



**Edgbaston Central Campus Development**  
Hybrid Planning Application

March 2012

**Ground Conditions Desk Study  
and Preliminary Risk  
Assessment**



**UNIVERSITY OF  
BIRMINGHAM**



University of Birmingham  
**Edgbaston Central Campus  
Development, Hybrid Planning  
Application**  
Ground Conditions Desk Study and  
Preliminary Risk Assessment

REP/01/CM

Final | 14 March 2012

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Job number 216558-06

**ARUP**





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# 1 Introduction

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Ove Arup and Partners (Arup) has been commissioned the University of Birmingham (UoB) to complete a desk study and Preliminary Risk Assessment of the Edgbaston Central Campus Development at Birmingham University.

The site which covers approximately 63 Ha is centred approximately on National Grid Reference (NGR) 404810 283860. The site location is given in Figure 1.

The aim of this report is to identify hazards in relation to foundation conditions and potentially harmful substances, and to determine from published information the geological and hydrogeological conditions beneath the site and within the immediate vicinity. These findings will inform a preliminary qualitative risk assessment to identify potential constraints and opportunities relating to redevelopment of the site. This report is a general desk study of the entire UoB Campus. As the masterplan develops, it will be necessary to review in more detail information relating to ground conditions at specific sites.

The desk study has been carried out in accordance with relevant guidance such as the Environment Agency's Contaminated Land Report 11, 2004 [1] guidance and the recently (2010) updated British Standard "Investigation of Potentially Contaminated Sites – Code of Practice", BS10175 [2].

## 1.1 Limitations

This report has been prepared for the UoB and takes into account their particular instructions and requirements. The benefit of this report may not be assigned to any third party. All reasonable skill, care and diligence have been exercised within the timescale available and in accordance with the technical requirements of the brief. Notwithstanding the efforts made by the professional team by undertaking the assessment and preparing the report, it is possible that other ground contamination or conditions as yet undetected may exist and consequently reliance on the findings of this report must be limited accordingly.

## 1.2 The Proposed Development

The proposed development consists of several individual developments, as listed in the schedule and shown on the red line application drawing included in Appendix A which form the Edgbaston Campus Development and includes the following:

- Demolition of the Gun Barrels pub, bowling green and bungalow to allow the development of the New Indoor Sports Facility and associated car park;
- Demolition of the Munrow sports centre and tennis courts and replacement with a new athletics track;
- Demolition of the Chemistry West building;
- Demolition of The Terrace Huts to make way for car parking;

- Demolition of the existing library;
- Construction of a new library;
- Development of new buildings fronting newly landscaped 'green heart' open space including potential location for small pavilion buildings within the 'green heart' open space;
- Refurbishment of part of the grade II\* Aston Webb building to create a new student services hub; and
- Construction of a new student accommodation block (Grange Road Student Residences) including a sports pavilion, café/bar and adjacent new road bridge.

Other works proposed include a new pedestrian route to the student residences at The Vale in the north of the site; an access road to the north of the metallurgy and Materials building; and traffic management/ improvements to the Pritchatts Road, located in the north of the Campus.

### 1.3 Information Sources

The following primary public information sources have been reviewed:

- Geological Survey of Great Britain (England and Wales) 1: 50 000 series, Sheet 168 of Birmingham, Solid and Drift edition (1996)[3];
- Envirocheck Historical Mapping[4];
- An Envirocheck Report[5] ;
- Multi Agency Geographical Information for the Countryside (MAGIC) maps - [www.magic.defra.gov.uk](http://www.magic.defra.gov.uk) [6]; and
- The Environment Agency Website - [www.environment-agency.gov.uk](http://www.environment-agency.gov.uk) [7].

The publically available information has been supplemented with a review of previous site investigation data and records held by the University along with reports held by Arup. The following previous site investigations have been provided and a selection of these has been reviewed:

- Ground Investigation at University of Birmingham Factual Report for University of Birmingham Engineer : Faber Maunsell Project number: PC073133 November 2007[8];
- Geotechnical Interpretative Report University of Birmingham Sports Facilities Development, Faber Maunsell Aecom December 2007[9];
- Ground Investigation, Birse, Selly Oak, Birmingham, Factual Report Version C Emmerson Moore Geosciences Ltd April 2007[10]; and
- Ground Investigation Report. Nicholls Colton Geotechnical. Proposed Student Accommodation, East Site, Selly Oak New Road, Birmingham (Nov 2011)[11].
- Report on Desk Study & Phase 1 Environmental Risk Assessment for Chancellor Court Auditorium University of Birmingham. Geotechnical Developments. December 2008[12] ;

- Ground Conditions for New Student Accommodation at Mason Hall, University of Birmingham. HM Geotechnics. October 2005 [13];
- Health and Safety File Incorporating the Geotechnical Investigation for Extension to Biology Building for The New Geography Block, Report No BG2612, 1999 [14];
- Geo-Environmental Ground Investigation and test report for a new steam supply at the University of Birmingham, Couch Consulting Engineers, 2006 [15].

Summaries of the above reports are provided in Appendix B.

## 1.4 Consultation

Consultation was undertaken with the Birmingham City Council Environmental Health Officer (EHO) by telephone on the 19 January 2012. The EHO reported that they had received a copy of the report by Geotechnical Developments [12] in connection with a previous planning application in 2008 (Ref; 2009/01614/PA). The report indicated that any potential sources of contamination have not adversely impacted the shallow soils. The EHO stated that other than this, there were no additional reports held by the Local Authority, other than those already owned by UoB.

Enquiries were also made to the Environment Agency (EA). The Environment Agency has confirmed that there is no contaminated land called a “special site” under the Part IIA of the Environmental Protection Act 1990. Furthermore the EA are not currently inspecting this or the adjacent land as a “potential special site” and have received no notification from the local authority that the land has been determined to be “contaminated land”.

## 2 The Site

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### 2.1 Site Location

The site is located approximately 4.5km to the south west of Birmingham city centre. The site is bound to the south by the Bristol Road (A38), The Vale to the north, to the west by the Birmingham & West suburban branch railway line and to the east Edgbaston Park Road. The site comprises the existing University of Birmingham main campus (Figure 1).

### 2.2 Site Description

The site largely comprises university buildings, with open areas of recreational spaces including sports grounds and an athletics track. There is system of internal roads and underground tunnels through the site and with car parking facilities located around the campus. The site boundary extends from The Vale Road in the north (approximate NGR 405133 284525), to the southern site boundary with the Bristol Road (at approximately NGR 404840 283120).

The site has an elevation of approximately 123.30m AOD in the south of the site rising to 146.30m AOD at the centre of the site at the junction of Pritchatts Road / University Avenue, falling slightly to 138m AOD in the north of the site.

The Bourn Brook flows along the southern boundary of the site in an easterly direction.

### 2.3 Surrounding Area

The Worcester and Birmingham canal lies to the west of the site and runs in a northeast to south alignment. The railway line is immediately parallel to the canal. The Queen Elizabeth hospital site is to the west of the railway, with residential properties further west and also to the north.

To the south of the site, the area is occupied by the Selly Oak and Bournbrook districts, which comprise a mix of commercial and residential properties. The A38 runs immediately south of the site and heads in a northeast to southwest alignment towards Birmingham city centre to the northeast.

The site is bound to the east by Edgbaston Park Road and is occupied by educational properties belonging to the University and King Edwards schools. Beyond this lies the Edgbaston Pool SSSI.

### 2.4 Geology

The published geology of the site is shown on the 1:50 000 BGS Sheet 168 for Birmingham, 1996 Solid and Drift edition [3]. The local details were described by R. Pickering in 1956 [16].

#### 2.4.1 Made Ground

The geological map shows no evidence of made ground, although it is likely that made ground does exist on site particularly in the area of the East Gate and to the

south where historical activity has taken place, (see history section 2.7). There may also be made ground in areas where earthworks has taken place to level the land for construction.

### 2.4.2 Alluvium

To the south of Ring Road South, across the southern edge of the University site, alluvial deposits are present associated with the Bourn Brook in the area coloured yellow on Figure 2. The alluvium is described as silty clay with sand and gravel and locally peat.

### 2.4.3 Glacial Deposits

The drift geology of the site comprises a thick and complex sequence of glacial deposits, which extend across the majority of the site. Only across the south east part of the site are glacial deposits locally absent.

Some of the details of the drift deposits on the University site are seen in boreholes and excavations from the 1950s, compiled and published by Pickering in 1956), see reference [16]. This described a sequence more than 20m thick in places, with eight separate units. The upper part of the sequence comprising Glacial till (coloured blue on Figure 2). The lower part of the sequence comprising mainly fluvio glacial deposits, interbedded with glaciolacustrine horizons (coloured pink on Figure 2).

The fluvio glacial deposits are described on the BGS map as yellow and orange sand and gravel. The glaciolacustrine deposits are described as yellow to brown stoneless clay and silt. The glaciolacustrine deposits occur in several places, including the western part of the site in the vicinity of West Gate, the area of the old gymnasium, (proposed for demolition) and in the area of the proposed new library (presently playing fields).

Much of the glacial material beneath the site area, particularly on the side of the Bourn Brook valley, is overlain by a thin gravelly Head deposit formed by periglacial mass wasting processes during the last glacial period.

The more permeable horizon of the drift deposits will contain minor amounts of perched groundwater, which may locally lead to seepages and springs particularly after wet periods.

### 2.4.4 Solid Geology

The solid geology of the site comprises the Triassic Bromsgrove Sandstone Formation and the underlying Wildmoor Sandstone Formation. The boundary between the two formations underlies the university along the dashed line shown on Figure 2.

The BGS map describes the Bromsgrove Sandstone as a red-brown micaceous sandstone, pebbly in part, interbedded with mudstone in the upper part.

The BGS map describes the Wildmoor Sandstone Formation as orange-red feldspathic sandstone with sparse, thin mudstone beds.

The very south eastern corner of the site, within the area of the Gun Barrels public house, is crossed by the north east to south west trending Birmingham fault. This down throws to the south east the Triassic Mercia Mudstone Formation. The Mercia Mudstone is described as red, with grey-green siltstone and sandstone beds.

## 2.5 Previous Ground Investigations

A review of previous reports has been carried out and a brief summary is provided in Table 1 below. Figure 3 shows the approximate location for each of the reports provided.

