

PHASE 1 PRELIMINARY GEO-ENVIRONMENTAL RISK ASSESSMENT

Symmetry Park East, Gloucester



JER8631
PHASE 1 PRELIMINARY RISK
ASSESSMENT
00
June 2020

REPORT

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
00	Draft	[REDACTED]	[REDACTED]	[REDACTED]	26/06/2020
01	Final	[REDACTED]	[REDACTED]	[REDACTED]	14/08/2020

Approval for issue

[REDACTED] Associate Director 26 June 2020

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EXECUTIVE SUMMARY

RPS Consulting Services Ltd (RPS) was commissioned by Tritax Symmetry Gloucester Ltd to undertake a Phase 1 Preliminary Geo-Environmental Risk Assessment of land known as Symmetry Park East, Gloucester. The report has been commissioned prior to the proposed redevelopment of the site.

The principal objectives of the assessment will be to determine the potential for soil and groundwater contamination to be present which could impact future site users/occupiers and the wider environment, significantly constrain the proposed use of the site or significantly affect the development process. The site's suitability for its proposed use would be determined in accordance with the National Planning Policy Framework.

Current Site and Surrounding Land Use

The site currently comprises undeveloped agricultural land, comprising three adjoining arable farmed fields. The site is in a predominantly rural location, surrounded by farmland on three sides and located south east of the M5 Quedgeley Interchange. To the west of the site, a recently constructed energy recovery facility has replaced a former light industrial estate and former airfield. There is also a Garden Centre to the west, and a business park (formerly RAF site) to the north.

History of Site and Surrounding Land use

A review of historical maps indicates that the site's use has remained unchanged. Off-site historical potential sources of contaminants of concern include the former industrial estate, which featured sewage beds and tanks, and the former RAF site.

Environmental Setting

The site is indicated to be underlain by a Secondary Undifferentiated Aquifer associated with the Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated). The site is in a zone of medium groundwater vulnerability.

The site is not located in a groundwater Source Protection Zone (SPZ) and there are no sensitive groundwater abstractions in the vicinity of the site.

The nearest surface water features are a series of field boundary ditches, the closest of which is located adjacent to the southern boundary of the site.

The closest residential property is located approximately 10m from the south of the site, however there are no other adjacent residential properties, schools, hospitals, care homes or other sensitive land uses in the near vicinity of the site.

Outline Conceptual Site Model

An outline conceptual site model (CSM) has been derived on the basis of the desktop study and site reconnaissance, which has identified a limited number of potential sources of contamination and associated pollutant linkages. There is a minor potential for the generation of ground gas associated with infilled land on site and made ground/infilled land near the site.

Recommendations

It is recommended that the potential for contamination and associated pollutant linkages is assessed through a Phase 2 Geo-Environmental Site Investigation. The investigation should be targeted to provide information on the concentrations of contaminants of concern (if present) within the soils and shallow groundwater beneath the site and the generation of ground gases. If the site investigation identifies the presence of potentially significant contamination or ground gases further investigation, monitoring, risk assessment and remediation may be necessary.

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If contamination is present, increased materials management/disposal costs may be realised as part of the redevelopment. If excavated materials are to be reused on site a Materials Management Plan may be required and appropriate licenses/exemptions will be required.

It would be prudent to combine any site investigation undertaken for geo-environmental purposes with geotechnical testing. Soakaway testing could also be undertaken - low permeability soils could prevent the use of soakaways.

1 INTRODUCTION

1.1 Preamble

- 1.1.1 RPS Consulting Services Ltd (RPS) was commissioned by Tritax Symmetry Gloucester Ltd to undertake a Phase 1 Preliminary Geo-Environmental Risk Assessment of Symmetry Park East, Gloucester. The report has been commissioned prior to the proposed redevelopment of the site.
- 1.1.2 The site covers an area of approximately 20.54 hectares and currently comprises undeveloped agricultural land. A site location plan is presented as Figure 1.
- 1.1.3 Final Development plans have not been made available for review at this time.

1.2 Objectives

- 1.2.1 The principal objectives of the assessment are to determine the potential for soil and groundwater contamination to be present which could impact future site users/occupiers and the wider environment, significantly constrain the proposed use of the site or significantly affect the development process, specifically for the proposed use of the site for B8 logistics.
- 1.2.2 The key tasks of this assessment were as follows:
- To assess potential sources of contamination at the site, associated with historical and current land uses both on site and in the surrounding area;
 - To review the environmental setting to assess the sensitivity of the surrounding area to ground contamination;
 - To produce an outline Conceptual Site Model (CSM) identifying the pathways by which potential contamination may impact the identified receptors via pollutant linkages; and,
 - To provide recommendations for further assessment/ investigation of potential pollutant linkages, where considered necessary

1.3 Legislation and Guidance

- 1.3.1 This report has been produced in general accordance with:
- Contaminated Land (England) Regulations 2006 (as amended);
 - DEFRA Environmental Protection Act 1990: Part 2A - *Contaminated Land Statutory Guidance* (2012);
 - DEFRA and Environment Agency (2004) Contaminated Land Report 11 (CLR 11): *Model Procedures for the Management of Land Contamination*;
 - National Planning Policy Framework (2019);
 - CIRIA Document C665: *Assessing Risks Posed by Hazardous Ground Gases to Buildings*;
 - British Standard requirements for the 'Investigation of potentially contaminated sites - Code of practice' (ref. BS10175:2011+A1:2017);
 - British Standard requirements for the 'Code of practice for ground investigations' (ref. BS5930:2015); and
 - British Standard requirements for the 'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings' (ref BS8485:2015+A1:2019).
- 1.3.2 Details of the limitations of this type of assessment are described in Appendix A.

2 SITE RECONNAISSANCE AND DESK STUDY

2.1 Site Reconnaissance

2.1.1 This section of the report is based upon observations made during a site visit carried out on 30 June 2020. A site boundary plan is provided as Figure 2. Selected photos are shown in Appendix B.

The Site

Table 1 – Summary of on-site activities

Section	Description
Background:	The site is located south of Gloucester, near to the M5 Quedgeley Interchange at National Grid Reference SO804106. It is irregularly shaped and occupies an area of approximately 20.54 ha. The site slopes gently from the east to west at an elevation of between 20m and 30mAOD.
Site Layout:	The site comprises three arable agricultural fields bounded by hedgerows with woodland prominent on its eastern boundary.
Activity / Operations:	site use is dominated by arable farmland with a public right of way running east to west in the south of the site.
Building Structure(s):	There were no buildings or structures present on site.
Surface Cover:	The majority of the site has topsoil cover.
Drainage:	Drainage ditches of various depths are located around the perimeter of the fields and are associated with hedgerows and trees. These were most prominent in the northwest of the site where a ditch of about 0.5 m depth was identified with steep slopes of several metres height behind this to the road to the north. A drainage ditch was also encountered in the south eastern corner of the site running east to west and joining the neighbouring field to the east.
Bulk Storage / Tanks:	There was no notable storage of materials or tanks on site.
Waste:	There was no notable waste stored on site.
Air Emissions:	The site does not operate any licensed air emissions.
Electricity Sub-Stations /Transformers:	No electricity substations or transformers were identified on site or in the immediate vicinity.
Visual Evidence of Contamination:	No visual evidence of surface contamination was identified during the site inspection.
Statutory Nuisance:	RPS is not aware of any statutory nuisance complaints associated with the site.
Other Issues:	None identified.

