounding

There are no CLRENS, IPCs, IPPCs and LAPPCEs within 500m of the site boundary.

4.3 Health & Safety

There are no explosive sites, Notification of Installations Handling Hazardous Substances (NIHHS), planning hazardous substance consents, registered radioactive substances consents or Control of Major Accident Hazard sites (COMAH) registered at the site.

There is one active COMAH site (Upper Tier) within 1km of the site boundary which is at Johnson Matthey Plc. located approximately 625m west of the site.

There are two planning hazardous substance consents recorded within 1km of the site boundary. The consents relate to Johnson Matthey Plc. located 625m west, and Syntex ICI Clitheroe located 650m west of the site.

There are no explosive sites, registered radioactive substances consent or NIHHS sites within 1km of the site boundary.

4.4 Ecology

There are two Sites of Special Scientific Interest (SSSI) within 500m of the site boundary; Coplow Quarry located 160m north-west, and Salthill and Bellmanpark Quarries located 185m south of the site. Both the sites are SSSI because of the Geological Conservation Review. Salthill Quarry is additionally a designated Local Nature Reserve.



4.5 Trade Entries

There are two trade entries held on record for the site; both are inactive.

There are twenty four trade entries located within 250m of the site boundary of which fourteen are active. The notable active trade entries relate to precision engineers, vehicle garage, industrial engineers, aluminium fabricators and car component manufacturers, most being located adjacent to the site at various premises on the Link 59 Business Park.

There is one fuel station entry within 500m of the site; AJA Smith Haulage located 435m south of the site, now obsolete.



5.0 SITE HISTORY

Available extracts of historical Ordnance Survey (OS) maps were used to research the history of the site and the surrounding area. Copies of all historical Ordnance Survey maps reviewed are included in Appendix C and a summary is provided below including highlighted potentially contaminative uses in Tables 5.1 and 5.2.

5.1 Review of Site History

5.1.1 On Site History

The earliest historical map (1847) shows the site to be occupied by fields. The 1886 map shows the site developed as the Clitheroe Union Workhouse, with the site layout similar to that present today. The site continues to be named the Clitheroe Union Workhouse until the 1955 map, when it is renamed Clitheroe Hospital. Little change in site layout is indicated over time.

Table 5.1 Site Historical Potentially Contaminative Land Uses

Location	Feature	Year	Notes
Whole site	Clitheroe Union Workhouse/Hospital	Circa mid to late nineteenth century/ 1950's to present day	General occupancy, fuel storage and burning, possible waste disposal

5.1.2 Surrounding History

The earliest map (1847) shows the site surrounded by farmland with the Blackburn Railway located approximately 100m north and north-west of the site boundary. Beyond the railway is Coplow Hill Quarry. Salt Hill Quarry is located approximately 400m south of the site, and a further unnamed small quarry is located approximately 100m west of the site.

The 1890 map shows Bellmanpark Quarry located approximately 400m to the east, with a small mineral railway connecting the quarry to the Blackburn Railway.

There are few changes shown to the surrounding area until the 1912 map, when a mineral railway is shown running from Salt Hill Quarry around the eastern side of the site, and connecting with the main railway line to the north.



Little change in the immediate surrounding area is shown until the 1988 map, although the development of Clitheroe to the south-west is evident. The 1988 map shows the development of Ribblesdale Cattle Market approximately 200m to the south-east.

Much development of the surrounding area can be seen on the 2006 map, including the Tarmac works 800m to the north-west, an unnamed works 600m to the west, a further works and conveyors 400m to the north, and Salthill industrial estate 400m to the south.

Table 5.2 Surrounding Historical Potentially Contaminative Land Uses within 250m of the Site

Distance and Direction	Feature	Year	Notes
100m west	Unnamed quarry	1886 – pre 1972	Possibly infilled
200m north-west	Coplow Hill Quarry	1887 - pre 1970	Possibly infilled
200m south	Salthill Quarry	1890 - 1977	Disused by 1977 and then later infilled.



