

P3Eco Ltd

P3Eco (Bicester) Ltd and A2Dominion Group

NW Bicester Eco Development

DESK STUDY - Masterplan Site



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EXECUTIVE SUMMARY

Site Location	The town of Bicester lies approximately 24km to the north east of Oxford and 28km to the south east of Banbury. The M40 motorway lies 2km to the south west, with ready access to the town from Junction 9. The south-east of the proposed NW Bicester eco development Site terminates against the outer limits of Bicester at the A4095; while to the north-west and north-east lie the villages of Bucknell and Caversfield.
Current Site Use	The Site is predominantly used for agriculture, with the land having an agricultural land value Grade of 3 (good to moderate quality). The principal land uses on Site are for arable cropping and rotational grassland. On the eastern Site boundary, there is a small business park and a police transport base.
Site and Surrounding Area History	<p>Since the earliest available historical map of 1881, the Site has been dominated by agriculture. The only major change from 1881 to the present day was the construction of the NW to SE trending Great Western Railway in 1910, through the centre of the Site. Since then, there has been no significant change in land use.</p> <p>Meanwhile, the town of Bicester expanded outwards from a small centre 1.5km SE of the Site in 1881, to bordering the eastern Site boundary at the present day. The expansion has been overwhelmingly residential and there has been no industrial activity in proximity to the Site.</p>
Environmental Setting	<p>The landscape character of the Site is defined by its gently falling topography from the north-west to south-east. There are three streams on Site; two minor, unnamed streams (flowing in a NW to SE direction), which feed the N to S flowing River Bure in the north-eastern corner of the Site.</p> <p>Geologically, the Site is underlain by a thin cover of superficial deposits, before the solid geology is encountered. At rock head, this is represented by the Cornbrash Formation, which primarily comprises bioclastic limestone. This is underlain by the Forest Marble Formation, which comprises grey calcareous mudstone with lenticular beds of bioclastic limestone. Deeper (older) geological units are not represented in outcrop on Site.</p>
Conceptual Site Model	Possible contaminants relate to agricultural chemicals and fuels as well as rail-derived contaminants. A former small landfill has also been identified in the east of the Site at the location of the business park; however information available suggests this was filled with inert material. Likewise, small offsite quarries identified within the Envirocheck Report appear to have been infilled and now contain trees/other vegetation.
Qualitative Risk Assessment	If contamination is present on Site, it is not expected to be widespread or significant; therefore the qualitative risks to humans and groundwater are, at this stage, considered to be low. However, the risk to surface water due to agricultural chemical runoff (particularly nitrates) is considered to be moderate to high (as the Site is within a Nitrate Vulnerable Zone). Additionally, basic radon protection measures will be required for new dwellings and extensions.
Geotechnical Considerations	Bedrock is expected to be close to the surface, which should prove to be an adequate founding material. However, the limestone may be affected by dissolution features, although there is no evidence of this from the (limited) borehole logs obtained for the Site.
Recommendations	A targeted, intrusive ground investigation is recommended in order to confirm or refute the environmental and geotechnical conclusions presented in this report. This will increase confidence in our understanding of the nature of the Site and any possible constraints to the future development of the eco development.

1 INTRODUCTION

1.1 Terms of Reference

Hyder Consulting (UK) Ltd. (Hyder) has been instructed by P3Eco Ltd. (P3Eco) and A2Dominion Group Ltd. (A2Dominion) to undertake a Desk Study for a proposed new eco development on the north-western periphery of the town of Bicester, Oxfordshire. The study has been undertaken to assess the potential Geo-Environmental and Geotechnical risks in relation to the proposed development of the Masterplan Site.

1.2 Scope of Works

The purpose of this report is to identify the environmental, geological, hydrogeological and hydrological conditions present at the Site, and together with knowledge of the historic land use, develop an understanding of any potential contamination risks that might arise from current or potential future use of the Site. This report also lists the potential Geotechnical constraints to the proposed development which warrant consideration.

1.3 Sources of Information

Public register information relating to the Site and the surrounding area has been obtained mainly from the Landmark Information Group Ltd. Envirocheck Report, a copy of which is included in Appendices A and B of this report. A drawing entitled “Envirocheck Information” is also included within Appendix A, which shows information relevant to the Site, in a concise manner. The references assigned to each symbol match those in the Envirocheck Datasheets.

Reference is also made where applicable to a draft concept study report produced by Halcrow in February 2009 (Ref. 1) and “a vision for the future of Bicester” report prepared by Farrels in June 2009 (Ref. 2).

1.4 Basis of Environmental Risk Assessment

This environmental assessment has been undertaken with due regard to Contaminated Land Guidance Documents issued by the Department of the Environment Food and Rural Affairs (DEFRA). The Guidance requires a risk-based approach, with the potential environmental risk assessed qualitatively; using the ‘source-pathway-target’ pollutant linkage concept contained in Part IIA of the Environment Protection Act (Ref. 3).

Specific comment is made regarding the Site’s status in the Contaminated Land Regime implemented on 1st April 2000 as Part IIA of the Environmental Protection Act 1990 (as amended), and the actual or potential designation of the Site as ‘Contaminated Land’ as defined in section 78A(2) of the Act. Unless specifically stated as relating to this definition, references to ‘contamination’ and ‘contaminants’ relate in general terms to the presence of potentially hazardous substances, in, on, or under the Site.

References to risk classifications are made according to the definitions negligible to very high, which are described in Appendix C.

1.5 Limitations and Expectations

This report has been compiled from a number of sources, including historical maps and records from regulatory and statutory bodies procured through the Landmark Information Group Ltd., Envirocheck Report, which Hyder believes to be trustworthy. However, Hyder is unable to guarantee the accuracy of information provided by others. The report is based on information available at the time, and as such, the potential exists for further information to become available, which may change this report's conclusion and for which Hyder cannot be responsible.

2 SITE SETTING

2.1 Location

The town of Bicester lies approximately 24km to the north east of Oxford and 28km to the south east of Banbury. The M40 motorway lies 2km to the south west, with ready access to the town from Junction 9.

The proposed eco development Site will comprise approximately 5,000 homes with supporting employment and education infrastructure, and will be situated on the north-western periphery of Bicester, beyond the A4095 (which forms part of the Bicester Ring Road), approximately 1.5km from the town centre. The Site covers an area of approximately 416ha and at present, comprises Grade 3 agricultural land with a number of farmhouses and other buildings, as well as a small commercial area on the western side of Howes Lane (A4095). Immediately beyond the Site to the north-west is the village of Bucknell, with Caversfield located on the north-eastern Site boundary, beyond the B4100 highway.

The location of the Site is presented in Figure 1. At the time of writing, a definitive Site layout plan is not available; therefore a drawing is not included.

2.2 Topography

The 1:25,000 scale Ordnance Survey map of the area shows that the topography of the Site falls gently by approximately 10m from the north-western boundary to the south-eastern boundary (from ~95m AOD to ~85m AOD). This topography is typical of the gently rolling nature of this part of Oxfordshire.

2.3 Site Description

A Site walkover survey was undertaken by two Hyder Geotechnical and Geo-Environmental Engineers between 30th June and 2nd July 2010. The aim of the survey was to attempt to identify and target potential Site constraints to the development that may not have been apparent from the desktop study review of available documents alone.