Table 1 Summary of Previous Reports

Report Title	Investigation	Findings
Report on Desk Study & Phase 1 Environmental Risk Assessment for Chancellor Court Auditorium University of Birmingham. Geotechnical Developments Dec 2008	Desk Study & Phase 1 Environmental Risk Assessment	Evidence of the semi volatile compound (SVOC), Bis (2-ethylhexyl) phthalate was found within the groundwater, although the concentration was significantly below the World Health organisation (WHO) screening values. Despite this, a moderate risk rating was applied to the site.
Ground Investigation, Birse, Selly Oak, Birmingham, Factual Report Version C April 2007 Emmerson Moore Geosciences Ltd	Geotechnical investigation to Battery Retail Park. Investigation comprised boreholes, drillholes, trial pits, laboratory testing and reporting.  15 boreholes, 5 window sample holes and 7 trial pits. Gas and groundwater standpipes installed.	Made Ground up to 3.10m thick loose red/brown to very dense granular material.  Re-worked alluvium /alluvium, medium dense to very dense gravels, cobbles, boulders sand and firm to stiff clays and organic clays. Variable thickness, over 2.5m in places.  Bedrock comprised thinly bedded locally weathered and fractured sandstone with interbedded mudstone and siltstone.  Elevated levels of lead max 920mg/kg.
Ground Investigation Report. Nicholls Colton Geotechnical. Proposed Student Accommodation, East Site, Selly Oak New Road, Birmingham. November 2011	Site investigation for a multi-storey student residence with sports and leisure facilities on the East Site, Selly Oak. Investigation comprised 13 boreholes, 2 rotary coreholes, 15 trial pits, in situ and laboratory testing and reporting.	The ground investigation revealed made ground, superficial deposits of clay, sands and gravel, overlying the Wildmoor Sandstone formation.  Concrete slab 0.3m thick and intact foundations present.  GW encountered at 2.0m bgl  Elevated As, Pb, Ni, hydrocarbons  Chrysotile asbestos identified.  Slightly elevated Cu, VOCs and hydrocarbons  Gas characterisation 1 very low risk.
Ground Investigation at University of Birmingham Factual Report for University of Birmingham Engineer: Faber Maunsell Project Number: PC073133 November 2007  Geotechnical Interpretative Report	Geotechnical investigation to site area covered by South Car Park. Investigation comprised 7 boreholes, 10 drillholes, 10 trial pits, in situ and laboratory testing and reporting.  Interpretative report of above.	Made Ground  Bromsgrove Sandstone & Mercia Mudstone  Elevated levels of TPH, pH, PAH in soil samples; Elevated mg, k, Cl in groundwater samples



University of Birmingham Sports Facilities Development, Faber Maunsell Aecom December 2007		
Ground Conditions for New Student Accommodation at Mason Hall, University of Birmingham. HM Geotechnics October 2005	Site investigation at Mason Hall. Investigation comprised 18 boreholes, 20 trial pits, laboratory testing and reporting.	Made ground up to 1.6m, (concrete slabs, old services at 0.5m and 0.75m bgl)  Glaciofluvial deposits 1.4 – 4.9m  Bedrock of Bromsgrove & Wildmoor Sandstone Difficult to distinguish between the base of the glaciofluvial and weathered bedrock surface. Significant contamination not identified.
Health and Safety File Incorporating the Geotechnical Investigation for Extension to Biology Building for The New Geography Block, Report No BG2612 1999.	Fieldwork and laboratory testing for extension of the existing Biology Building. Investigation comprised boreholes and laboratory testing.	Made ground to 5m bgl, medium dense brown slightly-grey brown silty sand containing bricks. Soft black peaty clay and clayey sand (alluvium) 0.10 to 1.0m thick Glacial deposits of medium dense to dense brown sandy gravel with pockets of firm silty clay. Weathered Triassic sandstone described as becoming very dense very poorly cemented sand/ very weak sandstone.  GW present at 127.5 and 131.0m AOD, dropping in a westerly direction. Limited chemical testing identified high levels of toluene (max 4030mg/kg) and pH >9.
Geo-Environmental Ground Investigation and test report for a new steam supply at the University of Birmingham, Couch Consulting Engineers 2006	Ground investigation for the proposed construction of a below ground subway. Three boreholes to 10m , one hand dug pit to 1.2m	Made Ground- 0.3m -6.0m bgl.  >10m Superficial deposits of gravel and clay, underlain by medium dense gravelly sand.  Groundwater encountered at 3.65mbgl and perched water at 6.0m bgl at base of MG/ clay interface. High levels of sulphide detected.

In general, the previous reports confirm the geology presented on the BGS map. The previous investigations broadly identify similar geological conditions comprising made ground, superficial deposits of alluvium and or glaciofluvial deposits with underlying bedrock of Triassic Sandstone and Mudstones. The made ground and superficial deposits vary greatly across the site in both thickness and composition.

A summary of selected reports provides further details of the geology and contamination across the site and is provided in Appendix B.

## 2.6 Hydrogeology

The Bromsgrove Sandstone is classed as a Principal Aquifer.

The Environment Agency describes a Principal aquifer as layers of rock or drift deposits that have high intergranular and/or fracture permeability allowing the rock to storage a large amount of water. They may support water supply and/or river base flow on a strategic and /or regional scale. In most cases, principal aquifers are aquifers previously designated as major aquifers, [7].

The Mercia Mudstone, in the south-eastern corner of the site is classed as a Secondary B aquifer. A Secondary B aquifer predominantly has lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering [7].

The Glaciofluvial sand and gravel deposits are classed as a Secondary A aquifer. Secondary A aquifers comprise permeable layers that are 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 Glaciolacustrine deposits are described as unproductive strata and have a low permeability with negligible groundwater storage capacity.

### 2.6.1 Soil Leachability

The Envirocheck Report [5] shows the soils in this area are classified as having a high leaching potential.

### 2.6.2 Source Protection Zone

The Environment Agency has defined Source Protection Zones (SPZs) for groundwater sources such as boreholes used for public water supply. These zones show the risk of contamination posed by activities that may cause pollution of the groundwater in the area, the closer the activity, the greater the risk, [7].

The site does not within a Source Protection Zone.

The Envirocheck report indicates a Source Protection Zone borehole located immediately west of the railway line near to West Gate.

## 2.7 Site History

Historic Ordnance Survey (OS) maps dating back to 1888 have been obtained as part of an Envirocheck Report and have been reviewed. The historical summary is provided below.

Table 2 Summary of Historical Activity

Date	Historical On- Site Activity	Historical Off- Site Activity
1888	<p>The site is occupied by as parcels of land, with hedgerow or tree-lined field boundaries.</p> <p>A well is present within the south-western section of the site.</p> <p>The southern section of the site is occupied by a rifle range, with the Gun Barrels Inn situated in the vicinity of the current Gun Barrels Pub, to the south east.</p> <p>Along the eastern site boundary a small gravel pit is shown. This was located in the area of East Gate that is today used as the main entrance to the campus</p>	<p>The Birmingham &amp; West suburban branch railway line and the adjacent Worcester &amp; Birmingham Canal and tow path are present in their current day location, to the west of the site.</p> <p>A tramway is present along the Bristol Road to the south of the site.</p>
1904	<p>University under construction. Evidence of two buildings occupying the south western section of the site and the University Road heading toward the buildings.</p> <p>A large cycle works occupies the south western site boundary. Adjacent to the cycle works is a Gun &amp; Rifle Factory.</p>	<p>The area to the south of the site is occupied by residential properties including a hotel, tram depot and Friends Meeting House.</p> <p>Sand pits are located approximately 250m from south western site boundary. A metal works lies approximately 150m further south from the sand pits.</p>
1917-1938	<p>The main red brick university buildings including the clock tower and the Aston Webb buildings had been constructed / under construction along with an internal road system to the south of University Road.</p> <p>A gasometer is shown approximately 150m west of the clock tower.</p> <p>The cycle works, in the south, has extended slightly.</p>	<p>There is a timber yard on the southern boundary, opposite Arley road.</p>
1938-1955	<p>The cycle works to the south had extended further and there were now numerous factories including “Boxfoldia” a cardboard box manufacturer and undefined works along the south boundary of the site occupying Dale Road.</p>	<p>The Queen Elizabeth (QE) hospital is shown to the west and links to the site via the extended University Road.</p>
1955- 1966		<p>An unspecified depot (possibly the timber yard) and garage present on southern boundary occupying the land east of the Gun &amp; Rifle factory between the Bristol Road and the Bourn Brook. The depot and garage are shown on the maps up until the</p>

		late 1990s. and Petrol filling station.
1966-1980	Major expansion of the university underwent with development on land to the north of University Road. The gravel pit no longer shown.	Two refuse tips approximately 250m from the south west corner of the site, located on the former sand and gravel workings.

Since the 1960s the area surrounding the site has undergone general development. To the east there has been construction of further university buildings and the King Edwards School and to the west expansion of the QE Hospital. The timber yard (Vincent Timbers) and the garage, formerly Patrick Motors, were demolished in 1997/1998, for the construction of a Tesco Express

In more recent years the land to the west and south has undergone major redevelopment with the construction of the new QE hospital and the Selly Oak Bypass and associated trunk road system in the area. There is evidence on the historical maps of tanks being present at various locations on site over time. There is also evidence of streams or a brook flowing through the north- west section of the site in the area of the present day Munrow Centre.

It is also important to note that the historical maps may miss evidence of historical activity and other potential hazards may not be indicated on the maps.

## 2.8 Buried / Underground Structures

There are a series of underground tunnels across the university campus which the University has mapped. There is also an underground mine “The Model Mine” that was historically used by the engineering department. The entrance to the mine is located near to the south car park, in the south-eastern corner of the site and extends north beneath Ring Road South and the Physics East Building.

The recent ground investigation just to the south of the site boundary for the proposed new Grange Road Student Residences revealed intact concrete floor slabs.

## 2.9 Environmental Setting

The environmental datasets contained within the Envirocheck Report [5] have been reviewed. A summary of the findings is given below. Further details are provided in Appendix C.

### On site

- The site is within a Nitrate Vulnerable Zone.
- There are three records relating to discharge consents for the onsite area.
- There is one record of a pollution incident which occurred in 1997 and was classed as a minor incident.
- There are four groundwater abstraction licences held by the University.
- There are no recorded landfill sites with the university site boundary.

- There were two mineral workings located on site. Both were opencast workings within the sand and gravel deposits and have now ceased. These records relate to the gravel pit working shown on the historical maps and not the Model Mine within the grounds.
- The nearest surface water feature is the Bourn Brook which flows through the southernmost section of the site. The brook flows east to its confluence with the River Rea at Cannon Hill Park just over 1km to the east of the site. The Environment Agency Web site records for 2009 show the chemistry water quality, in the Bourn Brook, as Grade B and the biology as D.
- There are three active records for registered radioactive substance permits held by the University.

University records show the location of a low level radioactive waste disposal area. A map provided by the university estates department has been reviewed, locating the disposal area which states that low level radioactive waste material was deposited at 1300ft (approximately 400m) below ground level. The Health and Safety department at the university have confirmed that there is no plausible risk, which is verified by the survey undertaken in the 1990s. This is discussed later in Section 3.2.1 and detailed in Appendix D.

### Off site

- The surrounding area is also within a Nitrate Vulnerable Zone.
- Edgbaston Pool a Site of Special Scientific Interest (SSSI), is situated approximately 134m at its nearest to the eastern site boundary.
- There are five discharge consents within 500m of the site;
- There are records for three pollution incidents within the nearby surrounding area each incident was classified as minor incident.
- The Envirocheck Report indicates that there are a total of six recorded historical landfill sites within the surrounding area; however the records all refer to one location to the south west of the site, as discussed in section 2.8 above. The records show that the landfill licence was held by the Birmingham Battery and Metal Company Ltd, and input began in 1967. The site was licensed to receive inert, industrial and household waste. The last input date at the landfill was given as December 1987.
- There is one operational registered waste treatment or disposal site licensed to JP Monk Reservoir motors scrap yard, approximately 550m to the west.
- The QE hospital, located approximately 200m to the west at its closest, holds an active registered radioactive substance permit.
- The nearest active contemporary trade is located south of the site at Tesco Express filling station along Bristol Road. Within 500m of the site boundary there are 12 active contemporary trade entries and these include: Garage services, Tyre Dealers, Car Body repairs, fireworks stockist, MOT

services, commercial cleaning services, vacuum sales and services, classic car specialists and hospitals.

- There are two fuel station entries recorded on site (in map A). There are three fuel station entries recorded on map B- south east of the site. There is one fuel station entry recorded on each of the maps C and D to the North West and north east of the site.
- The Worcester and Birmingham canal lies immediately along the western site boundary of the University campus. The Envirocheck report records the water quality within the canal sampled near to the battery works, has a GQA Grade E in 2000. The Environment Agency Web site record available for 2009 shows the chemistry water quality as Grade D and the biology as F (A being Very Good, F being bad).

### 3 Preliminary Risk Assessment of Contaminated land

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Current legislation on contaminated land is principally contained in Part IIA of the Environmental Protection Act 1990 introduced by Section 57 of the Environment Act 1995. The Contaminated Land Regulations came into force on 1<sup>st</sup> April 2000 and introduced the current regime for identifying and remediating contaminated land.

The legislation endorses a ‘risk assessment’ approach, where remedial action is only required if there are unacceptable risks to health or the environment, taking into account the use of the land and its environmental setting.