6.0 GEOLOGY, HYDROGEOLOGY AND HYDROLOGY

6.1 Geology

Details of the geology underlying the site have been obtained from the following sources:

- British Geological Survey (BGS) Sheet No. 68 (Clitheroe) Solid and Drift Edition, 1:50,000 scale;
- BGS website (Geology of Britain and Borehole Records Map Viewer);
- Indicative Radon Map Number 17 Lancashire, South Cumbria and Western North Yorkshire, Health Protection Agency and British Geological Survey (2007);
- Envirocheck Mining & Ground Stability Report; and,
- Environmental database.

6.1.1 Made Ground

Published maps provide no evidence that Made Ground deposits are present. Made Ground is expected to be present as a result of the site's development history.

6.1.2 Superficial Geology

The geological map indicates that the site is underlain by Devensian Till (clay).

6.1.3 Solid Geology

The geological map indicates that the solid geology consists of the Clitheroe Limestone Formation and Hodder Mudstone Formation of the Chatburn Limestone Group. The Peach Quarry Limestone Member is shown to be present on the southern part of the site. The limestone beds are shown to be dipping at a 40 degree angle towards the south.

6.1.4 BGS Soil Chemistry

Table 6.1 below gives details of soil chemistry, as provided by the environmental database (source: Urban Soil and Soil Chemistry data provided by the British Geological Survey).



Table 6.1 BGS Soil Metal Concentrations

Determinand	Soil Concentration Range	
	Min (mg/kg)	Max (mg/kg)
Arsenic	15	25
Cadmium	<1.8	
Chromium*	60	90
Lead	<150	
Nickel	15	30

*Assumed to be Total Chromium

All the metal concentrations above are at levels that may not be considered to pose a potential risk to human health for a residential end-use and are in line with those found in the immediate surrounding area.

6.1.5 Radon

The Envirocheck Report indicates as follows the property is in an intermediate probability radon area, as 1% to 3% of homes are above the action level. However, no radon protection measures are required in the construction of new dwellings or extensions.

The indicative radon map indicates that the site is in an area where full radon protection measures are required within the construction of new dwellings or extensions.

A conflict arises in the two assessments and it is recommended that a full radon report should be obtained from the British Geological Survey.

6.1.6 Mining

The Mining and Ground Stability Report indicates the site is not within a coal mining affected area, and there are no man made cavities, natural cavities or records of mining instability within 500m.

There are BGS recorded mineral sites within 500m of the site; these are summarised in Table 6.2. Some of the locations relate to historical landfill licences (details summarised in Table 4.1).



Table 6.2 Recorded BGS mineral sites and Related Information within 500m of the Site

Distance and Direction	Site	Status	Resource	Comments
165m north-west	Coplow Hill (1846 to pre 1972)	Ceased	Limestone	Filled Ground (quarry pit etc) 1972 - 1977
340m south	Salt Hill Quarry (1847-1955)	Ceased	Limestone	Infilled Ground (quarry pit etc) 1977
480m south-west	Tower Hill (part of Salt Hill Quarry)	Ceased	Clay and Shale	
300m north	Bankfield Quarry 1847-1977	Ceased	Limestone	Infilled Ground (quarry pit etc) pre 1977
365m south-east	Bellmanpark Quarry (1847 – pre-1977)	Ceased	Limestone	Filled Ground (quarry pit etc) 1977

6.1.7 Ground Stability

Table 6.3 indicates the potential ground stability hazards on site, as obtained from the environmental database. The motion map shows data from the site indicating it to be stable.

Table 6.3 Ground Stability Hazards

Ground Stability Hazard	Risk
Collapsible Ground	Very Low
Compressible Ground	No Hazard
Ground Dissolution	Low – Very Low
Landslide	Very Low
Running Sand	Very Low
Shrinking or Swelling Clay	Very Low

6.2 Hydrogeology

Details of the hydrogeology underlying the site have been obtained from the following:

- Environment Agency website; and,
- Environmental database.



6.2.1 Groundwater Classification

Sources indicate that the groundwater is classified as follows:

- The Superficial Deposits (Till) are classified as Unproductive Strata. Unproductive Strata are defined as rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.
- The Clitheroe Limestone Formation, Hodder Mudstone Formation and Peach Quarry Limestone are designated as Secondary A Aquifers. Secondary A Aquifers are defined as being 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.