The Surrounding Area

2.1.2 The site is located in an area of mixed agricultural, retail, commercial and industrial land use. At the time of the site inspection, neighbouring land consisted of the following:

Table 2 – Neighbouring Land Uses

Direction	Description
North:	Agricultural land, light industrial business park. Large warehouse / office structures, with area of waste skips to the northwest beyond Stonehouse road.
East:	Agricultural land, rural residential
South:	Arable farmland with house located immediately to the southwest. Access route through field on southern boundary.
West:	Energy recovery facility, business park, garden centre

2.1.3 Several small drains/ditches were observed during the site inspection.

2.2 Site History

Historical Map Review

2.2.1 The following review is based on past editions of readily available Ordnance Survey (OS) maps. These include scales of 1:1,250, 1:2,500 and 1:10,000 dated 1882 to 2020. Extracts from selected historical maps are provided as Figure 3 to Figure 8. The review is also based on available aerial photography dated 1999 to 2018.

Table 3 – Historical Site Uses

On-site Land Use and Features	Dates
Undeveloped agricultural land with field boundaries and footpath across centre	1882 - present
Small pond (central area)	1882 - 2001

Table 4 – Historical Neighbouring Site Uses

Surrounding Land Uses (250m radius)	Orientation	Distance	Dates	
			From	To
Stonehouse Lane – Diverts nearer to north western corner circa 1974	N	0m	1882	present
Lane – Becomes A419 circa 1971, bounding western perimeter – Becomes B4008 circa 1990	W	0m	1882	present
Track to St Peters Church	S	0m	1882	present
Lodge residential building	SW	10m	1901	present
Garden Centre Glasshouse – Becomes 'Countryside Centre', numerous additional structures circa 2001 – Smaller structures replaced by car park, large retail garden centre structure circa 2010	W	20m	1986	present
Bilton Industrial Estate – Becomes Bilton Cargo Centre circa 1990	W	30m	1971	2001
Javelin Park EFW facility	W	35m	2018	present
Mount farm tree plantation	E	80m	1882	present
M5 Motorway, Quedgeley Interchange – Junction road improvements, construction of roundabouts circa 2010	NW	180m	1971	present
Tank	W	200m	1971	2001
Airfield	W	214m	1949	1954
Sewage Beds	W	250m	1971	2001
RAF Quedgeley site 6 – Becomes Quedgeley East Business Park unknown date	N	250m	1971	present

2.2.2 Aerial photographs dated 1999 to 2018 suggest that the site use has remained unchanged. The photographs suggest that the land to the west of the site has undergone demolition of structures and redevelopment during this period.

Site Planning History

2.2.3 Relevant planning records for the site, obtained from Stroud district and Gloucestershire County Council planning websites are summarised as follows:

- Land immediately adjacent to the north: Application references:
 - S.16/1724/OUT: Outline planning application for a business park comprising B1 (Business), B2 (General Industrial) and B8 (Storage or Distribution) including access arrangements and demolition of existing business park.
 - S.19/2611/DISCON Discharge of condition 12 (Land contamination part 5 - Validation) from the application S.16/1724/OUT for phase 1 only.
- Land adjacent to the west: Application references:
 - 12/0008/STMAJW Proposed development of an Energy from Waste (EfW) facility for the combustion of non-hazardous waste and the generation of energy, comprising the main EfW facility, a Bottom Ash processing facility and Education/Visitor Centre, together with Associated/Ancillary Infrastructure including Access Roads, Weighbridges, Fencing/Gates, Lighting, Emissions Stack, Surface Water Drainage Basins and Landscaping.
 - S.19/2135/FUL Erection of four buildings (5 units) for B1c (Light Industry), B2 (General Industry) and B8 (Storage and Distribution) uses and associated access and drainage infrastructure

2.3 Environmental Setting

Geology

2.3.1 Based on British Geological Survey (BGS) mapping (1:50,000-scale) and the Environment Agency (EA) Groundwater Vulnerability mapping (1:100,000-scale), the stratigraphic sequence and aquifer classifications beneath the site are indicated to be as follows:

Table 5 – Descriptions of Geological Strata

Strata	Description	Aquifer Classification
Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated)	Mudstone. Marine calcareous mudstone and silty mudstone, and limestone.	Secondary Undifferentiated Aquifer

2.3.2 There are a number of BGS borehole records located approximately 200m to 300m to the north west of the site likely to be associated with the construction of the M5 Quedgeley Interchange. BGS Borehole reference SO81SW67, extends beyond 10m below ground level, the encountered stratigraphic sequence can be summarised as follows:

- Made Ground comprising firm brown sandy gravelly CLAY. 0.00 – 0.65m bgl
- Firm grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine flint and occasional limestone. 0.65 – 1.20m bgl
- Firm grey mottled orange brown slightly sandy CLAY. Rare subangular to angular flint gravel. Becoming very stiff at depth 1.20 – 2.80m bgl
- Stiff to very stiff grey green mottled orange slightly sandy Clay with occasional fine gypsum crystals 2.80 – 4.00m bgl

- Very stiff dark grey blue thinly laminated CLAY/very weak
Completely weathered Mudstone. 4.00 – 7.00m bgl
- Very stiff to hard dark grey blue thinly laminated calcareous CLAY
Including rare bands of limestone. 7.00 – 8.90m bgl
- Very Weak highly weathered dark grey blue thinly laminated
Calcareous Mudstone with occasional shell fragments. 8.90 – 10.14m bgl.

2.3.3 There is the potential for Made Ground to be present on site, associated with its agricultural history and associated shallow soil workings. However, Made Ground of significant thickness is not anticipated to be widespread owing to the site’s limited history of development. There is the potential for infilled ground associated with a former pond identified in the centre of the site on historical mapping. At present the nature and thickness of any Made Ground on site is unknown.

Hydrogeology

- 2.3.4 The site is located above a Secondary Undifferentiated Aquifer relating to the Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated). These formations have varying characteristics in different locations. According to Groundwater vulnerability mapping, the site is in a zone of medium vulnerability associated with groundwater flow through poorly connected rock fractures.
- 2.3.5 According to EA data, the site not located in a groundwater Source Protection Zone (SPZ).
- 2.3.6 Under the Water Framework Directive, the Environment Agency’s local River Basin Management Plan classifies groundwater chemical quality beneath the site as good quality (2016).
- 2.3.7 Information provided by the EA indicates that there are no records of active licensed groundwater abstractions within 2km of the site.

Surface Water

2.3.8 There are no watercourses within 1km of the site which are classified within the River Basin Management Plan published by the EA under the European Water Framework Directive (2000). A list of all nearby watercourses and water bodies within 250m of the site is as follows:

Table 6 – Nearby Watercourses and Water Bodies

Watercourse / Body	Quality Classification	Approx. Distance and Direction from Site
Ditch/field drain	N/A	Adjacent to southern boundary
Ditch/field drain	N/A	100m south
Ditch/field drain	N/A	150m south
Ditch/field drain	N/A	250m north east
Pond	N.A	250m east

- 2.3.9 Information provided by the EA indicates that there are two records of active licensed surface water abstractions within 2km of the site.
- 2.3.10 There are two records of active surface water discharge consents within 500m of the site. These relate to the release of treated effluent/process effluent to tributaries of Beaufair Brook (373m West) and River Severn (489m North).
- 2.3.11 According to the Environment Agency (EA) flood risk mapping, the site has a number of locations at medium or high risk of surface water flooding, including in the centre of the site and in the north western corner of the site.

Fluvial / Tidal Flood Risk

- 2.3.12 According to the Environment Agency (EA) flood map, the site is not located within an indicative fluvial floodplain, with the annual probability of flooding classified as less than 1 in 1000 (0.1%).

