

Geological Assessment - Detailed

The **Cornbrash Formation** is the youngest bedrock unit within the site area, cropping out over about half the search area, almost all of the site area, 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 Bladon Member and 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.

Along valley sides, the Cornbrash Formation outcrops may be affected by cambering. Cambering is a widespread phenomenon in the south and east Midlands, although it is not known whether it affects the strata at this site. Cambering takes place where beds of resistant, permeable rocks such as limestone overlie impermeable clay (or mudstone which weathers and softens to clay) along valley sides and escarpments. The superincumbent load coupled with water movement along the interface causes the soft plastic clay material to squeeze or wash out. Intervening sand beds may exacerbate the effect, but even where such permeable beds are absent, large thicknesses of clay may be lost by squeezing. As a result, the vertical thickness of the clay beds reduces, and the limestone strata are lowered as a 'camber', comprising blocks separated by minor faults parallel to the valley axis. The cambered strata may themselves undergo brittle fracture, so forming blocks separated by vertical joints normal to the direction of movement, on which minor vertical displacements may take place (forming 'dip-and-fault' structures). The displacements on the faults associated with cambering is usually quite small (up to 3 m), and they may be undetectable at the surface other than in excavations. In addition, the spacing may be too close (tens of metres) for them to be distinguishable at 1:10 560 or 1:10 000-scale. Cambering is thought to have been initiated during Pleistocene periglacial conditions. It is probably not an ongoing process here, but may merge into landslide movement downslope and must be considered a potential engineering hazard.

In narrow valleys a consequence of squeezing of the clay strata may be valley bulging, in which the softer material is forced upwards in the floor of the valley, above its normal position, becoming folded and possibly faulted. This may also cause the downslope ends of cambers to be disrupted.

Downhill (lateral) movement of the blocks may cause wide fissures (known as 'gulls') to form. The gulls are likely to fill with loose rock and soil, and in some cases with clay, but can remain as voids. Gulls may also result from the collapse of cavities in limestone formed by dissolution along joints. Such an origin may be evident from a regular pattern or orientation of gulls parallel to local joint sets or not at right angles to the inferred direction of extension. Many gulls develop by a combination of these causes.

Geological Assessment - Detailed

Additional Geological Considerations (see Section 4):

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 100m 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, 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.

Hydrogeology and groundwater vulnerability:

The areas of worked ground, although not within the site area, may contain groundwater that may have an effect on groundwater beneath the site, albeit at depth. The areas of worked ground occur within the White Limestone Formation (see below).

There are small patches of alluvium, and possibly head, within the site area in the floors and flanks of some of the valleys. These deposits are of variable permeability. Groundwater may be present in limited quantities in the less permeable deposits, otherwise it is likely to be in hydraulic conductivity with the Forest Marble Formation bedrock if the bedrock is relatively permeable, or will be perched and drain out if it is more permeable than the bedrock. The deposits are very small in area and thickness and there is no borehole water level information relating to them. However, the water is likely to be in hydraulic continuity with, and at a similar level to, surface water.

The Great Oolite Group limestones transmit water via fractures that can be enhanced by dissolution; water movement through them can therefore be rapid.

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.

Geological Assessment - Detailed

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 no water analyses from the Cornbrash and Forest Marble Formations, but anticipate that water from the limestones will be similar to that from the White Limestone Formation. All of the boreholes in the area that have analyses are deeper ones drilled into, and abstracting water from, the White Limestone Formation. A typical analysis, one from 1905 of the water from the Gowell Farm borehole, records total dissolved solids of 380 mg/l, a chloride ion concentration of 16 mg/l, a hardness of 207 mg/l (as CaCO_3), and nitrates of 0.2 mg/l. A 1935 analysis of several samples, taken under pumping conditions, record total dissolved solids of about 300-400 mg/l and a chloride ion concentration of 13-32 mg/l. The outcrop, and thus recharge area, of the White Limestone Formation lies to the north-west of the site area, within the search area. There are areas of worked ground in this formation in the search area. Depending upon the unknown depth of the worked ground areas, the water level in the White Limestone Formation may lie above the floor of any quarry or similar excavation. If any such worked ground has been backfilled and it is unlined, it is possible that the backfill material may affect groundwater flow beneath the site and may be in contact with the water within the White Limestone Formation. It is possible that under these conditions, the water in this formation may be, or become, contaminated and may eventually be transmitted down hydraulic gradient to the water in the formation beneath this site.

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.

Individual sites will always require more detailed assessments to determine the specific impact on groundwater resources. The maps only represent conditions at the surface and where the soil and/or underlying formations have been disturbed or removed, the vulnerability class may have been changed and site specific data will be required.

Natural Land Gas

Section 2 indicates whether or not there is any potential susceptibility of the report area to surface or near-surface emissions of methane and/or carbon dioxide from natural sources or mining. Where methane and carbon dioxide emissions do occur at the surface most appear to be derived from abandoned shallow coal mines although a number of recorded incidences originate from peat and other natural deposits of organic materials, such as in buried ponds or river channels. It should be noted that the exact extent of potential sources of natural land gas, particularly that of peat and other organic deposits, can be difficult to predict.

Geological Assessment - Detailed

An indication of potential for gas emissions does not necessarily indicate that there is a problem. That would depend on (1) the quantity of gases in the source rocks or superficial deposits, (2) whether they have been released and (3) whether there are pathways for transmission and locations for accumulation.

The relatively small number of gas emission incidents from coal mining and natural sources recorded in most areas of the UK suggests that the hazard is relatively minor and of local significance compared, for example, with the extensive problems associated with mining related subsidence or gas problems associated with landfill sites. However, in some parts of the coal fields, such as in parts of Northumberland, a relatively high number of gas emission sites have been identified, so the gas hazard is correspondingly greater. Whereas specific problems with methane and carbon dioxide from natural sources and mining can cause severe and, sometimes, expensive or dangerous problems, most gas emissions from natural sources and mining can usually be dealt with readily if they do arise.

A Residential Property or Non-Residential Property, Commercial or Development Site (maximum of 25 hectares) coal mining search from the Coal Authority (http://www.ppsearches.co.uk/coal_mining_searches.htm) will indicate whether any shafts or adits, which may act as pathways for gas, are located within 20 m of the boundary of the property or site. Where the Coal Authority is aware that a property or site being the subject of a search has been affected by mine gas, this information will be included in the Coal Mining Search Report.

If the report area is potentially susceptible to surface or near-surface emissions of methane and/or carbon dioxide from natural sources or mining, (1) caution should be exercised in forward planning on the basis that hazards from natural methane and carbon dioxide impose a constraint on development by virtue of public health or safety implications; (2) developers need to be aware that potential problems may be associated with gas emissions; (3) employers at some places of work may have responsibilities under the Health and Safety at Work etc Act 1974 to monitor gas levels; and (4) there may be a need to consult an appropriate specialist or to seek further information through desk studies and/or site investigations.

The information in this report should not be used in place of a site investigation. The existence of gas emissions at specific sites can only be established by detailed site investigation. The level of risk from methane or carbon dioxide in a particular building or underground cavity can only be established by monitoring the spaces in which it may accumulate.

Radon

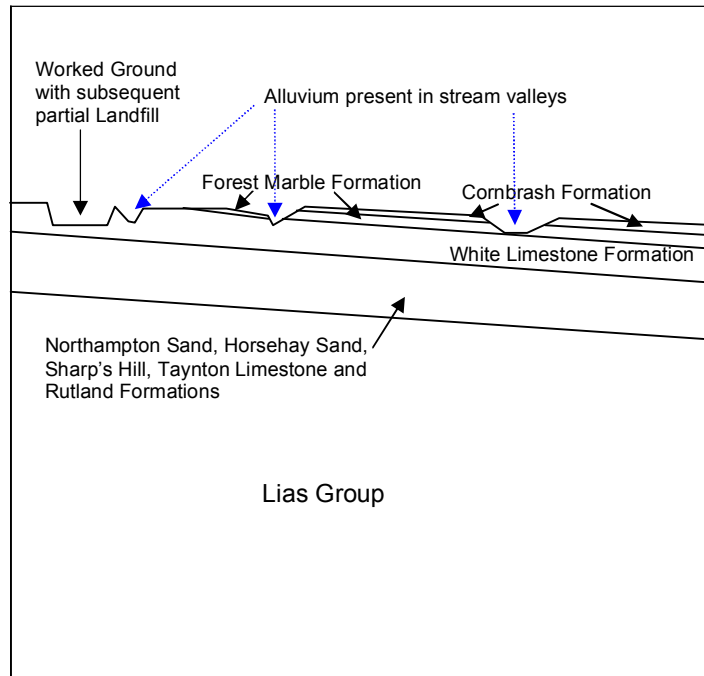
Section 2 describes the level of Radon Protective Measures required during the construction of new buildings or extensions to existing buildings, at the site. This determination complies with information set out in *BR211 Radon: Guidance on protective measures for new dwellings (2007 edition)*, which also provides guidance on what to do if the result indicates that protective measures are required (please see BRE Website for more details: www.bre.co.uk/radon). This assessment is based on the Radon Potential Dataset produced jointly by the BGS and the Health Protection Agency (for more information please see the BGS website at www.bgs.ac.uk/radon).

Section 4: Schematic Geological Cross-Section of the Site

Not to scale

grid ref of north-west side of site
45385 22653

grid ref of south-east side of site
45775 22335



This sketch represents an interpretation of the geometrical relationships of the main rock units described in the text. Not to scale.

Section 5: Geological maps

Extracts of geology maps around your site are provided in this section, taken from the BGS Digital Geological Map of Great Britain at the 1:50,000 scale (DiGMapGB-50). The first four maps show separately the four main layers of geology that may be present in an area – **artificial (man-made) deposits**, **landslip deposits**, **superficial deposits** and **bedrock**. The fifth 'combined geology' map shows all four rock layers superimposed on the same map, to show the rocks that occur at the surface just beneath the soil.

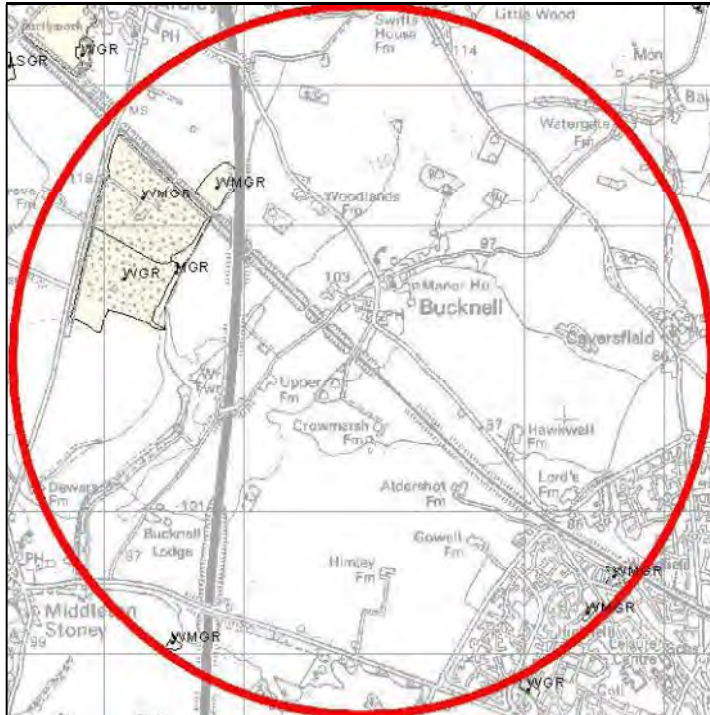
More information on DiGMapGB-50 and how the various rock layers are classified can be found on the BGS website (www.bgs.ac.uk), under the DiGMap and BGS Rock Classification Scheme areas. Further descriptions of the rocks listed in the map keys can also be obtained by searching against the Computer Code on the *BGS Lexicon of named Rock Units*, which is also on the BGS Website at by following the 'GeoData' link. The computer codes are labelled on the maps to try and help in their interpretation (with a dot at the bottom left hand corner of each label). However, please treat this with caution in areas of complex geology, where some of the labels may overlap several geological formations. If in doubt, please contact BGS enquiries.

The geological formations are listed broadly in order of age in the map keys (youngest first) but only to the formation level (a formation is a package of related rocks). Within formations, please be aware that individual members may not be ordered by age.

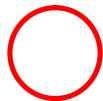
Geological Assessment - Detailed

Artificial deposits

These include deposits moved and disturbed by man.



Scale: 1:50000 (1cm = 500m)



SITE LOCATION

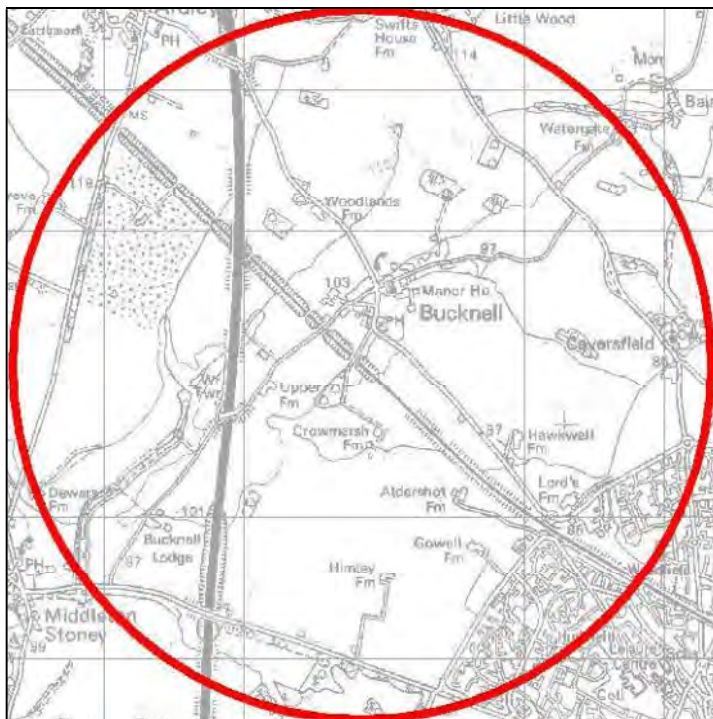
Key to Artificial deposits:

Map colour	Computer Code	Rock name	Rock type
	LSGR	LANDSCAPED GROUND (UNDIVIDED)	UNKNOWN/UNCLASSIFIED ENTRY
	MGR	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT
	WGR	WORKED GROUND (UNDIVIDED)	VOID
	WMGR	INFILLED GROUND	ARTIFICIAL DEPOSIT

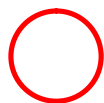
Geological Assessment - Detailed

Landslip deposits

These include natural deposits formed by sliding and mass-movement of soils and rocks on hill slopes (an alternative term for Landslip deposits is 'Mass Movement Deposits')



Scale: 1:50000 (1cm = 500m)



SITE LOCATION

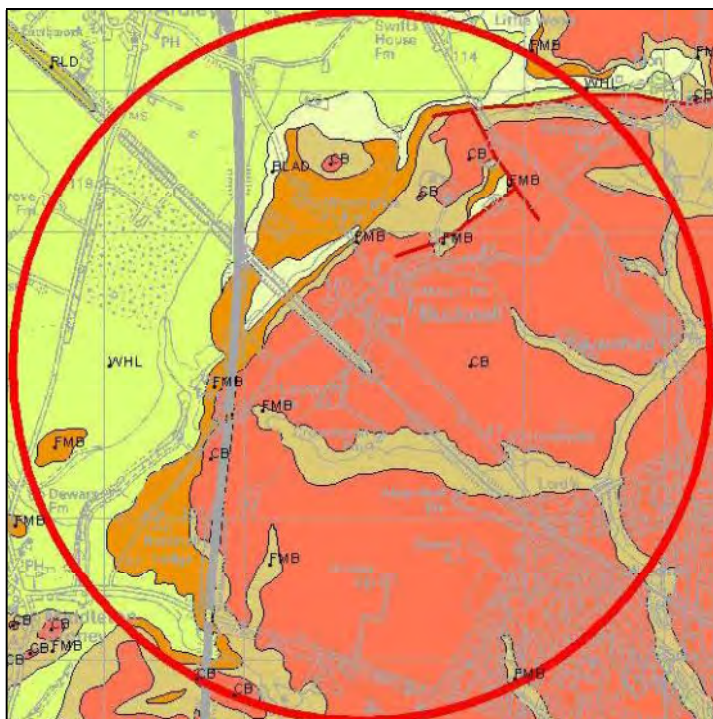
Key to Landslip deposits:

No deposits are mapped in the search area

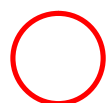
Geological Assessment - Detailed

Bedrock

Bedrock forms the ground underlying the whole of an area, upon which the other geological layers listed above may lie (an alternative term for Bedrock is 'Solid Geology')



Scale: 1:50000 (1cm = 500m)



SITE LOCATION



Fault



Coal, ironstone or other mineral vein

Note: Faults and Coals, ironstone & mineral veins are shown for illustration and to aid interpretation of the map. Not all such features are shown and their absence on the map face does not necessarily mean that none are present

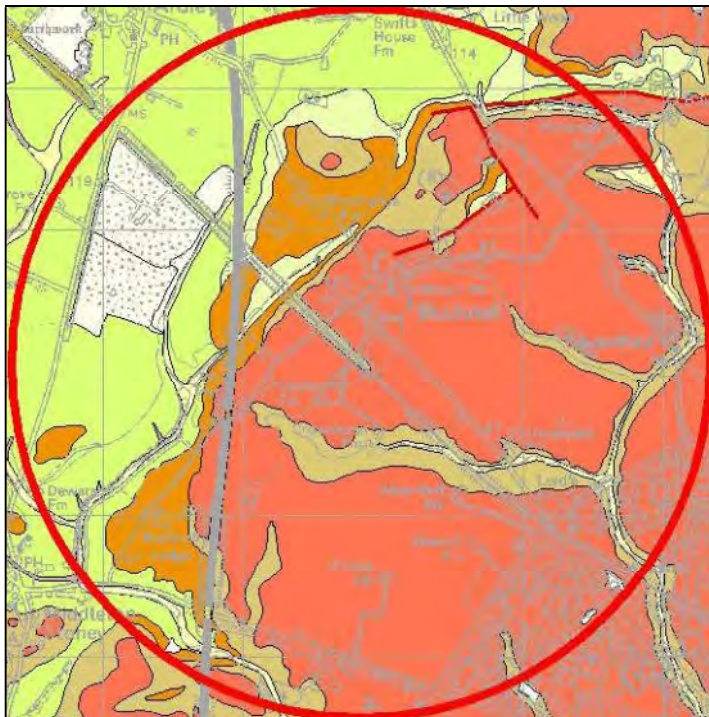
Key to Bedrock geology:

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

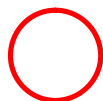
Geological Assessment - Detailed

Combined 'Surface Geology' Map

This map shows all four rock layers overlaid from the previous maps.



Scale: 1:50000 (1cm = 500m)



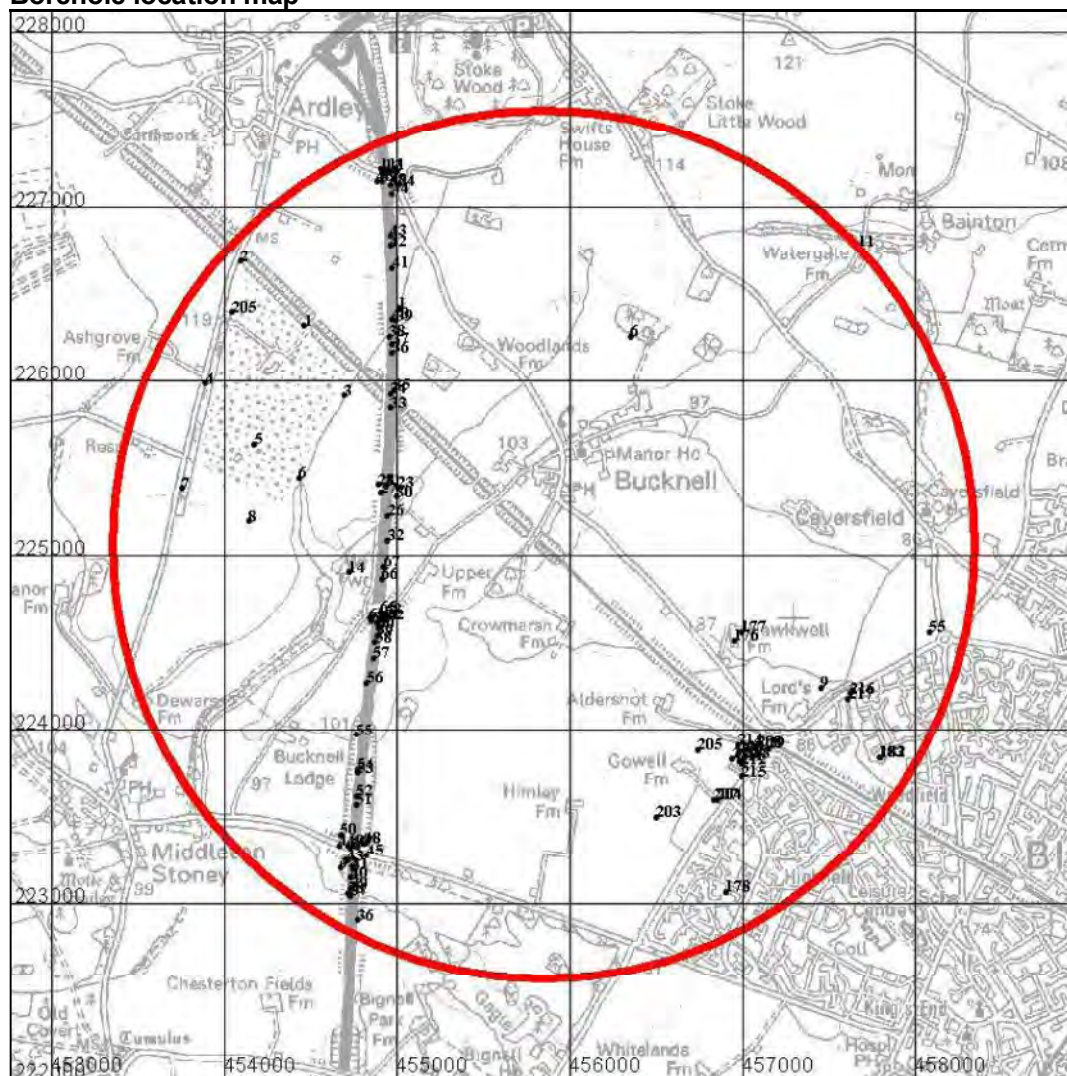
SITE LOCATION

Please see the Keys to the Artificial, Landslip, Superficial and Bedrock geology maps.

Section 6: List of geological data available around the site

This section lists the principal data sets held in the National Geoscience Records Centre that are relevant to the site. Descriptions of the data sets and how to obtain copies of records from them are given in Sections 7 and 8. Users with access to computing facilities can make their own index searches using the BGS Internet Geoscience Data Index, accessible through the BGS website at www.bgs.ac.uk

Borehole location map



Scale: 1:40000 (1cm = 400m)

Geological Assessment - Detailed

Borehole records

(A blank Length field indicates the borehole is confidential or no depth has been recorded digitally.)

