Appendix G

TurfTrax Report

TurfTrax
Ground Management Systems

A report to Bicester Town Council on a Tier 1 hydrological risk assessment of an area of land identified for development as a new cemetery on the NW outskirts of Bicester.

6th March 2008

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Bicester Town Council

A report to Bicester Town Council on a Tier 1 hydrological risk assessment of an area of land identified for development as a new cemetery on the NW outskirts of Bicester.

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1 Executive summary

Peter Mitchell Associates, on behalf of TurfTrax Ground Management Systems Limited, have completed a Tier 1 hydrological risk assessment of land being considered for development as a new cemetery for Bicester. The key issues that have been identified are summarised below.

The Council has identified broad areas of land on the outskirts of the town. This report is an initial assessment of the identified site to the NW to establish its suitability for use as a cemetery. In order to study independent data concerning the site, a Detailed Geological Assessment report was commissioned from the British Geological Survey (BGS). This Assessment is attached as an appendix to this report and extracts from it have been incorporated into the text below.

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

Subject to appropriate site investigations and agreement with the EA, it may be possible to either adjust the risk rating of the site or to design measures, such as drainage or specifications for burials, to mitigate risk to groundwater.

It is recommended that this report and the accompanying BGS report be sent to the EA, and dialogue should be established with the EA, to ascertain it's requirements for further assessment of this site's suitability for development as a cemetery.

Subject to the outcome of this dialogue, if detailed site investigations were thought desirable, it is proposed that a specific area for development is identified and that this should be subject to the following site investigative works:

1. A topographic survey to provide a basis for designing the cemetery and any necessary drainage infrastructure.

2. An electro-magnetic induction (EMI) survey to provide a basis for establishing the most appropriate locations for excavating test pits down to a maximum depth of 3.5 m and installing a minimum of three dip wells (up to 10 m deep) to monitor ground water depth. The EMI data would be shown on the site plan to two different depths (200 mm and 1.2 m).

3. Assessment of the soil profile pits, and to 'window sample' material removed during the boring of the dip wells, in terms of the type, condition and physical properties of the soil exposed. The results will be used to determine factors that may influence the appropriateness of the site for burial purposes and the vulnerability of the environment to contamination from the proposed development.

4. Monitor the groundwater levels in the dip wells over a winter period, i.e. during the period of highest rainfall.

5. Determine any appropriate options for mitigating risk to ground and surface water by improving the surface and subsurface drainage status.

Depending upon the results of this sampling and analysis, it may be possible to use the site as a cemetery subject to certain restrictions such as the installation of an appropriate drainage scheme.

2 Introduction

This report is an initial assessment of a broad area of land on the NW outskirts of Bicester with respect to it's suitability for use as a cemetery.

Whilst definitive data regarding the pollution from cemeteries is scarce, any planning application for a new cemetery will be assessed by the local Environment Agency (EA) team against their Research and Development Technical Report P223 published in 1999 entitled 'Pollution Potential of Cemeteries – Draft Guidance'. The approach to risk assessment adopted by the report can be summarised by the following excerpt:

"in order to be able to provide guidance which will enable Environment Agency staff to adopt a consistent approach when assessing the risks associated with the development of human or animal burial grounds. The guidance is directed principally at the potential threats to groundwater resources, but account is taken also of possible risks to surface waters, soils and the atmosphere"[1]

The report provides a framework for assessing the risks associated with cemeteries. The first stage is a 'Tier One' preliminary site assessment that provides an initial review of the potential pathways for contamination and receptors in proximity to the site.

The P233 report sets out the likely types and quantities of pollutants released by the burial of human bodies. The key to whether a site would be considered suitable is the rate at which such pollutants would be transported through the ground to enter water supplies:

"Pathways which pose the greatest threat to groundwaters from dissolved and particulate contaminants are those where hydrogeological factors allow rapid movement of pollutants from the source to the groundwater...

Consequently, coarse granular or heavily fractured sub-soils, fissured aquifer materials, or those of restricted mineralogy, are unlikely to offer significant opportunities for attenuation by many of the processes...By contrast, aquifers composed of sediments or rocks of mixed mineralogy and in which groundwater flows are irregular, provide more effective protection of groundwater from surface derived pollution."[2]

The EA's Technical Report P223 identifies that the number of burials in a proposed cemetery will affect the overall assessment of the environmental risk. Thus a site considered low risk in terms of groundwater vulnerability, automatically becomes a high risk proposal if more than 100 burials are anticipated each year. This relationship between vulnerability class, burial rates and level of risk is shown schematically in Figure 5.2 of P223, featured later in this report.

[1] P223 page 1
[2] P223 page 30

The first step in considering any proposed cemetery site at Bicester should therefore be to assess it against a groundwater vulnerability ranking chart (Table 1):

Table 1. Groundwater Vulnerability Ranking Chart (Table 5.1 in P223)

Ranking	**Very Low**	**Low**	**Moderate**	**High**	**Very High**
Drift type	Clay	Silt	Silty sand	Sand / gravel	Absent
Drift thickness	>5m	>3 – 5m	3m	0 – 3m	Absent
Depth to water table	>25m	11 – 25m	10m	5 – 9m	< 5m
Flow mechanism	Intergranular				Fissured
Aquifer	Non-aquifer		Minor aquifer		Major aquifer
Abstraction and Source Protection Zone	Outside Zone 111	Within Zone 111	Close to boundary of Zones 11 & 111	Within Zone 11	Within Zone 1 or <250m from private source
Watercourses and springs	>100m	>70 <100m	>50 <70m	>30m <50m	<30m
Drains	>100m	>40 <100m	30 – 40m	>10 <30m	<10m

A scoring scheme (Table 2) is used to provide a comparison mechanism:

Table 2. Scoring scheme for Tier 1 risk assessments

Vulnerability	Element score	Total score (Range)
Very low	2 – 1	16 – 8
Low	4 – 3	32 -24
Moderate	6 – 5	48 – 40
High	8 – 7	64 – 56
Very high	10 – 9	80 – 72

Using this system, a total score (range) for vulnerability class can be obtained for each site:

Table 3. Vulnerability class for Tier 1 risk assessments

Low vulnerability	8 – 32
Moderate vulnerability	32 – 56
High Vulnerability	56 – 80

The vulnerability class is then considered in the light of burial rates and an overall level of risk projected. In order to study independent data concerning the site, a Detailed Geological Assessment report was commissioned from the British Geological Survey (BGS). This Assessment is attached as an appendix to this report and diagrams and text extracts from it have been incorporated into the text below.

3 Site location and description

There are two potential sites located on the NW outskirts of Bicester as shown below:

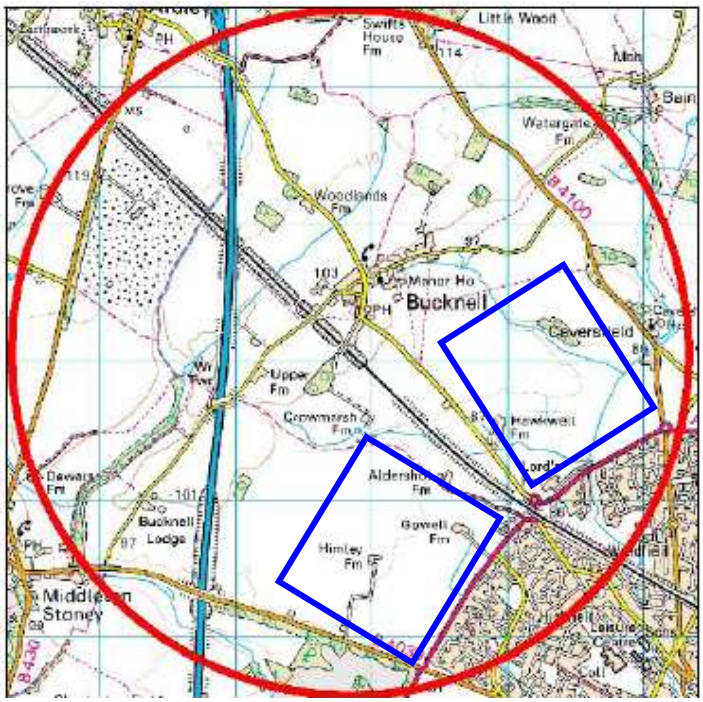

Figure 1. Site location plan.