Ecologically Sensitive Sites

- 2.3.13 Natural England data indicates that there are no ecologically sensitive sites, that constitute environmental receptors as defined within Table 1 of the DEFRA Environmental Protection Act 1990: Part 2A - Contaminated Land Statutory Guidance (2012), located within a 1km radius of the site.
- 2.3.14 According to Natural England data, the site is located within a designated SSSI impact risk zone, these require consultation for all developments including infrastructure, energy and residential.

Other Sensitive Sites

- 2.3.15
- 2.3.16 There are no records of World Heritage Sites, National Parks, Listed Buildings, Conservation Areas or Scheduled Ancient Monuments within 250m of the site.

Radon

- 2.3.17 According to the Indicative Atlas of Radon in England and Wales published by the Health Protection Agency (part of Public Health England) and the British Geological Survey, the site is located within an area where less than 1% of properties are affected by radon and no radon protection measures are required.

Coal Authority

- 2.3.18 The Interactive Map Viewer on the Coal Authority website indicates that the site is not located in a coal mining reporting area.

Non-Coal Mining

- 2.3.19 There are no records of natural cavities, surface or underground workings, non-coal mining or other mineral extraction operations within 1km of the site.

Natural Land Stability

- 2.3.20 BGS data indicates that the site is located within an area at low risk from shrink swell clays and very low risk from collapsible deposits and landslides. The risk associated with running sands, compressible deposits and ground dissolution is indicated to be negligible.

2.4 Authorised Processes and Pollution Incidents

Landfills and Waste Sites

- 2.4.1 Data provided by the EA, Local Authority and BGS indicates that there are no recorded licensed or known historical landfill sites located within 250m of the site.
- 2.4.2 Information provided by a number of sources (detailed below) shows that there is one waste treatment/transfer sites recorded within 250m of the site. This is described within the following table.

Table 7 – Landfill / Waste Transfer / Waste Treatment Sites

Source of Record	Approx. Distance and Direction	Licence Details	Waste Type and Details
Waste Transfer / Treatment Sites			
Waste Treatment Project	158m W	Application date 2013	Application associated with construction of an energy from waste project. Incineration and mechanical biological treatment of residential waste.

Environmental Permits

2.4.3 EA and Local Authority data indicates that there are processes regulated by an Environmental Permit (under the Environmental Permitting Regulations 2010) within 500m of the subject site. This is described within the following table.

Table 8 – Environmental Permits

Licence Holder	Approx. Distance and Direction from Site	Permitted Activity
Urbaser Environmental Limited Javelin Park Energy Recovery Facility EPR/CP3535CK Permit Number: KP3439YD Status: Effective	211m west	Process: Incineration of non-hazardous waste
St Josephs Travellers Park, Hiltmead Lane, Moreton Valence, Gloucester, Gloucestershire, GL2 7NQ EPRDP3327GC	373m west	Discharge of sewage to tributary of Beaufair Brook
Colethrop Farm, Haresfield	489m north	Trade discharge: process effluent to tributary of River Severn.

2.4.4 There are a number of waste exemptions within 500m of the site associated with agricultural processes including cleaning, storage, spreading and burning of wastes.

COMAH Sites

2.4.5 There is one record of operations under the Control of Major Accident Hazards (COMAH) Regulations 1999, located within 500m of the site. This relates to WL Vallance Ltd, Unit 11 Javelin Park, 17m west of the site. This is a historical NIHHS site.

Pollution Incidents

2.4.6 Environment Agency data indicates that there are no records of ‘major’ or ‘significant’ pollution incidents within 500m of the site.

2.5 Unexploded Ordnance

2.5.1 Reference to the online interactive Zetica Regional Unexploded Bomb Risk map for indicates that the site is in an area of low potential risk from Unexploded Bombs. However, the site is in an area of known military history associated with RAF Quedgeley site 6 located 250m north, in general

accordance with CIRIA Report consideration of undertaking further risk assessment in the form of a Desk Based Threat Assessment should be considered.

3 PRELIMINARY CONCEPTUAL SITE MODEL

3.1 Background

3.1.1 An preliminary conceptual site model (CSM) consists of an appraisal of the *source-pathway-receptor* 'contaminant linkages' which is central to the approach used to determine the existence of 'contaminated land' according to the definition set out under Part 2A of the Environmental Protection Act 1990. For a risk to exist (under Part 2A), all three of the following components must be present to facilitate a potential 'pollutant linkage'.

- **Source** referring to the source of contamination (Hazard).
- **Pathway** for the contaminant to move/migrate to receptor(s).
- **Receptor** (Target) that could be affected by the contaminant(s).

3.1.2 Receptors include human beings, controlled waters and buildings / structures. The National Planning Policy Framework, used to address contaminated land through the planning process, follows the same principles as those set out under Part 2A. Further details on the Part 2A regime are presented within Appendix C.

3.2 Potential Pollutant Linkages

3.2.1 Each stage of the potential pollutant linkages have been assessed individually on the basis of information obtained during the site reconnaissance, and desk study exercise and are discussed in the following section.

Potential Contaminant Sources

On Site – Current Land Use

3.2.2 Current agricultural use of the site is unlikely to result in significant contamination. There is the potential for diffuse pesticide/herbicide contamination to be present and the potential for localised hydrocarbon contamination associated with any fuel/oils spills associated with vehicles and agricultural machinery.

3.2.3 Made Ground may be present beneath the site, and there is the potential for infilled ground associated with a former pond identified in the centre of the site. Where present this could represent a potential source of contamination and / or ground gas and could contain contaminants such as asbestos, particularly if soil materials have been imported from elsewhere. It is likely that any soil contamination associated with made ground will be minor and of limited extent.

On Site – Historical Land Uses

3.2.4 Historical use of the site appears to be largely limited to agricultural uses. There is the potential for diffuse pesticide/herbicide contamination to be present and the potential for localised hydrocarbon contamination associated with any fuel/oils spills associated with vehicles and agricultural machinery.

Off-site – Current Land Uses

3.2.5 Current off-site potential sources of contamination include the Javelin Park Energy Recovery Facility. Waste processing and other operations at the facility represent a potential source of contaminants including metals, hydrocarbons and other organic compounds.

Off-Site – Historical Land Uses

- 3.2.6 Historical use of the area surrounding the site which includes Bilton Industrial estate, tanks, sewage beds, airfield, RAF Quedgeley site no.6, Quedgeley Interchange, etc may have resulted in a wide range of inorganic and organic contaminants including metals, asbestos, hydrocarbons and solvents. There is also the potential for the generation of ground gas associated with any filled land. The Airfield and RAF site may also have been used to store/test munitions. Any impact from these land uses on on-site soil quality are likely to be minor.
- 3.2.7 Construction of the Quedgeley Interchange to the north west of the site may have included cut/fill schemes creating significant volumes of made ground which may represent a potential source of ground gas.

Potential Pathways

- 3.2.8 In areas of the completed development covered by buildings or hardstanding the risks to human health receptors associated with ground contamination (if present) via the pathways of dermal contact, ingestion and dust inhalation will be mitigated by the surface cover. However, in areas of soft landscaping, these pathways could be active. In addition, there would be potential for the airborne migration of soil/dust from these areas to the wider site and off site.
- 3.2.9 There is the potential for ground gas and volatile contaminants of concern in soil and/or groundwater (if present) beneath the site to impact future site users via the inhalation pathway in indoor areas of the completed development.
- 3.2.10 The site is indicated to be underlain by the low permeability Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated), which will likely limit the vertical migration of contaminants of concern to deeper groundwater and mitigate the lateral off-site and on-site migration of contaminants of concern via shallow groundwater (where present).