The agricultural land value is Grade 3 (good to moderate quality). As characterised by Grade 3 land, the principal land uses on Site are for arable cropping and rotational grassland, e.g. cereals or as grass leys for dairy cows, beef and sheep. Fields are bounded either by post and wire fences or by dense hedges with some large trees. Most fields were surrounded by drainage ditches approximately 0.5m to 0.75m deep, though all were dry at the time of the Site walkover.

Existing buildings within the Site boundary include those at Himley Farm, Aldershot Farm and Gowell Farm, located to the south of the railway line, and Hawkwell Farm, Lord's Farm and Home Farm located to the north. Home Farm and Himley Farm contain Grade II Listed Buildings.

The Site is dissected through its centre by the north-west to south-east trending Birmingham Snow Hill to London Marylebone railway, with the Bucknell/Bicester Road running roughly parallel to its east. In the north-west of the Site, the railway lies in a cutting, which rises to an embankment of around 5 metres height in the south-east.

The employment land on the western side of Howes Lane comprises a Thames Valley Police Traffic Base and the Avonbury Business Park, with a range of small business units.

A small number of photographs from the Site walkover survey are included in Appendix D for reference.

2.4 Surrounding Land Uses

For the purposes of this report, the Masterplan Site comprises the area contained within the pink line shown in Figure 1.

The surrounding land uses are predominantly residential to the south-east within Bicester town, while agricultural land dominates in all other directions.

The current surrounding land uses are summarised in Table 2.1 below.

Table 2.1: Surrounding Land Uses

Direction	Location	Land Use	Comments
North, north-west and west	Adjacent	Agricultural land/some woodland and hedgerows	Land dominated by fields and associated farms
South	Adjacent and beyond	B4030 highway and Bignell Park (woodland and mainly open, undeveloped land)	Bignell Park is a privately-owned estate with hotel and grounds
East and south-east	Adjacent and beyond	A4095 ring road with the town of Bicester on its eastern side	Area dominated by the residential properties of north-west Bicester
North-west	Approximately 800m from Site boundary	Small village of Bicknell	None
North-east	Adjacent	Small village of Caversfield beyond B4100 highway	None

2.5 Unexploded Ordnance

Information pertaining to the risk of unexploded ordnance for the Site has been obtained from Zetica. Their 'Regional Unexploded Bomb Risk Map' indicates that the Site is located within an area of 'low risk'. Low risk regions are those with a bombing density of up to 10 bombs per 1,000 acres (See datasheet in Appendix E). The "Density of Bombs per Borough" table records 0 for both high explosive and anti-personnel ordnance and 4 for incendiary devices.

3 ENVIRONMENTAL SETTING

3.1 Hydrology

There are three main watercourses on Site; two streams flow in a north-westerly to south-easterly direction through the centre and northern parts of the Site, with both discharging into a third stream (the River Bure) in the centre and north-east of the Site area. The River Bure flows off-Site in a roughly north-easterly to south-westerly direction.

The principal drainage direction on Site is likely to follow the topography and dip of the underlying geology, which very gently slopes to the south-east.

3.2 Geology

The following section contains extracts and information obtained from the 1:50,000 scale British Geological Survey (BGS) Map of Buckingham (Ref. 4), BGS borehole logs from holes drilled on and near to the Site (Appendix F) and from a BGS detailed Geological Assessment of the Site area (also contained within Appendix F). Refer to the drawing entitled “Envirocheck Information” in Appendix A for a location plan of the BGS boreholes and their corresponding reference numbers.

3.2.1 Superficial Deposits

Late Quaternary age superficial deposits of Alluvium flank the three streams in narrow tracts, typically some 20m wide (locally up to 80m wide) and some 1m to 3m in thickness. The Alluvium typically comprises sandy, calcareous clay overlying gravelly clay with limestone clasts and may locally include highly compressible, organic-rich (peaty) layers.

Head deposits may be present near the streams where the erosive action of the water has carved small valleys. These deposits are formed by soil creep or hill wash and their composition reflects that of the local materials from which they were derived, either the bedrock or other types of superficial deposits (or both). They are typically poorly stratified and poorly sorted and are not expected to be present in thicknesses much greater than 1m.

Beneath the topsoil, the remainder of the Site has only a thin cover (approximately 1m) of superficial deposits, mainly derived from the partial to complete weathering of the underlying solid geology.

3.2.2 Solid Geology

The landscape of the Site follows the underlying geology, which dips in a south-easterly direction at a very gentle $\sim 0.7^\circ$. The Site area is underlain at rockhead by various formations and members of the Great Oolite Group, of Mid-Jurassic age, which are dominated by limestones with subordinate mudstone beds.

There are no geological faults shown on Site; however some minor faults have been mapped to the north-east of Bucknell village, with ground displacements of up to some 5m. Faults are planes of movement, along which, adjacent blocks of rock strata have moved relative to each other. They commonly consist of zones, perhaps up to several tens of metres wide, containing several to many fractures. The portrayal of such faults as a single line on the geological map is therefore a generalisation. The geological faults in the Bicester area are ancient in origin and

are today mainly inactive, therefore are not thought to present a threat to the proposed development.

Sequence of Strata

The Cornbrash Formation (CB) is the youngest bedrock unit represented and dominates the outcrop within the Site area. It comprises approximately 5m of thick grey to brown, bioclastic, rubbly-bedded limestone with thin subordinate beds of grey mudstone.

The older, underlying Forest Marble Formation (FMB) is exposed as a narrow outcrop on the flanks of the three stream valleys where the Cornbrash Formation has been eroded. The FMB comprises approximately 5m to 10m of grey calcareous mudstone with lenticular beds of bioclastic, ooidal limestone (particularly common at the base).

Although not represented in outcrop on Site, the FMB is underlain at an erosive contact by the White Limestone Formation (WHL), which crops approximately 2km to the north-west. The WHL comprises up to 25m of white to yellow, bedded, peloidal and bioclastic limestone (see Additional Geological Considerations below).

The White Limestone Formation is underlain by four further formations of the Great Oolite Group: in ascending order the Horsehay Sand, the mudstone-dominated Sharp's Hill, the Taynton Limestone and the mudstone-dominated Rutland formations, totalling approximately 20m in thickness. These are then underlain by 2m to 6m of the ferruginous sandstones of the Northampton Sand Formation before the 100m+ of the mudstone-dominated Lias Group is encountered.

The geological ground profile for the Site is expected to be confirmed in more detail following completion of an initial ground investigation.

3.3 Hydrogeology

With the exception of the Forest Marble Formation cropping out in the floors and sides of the valleys, the whole of the Site area is underlain by the Cornbrash Formation. This is a local aquifer and water strikes have been recorded in shallow boreholes drilled within the Site area (Appendix F). The standing water levels are generally between 0.5m and 4.0m below the ground surface.

The Forest Marble Formation may hold small quantities of water in any limestone bands present, but the upper part generally acts as an aquiclude, i.e. an essentially impermeable barrier between the Cornbrash Formation and the underlying White Limestone Formation. None of the boreholes drilled through the Forest Marble Formation in the Site area recorded water strikes within this Formation.