Total number of records: 98

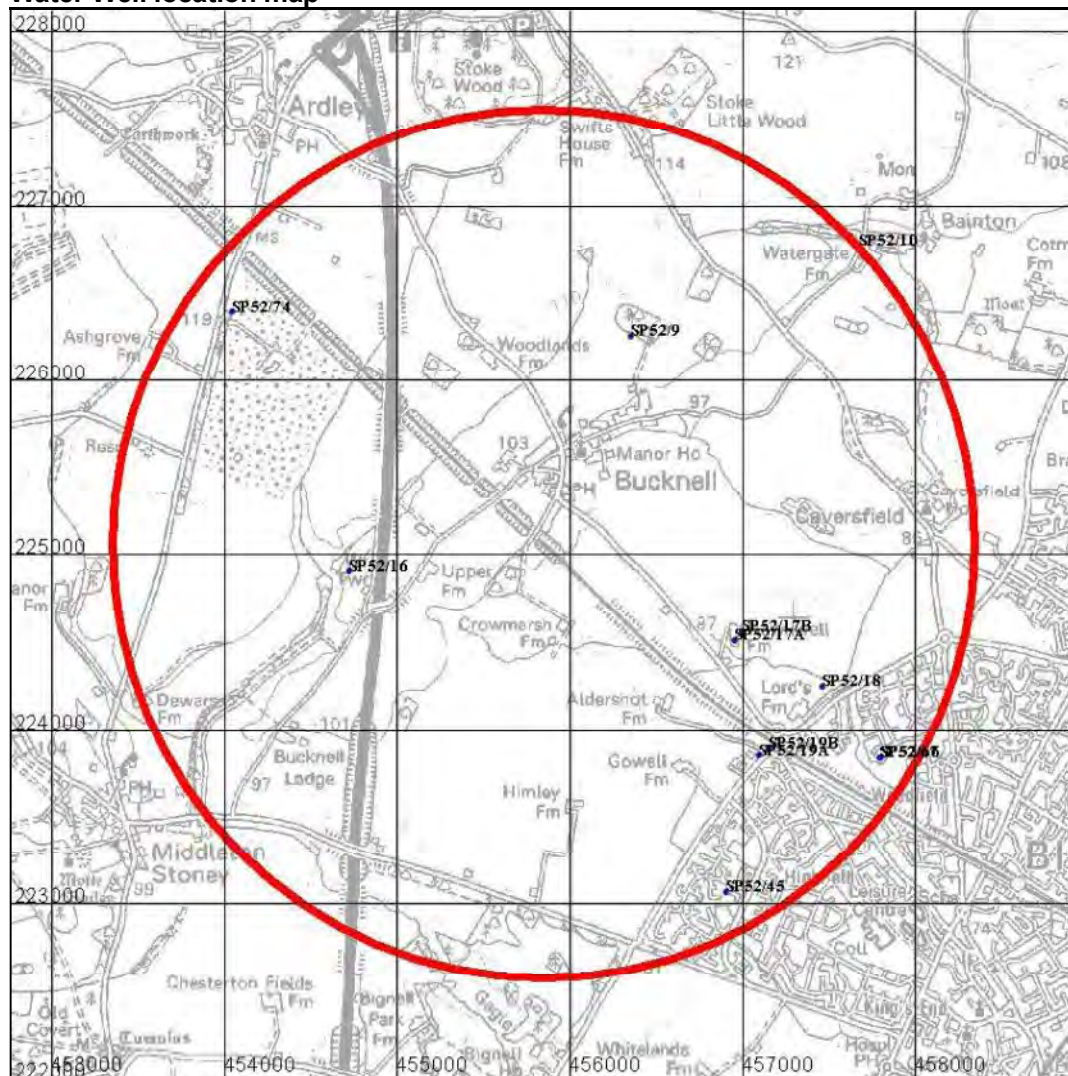
The 'Office' column shows the office at which the records are held and from where copies can be obtained (see contact details later in the report). KW=Keyworth, MH & MW=Murchison House, WL=Wallingford, EX=Exeter

Regno	Grid reference	Name	Length	Office	SIR
SP52NE1	SP 55010 26410	ARDLEY FIELDS NO.10		KW	
SP52NE6	SP 56350 26250	MANOR FARM BUCKNELL	76.50	WLKW	
SP52NE11	SP 57670 26770	LODGE FARM BAINTON	40.84	WLKW	
SP52NE23	SP 55000 25381	OXFORD-BANBURY SECTION 529	1.00	KW	
SP52NE24	SP 55004 27117	OXFORD-BANBURY SECTION 547	1.00	KW	
SP52NW1	SP 54460 26310	ARDLEY FIELDS NO.1		KW	
SP52NW2	SP 54090 26680	ARDLEY FIELDS NO.2		KW	
SP52NW3	SP 54690 25910	ARDLEY FIELDS NO.3		KW	
SP52NW4	SP 53890 25980	ARDLEY FIELDS NO.4		KW	
SP52NW5	SP 54170 25630	ARDLEY FIELDS NO.5		KW	
SP52NW6	SP 54430 25440	ARDLEY FIELDS NO.6		KW	
SP52NW7	SP 53750 25380	ARDLEY FIELDS NO.7		KW	
SP52NW8	SP 54140 25190	ARDLEY FIELDS NO.8		KW	
SP52NW12	SP 54930 27200	M40 ARDLEY 274P	4.00	KW	
SP52NW26	SP 54940 25220	BUCKNELL EMBKMENT E11 24000-24570 TP527	2.30	KW	313
SP52NW27	SP 54900 25350	BUCKNELL EMBKMENT E11 24000-24570 TP525	2.90	KW	313
SP52NW28	SP 54890 25400	BUCKNELL EMBKMENT E11 24000-24570 TP528	3.40	KW	313
SP52NW30	SP 54996 25329	BUCKNELL EMBKMENT E11 24000-24570 TP526	1.00	KW	313
SP52NW31	SP 54930 25390	BUCKNELL EMBKMENT E11 24000-24570 BHY2	20.00	KW	313
SP52NW32	SP 54940 25080	BUCKNELL EMBKMENT E11 24000-24570 TP524	1.00	KW	313
SP52NW33	SP 54960 25840	BUCKNELL EMBKMENT E11 24000-24570 TP531	4.00	KW	313
SP52NW34	SP 54960 25920	BUCKNELL EMBKMENT E11 24000-24570 BHY3	19.00	KW	313
SP52NW35	SP 54980 25940	BUCKNELL EMBKMENT E11 24000-24570 TP534	1.00	KW	313
SP52NW36	SP 54970 26160	BUCKNELL EMBKMENT E11 24000-24570 BH069	20.00	KW	313
SP52NW37	SP 54970 26210	BUCKNELL EMBKMENT E11 24000-24570 TP537	1.00	KW	313
SP52NW38	SP 54950 26250	BUCKNELL EMBKMENT E11 24000-24570 TP536	1.00	KW	313
SP52NW39	SP 54990 26340	BUCKNELL EMBKMENT E11 24000-24570 TP540	1.00	KW	313
SP52NW40	SP 54970 26350	BUCKNELL EMBKMENT E11 24000-24570 TP538	1.00	KW	313
SP52NW41	SP 54970 26640	BUCKNELL EMBKMENT E11 24000-24570 TP541	1.00	KW	313
SP52NW42	SP 54960 26770	ARDLEY CUTTING C10 25780-27040 TP542	1.00	KW	313
SP52NW43	SP 54960 26830	ARDLEY CUTTING C10 25780-27040 TP543	1.00	KW	313
SP52NW44	SP 54970 27070	ARDLEY CUTTING C10 25780-27040 TP545	2.00	KW	313
SP52NW45	SP 54880 27140	ARDLEY CUTTING C10 25780-27040 TP544	1.00	KW	313
SP52NW46	SP 54920 27180	ARDLEY CUTTING C10 25780-27040 TP546	1.00	KW	313
SP52NW48	SP 54960 27120	ARDLEY CUTTING C10 25780-27040 BH070	25.00	KW	313
SP52NW49	SP 54910 27140	ARDLEY CUTTING C10 25780-27040 BH070A	15.00	KW	313
SP52NW111	SP 54903 27210	M40 OXFORD-BIRMINGHAM M/W BH075	12.00	KW	3322
SP52NW205	SP 54040 26390	ARDLEY FIELDS	10.20	WLKW	
SP52SE5	SP 57090 23840	GOWELL FARM BICESTER	43.28	WLKW	
SP52SE9	SP 57450 24230	BICESTER	79.85	WLKW	
SP52SE29	SP 57150 23880	GOWELL FARM 2	43.00	WLKW	
SP52SE55	SP 58080 24550	CAVERSFIELD SEWER BICESTER BH370/5	6.00	KW	
SP52SE176	SP 56950 24500	LORDS FARM		WL	
SP52SE177	SP 56990 24550	LORDS FARM		WL	
SP52SE178	SP 56900 23060	KINGS END FARM BICESTER		WL	
SP52SE182	SP 57800 23830	SLADE FARM CAVERSFIELD	28.96	WL	
SP52SE183	SP 57790 23830	WRETCHWICK FARM BICESTER		WL	
SP52SE203	SP 56500 23490	GOWELL FARM BICESTER 1	2.25	KW	37679
SP52SE204	SP 56850 23590	GOWELL FARM BICESTER 2	1.75	KW	37679
SP52SE205	SP 56740 23870	GOWELL FARM BICESTER 3	1.37	KW	37679
SP52SE206	SP 56970 23850	GOWELL FARM BICESTER 4	1.75	KW	37679
SP52SE207	SP 56830 23590	GOWELL FARM BICESTER TP 2	1.65	KW	37679
SP52SE208	SP 57080 23890	GOWELL FARM BICESTER TP 4	1.61	KW	37679
SP52SE209	SP 56980 23860	GOWELL FARM BICESTER 2	4.22	KW	37680
SP52SE210	SP 56940 23820	GOWELL FARM BICESTER 3	4.06	KW	37680
SP52SE211	SP 56980 23810	GOWELL FARM BICESTER 4	3.49	KW	37680
SP52SE212	SP 56990 23790	GOWELL FARM BICESTER 5	4.10	KW	37680
SP52SE213	SP 57010 23820	GOWELL FARM BICESTER 6	3.66	KW	37680
SP52SE214	SP 56970 23900	GOWELL FARM BICESTER 7	3.56	KW	37680

Geological Assessment - Detailed

Regno	Grid reference	Name	Length	Office	SIR
SP52SE215	SP 56990 23720	GOWELL FARM BICESTER TP 1	0.88	KW	37680
SP52SE216	SP 57620 24200	LORDS LANE BICESTER OXFORDSHIRE 1	2.95	KW	37773
SP52SE217	SP 57610 24170	LORDS LANE BICESTER OXFORDSHIRE 2	2.80	KW	37773
SP52SW1	SP 54880 24600	M40 CARDINGTON 248P	6.00	KW	
SP52SW5	SP 54730 23310	M40 BUCKNELL LODGE 235P	8.00	KW	
SP52SW14	SP 54720 24900	TROWPOOL WELL BICESTER	7.62	WLKW	
SP52SW36	SP 54770 22900	MIDDLETON STONEY SOUTH CUTTING C8 TP495	1.00	KW	313
SP52SW37	SP 54730 23040	EAGLE BROOK EMBANKMENT E10 TP496	3.00	KW	313
SP52SW38	SP 54710 23050	EAGLE BROOK EMBANKMENT E10 BHY5	10.20	KW	313
SP52SW39	SP 54730 23080	EAGLE BROOK EMBANKMENT E10 TP498	2.00	KW	313
SP52SW40	SP 54730 23140	EAGLE BROOK EMBANKMENT E10 TP499	1.00	KW	313
SP52SW41	SP 54740 23190	EAGLE BROOK EMBANKMENT E10 TP500	2.00	KW	313
SP52SW42	SP 54670 23200	EAGLE BROOK EMBANKMENT E10 TP501	2.00	KW	313
SP52SW43	SP 54710 23240	MIDDLETON STONEY NORTH CUTTING C9 TP502	2.00	KW	313
SP52SW44	SP 54660 23330	MIDDLETON STONEY NORTH CUTTING C9 TP503	1.00	KW	313
SP52SW45	SP 54820 23270	MIDDLETON STONEY NORTH CUTTING C9 TP504	0.00	KW	313
SP52SW46	SP 54740 23330	MIDDLETON STONEY NORTH CUTTING C9 TP505	3.00	KW	313
SP52SW47	SP 54770 23320	MIDDLETON STONEY NORTH CUTTING C9 BH066	19.00	KW	313
SP52SW48	SP 54810 23340	MIDDLETON STONEY NORTH CUTTING C9 TP507	1.00	KW	313
SP52SW49	SP 54710 23330	MIDDLETON STONEY NORTH CUTTING C9 BH065	14.00	KW	313
SP52SW50	SP 54670 23390	MIDDLETON STONEY NORTH CUTTING C9 TP506	2.00	KW	313
SP52SW51	SP 54760 23560	MIDDLETON STONEY NORTH CUTTING C9 TP508	2.00	KW	313
SP52SW52	SP 54760 23610	MIDDLETON STONEY NORTH CUTTING C9 TP509	3.00	KW	313
SP52SW53	SP 54770 23740	MIDDLETON STONEY NORTH CUTTING C9 TP510	2.00	KW	313
SP52SW54	SP 54770 23760	MIDDLETON STONEY NORTH CUTTING C9 BHY1	2.00	KW	313
SP52SW55	SP 54760 23960	MIDDLETON STONEY NORTH CUTTING C9 TP511	3.00	KW	313
SP52SW56	SP 54820 24260	BUCKNELL EMBANKMENT E11 TP513	3.00	KW	313
SP52SW57	SP 54860 24400	BUCKNELL EMBANKMENT E11 TP514	3.00	KW	313
SP52SW58	SP 54870 24490	BUCKNELL EMBANKMENT E11 TP515	3.00	KW	313
SP52SW59	SP 54880 24530	BUCKNELL EMBANKMENT E11 TP516	3.00	KW	313
SP52SW60	SP 54890 24570	BUCKNELL EMBANKMENT E11 TP517	2.00	KW	313
SP52SW61	SP 54840 24630	BUCKNELL EMBANKMENT E11 TP518	3.00	KW	313
SP52SW62	SP 54940 24620	BUCKNELL EMBANKMENT E11 TP519	2.00	KW	313
SP52SW63	SP 54850 24610	BUCKNELL EMBANKMENT E11 BH067	10.00	KW	313
SP52SW64	SP 54910 24620	BUCKNELL EMBANKMENT E11 BH068	20.00	KW	313
SP52SW65	SP 54900 24670	BUCKNELL EMBANKMENT E11 TP520	1.00	KW	313
SP52SW66	SP 54910 24860	BUCKNELL EMBANKMENT E11 TP522	0.00	KW	313
SP52SW67	SP 54920 24930	BUCKNELL EMBANKMENT E11 TP523	0.00	KW	313
SP52SW68	SP 54928 24655	M40 OXFORD-BRMHAM OXFORD-BANBURY BH0685	10.00	KW	3322

Water Well location map



Scale: 1:40000 (1cm = 400m)

Geological Assessment - Detailed

Water Well Records

Total number of records: 12

All these records are registered in the main Borehole Records collections (see Borehole Records Table and map above), and duplicate, or partial duplicate copies may be held at other sites (at Keyworth KW, Exeter EX or Murchison House MH). These represent records that are held in the National Well Record Archive of water wells and boreholes held at Wallingford (WF) or Murchison House (MW). The Well Registration number is used to index records in the National Well Record Archive please quote this if applying for copies of water wells (see contact details later in the report).

Additional index information may be held for the Water Well Records as indicated below, indicating the information that can be found on the well record itself. If fields are blank, then the well record has not been examined and its contents are unknown. A Yes or a No indicates that the well record has been examined and the information as indicated is, or is not, present. This information should help you when requesting copies of Records.

KEY:

Aquifer = The principal aquifer recorded in the borehole
G = Geological Information present on the log
C = Borehole construction information present on the log
W = Water level or yield information present on the log
Ch = Water chemistry information present on the log

Well Reg No.	BH Reg No.	Name	Grid Easting	Grid Northing	Depth (m)	Date	Aquifer	G	C	W	Ch
SP52/74	SP52NW205/BJ	ARDLEY FIELDS (LAND FILL SITE)	454040	226390	10.20		GREAT OOLITE GROUP	Yes	Yes	Yes	No
SP52/9	SP52NE6/BJ	MANOR FARM	456350	226250	76.50	1924	UNKNOWN	Yes	Yes	Yes	No
SP52/10	SP52NE11/BJ	BUCKNELL LODGE FARM	457670	226770	41.00	1949	UNKNOWN	Yes	Yes	Yes	No
SP52/16	SP52SW14/BJ	BAINTON BUCKNELL P.S.	454720	224900	7.60		GREAT OOLITE GROUP	Yes	Yes	Yes	Yes
SP52/19A	SP52SE5/BJ	BICESTER P.S.	457090	223840	34.20	1905	GREAT OOLITE GROUP	Yes	Yes	Yes	Yes
SP52/17A	SP52SE176/BJ	LORDS FARM, BICESTER	456950	224500	3.70		GREAT OOLITE GROUP	No	Yes	No	No
SP52/67	SP52SE183/BJ	WRETCHWICK FARM	457790	223830			UNKNOWN	No	Yes	No	No
SP52/17B	SP52SE177/BJ	BICESTER LORDS FARM, BICESTER	456990	224550	3.70		GREAT OOLITE GROUP	No	Yes	No	No
SP52/45	SP52SE178/BJ	KINGS END FARM	456900	223060			UNKNOWN	No	Yes	No	No
SP52/66	SP52SE182/BJ	BICESTER SLADE FARM	457800	223830	29.00	1909	GREAT OOLITE GROUP	Yes	Yes	Yes	No
SP52/18	SP52SE9/BJ	CAVERSFIELD									
SP52/18	SP52SE9/BJ	LORDS FARM BICESTER	457460	224240	79.90		UNKNOWN	Yes	Yes	Yes	No
SP52/19B	SP52SE29/BJ	BICESTER P.S.	457150	223880	42.80	1936	UNKNOWN	Yes	Yes	Yes	Yes

Geological Assessment - Detailed

Boreholes with water level readings

Total number of records: 1

Reference	Easting	Northing	Location	Start_date	End_date	Readings
SP52/19	457130	223870	EX BICESTER P.S.			

There are no records for Locations with aquifer properties in the selected area

Site investigation reports

Total number of records: 26

Number	Office	Title
313	KW	OXFORD TO BIRMINGHAM NEW ROUTE WENDLEBURY TO SOULDERN SECTION
1440	KW	BICESTER RAF PROJECT NRS 84-0177 AND 87-0234 REPLACEMENT OF WATER MAINS
2438	KW	UPPER HEYFORD RAF CONSOLIDATED SUPPORT CENTRE
3310	KW	M40 OXFORD TO BIRMINGHAM MOTORWAY BANBURY BY PASS
3322	KW	M40 OXFORD TO BIRMINGHAM MOTORWAY OXFORD TO BANBURY SECTION
6285	KW	OXFORD TO BIRMINGHAM M40 MOTORWAY
6292	KW	BICESTER SOUTHERN BYPASS INTERPRETATIVE REPORT EMBANKMENT DESIGN
		SUPPLEMENT LONDON-BIRMINGHAM-BIRKEHEAD TRUNK ROAD A41
6293	KW	BICESTER SOUTHERN BYPASS INTERPRETATIVE REPORT EMBANKMENT DESIGN
		SUPPLEMENT LONDON-BIRMINGHAM-BIRKEHEAD TRUNK ROAD A41
6812	KW	A43: M40 TO B4031 IMPROVEMENT
7811	KW	RAF UPPER HEYFORD BASE THEATR
17835	KW	A43:M40 TP B4031 IMPROVEMENT
17836	KW	A43:M40 TO B4031 IMPROVEMENT
17838	KW	A43:M40 TO B4031 IMPROVEMENT SUPPLEMENTARY GROUND INVESTIGATION
19905	KW	BICESTER SOUTHERN BY-PASS
27597	KW	LANGFORD VILLAGE BICESTER
35484	KW	FEWCOTT ROAD FRITWELL
37469	KW	LAUNTON ROAD BICESTER OXFORD
37552	KW	TELFORD ROAD BICESTER
37595	KW	RAF UPPER HEYFORD OXFORDSHIRE
37679	KW	GOWELL FARM BICESTER OXFORDSHIRE
37680	KW	GOWELL FARM BICESTER OXFORDSHIRE
37773	KW	LORDS LANE BICESTER OXFORDSHIRE
37835	KW	MAIN STREET STOKE LYNE
37884	KW	EURO 5 DISTRIBUTION CENTRE ARDLEY OXFORDSHIRE
37988	KW	ROYAL ORDNANCE BICESTER OXFORDSHIRE
43801	KW	RAF BASE UPPER HEYFORD

National Grid geological maps (1:10,000 and 1:10,560 scale)

Total number of records: 4

Map	Type	Survey	Published	Revision
SP52NE	C	2000	2000	
SP52NW	C	2000	2000	2000
SP52SE	C	1999	2000	
SP52SW	C	1999	2000	

There are no records for County Series geological maps (1:10,560 scale) in the selected area

New Series medium scale geological maps (1:50,000 and 1:63360 scale)

Total number of records: 1

Sheet	Title	Type	Survey	Published	Revision
219	Buckingham	C	2000	2002	

Geological Assessment - Detailed

Old Series one inch geological maps (1:63360 scale)

Total number of records: 3

Sheet	Title	Type	Survey	Published	Revision
45NE	Buckingham	D		1873	
45NE	Buckingham	S		1871	
45SE	Bicester	S		1863	

There are no records for Hydrogeological maps (various scales) in the selected area

Geological Memoirs

Total number of records: 1

Title	Date
Buckingham	2002

There are no records for Technical reports in the selected area

There are no records for Waste sites in the selected area

Mining plans

Total number of records: 3

Record Type	Plan No.	Title
KP	12374	OXFORDSHIRE/BANBURY PROSPECT 1984-1985 VIBROSEIS PLANING MAP
KP	12375	OXFORDSHIRE/BANBURY PROSPECT NCB & OIL COMPANY DATA TRADED & UNTRADED 1984
KP	18191	WESTPHALIAN A & B OF THE COALFIELDS OF ENGLAND & WALES (INCLUDING CANONBIE)

Geological Assessment - Detailed

Section 7: Descriptions of BGS databases

Note that this report is not a definitive listing of all data held in BGS.

Borehole Records and Water Wells

Records of boreholes, shafts and wells from all forms of drilling and site investigation work. Some 900,000 records dating back over 200 years and ranging from one to several thousand metres deep. Currently some 50,000 new records are being added to the collection each year.

A small percentage of the borehole records are held commercial-in-confidence for various reasons and cannot be released without the written permission of the originator. If any of the records you need are listed as confidential apply in the normal way. BGS Enquiry Service staff will release the data where this is possible or provide you with the information needed to contact the originator.

Where records are held in more than one office, the contents may differ. Enquiries principally requiring water related information should contact the Wallingford or Edinburgh office.

Water levels

These represent a subset of records within the National Well Record Archive of water wells and boreholes where there are either digital or analogue time series of water levels, or where available water level data span multiple years. Time series data are held for approximately 1500 boreholes distributed nationally. Other water level data is available where records have been inspected and digitised. Records are identified by the Well Registration number used for water wells (see above). Please contact our Wallingford office to discuss your specific requirements and to obtain costs.

Aquifer properties

These are locations where data on aquifer physical properties (transmissivity, specific yield, storage, porosity or hydraulic conductivity) are held. The data include raw data from field and laboratory investigations, and site-specific summaries of the data. Coverage is limited to aquifers in England and Wales. Records are identified by an aquifer property identifier, which should be quoted when ordering data. This data should be ordered separately, but will normally be provided and charged for as part of the relevant borehole records.

Site investigation reports

Additional laboratory and test data may be available in these reports, subject to any copyright and confidentiality conditions. The grid references used are based on an un-refined rectangle and therefore may not be applicable to a specific site. Borehole records in these reports will be individually referenced within the borehole records collection, described above.

Geological maps

- **National Grid maps (1:10,000 and 1:10560 scale)** - Since the 1960s the standard large-scale map for recording geological information has been the Ordnance Survey (OS) quarter sheet covering a 5km square area. The maps are supplied in different formats depending on their age and the method of reproduction used. Only the latest most up-to-date version is listed.
- **County Series map sheets (1:10,560 scale)** - Maps produced on OS County Series sheets between approximately 1860 and 1960. The list indicates distinct examples of maps from separate surveys or revisions. It is advisable to discuss your requirements before ordering or travelling to view these maps.
- **New Series medium scale maps (1:50,000 and 1:63360 scale)** - Maps at either scale covering the OS New Series one-inch map sheet areas used by BGS. Please note that the sheet numbering is not the same as used for current OS 1:50,000 topographic maps.
- **Old Series medium scale one-inch maps (1:63,360 scale)** - Early geological mapping covering the OS Old Series one-inch map sheet areas. Applies to England and Wales only.

While there may be information relevant to your enquiry on older maps, you will generally want the latest

Geological Assessment - Detailed

edition, and National Grid maps will be preferred to County Series maps, and New Series to Old Series.

Memoirs

Explanatory sheet memoirs describing the geology of the areas covered by either the medium scale (1:50,000 and 1:63,360) map series.

Technical reports

The open file reports listed are mainly from the Onshore Geology Series. These include descriptions of the geology for the National Grid series geological sheets. Please note that the location details in the database are not yet complete so it is possible that not all the relevant reports available will be listed.

Waste sites

Listing of some 3500 waste sites for England and Wales identified by BGS as part of a survey carried out on behalf of the Department of the Environment in 1973. Later information is available from the Environment Agency.

Mine Plans

Plans of various types, principally relating to mining activity and including abandonment plans. For mine plans, the coverage is not comprehensive, but that for Scotland is the most complete. The search includes the collection of Plans of Abandoned Mines (Other than Coal & Oil Shale) for Scotland and the non-coal plans in the BGS Land Survey Plans collection, (mainly Scotland). Microfilm copies of the Plans of Abandoned Mines (Coal & Oil Shale) for Scotland and the Coal Authority's catalogues are available for consultation by prior appointment.

The mine plans listed for the rest of England and Wales (excluding SW England, which is not covered) include working copies, compilations and interpretations, which may be copyright or confidential and therefore not be available for purchase. The general nature of some of the plans means that they may not be applicable to a specific site. However, the presence of mining data could indicate that further specialist advice or interpretation is required. Large-scale plans produced for site investigations or other purposes are also included for completeness.

Section 8: How to access or inspect data

Borehole Records – contact BGS Enquiry Service (see end of section)

Copies of borehole records can be supplied (order form enclosed) at the flat rate of £13 (+VAT) per log with a minimum charge £26 (+VAT). Normal first class postage within the UK is included. Next day recorded delivery or express parcel dispatch is available on request and charged at cost. Copies of documents can be forwarded by facsimile transmission at an additional charge of £0.50 (+VAT) per A4 sheet. Records with additional detailed geological information derived from BGS examination of borehole material may be charged at the current 'value-added' rate. If you have a need for data with particular geological characteristics, then please contact the enquiries office to discuss your requirements (additional charges may apply).

Alternatively you can make an appointment to visit the relevant enquiry office and examine the records yourself. The Commercial User Ticket (see below) covers inspection of the borehole logs and includes access to a set of relevant documents for one unit area (typically a 5 km x 5 km area). A further charge of £19 (+ VAT) is due for each additional set examined. Data can be freely extracted from the records but any copies requested will be charged as above.

Water wells – contact BGS Enquiry Service

Copies of records can be supplied (order form enclosed) at the flat rate of £13 (+VAT) per log with a minimum charge £26 (+VAT). Normal first class postage within the UK is included. Next day recorded delivery or express parcel dispatch is available on request and charged at cost. Copies of documents can be forwarded by facsimile transmission at an additional charge of £0.50 (+VAT) per A4 sheet. If you have a need for data with particular hydrogeological characteristics, then please contact the relevant enquiries office (England and Wales =Wallingford, Scotland=Edinburgh) to discuss your

Geological Assessment - Detailed

requirements (additional charges may apply).

Alternatively you can make an appointment to visit the relevant enquiry office and examine the records yourself.