Potential Receptors

- 3.2.11 Post development human health receptors include site users and neighbouring site users.
- 3.2.12 During the redevelopment process, construction personnel and neighbouring site users may be at increased risk from ground contamination, especially if soils are being disturbed. Providing construction workers adopt appropriate levels of hygiene and personal protective equipment based on appropriate risk assessment in accordance with the requirement of the CDM Regulations 2015, they are not considered to be at significant risk from potential contaminants of concern and have not been considered further as part of this assessment. Dust mitigation measures may be necessary to protect neighbouring sites users.
- 3.2.13 The nearest surface water features are a series of field drains/ditches which cross the site and off-site ones, the closest of which is located adjacent to the south of the site. Measures may need to be implemented during the redevelopment process to protect surface water receptors.

3.3 Preliminary Conceptual Site Model

- 3.3.1 An preliminary CSM has been developed on the basis of the site reconnaissance and desk study. The CSM is used to identify potential sources, pathways and receptors (i.e. potential pollutant linkages) on site and is summarised in the table below:

Table 9 – Preliminary Conceptual Site Model

Potential Source	Contaminants of Concern	Via	Potential Pathways	Post Development Linkage Potentially Active?	Receptors
On site : Undeveloped agricultural land	Metals, asbestos, hydrocarbons. Potential for diffuse pesticides/herbicides	Soil	Direct contact/ingestion	✓	Future site users
			Inhalation of volatiles	✓	
			Airborne migration of soil or dust	✓	Off-site users
			Leaching of mobile contaminants	✗	Secondary Undifferentiated Aquifer Field drains and ditches
		Groundwater	Direct contact/ingestion	✗	Future site users Off-site users
			Inhalation of volatiles	✓	Future site users Off-site users
			Vertical and lateral migration in permeable strata	✗	Secondary Undifferentiated Aquifer Field drains and ditches
Off-site – current: Energy Recovery Facility	Metals, asbestos, hydrocarbons, solvents,	Groundwater	Direct contact/ingestion	✓	Future site users
			Inhalation of volatiles	✓	Future site users
Off site – historical: Industrial estate, including tanks and sewage beds, airfield, RAF site.					
On and off-site – Made Ground	Carbon dioxide and methane	Ground Gas	Inhalation of ground gas	✓	Future site users
				✓	
			Explosive risks	✓	Future site users Off-site users

3.3.2 The risk assessment is based upon the available information relating to the site. Should ground conditions inconsistent with those outlined in this report be encountered RPS should be contacted to enable further assessment.

4 PRELIMINARY GEOTECHNICAL ASSESSMENT

4.1 Preliminary Geotechnical Risk Register

4.1.1 The following table provides a summary of key potential geotechnical hazards including preliminary indication of whether the site is likely to be affected by the hazard.

Table 10 – Preliminary Geotechnical Risk Register

Hazard Description	Potential for Hazard Low/Moderate/High	Comments
Sudden lateral / vertical changes in ground conditions	Low to Moderate	<p>Published BGS information indicates the ground conditions across the site are likely to be largely consistent with no superficial deposits indicated to be present beneath the site. Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated) is mapped as underlying the site.</p> <p>Although Made Ground is not mapped across the site it may be present locally at variable thickness associated with the former use and may give rise to some inconsistency.</p> <p>Variation in the nature and distribution of soils may result in the potential for excessive differential and total settlement for proposed structures, dependent on the foundation solutions adopted.</p>
Deeper pockets of Made Ground	Low	<p>There is the potential for deeper pockets of Made Ground to be present associated with historical infilling of ponds and hollows.</p> <p>Made Ground has the potential for uncontrolled settlement which could result in excessive creep, differential and total settlement of buildings and infrastructure.</p> <p>Made Ground is generally not a suitable founding strata and foundation maybe required to penetrate the full thickness and found in competent underlying natural strata.</p> <p>There is a potential for buried obstructions to be present within any Made Ground associated with the historical land uses.</p>
Highly compressible / low bearing capacity soils, (including peat and soft clay)	Low to Moderate	<p>There is a potential for pockets of low strength clays to be present within the weathered portion of the Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated).</p> <p>Low strength weathered strata could result in excessive differential and total settlement of buildings and infrastructure.</p>
Ground dissolution features / natural cavities	Low	<p>Ground conditions beneath the site are not consistent with these conditions.</p>
Shrinking and swelling clays	Moderate	<p>The near surface soils may be of low to moderate volume change potential (this should be confirmed via geotechnical laboratory testing), which could result in settlement / heave of foundation and earthworks in particular when located within the influences of trees.</p> <p>Mature trees have been identified adjacent to the site. The potential effect of these on the depth required for the foundation should be assessed in accordance with the NHBC Manual guidelines.</p> <p>To mitigate the effects of potential heave or shrinkage, formation levels within these strata should be protected</p>

Hazard Description	Potential for Hazard Low/Moderate/High	Comments
		from the action of trees and vegetation and their exposure time kept to a minimum prior to casting and buried concrete.
Slope stability issues	Low to Moderate	Any significant slopes present on site or any temporary slopes created as part of the development should be subject to appropriate geotechnical design based on site-specific site investigation information.
High groundwater table (including waterlogged ground)	Low to Moderate	There is the potential for shallow perched groundwater to be present beneath the site associated with the Made Ground. Groundwater control/exclusion measures may be required to enable formation of any excavations required at the site depending on localised conditions. This may include pump and pumping, dewatering or sheet piled cofferdams in extreme circumstances. However, requirements for this should be confirmed via intrusive investigation and subsequent groundwater level monitoring.
Underground mining	Low	Ground conditions beneath the site are not consistent with these risk factors.
Concrete classification	Moderate	Any Made Ground may contain sulphate bearing soils. Chemical laboratory analysis should be undertaken on soil samples collected from each strata encountered beneath the site to determine a Design Sulphate Class and an Aggressive Chemical Environment for Concrete (ACEC) Classification for proposed buried structures as part of the development.
Seismic Activity	Low	The Eurocode 8 seismic hazard zoning maps for the UK (Musson and Sargeant, 2007) indicate that horizontal Peak Ground Acceleration (PGA) values with 10% probability of being exceeded in 50 years (475 year return period) are between 0.00 and 0.02g, which is considered very low.
Radon	Low	BGS and Public Health England data indicates that the site is located within an area where less than 1% of properties are above the action level. No radon protection measures are necessary.

4.2 Preliminary Geotechnical Recommendations

Ground Conditions

- 4.2.1 The ground conditions at the site are anticipated to comprise the Blue Lias and Charmouth Mudstone formation below the surface topsoil covering. A site-specific detailed ground investigation will be required to determine the geotechnical characteristics of the soils present on site to inform any subsequent design substructure design and to confirm groundwater levels. The below advice is therefore, provided for preliminary purposes only and will need to be reappraised following completion of an appropriate ground investigation.

Foundations

- 4.2.2 For lightly to moderately loaded structures, it is anticipated that shallow spread foundations in Blue Lias and Charmouth Mudstone formation will be suitable, subject to confirmation of the depth to the stratum, the volume change potential of the soils, the extent of any weathered or desiccated zone and presence of any relict failure planes known to be a feature of this stratum. For moderately

to highly loaded structures, piled foundations extending into the Blue Lias and Charmouth Mudstone formation may be required. It is likely that Continuous Flight Auger (CFA) piling will be most suitable based on the site setting and anticipated ground conditions.

4.2.3 The guidance set out in NHBC Chapter 4.2 Building Near Trees will need to be adhered to in relation to specifying minimum foundation depths and any heave precautions required.