The White Limestone Formation constitutes a major aquifer in the area, which provides some sources of public supply. There are several boreholes in the wider area, some within the Site area, that penetrate this formation:

- A 34m deep borehole at Gowell Farm (SP52/19 at SP 5709 2384), drilled pre-1909 to supply Bicester with water. This penetrated the complete 25m thickness of the White Limestone Formation, underlying about 7.2m of Forest Marble Formation and terminating in the underlying Rutland Formation. Water was struck at 28m and 32m below the ground level in the White Limestone Formation. The rest water level rose to

the surface after the first strike, and was artesian, with a rest water level about 1m above ground level (about 88m AOD) after the second strike. The yield was over 7 l/s.

- An 80 m deep borehole at Lords Farm (SP52/18 at SP 5746 2424), drilled in 1941, was drilled through a similar sequence and terminated in the Lias. It struck water in the Cornbrash Formation, which was cased out, and at two levels below the White Limestone Formation. The rest water level was at 11m below ground level (about 68m AOD) and it yielded 1.7 l/s.

Other records of water levels at Lords Farm (SP52/17A, B and C at about SP 569 245) show that the water level was at approximately 3.6m of ground level (about 76m AOD).

In addition to the available geological information, the Environment Agency (EA) Groundwater Vulnerability Map on the EA website (Ref. 5) has been reviewed to determine the vulnerability of the groundwater underlying the Site with the following conclusions:

- The superficial deposits are not classified as an aquifer. The underlying Cornbrash Formation is classified as a Secondary 'A' Aquifer, which comprises "permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers."

This designation corresponds with the geological interpretation given above.

There are insufficient data to determine a groundwater flow direction, but locally it will probably be towards the nearest stream and regionally, down-dip towards the south-east.

3.3.1 Groundwater Source Protection Zones

The Environment Agency (EA) has defined Source Protection Zones (SPZs) for groundwater sources such as wells, boreholes and springs used for public drinking water supply. The SPZs show the risk of contamination from any activities that might cause pollution in the area.

Source protection zones are defined as follows:

A Source Protection Zone III is the total area needed to support removal of water from a borehole, and to support any discharge from the protected borehole/well/spring used for public drinking water supply.

A Source Protection Zone II (outer protection zone) covers pollution that takes up to 400 days to travel to the abstraction point, or 25% of the total catchment area – whichever area is the biggest.

A Source Protection Zone I (inner protection zone) defines an area where pollution can travel from the source to the extraction point within 50 days. A Source Protection Zone I also has a minimum 50m protection radius around a public supply borehole.

According to the EA website (Ref. 5), the Site does not lie within a SPZ.

3.4 Flooding

According to the Environment Agency Flood Maps included within the Envirocheck Report (Appendix A), the Site does not generally lie within a zone susceptible to flooding; however, the River Bure that flows off-Site in a roughly north-easterly to south-westerly direction is shown to

present a risk of “Flooding from Rivers or Sea without Defences (Zone 3)” to an area confined to the stream’s valley (i.e. its natural floodplain).

Note that EA flood maps are based upon coarse DTM and JFLOW modelling and are not considered suitable to delineate the flood plain to support a planning application. Note also that the two, north-west to south-east flowing streams that discharge to the River Bure, have not been modelled by the EA, as they are too small. As such, a separate, Site-specific hydraulic model should be developed in order to confirm the flood plain extents across the Site.

3.5 Drainage Soakaways

As part of the development, the suitability of the ground for accepting soakaways for surface water drainage will need to be considered. Based on the available documented evidence on the geology and visual evidence from the Site walkover (where the superficial deposits were typically loamy and all field drainage ditches and the northernmost of the two streams that feed the Bure River were dry), it is considered at this stage that the ground will likely be suitable for some form of soakaway. This assumption should be proved or disproved during an intrusive ground investigation.

3.6 Cemeteries

A Tier 1 hydrological risk assessment of land being considered for development as a new cemetery was undertaken for the Site area in 2008 by Peter Mitchell Associates, on behalf of TurfTrax Ground Management Systems Ltd. (Appendix G). A brief summary on the preliminary Risk Rating (prior to an intrusive ground investigation) in the report is as follows:

“The vulnerability ranking assigned to this site is ‘Moderate’, and the numbers of anticipated annual burials gives a Risk Rating of ‘High’. The site characteristics that raised the vulnerability score were:

- Absence of superficial deposits
- High water table
- Aquifer – the area is underlain by a minor aquifer”

3.7 Archaeology and Heritage

There are no archaeological constraints highlighted from the Envirocheck Report and Historical Maps, however this information is not exhaustive and it is required that a County Archaeologist completes a field evaluation prior to the determination of any planning application.

Home Farm and Himley Farm are listed buildings that reside within the Site and the Church of St Lawrence in Caversfield, adjacent to the Site, is a Grade II* listed building. In all cases, sympathetic design will be a priority for developments in close proximity to these buildings.

3.8 Other Considerations

Four mobile telecommunications masts were identified within land belonging to Messrs. Malins. It is presumed that these are permanent features and any future development would need to be worked around them.

Overhead 33kv electrical cables enter the Site area in the south-eastern corner, before forming a junction near the south-western corner, with one branch continuing off-Site to the west and another branch continuing through the Site in a north-easterly direction, before exiting just north of Bucknell Road. Safe clearances must be maintained from buildings constructed under or adjacent to overhead lines. Safe clearances must also be maintained for trees and structures such as street lighting.

Former quarries and other former mineral sites as noted in the Envirocheck Report were investigated; however these appear to have been re-vegetated by now, with the extracted material presumably used in nearby buildings and stone walls.

4 HISTORICAL INFORMATION

4.1 Historical Mapping

Historical Ordnance Survey maps, included as part of the Envirocheck Report have been obtained for the NW Bicester eco development Site, with significant observations summarised in Table 4.1.

The historical Ordnance Survey maps are included for reference within Appendix B.

Table 4.1: Historical Mapping Summary

Map Date	Map Scale	Site Land Use	Surrounding Area Land Use
1881	1:2,500	The Site is occupied by agricultural land, with seven farms/small holdings, and various connecting access tracks. The Site is dissected through its centre by the north-west to south-east trending Bucknell/Bicester Road	The centre of the village of Bucknell is shown 800m to the north-west of the Site boundary and the parish of Caversfield is shown on the north-eastern Site boundary. Bignell House is shown 600m south of the Site. All other surrounding land is agricultural/undeveloped land, containing some woodland and a number of streams and ditches
1884-1885	1:10,560	No significant change in land use of Site since 1881	No significant change in land use since 1881
1899	1:2,500	No significant change in land use of Site since 1881	Between 1881 and 1899, trees were introduced below the southern Site boundary, called the Bignell Belt, with Bignell Park now established in the grounds to the south
1900	1:10,560	No significant change in land use of Site since 1881	No significant change in land use since 1899
1922	1:2,500	The north-west to south-east trending Great Western Railway (Ashendon & Aynho branch) was constructed in 1910, which runs through the centre of the Site, (west and) parallel to the Bucknell/Bicester Road	The Great Western Railway (Ashendon & Aynho branch), constructed in 1910, services Bicester to the south. At this time Bicester is a small town, with its boundary located approximately 1.4km to the south-east
1923	1:10,560	A lime kiln and small quarry are shown on the Site's south-eastern boundary, adjacent to the railway line and Gowell Farm	The shallow bedrock in the area is suggested by three old off-Site quarries located between 700m and 1.2km south-east of the Site towards Bicester
1938	1:10,560	No significant change in land use of Site since 1910	Bicester is slowly expanding north-westwards
1952	1:10,560	No significant change in land use of Site since 1910	Continued small-scale expansion of Bicester
1955	1:10,000	No significant change in land use of Site since 1910	No significant change in land use since 1955
1966	1:10,000	No significant change in land use of Site since 1910	No significant change in land use since 1955
1967	1:1,250	No significant change in land use of Site since 1910	No significant change in land use since 1955
1970	1:10,000	The lime kiln and quarry shown on the Site's south-eastern boundary, adjacent to the railway line and Gowell Farm are no longer shown	Rapid and large scale expansion of Bicester has occurred to the north-west, towards the Site. The town boundary is now only 500m away from the Site. Caversfield has also expanded south-eastward by this time