Figure 2. Site aerial view.

The land is predominantly under agricultural use with a relatively small area occupied by buildings. It is traversed by a stream and a railway line. The slope and principal drainage direction is to the south-east. The drainage is dendritic in pattern and tributaries run in other directions.

Site elevation ranges from 75 metres above Ordnance Datum (OD) in the stream valley in the south to 120 m in the north-west of the search area.

4 Site geology and hydrogeology

The geology of the site is summarised in Figures 3 and 4.

grid ref of north-west side of site
$^{4}5385\ ^{2}2653$

grid ref of south-east side of site
$^{4}5775\ ^{2}2335$

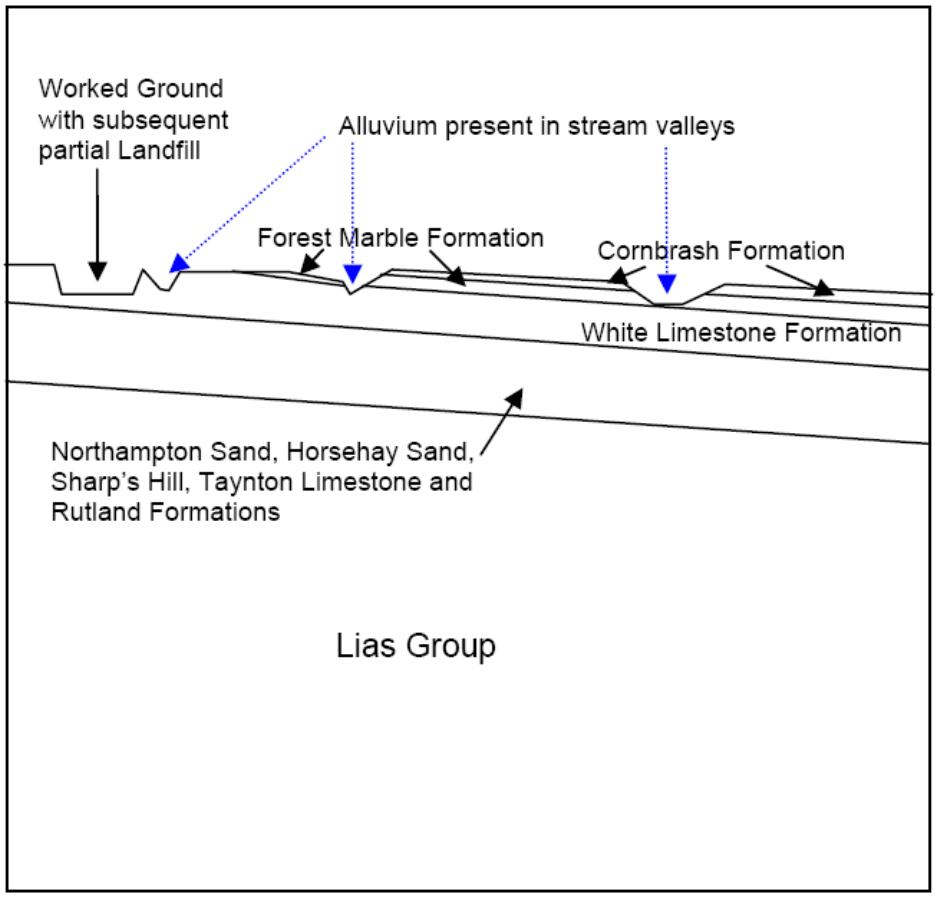

Figure 3. Schematic diagram of NW site geology.

The site identified for potential cemetery development only occupies approximately the middle third of the surface, i.e. situated on the Forest Marble Formation.

4.1 Superficial deposits (Drift)

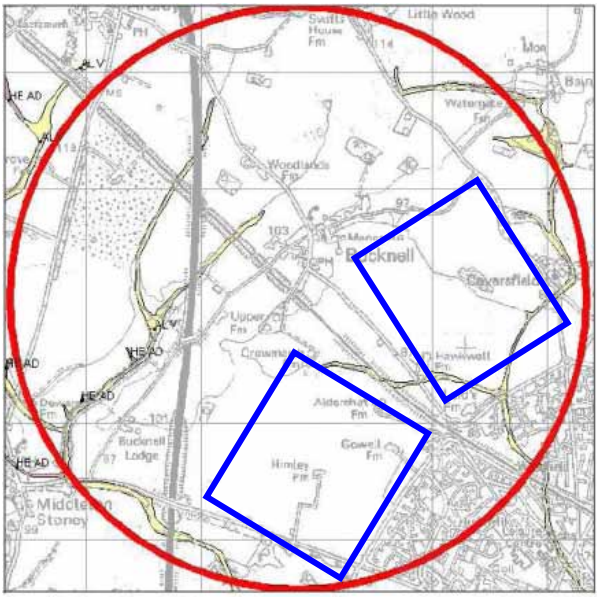

Figure 4a. Superficial geology in the NW area.

Map colour	Computer Code	Rock name	Rock type
	ALV	ALLUVIUM	CLAY, SILT, SAND AND GRAVEL
	HEAD	HEAD	CLAY, SILT, SAND AND GRAVEL

The BGS report covers a wider area than that for the proposed cemetery development and includes land to the west of the M40 motorway and the built up area to the east of the site, hence its reference to two streams.

The streams are flanked by narrow tracts of **alluvium** of late Quaternary age, comprising sandy silty calcareous clay overlying gravelly sandy silty clay, with limestone clasts. The alluvial deposits are up to 150 m wide, are generally between 1 to 2 m in thickness (rarely exceeding 3 m in thickness). They may locally include highly compressible, organic-rich (peaty) layers.

Locally, hollows in these valley sides are floored by thin deposits of **head**, formed by soil creep or hill wash. Their composition reflects that of the local materials from which they were derived, either the bedrock or other types of superficial deposit, or both in combination. Head deposits typically are poorly stratified and poorly sorted, and can be variable in composition. Locally, they are typically composed of variably stony sandy silty clay. Head deposits may be more extensive than shown on the geological map, but if so, probably only as a layer between 0.3 m and 1 m in thickness, and possibly discontinuous.

It can be appreciated that the location of any cemetery development would not include either stream. There are thus effectively no superficial deposits within the search area.

4.2 Rockhead depth

Rockhead is close to the surface.