4.2.4 Should any areas of Made Ground be encountered, it should be removed and replaced with suitably engineered granular fill, or founded extended below this stratum to bear on the more competent natural soils below.

Floor Slabs

4.2.5 It is anticipated that natural soils will be encountered at proposed floor slab levels. Ground bearing floor slabs are therefore likely to be appropriate based on the anticipated ground conditions on site, notwithstanding the effects of any nearby trees, where appropriate guidance should be followed.

Other issues

4.2.6 Given the development history of the site, the presence of former buried structures is not anticipated. The natural site won materials are likely to be suitable for reuse within any proposed earthworks subject to appropriate investigation, testing, assessment, and classification. Groundwater is not anticipated to be at shallow depth below the site although this can only be confirmed following intrusive ground investigation. The Blue Lias and Charmouth Mudstone formation are known to contain relict failure planes which may be subject to reactivation under certain circumstances and this should be carefully considered during any future substructure, slope stability or retained earth design.

5 CONCLUSIONS AND RECOMMENDATIONS

- 5.1.1 The outline CSM produced as part of this Preliminary Risk Assessment has identified a limited number of potential sources of contamination that could have resulted in minor localised soil or groundwater contamination. There is also a limited potential for the generation of ground gas.
- 5.1.2 There is the potential for several pollutant linkages to be active on completion of the development that could impact human health receptors but we anticipate that basic mitigation could be used to manage the risk. Given the environmental setting, controlled waters receptors are unlikely to be at significant risk.
- 5.1.3 It is therefore recommended that the presence of potential contaminants and ground gas is investigated as part of a Phase 2 Geo-Environmental Site Investigation prior to redevelopment of the site. The scope of this investigation should include the following:
- Drilling of a number of shallow boreholes across the site;
 - Installation of groundwater and gas monitoring wells in boreholes;
 - Collection of representative soil and groundwater samples from beneath the site with chemical analysis of these samples for identified contaminants of concern;
 - Collection of presentative soil samples from beneath the site with geotechnical laboratory testing to allow geotechnical classification of the underlying ground conditions.
 - Ground gas monitoring in wells installed across the site;
 - Assessment of ground conditions and generic quantitative risk assessment of soil and groundwater chemical analysis results to determine the potential for the identified potential pollutant linkages to remain active upon redevelopment of the site;
 - Geotechnical Assessment of ground condition to facilitate preliminary foundation and pavement design and excavatability; and
 - Provision of recommendations (where necessary) for remediation/mitigation measures to ensure that any identified potential pollutant linkages are not active upon redevelopment of the site.
- 5.1.4 If the site investigation identifies the presence of potentially significant contamination or ground gases further investigation, monitoring, risk assessment and remediation may be necessary.
- 5.1.5 It is likely that the pollutant linkages will be such that they could be mitigated by the use of typical measures such as a surface cover system, gas protection measures and 'barrier' water supply pipe. There may however be a requirement for a degree of remediation and increased soil/groundwater disposal cost may be realised. If excavated materials are to be reused on site a Materials Management Plan may be required and appropriate licenses/exemptions will be required.
- 5.1.6 It would be prudent to combine any site investigation undertaken for geo-environmental purposes with a geotechnical site investigation. It may also be beneficial to incorporate soil permeability testing to inform preliminary SUDS design – low permeability soils could prevent the use of soakaways.