The legislation defines contaminated land as:

“Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that significant harm is being caused or there is a significant possibility of significant harm being caused; or pollution of controlled waters is being, or is likely to be, caused”.

The definition of contaminated land embodies the concept of risk assessment. The risk assessment methodology is described further in CLR 11 [1], in terms of significant pollutants and significant pollutant linkages within a source-pathway-receptor model of the site. The model comprises identification of:

**Sources** – the key pollutant hazards associated with the site;

**Receptors** – the key targets at risk from the sources; and,

**Pathways**– the means by which the contaminant can cause harm to the receptor.

For land to be identified as contaminated all three elements of a significant pollutant linkage must be present.

A qualitative assessment of risks has been completed by identifying the nature of potential contamination hazards, potential receptors on and around the site, and by considering the likely pathways between them.

#### 3.1 Conceptual Site Model

The EA requirements for Land Contamination Reports define the conceptual model for a site as follows:

*“The conceptual model is a representation of the understanding of the site and the surrounding environment including the geology, groundwater, surface water bodies, potential contamination, processes acting on substances present and contaminant migration pathways. It should describe all potential pollutant linkages at the site, taking into account the current and proposed uses of the site”*

## 3.2 Potential Sources of Contamination

### 3.2.1 On site

#### Current on site potential sources include:

- Made ground, although not shown on the geological maps, has been proven in the proposed location for the student residences at Grange Road in the south of the site. Made ground may also be present in the areas of historical mineral workings. The extent, thickness and composition of made ground material is variable and is a potential source of contamination.
- The university is registered to hold radioactive substances. It is anticipated that the radioactive material on site is low- level and associated with education and research purposes.
- Evidence from the university Estates department indicates a historical radioactive waste disposal area located within the campus in the area of land immediately south of computer science and west of Alta Bioscience. The Health and Safety department at the university hold limited information regarding the radioactive waste, but state that during the 1950s low level radioactive material was deposited approximately 400m below ground, within a borehole. The material is believed to be phosphorus -32 and sulphur-35 which have very short half lives of between 14 days and 90 days. A series of tests at shallow depths were carried out by the university in 1999. The tests did not identify any radioactive material above detection level, within the vicinity of the waste store and concluded that there is no detectable radiological hazard present on site. No proposals lie directly above this area, although the nearest proposed works is for the demolition of the chemistry west building approximately 50m to the northwest. See Appendix D.
- In the southern area of the site, adjacent to the proposed new access bridge to Dale Road, there are three large gas holders. The gas holders were not shown on the historical mapping prior to 1999, and would suggest they are of modern construction with appropriate bunding / mitigation measures in place.
- There are electricity sub stations and an electricity switching station situated within the university campus, which are a potential source of PCBs;
- Car parking areas around the site are a potential source of low levels of contamination associated with leaks from vehicles although the risk would be very minimal as interceptors and drainage capture would have reduced this risk;
- Potential for the existing older building stock, which are due for demolition, to contain asbestos containing material (ACM);
- Other on site sources may include ancillary buildings which stored fuels and chemicals and possible below ground tanks.



### Historical sources on site

The first edition maps in 1888 show gravel workings, which occupy the area around the East gate up until at least 1958.

Between 1888 and 1995 a well, tanks and a gasometer were present in the vicinity of the existing Chemistry West Building (Y3).

The historical maps also show a tank immediately west of the Baber Institute of Fine Arts in the east of the site.

Historical on site sources of contamination include the Cycle works, and Gun & Rifle factory which once occupied part of the southern boundary of the site. Both factories have recently been demolished to make way for the A38 Selly Oak By-pass and proposed student halls of residence. The A38 Selly Oak By-pass has since been constructed and is fully operational. The remainder of the factory sites land currently remains undeveloped and is the site for the proposed new student accommodation and sports pavilion.

It is considered during construction of the by-pass limited remediation will have taken place along the route. The area proposed for the student accommodation and sports pavilion has not undergone any remediation to date.

### 3.2.2 Off site

#### Current off-site potential sources of contamination include:

- The Tesco Express filling station south of the site.

#### The historical off site sources include:

A depot/ timber yard and a garage occupied the land immediately adjacent to the southern boundary of the site from the late 1950s up until the late 1990s when the buildings were demolished to make way for the A38 Selly Oak By-pass and the Tesco Express & petrol station.

The battery works landfill site was licensed to receive inert, industrial and household waste and although it is a historical landfill, it is still present and is also considered a current off site source of contamination. Given the date of operation it is considered that the landfill would not have been lined and waste would have been deposited directly within the former sand and gravel workings. The historical mapping also show surface water courses flowing in the area connecting with the Bourn Brook, which then goes on to flow through the site. It is considered that the industrial waste within the landfill was that associated with the adjacent Battery and Metal factory that also operated the landfill site.

Approximately 500m south-west of the site, part of the land formerly owned by the Battery and Metals Works was redeveloped as Battery Retail Park in the 1990s. The Battery and Metal works main office building remained until its demolition in 2008/2009. The land where the office once stood currently remains empty and it is not known if any remediation has taken place at the site.

### 3.3 Potential Receptors

The potential receptors are grouped in to three main categories, Human Beings, Environmental and the Built Environment. Information relating to source, pathway and receptor linkages is contained in on and off site conceptual site model information reported in Table 3 Conceptual Site Model.

#### 3.3.1 Human Health

The main human contaminant receptors for the site are considered to be:

- Students/ staff/ visitors at the University; and
- Construction workers for the proposed works.

Sensitive off site receptors are considered to be:

- The nearby residents, schools and hospital.

#### 3.3.2 Environmental

The main environmental receptors are:

- Groundwater: The extensive deposits of Glaciofluvial sand and gravel form a Secondary A aquifer and are underlain by the Bromsgrove Sandstone Formation. The sandstone is classified as a Principal Aquifer and extends beneath the majority of the site. The Mercia Mudstone, in the south-eastern corner of the site is classed as a Secondary B aquifer.
- Surface waters: The Worcester and Birmingham Canal, the Bourn Brook and River Rea catchment.
- Edgbaston pool SSSI situated approximately 200m to the west of the site, and the adjacent Winterbourne Botanical gardens.

#### 3.3.3 Built Environment

Buried concrete structures such as foundations and services beneath the site can be at risk from sulphate attack, which is the degradation of concrete caused by high sulphate within the ground. High sulphate content can be naturally occurring in some rock types and can also be present in contaminated ground or groundwater. The ground investigation data from the site [9] show the sulphate content in the Mercia Mudstone and the superficial deposits in the south cark park have been assessed in accordance with BRE Special Digest 1 [20] for each of the material types encountered. The Design Sulphate Class and Aggressive Chemical Environment for Concrete Class (ACEC Class) for soil types are DS1 and AC-1.

The shallower occurrence of the Mercia Mudstone is limited to the south western section of the site. The majority of the site is underlain by superficial deposits and Sandstone, with some made ground, which should also be assessed in terms of Concrete design.

### 3.4 Industrial profiles

Industrial profiles provide a general classification of various industrial activities and provide a guide to the type of contamination which might be expected. Industrial profiles for the historical activities on and around the site are provided on the Environment Agency Web site and have been summarised below:

Cycle Works/ Motor works / gun and rifle factory – Engineering Works [19]

For this historical use, typical contaminants might include:

- metals, metalloids and compounds such as: aluminium, antimony, barium, cadmium, chromium, copper, iron, lead, nickel, selenium, silver, tin, zinc;
- Inorganic ions, acids, alkalis, fuel and other oils;
- Solvents and other general industrial contaminants such as asbestos and polychlorinated biphenyls (PCBs).

Table 3 Conceptual Site Model presents an assessment of whether there is a plausible pathway between the potential receptors and each of the possible sources of contamination at the site.

Table 3 Conceptual Site Model

	Sources	Pathway	Receptor	Plausibility of Linkage if no mitigation adopted
On site Current	Possible Asbestos containing Materials in current building stock due for demolition	Inhalation Dermal contact Ingestion Direct exposure Air borne particulates	<b>Human Health:</b> Construction workers, site users, visitors, neighbours, school, hospital	Not plausible if correct surveys and procedures are adopted when assessing and removing asbestos.
	Made Ground including confirmed asbestos and potentially contaminated materials of unknown composition	Inhalation Dermal contact Ingestion Direct exposure Ingestion via contaminants bio accumulated in plants	<b>Human Health:</b> Construction workers, site users, visitors, neighbours, school, hospital	Plausible: Mitigation and controls will be required during the construction phase
		Migration via man made pathways such as drains and underground services, mine workings Migration via historical field boundaries Transfer of contaminants via surface run off Leaching and migration into ground and surface water	<b>Environmental:</b> Surface water systems, including Bourne Brook and River Rea Catchment, Worcester and Birmingham canal Groundwater: Underlying Principal and Secondary aquifers	
		Direct Contact	<b>Building Fabric</b>	

	Sources	Pathway	Receptor	Plausibility of Linkage if no mitigation adopted
			<b>Sulphates</b> , abnormal pH and hydrocarbons may impact foundations and/or water supply pipes	
	Radioactive waste disposal area	Inhalation Dermal contact Ingestion Direct exposure Air borne particulates	<b>Human Health:</b> Construction workers, site users, visitors, neighbours, school, hospital	Not plausible: Deep underground disposal during the 1950's with very short half lives Survey in 1999 did not detect radiation above background counts, concluding no detectable radiological hazard.
	Gas Holders	Inhalation Dermal contact Ingestion Direct exposure	<b>Human Health:</b> Construction workers, site users, visitors, neighbours, school, hospital	Not plausible: modern construction, bunding and pollution controls measures are anticipated
	Gas holders	Migration via man made pathways such as drains and underground services, mine workings Migration via historical field boundaries Transfer of contaminants via surface run off Leaching and migration into ground and surface water	<b>Environmental:</b> Surface water systems, including Bourne Brook and River Rea Catchment, Worcester and Birmingham canal Groundwater: Underlying Principal and Secondary aquifers	Not plausible: modern construction, bunding and pollution controls measures are anticipated
		Direct Contact	<b>Building Fabric</b> <b>Sulphates</b> , abnormal pH and hydrocarbons may impact foundations and/or water supply pipes	
	Car parking : hydrocarbons from fuel leaks	Inhalation Dermal contact Direct exposure	<b>Human Health:</b> Construction workers, site users, visitors,	Very limited plausibility associated with leaks and spills and surface run off, as mitigation is provided in interceptors
	Ancillary buildings/ stores Electricity substation and switching	Transfer of contaminants via surface run off Leaching and migration into ground and surface water. Migration via man made pathways such as drains and	<b>Environmental:</b> Surface water & Groundwater systems	

	Sources	Pathway	Receptor	Plausibility of Linkage if no mitigation adopted
	station PCBs	underground services		
On Site Historical	Gasometer (gas holder) shown 1917 to 1955 Tanks; near Mech & Civil Eng building (1904) & Barber inst.	Inhalation Dermal contact Ingestion Direct exposure	<b>Human Health:</b> Construction workers, site users, visitors, neighbours, school, hospital	Limited Plausibility: the gasometer was removed prior to 1960. Residual contamination may remain (depending upon level of remediation).
		Migration via historical field boundaries Transfer of contaminants via surface run off Leaching and migration into ground and surface water. Migration via man made pathways such as drains and underground services	<b>Environmental:</b> Surface water & Groundwater systems	
	Former Cycle Works and Gun & Rifle Factory	Inhalation Dermal contact Ingestion Direct exposure	<b>Human Health:</b> Construction workers, site users/ residents & visitors, neighbours,	Plausible: factories have been demolished and only part of the land has been redeveloped, Contamination remains in undeveloped areas.
		Migration via historical field boundaries Transfer of contaminants via surface run off Leaching and migration into ground and surface water. Migration via man made pathways such as drains and underground services	<b>Environmental:</b> Surface water & Groundwater systems	
Off site current	Tesco Petrol Station	Inhalation	<b>Human Health:</b> Construction workers, site users, visitors, neighbours,	Not Plausible: should have adequate containment facilities
		Transfer of contaminants via surface run off Leaching and migration into ground and surface water. Migration via man made pathways such as drains and underground services	<b>Environmental:</b> Surface water & Groundwater systems	Not plausible: Mitigation measures in place.
	Depot, timber yard, garage	Migration via historical field boundaries Transfer of contaminants via surface run off Leaching and migration into	<b>Environmental:</b> Surface water & Groundwater systems	Not plausible-redeveloped/ possible remediation