4.3 Bedrock geology:

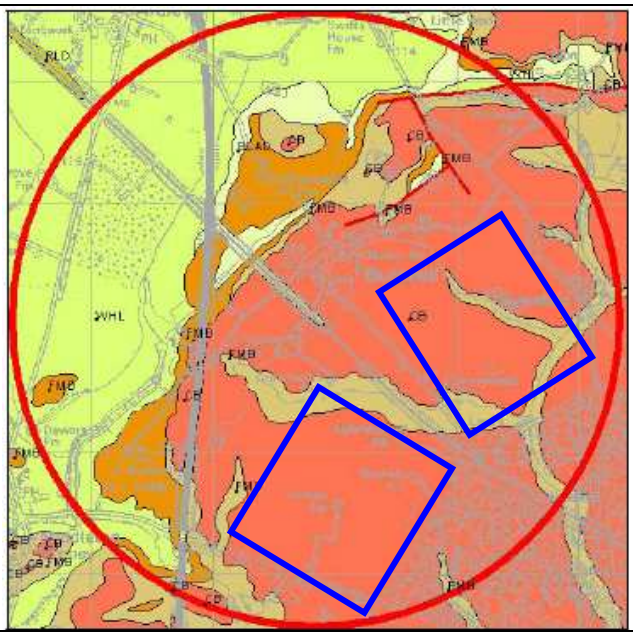

Figure 4. Bedrock geology in the NW area.

Key to bedrock geology maps:

Map colour	Computer Code	Rock name	Rock type
	CB	CORNBRASH FORMATION	LIMESTONE
	FMB	FOREST MARBLE FORMATION	LIMESTONE
	FMB	FOREST MARBLE FORMATION	LIMESTONE AND MUDSTONE, INTERBEDDED
	WHL	WHITE LIMESTONE FORMATION	LIMESTONE
	BLAD	BLADON MEMBER	MUDSTONE AND LIMESTONE, INTERBEDDED
	RLD	RUTLAND FORMATION	MUDSTONE

The search 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.

The **White Limestone Formation**, forms a broad plateau to the north-west of the proposed cemetery. This comprises 10 to 18 m thickness of white to yellow, bedded, peloidal and bioclastic limestone (see **Additional Geological Considerations** below).

The White Limestone Formation is overlain with an erosive contact by the **Forest Marble Formation**. The Forest Marble Formation forms a narrow outcrop between the White Limestone and Cornbrash Formations, and also crops out on the flanks of the stream valleys. The Formation is composed of 3 to 5 m of grey calcareous mudstone with lenticular beds of bioclastic, ooidal limestone, particularly common at the base, where they are widely distinguished on the map extracts.

The **Cornbrash Formation** is the youngest bedrock unit within the site area, cropping out over most of the area proposed as cemetery and forming a broad south-east sloping plateau. It

comprises about 3 m thick grey to brown bioclastic shelly rubbly-bedded limestone with thin subordinate beds of grey mudstone.

Mudstone beds in the Forest Marble Formation may be unstable on steep slopes or in excavations.

The limestone-dominated units of the White Limestone, Forest Marble and Cornbrash 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.

Additional geological considerations:

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 about 20 m in thickness. These are underlain by the 2 to 6 m of the ferruginous sandstones of the Northampton Sand Formation. Beneath these are over 100 m of the mudstone-dominated Lias Group.

The bedrock strata dip very gently (less than 0.5°) to the south-east. Faults have been mapped to the north-east of Bucknell, beyond the proposed cemetery development, with displacements of up to about 5 m. It is important to understand the nature of geological faults, and the uncertainties which attend their mapped position at the surface. 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. Geological faults in this area are of ancient origin, are today mainly inactive, and are thought to present no threat to property.

4.4 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 Cornbrash Formation bedrock. This is a local aquifer and several water strikes have been recorded in shallow, site-investigation boreholes drilled within the site area. The rest water levels are generally slightly higher than the strike levels; both are generally between about 0.5 and 4.0 m below the ground surface.

The Forest Marble Formation, where present beneath the area, may hold small quantities of water in any limestone bands present, but the upper part generally acts as an aquiclude between the Cornbrash Formation and the underlying White Limestone Formation. There are no boreholes drilled through the Forest Marble Formation in the site area that record water strikes within it.

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

- A 34 m deep borehole at Gowell Farm (SP52/19 at SP 5709 2384), drilled pre-1909 to supply Bicester with water, penetrated the complete 25 m thickness of the White Limestone Formation, underlying about 7.2 m of Forest Marble Formation and terminating in the underlying Rutland Formation. Water was struck at 28 m and 32 m 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 1 m above ground level (about 88 m above OD) 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 11 m below ground level (about 68 m above OD) 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 within 3.6 m below ground level (about 76 m above OD).

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.

The alluvium, and Cornbrash and Forest Marble Formations beneath the site are classified as Minor Aquifers with high soil leaching potential on the Environment Agency's Groundwater Vulnerability Map, Sheet 30, Northern Cotswolds.

5 Boreholes

The plan below shows the location of boreholes relative to the proposed cemetery development:

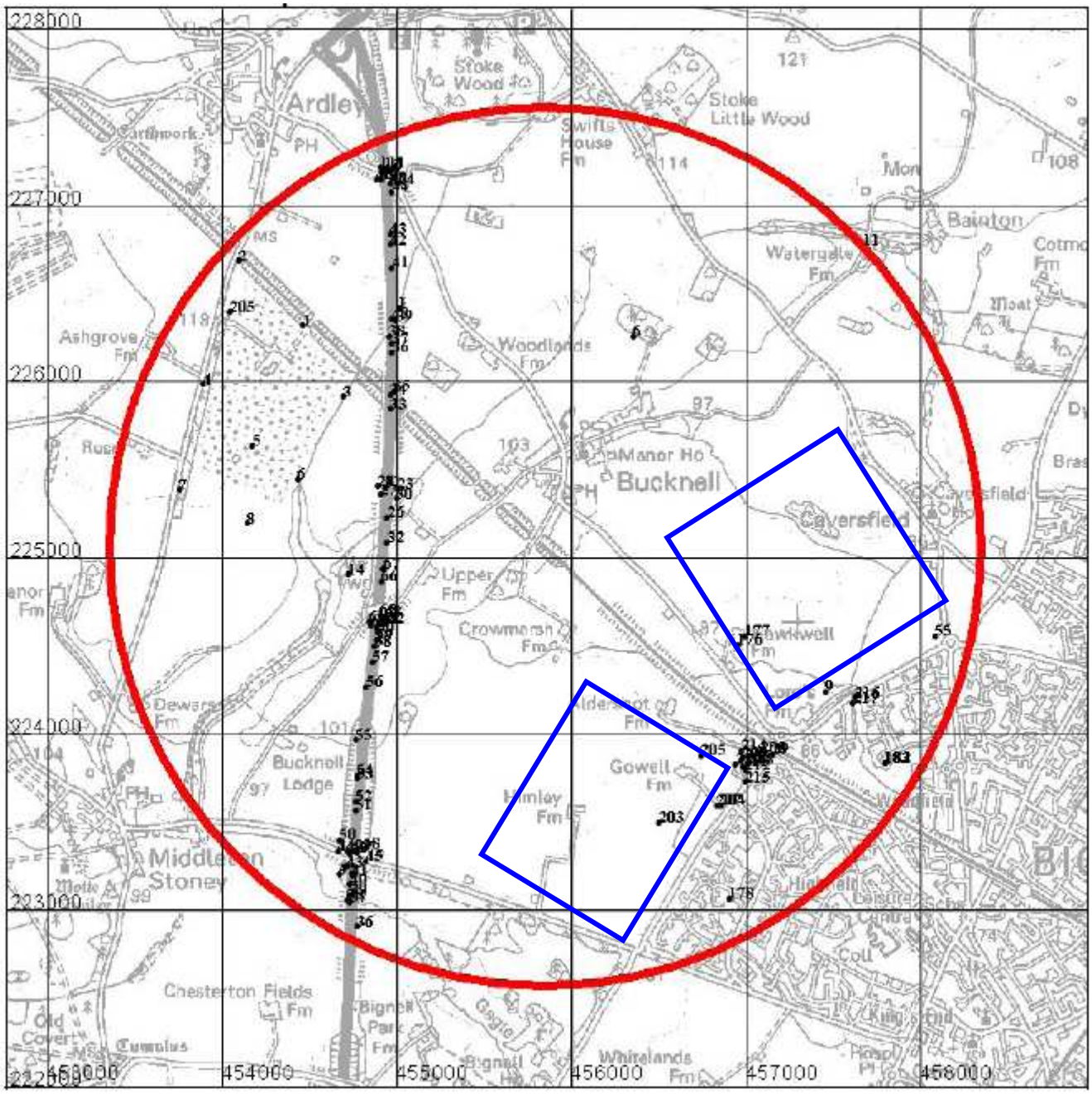

Figure 5. Site location, boreholes and watercourses.

The BGS report includes an extensive table referring to these boreholes.

6 Water wells

The plan below shows the location of water wells relative to the proposed cemetery development:

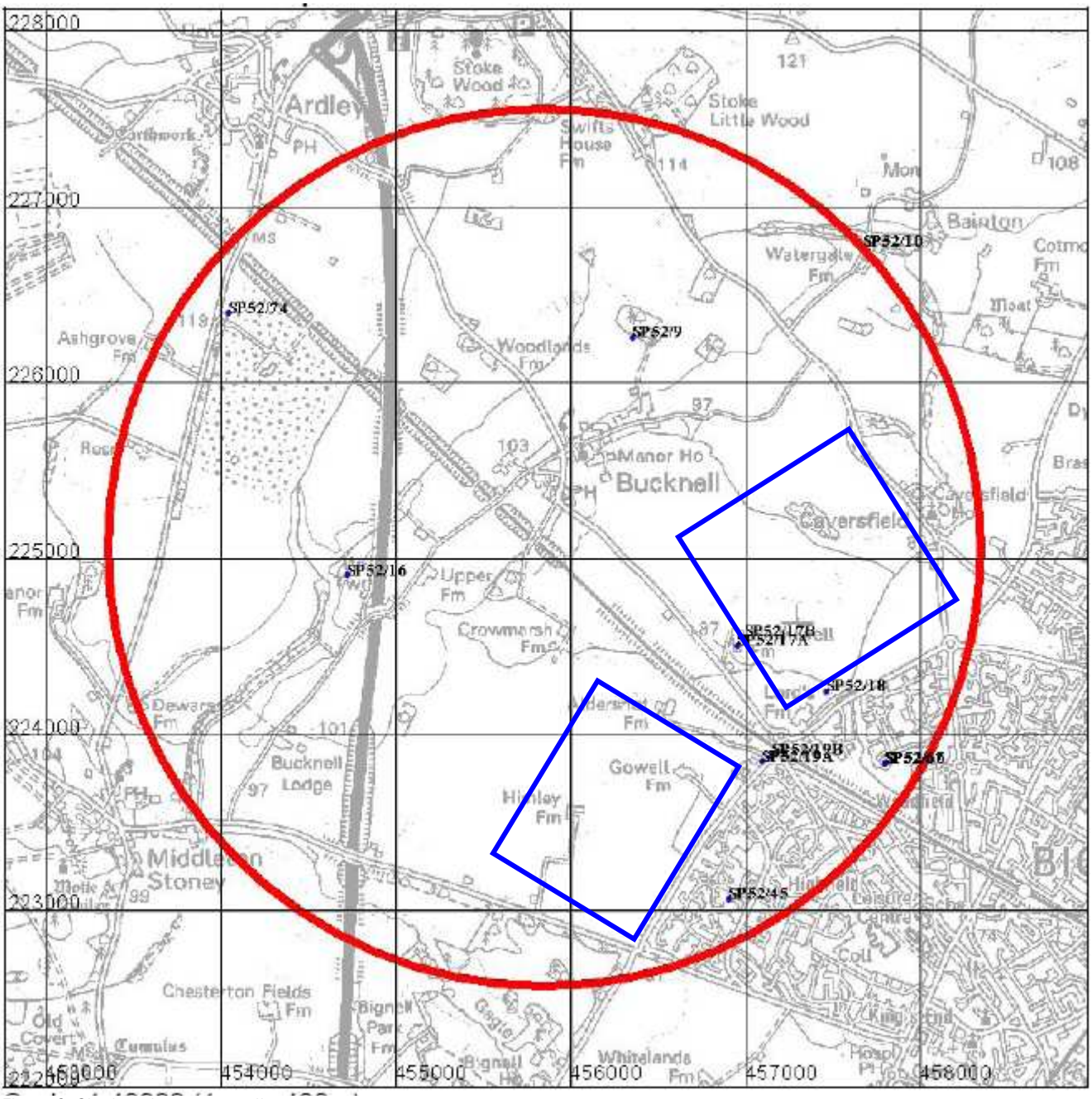

Figure 6. Site location, water wells.

The BGS report includes an extensive table referring to these water wells.

7 Indicative flood plains

According to the EA's website, the NW of Bicester lies outside any indicative flood plain (Figure 6).

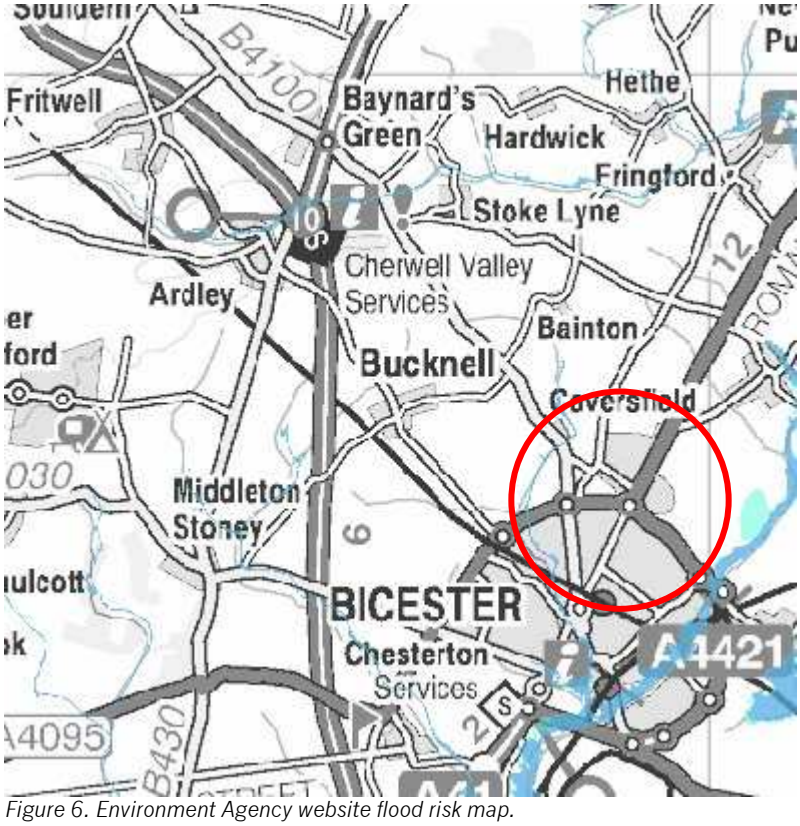

Figure 6. Environment Agency website flood risk map.