Table 4.1: Historical Mapping Summary (Contd.)

Map Date	Map Scale	Site Land Use	Surrounding Area Land Use
1971	1:2,500	No significant change in land use of Site since 1970	On the southern side of the railway, Bicester town has now reached the Site boundary at the A4095 (Howes Lane)
1982	1:10,000	No significant change in land use of Site since 1970	No significant change in land use since 1971
1988	1:10,000	A depot is shown on the site of the old quarry on the Site's south-eastern boundary, adjacent to the railway line and Gowell Farm	Bicester has rapidly expanded to its north
1993	1:10,000	No significant change in land use of Site since 1988	The M40 motorway was opened in 1990. At its closest to the Site, the motorway lies 300m to the west of the south-western corner
1996	1:10,000	More structures (Thames Valley Police Traffic Base) are shown adjacent to the depot on the Site's south-eastern boundary	Further expansion of Bicester to its north
1999	1:10,000	No significant change in land use of Site since 1996	No significant change in land use since 1996
2006	1:10,000	The depot adjacent to the police base has been replaced by four new square structures and presumably now form the Avonbury Business Park, though this is not named on the historical maps	Bicester has now fully expanded to the north-west and has reached the A4095. The Site's south-eastern boundary is now fully bordered by Bicester beyond the A4095
2010	1:10,000	No significant change in land use of Site since 2006	No significant change in land use since 2006

5 REGULATORY INFORMATION

5.1 Envirocheck Report

Information on environmental data for the Site and general surrounding area (up to a 500m search distance from the Site boundary) has been obtained from the Envirocheck Report and from the UK Government's MAGIC website (Multi-Agency Geographic Information for the Countryside). The search findings are summarised in Table 5.1.

Table 5.1: Summary of Findings from Envirocheck Report

Environmental Factor	Distance to Closest Site Boundary				Details
	On Site	0-250m	251-500m	501-1000m	
Active Discharge Consents	3	0	1	0	All on Site consents relate to effluent discharges from farms to a surface water
Surface Water Abstractions	0	0	0	0	None recorded within 500m of Site
Groundwater Abstractions	3	0	0	0	All are registered to boreholes at Lord's Farm for general farming and domestic purposes. Two abstractions are shown on the map at Hawkwell Farm in the centre of the Site, but these are not recorded in the Envirocheck Datasheets. One water abstraction point was identified during the walkover in Lord's Farm between two mobile telecommunications masts (see Point B3 in the "Envirocheck Information" drawing in Appendix A).
Active Integrated Pollution Controls	0	0	0	0	None recorded within 500m of Site
Integrated Pollution Prevention and Control	0	0	0	0	None recorded within 500m of Site
Active Local Authority Pollution Prevention and Controls	0	1	0	0	There is one pending Air Pollution Control application for waste oil burners at Teslayne Engineering, Caversfield
Local Authority Pollution Prevention and Control Enforcements	0	0	0	0	None recorded within 500m of Site
Pollution Incidents to Controlled Waters	0	0	1	0	An incident occurred on an unknown property in Bicester town involving a general pollutant on the 16 th of December 1997. The incident was classified as "minor"
River Quality	0	0	0	0	No sampling points recorded within 500m of Site
River Quality Biological Sampling Points	0	0	0	0	No sampling points recorded within 500m of Site
River Quality Chemistry Sampling Points	0	0	0	0	No sampling points recorded within 500m of Site

Table 5.1: Summary of Findings from Envirocheck Report (Contd.)

Environmental Factor	Distance to Closest Site Boundary				Details
	On Site	0-250m	251-500m	501-1000m	
Substantiated Pollution Incident Register	0	0	0	0	No incidents recorded within 500m of Site
Water Industry Act Referrals	0	0	0	0	None recorded within 500m of Site
Historical Landfill Sites	1	0	0	0	The land now occupied by the police base and other commercial units on the Avonbury Business Park is classified as a former landfill (Gowell Farm Landfill). Local Authority records contained within the Envirocheck Report state the deposited waste as being “ash, glass, brick, pottery”, which was likely used as fill for the old quarry on Site. Having visited the area, there is no evidence of a landfill having existed due to the development comprising hard standing and paving stones and there are no landfill gas vents visible.
Licensed Waste Management Facilities (Locations)	0	0	0	0	None recorded within 500m of Site
Registered Active Landfill Sites	0	0	0	0	None recorded within 500m of Site
BGS Recorded Landfill Sites	0	0	0	0	None recorded within 500m of Site
Registered Waste Treatment or Disposal Sites	0	0	0	0	None recorded within 500m of Site
BGS Recorded Mineral Sites	2	2	0	0	All four recorded sites relate to opencast quarrying of limestone within the Cornbrash Formation. None of these were found during the Site walkover and have presumably been filled.
Natural and Mining Cavities	0	0	0	0	None recorded within 500m of Site
Shallow Mining Hazards	0	0	0	0	No history of mining within 500m of the Site - only quarrying has occurred
Control of Major Hazards Sites (COMAH)	0	0	0	0	None recorded within 500m of Site

Table 5.1: Summary of Findings from Envirocheck Report (Contd.)

Environmental Factor	Distance to Closest Site Boundary				Details
	On Site	0-250m	251-500m	501-1000m	
Notification of Installations Handling Hazardous Substances (NIHHS)	0	0	0	0	None recorded within 500m of Site
Planning Hazardous Substance Consents	0	0	0	0	None recorded within 500m of Site
Active Contemporary Trade Directory Entries	7	1	0	0	From the Site walkover undertaken between 30 th June and 2 nd July 2010, the units within the Avonbury Business Park are occupied by Ravensburger Ltd; Fleet Claims; Tiffen; Imaging Associates Ltd; Rationel (UK) Ltd and Biotronik UK Ltd. Turney Agriforce operates an agricultural vehicle sales and service business from Lord's Farm.
Fuel Station Entries	0	0	0	0	None recorded within 500m of Site
Radon Potential – Radon Affected Areas	Yes	n/a	n/a	n/a	Basic Radon Protective Measures are required for the report area as the estimated probability of a property being above the radon Action Level is 3 to 5%. See BGS BR211 Radon Report in Appendix H
Nitrate Vulnerable Zone					The Site is located within a Surface Water Nitrate Vulnerable Zone. These are areas where nitrate pollution from agricultural activities to surface water is a recognised problem
Areas of Adopted Green Belt	0	0	0	0	None recorded within 500m of Site
Areas of Unadopted Green Belt	0	0	0	0	None recorded within 500m of Site
Ramsar Sites	0	0	0	0	None recorded within 500m of Site
Special Areas of Conservation	0	0	0	0	None recorded within 500m of Site
Special Protection Areas	0	0	0	0	None recorded within 500m of Site
National Nature Reserves	0	0	0	0	None recorded within 500m of Site

Table 5.1: Summary of Findings from Envirocheck Report (Contd.)