	Sources	Pathway	Receptor	Plausibility of Linkage if no mitigation adopted
		ground and surface water. Migration via man made pathways such as drains and underground services		
	Historical Landfill leachate and gas	Leaching and migration into ground and surface water. Migration via man made pathways such as drains and underground services Migration via historical field boundaries and streams Transfer of contaminants via surface run off Migration and accumulation of ground gases	<b>Human Health:</b> Construction workers, site users, visitors, neighbours, school, hospital	Not plausible when mitigation measures are applied such as PPE
	Historical Landfill leachate and gas (continued)		<b>Environmental:</b> Surface water systems, including Bourne Brook and River Rea Catchment, Groundwater: Underlying Principal and Secondary aquifers	Plausible
			Building stock	Not Plausible accumulation of gases within new building stock if gas risk assessment and mitigation is applied.
Off site historical	Sites of demolished Battery and Metal works			Not plausible

### 3.5 Geotechnical properties / Foundation Conditions

The ground investigations suggest the presence of thick accumulations of clay and gravels within the alluvium deposits of the Bourn Brook river valley. There is some uncertainty regarding the origin of the clays and gravels it is considered that the Bourn Brook is a small river valley and would not necessarily produce such thick alluvial deposits. The layers of clay and gravels may be attributed to glacial Head deposits which have moved down the valley sides from the higher levels of the site. If Head deposits are present at this location it should be noted that Head deposits present difficult engineering properties and slip surfaces, which should be taken in to consideration in the design of any foundations. It is not recommended to use shallow foundations where Head deposits are present.

More suitable founding mediums and foundation types are presented below:

Table 4 Foundation Conditions

Strata type (colour coding as Figure 2)	Building Type	
	Lightly Loaded and/or tolerant to settlement	Heavily loaded and/or sensitive to settlement
Alluvium	Pad foundations (for very lightly loaded foundations)	Piles
Glaciofluvial Deposits	Pad foundations	Pad Foundations or piles
Mercia Mudstone	Pad foundations	Piles
Bromsgrove/Wildmoor Sandstone	Pad foundations	Pad foundations

Locally high groundwater may be an issue in places e.g.: in the Bourn Brook valley within the superficial deposits. Due to the thickness and variability of the superficial deposits, larger structures are likely to require piled foundations into the underlying bedrock.

### 3.6 Potential Ground Hazards

A summary of the potential ground hazards thought to be present on site are given in Table 5 below. The summary is based on the desk study information and the reports provided for review. There are areas within the proposed development site which have not been subject to ground investigation and chemical testing, and so the potential for ground hazards remains unknown.

The potential contamination sources are shown on Figure 4 and potential ground hazards on Figure 5.

Table 5 Potential hazards associated with the proposals

Proposed Construction		Potential hazardous ground conditions
New Builds & Enabling Works	New Indoor Sports Facility and Car Park	Birmingham fault; different geology either side of fault Location of “Model Mine”. Localised low level contamination.
	New Main Campus Library	Thick accumulations of glaciolacustrine deposits
	New Grange Road Student Residences and Sports Centre and bar	Contamination from former works including metals, organics and asbestos. Potential variable ground conditions and made ground following demolition of original works Possible Head deposits Intact concrete foundations and factory slab
	New Library Store	Thick accumulations of glaciolacustrine deposits
	New sports pavilion (no 16b)	Thick accumulations of glaciolacustrine deposits
	Gisbert Kapp Multi storey Car Park	No issues identified
	Grange Road bridge crossing	Thick accumulations of superficial deposits; Possible Head deposits; possible made ground
	Library Enabling Works	Thick accumulations of superficial deposits; Possible made ground
	Replacement development on site of Munrow Sports Centre	Thick accumulations of superficial deposits; Possible made ground
	Green Heart landscaping	Possible localised low level contamination from existing car parking.
Improvements to traffic systems and car parking (including pedestrian traffic)	Extended Grange Road car park	Possible localised low level contamination from existing car parking. Thick accumulations of superficial deposits
	Access Road to the rear of Gisbert Kapp	No issues identified
	Pritchatts Road Improvements	Possible localised low level contamination from existing road; possible areas of thick accumulations of superficial deposits along route.
	Extension to Pritchatts Road Car Park	Possible localised low level contamination from existing car parking
	Pedestrian and cycle route to the Vale	No issues identified
Proposed Demolition	Terrace Huts	Possible localised low level contamination associated with servicing and heating the building and in areas of made ground
	Chemistry West-	
	Old Gym	Possible asbestos containing materials within building stock
	Existing Library	
	Sub-Station 24	
	Munrow Sports Centre	



### 3.7 Summary of Findings

The publically available records show that the university site was developed from the beginning of the C20th, with major expansion in the 1960s. During this time there have been potential sources of contamination located on site, including gas holders and a gasometer, fuel tanks, infilled gravel pits and the cycle works and gun & rifle factory. Not shown on the mapping are the current day ancillary buildings, including potential hazards on site associated with the heating, maintenance and other chemical stores (e.g. for the swimming pool in the Munrow centre and those held in the Chemistry West building).

A radioactive waste disposal area within the campus was surveyed in 1999. The waste is buried at nearly 400m below ground during the 1950s. The waste is believed to have very short half lives of up to 90 days. The survey was carried out down to 1.5m and did not detect any radiation above background levels. The survey concluded that there was no detectable radiological hazard present on site at shallow levels. No proposals lie directly above this area, although the nearest proposed works is for the demolition of the chemistry west building approximately 50m to the northwest and is not considered a plausible risk.

The land along and immediately adjacent to the southern site boundary presents the greatest historical potential source of contamination. This area has undergone a period of demolition over the past decade or so.

The area for the proposed New Grange Road Student residences was previously occupied by the Aerial cycle/motor works, Boxfoldia and in part the gun & rifle factory. These premises have since been demolished and the Selly Oak New Road has recently been constructed in the immediate vicinity. No remediation has taken place at the proposed residence site and elevated hydrocarbon and heavy metal contamination have been identified within the ground.

The geological ground conditions are generally comprised of made ground, superficial deposits of alluvium and glaciofluvial material, with bedrock comprising Triassic sandstones and mudstones. The superficial deposits across the site vary in composition and in some areas are of considerable thickness and absent in others. The Birmingham fault crosses the south eastern part of the site, although the exact location has not been confirmed by previous investigation.

## 4 Recommendations for Further Work

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It is recommended that a comprehensive ground investigation (GI) including further detailed desk studies are carried out. This should be in the areas of proposed construction that have not already had GI works, and will determine the level of contamination at each location, and allow ground gas and groundwater monitoring to be carried out, and thereby to inform foundation design and the design of mitigation measures should they be shown to be required.

Ground investigation data already available should be reviewed in detail on a site by site basis, as plots come forward for investigation and supplemented with further works if necessary.

Ground investigations should also be carried out to determine the underlying ground conditions and identify geotechnical properties at each specific site. The investigation should achieve the following objectives:

- Provide information regarding the chemical composition of the soils in those parts of the site such as the former cycle works in the south that may be contaminated;
- Allow monitoring of ground gases and groundwater quality;
- Provide information regarding the ground conditions beneath the proposed construction areas; and,
- Provide preliminary information regarding the geotechnical conditions at the site to inform the preliminary design of foundations and other structures.

It is also recommended that a review of any remediation and verification reports, if available, is carried out for the proposed student accommodation and adjoining (i.e. the former cycle works and gun factory) sites.

It is also recommended that an asbestos survey is carried out on all properties proposed for demolition, and the relevant removal of any identified Asbestos Containing Materials (ACM) is carried out in accordance with the relevant guidelines, prior to demolition.

Decontamination and removal of potentially hazardous substances including the current services and drainage pipes will require decommissioning and capping to prevent opening of potential contamination pathways.

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- [2] British Standard “Investigation of Potentially Contaminated Sites – Code of Practice”, BS10175, 2010.
- [3] Geological Survey of Great Britain (England and Wales) 1: 50 000 series, Sheet 168 of Birmingham, Solid and Drift edition (1996);
- [4] Envirocheck Historical Mapping Order No: 216558, November 2011;
- [5] Envirocheck Report Order No:36938625\_1\_December 2011;
- [6] Multi Agency Geographical Information for the Countryside (MAGIC) maps - [www.magic.defra.gov.uk](http://www.magic.defra.gov.uk);
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- [15] Geo-Environmental Ground Investigation and test report for a new steam supply at the University of Birmingham, Couch Consulting Engineers, 2006;
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# Figures

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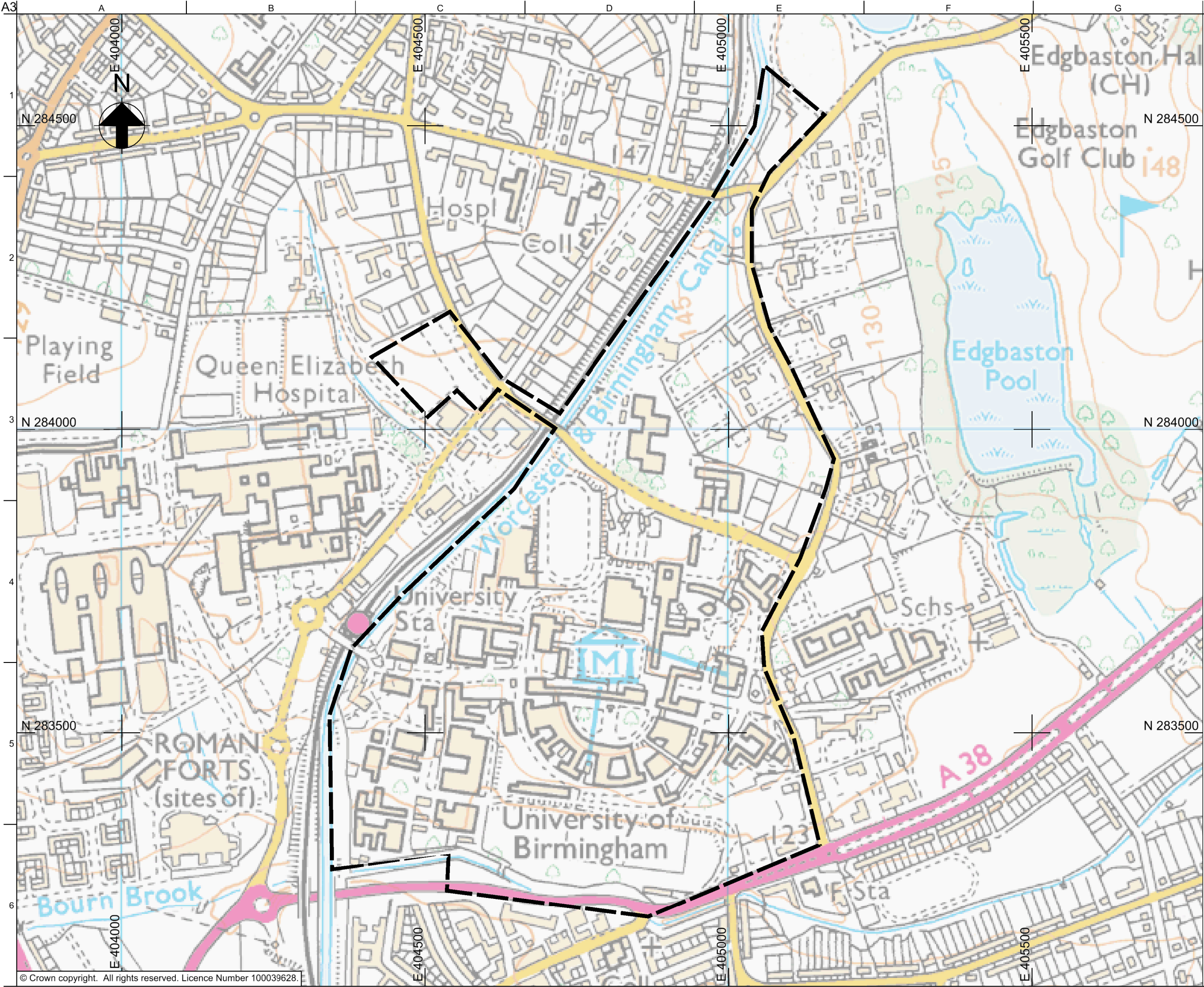
Figure 1 Site Location Plan