The soils overlying the Secondary A Aquifer are classified as having low urban leaching potential.

6.2.2 Groundwater Abstractions

The environmental database search indicates there are two active groundwater abstraction sites within 1km of the site as summarised in Table 6.4.

Table 6.4 Groundwater Abstractions

Operator	Abstraction	Distance and direction from site
Clitheroe Auction Mart Co Ltd	Other industrial / commercial / public services – general use	315m south-east
Lafarge Tarmac Trading Ltd	Other industrial / commercial / public services – dust suppression	400m north-west

6.2.3 Groundwater Quality

The site is not located within a Source Protection Zone.

6.2.4 Hydrology

Details of the hydrology of the area have been obtained from the following sources:

- The Environment Agency website; and,
- Environmental database.



6.2.5 Watercourses

The nearest surface water feature is a pond located 75m south-east of the site.

Mearley Brook is located 100m north-west of the site. The Water Framework Directive - River Basin Management Plans have been consulted and indicate that the Brook is of moderate ecological status and does not require assessment.

6.2.6 Surface Water Abstractions

The environmental database search indicates there are no active surface abstractions at or within 500m of the site.

6.2.7 Discharge Consents

The environmental database search indicates there are no active discharge consents pertaining to or within 500m of the site.

6.2.8 Pollution Incidents

The environmental database search indicates that there have been no pollution incidents at the site.

There have been six pollution incidents to controlled waters within 250m of the site. Table 6.5 provides information relating to the incidents.

Table 6.5: Pollution Incidents with 250m of the Site

Incident Type	Property Type	Receiving Water	Cause	Distance and Direction	Notes
Cat 2 - Significant	Not Given	Pimlico/Mearley Brook	Unknown	180m NE	Miscellaneous inert suspended solids (1992)
	Road	Freshwater stream/river	Road Traffic Accident	215m N	Oils – Diesel (including agricultural) (1998)
Cat 3 - Minor	Not Given	Tributary of Mearley Brook	Miscellaneous	240m SE	Rubble/litter or solids (1995)
	Not Given	Not Given	Accident/leakage	240m SE	Oil spill (1996)



6.2.9 Prosecutions

The environmental database search indicates that there have been no prosecutions relating to controlled waters or authorised processes on the site. The database indicates there has been one prosecution within 500m of the site relating to a blocked sewer system 465m to the south.

6.2.10 Flood Potential

Environment Agency mapping indicates the site is not considered to be at risk from flooding from rivers, surface water or reservoirs, although some of the nearby brooks and streams may be at risk of flooding.



7.0 PRELIMINARY CONTAMINATION RISK ASSESSMENT

The site is being considered for future development and has been assessed on the basis of its suitability for the proposed end use, in line with current UK guidance including the National Planning Policy Framework (NPPF), March 2012.

For a risk of pollution or environmental harm to occur as a result of ground contamination, all of the following elements must be present:

- A source, i.e. a substance that is capable of causing pollution or harm;
- A receptor (or target), i.e. something which could be adversely affected by the contaminant; and
- A pathway, i.e. a route by which the contaminant can reach the receptor.

If one of these elements is absent there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

Potential sources, pathways and receptors have been identified and the risks associated with possible pollutant linkages outlined. At this stage and in accordance with current guidance the following significant sources, pathways and receptors have been defined for the proposed residential end-use.

The conceptual model established from desk based information is that the site, currently disused (with limited potential for contamination due to past use and hardstanding presence) may be underlain by Made Ground associated with past development, in turn underlain by Devensian Till and the Clitheroe Limestone Formation, Hodder Mudstone Formation and Peach Quarry Limestone (Secondary A Aquifers). The site is not located in a Source Protection Zone, with limited sensitive surface waters present proximal to the site. It is considered that the presence of Till (clay) and the distance to controlled waters receptors may limit the leaching of any potential contaminants from the site.

7.1 Potential Hazard Sources

Based on the desk based information, there are limited potential on-site and off-site sources of potential contamination that may impact upon the site.