Records for England and Wales are held at Wallingford where the visitor charge is £9.50/hour (+VAT, with a minimum charge of £19 (+VAT).

Records for Scotland are held with the borehole records at our Edinburgh office the above Borehole Record charges cover them and apply.

BGS Memoirs, maps and open file reports – contact BGS Sales (details below)

BGS Memoirs, maps and open file reports relevant to your area can be examined in the appropriate BGS Library. Copies can be ordered from our main Sales Desk: Sales Desk, British Geological Survey, Keyworth, Nottingham NG12 5GG Tel: 0115 936 3241, Fax: 0115 936 3488, E-mail: sales@bgs.ac.uk.

Sales Desks are also located in Edinburgh; Tel: 0131 650 0358, Fax: 0131 667 2785, E-mail: scotsales@bgs.ac.uk, and London; Tel: 020 7589 4090, Fax: 020 7584 8270, E-mail: bgs london@bgs.ac.uk. BGS London also maintains a reference collection of all BGS publications.

Please check price and P&P before ordering.

Waste Sites – contact BGS Enquiry Service

Copies of register entries, containing a variety of levels of data recording, can be obtained from the BGS Enquiry Service (price on application). The registers can also be inspected by visit (see above)

Mine Plans – contact BGS Enquiry Service

Mine Plans are available for consultation by prior appointment. Copies can also be obtained - price on application.

Commercial User Ticket – contact BGS Enquiry Service

A combined day ticket for commercial visitors to the National Geological Data Centre and the Library is £55 (+VAT) and there is a £33 (+VAT) day ticket for visitors who only wish to use the Library. Frequent visitors can purchase an annual subscription at £275 (+VAT) for access to the NGDC and the Library or £155 (+VAT) for use of the Library only. Further details can be provided on request.

Geological Assessment - Detailed

BGS ENQUIRY SERVICE Contact Details:

Keyworth (KW) Office

For Borehole and other records (excluding water well records & hydrogeological data) in England & Wales (excluding Northern England, and Devon & Cornwall):

Records & Data Enquiries
Kingsley Dunham Centre
Keyworth
Nottingham
NG12 5GG
Tel: 0115 9363143
Fax: 01159 363276

Exeter (EX) Office

For Borehole and other records (excluding water well records & hydrogeological data) in Devon & Cornwall:

Records & Data Enquiries
BGS Exeter Business Centre
Forde House
Park Five Business Centre
Harrier Way
Sowton
Exeter
Devon
EX2 7HU
Tel: 01392 445271
Fax: 01392 445371

Wallingford (WL) Office

For water well records and hydrogeological data (water levels, water chemistry and aquifer properties) in England & Wales:

Records & Data Enquiries
British Geological Survey,
Maclean Building,
Wallingford,
Oxford
OX10 8BB.
United Kingdom
Tel: 01491 838800
Fax: 01491 692345
Email: hydroenq@bgs.ac.uk

Murchison House (MH or MW) Office:

For water well records and hydrogeological data for Scotland, and all other records in Scotland & Northern England:

Records & Data Enquiries
Murchison House
West Mains Road
Edinburgh
EH9 3LA
Tel: 0131 650 0282
Fax: 0131 650 0252
Email: boreholesnorth@bgs.ac.uk

Section 9: More detailed geological reports available from BGS

This report forms part of the GeoReports range offered by the BGS Enquiry Service, including reports describing site geology, hydrogeology and geological hazards. For details on these please contact:

BGS Central Enquiries Desk
British Geological Survey
Kingsley Dunham Centre
Keyworth
Nottingham
NG12 5GG
Tel: 0115 936 3143
Fax: 0115 936 3276
Email: enquiries@bgs.ac.uk

Or visit the GeoReports online shop at www.bgs.ac.uk/georeports

Section 10: Supporting Information

- The geological map extracts in Section 5 of this report are extracted from the BGS 1:50,000 scale Digital Geological Map of Great Britain (DiGMapGB-50). More information on DiGMapGB-50 can be found on the BGS website at http://www.bgs.ac.uk/products/digitalmaps/digmapgb_50.html
- Further descriptions of the rocks listed in the map keys in Section 4 can be obtained by searching against the Computer Code (in the map Key) on the *BGS Lexicon of named Rock Units*, which can be found on the BGS Website at www.bgs.ac.uk by following the 'GeoData' link
- Descriptions of how the various rock layers identified on the maps are classified can be found in the [BGS Rock Classification Scheme](#).

Section 11: 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.

Copyright:

Copyright in materials derived from the British Geological Survey's work, is owned by the Natural Environment Research Council (NERC) and/ or the authority that commissioned the work. You may not copy or adapt this publication, or provide it to a third party, without first obtaining NERC's permission, but if you are a consultant providing advice to your own client you may incorporate it unaltered into your report without further permission, provided you give a full acknowledgement of the source. Please contact the BGS Intellectual Property Rights Manager, British Geological Survey, Kingsley Dunham Centre, Keyworth, Nottingham NG12 5GG. Telephone: 0115 936 3100.

© NERC 2008 All rights reserved.

This product includes mapping data licensed from the Ordnance Survey® with the permission of the Controller of Her Majesty's Stationery Office. © Crown Copyright 2008. All rights reserved. Licence number 100037272



Report issued by:

BGS Enquiry Service

Appendix G

TurfTrax Report



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

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.**

Table of Contents

1	Executive summary	1
2	Introduction	3
3	Site location and description	5
4	Site geology and hydrogeology	6
5	Boreholes	11
6	Water wells	12
7	Indicative flood plains	13
8	Groundwater source protection zones (SPZs)	14
9	Risk assessment	15
10	Discussion and conclusions	17
11	Recommendations	18
12	Contact details	19
13	Appendices	20
	BGS Report No. GR 118 892_1 (2008)	21
	Publications on drainage and soil management	49
	TurfTrax terms and conditions	53

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 its 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 its 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:

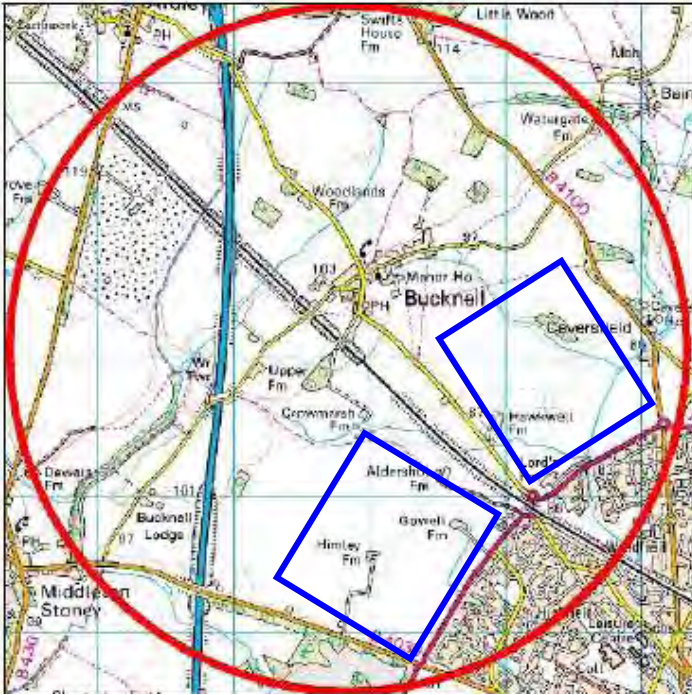


Figure 1. Site location plan.



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
45385 22653

grid ref of south-east side of site
45775 22335

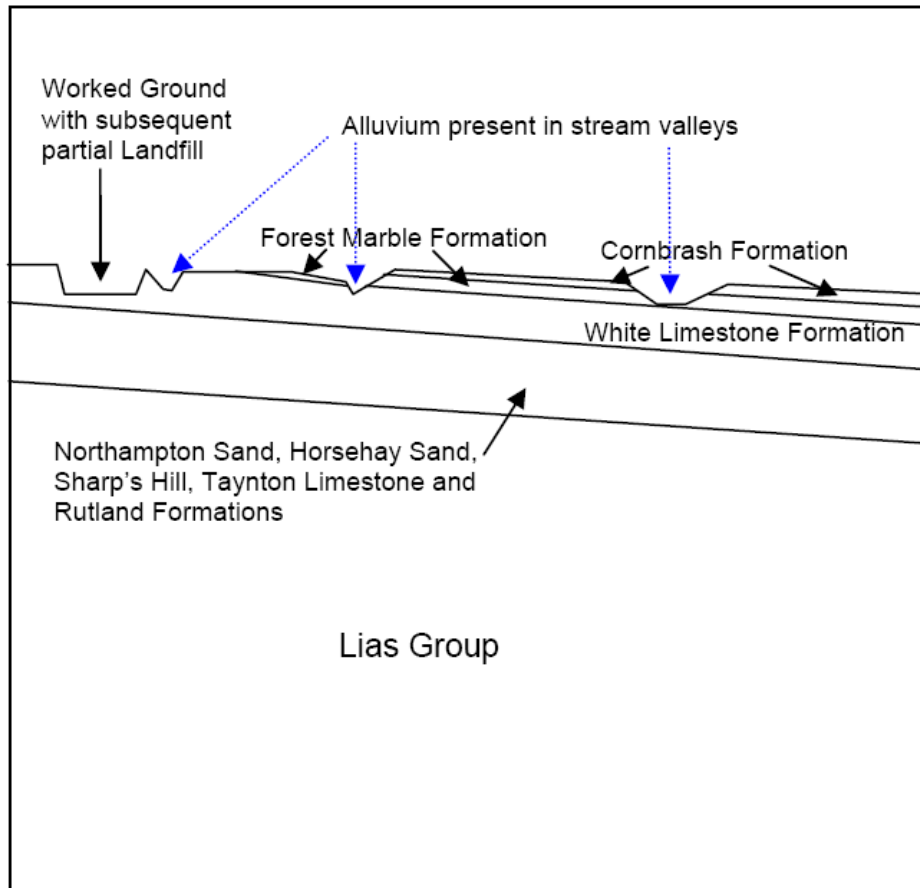




Figure 3. Schematic diagram of NW site geology.

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:

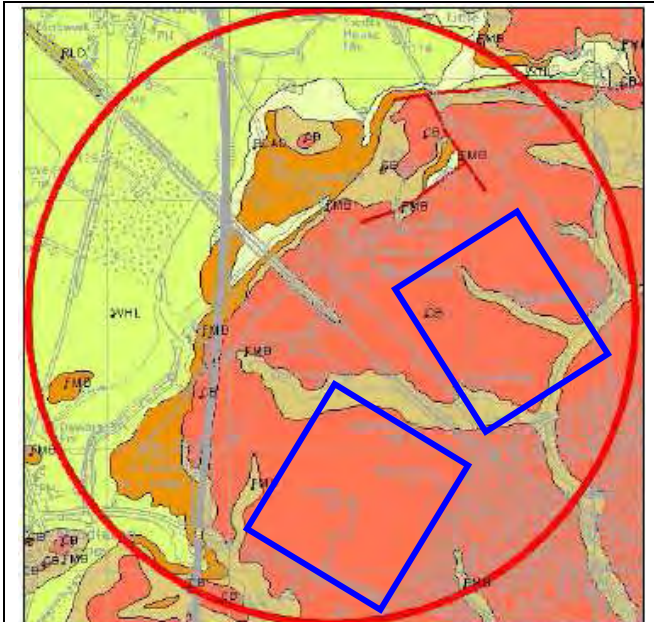








Figure 4. Bedrock geology in the NW area.

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:

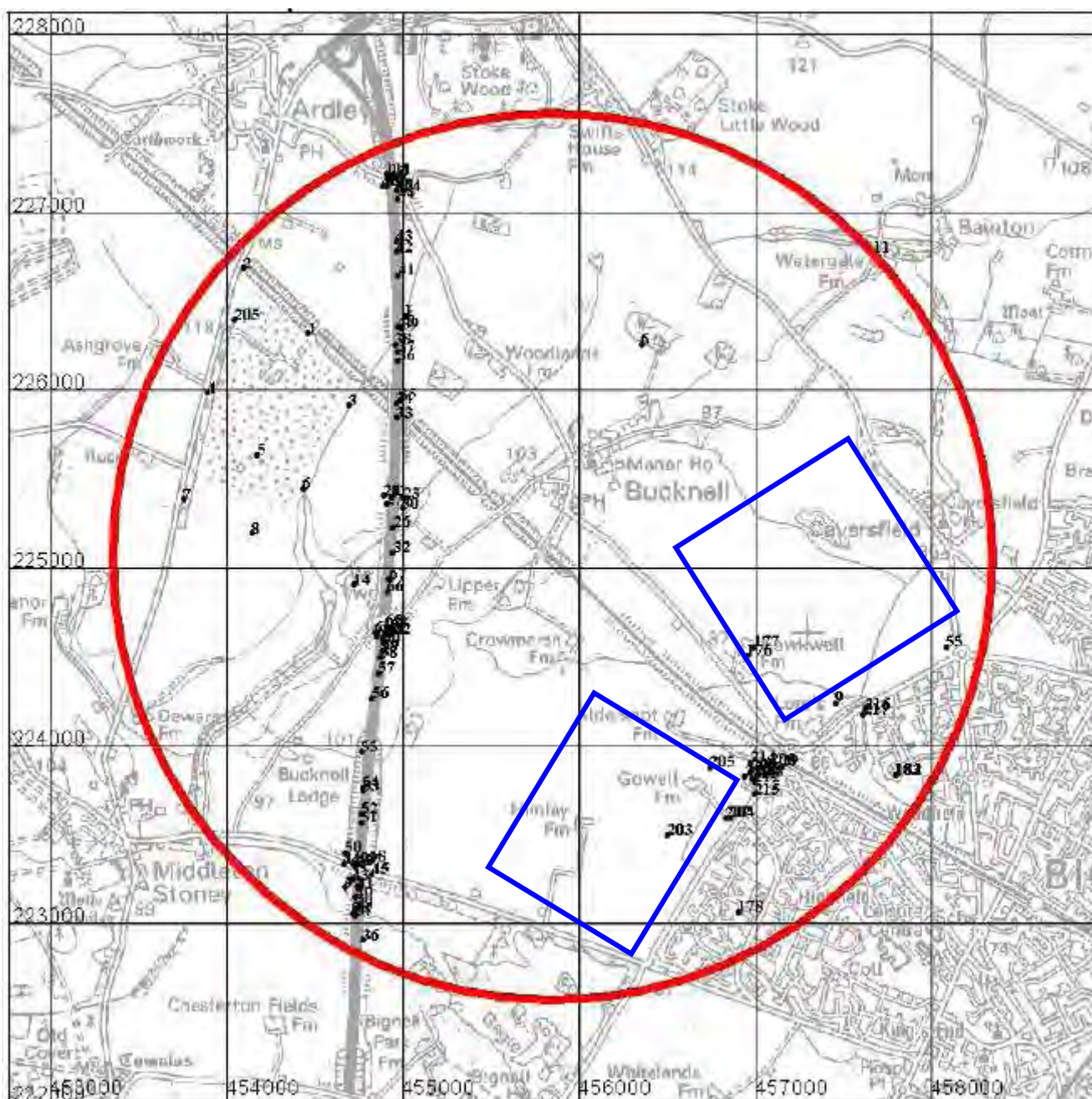


Figure 5. Site location, boreholes and watercourses.

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:

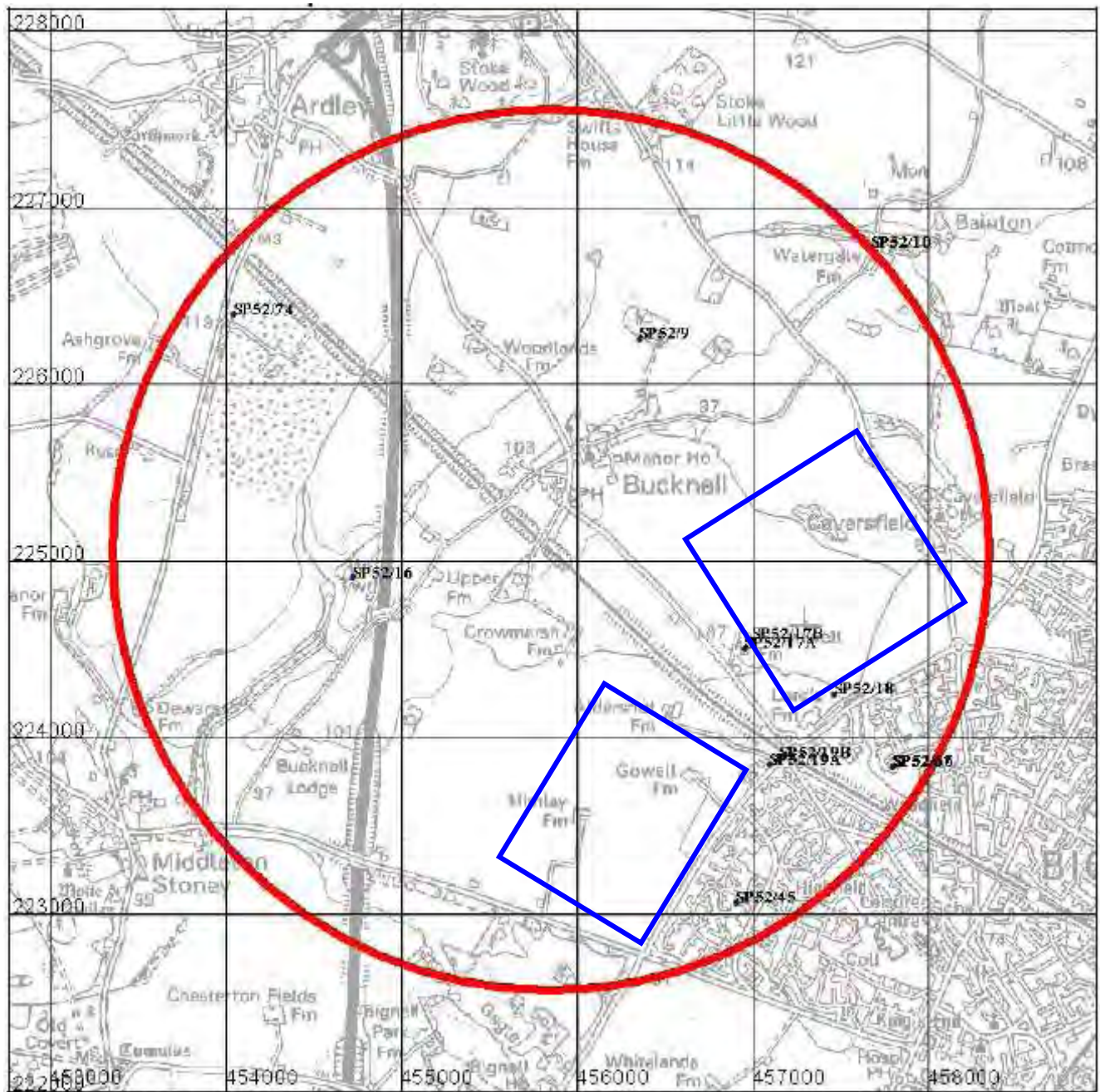


Figure 6. Site location, water wells.

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):

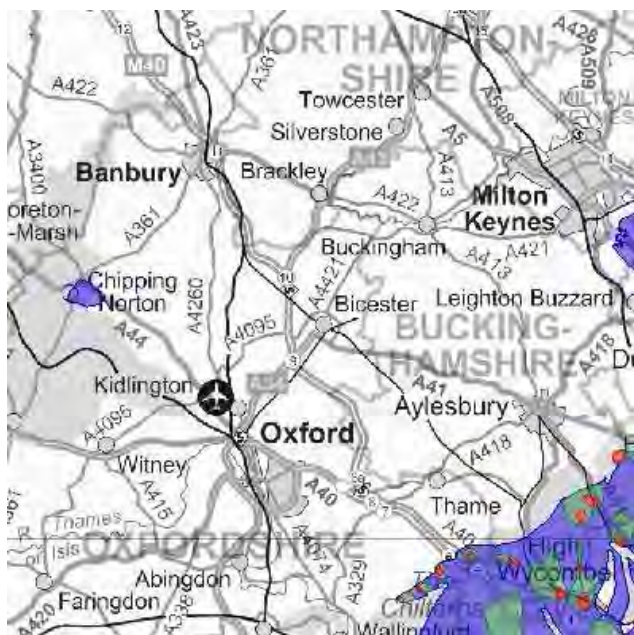


Figure 7a. Ground Water Source Protection Zones
Key: Purple = Total catchment, Green = Outer Zone, Red = Inner Zone. Taken from Environment Agency website SPZ map.



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: ☒ 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.

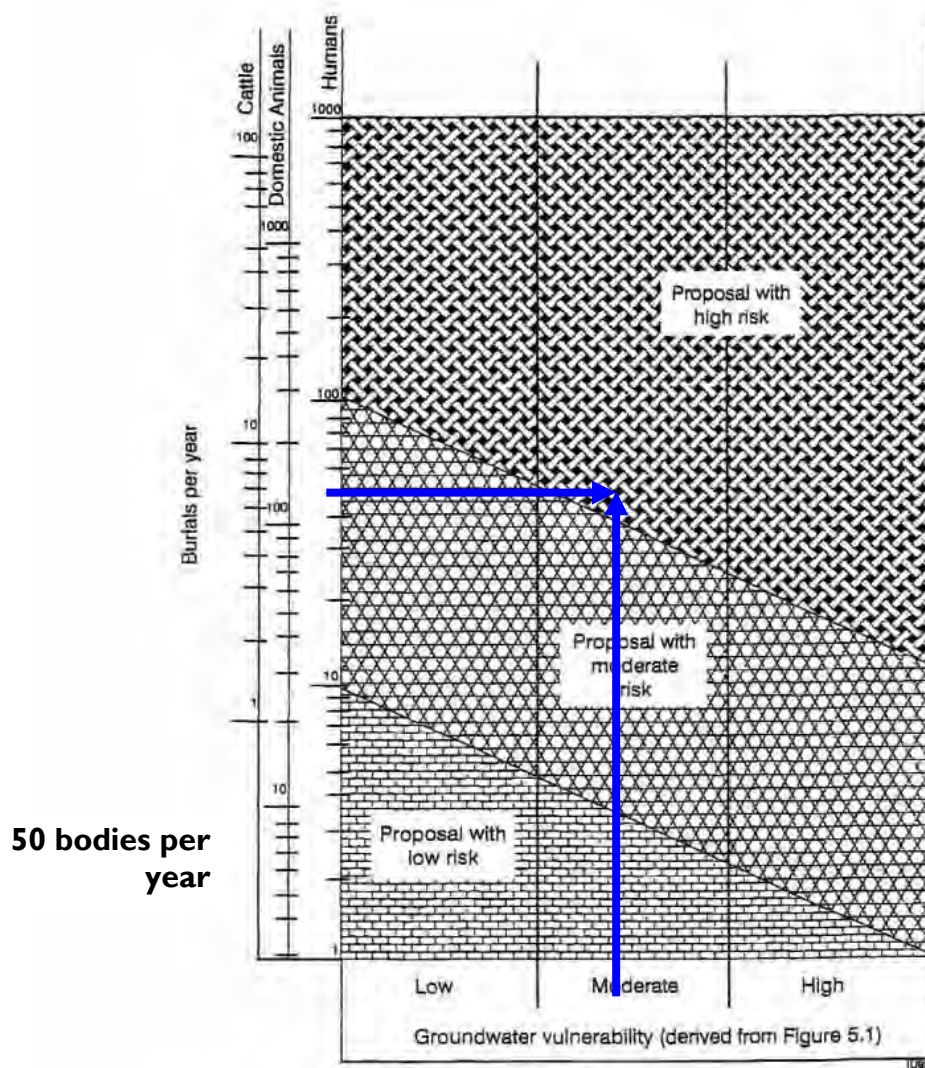


Figure 5.2 Schematic relationship between burial rates, vulnerability class and level of risk

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

This presentation is confidential and is only for the use of officers of Bicester Town Council and Cherwell District Council (and their representatives). Without the specific consent in writing of TurfTrax Ground Management Systems Limited, no copies of this presentation are to be made and information contained herein should not be communicated to any third party. At the request of TurfTrax Ground Management Systems Limited all copies of this document, in whatever form, are to be returned.

12 Contact details

Commercial Office
Chequers Court
31 Brown Street
Salisbury
Wiltshire
SP1 2AS

Tel: 01722 434000
Fax: 01722 434040

Technical Office
Unit 1, Highfield Parc
Highfield Road
Oakley
Bedfordshire
MK43 7TA

Tel: 01234 821750
Fax: 01234 821751
Email: richard.earl@turftrax.com

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.

Alexandrou, A. & **Earl, R.** (1998). The relationship between the pre-compaction stress, volumetric water content and initial dry bulk density of soil. *Journal of Agricultural Engineering Research* 71, 75-80.

Alexandrou, A. & **Earl, R.** (1997). Development of a technique for assessment the behaviour of soil under load. *Journal of Agricultural Engineering Research* 68, 169- 180.

Alexandrou, A. & **Earl, R.** (1995). In situ determination of the pre-compaction stress of a soil. *Journal of Agricultural Engineering Research* 61, 67-72.

Bulson, H.A.J., **Welsh, J.P.**, Stopes, C.E. & Woodward, L. (1996). Agronomic viability and potential economic performance of three organic four year rotations without livestock, 1988-1995. *Aspects of Applied Biology* 47: Rotations and cropping systems, 277-286.

Churcher, D.W., Greenwood, J.R., **Vickers, A.W.** Morgan, R.P.C., Coppin, N.J. & Norris, J.E. (1999). A bioengineering demonstration trial, Kent, England. In: *Proceedings 2nd International Conference on Landslides, Slope Stability and the Safety of Infrastructures*. ISBN 981-04-1537-0.