FIGURES

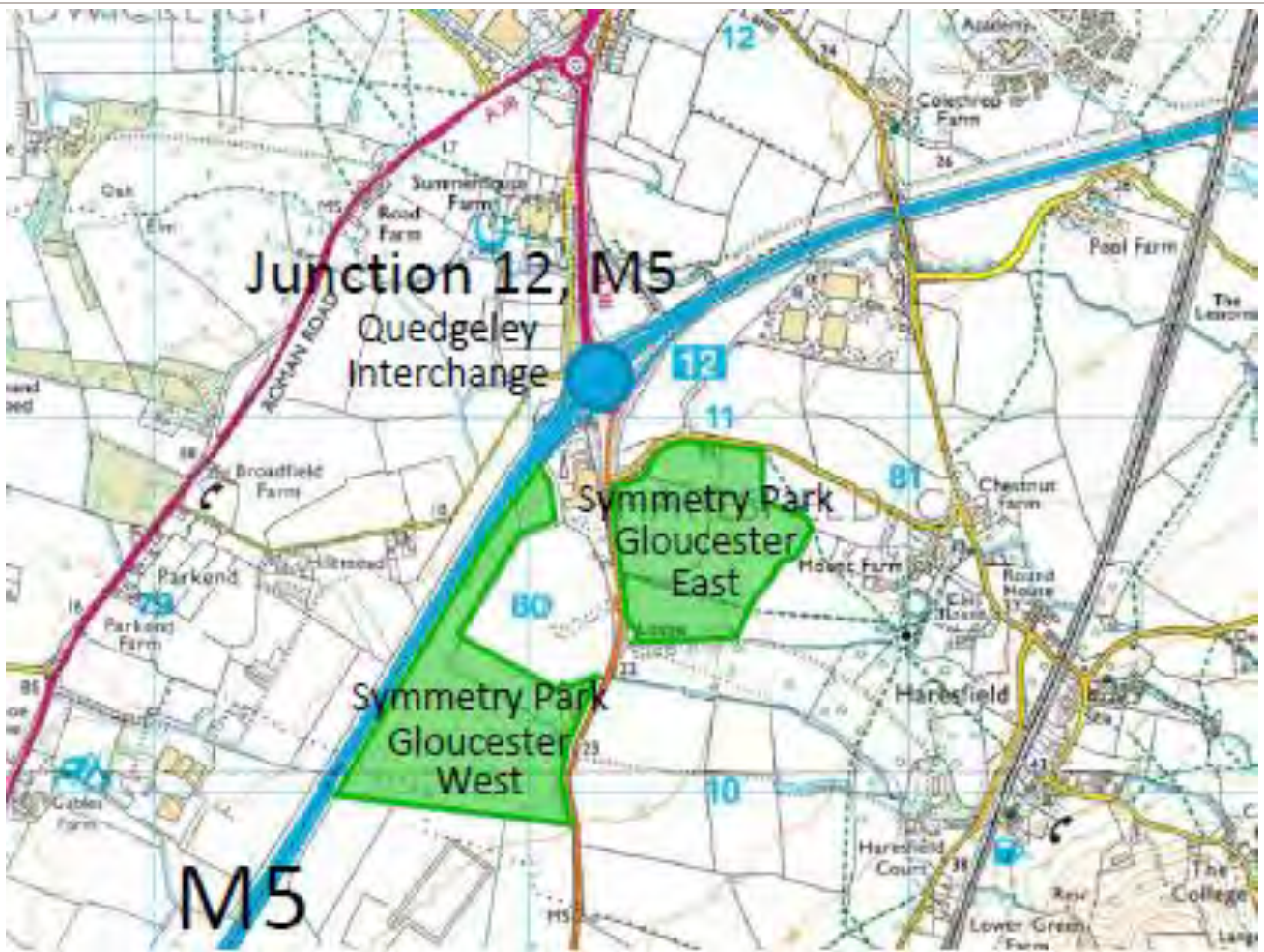


Figure 1: Site Location Plan



Figure 2: Site Boundary Plan

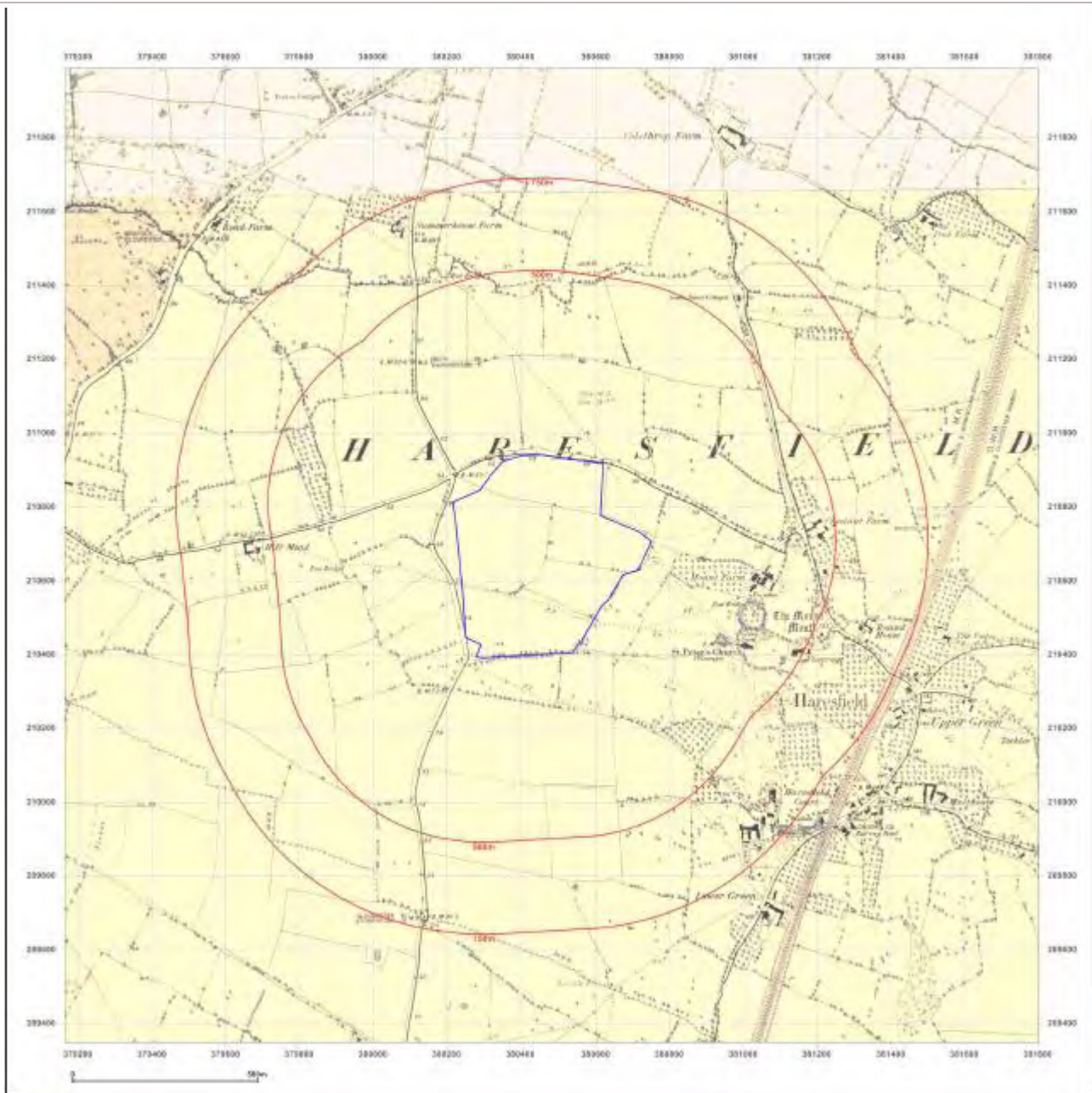


Figure 3: Historical Map Extract 1882 - 1883

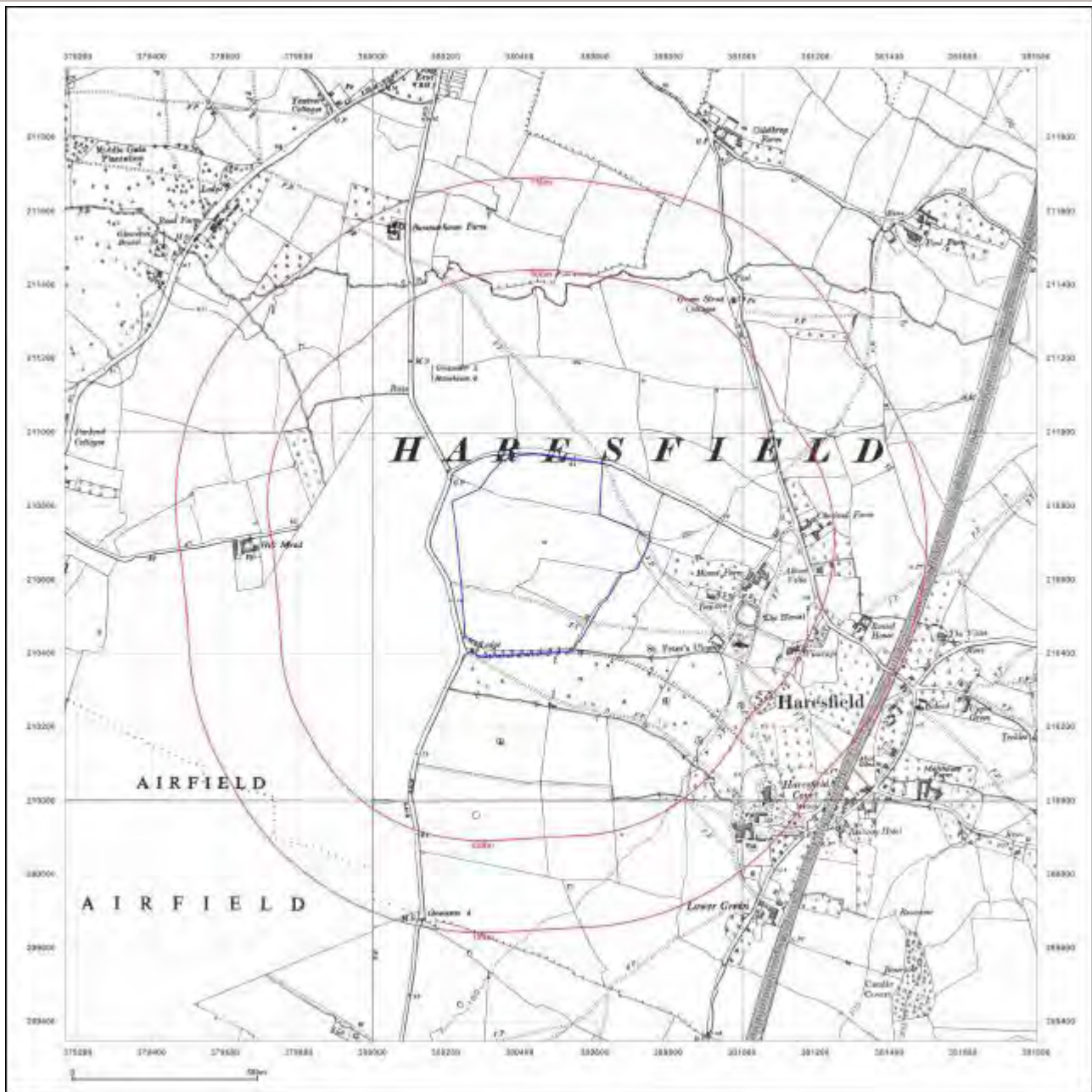


Figure 5: Historical Map Extract 1954

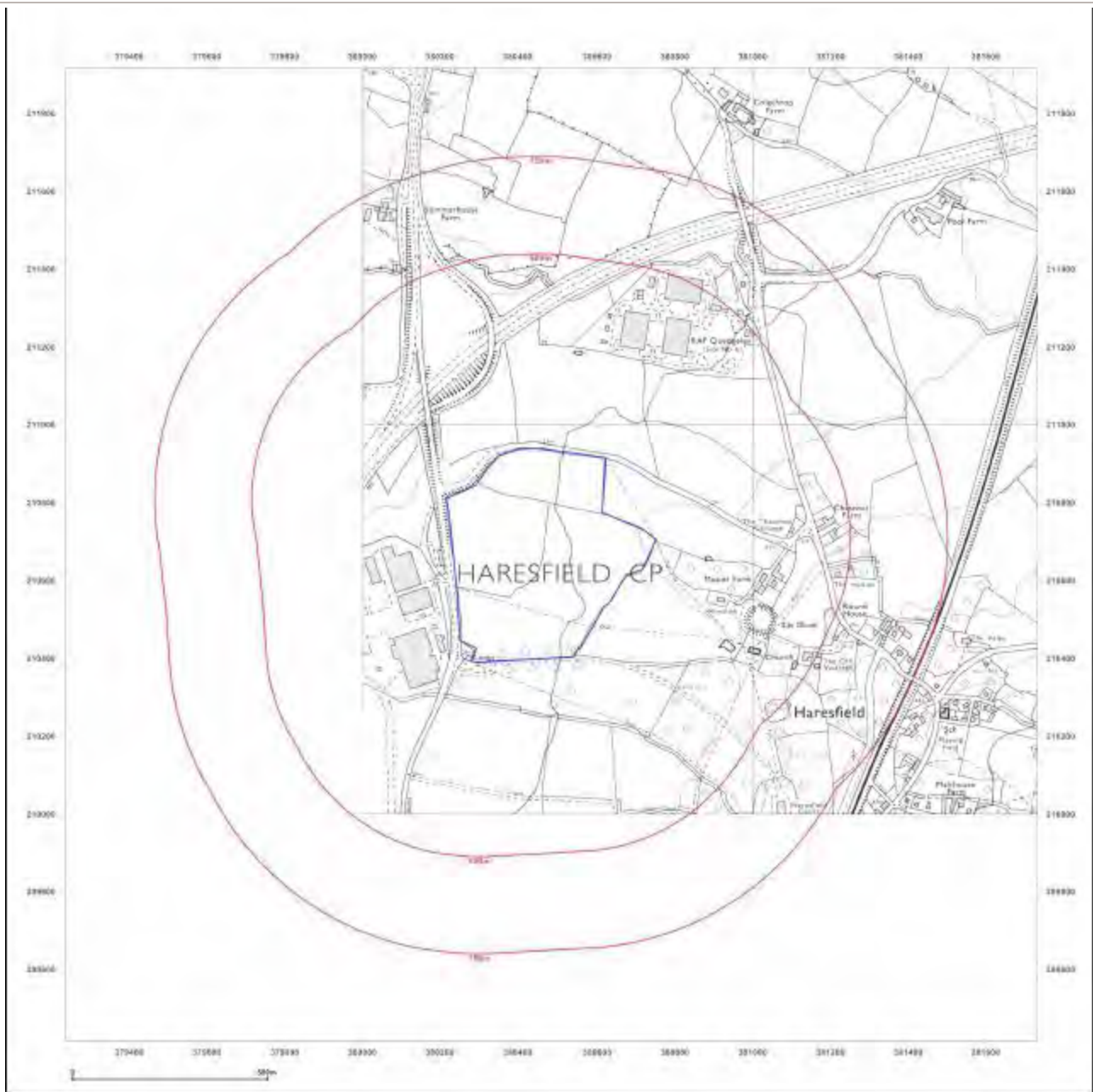


Figure 6: Historical Map Extract 1974

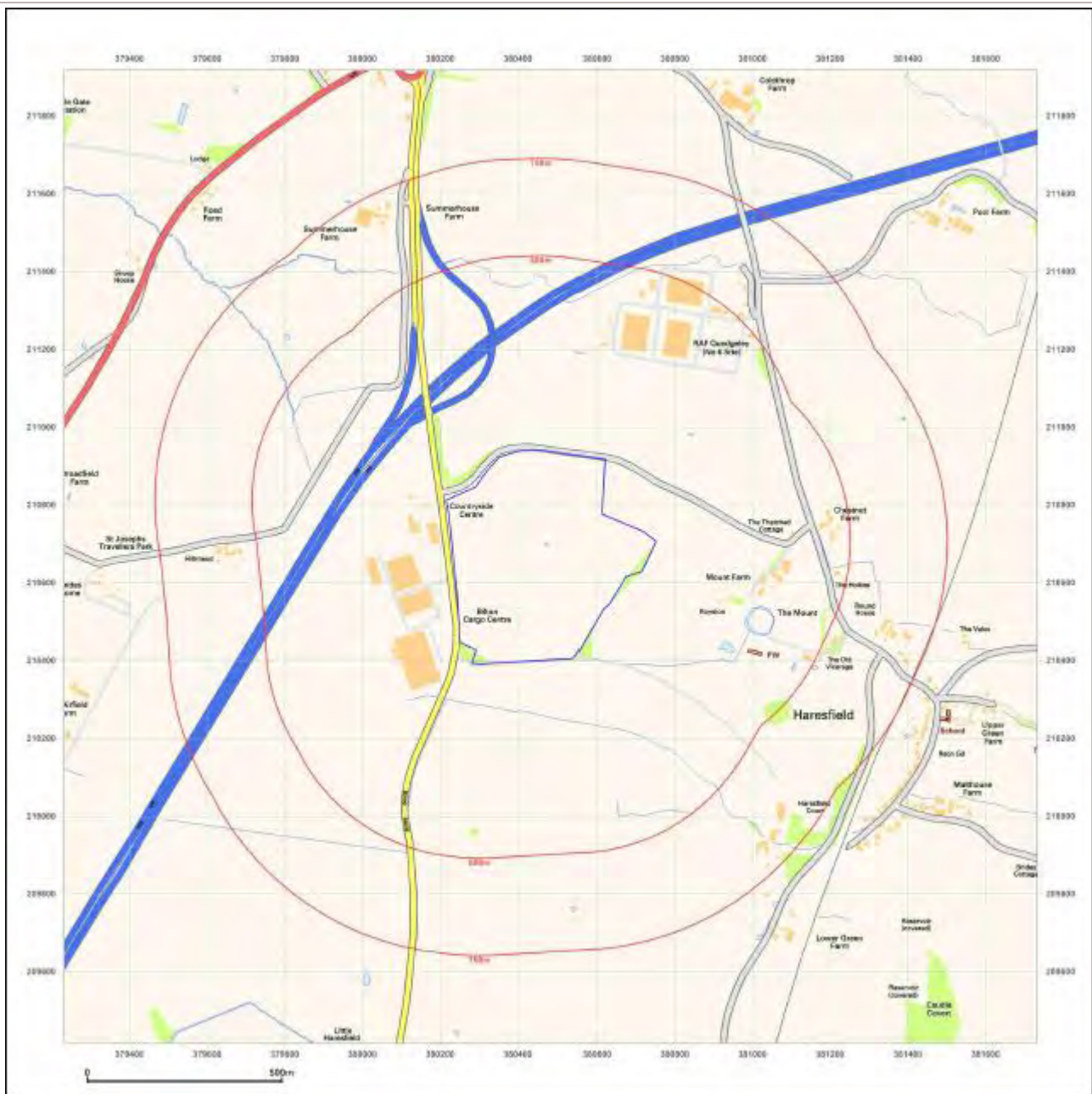


Figure 7: Historical Map Extract 2001



Figure 8: Historical Map Extract 2020



Annexes



Schedule of Accommodation
All areas are square feet gross internal

Unit	B8	Offices	Total	Parking	Net Site Area
01	522,500	25,000	547,500	424no. cars	23.00 acres
02	250,000	10,000	260,000	199no. cars	12.20 acres
Total			807,500 sq.ft.		35.20 acres
Gross site area (within red line)					51.13 acres