7.1.1 On-site Sources

Based on the historical and present uses of the site, it is considered that there are limited contaminative sources, namely the possible presence of Made Ground in previously developed areas of the site, and the fuel oil storage tanks.

7.1.2 Off-Site Sources

Based on historical uses identified surrounding the site it is considered that there are a limited number of potential off-site contamination sources, including possibly infilled quarries and nearby industrial processes.

7.2 Contamination Pathways

Potential contamination pathways, listed below, are proposed considering the future proposed clinical and residential end-use of the site:

- Dermal contact;
- Inhalation of vapours or dusts;
- Ingestion of soil and dusts;
- Ingestion of home grown produce (fruit and vegetables);
- Leaching to surface run-off/drainage;
- Leaching to groundwater;
- Lateral and vertical migration of groundwater;
- Ground gas generation/accumulation; and,
- Migration along/into service conduits and pipe work.

7.3 Contamination Receptors

Receptors that may be affected by potential contamination for the future clinical and residential development are considered to be:



- Future site users (occupants and visitors);
- Construction/maintenance workers;
- Underlying groundwater (Secondary A Aquifer);
- Surface waters (Mearley Brook ~ 100m away);
- Buildings / Services; and,
- Adjacent properties and land users.

7.4 Ground Contamination Risk Assessment

By considering the sources, pathways and receptors, a preliminary assessment of the environmental risk is made with reference to the significance and degree of the risk. This assessment is based on consideration of whether the source contamination can reach a receptor and hence whether it is of significance (CIRIA C552).

The risk assessment has been carried out by assessing the severity of the potential consequence, the sensitivity of the target and the likelihood of occurrence, based on the categories given below (Tables 7.1 to 7.3).

A summary of the preliminary risk assessment for both on-site and off-site sources is given in Table 7.4.

Table 7.1 Potential Hazard Severity Definition

Category	Definition
Severe	Acute risks to human health, catastrophic damage to buildings/property, major pollution of controlled waters
Medium	Chronic risk to human health, pollution of sensitive controlled waters, significant effects on sensitive ecosystems or species.
Mild	Pollution of non sensitive waters, significant damage to buildings or structures
Minor	Requirement for protective equipment during site works to mitigate health effects, damage to non sensitive ecosystems or species, minor damage to buildings or structures

The likelihood of an event (probability) takes into account both the presence of the hazard and target and the integrity of the pathway and has been assessed based on the categories given below.



Table 7.2 Probability of Risk Definition

Category	Definition
High likelihood	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term
Low likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable

The potential severity of the risk and the probability of the risk occurring have been combined in accordance with the following matrix in order to give a level of risk for each potential hazard.

Table 7.3 Level of Risk for Potential Hazard Definition

		Potential Severity			
		Severe	Medium	Mild	Minor
Probability of Risk	High Likelihood	High	High	Moderate	Low/Moderate
	Likely	High	Moderate	Low/Moderate	Low
	Low Likelihood	Moderate	Low/Moderate	Low	Low
	Unlikely	Low/Moderate	Low	Low	Low

7.5 Summary of Risk Assessment

The Preliminary Risk Assessment (PRA) is summarised as Table 7.4.

The contamination risk posed by off site and on site sources to all receptors are considered to be generally **low**. Exceptions to this include the risk posed by the fuel tanks to controlled waters and ground gas originating from the Made Ground deposits which are considered to pose a **low to moderate** risk. The risk from natural ground sources is considered to pose a **moderate** risk to human health.

None of the risks identified are considered to be unacceptable for the proposed residential development.