S.K. Cook, W.F. Cormack, M. Green, J.M. Holland, A.R. Leake and **J.P. Welsh.** (2000). Farming systems for the new Millennium. *Aspects of Applied Biology* 62. AAB, Wellesbourne, UK.

Davies, D.H.K. & **Welsh, J.P.** (2002). Weed control in organic cereals and pulses. In: *Organic cereals and pulses* (eds) D Younie, BR Taylor, JP Welsh and JM Wilkinson. Chalcombe Publications, Lincoln, UK. 77-114.

Earl, R. (1998). Tillage - soil, plant and implement considerations. *Landwards* 53, 17-23.

Earl, R. (1998). Principles of traction and compaction. *Landwards* 53, 14-16.

Earl, R. (1997). Prediction of trafficability and workability from soil moisture deficit. *Soil and Tillage Research* 40, 155-168.

Earl, R. (1997). Assessment of the behaviour of field soils during compression. *Journal of Agricultural Engineering Research* 68, 147- 158.

Earl, R. (1996). Prediction of trafficability and workability using tensiometers. *Journal of Agricultural Engineering Research* 63, 27-34.

Earl, R., Taylor, J.C., Wood, G.A., Bradley, I.T., Waite, T., **Welsh, J.P.**, Godwin, R.J. & Knight, S.M. (2003). Soil factors and their influence on within-field crop variability, Part I: Field observation of soil variation. *Biosystems Engineering* 84(4), 425-440.

Earl, R. & Alexandrou, A. (2001). Deformation processes below a plate sinkage test on sandy loam: theoretical approach. *Journal of Terramechanics* 38, 153-162.

Earl, R. & Alexandrou, A. (2001). Deformation processes below a plate sinkage test on sandy loam: experimental approach. *Journal of Terramechanics* 38, 163-183.

Earl, R. & Carter, A.D. (1991). The sampling of water in an unsaturated soil. *The Agricultural Engineer* 46, 50-51.

Earl, R. and Wheeler, P.N. Lined moles cut drainage costs. *Arable Farming*, June 1993, p 27-32.

Earl, R., Wheeler, P.N., Blackmore, B.S. & Godwin, R.J. (1996). Precision farming - the management of variability. *Landwards* 51(4), 18-23.

Godwin, R.J., Richards, T.E., Wood, G.A., **Welsh, J.P.** & Knight, S.M. (2003). An economic analysis of the potential for precision farming in UK cereal production. *Biosystems Engineering* 84(4), 533-545.

Godwin, R.J., Wood, G.A., Taylor, J.C., Knight, S.M. & **Welsh, J.P.** (2003). Precision farming of cereal crops: A review of a six year experiment to develop management guidelines. *Biosystems Engineering* 84(4), 375-391.

Greenwood, J.R., **Vickers, A.W.**, Morgan, R.P.C., Coppin, N.J. & Norris, J.E. (2001). Bioengineering: The Longham Wood Cutting field trial. CIRIA Project report 81. ISBN 0 86017 881 1.

Gregory, A.S., Kendall, B.A., **Earl, R.** & **Vickers, A.W.** (2002). The effects of engineering practices and incorporation of amendments on soil structural development in a clay soil-forming material used as a landfill restoration cap. A report for shanks first fund.

Gregory, A.S. & **Vickers, A.W.** (2004). The effects of amendments on soil structural development in a clay soil-forming material used as a landfill restoration cap. *Soil Use and Management*.

Kendall, B.A., Gregory, A.S., **Earl, R.**, & **Vickers, A.W.** (2001). The effects of engineering practices and amendments on soil structural development in a clay landfill restoration cap. In: Eighth International Waste Management and Landfill Symposium. 1st - 5th October 2001. Sardinia, Italy. Proceedings. Volume 4. pp 371-380.

Morgan, R.P.C., McIntyre, K., **Vickers, A.W.**, Quinton, J.N. & Rickson, R.J. (1997). A rainfall simulation study of soil erosion on rangeland in Swaziland. *Soil Technology* 11, 291-299.

Pearce, B.D., Wolfe, M.S. & **Welsh, J.P.** (2002). Review of knowledge of the potential impacts of genetically modified organisms (GMO) on organic agriculture. In: Proceedings of the 14th IFOAM World Congress, Canada.

Philipps, L., **Welsh, J.P.**, Bulson, H.A.J. & Woodward, W. (1999). Agronomic viability and potential economic performance of three organic four year rotations without livestock, 1988-1998. Proceedings of the 12th IFOAM Conference - Organic Agriculture: Credible Solutions for the 21st Century, Argentina. 109-115.

J Powell, G Davies, S Fowler, M Hovi, N Lampkin, M Lennartsson, S Padel, B Pearce, L Philipps, J Robertson, E Stockdale, C Watson, R Weller, **J Welsh** and M Wolfe. (2002). Proceedings of the UK Organic Research 2002 Conference. Organic Centre Wales, Aberystwyth, UK.

Reeve, M.J. and **Earl, R.** (1990). The effect of soil strength on agricultural and civil engineering field operations. Soil Survey Report, MAFF Contract 3806.

Schmidt, H., Philipps, L., **Welsh, J.P.** & Fragstein, P.V. (1999). Legume breaks in stockless organic farming rotations: Nitrogen accumulation and influence on the following crops. *Biological Agriculture and Horticulture* 17, 159-170.

Spoor, G., **Earl, R.** and Wheeler, P.N. (1992). Development of lower cost drainage systems for heavy soils. HGCA Project Report No 64.

Spoor, G., **Hann, M J**, Godwin, R J, Leeds-Harrison, P B, Miller, S M. (1987). Machinery Developments for Reducing Draught and Improving the Grading Characteristics of Mole Ploughs. ASAE 5th National Drainage Symposium.

Taylor, J.C., Wood, G.A., **Earl, R.** & Godwin R.J. (2003). Soil factors and their influence on within-field crop variability, Part II: Spatial analysis and determination of management zones. *Biosystems Engineering* 84(4), 441-453.

Taylor, J.C., Wood, G.A., **Welsh, J.P.** & Knight S. (2000). Exploring management strategies for precision farming of cereals assisted by remote sensing. *Aspects of Applied Biology* 60: Remote Sensing in Agriculture, 53-60.

Thomasson, A.J., Carter, A.D., Jones, R.J.A., Leverton, R.E., **Earl, R.**, Bouma, J., Van Wijk, A.L.M., Feddes, R.A., Van Lanen, H.A.J., Kabat, P. And Hack-ten Broeke, M.J.D. (1989). Use of modern physical field methods and computer simulation for land evaluation purposes. Report to EC DG VI, Research Contract No 5711.

Toyne, K. & **Vickers, A.W.** (2003). Critical evaluation of the ASTM method of measuring percolation rates of rootzones materials. Paper presented at National Turfgrass Foundation National Conference, Southport. November 2003.

Vickers, A.W. & James, I.T. (2003). Management of cracking in clay soils used for cricket pitches. Paper presented at the Institute of Groundsmanship Annual Conference, Leicester, April 2003.

Vickers, A.W. (2002). Experimental Design for evaluation of products for sportsturf. Paper presented at National Turfgrass Foundation National Conference, Southport. November 2002.

Vickers, A.W. (2001). Optimisation of rolling on cricket pitches. Paper presented at the 2001 Institute of Groundsmanship Annual Conference, Haydock.

Vickers, A.W. (2001). Soil water management for sports surfaces. Paper presented at the 2001 Institute of Groundsmanship Annual Conference, Haydock.

Vickers, A.W. & Morgan, R.P.C. (1999). Soil water monitoring to assess the effectiveness of three bioengineering treatments on an unstable Gault Clay cutting in Southern England. In: *Proceedings 2nd International Conference on Landslides, Slope Stability and the Safety of Infrastructures*. ISBN 981-04-1537-0

Vickers, A.W. (1994). A simple field erodibility index based on some English soils. In: *Conserving Soil Resources, European Perspectives*. Edit. R.J. Rickson. CAB International. pp 70 - 78.

Welsh, J.P., Philipps, L. & Cormack, W.F. (2002). The long-term agronomic performance of organic stockless rotations. In: *Proceedings of the UK Organic Research 2002 Conference*. Organic Centre Wales, Aberystwyth, UK. 47-50.

Welsh, J.P., Wolfe, M.S. & Pearce, B.D. (2002). The performance of cereal varieties under organic systems in on-farm trials in England. In: *Proceedings of the 14th IFOAM World Congress, Canada*.

Welsh, J.P., Wolfe, M.S., Snape, J. & Pearce, B.D. (2002). Generating and evaluating a novel genetic resource in wheat in diverse environments. In: *Proceedings of the 14th IFOAM World Congress, Canada*. 311.

Welsh, J.P. & Wolfe, M.S. (2002). The performance of variety mixtures and the potential for population breeding in organic farming systems. *Proceedings of the ECO-PB Symposium: Organic seed production & plant Breeding – strategies, problems and perspectives*, Berlin.


Welsh, J.P., Wood, G.A., Godwin, R.J., Taylor, J.C., **Earl, R.**, Blackmore, S. & Knight, S.M. (2003). Developing strategies for spatially variable nitrogen application in cereals, Part I: Winter barley. *Biosystems Engineering* 84(4), 481-494.

- Welsh, J.P.**, Wood, G.A., Godwin, R.J., Taylor, J.C., **Earl, R.**, Blackmore, S. & Knight, S.M. (2003). Developing strategies for spatially variable nitrogen application in cereals, Part II: Wheat. *Biosystems Engineering* 84(4), 495-511.
- Welsh, J.P.**, Bulson, H.A.J., Stopes, C.E., Froud-Williams, R.J. & Murdoch, A.J. (1999). The critical weed-free period in organically-grown winter wheat. *Annals of Applied Biology* 134, 315-320.
- Welsh JP**, Bulson H A J, Philipps L and Wolfe M. (1999). Weed control strategies for organic cereal crops. *Proceedings of the 1999 Brighton Crop Protection Conference – Weeds*. 945-950.
- Welsh JP**, Bulson H A J, Stopes C E, Froud-Williams R J and Murdoch A J. (1997). Mechanical weed control in organic winter wheat. *Aspects of Applied Biology 50: Optimising Cereal Inputs - Its Scientific Basis*. 375-384.
- Welsh JP**, Bulson H A J, Stopes C E, Murdoch A J and Froud-Williams R J. (1997). The critical period of weed competition and its application in organic winter wheat. *Proceedings of the 1997 Brighton Crop Protection Conference - Weeds*. 105-110.
- Welsh JP**, Bulson H A J, Stopes C E, Froud-Williams R J and Murdoch A J. (1996). Weed control in organic winter wheat using a spring-tine weeder. *Proceedings of the Second International Weed Control Congress, Copenhagen*. 1127-1132
- Wood, G.A., **Welsh, J.P.**, Godwin, R.J., Taylor, J.C., **Earl, R.** & Knight, S.M. (2003). Real-time measures of canopy size as a basis for spatially varying nitrogen applications to winter wheat sown at different seed rates. *Biosystems Engineering* 84(4), 513-531.
- D. Younie, B.R. Taylor, **J.P. Welsh** & J.M. Wilkinson. (2002). *Organic Cereals and Pulses*. Chalcombe Publications, Lincoln, UK.
- Zimbone, S.M., **Vickers, A.W.**, Morgan, R.P.C. & Vella, P. (1996). Field investigations of different techniques for measuring soil surface shear strength. *Soil Technology*. 9. pp 101 – 111.

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:

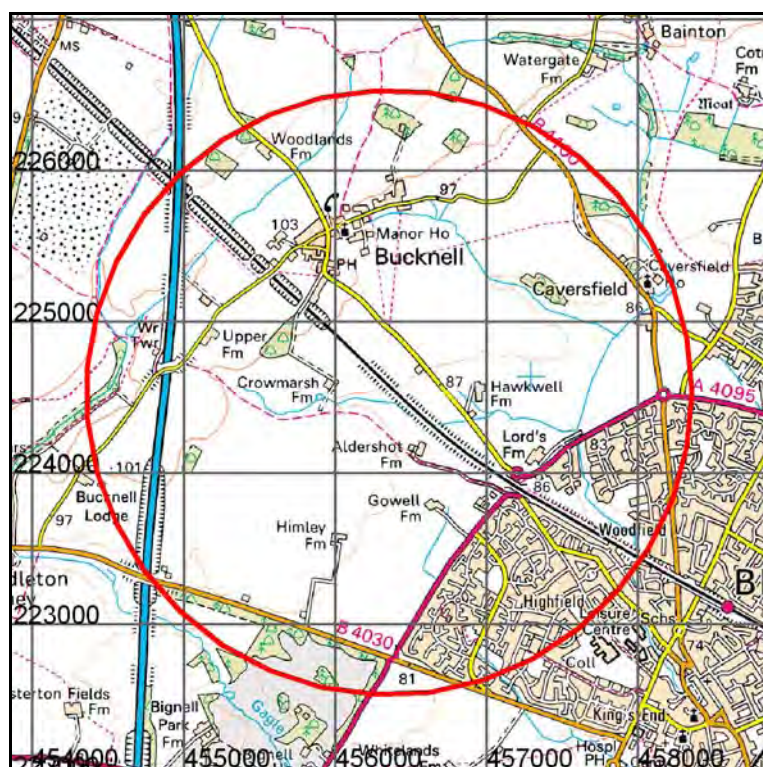
Advisory report on the requirement for radon protective measures in new buildings and extensions.

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.



This product includes mapping data licensed from Ordnance Survey.
© Crown Copyright and/or database right 2010. Licence number 100037272

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

Keyworth (KW) Office

British Geological Survey
Kingsley Dunham Centre
Keyworth
Nottingham
NG12 5GG
Tel: 0115 9363143
Fax: 0115 9363276
Email: enquiries@bgs.ac.uk

Wallingford (WL) Office

British Geological Survey
Maclean Building
Wallingford
Oxford
OX10 8BB
Tel: 01491 838800
Fax: 01491 692345
Email: hydroenq@bgs.ac.uk

Murchison House (MH) Office

British Geological Survey
Murchison House
West Mains Road
Edinburgh
EH9 3LA
Tel: 0131 650 0282
Fax: 0131 650 0252
Email: enquiry@bgs.ac.uk



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.

Copyright:

Copyright in materials derived from the British Geological Survey's work, is owned by the Natural Environment Research Council (NERC) and/ or the authority that commissioned the work. You may not copy or adapt this publication, or provide it to a third party, without first obtaining NERC's permission, but if you are a consultant providing advice to your own client you may incorporate it unaltered into your report without further permission, provided you give a full acknowledgement of the source. Please contact the BGS Copyright Manager, British Geological Survey, Kingsley Dunham Centre, Keyworth, Nottingham NG12 5GG. Telephone: 0115 936 3100.
© NERC 2010 All rights reserved.

This product includes mapping data licensed from the Ordnance Survey® with the permission of the Controller of Her Majesty's Stationery Office. © Crown Copyright 2010. All rights reserved. Licence number 100037272



**Report issued by
BGS Enquiry Service**

APPENDIX 12B

Interpretive Report

P3Eco (Bicester) Ltd and A2Dominion Group
NW Bicester Eco Development
Geotechnical Interpretative Report - Exemplar Site





P3Eco (Bicester) Ltd and A2Dominion Group

NW Bicester Eco Development

Geotechnical Interpretative Report - Exemplar Site

Author Harriet Buckland

Checker M Lundie

Approver C Plumb

Report No 2505-UA001881-UP33R-01

Date November 2010

This report has been prepared for P3Eco (Bicester) Ltd and A2Dominion Group in accordance with the terms and conditions of appointment for NW Bicester Eco Development contract, dated May 2010. Hyder Consulting (UK) Limited (2212959) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

CONTENTS

1	INTRODUCTION	1
1.1	Background to the Proposed Development	1
1.2	Objectives of the Report	1
2	THE EXEMPLAR SITE SETTING	2
2.1	Site Location.....	2
2.2	Site Description	2
2.3	Public Register and Historical Information	2
2.4	Geology and Hydrology	2
2.5	Hydrogeology	4
2.6	Flooding.....	5
2.7	Drainage Soakaways.....	5
3	GROUND INVESTIGATION	6
3.1	Site Works	6
3.2	Sampling.....	6
3.3	Laboratory Testing.....	7
4	GROUND CONDITIONS ENCOUNTERED	8
4.1	Summary of Strata Sequence.....	8
4.2	Groundwater and Ground Gas	9
5	GEOTECHNICAL PROPERTIES	10
5.1	Introduction.....	10
5.2	Superficial Deposits/Head	10
5.3	Completely Weathered Limestone.....	10
5.4	Interbedded Limestone.....	11
5.5	General.....	12
5.6	Foundations.....	13
5.7	Excavations	14
5.8	General Construction Issues	14
5.9	Roads	15
5.10	Radon Protection.....	15
5.11	Protection of Buried Concrete.....	15
5.12	Permeability Testing	15
6	CONTAMINATED LAND	16
6.1	Introduction.....	16
6.2	Human Health Risk Assessment	16
6.3	Ground Gas Risk Assessment.....	20
6.4	Controlled Waters Risk Assessment	21
7	Description of Existing Baseline Conditions	23

7.1	Design and Mitigation	23
7.2	Assessment of Residual Effects	27
7.3	Summary	27
8	CONCLUSIONS	28
8.1	Ground and Groundwater Conditions	28
8.2	Engineering Considerations.....	28
8.3	Contamination	28
9	REFERENCES	29

Figures

- Figure 1:
Site Location Plan
- Figure 2:
Exploratory Hole Location Plan
- Figure 3:
Proposed Site Development Plan

Appendices

- Appendix A: Risk Assessment Definitions

1 INTRODUCTION

Hyder Consulting (UK) Limited (HCL) has been instructed by P3Eco (Bicester) Ltd. (P3Eco) and A2Dominion Group Ltd. (A2Dominion) to undertake a Geotechnical and Geo-Environmental intrusive investigation with subsequent factual and interpretative reports for a proposed new eco development on the north-western periphery of the town of Bicester, Oxfordshire.

This geotechnical interpretative report presents a summary of data collected during an initial preliminary ground investigation undertaken at the proposed Exemplar site in August 2010 and provides advice relating to the physical and chemical nature of the ground based on interpretation of this data. Prior to undertaking the ground investigation, a desk study report (Ref. 1) and following completion of the investigation a factual report (ref. 2) were produced by HCL, which should be read in conjunction with this document.

1.1 Background to the Proposed Development

Land at NW Bicester is identified in the Supplement to Planning Policy Statement 1 (PPS1) entitled 'Eco Towns' (July 2009) as a potential location for an Eco Town. PPS1 sets out the Government's overarching planning policies on the delivery of sustainable development through the planning system. The Supplement to PPS1 sets out a range of criteria against which Eco Town proposals should be assessed.

The development of land at NW Bicester as an Eco Town has been promoted by P3Eco. P3Eco have selected A2Dominion as its development partner for the promotion and implementation of the Exemplar scheme (see Figure 1 – site location plan for land proposed for the Exemplar Scheme) and also as its affordable housing partner in respect of the wider Masterplan scheme.

The proposed development is still in the preliminary design stage and as such, the ground investigation was designed based on the information provided within the desk study to provide the assessment of general ground conditions and parameters from a geotechnical, hydrogeological and geo-environmental perspective.

The purpose of this report therefore is to identify the geotechnical, environmental, geological, hydrogeological and hydrological conditions and constraints to the proposed eco development present at the Exemplar site. In addition to use the information gathered during the investigation and desk study phases, including the historic land use knowledge, to develop an understanding of any potential contamination risks that might arise from current or potential future use of the site.

1.2 Objectives of the Report

The principal objective of the report is to provide an assessment of the current geotechnical and geo-environmental conditions of the proposed Exemplar site. To this end, this report aims to:

- Establish ground and groundwater conditions beneath the site;
- Identify the presence of contaminants within the soil;
- Identify health and safety issues arising as a result of the ground conditions; and
- Discuss materials management and waste disposal issues.

In order to meet these objectives, a preliminary site-specific intrusive ground investigation was undertaken by HCL's in-house SI contracting division, using CJ Associates Ltd. (CJA) as the specialist drilling subcontractor, with all technical direction and supervised provided by HCL.

2 THE EXEMPLAR SITE SETTING

2.1 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 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 whole of the development 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.

This geotechnical interpretative report is restricted to the Exemplar site, which extends over an area of approximately 21.1ha, situated within the north eastern boundary of the whole development site, to the south of Caversfield. The sole landowner of the Exemplar development site is Mr Phipps.

The location of the site is presented in Figure 1 with the proposed site development plan included in Figure 3; and comprises of predominantly two storey houses, although this is subject to change and was current at the time of writing.

2.2 Site Description

The Exemplar site is predominantly flat, arable farmland and the agricultural land value is Grade 3 (good to moderate quality) which is currently being used as grazing land for livestock at the time of the ground investigation. 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 and Ground Investigation.

The site is dissected from east to west by a low flow watercourse/stream, with ground level dropping at a low grade to the river. There is one stream on the Exemplar site (flowing in a NW to SE direction), which feed the N to S flowing River Bure.

Existing buildings within the Site boundary comprise those at Home Farm. The buildings here contain grade 2 listed buildings.

2.3 Public Register and Historical Information

Public register information relating to the Site and the surrounding area has been obtained mainly from the Landmark Information Group Ltd. A full review of public register and historical information can be seen in the desk study report (Ref. 1).

2.4 Geology and Hydrology

The following section contains extracts from the accompanying desk study report (Ref. 1) and supplemented by information gained from the recent ground investigation.

2.4.1 Superficial Deposits

Late Quaternary age superficial deposits of Alluvium flank the 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.

2.4.2 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 rock head by various formations and members of the Great Oolite Group, of Mid-Jurassic age, which are dominated by limestone's 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 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 in the area 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.

2.5 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. 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 at the Exemplar Site reached the Forest Marble 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 below ground level (about 76m AOD).

In addition to the available geological information, the Environment Agency (EA) Groundwater Vulnerability Map on the EA website 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 is 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.

2.5.1 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, the Site does not lie within a SPZ.

2.6 Flooding

Information contained within the desk study report (Ref. 1) indicates that the site is not within the zone of potential flooding from fluvial watercourses. According to the Environment Agency Flood Maps included within the Envirocheck Report, the Site does not generally lie within a zone susceptible to flooding; however, the River Bure that flows to the south east of the 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. The stream that flows across the site in a west to east direction has not been modelled by the EA, as it is too small. As such, a separate, Site-specific hydraulic model should be developed in order to confirm the flood plain extents across the Site.

2.7 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 stream that feeds the River Bure were dry), it is considered at this stage that the ground will likely be suitable for some form of soakaway, this is discussed in more detail within the Hyder Exemplar Site Drainage Strategy Report (Ref.3).

3 GROUND INVESTIGATION

The preliminary ground investigation for the whole site was carried out between 2nd August and 16th August 2010 and included the investigation of the Exemplar site. The investigation was undertaken and supervised by HCL on behalf of A2Dominion and P3Eco.

The site specific ground investigation at the Exemplar site was designed to address the objectives identified within Section 1.2 of this report. The findings of the ground investigation, GI are summarised below and are detailed in the HCL Factual Report (Ref. 2)

3.1 Site Works

The completed scope of the ground investigation at the Exemplar site is as follows:

- 3 no. window sample boreholes with rotary follow on to maximum depth of 7m below ground level (bgl) with Standard Penetration test (SPTs) at 1m interval to 5m and at 1.5m intervals thereafter. Gas and groundwater monitoring standpipes were installed within two of the three boreholes;
- 2 no. in-situ permeability tests within selected boreholes;
- 6 no. machine excavated trial pits to depths of up to 2.9m bgl; and
- 3 no. in-situ soakaway tests within selected machine-excavated trial pits.

The depth, thickness and descriptions of the strata (including depths of sampling points) are given on the relevant exploratory logs, presented within the HCL Factual Report (Ref. 2).

Upon their completion, the trial pits were safely backfilled and compacted and the ground re-instated, as far as practicable. Selected rotary boreholes were completed with gas and groundwater monitoring installations for monitoring purposes with raised locking covers.

3.2 Sampling

A Geotechnical Engineer from HCL logged the boreholes and trial pits in accordance with the recommended procedures provided by document BS5930:1999 "Code of Practice for Site Investigations" (Ref. 4). Disturbed, undisturbed and environmental samples were collected from the exploratory holes, which were subsequently sent for geotechnical, chemical and contamination analysis with the testing scheduled by HCL.

Water was added to all boreholes to assist drilling so groundwater inflows were not apparent. Groundwater was recorded in TP1 at a depth of 2.9m, but there was insufficient inflow to allow sampling.

Furthermore boreholes BH1 and BH5 have been installed with groundwater and gas monitoring standpipes and an ongoing programme of monitoring is currently taking place over a three month period to allow the groundwater and gas levels to stabilise and to be recorded over a range of (short-term) climatic variations.

The full results of the gas and groundwater monitoring will be issued as a separate addendum to this interpretative report.

3.3 Laboratory Testing

Geotechnical and chemical laboratory testing was undertaken on selected samples taken from the boreholes and trial pits and are summarised in Table 3.1 below. Testing of all samples was scheduled by HCL and undertaken by an HCL appointed laboratory. The test results are discussed within Sections 5 to 8 of this report and are presented in full within the HCL Factual Report (Ref. 2). Asbestos presence was analysed as a precautionary health and safety measure due to the desk study identifying possible ACMs (Asbestos Containing Materials) as being present on site, and possibly residing in the ground following demolition of former buildings.