Environmental Factor	Distance to Closest Site Boundary				Details
	On Site	0-250m	251-500m	501-1000m	
Local Nature Reserves	0	1	0	0	Bure Park, at its closest, is located immediately within the A4095 on the Bicester side and is fed by the River Bure
Sites of Special Scientific Interest (SSSI)	0	0	1	0	<ol style="list-style-type: none"> 1. Ardley Cutting and Quarry (3 Units), designated for Geological Conservation Review and as a Local Wildlife Trust Reserve. Located 400m north-west of Site along the railway line. This is adjacent to the Ardley Trackways Geological SSSI (Unit 1) 2. Ardley Trackways Geological SSSI (Unit 2) is located 1.3km north-west of the nearest Site boundary (beyond the M40 Motorway)
Areas of Archaeological/Heritage importance	0	0	0	0	None recorded within 500m of Site

6 CONCEPTUAL MODEL

6.1 General

The aim of this initial conceptual model and risk assessment is to provide a preliminary identification of the risks to the Site, site users and the surrounding area posed by any contamination present on Site. The assessment is based on identification of “pollution linkages”, i.e., source-pathway-receptor relationships. This approach is in accordance with the guidance that accompanies Part IIA of the Environmental Protection Act of 1990, where land is considered to be contaminated when “significant harm” is occurring, or where there is the “significant possibility of significant harm” or where pollution of controlled waters is being, or is likely to be caused. In such cases the pollution linkage itself is defined as “significant”.

The source and pathway to receptors must be present for there to be a risk. The preliminary risk assessment assesses the strength of the link between the source, the pathway and the receptor.

- **Source** – Contaminant that has potential to cause harm to environmental receptors. In a wider sense, sources can include particular ground conditions, for example the existence of redundant footings, which have the potential to impact on re-development proposals.
- **Pathway** – The route by which the source is brought into contact with the receptor. This can include the transport of contamination via groundwater, wind-blown dust, vapours, excavation and deposition etc.
- **Receptor** – Human beings, other living organisms, physical systems and built structures that could be affected by the source. A receptor will only be affected if a pathway from the source to the receptor is present. Groundwater and surface water systems can be considered as receptors in their own right as their quality is regulated by the statutory bodies, as well as being pathways for contaminant migration to other receptors.

6.2 Potential Sources of Contamination

Following a review of available information, including a Site walkover survey, the following potential current and historical contamination sources have been identified on Site.

It is not considered that there are viable contaminant sources off Site (within 500m) that would currently be causing “significant harm” to the Site, or presenting the “significant possibility of significant harm”.

On Site

As summarised in Table 4.1, the historical maps show that the Site area has essentially been uninfluenced by industrial activity until the present day, having been mainly concerned with agricultural production. The only historical non-agricultural activities relate to a small quarry and limekiln near Gowell Farm (now replaced by the Avonbury Business Park and Thames Valley Police Traffic Base, following landfilling of the area) and the construction of the Great Western Railway line in 1910.

The principal contaminant sources are therefore considered to be as follows:

- Treated final and trade effluent as well as surface water drainages from the farms as indicated by the discharge consents;
- Old filter bed within the grounds of Home Farm (west of the access road to the farm from the B4100);
- Railway line (Ref. 6);
- Former landfill in old quarry near Gowell Farm at the Avonbury Business Park and police base;
- Former/existing vehicle depots at the Avonbury Business Park and police base (Ref. 7);
- Pesticides, herbicides and fertilisers from agricultural activities;
- Above ground fuel tanks at farms;
- Asbestos cement sheeting within the fabric of farm buildings; and
- Soil underlying the Site that may be locally contaminated by materials stored on Site (e.g. private farm diesel/fuel oil and agricultural chemicals).

6.3 Potential Receptors

Potential receptors of any contamination from the above sources on the Site are identified below:

- Existing Site users;
- Future construction workers;
- Future Site users of the proposed development;
- Surface water features i.e. the three streams on Site;
- Groundwater within the Secondary 'A' Aquifer underlying the Site; and
- Current buildings/proposed buildings and associated services.

6.4 Potential Pathways

Potential pathways of any contamination from the above sources to the identified receptors on the Site are identified below:

- Direct dermal contact by humans with soil and/or groundwater;
- Ingestion of soil and/or groundwater by humans;
- Inhalation of toxic gas and volatile organic compounds;
- Leaching of contaminants from soil into groundwater;
- Groundwater migration to surface waters;
- Lateral groundwater migration off Site;
- Lateral migration of groundwater on Site;
- Lateral/ horizontal movement of liquid contaminants through soil pores;
- Surface water run-off via drains to surface waters; and
- Direct contact of chemically aggressive soil and groundwater with proposed buried structures and services.

7 QUALITATIVE HUMAN HEALTH and ENVIRONMENTAL RISK ASSESSMENT

7.1 Qualitative Methodology

The risk assessment considers the potential sources, receptors and pathways identified in Section 6, and the linkages are summarised in Table 7.1. This assessment takes account of specific chemicals of concern or groups of similar contaminants of concern (COC).

Table 7.1 Pollutant Linkages for Site

Contaminant	Source	Pathway	Receptor	Linkage Number
Metals and metalloids, hydrocarbons (oil/ fuel), solvents, phenols, pesticides/ herbicides/ fertilisers, pathogens	Soil underlying Site		Current Site users	1
	Storage & spillage of oils/fuels/chemicals/ solvents at farms	-Direct contact with soils; -Ingestion of soils/dust;	Construction Workers	2
	Handling of hazardous substances inc. asbestos at farms	-Inhalation of soils/dust; -Indoor/outdoor inhalation of ground; gases and/or vapours	Future Site Users (post development)	3
	Above ground fuel tanks and agricultural chemical containers		Buildings & Services	4
Metals and metalloids, hydrocarbons (oil/ fuel), solvents, phenols, pesticides/ herbicides/ fertilisers, pathogens	Leaching from contaminants on and within the soil	-Surface water runoff to streams;	Secondary 'A' Aquifer	5
		-Leaching of contaminants from soils to groundwater; -Groundwater flow	On-Site Surface Water Features	6
Metals and metalloids, hydrocarbons (oil/ fuel), solvents, phenols, herbicides	Spills within on-Site railway (hydrocarbons, solvents and herbicides leaching directly to groundwater)	Leaching of contaminants from soils to groundwater	Secondary 'A' Aquifer	7

Table 7.1 Pollutant Linkages for Site (Contd.)