Table 7.4 Preliminary Contamination Risk Assessment

ON SITE SOURCES						
Source	Pathway	Receptor	Justification	Severity	Probability	Risk
Ground Conditions – Possible presence of Made Ground	Dermal contact, ingestion and/or inhalation of vapours or dusts	Human Health – Future residential site users	The risk rating is based on the limited historical and recent potential contaminative uses of the site identified.	Medium	Unlikely	Low
		Human Health – Construction Workers	The risk rating is based on the above with mitigation measures in place such as good working practices and PPE.	Minor	Low	Low
	Leaching, and lateral and vertical migration of surface and ground waters	Controlled Waters (Secondary B Aquifer)	It is likely that the low permeability superficial deposits (Devensian Till) present at the site would provide some protection to the Secondary A Aquifer.	Medium	Unlikely	Low
		Controlled Waters (surface waters relating to on site drainage)	Any contamination is likely to be limited to leakage from the above ground fuel storage tanks. The hardstanding and bunds appear to be in good condition.	Medium	Low	Low/ Moderate
		Controlled Waters (off-site surface waters)	Any migration from the site to nearby surface waters will be limited due to low permeability strata of the Devensian Till. The nearest surface water features are also located at sufficient distance away from the site.	Medium	Unlikely	Low
		Adjacent Properties and Land Users	The risk rating is based on the limited historical and recent potential contaminative uses of the site identified, in addition to the presence of low permeability superficial deposits (Devensian Till).	Medium	Unlikely	Low
Ground gas – Possible presence of Made Ground	Generation and migration / accumulation of ground gases	Human Health – Future site users	The risk is worst case based on the possible presence of Made Ground on site.	Severe (Asphyxiation & Explosion)	Unlikely	Low/ Moderate
		Buildings and services		Severe (Explosion)	Unlikely	Low / Moderate



ON SITE SOURCES						
Source	Pathway	Receptor	Justification	Severity	Probability	Risk
Radon gas & carbon dioxide gas from natural bedrock sources	Generation and migration / accumulation of ground gases	Human Health – Future site users	The risk is based on the site being located in an intermediate probability radon area and a limestone area	Severe (Carcinogen & Asphyxiation)	Low	Moderate

OFF SITE SOURCES						
Source	Pathway	Receptor	Justification	Severity	Probability	Risk
Soil and groundwater contamination associated with present and historical uses surrounding the site.	Dermal contact, ingestion and/or inhalation of vapours or dusts	Human Health – Future residential users	Historically and presently, the site has been surrounded by a limited number of potentially contaminative sources, apart from possibly infilled quarries and nearby industrial processes. The presence of low permeability Devensian Till will limit both lateral and vertical migration thus potentially removing a viable pathway.	Medium	Unlikely	Low
		Human Health – Construction Workers		Minor	Unlikely	Low
	Lateral migration	Controlled Waters – shallow groundwater beneath the site		Medium	Unlikely	Low
Ground gas –Possible infill of historical quarries in vicinity	Generation and migration / accumulation of ground gases	Human Health – Future site users	The risk is worst case based on the possible infill of nearby historical quarries	Severe (Asphyxiation & Explosion)	Unlikely	Low / Moderate
		Buildings and services		Severe (Explosion)	Unlikely	Low / Moderate
Radon gas & carbon dioxide gas from natural bedrock sources	Generation and migration / accumulation of ground gases	Human Health – Future site users	The risk is based on the site being located in an intermediate probability radon area and a limestone area	Severe (Carcinogen & Asphyxiation)	Low	Moderate



8.0 CONCLUSIONS & RECOMMENDATIONS

8.1 Conclusion

The site has had limited historical potential contaminative uses. Based on the desk based information and PRA for the proposed clinical and residential future end use, it is not considered that the site would pose a significant risk.

The contamination risk posed by off site and on site sources to all receptors are considered to be generally **low**. Exceptions to this include the risk posed by the fuel tanks to controlled waters and ground gas originating from the Made Ground deposits which are considered to pose a **low to moderate** risk. The risk from natural ground sources is considered to pose a **moderate** risk to human health.

Based on the desk based information, it is not considered that further intrusive site investigations are required to refine the PRA at outline planning stage. WYG conducted early consultation with Ribble Valley Borough Council on the basis that there were a number of landfills within the general vicinity of the development site. A conversation with the Contaminated Land Officer confirmed that they would not require ground investigation at outline planning stage.

In order to refine the PRA during detailed planning it is likely that ground investigation will be required to formulate a Refined Risk Assessment (RRA).