Figure 2 Geological Map

Figure 3 Previous Site Investigation Reports

Figure 4 Potentially Contaminative Sources


Figure 5 Potential Ground Hazards



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Do not scale

### Legend:

 University of Birmingham, Edgbaston Campus

01	29/02/12	DF	LS	PS
Information				
Issue	Date	By	Chkd	Appd

# ARUP

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Client  
University of Birmingham

Job Title  
Edgbaston Central Campus  
Development

Site Location Plan

Scale at A3 1:6000

Discipline Ground Engineering

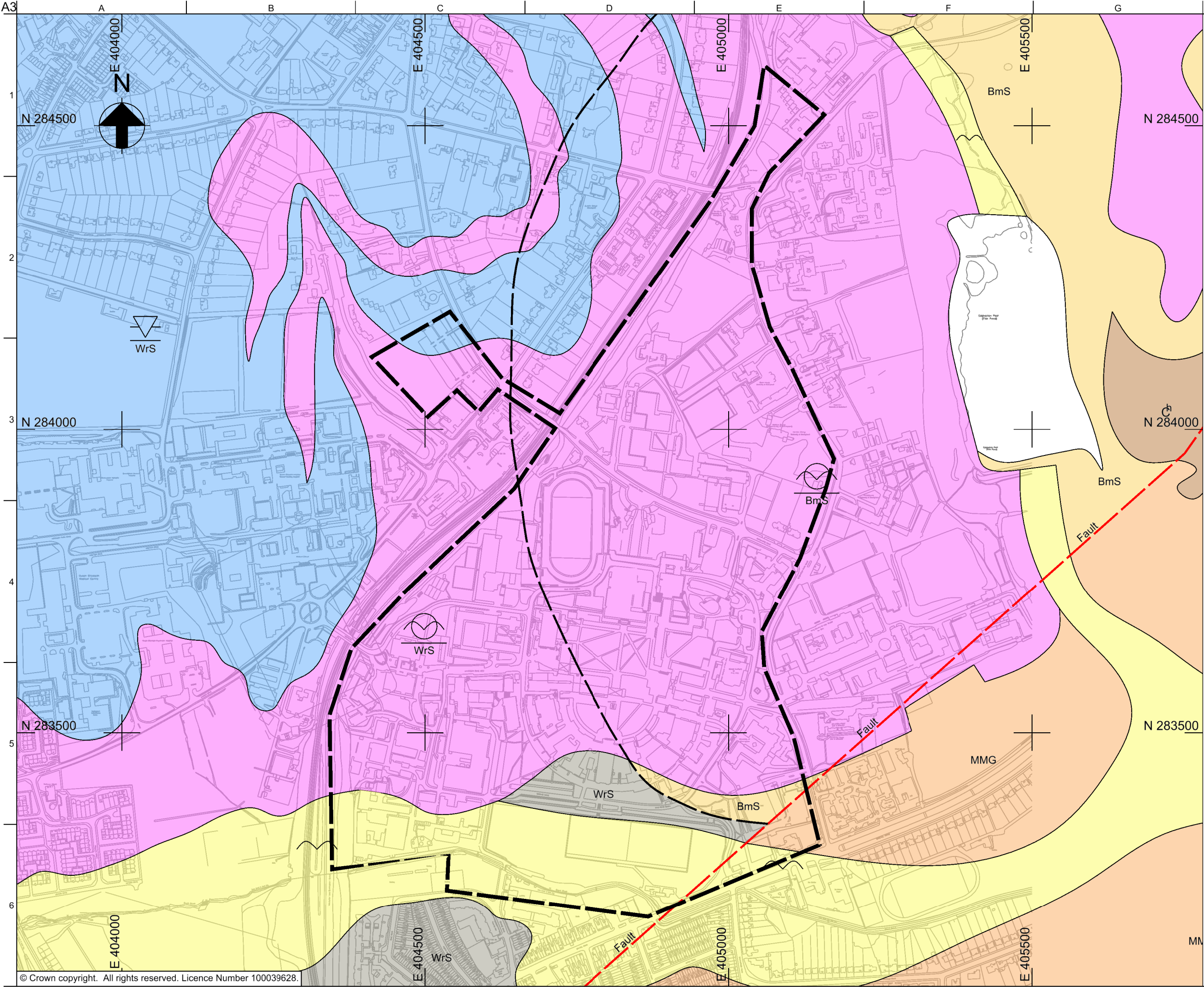
Job No 216558-00 Drawing Status Information

Drawing No Figure 01 Issue

global.arup.com/europe/Midlands/jobs/2160002/16558-004 Internal Project Data/4-03 Drawings/Civil/CivilCG\_Geotechnics/Drawings & Sketches/2012-02 Masterplan Desk Study Figures/Figure\_01 - Site Location Plan.dgn

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**Legend:**

- University of Birmingham, Edgbaston Campus
- Alluvium
- Head Deposits
- Glacial Till
- Glaciofluvial Deposits
- Mercia Mudstone
- Bromsgrove Sandstone
- Wildmoor Sandstone
- Fault

01	29/02/12	DF	LS	PS
Information				
Issue	Date	By	Chkd	Appd

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Client  
 University of Birmingham

Job Title  
 Edgbaston Central Campus Development

Geological Map

Scale at A3 1:6000	
Discipline Ground Engineering	
Job No <b>216558-00</b>	Drawing Status <b>Information</b>
Drawing No <b>Figure 02</b>	Issue



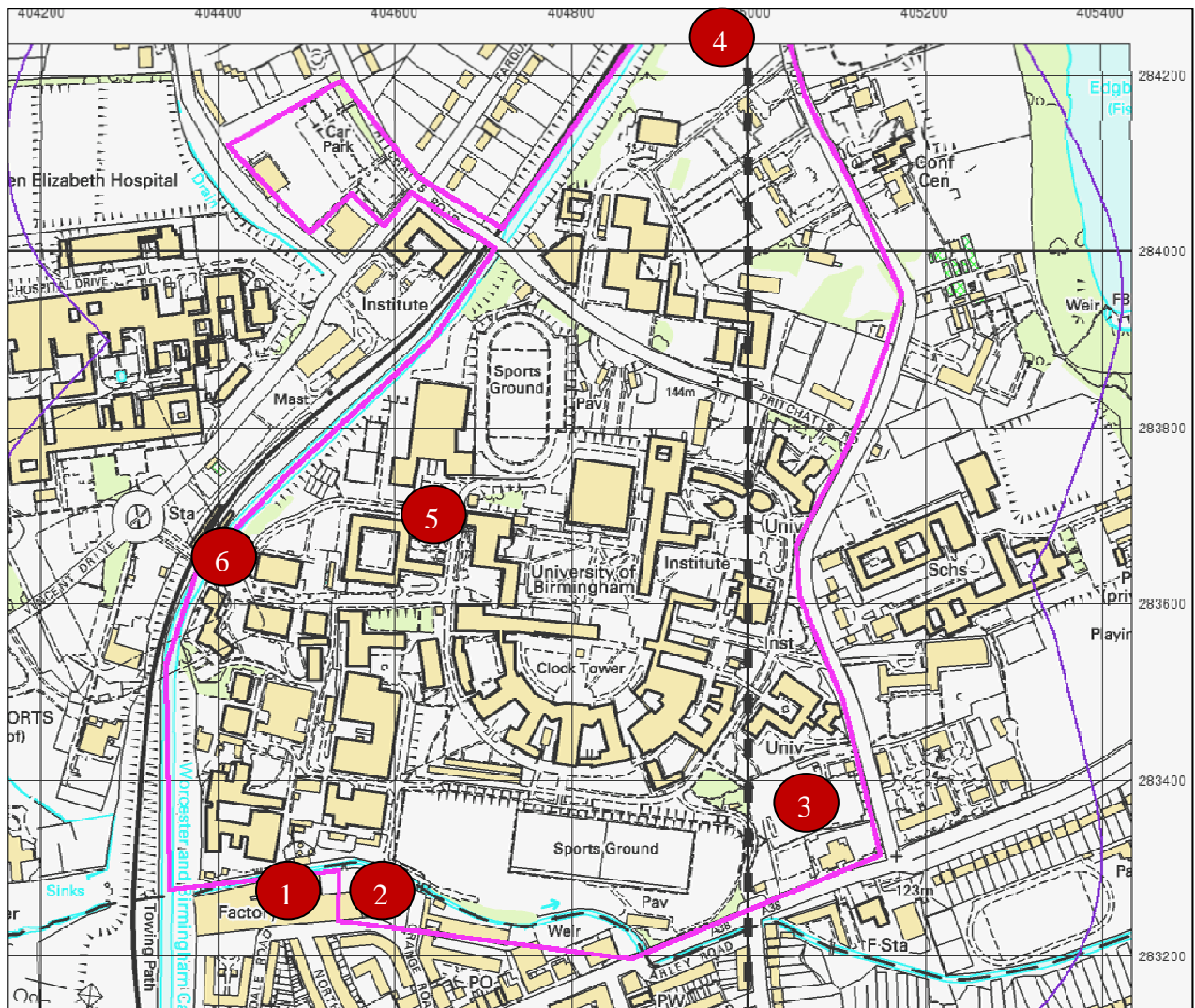


Figure 1 Previous Site Investigation Reports

1 Ground Investigation, Birse, Selly Oak, Birmingham, Factual Report Version C April 2007 Emmerson Moore Geosciences Ltd

2 Ground Investigation Report. Nicholls Colton Geotechnical. Proposed Student Accommodation, East Site, Selly Oak New Road, Birmingham (Nov 2011)

3 Ground Investigation at University of Birmingham Factual Report for University of Birmingham Engineer: Faber Maunsell Project Number: PC073133 November 2007; Geotechnical Interpretative Report University of Birmingham Sports Facilities Development, Faber Maunsell Aecom December 2007

4 Report on the Ground Conditions for New Student Accommodation at Mason Hall, University of Birmingham. HM Geotechnics October 2005;

5 Health and Safety File Incorporating the Geotechnical Investigation for Extension to Biology Building for The New Geography Block, Report No BG2612 1999.