Table 3.1: Summary of Analysis Undertaken on Scheduled Samples

Type of Test	Standard	Number of Samples
Geotechnical Testing on Soil Samples		
Soil Moisture Content	BS1377:1990 Part 2:3	11
Atterberg tests	BS1377:1990 Part 2:4 & 5	11
Particle Size Distribution tests (PSDs)	BS1377:1990 Part 2:9	8
Consolidation Tests	BS1377:1990 Part 5	3
Point Load Tests	International Journal of Rock Mechanics, Science and Geomechanics, Abstract volume 22, No.2 pp 51 to 60, 1985	5
Unconfined Compressive Strength	ISRM Suggested Methods pp 111 to 116 1981	3
Compaction testing, 2.5kg rammer	BS1377:1990 Part 4	2
BRE Sulphate Suite	BRE Special Digest 1:2005	7
Type of Test	Standard	Number of Samples
Contamination Tests		
Soil		
arsenic, barium, beryllium, cadmium, chromium, nickel, lead, copper, zinc, mercury, lithium, magnesium, phosphorous, potassium, selenium, sodium, strontium, zinc	MCERTS Accredited	7
Total, complex and free cyanide, total phenols, sulphide and pH.	MCERTS Accredited	7
Speciated PAH (USEPA 16)	MCERTS Accredited	6
TPH GRO/DRO/MRO	MCERTS Accredited	6
TPH (Total Petroleum Hydrocarbons) 6 banded	MCERTS Accredited	6
Total pheols	MCERTS Accredited	6
PAH	MCERTS Accredited	6
Asbestos screen	MCERTS Accredited	1

4 GROUND CONDITIONS ENCOUNTERED

4.1 Summary of Strata Sequence

The typical strata sequence encountered across the proposed Exemplar Site has been summarised in Table 4.1, with the full exploratory hole logs presented within the HCL Factual Report (Ref 2). The material properties and engineering considerations of the strata encountered are discussed respectively in Section 5 of this report and the contamination testing is discussed in Section 6.

The strata sequence generally comprises of Topsoil overlying an orange-brown, superficial head deposits comprising of gravelly, sandy Clay with many cobbles and / or orange-brown, sandy, clayey Gravel and Cobbles. Below this superficial layer, yellow-grey, sandy Gravel, and in places yellow grey Clay was encountered. This layer is thought to be a completely weathered layer derived from the underlying limestone as it grades into a limestone rock with depth. Below this level, the stratum alternates between generally a moderately strong to strong limestone, interbedded with stiff Clay and Mudstone layers. The weathered and strong limestone rock with interbedded clay and mudstone layers combine to form part of the cornbrash formation.

The strata descriptions used in the factual report (Ref. 2) are in accordance with BS 5930:1999 (Ref. 4).

Table 4.1: General Sequence of Strata across Site

Stratum	General description of Stratum	Typical Depth Range (m bgl)
Topsoil	Topsoil	GL to 0.2m (Max. 0.3m)
Superficial/Head deposits	Red brown, clayey sandy gravel with cobbles, or in places gravelly sandy Clay with cobbles	To 0.6m (max 0.8m)
Completely Weathered Limestone	Recovered as yellow-grey, sandy Gravel and in places yellow grey Clay	To 1.9m, maximum 2.9m
Interbedded Limestone and Clays	Interbedded moderately strong to strong Limestone and stiff or hard Clay and mudstone	1.9 to >7m

4.2 Groundwater and Ground Gas

During the ground investigation at the Exemplar site, water was added to the boreholes to assist the rotary drilling process within the limestone rock to keep the drill bit cool and limit the rock dust generated. It was therefore not possible to carry out groundwater monitoring of the boreholes during the investigation. All of the six trial pits excavated were found to be dry apart from trial pit, TP 1 which struck water at a depth of 2.9m bgl, located immediately above what is thought to be the top of the interbedded Limestone/Clay. Water entered the TP1 pit as a slow trickle that was not sampled due to the low rate of inflow.

Gas and groundwater monitoring results following completion of the ground investigation at the Exemplar site are ongoing. A further two visits will be carried out as part of monitoring over the next three months of monitoring. Available results are presented within Table 4.2; the remaining monitoring results will be reported separately as an addendum report.

Table 4.2: Groundwater Levels from Monitoring Visit on 13/08/10

Borehole	Eastings	Northings	13/08/2010 (m bgl)
BH1	457493	225428	3.1
BH5	457618	224855	6.3

The results show that borehole, BH1 recorded a standing water level at 3.1m bgl and borehole, BH5 recorded a standing water level at 6.3m bgl. The 13th August monitoring visit suggests that excavations for foundations will not encounter groundwater as the excavation required for the proposed development will typically be limited to a depth of less than 2m bgl.

However, excavations during the ground investigation within the surrounding area were carried out following heavy rain and encountered shallower groundwater inflows above the limestone. Therefore, where foundations are based at shallow level on top of the limestone, some water inflow may be expected following heavy rain where the water is perched above the limestone.

During the ground water monitoring visit, gas measurements were taken from the boreholes, with the results showing that no methane was present and only a small concentration of carbon dioxide was present (max. 3.6% in BH5). The complete set of three month gas and ground water monitoring results will be issued as an Addendum report once the results have been obtained.

5 GEOTECHNICAL PROPERTIES

5.1 Introduction

A testing programme for soil samples recovered from the exploratory hole locations was scheduled by HCL and carried out by a designated laboratory, as specified by document BS1377:1990 "Methods of Tests for Soils for Civil Engineering Purposes" (Ref. 5). The results are summarised in this Section and included in full in the factual report (Ref. 2).

5.2 Superficial Deposits/Head

The superficial deposits/Head are generally consistent across the Exemplar site with a typical subsoil depth of 0.6m. The deposits predominantly comprise of a reddish/orange, brown clayey Gravel with cobbles, or in places a gravelly Clay with cobbles. Based on inspection of the trial and archaeological pits, the material composition varies with depth. When the ground level drops towards the streams or water courses, the granular content of the subsoil decreases and vice versa. Therefore at a higher elevation there is a much higher content of granular material, with increasing cobble content.

5.2.1 Laboratory Testing on Superficial Deposits/Head

One atterberg limits test and one moisture content test was carried out on a cohesive sample of the superficial deposits in trial pit, TP5. The material was found to be of intermediate plasticity with a plasticity index, PI value of 20%. The moisture content testing for the same material indicates a mc of 22%.

Five particle size distribution tests were carried out on the subsoil and indicate this material to comprise mainly silty/clayey, sandy gravel and some cobbles; although in places the cobble fraction is more dominant. Two compaction tests at 0.5m depth were carried out in the superficial deposits and the maximum dry density ranged from 1.65 mg/m³ to 1.83mg/m³ and optimum moisture content of between 13% and 16%.

In accordance with BRE Special Digest SD1 (Ref. 9), sulphate content and pH value testing was carried out on selected soil samples and the test results lie within the limit of Sulphate Design Class DS-1, as defined within the BRE guidelines. The minimum pH value is 6.4 and the maximum sulphate value is 100mg/l. The groundwater regime is considered as mobile, therefore an Aggressive Chemical Environment for Concrete (ACEC) classification of AC-1 is considered appropriate.

5.2.2 In Situ Testing in the Superficial Deposits

Two standard penetration tests, SPT's were carried out within the superficial deposits both giving SPT values in excess of 50 blows, suggesting that the superficial deposits are very dense (Ref. 6).

5.3 Completely Weathered Limestone

The completely weathered Limestone was generally recovered as a yellow-grey, sandy Gravel and yellow grey Clay. This material grades to a moderately weathered limestone with depth.

5.3.1 Laboratory testing on the completely weathered Limestone

Two atterberg Limit tests were carried out on the completely weathered limestone in trial pit, TP1 at 2.6m and in TP3 at 1.5m. Both tests indicate a high plasticity within this stratum, with PI values of 31% recorded for both samples. Moisture content testing carried out on these samples give mc values of 22% and 24%.

Three particle size distribution tests were carried out on the weathered limestone in TP1, TP4 and TP6. Tests indicate that the material is a silty /clayey, sandy Gravel with some cobbles.

5.3.2 In situ testing in the completely weathered Limestone

One SPT test was carried out within the completely weathered Limestone and gives an SPT value in excess of 50.

5.4 Interbedded Limestone

The Limestone was encountered in all exploratory holes, however due to the high strength of the material, excavation of the Limestone was not possible with the JCB 3CX. Rotary coring was used to investigate the limestone strata to depths of up to 7m.

The Limestone was generally moderately strong to strong, oolitic and frequently fossiliferous and grey, interbedded at medium spaced intervals with a stiff to very stiff or hard grey, silty Clay.

5.4.1 Laboratory testing on the interbedded Limestone

Eight atterberg limit tests were carried out on the Clays that are interbedded within the limestone at various depths in order to get a moisture content/Atterberg Limit profile. The tests indicate that the material is generally of intermediate plasticity, with PI values of between 23% and 26% recorded. One test result at depth gives a lower plasticity of 14%, chart 5.1 shows the mc/PI profile for Clays within the interbedded Limestone:

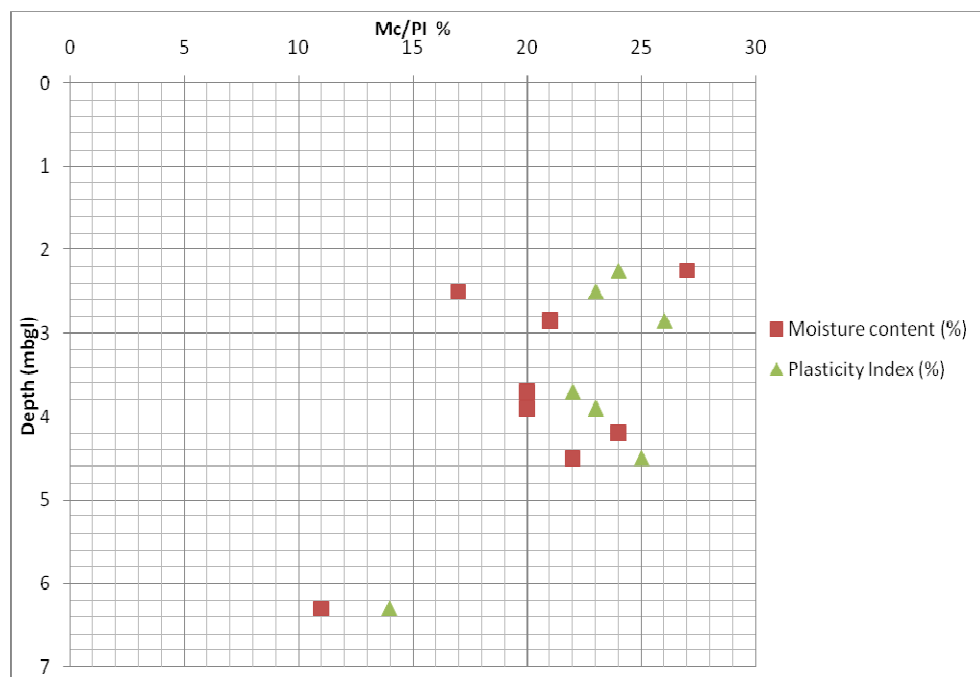


Chart 5.1 mc/PI profile for the interbedded Limestone

Moisture content testing was carried out on all of the samples tested for Atterberg Limits and give mc values of between 11% and 27%. One dimensional consolidation testing was carried out on three clay samples from the interbedded Limestone, from borehole BH1 at 4.5m, BH5 at 2.25m and from BH5 at 3.9m. Test results indicate a coefficient of volume compressibility (M_v) values ranging from 0.013 m^2/MN to 1.119 m^2/MN and coefficient of consolidation (C_v) values ranging from 0.678 m^2/yr to 11.6 m^2/yr .

The minimum pH value in the interbedded Limestone is 6.4. and the maximum sulphate value is 240mg/l.

Point load tests indicate Point Load Indices ($I_{s(50)}$) of between 0.09MPa and 4.14MPa in a diametral direction and 0.22MPa and 3.98MPa in an axial direction.

Testing to determine the Unconfined Compressive Strength (UCS) of the limestone was carried out and indicates a UCS of between 19.3mpa and 39.8MPa.

5.4.2 In situ testing in the interbedded Limestone

Fourteen SPT tests have been carried out within the Limestone bands, thirteen of these giving results in excess of 50 blows. One anomalous result gives an SPT count of 28.

One SPT result is available within a Clay band within BH5 at a depth of 4.1m. This gives an SPT value of 38 which gives an undrained shear strength of 171kN/m² and indicates that this material is very stiff.

5.5 General

Geotechnical Parameters for each principal stratum type encountered within the boreholes are summarized in Table 5.1. These are based on available test results or published data. It is important that the accompanying notes and previous reports are read in detail when using this data for design and the construction process.

Table 5.1 – Summary of geotechnical properties

	Plasticity Indices			Natural Moisture Content	Undrained Cohesion	Effective angle of Shearing Resistance	Unconfined Compressive Strength	Standard Penetration Test	Concrete Class	Coefficient of volume compressibility /Coefficient of Consolidation
Strata	LL (%)	PL (%)	PI (%)	%	Cu (kPa)	Phi' (degrees)	UCS (MPa)	('N') value	DC/ACEC	(m ² /MN)/(m ² /year)
Superficial deposits cohesive	49	29	20	22	150 based on description	30 based on PI value	-	>50	AC-1	N/A
Superficial deposits Granular	-	-	-	-	-	40 (based on description SPT and BS 8002)	-	>50	AC-1	N/A
Weathered Limestone Granular	-	-	-	-	-	40 (based on description , SPT and BS 8002)	-	>50	AC-1	N/A
Weathered Limestone Cohesive	54-58	23 - 27	31	22-24	>150 based on description and SPT result	28	-	>50	AC-1	N/A
Interbedded Limestone Rock						40 (based on values published by Hoek and Bray)	19-40	>50	AC-1	
Interbedded Limestone Clay	29-46	15 - 23	14 - 26	11-24	>150 based on description and SPT result	28	-	38	AC-1	0.013 to 1.119 / 0.678 to11.6

5.6 Foundations

The exploratory hole logs indicate that shallow strip or pad foundations will be suitable for the proposed residential two storey site development shown in Figure 3.

Based on Atterberg testing, the cohesive strata on the Exemplar site are generally of between low and medium volume change potential. Foundation design should be carried out in conjunction with landscaping design and in accordance with the guidance provided in NHBC chapter 4.2 (Ref. 7) to ensure that no damage to foundations results from shrinkage/swelling of clays.

Due to the potential presence of medium volume change potential Clay beneath the Superficial Deposits, it is recommended based on NHBC chapter 4.2 that foundations are located at a

minimum of 0.9m below ground level (where roots are noted / present then foundations should be extended below the level of the roots – see section 5.8.1), unless limestone is encountered at shallower depth.

There is some variability in the depth to the interbedded limestone across the site, so that when considering foundation types and loadings, consideration of differential settlement should be taken between those areas where limestone might lie directly beneath the foundation and where foundations are underlain by cohesive weathered limestone or Clays. Based on this variability in likely founding strata, strip foundations are not recommended for long rows of terraced houses without the inclusion of flexible movement joints and/or frequent gaps.

No Made Ground was recorded in any of the exploratory holes, however if Made Ground or soft material is encountered in any of the excavations for foundations then this material should be excavated and replaced with suitably compacted, granular fill. All shallow foundations should be inspected by a suitably qualified Geotechnical Engineer, to confirm that a suitable founding stratum is available.

5.7 Excavations

Prior to excavation, any utilities services are to be disconnected and removed under the footprints of the proposed areas of works. Excavations for foundations although slow in the dense gravel, should prove straightforward with a standard backhoe machine excavator, as proven by the trial pitting during the ground investigation.

All pits were stable during the ground investigation, water ingress occurred in one exploratory hole, TP1, however this was below the proposed depth of foundation excavation. Excavations for ground investigation within the surrounding area were carried out following heavy rain and encountered shallower groundwater inflow, above the limestone. Where foundations are based at shallow level on top of the limestone, some water inflow may be expected following heavy rain where the water is perched above the limestone, and some form of dewatering during temporary works may be required.

If any excavations for other infrastructure are required to greater depth, there is an increased possibility of encountering groundwater.

5.8 General Construction Issues

Should significant changes in ground level be required as part of the proposed development of the Exemplar site, the excavatability of the limestone must be considered, as the ground investigation proved that this material is extremely difficult to dig. The overlying superficial and weathered deposits also present difficult/slow digging conditions. Excavations for drains, services and infrastructure may also prove difficult and time consuming, particularly where the limestone is at a shallower depth.

Where the ground slopes steeply towards the water course that passes across the site in an east – west orientation, consideration of slope stability is required to ensure that no instability of the superficial deposits is induced through foundation loading, and/or cuttings for roads and other infrastructure. It is recommended that the foundations to proposed properties in steeply sloping areas are deepened to found below any potential zone of influence to the slope.

A badger sett is located in the centre of the site. The development must follow current guidelines, and the recommendations of the appointed ecologist when constructing in the vicinity of this habitat.

Any soft material encountered should not be re-used as backfill beneath any planned structures, road pavements, hard standing areas or other areas that may be sensitive to future settlement.

5.8.1 Building Near Trees

Where the development is proposed adjacent to existing or proposed planting, foundations should comply with the requirements of NHBC Guidelines Chapter 4.2 (Ref. 7). In which case, it may be necessary to extend the foundation depths quoted in Section 5.5.

5.8.2 Solution Cavities/Swallow Holes

Although no evidence of solution cavities or swallow holes were recorded during the preliminary ground investigation, these features may be present within the site, particularly in the limestone deposits. Any evidence of such features discovered during excavations should be investigated further by an experienced Geotechnical Engineer, and an appropriate remediation scheme adopted if deemed necessary.

5.9 Roads

The roads on site should be constructed in accordance with Design Manual for Roads and Bridges (DMRB) Volume 4, Section 1, Part 1 (HA44/91), (Ref 8) and Volume 7, Section 2, Part 2 (HD25/94). Further ground investigation should include CBR testing, once founding levels and layouts for the roads are known, in order to assist in the design of roads and bridges.

Particular care should be taken to avoid excessive trafficking in areas of proposed roads, and pavements should be constructed soon after excavation in order to limit deterioration and softening of the formation.

5.10 Radon Protection

As part of the Desk Study Report (Ref. 1), a detailed BR 211 Radon Report was obtained from the British Geological Survey (BGS), which states that basic radon protection measures are required for the site area as the estimated probability of a property being above the Action Level for radon is 3-5%.

Details on the technical specifications for basic radon protection measures are given in document BRE Report BR211 (Ref. 9).

5.11 Protection of Buried Concrete

The pH values tested in the superficial material are greater than 6.4 and the groundwater regime is considered as 'mobile' water. The laboratory testing for sulphate and pH has recorded results indicative of ACEC Class AC-1 as described in BRE Special Digest 1 3rd Edition, (2005).

5.12 Permeability Testing

Two falling head tests were undertaken within boreholes BH1 and BH2 at the Exemplar site.

Soakaway testing was undertaken in TP3, TP4 and TP6 within the limestone rock and indicates a coefficient of permeability (K) between 0 (failed test with limited or no soakage) and $3.95 \times 10^{-5} \text{ms}^{-1}$.

The full permeability test results are shown in the Hyder factual report (Ref. 2) and the Hyder Exemplar Site Drainage Strategy Report (Ref.3).

6 CONTAMINATED LAND

6.1 Introduction

This Section of the report relates to the potential risks to human health and controlled waters that development of the site may represent. This Section also describes:

- The current baseline conditions at the Exemplar site;
- Any potential impacts and the mitigation measures required to prevent, reduce or offset any potentially significant adverse effects; and
- The likely residual effects after these measures have been implemented.

To assist the understanding of the principles of this subject and their particular application within the context of the proposed development, it is recommended that the reader refers to the associated Hyder Consulting (UK) Ltd. (HCL) Desk Study Report (Ref. 1).

Establishment of Baseline Conditions

The baseline conditions for the Exemplar site and vicinity have been determined based on the Phase 1 Desk Study Report and from laboratory testing results obtained from the follow-up preliminary intrusive ground investigation undertaken on site in August 2010.

Assessment of Effects

The potential effects on the identified receptors from contaminants at baseline conditions at the Exemplar site have been assessed under the headings 'Human Health Risk Assessment', 'Ground Gas Risk Assessment' and 'Controlled Waters Risk Assessment'.

6.2 Human Health Risk Assessment

The Statutory Guidance on Part IIA of the Environmental Protection Act 1990, as set out in DEFRA Circular 01/2006, and Contaminated Land Report 11 (CLR 11) form the basis on which this contaminated land assessment has been undertaken.

Current legislation and guidance on the assessment of potentially contaminated sites acknowledges the need for a tiered risk based approach comprising:

- Tier 1 Assessment: Comparison of site contaminant levels against generic standards and compliance criteria including an assessment of risk using a source-pathway-receptor model.
- Tier 2 Assessment: Derivation of site-specific risk assessment criteria and calculation of site-specific clean-up goals.

The assessment has therefore been undertaken in a phased approach, focussing initially on the Tier 1 Assessment. The Tier 1 assessment includes the following stages, which were completed where applicable:

- Zoning of data/site averaging areas;
- Maximum Concentration Assessment - comparison of maximum detected concentrations against relevant Generic Assessment Criteria (GAC);
- Mean and Maximum Value Statistical Analysis – consideration of statistical outliers and 95% Upper Confidence Levels (UCLs) against relevant GAC;

- Risk Evaluation/Assessment of Significant Results; and
- Identification of the need for Tier 2 Assessment and derivation of Site Specific Assessment Criteria (SSAC).

The current philosophy in the assessment and remediation of contaminated land in the UK is to adopt an 'end use' approach whereby the significance of contamination at a site is evaluated according to either the existing use or to a proposed development end use.

For the Tier 1 Assessment, Environment Agency published generic Soil Guideline Values (SGVs) derived using the Agency's CLEA model, was used. Where these are not available, GAC published by LQM/CIEH were utilised (Ref 11).

The assessment criteria relevant to the standard sensitive receptor setting within the CLEA model has been used i.e. a female receptor aged 1 to 6 years, a residential building (small terraced house) and a sandy loam soil with a pH7 and SOM 1%. Given the proposed site end use, the stringent "residential with plant uptake" land use scenario has been adopted.

Zoning of Data/Site Averaging Areas

The development is expected to comprise predominantly residential properties, therefore the site has been considered to comprise one zone and averaging area for the purposes of this assessment.

Tier 1 Assessment

In order to focus on contaminants of potential concern (COPC), the laboratory testing results have been compared with the respective SGVs/GAC. The results and respective screening criteria are presented in Tables 6.1 to 6.4.

Any contaminants that exceed the SGVs/GAC are considered to be COPC. Those that do not exceed the respective SGVs/GAC are not considered to be COPC and do not require further assessment in relation to the proposed development of the site.

Table 6.1 Summary of Analytical Chemical Testing Results (Inorganic)

Determinand	Number of Samples Tested	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	SGV/GAC (mg/kg) Res. with Plant Uptake	No. of Exceedances
Arsenic	7	10.5	21	32 ⁽¹⁾	0
Barium	7	21	221	1300 ^{(2)*}	0
Beryllium	7	0.4	3.7	51 ⁽²⁾	0
Cadmium	7	<0.2	0.4	10 ⁽¹⁾	0
Chromium	7	11.3	31	3000 ⁽²⁾	0
Copper	7	7.1	17.1	2330 ⁽²⁾	0
Lead	7	7	68.8	450 ⁽³⁾	0
Mercury	7	<0.5	<0.5	1 ⁽¹⁾	0
Nickel	7	16.4	28.9	130 ⁽¹⁾	0
Selenium	7	<0.5	0.6	350 ⁽¹⁾	0

Zinc	7	18.5	65	3750 ⁽²⁾	0
Cyanide (free)	7	<0.5	<0.6	53 ⁽²⁾	0
Cyanide (complex)	7	<0.5	<0.6	266 ⁽²⁾	0
Asbestos	1	Not detected	N/A	N/A	N/A

1 EA published SGV

2 LQM/CIEH published GAC (2nd Edition)

3 Previous EA published SGV (currently withdrawn)

*Residential without plant uptake scenario

Table 6.2 Summary of Analytical Chemical Testing Results (PAH)

Determinand	Number of Samples Tested	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	GAC (mg/kg) Res. with Plant Uptake	No. of Exceedances
Naphthalene	6	<0.1	<0.1	1.5 ⁽¹⁾	0
Acenaphthylene	6	<0.1	<0.1	170 ⁽¹⁾	0
Phenanthrene	6	<0.1	1.6	92 ⁽¹⁾	0
Benzo(a)anthracene	6	<0.1	2.3	3.1 ⁽¹⁾	0
Benzo(b)fluoranthene	6	<0.1	1.9	5.6 ⁽¹⁾	0
Benzo(k)fluoranthene	6	<0.1	1.1	8.5 ⁽¹⁾	0
Benzo(ghi)perylene	6	<0.1	2.0	44 ⁽¹⁾	0
Pyrene	6	<0.1	4.5	560 ⁽¹⁾	0
Benzo(a)pyrene	6	<0.1	<0.1	0.83 ⁽¹⁾	0
Fluorene	6	<0.1	0.2	160 ⁽¹⁾	0
Fluoranthene	6	<0.1	4.9	260 ⁽¹⁾	0
Acenaphthene	6	<0.1	<0.1	210 ⁽¹⁾	0
Anthracene	6	<0.1	0.6	2300 ⁽¹⁾	0
Chrysene	6	<0.1	2.4	6 ⁽¹⁾	0
Dibenzo(ah)anthracene	6	<0.1	0.3	0.76 ⁽¹⁾	0
Indeno(123cd)pyrene	6	<0.1	1.6	3.2 ⁽¹⁾	0
Total PAH (USEPA 16)	6	<1.40	<1.53	No value	N/A

1 LQM/CIEH published GAC (2nd Edition)

Table 6.3 Summary of Analytical Chemical Testing Results (TPH)

Determinand	Number of Samples Tested	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	GAC (mg/kg) Res. with Plant Uptake	No. of Exceedances
Gasoline Range Organics (GRO)					
C5-6	6	<0.2	<0.2	30 ⁽¹⁾	0
C6-7	6	<0.2	<0.2	73 ⁽¹⁾	0
C7-8	6	<0.2	<0.2	73 ⁽¹⁾	0
C8-10	6	<0.2	<0.2	19 ⁽¹⁾	0
Aliphatic Fractions					
C8-10	6	<4	<5.25	19 ⁽¹⁾	0
C10-12	6	<4	<5.25	93 (48) ⁽¹⁾	0
C12-16	6	<4	5.03	740 (24) ⁽¹⁾	0
C16-21	6	<4	<5	45000 (8.48) ⁽¹⁾	0
C21-35	6	<9.61	<10.43	45000 (8.48) ⁽¹⁾	0
Aromatic Fractions					
C8-10	6	<4	<5	27 ⁽¹⁾	0
C10-12	6	<4	<5	69 ⁽¹⁾	0
C12-16	6	<4	<5	140 ⁽¹⁾	0
C16-21	6	<4	<5	250 ⁽¹⁾	0
C21-35	6	<9.61	<10.43	890 ⁽¹⁾	0

Table 6.4 Summary of Analytical Chemical Testing Results for Soils (BTEX)

Determinand	Number of Samples Tested	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	GAC (mg/kg) Res. with Plant Uptake	No. of Exceedances
BTEX					
Benzene	6	<0.01	<0.01	0.33 ⁽¹⁾	0
Toluene	6	<0.01	<0.01	610 ⁽¹⁾	0
Ethyl Benzene	6	<0.01	<0.01	350 ⁽¹⁾	0
m/p-Xylene	6	<0.01	<0.01	230 ⁽¹⁾	0
o-Xylene	6	<0.01	<0.01	250 ⁽¹⁾	0

1 LQM/CIEH published GAC (2nd Edition)

Values in blue are solubility saturation limits. Values in green are vapour saturation limits.