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client

TRITAX SYMMETRY
A TRITAX BIG BOX COMPANY

project
Symmetry Park
Junction 12, M5
Gloucester

drawing
Illustrative Masterplan

scale 1:1000 @ A0 drawn up
checked alps date 18/09/20



Schedule of Accommodation
All areas are square feet gross internal

Unit	B8	Offices	Total	Parking	Net Site Area
01	522,500	25,000	547,500	424no. cars	24.95 acres
02	250,000	10,000	260,000	199no. cars	12.20 acres
Total			807,500 sq.ft.		37.15 acres
Gross site area (within red line)					51.13 acres

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TRITAX SYMMETRY
A TRITAX BIG BOX COMPANY

project
**Symmetry Park
Junction 12, M5
Gloucester**

drawing

Illustrative Masterplan

scale 1:1000 @ A0 drawn up

checked alps date 18/09/20

no



APPENDICES

Appendix A
General Notes

RPS CONSULTING SERVICES LTD

GENERAL NOTES

PHASE 1 - ENVIRONMENTAL RISK ASSESSMENT / DESK STUDY ENVIRONMENTAL REVIEW

1. A "desk study" means that no site visits have been carried out as any part thereof, unless otherwise specified.
2. This report provides available factual data for the site obtained only from the sources described in the text and related to the site on the basis of the location information provided by the Client.
3. The desk study information is not necessarily exhaustive and further information relevant to the site may be available from other sources.
4. The accuracy of maps cannot be guaranteed and it should be recognised that different conditions on site may have existed between and subsequent to the various map surveys.
5. No sampling or analysis has been undertaken in relation to this desk study.
6. Any borehole data from British Geological Survey sources is included on the basis that: "The British Geological Survey accept no responsibility for omissions or misinterpretation of the data from their Data Bank as this may be old or obtained from non-BGS sources and may not represent current interpretation".
7. Where any data supplied by the Client or from other sources, including that from previous site investigations, have been used it has been assumed that the information is correct. No responsibility can be accepted by RPS for inaccuracies in the data supplied by any other party.
8. This report is prepared and written in the context of an agreed scope of work and should not be used in a different context. Furthermore, new information, improved practices and changes in legislation may necessitate a re-interpretation of the report in whole or in part after its original submission.
9. The copyright in the written materials shall remain the property of the RPS Company but with a royalty-free perpetual licence to the Client deemed to be granted on payment in full to the RPS Company by the Client of the outstanding amounts.
10. The report is provided for sole use by the Client and is confidential to them, their professional advisors, no responsibility whatsoever for the contents of the report will be accepted to any person other than the Client. [Unless otherwise agreed]
11. These terms apply in addition to the RPS "Standard Terms & Conditions" (or in addition to another written contract which may be in place instead thereof) unless specifically agreed in writing. (In the event of a conflict between these terms and the said Standard Terms & Conditions the said Standard Terms & Conditions shall prevail.) In the absence of such a written contract the Standard Terms & Conditions will apply.

Appendix B
Photographs



. Looking northwest from southeastern area of the site.



Drainage ditch running in southeastern corner of the site.



Looking southwest from northeastern corner .



Drainage ditch on northwestern boundary.



Looking south from northwestern corner .



Slopes in northwestern corner of the site

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Client: Tritax Symmetry

Date: July 2020

Project: Symmetry Park East

Appendix: B

Title: Site Photographs

Job Ref: JER8631

Appendix C

Part 2A (The Contaminated Land Regime)

CONTAMINATED LAND DEFINITION

Under Section 57 of the Environmental Act 1995, Part 2A was inserted into the Environmental Protection Act 1990 to include provisions for the management of contaminated land.

Subsequent regulations were first implemented in England in April 2000, Scotland in July 2000 and Wales in July 2001¹, providing a definition of ‘contaminated land’ and setting out the nature of liabilities that can be incurred by owners of contaminated land and groundwater.

According to the Act, contaminated land is defined as ‘any land which appears to the local authority in whose area the land is situated to be in such a condition, by reason of substances in, on or under the land that:

1. *significant harm* is being caused or there is a *significant possibility* of such harm being caused; or
2. *significant pollution* of controlled waters² is being caused or there is a significant possibility of such pollution being caused³

The guidance on determining whether a particular possibility is significant is based on the principles of risk assessment and in particular on considerations of the magnitude or consequences of the different types of significant harm caused. The term ‘possibility of significant harm being caused’ should be taken, as referring to a measure of the probability, or frequency, of the occurrence of circumstances that could lead to significant harm being caused.

The following situations are defined where harm is to be regarded as significant:

1. Chronic or acute toxic effect, serious injury or death to humans
2. Irreversible or other adverse harm to the ecological system
3. Substantial damage to, or failure of, buildings
4. Disease, other physical damage or death of livestock or crops
5. The pollution of controlled waters⁴.

With regard to radioactivity, contaminated land is defined as ‘any land which appears to be in such a condition, by reason of substances in, on or under the land that harm is being caused, or there is a *significant possibility of such harm being caused*⁵’.

The Risk Assessment Methodology

Risk assessment is the process of collating known information on a hazard or set of hazards in order to estimate actual or potential risks to receptors. The receptor may be humans, a water resource, a sensitive

¹ In England by The Contaminated Land (England) Regulations 2000, updated by The Contaminated Land (England) (Amendment) Regulations 2012; in Scotland by The Contaminated Land (Scotland) Regulations 2000, updated by the Contaminated Land (Scotland) Regulations 2005; and in Wales by The Contaminated Land (Wales) Regulations 2001, updated by the Contaminated Land (Wales) Regulations 2006.

² In Scotland the term “controlled water” has been updated to “water environment” under the Contaminated Land (Scotland) Regulations 2005 in line with the Water Environment and Water Services (Scotland) Act 2003.

³ The definition was amended in 2012 by implementation of the Water Act 2003.

⁴ Groundwater in this context does not include waters within underground strata but above the saturated zone.

⁵ The Radioactive Contaminated Land (Modification of Enactments) (England) Regulations 2006 and Contaminated Land (Wales) Regulations 2006.

local ecosystem or future construction materials. Receptors can be connected with the hazard via one or several exposure pathways (e.g. the pathway of direct contact). Risks are generally managed by isolating or removing the hazard, isolating the receptor, or by intercepting the exposure pathway. Without the three essential components of a source (hazard), pathway and receptor, there can be no risk. Thus, the mere presence of a hazard at a site does not mean that there will necessarily be attendant risks.

The Risk Assessment

By considering where a viable pathway exists which connects a source with a receptor, this assessment will identify where pollutant linkages may exist. A pollutant linkage is the term used by the DEFRA in their standard procedure on risk assessment. If there is no pollutant linkage, then there is no risk. Therefore, only where a viable pollutant linkage is established does this assessment go on to consider the level of risk. Risk should be based on a consideration of both:

- The likelihood of an event (probability) - takes into account both the presence of the hazard and receptor and the integrity of the pathway.
- The severity of the potential consequence - takes into account both the potential severity of the hazard and the sensitivity of the receptor.

For further information please see the Contaminated Land section on the DEFRA website (www.defra.gov.uk).