6 Geo-Environmental Ground Investigation and Test Report for a New Steam Supply at the University of Birmingham, Couch Consulting Engineers 2006

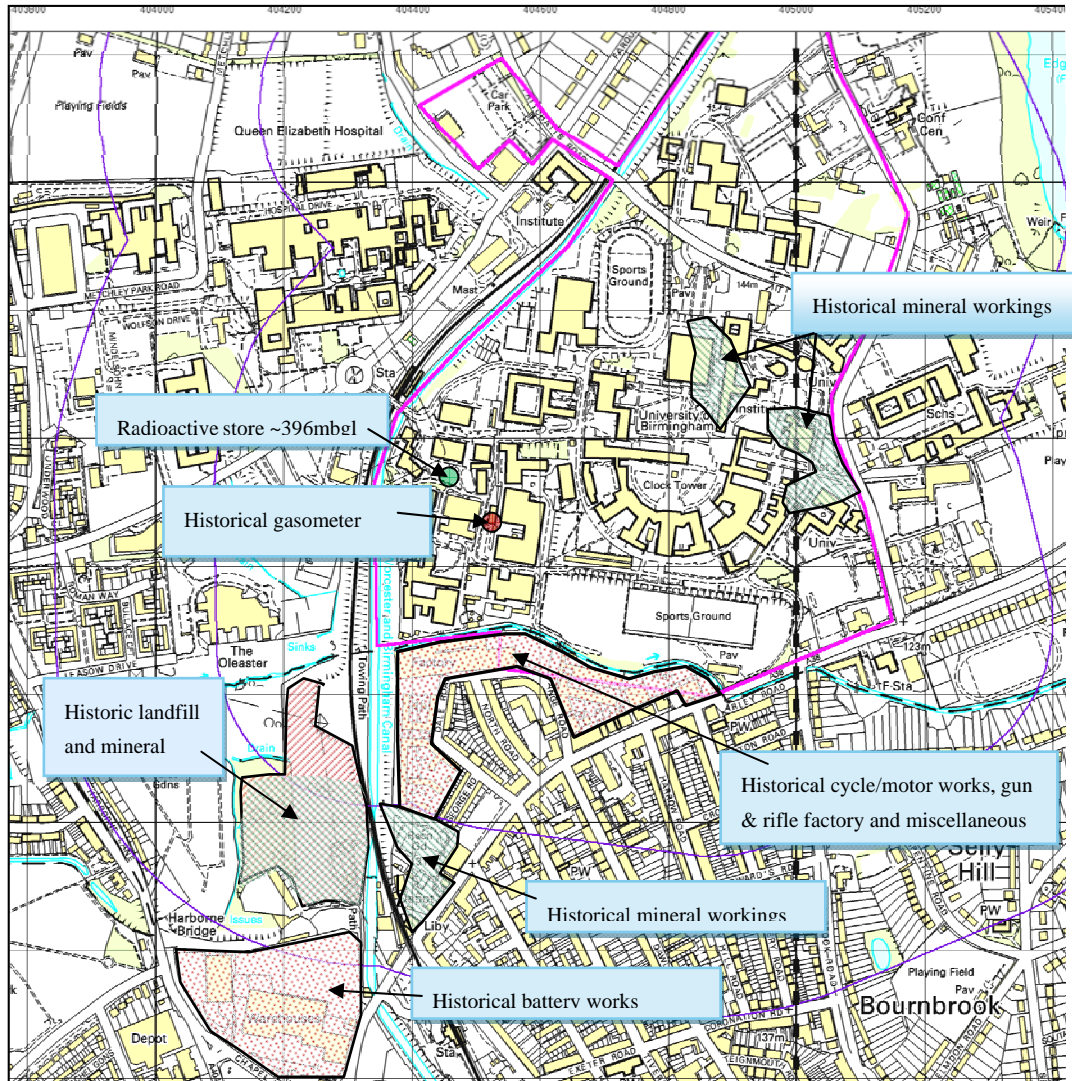


Figure 2 Potentially Contaminative Sources



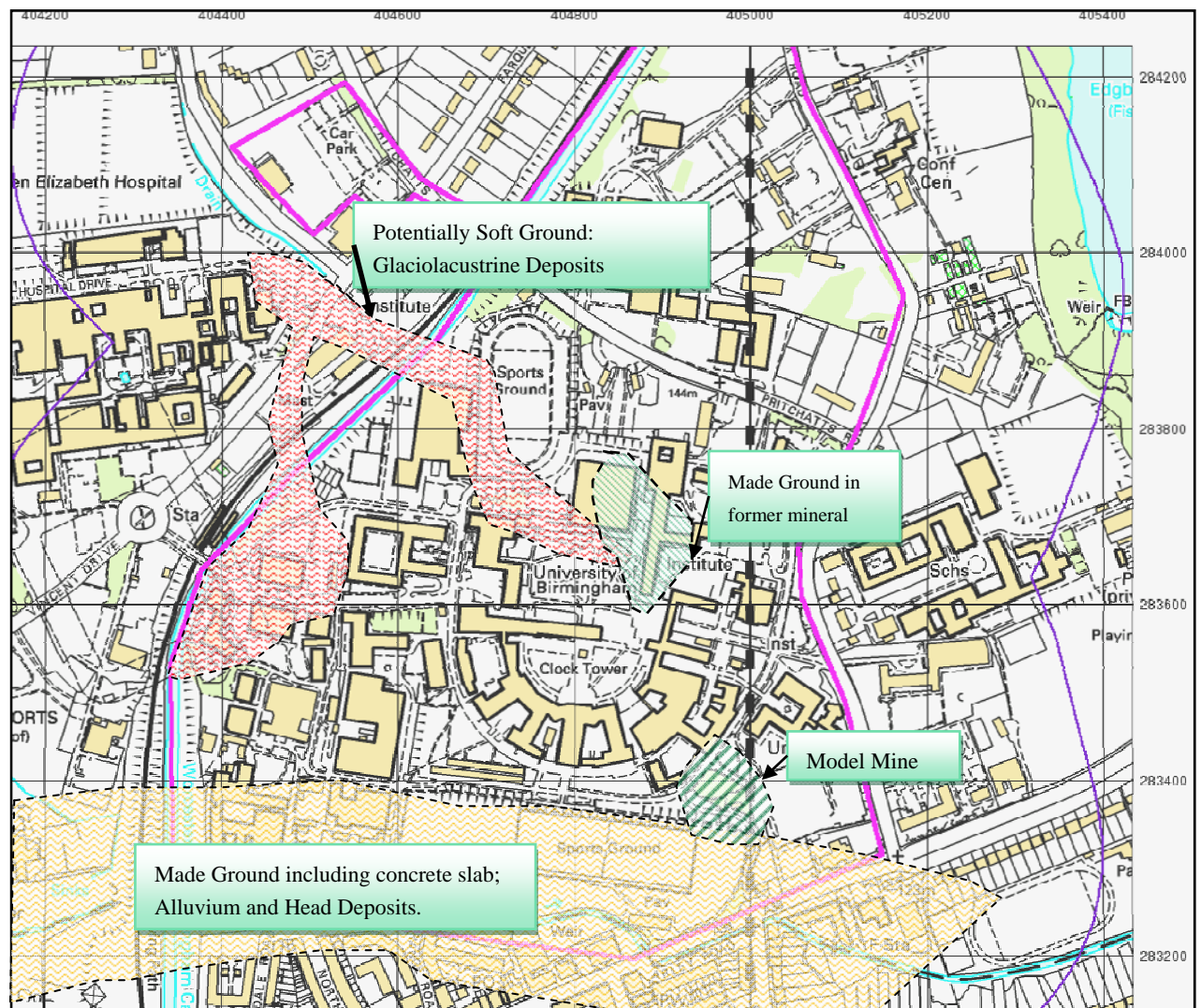


Figure 3 Potential Ground Hazards

\*Boundaries are approximate and not definitive, potential hazardous ground conditions are not restricted to those boundaries.



## Appendix A

### Schedule of Hybrid Application Project





Project	Description	Application type	Site ref.	Proposed floorspace sq m (gross internal)
New Sports Centre and route from Bristol Road to Chancellors Court	Demolition of ex Gun Barrels PH (1b) and bungalow adj South Car Park (1c) and construction of new sports centre (1a) with 50m pool, and 270-290 parking spaces (providing community access). Improvement of existing pedestrian route (1d) between new Sports Centre and Student Services Hub including minor landscaping works	Full	1a, 1b, 1c, 1d	Gain: 21,105  Loss: 987
Demolition of Sports Pavilion	Demolition of an ex sports pavilion on playing fields upon occupation of new Sports Pavilion and landscaping of site.	Full	2	Loss: 452
Grange Road Car Park	New permanent surface car park	Outline with all matters reserved except access	3	-
Student Services Hub	Insertion of rooflights and erection of plant compound <sup>1</sup>	Full	4	-
Grange Road bridge crossing	Bridge crossing of Bourn Brook into campus to provide access for service vehicles into campus and new ramp down to the Brook.	Outline with all matters reserved	5	-
Grange Road student residences and sports pavilion	New 6,750 m <sup>2</sup> student residences, bar/cafe and sports pavilion	Outline with landscaping appearance and layout reserved	6	Gain: 6,750
Demolition of Terrace Huts	Demolition and replacement with at grade parking (69 spaces)	Full	7	Loss: 1,321
Demolition of Chemistry West and research unit	Demolition of obsolete buildings and interim landscaping, pending longer term redevelopment	Full	8	Loss: 4,008
Demolition of Old Gym	Demolition of obsolete buildings and interim landscaping, pending longer term redevelopment	Full	9	Loss: 1567
'Green Heart' landscaping	Design guidelines for 'green heart' landscaped open space to replace existing car park and former Library site (area approx 5.7ha). Phase one (10a) and phase two (10b). Temporary car parking to the north of Muirhead Tower (10c).	Outline with all matters reserved	10	-
Demolition of existing library	Demolition of existing Library building (11b) on occupation of new Library pending new landscaping as part of 'Green Heart'. Demolition of old brick store to south of new library site (11a). Loss of car parking.	Full	11a and 11b	Loss: 16,333 (library)  Loss: 133 (small brick store)
Demolition of sub station 24	Demolition of substation	Full	12	Loss: 125
New main campus library	Construction of the new Main Campus Library on a site created by enabling works	Outline with all matters reserved	13	Gain: 14,448
Demolition of Munrow Sports Centre	Demolition of existing sports centre, loss of surface car park and tennis courts	Full	14	Loss: 9,759
Library enabling works	A new vehicular route linking the university ring road with Pritchatts Road to create the new Library site, requiring removal of the ex running track and groundworks (15a). New library store (15b). Surface car park removed. New surface car park provided (15c).	Outline with all matters reserved except access where the new route joins Pritchatts Road	15a, 15b and 15c	Gain: 1,650
Development of site of Munrow Sports Centre	Creation of new running track (16a) and erection of new sports pavilion (16b) and new surface car parking (16c).	Outline with all matters reserved	16	Gain: 300
Pritchatts road improvements	Changes to highway to improve pedestrian safety and environment,	Outline with all matters reserved	17	-

<sup>1</sup> Further works to this building are proposed in a separate application for Listed Building Consent submitted by Associated Architects

Project	Description	Application type	Site ref.	Proposed floorspace sq m (gross internal)
	including traffic management/ public realm improvements			
Access road to rear of Gisbert Kapp	Extend the existing access road into the Met & Met building off Pritchatts Road to create a loop road relieving traffic for Project 17	Outline with all matters reserved except access	18	-
Gisbert Kapp Car Park	Erection of new multi-storey car park	Outline with all matters reserved except access	19	Gain: 10,938
Pritchatts Road Car Park	Extension to surface car park	Full	20	-
Pedestrian and cycle route to The Vale	Construction of new pedestrian and cycle route from the rear of Met & Mat avoiding Edgbaston Park Road to the Vale Student Village. New crossings on Edgbaston Park Road and Somerset Roads	Full <sup>2</sup>	21	-



- 1a.

New Sports Centre and Car Park

1b.

Demolition of Gun Barrels Public House

1c.

Demolition of Bungalow

1d.

New Accessible Route from Chancellors Court to New Sports Centre

2.

Demolition of The Old Sports Pavilion

3.

Grange Road Car Park

4.

Aston Webb: New Student Services Hub

5.

New Access Road off Selly Oak New Road

6.

New Grange Road Student Residences and Sports Pavilion

7.

Demolition of Sportex Huts and Replacement with Surface Car Park

8.

Demolition of Chemistry West

9.

Demolition of Old Gym

10a.

'Green Heart' Landscaping - South

10b.