8 Groundwater source protection zones (SPZs)

The Environment Agency (EA) has defined Source Protection Zones (SPZs) for 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk.

Zone 1 (Inner protection zone)
Any pollution that can travel to the borehole within 50 days from any point within the zone is classified as being inside zone 1. This applies at and below the water table. This zone also has a minimum 50 metre protection radius around the borehole. These criteria are designed to protect against the transmission of toxic chemicals and water-borne disease.

Zone 2 (Outer protection zone)
The outer zone covers pollution that takes up to 400 days to travel to the borehole, or 25% of the total catchment area – whichever area is the greatest. This travel time is the minimum amount of time that we think pollutants need to be diluted, reduced in strength or delayed by the time they reach the borehole.

Zone 3 (Total catchment)
The total catchment is the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.

According to the EA's website, the Bicester area lies outside Zone 3 (Figures 7a & 7b):

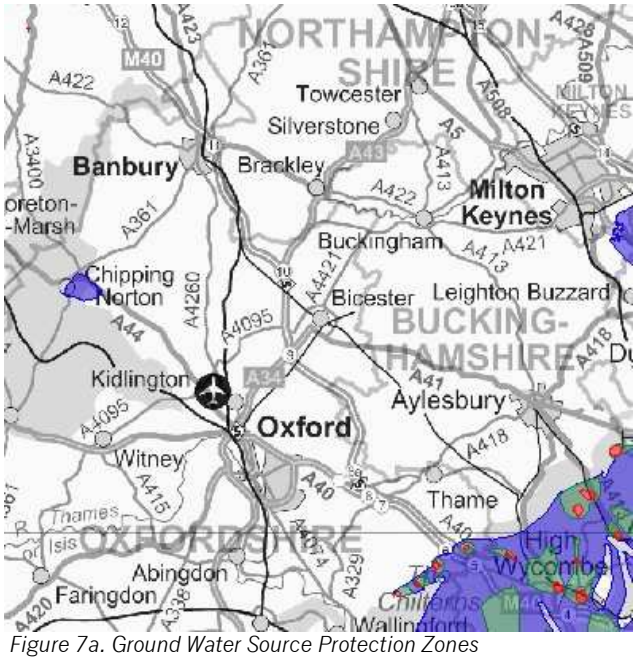

Figure 7a. Ground Water Source Protection Zones
Key: Purple = Total catchment, Green = Outer Zone, Red = Inner Zone. Taken from Environment Agency website SPZ map.

Figure 7b. Ground Water Source Protection Zones
Taken from Environment Agency website SPZ map.

9 Risk assessment

9.1 Site Vulnerability Assessment

Pertinent criteria, associated comment and assigned score are presented in Tables 4 and 5.

Table 4. Site vulnerability criteria and comment

Criteria	Comment
Drift Type	Absent
Drift Thickness	N/A
Depth to Water Table	0.5m to 4m
Flow Mechanism	Fracture Flow
Aquifer	Minor aquifer
Abstraction and SPZ	Outside SPZ 3
Watercourses and springs	>100 (subject to precise location within the identified area
Drains	None known to be present

Table 5. Site vulnerability assessment score sheet

Factor	Site Characteristics	Ranking	Score		
Drift type	Absent	Very High	10	-	9
Drift thickness	N/A	Very High	10	-	9
Depth to water table	0.5m to 4m	Very High	10	-	9
Flow mechanism	Fracture Flow	Very High	10	-	9
Aquifer	Minor aquifer	Moderate	6	-	5
Abstraction and Source Protection Zone	Outside SPZ 3	Very Low	2	-	1
Watercourses and springs	>100m	Very Low	2	-	1
Land Drains	None known to be present	Very Low	2	-	1
Total (range)			52	-	44

Vulnerability	Range	Actual
Low vulnerability	8 – 32	
Moderate vulnerability	32 – 56	44 - 52
High Vulnerability	56 – 80	

9.2 Vulnerability Class

Based upon the total ranking score indicated, the site may be classified with a vulnerability class of:

Low: [ ] Moderate: [X] High: [ ]

9.3 Scale of Development

The anticipated number of annual full earth burials, as opposed to cremated remains, is 50.

9.4 Level of Risk

The EA level of risk to the number of anticipated burial rates and groundwater vulnerability using a nomograph reproduced in Figure 8.

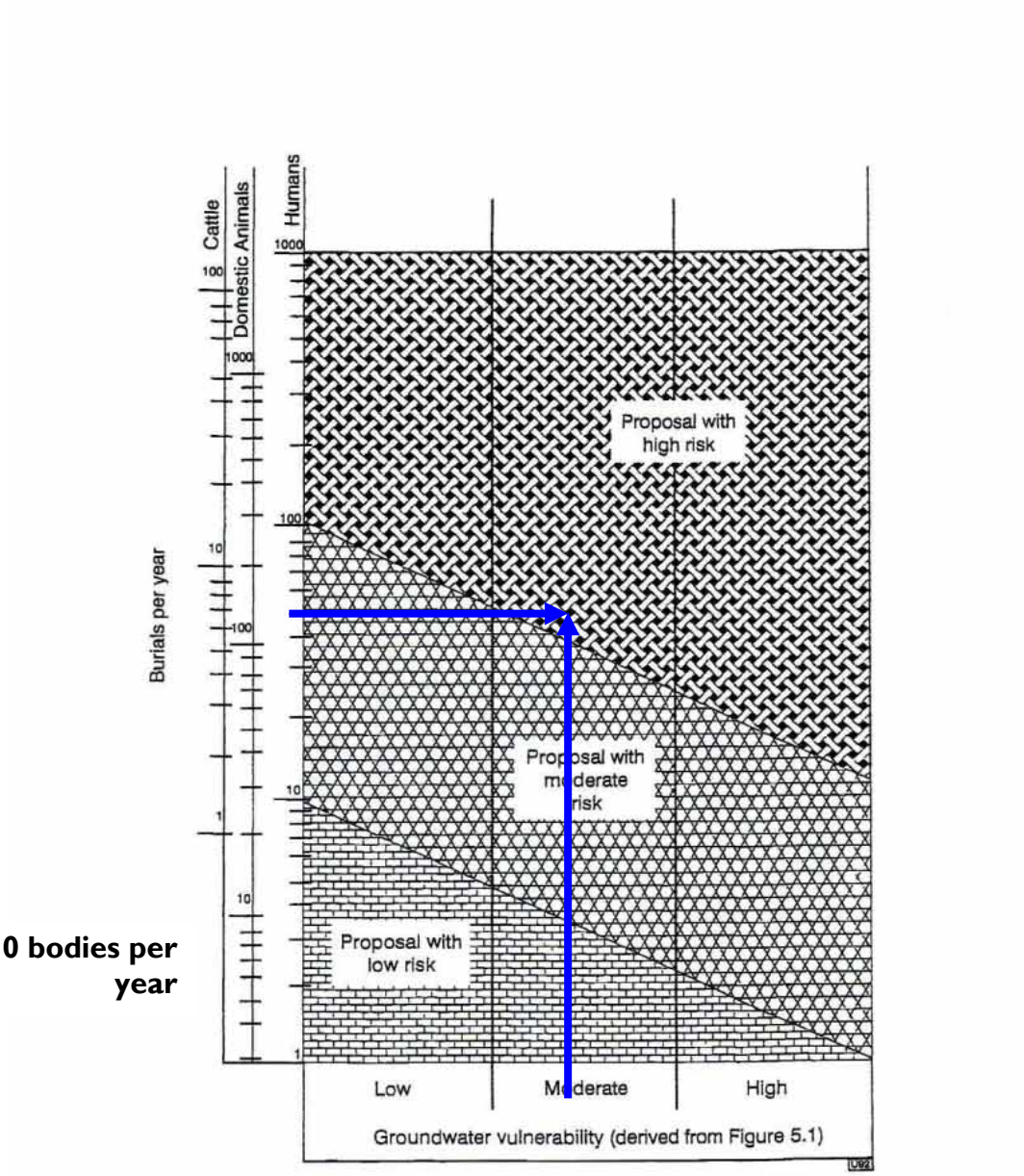

Figure 5.2 **Schematic relationship between burial rates, vulnerability class and level of risk**