Contaminants of Potential Concern

There are no contaminants that exceed the respective SGVs/GAC.

Human Health Risk Assessment Conclusions

None of the contaminants tested returned values greater than the respective SGVs/GAC, therefore the soil that has been tested is deemed suitable for use in gardens (including growing edible plants) without the need for treatment or other remedial action.

During site construction works, site workers should remain vigilant to the possible risk of encountering isolated areas of contaminated material. Should potentially contaminated material be encountered, further testing will be required to assess the risks to the health and safety of site workers and the environment. All persons engaged in site construction works should be made aware of the findings of the intrusive investigation and the hazards associated with handling potentially contaminated materials. It is recommended that all works are conducted in accordance with the Health and Safety Executive publication entitled "Protection of Workers and the General Public during the Development of Contaminated Land" (Ref. 13).

6.3 Ground Gas Risk Assessment

It should be noted that, in accordance with current best practice and guidance, the number and frequency of ground gas monitoring rounds is dependent on the sensitivity of the development and the generation potential of any ground gas source. In this case, the ground gas monitoring programme has been devised in order to establish a preliminary indication of the ground gas regime at the site.

Monitoring of the ground gas regime is to be undertaken on 4 occasions between August and November 2010. The full results are to be included in the associated Addendum to the Hyder Consulting Factual Report (Ref. 2).

The results of monitoring have and will be assessed using the current guidance document: CIRIA C665 "Assessing Risks Posed by Hazardous Ground Gases to Buildings" and BS8485:2007 "Code of Practice for the Characterization and Remediation from Ground Gas in Affected Developments".

Gas Screening Values (GSV)/hazardous gas flow rates for methane and carbon dioxide have been calculated and are summarised in Table 6.5. The corresponding Characteristic Gas Situation (CGS) is also presented in this table. It is understood that the proposed development is to comprise mainly residential houses and therefore the CGS for 'Situation A', defined in the guidance as '*all development types except those in Situation B*' has been considered (Situation B is defined as '*low rise housing with a ventilated underfloor void*').

Table 6.5 Maximum Gas Concentrations (Borehole 5) and GSVs

Max. CH ₄ (v/v %)	Max. CO ₂ (v/v %)	Max. Flow Rate (l/h)	Max. CH ₄ GSV (l/h)	Max. CO ₂ GSV (l/h)	Characteristic Gas Situation A
0	3.6	0.3	0	0.0108	1

Radon Gas

The above gas situation does not account for radon. As such, as part of the Desk Study Report, a detailed BR 211 Radon Report was obtained from the British Geological Survey (BGS), which states that basic radon protection measures are required for the site area. This is because the estimated probability of a property being above the Action Level for radon is 3-5%.

Details on the technical specifications for basic radon protection measures are given in document BRE Report BR211: Radon – Guidance on Protective Measures for New Buildings (Ref. 9).

Ground Gas Risk Assessment Conclusions

The results of the gas monitoring to date indicate a very low risk classification for the proposed development from methane and carbon dioxide. However, basic radon protection measures will be necessary in the construction of all new dwellings or extensions on site. Once the addendum report is available for the gas monitoring and risk assessment, the recommendations in the addendum should supersede the guidance in this section.

6.4 Controlled Waters Risk Assessment

The Controlled Waters Risk Assessment (CWRA) has been undertaken in accordance with the guidance suggested in the Model Procedures for the Management of Land Contamination (Contaminated Land Report 11, CLR 11) and comprised a staged approach (referred to as 'Levels'). A Level 2 Assessment has been undertaken for the purposes of this CWRA. For information, all Levels (1 to 4) are summarised in Table 6.6 below.

Table 6.6 – Quantitative Risk Assessment Levels

Level	Soil	Groundwater
1	Pore water contamination compared directly to receptor target concentration	Not applicable
2	Attenuation in unsaturated zone and dilution at the water table	Groundwater below source - groundwater data is compared directly to target concentrations
3	Attenuation in the aquifer	Attenuation and down gradient receptor or compliance point – groundwater concentration at the receptor/compliance point is predicted using numerical modelling
4	Dilution in the receptor	Dilution in the receptor - dilution in a receiving watercourse or pumping abstraction borehole (only with approval of EA)

The basis for the screening criteria is to ensure that the selected screening values are protective of the identified receptor. For groundwater the general approach is to use an environmental standard as experience shows that remediation of contaminated groundwater to background quality is not achievable (Environment Agency 2006a). The standard should be relevant to the current and future receptors and the standards compliance criteria should be considered.

Standards that are applicable to this study are:

- UK Environmental Quality Standards (EQS) for the protection of aquatic life (in both freshwater and saline environments);
- UK Water Supply (Water Quality) Regulations, 2000 and 1989.

The groundwater beneath the site is considered to be the receptor in the first instance and therefore the UK Drinking Water Standards (UKDWS) have been selected as the appropriate screening criteria for the Level 2 Assessment.

Level 2 Assessment

The Level 2 Assessment has been undertaken assuming that there is one hydrogeological unit (at a depth affected by the development) underlying the site (groundwater within the Cornbrash Formation Secondary 'A' Aquifer).

There are no contaminants that exceed their respective UKDWS.

Controlled Waters Risk Assessment Conclusions

As noted none of the contaminants tested returned values greater than the respective UKDWS, therefore the waters that has been tested indicate that no remedial action with regards to ground water is required.

7 Description of Existing Baseline Conditions

The Desk Study Report (Ref. 1) was undertaken for the entire NW Bicester Masterplan eco development site (which encompassed the Exemplar site) to determine likely soil, groundwater and contamination conditions.

A summary of the findings from the Desk Study Report and ground investigation, as relevant to the Exemplar site, is as follows:

- Since the earliest available historical map of 1881 to the present day, the site has been dominated by agricultural activity.
- There are two streams on site; one minor, unnamed stream (flowing in a NW to SE direction), which feeds the N to S flowing River Bure in the southern part of the site.
- Geologically, the site is summarised as follows:
 - 0-0.2m thickness of Topsoil;
 - 0.2-0.6m (up to 0.8m deep in places) of Subsoil, comprising an orange/brown gravelly/sandy Clay or sandy clayey Gravel;
 - 0.6m to 1.9m (up to 2.9m deep in places) of yellow sandy Gravel and in places yellow/grey Clay, grading to completely weathered Limestone (Cornbrash Formation);
 - From 1.9 to 7m depth, alternating Limestone and Clay bands of the Cornbrash Formation are represented.
- No water strikes were recorded within the Cornbrash formation or superficial deposits during drilling. Follow-up groundwater monitoring recorded groundwater standing at in excess of 3m depth on average.
- There are no historic or current sources of industrial activity; farming being the only use of the land. If contamination is present on site, it is not expected to be widespread or significant. However, naturally occurring radon is present and basic radon protection measures will be required for the construction of new dwellings and extensions.

The intrusive ground investigation undertaken on site confirms that there are no contaminants present above the relevant human health and controlled waters assessment criteria, therefore the baseline conditions on site are such that remedial action in terms of contamination is not necessary prior to redevelopment.

7.1 Design and Mitigation

In the following section, the criteria used to define the significance of the effects, both adverse and beneficial, are:

- Major impact – where the development would cause a large change to the existing environment;
- Moderate impact – where the development would cause a noticeable change to the existing environment;
- Minor impact – where the development would cause a small change to the existing environment; and
- Neutral – where no impact will occur on the environment.

7.1.1 Construction

Effects likely to arise on-site through construction activities are outlined below. All construction works have the potential to generate the following potential effects relevant to this assessment:

- Creation of areas of contamination e.g. through spillage;
- Waste generation;
- Dust generation;
- Risk to contamination of workers; and
- Mobilisation of contamination and migration into controlled waters.

As the contamination testing has not identified any COPC, it is not considered that construction work will lead to exposure of construction workers and members of the public to any existing contamination present within soils, nor is it expected that the work will mobilise existing contaminants into ground or controlled water (surface water and groundwater). However, the scale of the site is such that complete coverage of all land area during the ground investigation was uneconomical and impractical, and as such, there is always a possibility that contaminants may be present in previously unexplored areas. These possibilities are discussed below in the context of existing site conditions, i.e. pre-remediation:

7.1.2 Dust

Whilst likely not contaminated, dust and silt can result from ground disturbance during construction, which can lead to accidental ingestion, dermal contact or inhalation of particles by site workers and possibly the general public. In some cases, generation of dust and silt may also lead to deposition on nearby surface waters. These risks would be most severe in the event that construction works were to take place on contaminated land, however, as previously stated it is considered unlikely that the site is contaminated.

As no significant contamination sources have been identified, **the impact is assessed to be neutral to minor adverse**. Nevertheless, mitigation measures such as damping down, covering of stockpiles, use of wheel washes and covering of lorries during transportation will be implemented as part of a general, good site management plan to ensure that the potential effects associated with airborne dust are minimised.

7.1.3 Water

Construction activities can result in the mobilisation of contaminants within the soil and the creation of a pathway for contaminants to migrate to underlying groundwater. Pathways can also be created for the transport of contaminants to surface water via airborne dust and through overland flow from poorly managed stockpiles. However, as previously stated, negligible contaminant concentrations in the soil and groundwater have been measured in the explored areas of the site, therefore it is considered unlikely that the construction works will introduce new contamination from the shallow soil to the underlying Secondary 'A' Aquifer (Cornbrash Formation) and the two on-site streams. **The impact is assessed to be neutral.**

7.1.4 Work in Previously Unexplored Areas

In the event that construction activities are undertaken in areas where previously unknown contamination is encountered during construction, a management strategy would be devised to ensure that any risks associated with its mobilisation are minimised. If required, suitable arrangements for stockpiling will be implemented to minimise the potential for the leaching of

contaminated liquids and run-off of sediment through loading and exposure to rainwater. Mitigation measures will include stockpiling in bunded areas underlain by impermeable material away from watercourses. Stockpiles will be covered to prevent leaching of the material.

If excavation works are undertaken in areas where locally contamination water is identified, water may enter the excavations and lead to contaminants migrating vertically and horizontally. Abstraction of potentially contaminated water from excavations will need to be controlled to prevent cross contamination of soils and potential impact upon the Secondary 'A' Aquifer. Mitigation could include the abstraction and disposal of water to a foul sewer or to surface water following appropriate treatment (and with the appropriate consent in place).

It is prudent in unexplored areas for a suitably qualified Geo-environmental Engineer to be present during the construction works tasked with a watching brief, in order to ensure that correct measures are taken if unexpected contamination is encountered.

7.1.5 Waste

In general, material removed from an excavation will not normally be regarded as waste if:

- It is intended to be reused on site and meets risk based values;
- It is suitable for use as backfill and meets risk based values; and
- It does not need to be processed before it can be reused.

In such cases, the material is unlikely to be subject, at that point in time, to the duty of care for waste and environmental permitting. This should be agreed with the Environment Agency Waste Officer prior to works commencing. The document published by CL:AIRE The Definition of Waste: Development Industry Code of Practice provides further details about the criteria which should be met for re-use of soils on site.

If it is not possible to reuse excavated material on site, then off-site disposal to an appropriately licensed landfill may be required. In this case, due consideration should be given to the UK Landfill Directive. Furthermore, any materials without a defined use on site can be considered as waste.

As of July 2009, the final phase of the landfill regulations from 2002 came into force and developers should be aware of the impact that it could have on their developments.

With measures already in place, the final phase of the regulations means that specified wastes can no longer be disposed off site to landfill and all wastes intended for landfill must receive prior treatment. Options for treatment (which include chemical, biological, mechanical separation and sorting) exist for most wastes and exemptions to this requirement are only limited to: inert wastes where treatment is not technically possible and wastes where viable treatment would not reduce the quality or the hazard(s) posed to human health or the environment.

The basic Government policy applies in the management of waste, and sites should adhere to the following protocol:

- I. Reduction of the waste generated by managing the development to keep the amount of 'waste soil' to a minimum;
- II. Re-use or re-distribution of soil on site (this will require the necessary authorisation);
- III. Recovery or recycling by way of treatment on site (this will require the necessary authorisation); and finally

IV. Disposal, following pre-treatment (with necessary authorisation) to landfill.

If, having followed the above hierarchy, off-site disposal of soil is necessary; there is a requirement to determine whether the waste soil is “hazardous” or “non-hazardous”. This is undertaken by means of CATWASTE^{SOIL}, as described below.

CATWASTESOIL

The results of the investigation have been input into CATWASTE^{SOIL} (Ref. 14), which has determined from the total contaminant concentrations that the soil is non-hazardous.

Disposal

The geology identified at the site indicates that shallow spread foundations may be suitable for all anticipated low-load structures; therefore, the generation of spoil is expected to be minimal.

It is anticipated that any spoil generated may be reused on site for landscaping or other purposes, therefore it is expected that only minimal volumes of material may require disposal off-site.

In general, for offsite disposal, Waste Acceptance Criteria (WAC) testing is necessary once a waste has been characterised as hazardous or if a non-hazardous waste is to be disposed at an “inert” landfill site. Non-hazardous waste does not require WAC testing unless disposal to an “inert” landfill is being considered.

In the event that large volumes of material will require off-site disposal, WAC testing is recommended to confirm whether the material is inert and can therefore be disposed at an “inert” landfill (thereby attracting less landfill tax).

7.1.6 Accidental Spillage of Construction Related Material

During any construction work, there always some potential for accidental spillage of contaminated materials. The main source of spillages is considered to be from construction plant and materials stored on site, particularly fuel and lubricating hydrocarbons. **The impact is assessed as neutral to minor adverse** depending on the nature, frequency and volume of the spillage. Mitigation measures will include the storage of chemicals and contaminative material in accordance with the Environment Agency guidance; regular servicing and inspection of vehicles used on-site; restriction of refuelling of vehicles to bunded areas underlain by hard standing, or other impermeable materials and the restriction of vehicle movements within close proximity of the surface watercourses.

Overall, it is considered that the effect during construction will be neutral to minor adverse.

7.1.7 Operation

For the proposed primarily housing end use, it is expected that receptors will come into regular contact with the soil, therefore potential for accidental ingestion, dermal contact or inhalation of dust particles exists. However, as no contaminant sources have been identified from the historical or current use of the site (confirmed by laboratory testing of the soil and groundwater) **the impact is assessed as neutral**. If contaminated material were discovered in previously unexplored areas of the site, remedial measures would be implemented where a complete pollution linkage would be possible, e.g. if contaminated soil were discovered in an area earmarked for residential gardens, then appropriate remedial action would occur, such as

excavating the soil and replacement by clean material. Alternatively, a cover system could be employed.

It is anticipated that a small proportion of the site may contain retail/leisure facilities. During operation, there may be limited potential for accidental spillage of potentially contaminating materials from delivery locations and plant operational locations. Due to the expected hard standing in these areas with appropriate drainage infrastructure and the adoption of standard materials handling and storage procedures, **the impact is assessed as neutral**.

Overall, it is considered that the effect during operation would be neutral.

7.2 Assessment of Residual Effects

7.2.1 Construction and Operation

In those areas of the site covered by the intrusive ground investigation, no contaminated soil or groundwater was discovered. In those unexplored areas of the site, it cannot be conclusively stated that there are no contaminants present. However, should localised contaminated areas be encountered, the degree of contamination is not expected to be significant, and it is considered that the previously described mitigation measures would significantly reduced or completely mitigated any potential impacts. No residual effects are identified.

7.3 Summary

The intrusive ground investigation has demonstrated that no elevated concentrations of contaminants are present in the soil or groundwater in explored areas of the site. In unexplored areas of the site, the Desk Study Report indicates that it is unlikely that contaminants will be present in significant concentrations.

Construction impacts are considered to be neutral to minor adverse and will be mitigated thorough the use of appropriate PPE and good site management practices.

Operational impacts are considered to be neutral and therefore require no mitigation measures.

Overall, the contamination risks associated with the Exemplar site are considered to be very low, though the risks from naturally occurring radon gas require basic radon protection measures to be incorporated in the construction of new dwellings and extensions.

8 CONCLUSIONS

8.1 Ground and Groundwater Conditions

The ground investigation generally confirms the expected geology, the site being underlain by Topsoil overlying granular and in places cohesive superficial/head deposits to a depth of 0.6m, with weathered limestone (Possibly the Cornbrash formation) to depths of up to 2.9m and interbedded Limestone and Clay below the weathered layer. Laboratory and in situ testing of the soils has been carried out and are discussed in section 5.

Groundwater was encountered in exploratory hole TP1 at a depth of 2.9m within the Limestone beds, and following heavy rain, in other trial pits carried out in the surrounding area, groundwater was encountered as a perched water table above the limestone.

In subsequent monitoring visits, ground water was encountered at depths of 3.1m and 6.3m in BH1 and BH5 respectively.

8.2 Engineering Considerations

Shallow foundations are expected to be a suitable option for residential and low rise structures proposed at the site, however suitable precautions should be taken in line with NHBC Foundation guidance with respect to the presence of medium volume change potential cohesive strata. In areas of low grade sloping ground, slope stability must be considered when assessing structural loadings and any road cuttings.

Excavations for foundations and infrastructure should prove straightforward, though if deeper excavations are required, extremely difficult digging conditions are likely to be encountered below the top of the interbedded Limestone/Clay strata. Excavation sides are expected to remain stable, except following heavy rain and are expected to be dry up to <2m below ground existing level.

Excavations should be inspected by a suitably qualified geotechnical engineer to confirm that a suitable formation is present. Any soft or Made Ground materials should be removed to prevent differential settlement. Due to the variable depth to the interbedded Limestone and Clays, it is recommended that strip foundations be designed to prevent differential settlement, with movement joints incorporated. Test results for concrete classification to BRE standards for sulphate and pH testing has recorded results indicative of ACEC Class AC-1.

8.3 Contamination

None of the soil or water samples analysed contained contaminant concentrations above the relevant, corresponding screening values and no noteworthy elevated ground gas concentrations were observed. As such, the risks posed to human health and the environment is considered to be very low and no remedial action is required.

The risks posed to humans including site and maintenance workers are considered to be very low from pre-construction contamination. However, contamination from materials brought on to site during the construction phase must also be considered as harmful to human health and the environment.

9 REFERENCES

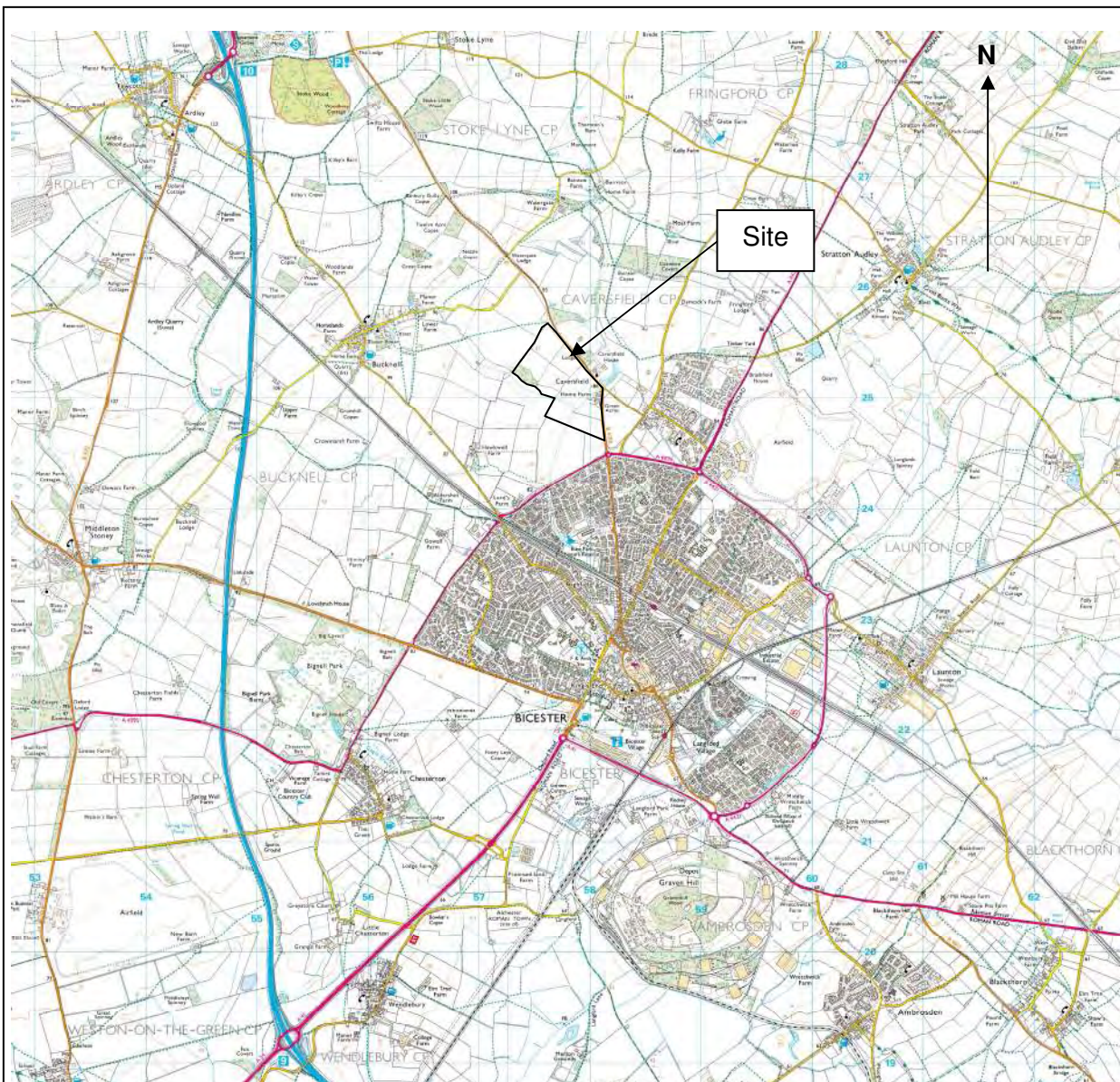
- 1 Hyder Consulting Limited, Desk Study, A2 Dominion Housing Group Ltd & P3Eco Ltd, NW Bicester Eco Development, July 2010, Report No.: 2501-UA001881-UP33R-01.
- 2 Hyder Consulting Limited, Factual Report, A2 Dominion Housing Group Ltd & P3Eco Ltd, NW Bicester Eco-Town – Exemplar Site, September 2010, Report No.: 2505-UA001881-UP33R-01
- 3 Hyder Consulting Limited, Factual Report, A2 Dominion Housing Group Ltd & P3Eco Ltd, NW Bicester Eco-Town – Exemplar Site Drainage, September 2010, Report No.: 2505-UA001881-UP33R-01
- 4 British Standards Institution (BSi), (1999). BS5930:1999, Code of Practice for Site Investigations. BSi, London.
- 5 British Standards Institution (BSi), (1990). BS1377:1990, Methods of Test for Soils for Civil Engineering Purposes. BSi, London.
- 6 CIRIA, 1995. Report 143: The Standard Penetration Test (SPT): Methods and Use. CIRIA, London.
- 7 NHBC, 2010. NHBC Standards, Part 4: Foundations.
- 8 Highways Agency (HA) Volume 4 Section 1 Part 1 HA 44/91.
- 9 BRE Report BR211: Radon – Guidance on Protective Measures for New Buildings
- 10 Concrete in aggressive ground, Special Digest 1:2005, 3rd Edition, The Concrete Centre, BRE Construction Division.
- 11 Land Quality Management (LQM) and Chartered Institute of Environmental Health (CIEH), 2007. Generic Assessment Criteria for Human Health Risk Assessment.
- 12 CIRIA, C552, Contaminated land risk assessment - a guide to good practice, 2001.
- 13 HSE, 1991: Protection of workers and the general public during development of contaminated land, guidance. HMSO, London.
- 14 European Commission, 1991. Council Directive 91/689/EEC of 12 December 1991 on hazardous waste. Official Journal L 377, 31/12/1991 P. 0020–0027