'Green Heart' Landscaping - North

10c.

Temporary Car Park
- 11a.

Demolition of Old Brick Store

11b.

Demolition of Existing Library

12.

Demolition of Substation 24

13.

New Library

14.

Demolition of Munrow Centre

15a.

Library Enabling Works

- Athletics Track Demolished

- New Internal Road Link to Pritchatts Road

- Ground Works

15b.

New Library Store

15c.

New Surface Parking on Link Road

16a.

New Running Track on Munrow Site

16b.

New Sports Pavilion

16c.

New Surface Parking by Running Track

17.

Pritchatts Road Improvements

18.

Access Road to the Rear of Gisbert Kapp

19.

New Gisbert Kapp Car Park

20.

Pritchatts Road Car Park

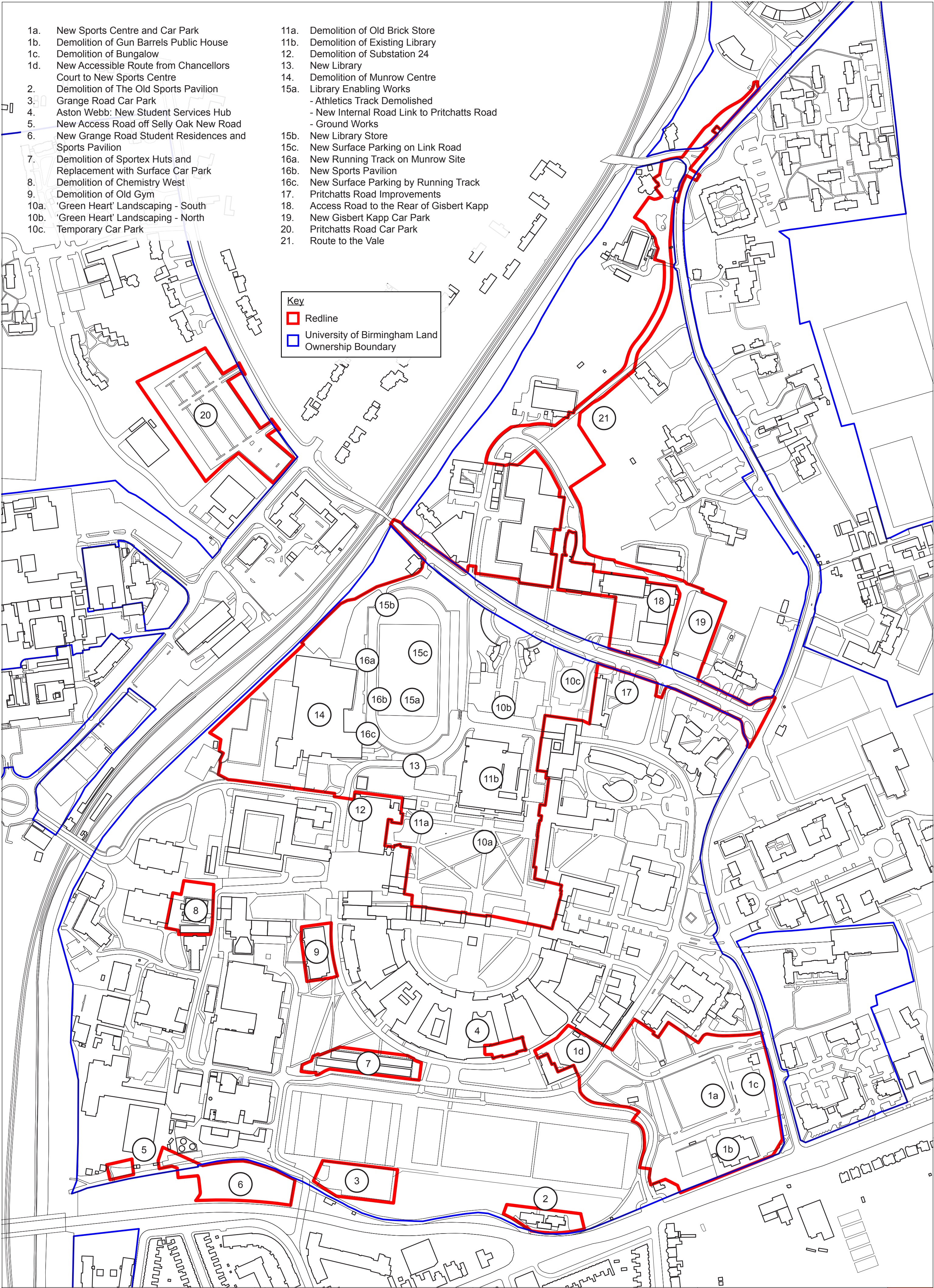
21.

Route to the Vale

Key

Redline

University of Birmingham Land Ownership Boundary







## **Appendix B**

### **Previous Site Investigations**



## **B1 Summary of Previous Site Investigations.**

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### **Ground Investigation, Birse, Selly Oak, Birmingham, Factual Report Version C April 2007 Emmerson Moore Geosciences Ltd**

A geotechnical investigation was undertaken between the 6th November and the 25th January 2007, for the then proposed Selly Oak New Road. The investigation was situated along the Bourn Brook, immediately along the university southern boundary. The investigation works extended west to the landfill and east towards the Southgate.

The ground investigation reports fifteen boreholes, five window sample holes and seven trial pits. Samples were taken for geotechnical and environmental laboratory testing. Gas and groundwater standpipes were also installed.

The ground investigation was undertaken within the immediate vicinity of the proposed New Grange Road student residences. A review of the exploratory holes within this location revealed made ground across the site. The made ground was generally described as loose red/ brown granular material to very dense granular material consisting of fine to coarse gravel- and cobble-sized fragments, predominantly of brick, but also of sandstone, coal ash and brick fragments. Made ground was over 3.10m thick in places (WS15).

The made ground is underlain by alluvium and described also as possible reworked alluvium, comprising medium dense to very dense gravels, cobbles, boulders sand and firm to stiff clays and organic clays. The alluvium deposits vary in composition and thickness across the site. In BH17 adjacent to Dale Road the alluvium was described as possible reworked alluvium of over 2.5m thick.

Bedrock comprised thinly bedded locally weathered and fractured sandstone with interbedded mudstone and siltstone

Actual ordnance datum levels are not provided within the factual report.

Chemical testing was undertaken and identified elevated levels of lead detected in TP02 at 480mg/kg at a depth of 1.4m located to the west of the railway; also in TP16 at 920mg/kg at a depth of 0.5m, located on the original junction of Dale Road and Grange Road; and also in BH29 at 250mg/kg at a depth of 3.1m, located east of the site adjacent to the A38.

### **Ground Investigation at University of Birmingham Factual Report for University of Birmingham Engineer: Faber Maunsell Project Number: PC073133 November 2007;**

A geotechnical and geo-environmental investigation was undertaken by Geotechnics Ltd at the site of the proposed New Sports Facility. The investigation was carried out between the 24th September and 17th October 2007 and comprised seven boreholes, ten drill holes, ten trial pits and three concrete coreholes.

Selected samples of soil, groundwater and gas were tested by Severn Trent Laboratories Ltd. A review of the chemical results indicated elevated levels of



Total Petroleum Hydrocarbons (TPH). Total TPH in trial pit TP7 was measured at 4600mg/kg, at relatively shallow depths of 0.4 to 0.5mbgl. TPH was also elevated in trial pits TP10 and TP3.

The pH values varied in all trial pits ranging from 5.8 in TP2 at a depth of 0.30m to 8.6 in TP7 at 0.40 – 0.50mbgl.

Slightly elevated to elevated polycyclic aromatic hydrocarbons (PAH) were reported for trial pits TP7 and TP10, with a maximum recorded level of 540mg/kg (TP7 at 0.4m to 0.5m).

The groundwater chemistry indicates elevated levels of magnesium, potassium and chloride, marginally exceeding the UK drinking water standards. This may (or may not) be due to background geological conditions, as salt deposits can be found within the Mercia Mudstone Group [17].

TPH was also detected in the groundwater samples from BH3.

None of the gas monitoring standpipes recorded methane at concentrations above the limit of detection of 0.1% v/v. The carbon dioxide levels were also generally low, varying between 0.3% v/v and 5.5% v/v.

**Ground Investigation Report. Nicholls Colton Geotechnical. Proposed Student Accommodation, East Site, Selly Oak New Road, Birmingham (Nov 2011)**

The ground investigation comprised thirteen boreholes, two rotary core holes and fifteen trial pits. Soil and groundwater samples were collected and sent to the laboratory for chemical analysis.

The ground investigation revealed made ground, superficial deposits of clay, sands and gravel, overlying the Wildmoor Sandstone formation.

It should be noted that in some areas the former factory slab is still intact and where penetrated, the concrete was up to 0.30m thick. Many of the exploratory holes encountered buried intact foundations and intact concrete slab at depth (1.5-2.5m) which prevented further downwards progress of holes CP9, and TP12.

Groundwater was encountered at approximately 2.0m below ground level (bgl).

The chemical analysis revealed elevated levels of metals including arsenic (39mg/kg), lead (683mg/kg), nickel (145mg/kg) and elevated hydrocarbons within the made ground. Benzo(a)pyrene (1.0mg/kg) was also identified within the made ground. 1630mg/kg of aromatic >C16 - C21 -and 9090mg/kg of aromatic >C21 - C35 were measured in soil sampled from TP13 at 2.40mbgl, within the sand and gravel alluvium deposits.

The presence of chrysotile asbestos was also confirmed during the laboratory analysis.

Chemical analysis of the groundwater samples revealed slightly elevated levels of copper and VOCs and significantly elevated levels of hydrocarbons.

Four sets of readings have been obtained to date to enable an initial characterisation of the gas regime. The results indicate no significant methane and

carbon dioxide concentrations, with no detectable methane ( $<0.1\%$  v/v) and a maximum of  $2.0\%$  carbon dioxide recorded respectively. Positive gas flows have generally not been recorded at the site, with only isolated positive flows of  $0.1$  litres per hour recorded.

The ground gas monitoring results have been compared with CIRIA Document C665. Using the worst case scenarios for flow ( $0.1$  l/hr), methane ( $<0.1\%$  v/v) and carbon dioxide ( $2.0\%$  v/v) the Gas Screening Values (GSV) for the site have been calculated as follows:

- GSV, Methane =  $0.0001$  l/hr
- GSV, Carbon Dioxide =  $0.002$  l/hr



## Appendix C

### Envirocheck Report Summary



## C1 Envirocheck Report

### C1.1 Environmental Setting

The environmental datasets contained within the Envirocheck report has been reviewed and the main onsite and offsite issues, within 500 m from the boundary of the site of the centre of the site, are outlined below.

As the site area covers just over 63 Ha the Envirocheck report is divided into four maps. Map A covers the south-western part of the site and surrounding area, map b to the south east, map C the northwest and map D covers the north east. See figure below.