8.2 Recommendations

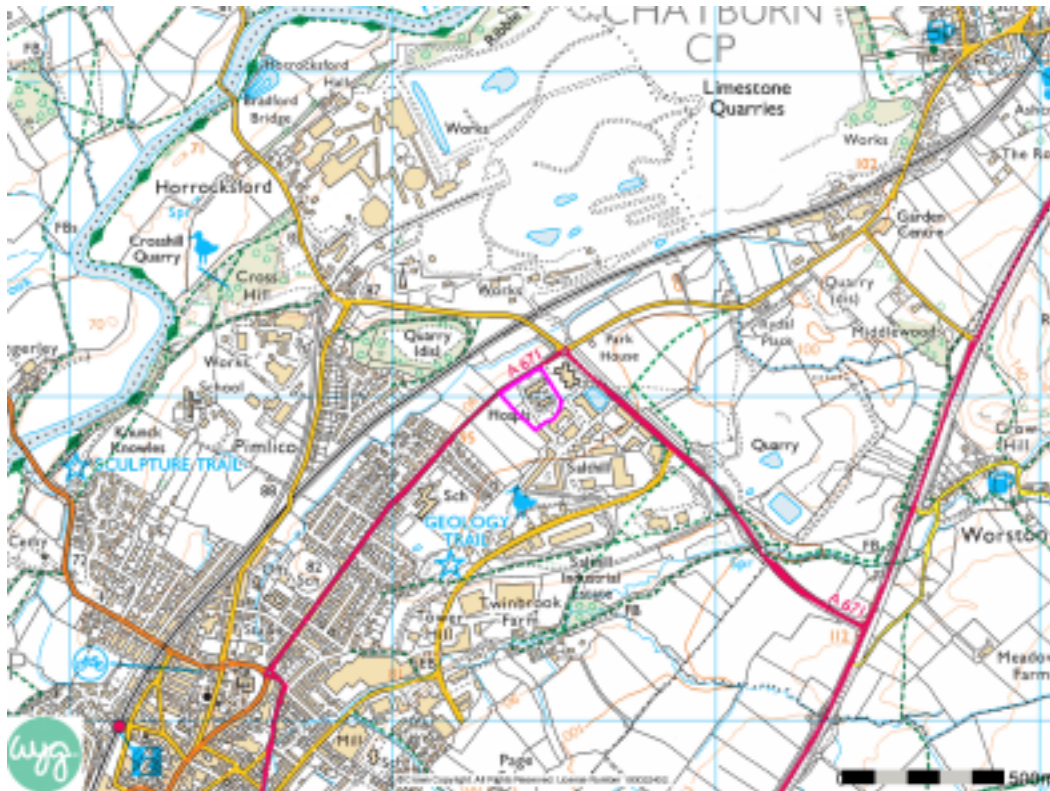
It is recommended that ground investigation is undertaken during the detailed planning stage in particular to determine gas risk posed site users with mitigation design (as required), a targeted assessment to determine if the fuel tanks have caused any localised impact and a geotechnical investigation to aid foundation design.

A bespoke radon report should be obtained from the British Geological Survey (BGS) for the site to determine the risk posed to future site users.



Figures





Key:  Site Boundary

Quay West at MediaCity UK
Trafford Wharf Road
Salford Quays
Manchester M17 1HH

Tel: 0161 872 3223
Fax: 0161 872 3192
E-mail enquiries @wyg.com



Project : Former Clitheroe Hospital

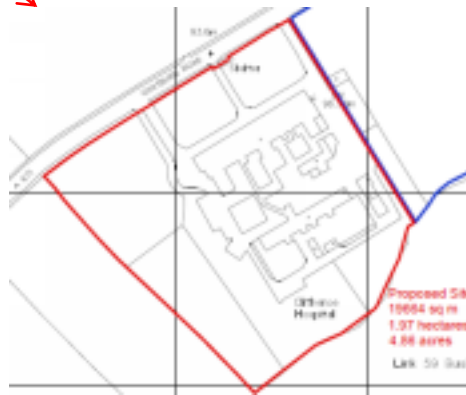
Client : NHS Property Services Ltd


Figure 1 – Site Location Plan

Project No.: A094939

Date: December 2015

Environmental Consultancy
Ground Technologies & Investigation



Key:  Site Boundary

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Ground Technologies & Investigation



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Figure 2 : Site Orientation Photographs

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Date: December 2015