Figures




Figure 1: Site Location Plan

Figure 2: Exploratory Hole Location Plan

Figure 3: Proposed Site Development Plan



Reproduced from the Ordnance Survey 1:25,000 with the permission of Her Majesty's Stationery Office. (c) Crown Copyright. Licence No AL 100005552

Client		Project		<div></div> <div>Hyder Consulting Ltd 5th Floor, The Pithay, All Saints St Bristol BS1 2NL Tel: 0870 000 3003 Fax: 0870 000 3903</div>	
<div></div> <div></div>		Bicester Eco Town Exemplar Site			
Scale N/A		Datum N/A		Title	
				Site Location Plan	
				Project Code UA001881	Issue A
				Drawing Number 001	



01	FIRST ISSUE	16/09/10
Issue	Description	Date

50mm on Original

Client



Status	PRELIMINARY NOT TO BE USED FOR CONSTRUCTION		
Scales	1:12,500	Current Issue Signatures	
		Author R.JORDAN	
Original Size	A3	Checker D.THOMAS	
Height Datum	-	Approver C.PLUMB	
Grid	GRID	© Copyright reserved	
Filename:2004-UA001881-UP33D-01.DWG			

Project

BICESTER
ECO TOWN

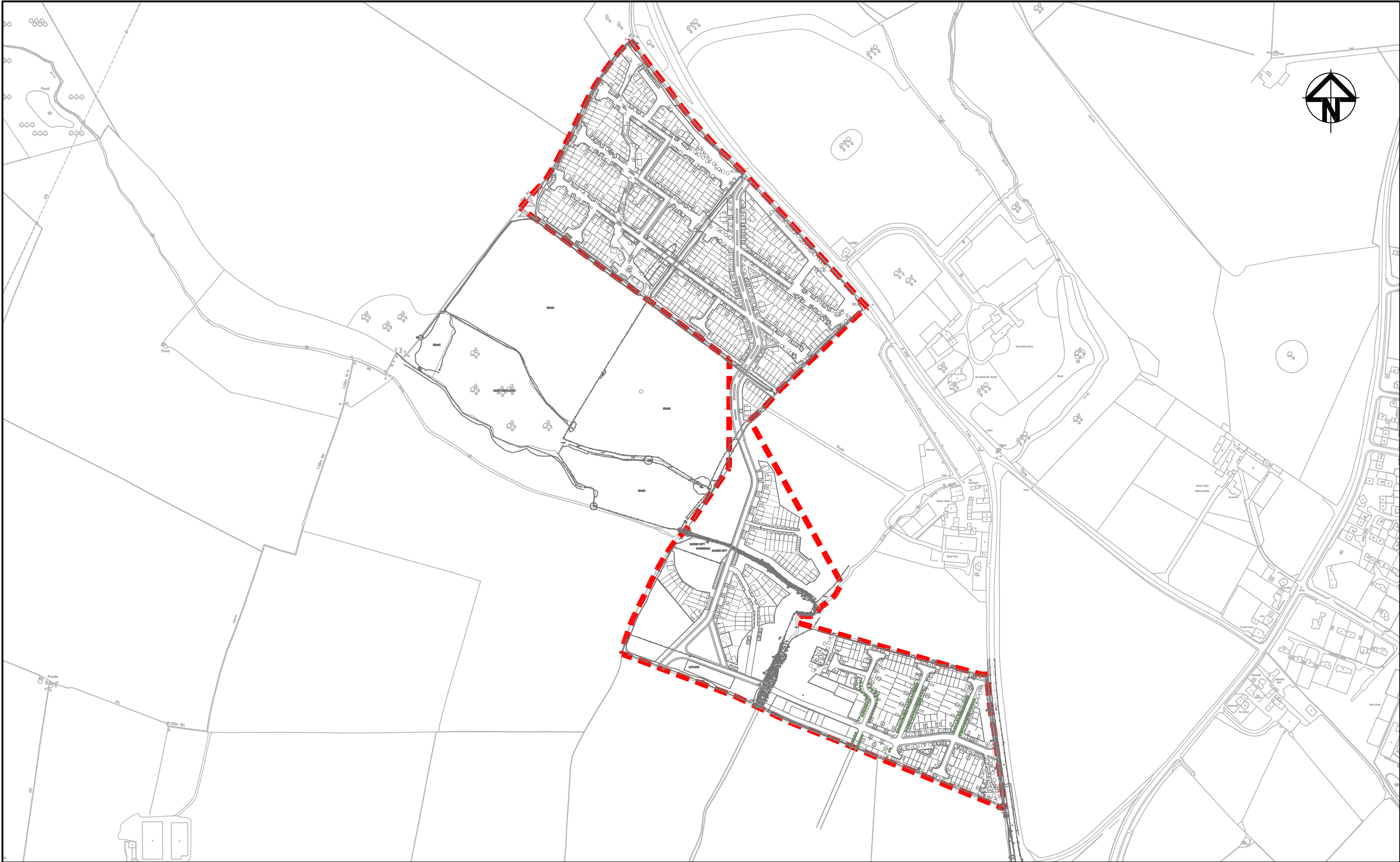
Title

EXEMPLAR SITE
WITH EXPLORATORY
HOLE LOCATIONS



Hyder Consulting (UK) Limited
29, Bressenden Place
London
SW15 5DZ
Tel: +44 (0)870 000 3006
Fax: +44 (0)870 000 3906

Drawing No.	Project No.	Issue
2004	UA001881	01



<div>KEY</div> <div>■■■■■■■■■■ EXEMPLAR BOUNDARY</div> <div>NOTE:</div> <div>HOUSING LAYOUT IS ILLUSTRATIVE ONLY</div>	<div>Client</div> <div> </div>	<div>Status</div> <div>PRELIMINARY</div>	<div>Project</div> <div>BICESTER ECO TOWN</div>	<div><div>Hyder Consulting (UK) Limited 29, Bressenden Place London SW15 5DZ Tel: +44 (0)870 000 3006 Fax: +44 (0)870 000 3906</div></div>																		
		<table border="1"><tr><td>Scales</td><td>1:5000</td><td colspan="2">Current Issue Signatures</td></tr><tr><td>Original Size</td><td>A3</td><td>Author</td><td>M.LLEWELLIN</td></tr><tr><td>Height</td><td></td><td>Checker</td><td>M.LUNDIE</td></tr><tr><td>Datum</td><td></td><td>Approver</td><td>M.LUNDIE</td></tr><tr><td>Grid</td><td>GRID</td><td colspan="2">© Copyright reserved</td></tr></table> <div>Filename: FIGURE 3-EXEMPLAR PLAN AREA.DWG</div>	Scales		1:5000	Current Issue Signatures		Original Size	A3	Author	M.LLEWELLIN	Height		Checker	M.LUNDIE	Datum		Approver	M.LUNDIE	Grid	GRID	© Copyright reserved
Scales	1:5000	Current Issue Signatures																				
Original Size	A3	Author	M.LLEWELLIN																			
Height		Checker	M.LUNDIE																			
Datum		Approver	M.LUNDIE																			
Grid	GRID	© Copyright reserved																				
<div>Issue</div> <div></div>	<div>Description</div> <div></div>	<div>Date</div> <div></div>																				

Appendices

Appendix A: Risk Assessment Definitions

Risk assessment considers the identified sources, the potential receptors and the pathways linking them together.

In the pollutant linkage table of this report, the column designated as 'Hazard (severity)' gives an indication of the sensitivity of a given receptor to a particular source being considered. It is a worst case classification and is based on full exposure via the particular linkage being examined. The derivation of the classes used to rank this particular aspect are given in the table below

Classification of Potential Consequence (Severity)

Classification	Human Health	Controlled Water	Built Environment	Ecosystems
Severe	Irreversible damage to human health. Short term (acute) risk to human health likely to result in "significant harm" as defined by Part 2a.	Substantial pollution of sensitive water resources	Catastrophic damage to buildings, structures or the environment	A short-term risk to a particular ecosystem or organism forming part of such ecosystem.
Medium	Chronic damage to human health. Non-permanent health effects to humans	Pollution of sensitive water resources or small scale pollution of sensitive water resources	Damage to buildings, structures or the environment	A significant change in a particular ecosystem or forming part of such ecosystem
Mild	Slight short term health effects to humans	Pollution to non-sensitive water resources	Damage to sensitive buildings, structures services or the environment.	Significant damage to crops
Minor	Non permanent health effects to human health (easily prevented by means such as personal protective clothing etc)	Insubstantial pollution to non-sensitive water resources	Easily repairable effects of damage to buildings or structures	Harm (although not necessarily significant harm which may result in financial loss or expenditure to resolve. e.g. loss of plants in a landscape scheme.

Subsequently, in the column entitled 'Likelihood of Occurrence', in the Pollutant Linkage table, an assessment is made of the probability of the selected source and receptor being linked by the identified pathway. This assessment is ranked based on site specific conditions as detailed in the table that follows

Classification of probability

High likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that there is a probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However it is by no means certain that even over a longer period such event would take place and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

In the Pollutant Linkage table of this report, the 'Potential Risk' column is an overall assessment of the actual risk, which considers the likely consequence of a given risk being realised and the likelihood of that risk being realised. The risk classifications are assigned using the following consequence/likelihood matrix:

Potential Consequence				
Severe	Moderate/Low	Moderate	High	Very High
Medium	Low	Moderate/Low	Moderate	High
Mild	Very Low	Low	Moderate/Low	Moderate
Minor	Very Low	Very Low	Low	Moderate/Low
Likelihood	Unlikely	Low	Likely	High

Table below describes the risk classifications

Risk Term	Description
Very High Risk	There is a high probability that significant harm could arise to a designated receptor from an identified hazard at the site without appropriate remedial action.
High Risk	Harm is likely to arise to a designated receptor from an identified hazard at the site without appropriate remedial action.
Moderate Risk	It is possible that without appropriate remedial action harm could arise to a designated receptor from an identified hazard. However it is either relatively unlikely that any such harm would be severe or if any harm were to occur it is more likely that such harm would be relatively mild.
Low Risk	It is possible that harm could arise to a designated receptor from an identified hazard but it is likely that this harm if realised would at worst normally be mild.
Very Low Risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

APPENDIX 16A

Preliminary Site Waste Management Plan (SWMP)

A2Dominion Group and P3Eco (Bicester) Ltd

Bicester Eco Development Exemplar

Site Waste Management Plan



Hyder Consulting (UK) Limited

2212959

5th Floor
The Pithay
All Saints Street
Bristol BS1 2NL
United Kingdom

Tel: +44 (0)117 372 1200

Fax: +44 (0)117 372 1508

www.hyderconsulting.com



A2Dominion and P3Eco Ltd

Bicester Eco Development Exemplar

Site Waste Management Plan

Author

Natalia Fernandez Ferro

Checker

Phil Harker

Approver

Phil Harker

Report No

UA001881

Date

November 2010

This report has been prepared for A2 Dominion and A3Eco in accordance with the terms and conditions of appointment for Site Waste Management Plan dated May 2010. Hyder Consulting (UK) Limited (2212959) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

CONTENTS

Abbreviations	i
1 Introduction	2
2 Background	4
3 Regulatory Framework	6
4 SWMP Roles and Responsibilities	14
5 SWMP Distribution	16
6 SWMP Implementation	17
6.1 Preparation and Concept Design Stage	17
6.2 Detailed Design Stage and Pre-construction Stage.....	17
6.3 Construction Stage	17
7 PSMWP Template for Bicester Eco development Exemplar Site	21
7.1 PSWMP Template: Homepage.....	21
7.2 PSWMP Template: Project Basic Details Sheet.....	25
7.3 PSWMP Template: Waste Actions Sheet	26
7.4 PSWMP Template: Forecast Waste Sheet.....	28
7.5 PSWMP Template: Waste Carriers Sheet	31
7.6 PSWMP Template: Waste Destinations Sheet	34
7.7 PSWMP Template: Actual Waste Movements Sheet	36
7.8 PSWMP Template: Key Performance Indicators Sheet.....	38
7.9 PSWMP Template: Reporting Sheet	40
7.10 PSWMP Template: Declaration	41
7.11 References	42

Abbreviations

ASL	Approved Supply List
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
C, D & E	Construction, Demolition and Excavation
CDM	Construction Design and Management
CLAIRE	Contaminated Land Applications in Real Environments
Defra	Department of Environment, Food and Rural Affairs
DoC	Duty of Care
EWG	European Waste Catalogue 2002
HWCN	Hazardous Waste Consignment Notes
HWR	Hazardous Waste Regulations
KPI	Key Performance Indicators
LA	Local Authority
LoW	List of Waste code
LoWR	List of Wastes (England) Regulations 2005
MSDS	Material Safety Data Sheets
PPC	Pollution Prevention and Control
PPS 1	Planning Policy Statement 1
PPS10	Planning Policy Statement 10
PSWMP	Phase Specific Waste Management Plan
SWMP	Site Waste Management Plan
WCN	Waste Consignment Note (for hazardous waste)
WCR	Waste Carrier Registration
WEEE	Waste Electrical and Electronic Equipment
WRAP	Waste & Resources Action Programme
WTN	Waste Transfer Note

1 Introduction

The Site Waste Management Plan (SWMP) is used to plan, implement, monitor and review waste minimisation and management on construction sites. In April 2008 the SWMP Regulations 2008 came into force in England for construction projects costing more than £300,000 excluding VAT.

The Bicester Eco development development will be brought forward in several phases. The first phase is the Exemplar site and incorporates some 393 residential units, energy centre, retail, commercial, a primary school site and public space. The progression of subsequent phase is not yet defined, for each of these phases there will need to be and phase specific SWMP used to:

- record the details of that phase of the project; and
- record the forecast of waste and the actual waste data

This report comprises of the SWMP Guidance and SWMP Template (Appendix A) for the first phase of Bicester Eco development development, the Exemplar Site. These have been prepared on behalf of A2Dominion and P3Eco in order to support the requirements of the planning application

The Exemplar SWMP Template will need to be updated prior to the commencement of the development, after planning has been approved and regularly during the course of the development. It will then be used to directly inform the waste management audit process and it will allow A2Dominion and P3Eco and contractors working for them to demonstrate how they comply with the SWMP Regulations 2008.

Preparing the SWMP Template encourages the review of current waste reduction and recovery practice levels, highlighting areas where Good and Best Practice in waste minimisation and management can be achieved. The SWMP Template also facilitates the identification and implementation of waste minimisation at the design stage and reuse and recycling opportunities during on site operations, reducing the quantities of construction waste sent to landfill. The Exemplar SWMP Template is presented in a series of 6 Stages that cover the construction project process from policy and setup to project completion and use:

- 1 **policy and setup:** the Project Pre-construction Team records the administration details and set targets;
- 2 **preparation and concept design:** the Project Pre-construction Team prepare the initial concept and take design decisions to reduce waste;
- 3 **detailed design:** the Project Pre-construction Team forecast the waste and record the waste reduction actions;
- 4 **pre-construction:** the Project Pre-construction Team record the waste carriers, waste destinations and waste management and recovery actions;
- 5 **construction:** the Project Team record the actual waste movements, and;
- 6 **post completion and use:** the Project Team review KPIs, report, compare actual quantities with estimates and sign the declaration.

The Exemplar SWMP Template can be used in conjunction with existing waste management tools and systems, such as the Waste & Resources Action Programme (WRAP) Net Waste Tool, WRAP Waste to Landfill Reporting Portal, SmartWaste Plus or the WRAP Site-specific Waste Analysis Tool (SSWAT).

The Exemplar SWMP Template provides options for planning and processing waste during the eventual construction activities on the site, whether for the existing client or the eventual developers. It also demonstrates that A2Dominion and P3Eco are a considerate clients who are interested in maximising opportunities for reuse and recycling that are cost neutral (or cost negative) and diverting waste from landfill.

The SWMP Guidance and the Exemplar SWMP Template have been designed to enable the project team to use the Exemplar SWMP Template to go beyond legislative compliance.

Note: the Exemplar SWMP Template and Guidance that constitute the SWMP Resources have been prepared at the concept design stage for A2Dominion and P3Eco. However, the SWMP Template will need to be adopted and updated as required during the detailed design, pre-construction and construction phases of the project, whether by A2Dominion and P3Eco or any Contractor. A2Dominion and P3Eco have legal requirements under the SWMP Regulations which need to be maintained throughout the life of the project from concept to completion. This note needs to be taken into account when reviewing and updating the SWMP Template.

2 Background

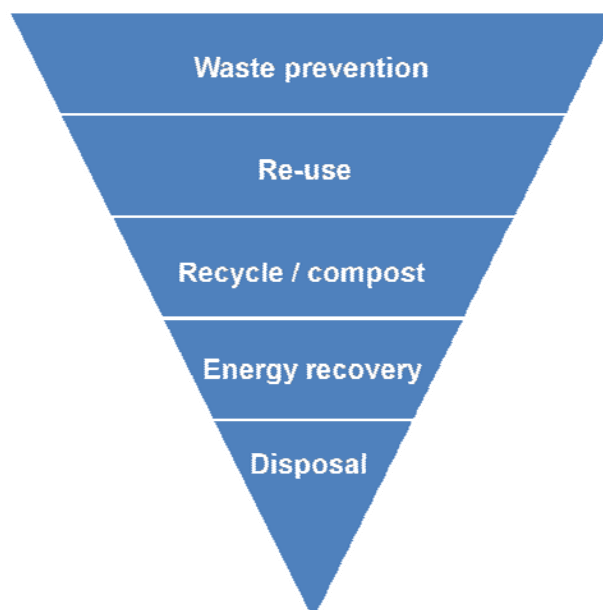
The SWMP relates to the development of the proposed first phase of the Bicester Eco development, the Exemplar Site. This lies in the north-eastern area of the area identified for the Eco development. The Exemplar Site development proposals include provision for the following:

- 393 residential units;
- a primary school site;
- B1(a) office accommodation;
- retail units (class A1 – A5);
- social and community facilities within class D with associated means of access;
- car parking;
- land scape;
- amenity space; and
- service infrastructure, including an energy centre.

Surplus or waste materials can arise from materials imported to the Exemplar Site or from those generated on site. Imported materials are those which are brought to the site for inclusion into the permanent works. Generated materials are those which exist on the site such as topsoil, sub-soil and trees. However, there are other considerations to waste management such as waste reduction; segregation of waste; disposal of waste; the financial impacts of waste disposal and the processes of recording, monitoring, training and reviewing the Exemplar SWMP Template.

The Exemplar SWMP Template outlines the procedures that shall be implemented at the project and demonstrates its benefit to the environment; how we can measure their effects and how these procedures and practices are sustainable. The management of waste shall follow the Waste Hierarchy shown in Figure 1 below:

Figure 1 Waste Hierarchy



All methods of eliminating or reducing waste shall be considered first, in order to minimise the surplus waste that has to be dealt with on site.

Waste prevention

Designers can greatly influence the waste produced on site and must be encouraged to consider the issue of waste in their design. For example, this can be achieved by:

- designing to suit component sizes;
- reducing the need for false work/temporary work;
- setting the level of the building to reduce excavations; and
- reusing spoil to form landscaping features.

If waste is not produced on site, it will not need to be dealt with. This can be assisted by:

- ordering the correct materials as specified;
- ordering the correct quantity of materials from accurate take-offs; and
- storing & handling materials correctly.

If there are any surplus materials from the project, it may be possible to use these on other packages and / or projects, either through contact with the buyer, or by advertising them on the company / project intranet. Materials could also be donated to local community projects or charities. There is also a website where surplus materials can be advertised for sale: www.WhatDoIDoWithThis.com. All of these options will avoid the cost of disposing of these surplus materials as waste.

Waste that cannot be eliminated or reduced falls into the following four categories for management:

Reused waste

If surplus materials can be used in the permanent works, they are classified as materials which have been reused on site. If they are surplus to requirements and need to be removed from site, but can still be used in their present form, they are classified as materials which can be reused off site.

Recycled waste

If surplus materials cannot be reused in their present form, but could be used on site in a different form they are classified as recycled on site. If the material cannot be reused on site in any form, it may be classified as recycled off site, e.g. non-returnable pallets sent to make chipboard.

Waste recovery

If surplus materials cannot be reused in their present form or used on site in a different form but could be diverted from landfill they are classified as materials which have been recovered. Recovery mainly refers to energy recovery (e.g. reuse a fuel) or biological recovery (e.g. composting).

Disposal to Landfill

If any of the above cannot be satisfied, then the only option left is to send the surplus materials to landfill.

3 Regulatory Framework

This section describes the main areas of European and national legislation impacting on waste management in the UK. It does not however address other international and European initiatives which either directly impact on waste or set the context within which waste policies are developed, such as: global commitments (Kyoto Protocol on Climate Change) and European commitments.

Waste Legislation originally focused on the disposal of waste, but since the introduction of the EC Framework Directive on waste, control has extended to include the storage, treatment, recycling and transport of waste. It is important to note that new legislation and amendments to existing legislation are introduced relatively frequently and the information provided here is as of November 2010.

Definition of Waste

“Waste” is defined by the Council Directive on Waste (75/442/EEC) as “any substance or object... which the producer or person in possession of discards, intends to discard or is required to discard”.

“Hazardous Waste” is waste with one or more properties hazardous to health or the environment as defined by the Hazardous Waste (England and Wales) Regulations 2005 (HWR). Hazardous properties are listed H1 to H14 in Schedule 3 of the HWR.

“Inert Waste” is waste that does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact, in a way likely to give rise to environmental pollution or harm to human health. The total leachability and pollutant content of the waste and the ecotoxicity of the leachate must be insignificant, and in particular not endanger the quality of surface water and/or groundwater.

“Non-hazardous waste” is waste which does not feature on the list of hazardous waste in the European Waste Catalogue (EWC) 2002.

Identification and Classification of Waste

Waste materials will be classified by reference to a six-digit code and associated description as required by the List of Wastes (England) Regulations 2005 (LoWR). Waste can be solid, liquid or sludge. Entries in the LoWR that are not marked with an asterisk (*) are “non hazardous” waste.

Entries in the LoWR that are marked with an asterisk could be classified as “hazardous” waste e.g. 17 06 05* construction materials containing asbestos. Hazardous waste can be listed as either an “absolute entry” or a “mirror entry”. An “absolute entry” is automatically considered to be hazardous waste. These entries are marked by an asterisk in the LoWR, but do not include a reference to “dangerous substances” in the description. A “mirror entry” may be hazardous depending on the concentration of “dangerous substances” present in the waste. In this case the hazardous properties of the waste must be assessed in accordance with the Environment Agency Technical Guidance Note WM2, “Hazardous waste: Interpretation of the definition and classification of hazardous waste”.

This assessment may require reference to chemical analysis, manufacturer's Material Safety Data Sheets (MSDS) or the Approved Supply List (ASL). An assessment of waste types, quantities, classification, storage and disposal options have been carried out and will be updated at each review of the SWMP. Waste produced during the project will be listed under the SWMP Template Stage 6.

Definition of Waste: Development Industry Code of Practice

In September 2008, Contaminated Land: Applications in Real Environments (CL:AIRE) published the Definition of Waste: Development Industry Code of Practice, which sets out good practice in dealing with excavated materials and their reuse. This Code of Practice signals a move from prescriptive waste management regulations to a risk-based approach. Developers can self regulate when reusing surplus soil, speeding up site preparation and reducing the amount of soils sent to landfill.

The following are outside the scope of the Code of Practice:

- Excavated infrastructure material such as pipework and storage tanks;
- Waste classification;
- Pre-treatment prior to landfill;
- Testing strategies;
- Remediation and construction methods;
- Waste Management Licensing and exemptions;
- Environmental Permitting (England and Wales) Regulations 2007 and consequent Amendment No.2 2009; and
- The status of unexcavated wastes subject to in-situ treatment.

This Code requires a significant degree of self regulation and relies upon the professional integrity of those involved. This Code of Practice introduced the principle of a Qualified Person to sign off a Declaration. This will be used by the Environment Agency officers in their decision-making relating to the applicability of waste legislation such as the need to obtain an Environmental Permit or Exemption.

This document may also be of assistance in preparing SWMP's for construction projects.

Waste Framework Directive

The revised EU Waste Framework Directive was adopted and published in the Official Journal of the European Union in November 2008 (L312/3) as Directive 2008/98/EC.

The Directive has established a framework for the management of waste across the EU and aims to encourage reuse and recycling of waste, as well as simplifying current legislation. It also defines certain terms, such as 'waste', 'recovery' and 'disposal', to ensure that a uniform approach is taken across the EU. Furthermore, it is an instrument for driving waste up the hierarchy through waste minimisation and increased levels of recycling and recovery. Sets out a number of procedures and criteria for construction, excavation and operational waste acceptance at landfills, including targets for the progressive reduction of biodegradable municipal waste (BMW) being sent for disposal in landfill.

The principles set up for the acceptance of hazardous and non-hazardous waste at relevant landfills include ensuring that the waste will not endanger human health and the

environment and satisfies the Waste Acceptance Criteria (WAC). They also set strict requirements for the acceptance of certain stable, non-reactive hazardous waste into non-hazardous waste landfills.

The Directive ensures that a uniform approach is taken across the EU. It requires Member States to:

- Give priority to waste prevention and encourage reuse and recovery of waste;
- Ensure that waste is recovered or disposed of without endangering human health and without using processes which could harm the environment;
- Prohibit the uncontrolled disposal of waste, ensure that waste management activities are permitted (unless specifically exempt);
- Establish an integrated and adequate network of disposal installations;
- Prepare waste management plans;
- Ensure that the cost of disposal is borne by the waste holder in accordance with the polluter pays principle; and
- Ensure that waste carriers are registered.