R&D Technical Report P223 37

Figure 8. Schematic relationship between burial rates, vulnerability class and level of risk (from EA R & D Technical Report P223 (1999).

With reference to Figure 8, the level of risk at this site is considered to be 'High'.

10 Discussion and conclusions

The vulnerability ranking assigned to this site is 'Moderate', however the numbers of anticipated annual burials gives rise to a Risk Rating of 'High'.

The site characteristics that raised the vulnerability score were:

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

Applied Geotechnical Engineering excavated a number of trial pits around the Bicester ring road during June 2006. Two trial pits were located near Lords Farm and revealed rubbly, very thinly bedded limestone with a clayey, sandy matrix down to 1.2 m with a stronger limestone beneath to 1.9 m (grave depth). Groundwater was not encountered in either trial pit.

There may be significant seasonal fluctuation in groundwater levels as the BGS report indicates that the watertable may be encountered between 0.5 m and 4 m. It would therefore be appropriate to install dipwells within the chosen area and monitor groundwater levels through a winter period to monitor levels and possibly reduce the risk rating of the site.

Subject to appropriate site investigations and agreement with the EA, it may be possible to either adjust the risk rating of the site or to design measures, such as drainage or specifications for burials, to mitigate any risk to groundwaters.

11 Recommendations

It is recommended that this report and the accompanying BGS report be circulated to the EA and dialogue established to ascertain requirements for further assessment of this site's suitability for development as a cemetery.

Subject to the outcome of this dialogue, if detailed site investigations were thought desirable, it is proposed that the site investigation should consist of the following:

1. A topographic survey to provide a basis for designing the cemetery and any necessary drainage infrastructure.

2. An electro-magnetic induction (EMI) survey to provide a basis for establishing the most appropriate locations for excavating soil profile pits down to a maximum depth of 3.5 m and installing a minimum of three dip wells (up to 10 m deep) to monitor ground water depth. The EMI data would be shown on the site plan to two different depths (200 mm and 1.2 m).

3. Assessment of the soil profile pits, and to 'window sample' material removed during the boring of the dip wells, in terms of the type, condition and physical properties of the soil exposed. The results will be used to determine factors that may influence the appropriateness of the site for burial purposes and the vulnerability of the environment to contamination from the proposed development.

4. Monitor the groundwater levels in the dip wells over a winter period, i.e. during the period of highest rainfall.

5. Determine any appropriate options for mitigating risk to ground and surface water by improving the surface and subsurface drainage status.

Depending upon the results of this sampling and analysis, it may be possible to use the site as a cemetery subject to certain restrictions such as the installation of an appropriate drainage scheme.

Confidentiality

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13 Appendices

Publications by key staff

A guide to better soil structure. Booklet based on MAFF funded project SP0305 "A national soil vulnerability-based framework for the provision of farm-specific guidance on the management of soil structure". National Soil Resources Institute, Cranfield University, Silsoe, Bedfordshire, MK45 4DT, September 2001.

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Standard Terms and Conditions