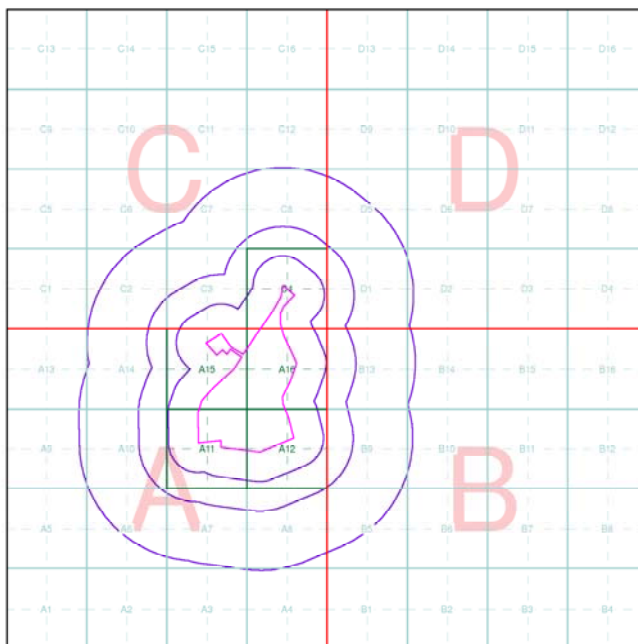


Figure A1 Index Map from Envirocheck

## C1.2 On Site Records

### C1.2.1 Enforcement and Prohibition Notices

There are two recorded Enforcement and Prohibition Notices within 1000m of the site. The enforcement and prohibition notices were served in the 1990's. Since then both buildings have been demolished as part of the Selly Oak By-pass and the QE Hospital developments. The notices are:

- National Blood Transfusion centre, west of the site -HMIP Annual Report 1992-1993, Inadequate record keeping and poor security and labelling (under RSA60); and
- Battery and Rolled Metals Ltd , southwest of the site 715 Bristol Road, originally adjacent to the Railway bridge -EA Data 24/07/1998, Prohibit the melting or casting of brasses or other alloys containing significant quantities if zinc or other metals likely to give rise to high levels of fumes.

### C1.2.2 Site Sensitivity

The site and the surrounding area are within a Nitrate Vulnerable Zone.

Edgbaston Pool a Site of Special Scientific Interest (SSSI), is situated approximately 134m at its nearest to the eastern site boundary. The 15.93 Ha site comprises woodland and over 7 Ha of lake and marshland. The lake is fed from the north by the Chad Brook. The SSSI is adjacent to Winterbourne Botanic Garden and Edgbaston Golf Course.

Edgbaston Pool was designated as a SSSI in 1986 and is currently classed as being in an "Unfavourable recovering condition". The Natural England Web site describes the Edgbaston Pool SSSI as not yet fully conserved but all the necessary management measures are in place. Provided that the recovery work is sustained, the SSSI will reach favourable condition in time.

### C1.2.3 Discharge Consents

	Map A	Map B	Map C	Map D
On site	8	0	0	0
Up to 500m off site	9	0	0	0
501 - 1000	0	1	0	0

There are eight records relating to discharge consents for the onsite area. The records relate to three different consents all held by the University of Birmingham. The consents allow the discharge of cooling waters and process water to be discharged into the Bourn Brook on the southern boundary of the site.

The University hold one other consent for the discharge of cooling water to the Bourn Brook, and is given as just outside the current site boundary, at the Junction of Bourn Brook Road and Bristol Road.

Severn Trent holds the remaining discharge consents for sewage and surface waters and storm overflows into the Bourn Brook and River Rea catchment.

#### C1.2.4 Pollution Incidents to Controlled Waters

	Map A	Map B	Map C	Map D
On site	4	0	2	0
Up to 500m off site	4	0	5	1
501 - 1000	2	0	4	0

The Envirocheck report quotes four pollution incidents (on Map A) to Controlled Waters within the site boundaries, although on further investigation there is only one incident that has occurred on the university site; this pollution incident was the result of a wrong connection introducing vehicle washings into the Bourn Brook in September 1997, and was classed as a minor incident.

The three other pollution incidents listed nearby relate to pollution caused by fire waters entering the bourn brook, and each incident was classified as minor.

Map C records two pollution incidents on site, although on inspection actually occurred in the nearby canal, offsite. Only one significant pollution incident has been recorded, which occurred approximately 300m east of the site in 1997 and was related to algal bloom.

#### C1.2.5 Integrated Pollution Prevention Controls

	Map A	Map B	Map C	Map D
On site	2	0	0	0
Up to 500m off site	1	0	0	0
501 - 1000	0	0	0	0

#### C1.2.6 Local Authority Pollution Prevention Controls

	Map A	Map B	Map C	Map D
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On site	1	0	0	0
Up to 500m off site	2	0	0	0
501 - 1000	5	3	1	0

Integrated Pollution Controls – related to Battery Rolled Metals Ltd (dissolved) just over 500m from south west corner of the site (The battery works closed in 1998 and was demolished in 2008/ 09).

### C1.2.7 Nearest Surface Water Feature & River Quality

The nearest surface water feature is the Bourn Brook which flows along the southern boundary of the site. The brook flows east to its confluence with the River Rea at Cannon Hill Park just over 1km to the east of the site. The Environment Agency website records for 2009 show the chemistry water quality as Grade B and the biology as D.

The Worcester and Birmingham canal lies immediately along the western site boundary of the University campus. The Envirocheck report records the water quality within the canal as a GQA Grade E in 2000. The Environment Agency website record available for 2009 show the chemistry water quality as Grade D and the biology as F (A being Very Good, F being bad).

### C1.2.8 Water Abstractions

	Map A	Map B	Map C	Map D
On site	6		0	0
Up to 500m off site	5	1	1	0
501 - 1000	0	1	0	0

The records show that the University hold four groundwater abstraction licences for general use. The start date for each of the permits is given as November 2010. The rate of abstraction is not supplied.

The university also held a surface water abstraction licence, to abstract water from the Bourn Brook. This licence is no longer valid.

It is reported that Cadbury Schweppes Plc also held an abstraction licence on site although this has been revoked or cancelled.

Other off site water abstraction licences are held by the University, Cadbury's, British Waterways and the QE hospital.

### C1.2.9 Recorded Landfill Sites

BGS, historical landfills and local authority land fill sites combined total

	Map A	Map B	Map C	Map D
On site		0	0	0
Up to 500m off site	6	0	0	0
501 - 1000		0	0	0

There are no recorded landfill sites with the university site boundary.

The Envirocheck report indicates that there are a total of six recorded historical landfill sites within the surrounding area; however the majority of these records all refer to one location to the south west of the site.. The records show that the landfill licence was held by the Birmingham Battery and Metal Company Ltd, and input began in 1967. The site was licensed to receive inert, industrial and household waste. The last input date at the landfill was given as December 1987. Registered Waste Treatment or Disposal Site

There is one operational registered waste treatment or disposal site licensed to JP Monk Reservoir motors, approximately 550m to the west. The site is operated as a scrap yard with very small input (10,000tonnes per year).

The QE Medical Centre on Vincent Drive, to the north-west of the site was previous licensed as a waste transfer station for household, commercial and industrial waste; however, this licence has been surrendered. The QE Medical Centre was also previously a registered waste treatment or disposal site, but the site was listed as dormant in 1993.

### C1.2.10 BGS Recorded Mineral Sites

The records show that there were two mineral workings located on site. Both were opencast workings within the sand and gravel deposits and have now ceased. These records relate to the gravel pit working shown on the historical maps.

### C1.2.11 Registered Radioactive Substances

	Map A	Map B	Map C	Map D
On site	20	0	0	0
Up to 500m off site	34	0	0	0
501 - 1000	0	0	0	4

There are 20 records for registered radioactive substance permits held by the University, although only three are active. The nearby hospital also holds active permits.

### C1.2.12 Contemporary Trade Directory Entries

	Map A	Map B	Map C	Map D
On site	2	0	0	0
Up to 500m off site	37	0	1	0
501 - 1000	55	8	8	4

The two contemporary trade directory entries on site for book binding and printing services are no longer active. The Envirocheck also lists a precision engineers and gunsmith factory on Grange Road, which are also inactive.

The nearest active contemporary trade is located south of the site at Tesco Express filling station along Bristol Road. Within 500m of the site boundary only 12 of the 37 contemporary trade entries are recorded as “Active” and include:

Garage services, tyre dealers, car body repairs, fireworks stockist, MOT services, commercial cleaning services, vacuum sales and services, classic car specialists and hospitals

There are two fuel station entries recorded on site (in map A), and these related to Esso at 479 Bristol Road and the chemical engineering department at the university, on University Road West.

There are three fuel station entries recorded on map B- south east of the site

There are on fuel station entries recorded on maps C and D to the North West and north east of the site.

## Appendix D

### Record of Radioactive Waste Store



## D1 Details of Radioactive Waste Store

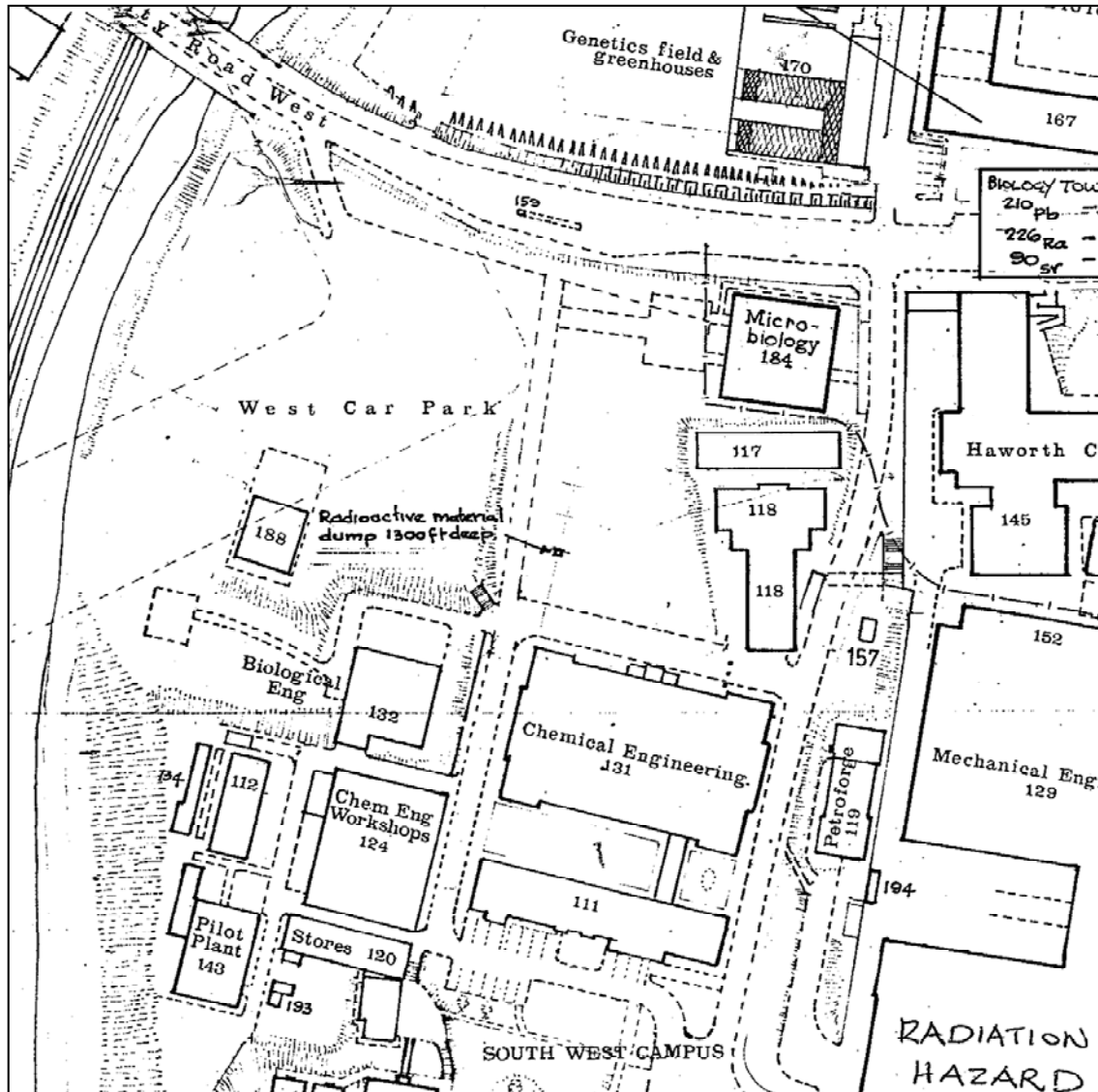


Figure D1 Extract from University of Birmingham Main Campus Layout Radiation Hazards Plan May 1979, provided by Estates Department.