Contaminant	Source	Pathway	Receptor	Linkage Number
Metals and metalloids, hydrocarbons (oil/ fuel), solvents, phenols, pesticides/ herbicides/ fertiliser	Made Ground at former landfill	-Direct contact with soils; -Ingestion of soils/dust; -Inhalation of soils/dust; -Indoor/outdoor inhalation of ground; gases and/or vapours	Current Site users	8
			Secondary 'A' Aquifer	9
Ground Gases (CH ₄ /CO ₂)	Made Ground at former landfill	Diffusion of gas from landfill	Current Site users	10
			Secondary 'A' Aquifer	11
			Buildings & Services	12
Ground Gas	Radon	Diffusion of gas from geological strata	Future Site Users (post development)	13

The pollutant linkages are considered further in Table 7.2. This table assesses the probability and consequence of the selected sources and receptors being linked by the identified pathways. Based on the assessed probability and consequence, an overall risk classification is assigned to each potential pollutant linkage. The definitions of the ratings given in this table (Probability, Consequence and Risk) are given in Appendix C.

Table 7.2 Initial Pollutant Linkages and Risk Assessment

Linkage Number	Probability	Consequence	Risk	Hazard Assessment*
1 to 3	Possible, as contact with soil will occur during farming then construction and post-construction (in gardens)	Mild - Site is mainly occupied by agricultural land with no previous contaminative industrial uses. Insoluble pollutants from agriculture are likely to remain localised to the source. Therefore, contact with soil is unlikely to result in long-term adverse health effects	Low	SI
4	Likely as buildings will be in contact with the soil	Negligible	Low	NA

*Definitions:

- SI – Site Investigation recommended
- NA – No Action required

Table 7.2 Initial Pollutant Linkages and Risk Assessment (Contd.)

Linkage Number	Probability	Consequence	Risk	Hazard Assessment*
5	Possible as a groundwater table is present beneath the Site within the Cornbrash Formation	Mild – Should contaminants be present within the soil on Site, these are likely to be in small volumes and cause localised pollution only	Low	SI
6	Likely – Pesticides, herbicides and fertilisers are soluble and are likely to drain with surface water runoff into the nearest surface water feature	Moderate – The Site area lies within a Nitrate Vulnerable Zone. These are areas where nitrate pollution from agricultural activities to surface water is a recognised problem. Any pathogens from treated final/ trade effluent discharges to localised surface water features are likely to cause localised pollution of the receiving watercourse only	Moderate to High	SI
7	Possible as a groundwater table is present beneath the Site within the Cornbrash Formation	Mild – While contaminants are likely to be present at the railway, these are likely to be in small volumes (as the Site does not contain a station or storage sidings) and cause localised pollution only	Low	NA – No development on railway land will occur
8	Very unlikely – The site is capped by paving stones and provides no pathway for site users to come into contact with the underlying landfill	Mild – The information available in the Envirocheck report states that the deposited waste comprised “ash, glass, brick, pottery”	Negligible	NA
9	Possible – If landfill is not lined or liner is not intact	Mild – The information available in the Envirocheck report states that the deposited waste comprised “ash, glass, brick, pottery”, which should not pose a significant threat to groundwater	Low	NA

*Definitions:

SI – Site Investigation recommended
 NA – No Action required

Table 7.2 Initial Pollutant Linkages and Risk Assessment (Contd.)

Linkage Number	Probability	Consequence	Risk	Hazard Assessment*
10	Very unlikely – The information available in the Envirocheck report states that the deposited waste comprised “ash, glass, brick, pottery”, which would not be expected to generate significant volumes of gas. Additionally, no gas vents were observed during the Site walkover	Severe – A build-up of typical landfill gases (CH ₄ and CO ₂) could cause explosion and asphyxiation respectively.	Low	NA
11	Very unlikely – See linkage no. 10 above	Moderate – While landfill gas typically contains organic compounds, which could cause pollution of groundwater, it is not expected that significant volumes of gas will be produced by the on-Site landfill, therefore the consequences to the Secondary ‘A’ Aquifer are not likely to be severe	Negligible to Low	NA
12	Very unlikely – See linkage no. 10 above	Severe, but only in the case of a build-up of landfill gas within a confined space, which could lead to ignition and explosion	Low	NA
13	Likely	Moderate	Moderate to High	AR

*Definitions:

- SI – Site Investigation recommended
- NA – No Action required
- AR – Action Required

7.2 Risk Assessment

Following review of the available information undertaken as part of this study, and consideration of the relevant pollutant linkages, a **Low risk to human health** is considered to be currently associated with the Site. This is due to the unindustrialised history of the Site and its use as primarily agricultural land, where crops/animals for human consumption are grown/reared. However, the natural geology of the area is such that there is a possibility of some radon gas accumulation in dwellings, therefore basic radon protective measures are required. See BGS BR211 Radon Report in Appendix H.

During the Site walkover survey, a farm building (approximate dimensions of 30m x 20m x 10m) was noted adjacent to the south-western side of Bucknell Road, some 950m NW of the junction (roundabout) with the A4095 (Lord’s Lane). The roof and front of the building appears to be

constructed from corrugated asbestos cement sheeting, which will require special precautions if part of the proposed redevelopment.

There is considered to be a **Negligible to Low risk to the underlying groundwater** within the Secondary 'A' Aquifer of the Cornbrash Formation. The aquifer is not used to supply public drinking water; however it may be important for small-scale localised supply. Additionally, the Site does not lie within a drinking water Source Protection Zone.

Due to the agricultural nature of the Site, where much of the land is used for growing crops, there is considered to be a **Moderate to High risk** of surface water pollution from pesticides/herbicides and nitrate fertilisers. The Site lies within a Nitrate Vulnerable Zone, which is an area where nitrogen loss from agriculture to water is recognised as a problem and needs to be reduced.

Assuming the redevelopment of the Site for residential purposes, which will involve the introduction of soft landscaping, it is considered that a **Low risk to future Site users** would exist, due to the Site's unindustrialised past and its current use as primarily agricultural land, where crops/animals for human consumption are grown/reared.

The risks to humans and the environment from the former landfill on the land now occupied by the Thames Valley Police Traffic Base and the Avonbury Business Park are classified as **Low**. This is based on the information available in the Envirocheck Report, which states that deposited waste comprised "ash, glass, brick, pottery". This material was likely used as fill for the old quarry on Site in order to enable the redevelopment of the area. Additionally, no gas vents were observed within the Avonbury Business Park or the police base during the Site walkover, which indicates that there may be no gas-venting issues.

8 GEOTECHNICAL CONSIDERATIONS

The main geotechnical considerations are listed in Table 8.1 below, which highlights the natural geological hazards identified within the Envirocheck Report (as sourced from the British Geological Survey), with additional comments added to reflect observations noted during the Site walkover survey.

Whilst not a hazard, available borehole information and observations during the Site walkover survey, suggest that bedrock is present across the Site at a relatively shallow depth (some 1m to 2m), which may cause some difficulty if deeper excavations are necessary, e.g. for basements or deep utility services runs.