Turftrax Ground Management Systems Limited
Terms and Conditions for the Supply of Services
Interpretation
In these Conditions
AGREED FEE means the charges agreed between TurfTrax and the Client in relation to the Specified Service
CLIENT means the person named on the Specification Sheet for whom TurfTrax has agreed to provide the Specified Service in accordance with these Conditions
CONTRACT means the contract for the provision of the Specified Service
DOCUMENT includes, in addition to a document in writing, any map, plan, graph, drawing or photograph, any film, negative, tape or other device embodying visual images and any disc, tape or other device embodying any other data
INPUT MATERIAL means any Documents or other materials, and any data or other information provided by the Client relating to the Specified Service
OUTPUT MATERIAL means any Documents or other materials, and any data or other information provided by TurfTrax relating to the Specified Service
SPECIFICATION SHEET means the sheet to which these Conditions are appended
SPECIFIED SERVICE means the service relating to geophysical surveys of land to be provided by TurfTrax for the Client and referred to in the Specification Sheet
TURFTRAX means TurfTrax Ground Management Systems Limited (registered in England under number 4135392) or its subsidiary as stated on the Specification Sheet
The headings in these Conditions are for convenience only and shall not affect their interpretation.
Supply of the Specified Service
TurfTrax shall provide the Specified Service to the Client subject to these Conditions. Any changes or additions to the Specified Service or these Conditions must be agreed in writing by TurfTrax and the Client.
The Client shall allow TurfTrax adequate access to its property at reasonable times and for so long as is necessary to enable TurfTrax to provide the Specified Service in accordance with the Contract.
The Client shall at its own expense supply TurfTrax with all necessary Documents or other materials, and all necessary data or other information relating to the Specified Service, within sufficient time to enable TurfTrax to provide the Specified Service in accordance with the Contract. The Client shall ensure the accuracy of all Input Material.
TurfTrax shall have no liability for any loss or damage, however caused, to the Input Material. All Output Material shall be at the sole risk of the Client from the time of delivery to or to the order of the Client.
The Specified Service shall be provided in accordance with the Specification Sheet subject to these Conditions.
Further details about the Specified Service, and advice or recommendations about its provision or utilisation, which are not given in TurfTrax's brochure or other promotional literature, may be made available on written request.
TurfTrax may correct any typographical or other errors or omissions in any brochure, promotional literature, quotation or other document relating to the provision of the Specified Service without any liability to the Client.
TurfTrax may at any time without notifying the Client make any changes to the Specified Service which are necessary to comply with any applicable safety or other statutory requirements, or which do not materially affect the nature or quality of the Specified Service.
Charges
Subject to any special terms agreed, the Client shall pay the Agreed Fee and any additional sums which are agreed between TurfTrax and the Client for the provision of the Specified Service or which, in TurfTrax's sole discretion, are reasonably incurred as a result of the Client's instructions or lack of instructions, the inaccuracy of any Input Material or any other cause attributable to the Client.
All charges quoted to the Client for the provision of the Specified Service are exclusive of any Value Added Tax, for which the Client shall be additionally liable at the applicable rate from time to time.
TurfTrax shall be entitled to invoice the Client on completion of the Specified Service.
The Agreed Fee and any additional sums payable shall be paid by the Client (together with any applicable Value Added Tax, and without any set-off or other deduction) within 30 days of the date of TurfTrax's invoice.
If payment is not made on the due date, TurfTrax shall be entitled, without limiting any other rights it may have, to charge interest on the outstanding amount (both before and after any judgment) at the rate of 4 % above the base rate from time to time of Barclays Bank plc from the due date until the outstanding amount is paid in full.
Rights in Input Material and Output Material
The property and any copyright or other intellectual property rights in:
any Input Material shall belong to the Client
any Output Material and any amendments or variations to the Input Material made by TurfTrax shall, unless otherwise agreed in writing between the Client and TurfTrax, belong to TurfTrax, subject only to the right of the Client to use the Output Material for the purposes of utilising the Specified Service.
Any Input Material or other information provided by the Client which is so designated by the Client and any Output Material shall be kept confidential by TurfTrax, and all Output Material or other information provided by TurfTrax which is so designated by TurfTrax shall be kept confidential by the Client; but the foregoing shall not apply to any Documents or other materials, data or other information which are public knowledge at the time when they are so provided by either party, and shall cease to apply if at any future time they become public knowledge through no fault of the other party.
The Client warrants that any Input Material and its use by TurfTrax for the purpose of providing the Specified Service will not infringe the copyright or other rights of any third party, and the Client shall indemnify TurfTrax against any loss, damages, costs, expenses or other claims arising from any such infringement.
Warranties and Liability
TurfTrax warrants to the Client that the Specified Service will be provided using reasonable care and skill and, as far as reasonably possible, in accordance with the Specification and at the intervals and within the times referred to in the Specification Sheet. Where TurfTrax supplies in connection with the provision of the Specified Service any goods (including Output Material) supplied by a third party, TurfTrax does not give any warranty, guarantee or other term as to their quality, fitness for purpose or otherwise, but shall, where possible, assign to the Client the benefit of any warranty, guarantee or indemnity given by the person supplying the goods to TurfTrax.
TurfTrax shall have no liability to the Client for any loss, damage, costs, expenses or other claims for compensation arising from any Input Material or instructions supplied by the Client which are incomplete, incorrect, inaccurate, illegible, out of sequence or in the wrong form, or arising from their late arrival or non-arrival, or any other fault of the Client.
Except in respect of death or personal injury caused by TurfTrax's negligence, or as expressly provided in these Conditions, TurfTrax shall not be liable to the Client by reason of any representation (unless fraudulent), or any implied warranty, condition or other term, or any duty at common law, or under the express terms of the Contract, for any loss of profit or any indirect, special or consequential loss, damage, costs, expenses or other claims (whether caused by the negligence of TurfTrax, its servants or agents or otherwise) which arise out of or in connection with the provision of the Specified Service or their use by the Client, and the entire liability of TurfTrax under or in connection with the Contract shall not exceed the amount of TurfTrax's charges for the provision of the Specified Service, except as expressly provided in these Conditions.
TurfTrax shall not be liable to the Client or be deemed to be in breach of the Contract by reason of any delay in performing, or any failure to perform, any of TurfTrax's obligations in relation to the Specified Service, if the delay or failure was due to any cause beyond TurfTrax's reasonable control.
Termination
Either party may (without limiting any other remedy) at any time terminate the Contract by giving written notice to the other if the other commits any breach of these Conditions and (if capable of remedy) fails to remedy the breach within 30 days after being required by written notice to do so.
Insolvency of Client
This clause applies if:
the Client makes any voluntary arrangement with its creditors or (being an individual or firm) becomes bankrupt or (being a company) becomes subject to an administration order or goes into liquidation (otherwise than for the purposes of amalgamation or reconstruction); or
an encumbrance takes possession, or a receiver is appointed, of any of the property or assets of the Client; or
the Client ceases, or threatens to cease, to carry on business; or
TurfTrax reasonably apprehends that any of the events mentioned above is about to occur in relation to the Client and notifies the Client accordingly.
If this clause applies then, without prejudice to any other right or remedy available to TurfTrax, TurfTrax shall be entitled to cancel the Contract or suspend any further provision of services under the Contract without any liability to the Client, and if the Services have been provided but not paid for the price shall become immediately due and payable notwithstanding any previous agreement or arrangement to the contrary.
General
These Conditions (together with the terms, if any, set out in the Specification Sheet) constitute the entire agreement between the parties, supersede any previous agreement or understanding and may not be varied except in writing between the parties. All other terms and conditions, express or implied by statute or otherwise, are excluded to the fullest extent permitted by law.
Any notice required or permitted to be given by either party to the other under these Conditions shall be in writing addressed to the other party at its registered office or principal place of business or such other address as may at the relevant time have been notified pursuant to this provision to the party giving the notice.
No failure or delay by either party in exercising any of its rights under the Contract shall be deemed to be a waiver of that right, and no waiver by either party of any breach of the Contract by the other shall be considered as a waiver of any subsequent breach of the same or any other provision.
If any provision of these Conditions is held by any competent authority to be invalid or unenforceable in whole or in part, the validity of the other provisions of these Conditions and the remainder of the provision in question shall not be affected.
Any dispute arising under or in connection with these Conditions or the provision of the Specified Service shall be referred to arbitration by a single arbitrator appointed by agreement or (in default) nominated on the application of either party by the President for the time being of Institute of Arbitrators.
English law shall apply to the Contract, and the parties agree to submit to the non-exclusive jurisdiction of the English courts.

Author:	Peter Mitchell Dr Richard Earl
Released by:	Dr James Welsh
Signed:	
Date:	6th March 2008

Appendix H

BGS BR211 Radon Report

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

GeoReports

Dylan Thomas
Hyder Consulting (UK) Ltd
HCL House
St Mellons Business Park
Cardiff
CF3 0EY

BR211 Radon Report:

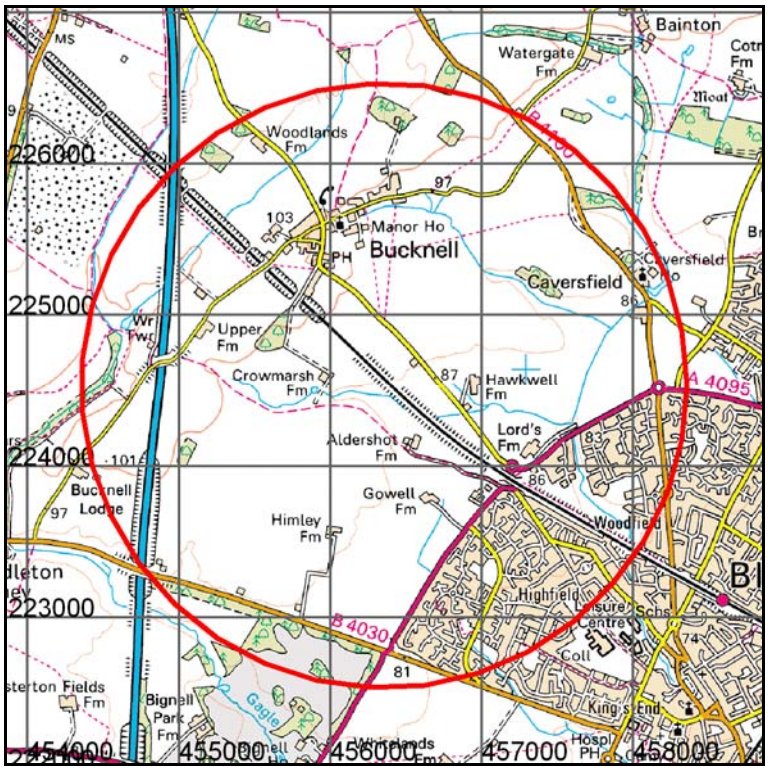
Advisory report on the requirement for radon protective measures in new buildings and extensions.