Table 8.1 Summary of Potential Natural Geological Hazards Relevant to the Site

Hazard	Hazard Potential
Compressible Ground	<p>Low – Any soft, cohesive/organic rich material which may be present within the alluvial sediments flanking the three on-Site streams may be susceptible to compression under loading. However, these sediments are not expected to be present in appreciable thicknesses, therefore the effect of compressible material would be lessened.</p> <p>Away from the streams and Alluvium, the hazard potential is Very Low as bedrock is close to the surface and should provide an adequate founding material.</p>
Ground Dissolution	<p>Low – Borehole logs for the Site do not show evidence of dissolution related features and there were no unusual depressions noted in the landscape during the Site walkover. However, the limestone-dominated units of the Cornbrash Formation, as well as the underlying Forest Marble and White Limestone Formations, may be affected by dissolution leading to the widening of joints and the formation of linear vertical voids, which are likely to fill with rubble and soil. Therefore, an appropriate ground investigation should be undertaken before the detailed design stage of the development.</p>
Landslide	<p>Very Low – The Site is not located in an area prone to landslides, however, mudstone beds in the Forest Marble Formation may be unstable in excavations.</p>
Running Sand	<p>Very Low – Available borehole information shows a thin cover of non-susceptible superficial deposits above bedrock.</p>
Shrinking or Swelling Clay	<p>Very Low – Available borehole information shows a thin cover of non-susceptible superficial deposits above bedrock</p>

At this stage, no significant geotechnical hazards have been identified that would be expected to cause excessive difficulties in the development of the Site. However, an intrusive ground investigation will be required in order to achieve accurate information on the ground properties for preliminary design purposes.

9 CONCLUSIONS

This desk study report has been written in order to highlight potential constraints to the development of the proposed Bicester eco development, based on the history and current land use of the Site and surrounding area (for contamination assessment purposes) as well as potential environmental issues such as topography, the presence of watercourses, geological hazards and sensitive land uses.

The history of the Site is a rural one dominated by agriculture, which continues to be the case at present. While the town of Bicester has expanded rapidly from a small centre located 1.5km south-east of the Site some 150 years ago, to a large town which borders the south-eastern Site boundary at present, the Site itself has remained essentially unchanged during this time.

As such, if contamination is present on Site, it is not expected to be widespread or significant, therefore the corresponding qualitative risks to humans and groundwater are, at this stage, considered to be low. However, the risk to surface water due to agricultural chemical runoff (particularly nitrates) is considered to be moderate to high (as the Site is within a Nitrate Vulnerable Zone). Additionally, basic radon protection measures will be necessary in the construction of new dwellings and extensions.

In terms of topography, the Site is gently sloping from the north-west to the south-east with no significant changes in ground levels across short distances. The geological information available suggests that bedrock is close to the surface, which should prove to be an adequate founding material, although it may cause difficulty in deeper excavations (for example in basements). Additionally, the limestone-dominated units of the Cornbrash Formation and the underlying Forest Marble and White Limestone Formations may be affected by dissolution features, although there is no evidence of this from the (limited) borehole logs obtained for the Site.

In summary, the desk study has not highlighted any significant constraints to the proposed development in terms of possible contaminants or natural geological hazards; however, this is only a preliminary desktop assessment and should be verified by means of an appropriately targeted ground investigation.

10 RECOMMENDATIONS

It is recommended that an intrusive ground investigation be undertaken to confirm the potential presence or absence of contamination within soils and groundwater and to determine the geotechnical properties of the ground for the proposed eco development layout. The ground investigation can also be targeted at those areas that may be outlined for a cemetery (see Section 3.6), where information relating to leachability and permeability of the ground will be particularly important.

The ground investigation should include:

- Coring of near surface rock, with associated strength testing for foundation design purposes;
- Trial pits for targeted contamination sampling e.g. near fuel and agricultural chemical storage areas and near the railway; and
- Trial pits for rock excavatability analysis and for soakaway testing.

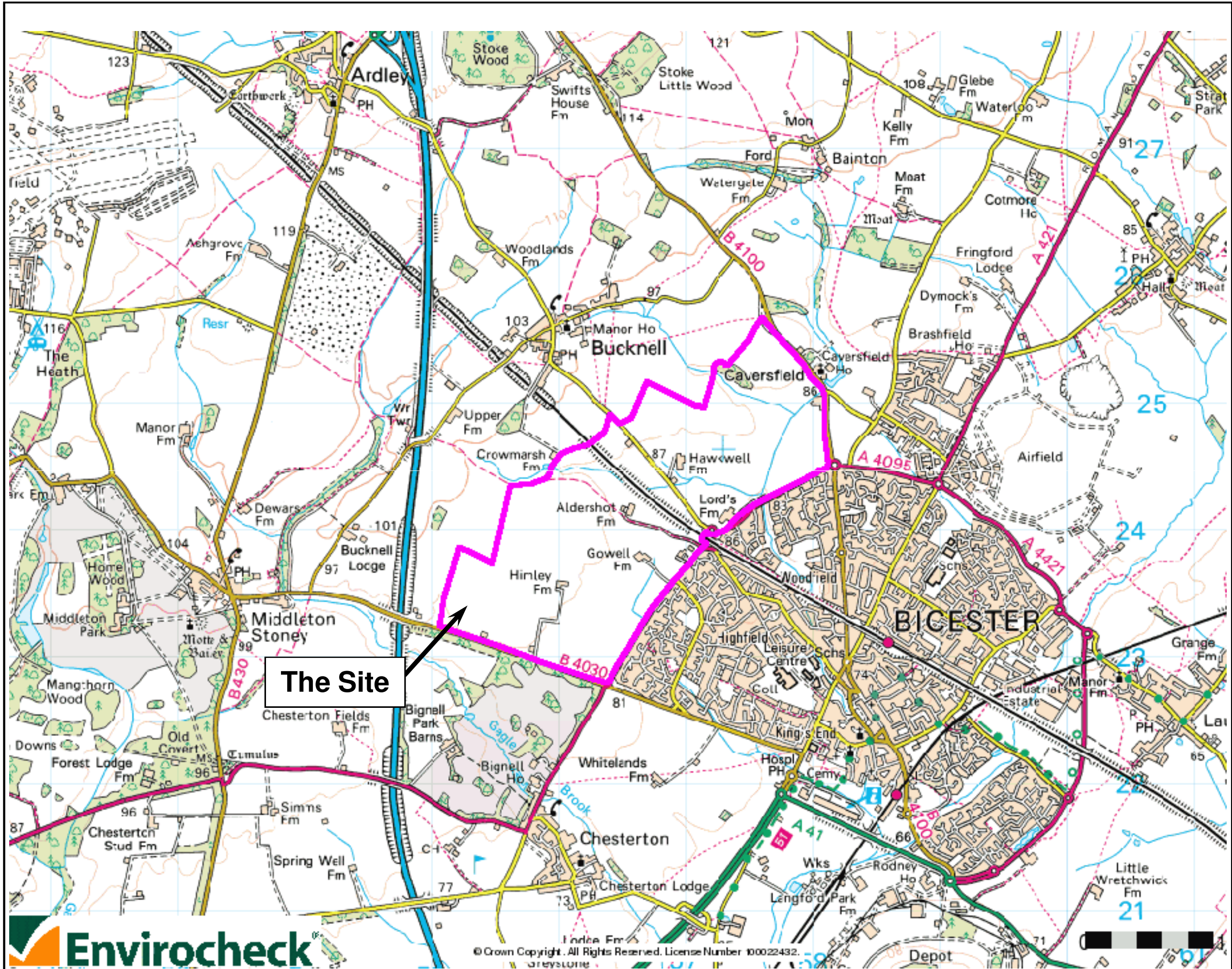
While covered in brief, detailed information on other issues relating to flood modelling, ecology, archaeology and heritage are outside of the scope of this report and reference should be made to accompanying reports produced by Hyder.

11 REFERENCES

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4. British Geological Survey, 2002. Solid and Drift Geological Map of Buckingham, Sheet P219.
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<http://maps.environment-agency.gov.uk> (accessed 05 July 2010)
6. Department of the Environment, 1995. Industry Profile: Railway Land. DoE.
7. Department of the Environment, 1996. Road vehicle fuelling, service and repair: transport and haulage centres. DoE.

Figures

Figure 1 – Site Location Plan



Client



P3Eco Ltd

Project

NW Bicester
Eco-Town

Title

Site Location Plan

Scale

NTS

Datum

N/A



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Project Code

UA001881

Drawing No.

Figure 1

Issue

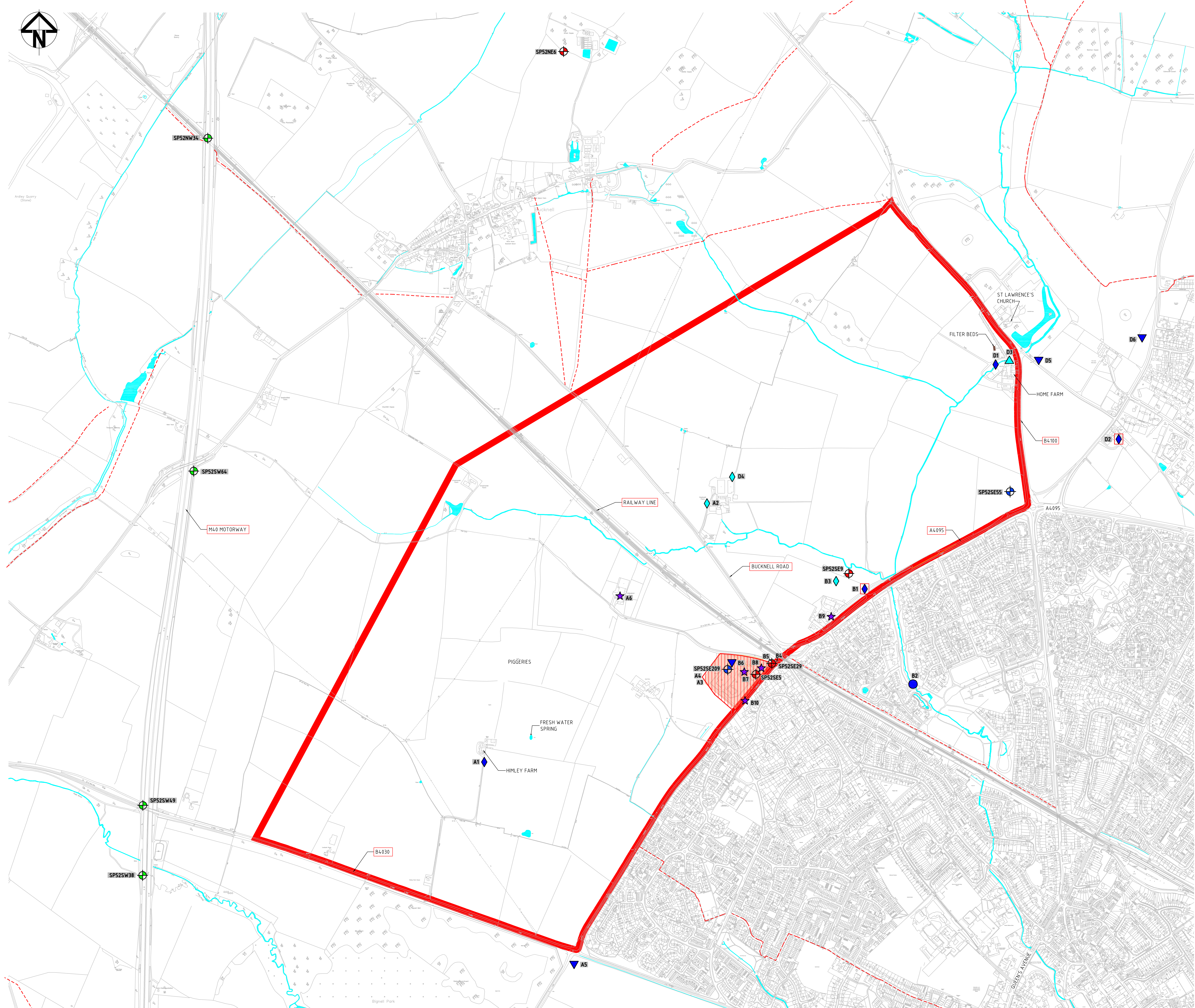
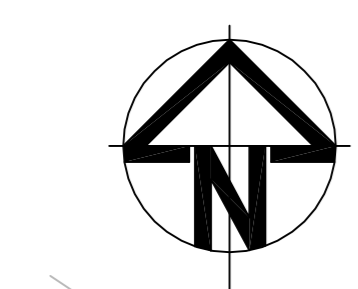
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Appendix A

Landmark Envirocheck Report Datasheets



- KEY**
- OVERALL SITE BOUNDARY
 - PUBLIC BRIDLEWAY
 - PUBLIC FOOTPATH
 - HEDGEROW
 - WOODLAND
 - WATER COURSE
 - B8 MAP ID - B-SLICE B, 8+ ITEM No.
 - ◆ DISCHARGE CONSENT
 - POLLUTION INCIDENT TO CONTROLLED WATERS
 - ◆ WATER ABSTRACTION
 - ★ TRADE DIRECTORY ENTRY
 - ▼ BGS RECORDED MINERAL SITE
 - ▲ LOCAL AUTHORITY POLLUTION PREVENTION AND CONTROL
 - MORE THAN ONE OF TYPE AT LOCATION
 - LOCAL AUTHORITY RECORDED LANDFILL SITE
 - EA HISTORIC LANDFILL (POLYGON)
 - BGS BOREHOLE DEPTH 0-10m
 - BGS BOREHOLE DEPTH 10-30m
 - BGS BOREHOLE DEPTH 30m+
 - A4095 POTENTIAL NOISE SOURCES - LOCAL ROAD NETWORK (INC. M40/A4095/B4100/B4430/BUCKNELL ROAD) AND RAILWAY LINE

01	FIRST ISSUE	11/06/10
Issue	Description	Date

Status: **DRAFT**

Scale	1:5000	Current Issue Signatures
Original Size	A0	Author: P. SWEENEY
Height	NEWLYN	Checker: SA. DAVIES
Grid	O.S.	Approver: SA. DAVIES
Filename	7015-UA001881-UP210-01.DWG	
Client		

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Project: **BICESTER ECO TOWN**

Title: **ENVIROCHECK INFORMATION**

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