Report Id: ***GR_200946/1***

Client reference:

Location and extent of site

This report describes a site located at National Grid Reference 456358, 224534. Note that for sites of irregular shape, this point may lie outside the site boundary. Where the client has submitted a site plan the assessment will be based on the area given.



Scale: 1:50 000 (1cm = 500 m)

Search area indicated in red

BR211 Radon Report

This is an advisory report on the requirement for radon protective measures in new buildings and extensions.

Requirement for radon protective measures

The determination below follows advice in *BR211 Radon: Guidance on protective measures for new buildings (2007 edition)*, which also provides guidance on what to do if the result indicates that protective measures are required.

BASIC RADON PROTECTIVE MEASURES ARE REQUIRED FOR THE REPORT AREA.

The BGS is not able to provide advice on the technical specifications of 'basic' and 'full' radon protective measures. This information is detailed in **BRE Report BR211 :Radon: Protective measures for new buildings** which may be purchased from **brebookshop.com.** BR211 offers guidance on the technical solutions that are required to satisfy Building Regulations requirements. Summary guidance is available on the web at: http://www.bre.co.uk/radon/protect.html.

If you require further information or guidance, you should contact your local authority building control officer or approved inspector.

Contact 020 7944 5758 or Email: partsac.br@communities.gsi.gov.uk for advice on the interpretation of guidance contained in BRE Report BR211 (2007).

What is radon ?

Radon is a naturally occurring radioactive gas, which is produced by the radioactive decay of radium which, in turn, is derived from the radioactive decay of uranium. Uranium is found in small quantities in all soils and rocks, although the amount varies from place to place. Radon released from rocks and soils is quickly diluted in the atmosphere. Concentrations in the open air are normally very low and do not present a hazard. Radon that enters enclosed spaces such as some buildings (particularly basements), caves, mines, and tunnels may reach high concentrations in some circumstances. The construction method and degree of ventilation will influence radon levels in individual buildings. A person's exposure to radon will also vary according to how particular buildings and spaces are used.

Inhalation of the radioactive decay products of radon gas increases the chance of developing lung cancer. If individuals are exposed to high concentrations for significant periods of time, there may be cause for concern. In order to limit the risk to individuals, the Government has adopted an Action Level for radon in homes of 200 becquerels per cubic metre (Bq m^{-3}). The Government advises householders that, where the radon level exceeds the Action Level, measures should be taken to reduce the concentration.

Radon in workplaces

The Ionising Radiation Regulations, 1999, require employers to take action when radon is present above a defined level in the workplace. Advice may be obtained from your local Health and Safety Executive Area Office or the Environmental Health Department of your local authority. The BRE publishes a guide (BR293)**: Radon in the workplace.** BRE publications may be obtained from The BRE Bookshop, I H S Technical Indexes Ltd., Willoughby Road, Bracknell, Berkshire RG12 8DW. Tel: 01344 404407, Fax: 01344 714440, website: www.brebookshop.com

Radon in existing buildings
Useful information is given in the following free publications which can be obtained by writing to:
Radon Studies, Radiation Protection Division, Health Protection Agency, Chilton, Didcot, Oxfordshire OX11 0RQ

Radon - A Householder's Guide
Radon - You Can Test for it
Radon - A Guide for Homebuyers and Sellers
Radon - A Guide to Reducing Levels in Your Home
Information in the booklets is also available on the DEFRA website at:
http://www.defra.gov.uk/environment/radioactivity/background/radon.htm

Householders are recommended to follow advice in **Radon - a householder's guide.** The guide outlines simple solutions for dealing with the radon problem depending on whether or not the home has been tested for radon. In radon affected homes, the problem of radon can usually be tackled with simple, effective and relatively inexpensive measures. These measures are comparable in cost to work such as damp-proofing and timber treatment. You can get practical advice about construction work to reduce radon levels from the Building Control Officer at your local council.

Is this property in a radon affected area – YES

The answer to the standard enquiry on house purchase known as **CON29 Standard Enquiry of Local Authority 3.13 Radon Gas: Location of the Property in a radon Affected Area is YES** this property is in a Radon Affected Area as defined by the Health Protection Agency (HPA).

The estimated probability of the property being above the Action Level for radon is: 3-5%.

In addition to the search area, the radon data includes a 75 metre zone around the site to allow for uncertainties in location data and geological line work.

The result informs you of the estimated probability that this particular property is above the Action Level for radon. This does not necessarily mean there is a radon problem in the property. The only way to determine whether it is above or below the Action Level is to carry out a radon measurement within the existing property.

Radon Affected Areas are designated by the HPA. They advise that radon gas should be measured in all properties within Radon Affected Areas.

If you are buying a currently occupied property in a Radon Affected Area you should ask the present owner whether radon levels have been measured in the property. If they have, ask whether the results were above the Radon Action Level and if so whether remedial measures were installed, radon levels were retested, and the that the results of re-testing confirmed the effectiveness of the measures.

For further information, advice about radon, its health risks and details of how to order the radon test, please contact the HPA Radon Helpline on 01235 822622 or go online at www.ukradon.org or write to Radon Studies at the Health Protection Agency, address above. You can obtain an information pack from the HPA free Radon answer phone on 0800 614529.

Contact Details

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British Geological Survey
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Terms and Conditions

General Terms & Conditions

This Report is supplied in accordance with the GeoReports Terms & Conditions available on the BGS website at www.bgs.ac.uk/georeports and also available from the BGS Central Enquiries Desk at the above address.

Important notes about this Report

- The data, information and related records supplied in this Report by BGS can only be indicative and should not be taken as a substitute for specialist interpretations, professional advice and/or detailed site investigations. You must seek professional advice before making technical interpretations on the basis of the materials provided.
- Geological observations and interpretations are made according to the prevailing understanding of the subject at the time. The quality of such observations and interpretations may be affected by the availability of new data, by subsequent advances in knowledge, improved methods of interpretation, and better access to sampling locations.
- Raw data may have been transcribed from analogue to digital format, or may have been acquired by means of automated measuring techniques. Although such processes are subjected to quality control to ensure reliability where possible, some raw data may have been processed without human intervention and may in consequence contain undetected errors.
- Detail, which is clearly defined and accurately depicted on large-scale maps, may be lost when small-scale maps are derived from them.
- Although samples and records are maintained with all reasonable care, there may be some deterioration in the long term.
- The most appropriate techniques for copying original records are used, but there may be some loss of detail and dimensional distortion when such records are copied.
- Data may be compiled from the disparate sources of information at BGS's disposal, including material donated to BGS by third parties, and may not originally have been subject to any verification or other quality control process.
- Data, information and related records, which have been donated to BGS, have been produced for a specific purpose, and that may affect the type and completeness of the data recorded and any interpretation. The nature and purpose of data collection, and the age of the resultant material may render it unsuitable for certain applications/uses. You must verify the suitability of the material for your intended usage.
- If a report or other output is produced for you on the basis of data you have provided to BGS, or your own data input into a BGS system, please do not rely on it as a source of information about other areas or geological features, as the report may omit important details.
- The topography shown on any map extracts is based on the latest OS mapping and is not necessarily the same as that used in the original compilation of the BGS geological map, and to which the geological linework available at that time was fitted.
- Note that for some sites, the latest available records may be quite historical in nature, and while every effort is made to place the analysis in a modern geological context, it is possible in some cases that the detailed geology at a site may differ from that described.

Report issued by
BGS Enquiry Service