The Site Waste Management Plans Regulations 2008

The SWMPs Regulations came into force on 6th April 2008. These Regulations do not apply in relation to projects planned prior to this date, but must be enforced where the construction began before 1st July 2008.

The Regulations require any client who intends to carry out a construction project with an estimated cost greater than £300,000 (excluding VAT), must prepare a SWMP conforming to these Regulations before construction work begins. There are additional requirements imposed on projects greater than £500,000 in value in relation to updating the SWMP.

If such a project is started without a SWMP, the client and the principal contractor are both guilty of an offence and will subsequently be penalised.

A SWMP records the type of waste produced on a construction site and how it will be reused, recycled or disposed of. The Regulations aim to:

- Increase the amount of construction waste that is recovered, reused and recycled to improve materials resource efficiency; and
- Prevent illegal waste activity by requiring that waste is disposed of appropriately, in accordance with the Waste Duty of Care provisions.

Fines

The Environment Agency and local government or council enforcement officers will enforce the SWMP Regulations.

A person found guilty of an offence is liable on summary conviction to a fine not exceeding £50k or on indictment to an unlimited fine. Where a corporate body is guilty of an offence, individual liability also applies to directors, managers and other persons acting in a similar capacity.

The enforcement body may also issue a £300 fixed penalty notice if any person fails to produce a SWMP or any other record when required to do so by an Enforcement Officer. A fixed penalty notice will mostly be issued to the site representative, e.g. Site Manager.

Duty of Care

The Duty of Care is set out in section 34 (1) of the Environmental Protection Act 1990 and imposes a duty on any person who is the holder of controlled waste. Any persons who import, produce, carry, keep, treat or dispose of controlled waste, or as a broker has control of such waste, is subject to a Duty of Care whereby they must take all reasonable applicable measures:

- To prevent another person illegally treating, keeping, depositing or otherwise disposing of the waste;
- To prevent the escape of waste; and
- To ensure that transfer of the waste only occurs to an “authorised person” and that the transfer is accompanied by a written description of the waste.

“*Waste Management, the Duty of Care, A Code of Practice*” DEFRA gives guidance on the measures that need to be taken to ensure that legal requirements are met. Specific guidance is given on the identification of waste, safe storage, transfer to the right person and requirements for checking up.

These Regulations impose requirements under section 34 (5) of the 1990 Act on any person who is subject to the Duty of Care as respect to the making and retention of documents and copies of them. Breach of these Regulations is a criminal offence. The Duty of Care and these Regulations do not apply to an occupier of domestic property.

The Regulations have been amended by the Environmental Permitting (England and Wales) Regulations 2007 and 2010 to introduce the new environmental permitting terminology. DEFRA is working on amendments to the Duty of Care regime, with new Regulations expected for late 2010.

Waste Transfer Note (WTN)

The Environmental Protection (Duty of Care) Regulations 1991 require a Waste Transfer Note (WTN) to be provided on the transfer of waste between parties. The WTN will contain enough information about the waste to enable anyone coming into contact with it to handle it safely and either dispose of it or allow it to be recovered whilst maintaining compliance with law. Copies of WTNs must be retained for 2 years minimum and be available for inspection by the environmental regulator following the transfer of waste. The Regulations give specific requirements for the content of a WTN, which must:

- Contain a written description of the waste and the corresponding 6 digit EWC / LOW reference code;
- State the quantity of waste;
- State whether the waste is loose or in a container, and if in a container, the type of container used;
- State the time and place of the transfer;
- State the name and address of the transferor and transferee;
- State whether the transferor is the producer of the waste;

- State to which category of person the waste is transferred to e.g. a registered waste carrier, or a holder of a waste management licence; and
- Provide details of any waste carrier's registration or any waste management licence, where used.

WTN will help prove that your Duty of Care has been properly discharged if a periodic audit is undertaken. This will help ensure that wastes are being handled correctly.

Waste Carrier's Registration (WCR)

The Control of Pollution (Amendment) Act 1989 establishes the requirement for carriers of controlled waste to register with the Environment Agency. There are a number of exceptions to these requirements, including charities, waste collection authorities and emergency situations.

Waste will only be removed from site using a subcontractor or supplier holding a valid WCR. The Environmental Manager will verify the details on the WCR with the Environment Agency Public Register.

Environmental Permitting

The Environmental Permitting (EP) (England and Wales) Regulations 2010 extend the permitting regime introduced in 2008 (which provided a unified system for permitting waste operations, mining waste operations, mobile plant and installations) to include water discharge consents, groundwater permits and radioactive substances regulations. The new Regulations also introduce the new waste exemptions regime which was consulted upon in 2008 and 2009.

The Environmental Permitting regime aims to protect the environment while simplifying the regulatory system and minimising the administrative burden on the regulators and the operators of the facilities regulated under the regime. The Regulations transpose the provisions of 18 European Directives regulating emissions to air, water and soil; waste management and management of specific substances.

The EP Regulations set out:

- which facilities need an environmental permit ("regulated facilities") or need to be registered as exempt;
- how to apply for, change, extend and surrender a permit and register an exemption;
- how the environmental protection requirements set out by European Directives and national policy are implemented within the conditions of the permits;
- a streamlined permitting system which uses standard rules;
- powers and functions of the regulators, the Secretary of State and the Welsh Assembly Government;
- transition to the new regime; and
- provisions for appeals against permitting decisions.

The 2010 EP Regulations change slightly the definition of regulated facility, i.e. a facility which is required to operate under the authority of a permit. The definition is quite complex and there is guidance available from the Environment Agency (Regulatory Guidance Note RGN EPR 2) to help operators understand:

- whether their activity/operation is a regulated facility;
- which type it is (e.g. an installation, a waste operation, a mining waste operation, a mobile plant etc.);
- how it is defined (i.e. which activities are part of the regulated facility) etc.

The most important change introduced by the 2010 EP Regulations is that regulated facilities can overlap. Hence, even if a waste operation is part of a regulated facility such as an installation, it will be itself a regulated facility. In other words, the waste operation will still require a permit whether stand alone or part of another regulated facility. The only exception to that is if the waste operation is exempt or excluded. However, the Regulators can adopt a common sense approach and, under certain conditions, group together regulated facilities under a single permit.

The Environmental Permitting (England and Wales) Regulations 2010 also introduce the new exemption regime. This regime, which had been consulted upon in 2008 and 2009, rationalises how waste operations are regulated on the basis of their risk. Many changes have been introduced, with the result that many more activities previously exempt are now regulated through a permit, and that many activities regulated under the Agency's Low Risk Waste regulatory approach are now exempt or require a permit. Provisions are in place to facilitate the transition to the new regime. The Waste Management Regulations (WMR) Stage by Stage Tool provides details of the new permitting and exemption system while highlighting the changes for each operation.

The Waste Champion is responsible for identifying activities and ensuring notification to the Environment Agency. The Environmental Manager will verify that permits are valid using the Environment Agency Public Register.

Hazardous Waste Regulations

The Hazardous Waste (England and Wales) Regulations 2005 (HWR 2005) were amended on 6 April 2009. This principally widened the scope of the exemption from hazardous waste producer registration with the Environment Agency.

These changes currently only affect England. The Welsh Assembly Government is consulting on changes to the Hazardous Waste (Wales) Regulations 2005 which can be found on the Welsh Assembly Government website. This new exemption criterion will be applied to customers in Wales pending the outcome of the consultation.

Under the Hazardous Waste Regulations 2005, *"it is an offence to produce hazardous waste at premises, or remove that waste from premises, unless those premises are either registered with the Environment Agency or are exempt."*

Where subcontractors produce hazardous waste, it will be removed under the Hazardous Waste Premises Registration for that site.

Hazardous Waste Consignment Notes (HWCN)

The Hazardous Waste (England and Wales) Regulations 2005 require a Hazardous Waste Consignment Note (HWCN) to be produced for each consignment of hazardous waste removed from site. This may take the form of either:

- A "Standard Procedure" (single movement) HWCN, where waste is moved from one premises to a Consignee in a single journey; or

- A “Multiple Collection” HWCN, where waste is collected from a number of premises and taken to the same Consignee.

HWCNs may be obtained from the Environment Agency or produced by the Consignor (subcontractor) or Consignee (waste disposal contractor); however they must contain all of the information required by the HWR.

Detailed guidance on the requirements for completion of HWCNs is available in “A Guide to the Hazardous Waste Regulation: Consignment Notes” HWR03 Version 2.0, Environment Agency, June 2006.

The HWR require details of consignments of hazardous waste to be maintained in a register. “A Guide to the Hazardous Waste Regulations: Record Keeping” HWR05 Version 2.0, June 2006 indicates that this duty will be met by keeping copies of HWCNs and Consignee Returns. Copies of HWCNs will be retained for 3 years.

Waste Electrical and Electronic Equipment (WEEE)

The Waste Electrical and Electronic Equipment (WEEE) Regulations 2006 apply to anyone who manufactures, imports, re-brands, distributes or sells WEEE and anyone who stores, treats, dismantles, recycles, disposes of, uses, repairs or refurbishes WEEE.

The Regulations apply to 10 categories of WEEE listed below, with a voltage of up to 1000 volts for alternating current, or up to 1500 volts for direct current.

- Large household appliances.
- Small household appliances.
- IT and telecommunications equipment.
- Consumer equipment.
- Lighting equipment.
- Electrical and electronic tools.
- Toys, leisure and sports equipment.
- Medical devices.
- Monitoring and control equipment.
- Automatic dispensers.

WEEE will be sent for recovery, recycling and/or treatment to either an Approved Authorised Treatment Facility (AATF) listed on the Environment Agency Public Register or a Producer take back / compliance scheme.

The Directive on the Landfill of Waste (Landfill Directive)

The Landfill Directive aims to improve standards of set waste to landfill across Europe, by setting specific requirements for the design, operation and aftercare of landfills, and for the types of waste that can be accepted at landfill sites.

It aims to reduce the pollution potential from landfilled waste that can impact on surface water, groundwater, soil, air and also contribute to climate change. In England and Wales the directive is applied under the Landfill (England and Wales) Regulations 2002 and must be fully implemented by July 2009.

This directive bans the landfilling of:

- a Waste which is corrosive, oxidising, highly flammable, flammable or explosive;
- b Liquid hazardous waste, infectious hospital and other chemical wastes;
- c Whole used tyres (from 2003); and
- d Shredded tyres (from 2006).

The Directive classifies landfills as hazardous, non-hazardous, or inert waste and prevents the co-disposal of hazardous and non-hazardous waste after July 2004. It also requires that waste must be pre-treated before being landfilled and that landfill gas must be collected, treated and used to produce energy. This means that if the gas cannot be used, it must be flared.

Planning Policy Statement 1 (PPS1): Delivering Sustainable Development (2005)

Whereas much of the guidance offered by PPS1 is of general or background relevance to the current proposals, the following specific points are noteworthy:

- Paragraph 3 of PPS1 identifies sustainable development as ‘the core principle underpinning planning’;
- Paragraph 20 highlights that development plan policies should take account of environmental issues, such as the mitigation of the effects of and the adaptation to climate change, the protection of the wider countryside, the potential impact of the environment on proposed developments and the management of waste in ways that protect the environment and human health, including producing less waste and using it as a resource wherever possible; and
- Paragraph 27 (x) addresses the impacts of climate change, the management of pollution, and natural hazards, the safeguarding of natural resources and the minimisation of impacts from the management and use of resources.

Planning Policy Statement: Eco towns; a supplement to PPS1 (2009)

Identifies specific criteria that a proposed Eco development must respond to; namely:

- ET19 (d) which states “developers will ensure that no construction, demolition and excavation waste is sent to landfill, except those types of waste where landfill is the least environmentally damaging option”

Plan Policy Statement 10 (PPS10): Planning for Sustainable Waste Management (July 2005)

The publication of Planning Policy Statement 10; Planning for Sustainable Waste Management (PPS10) established decision making principles to which regional planning bodies and all planning authorities should adhere when preparing planning strategies.

Paragraph 34 suggests that proposed new development should be supported by SWMPs to identify the volume and type of material to be demolished and/or excavated, opportunities for the reuse and recovery of materials and to demonstrate how off site disposal of waste will be minimised and managed.

4 SWMP Roles and Responsibilities

A2Dominion and P3Eco shall be responsible for adopting, implementing and updating the Site SWMP Template once this development obtains approval for the following key reasons:

- **Environmental Protection:** SWMPs help to manage and reduce the amount of waste produced, and therefore going to landfill. There are many other environmental benefits including: less harm to the local environment, avoiding fly tipping, reduced energy consumption and greater opportunities for reused and recycled materials.
- **Cost Saving:** Managing our material supply more efficiently will immediately cut costs. Better storage and handling of materials will reduce waste and enable better recovery. Reusing and recycling cuts disposal costs.
- **Legal Requirement:** SWMPs are a legal requirement for all projects over £300k in value in England. The SWMP Regulations 2008 is a Statutory Instrument of section 54 of the Clean Neighbourhoods and Environment Act 2005.

The SWMP Template includes a section on 'Actions' to inform all employees and subcontractors of their responsibility to support the SWMP both on and off site wherever they are required. This will ensure that A2Dominion and P3Eco meet their Duty of Care requirements and comply with the appropriate legislation and regulation. More importantly, it will encourage A2Dominion and P3Eco, including the eventual contractors to become more efficient in the use of resources, embed waste minimisation into the design and gain additional credits for BREEAM and/or Code for Sustainable Homes.

The Construction Design and Management (CDM) 2007 Regulations identify the legal duties, responsibilities and obligations of all the team members and are designed to improve health and safety and effectively plan for and manage risk on site.

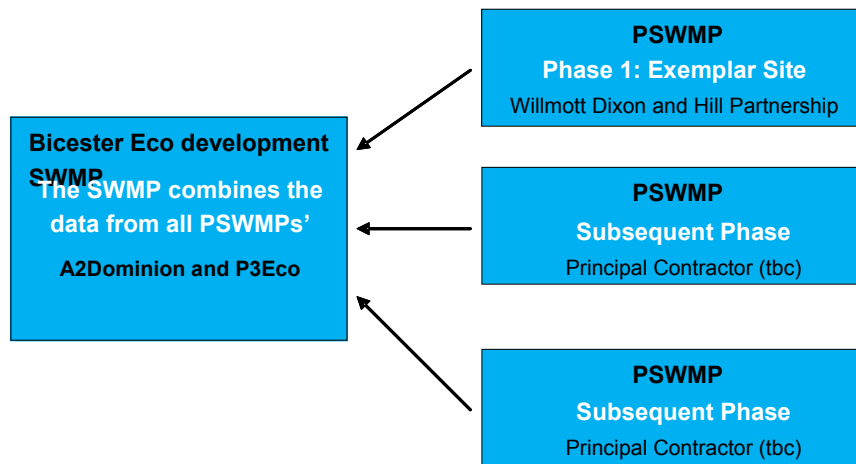
Individual Responsibilities

The key roles and associated responsibilities are summarised below:

Clients: A2Dominion and P3Eco

- appointing a principal contractor for the purposes of the SWMP Regulations;
- ensuring that the SWMPs is being implemented effectively;
- giving necessary direction to contractors e.g. setting contractual obligations;
- reviewing, revising and refining SWMPs where necessary in conjunction with the principal contractor; and
- compiling the information from the SWMPs from each phase (Exemplar Site, Energy Centre and Bicester Eco development) into the Bicester Eco development SWMP. Figure 2 demonstrates the inter-relationship between the Bicester Exo-town SWMP and the Phase Specific Waste Management Plans (PSWMP):

Figure 2 Waste Hierarchy



This combination shall provide a simple but effective system for specifying waste management, waste auditing and waste monitoring across the project and between contractors and sub-contractors. The SWMP and PSWMPs provide a consistent formula for waste management, reuse, recycling and disposal.

Principal Contractors: Willmott Dixon and Hill Partnership (on behalf of the Client)

- updating and delivering the PSWMP on behalf of the client;
- ensuring all procedures in the PSWMP are followed;
- ensuring all contractors are suitably qualified and experienced in dealing with the PSWMP and environmental issues and that the PSWMP tasks are contained within the terms of contracts to ensure understanding and accountability;
- ensuring that all legal and contractual requirements relating to the PSWMP and environment are met by ensuring adequate plans/procedures, licences and certificates are in place, and that they can be achieved;
- as a requirement of the SWMP Regulations the principal contractors shall regularly (not less than every six months) review the PSWMP to ensure that it accurately reflects the progress of the project and update where necessary;
- within three months of work being completed, the principal contractors must confirm that the PSWMP has been monitored (and updated) on a regular basis throughout the project; compare the actual waste quantities against the forecasted quantities of each waste type; and provide an explanation of any deviation from the plan;
- record in the PSWMP any cost savings realised through the implementation of the actions detailed in the PSWMP;
- establish procedures for the regular review and recording of the quality of the works as part of its Quality Management System; and
- maintain records relevant to the SWMP.

Contractors / Subcontractors

- will be responsible for carrying out the waste management tasks detailed in the PSWMP.

5 SWMP Distribution

The Project Pre-construction Team should prepare the PSWMP before the project starts, with attention drawn to any suggested actions for waste prevention. When the project starts, the PSWMP should be passed to the Project Team as part of the Project Handover Procedure. The Project Team is to ensure that copies of the developed PSWMP are distributed to the client, client's agent and CDM Coordinator. This shall be undertaken every time the plan is reviewed and updated. The PSWMP should also be included in all Subcontractor enquiries that are sent out by the Bicester Eco development Quantity Surveyor.

6 SWMP Implementation

6.1 Preparation and Concept Design Stage

At preparation and concept design, the Project Pre-construction Team shall be responsible for preparing the PSWMP including the completion of Stages 1 and 2 inclusive. The waste minimisation options included in Stage 2 shall help facilitate the proposed actions for the identified quantities of potential wastes recorded in Stage 3.

6.2 Detailed Design Stage and Pre-construction Stage

At detailed design stage, the Project Pre-construction Team shall be responsible for updating the PSWMP including Stages 1, 3 and 5. The Project Pre-construction Team shall also be responsible for the completion of Stages 4 and 6. The waste minimisation options included in Stage 5 shall help facilitate the proposed actions for the identified quantities of potential wastes recorded in Stage 6. The Project Pre-construction Team will include one or some of the following:

- Estimator;
- Design Coordinator; and
- Quantity Surveyor.

At pre-construction stage, the Project Pre-construction Team shall be responsible for updating the PSWMP including Stage 4.

6.3 Construction Stage

After the award of a contract, the PSWMP is to be fully developed, implemented, monitored and reviewed by the Project Team as follows:

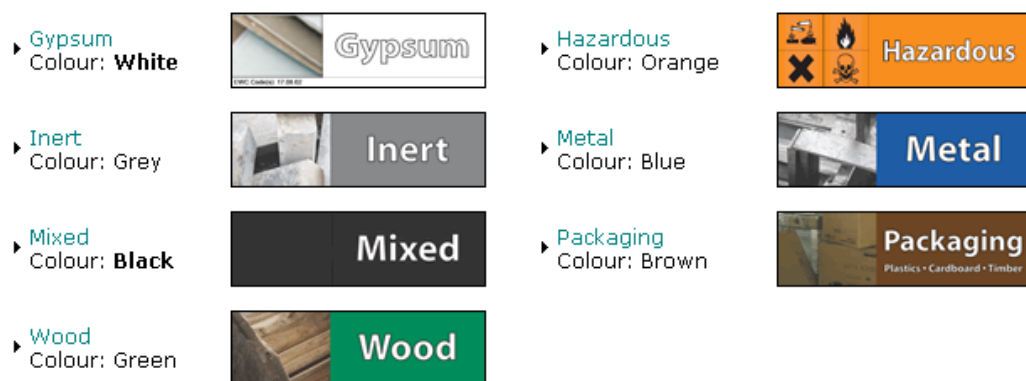
- review the PSWMP;
- identify further waste prevention actions;
- complete details of any further waste types which occur and actual waste prevention actions;
- make the PSWMP accessible to all relevant contractors and subcontractors;
- complete details of waste segregation arrangements during the project;
- provide instruction & training as necessary;
- carry out regular reviews of the PSWMP and record findings;
- carry out a final review and describe lessons learnt from any differences between the PSWMP and actual PSWMP performance within 1 month of the project completion;
- a comparison of the forecasted and actual quantities for each waste type within the PSWMP;
- an estimate of the cost saving achieved for the PSWMP; and
- confirm that the plan has been monitored on a regular basis to ensure that work is progressing according to the plan and that the plan was updated in accordance with the SWMP Regulations (2008).

Waste Segregation

Contractors shall introduce appropriate systems for the collection, sorting and processing of waste materials on site including metal, timber, aggregates and a range of hard and inert materials that are to be won for beneficial reuse on site. Systems shall be emplaced to manage hazardous materials including contaminated materials, hazardous materials and any remediation concentrates. This shall include an audit of all wastes and resources that leave the site or are beneficially reused on site using a common auditing tool. These activities shall be fully compliant with current legislation and regulation.

Where space permits, a specific area will be laid out and labelled to facilitate the separation of materials for potential recycling, reuse and return. Recycling and waste bins are to be kept clean and clearly marked in order to avoid contamination of materials. The labelling systems for Waste Management & Recycling shall follow the Waste Awareness Colour Coding Scheme.

Figure 3 Waste Awareness Colour Coding Scheme



If the skips are clearly identified, the bulk of the workforce will deposit the correct materials into the correct skip. Skips for segregation of waste currently include:

- Hazardous waste;
- Inert Waste;
- Wood waste;
- Gypsum waste;
- Metal waste;
- Paper waste;
- Plastic waste;
- General waste;
- Insulation waste; and
- Canteen / Office waste.

As works progress and other trades come to site, the skips should be placed to enable the original waste types to be removed from site with ease.

Instruction and Training

A2Dominion and P3Eco, or the Principal Contractor on their behalf, will provide onsite instruction of the appropriate separation, handling, recycling, reuse and return methods to be used by all parties, at all stages of the project. The SWMP shall also be outlined in the site induction process and individual responsible person (Waste Champion) shall be chosen to champion the auditing and monitoring.

CIRIA C650 Toolbox talks shall be carried out in the site induction classes to inform contractors and sub-contractors in how they should be involved with the waste, reuse and recycling requirements of the project. These toolbox talks and other workshops shall be prepared to empower responsible persons and subcontractors to promote and encourage the buy-in of waste minimisation, waste segregation and appropriate waste management across the Bicester Eco development.

Data Collection

The Waste Champion shall support the contractors and subcontractors to collect and enter data into their PSWMP and act as the point of contact for all enquiries. Instruction shall be given on how to assess waste volumes or tonnage and how to upload data to the SWMP. A paper-based system for recording data can also be used, but needs to be uploaded to the PSWMPs on a regular basis – preferably every week. Responsible persons shall also be asked to adopt a standardised coding system for their individual waste entries and the associated waste transfer notes (WTN) codes. All WTN shall be kept as a hard-copy on site.

PSWMP Monitoring

All waste collected from site by A2Dominion, P3Eco and / or Principal Contractor employed waste carrier(s) must be recorded and monitored on the Waste Destination Sheet. The waste carrier(s) will provide Waste Transfer Notes on collection of the waste, and in due course, provide records of the quantities of waste recycled or sent to landfill. This procedure will apply whether the waste has been 'pre-treated' (sorted into separate waste streams); or sent 'untreated' as general mixed waste. The preference should always be to pre-treat waste, as this is generally a cheaper alternative to sending away untreated waste.

However, if 'untreated' general mixed waste is sent for separation into the different waste streams at the waste transfer station, the waste management contractor carrying out this operation must be required to provide records of the quantities of each waste stream to allow tracking on the PSWMP Waste Destination Sheet.

The legal requirements for waste monitoring and auditing include the need for appropriate use of waste transfer notes, waste consignment notes and waste acceptance criteria. These are all defined in the Landfill Directive and briefly referenced in the Environment Agency Regulatory Guidance Note 14. However the system is not automated, can include a variety of formats and will be difficult to relate to targets, performance and continual improvement. The system does not account for materials that are reclaimed or recovered for reuse and recycling, and do not include indicators e.g. KPIs and EPIs. A more versatile system is required to compliment the legal requirements of the waste transfer notes, waste consignment notes and waste acceptance criteria. The Waste Champion shall identify a waste auditing tool to assist the delivery of the PSWMP.

Skips shall be monitored to ensure that there is no contamination of the separate waste streams. The waste segregation arrangements must be clearly identified on each container and regularly reinforced to personnel through tool-box talks. The type of surplus materials being produced must be regularly reviewed so that the site set-up can be changed to maximise reuse or recycling of waste. Subcontractors producing waste from their works should fill in the Actual

Waste Movements Sheet detailing any waste materials removed from site by their own waste management contractor(s). These waste management contractor(s) must also provide Waste Transfer Notes on collection of the waste and provide records of the quantities of waste recycled or sent to landfill.

The beneficial use of recycled aggregates and won materials from on site and off site , including on site crushing of stone, tile, brick mortar and concrete, shall be monitored. The WRAP Quality Protocol shall be used by contractors and subcontractors to verify the suitability of the recycled aggregates for use on site or off site. This is a standard protocol being adopted on numerous projects across UK with a proven level of success. The Quality Protocol shall also act as a benchmark to gauge the utilisation of the materials into higher grade applications on site. For example, the use of crushed concrete and crushed bricks and stone into foundations, concrete slabs and structural concrete as well as sub-base layers and piling mats.

The Actual Waste Movements Sheet should also be used to record a running total of the waste removed from the relevant phase of the Project. The PSWMP will be reviewed during the monthly meetings with subcontractors and will be included in the Monthly Progress Reports to A2Dominion and P3Eco.

Office/Welfare waste shall be sorted into a separate container, typically an 1100L Eurobin. Sites may also be able to take advantage of the Local Authority's recycling scheme by obtaining separate bins for recyclable waste for regular collection by the LA.

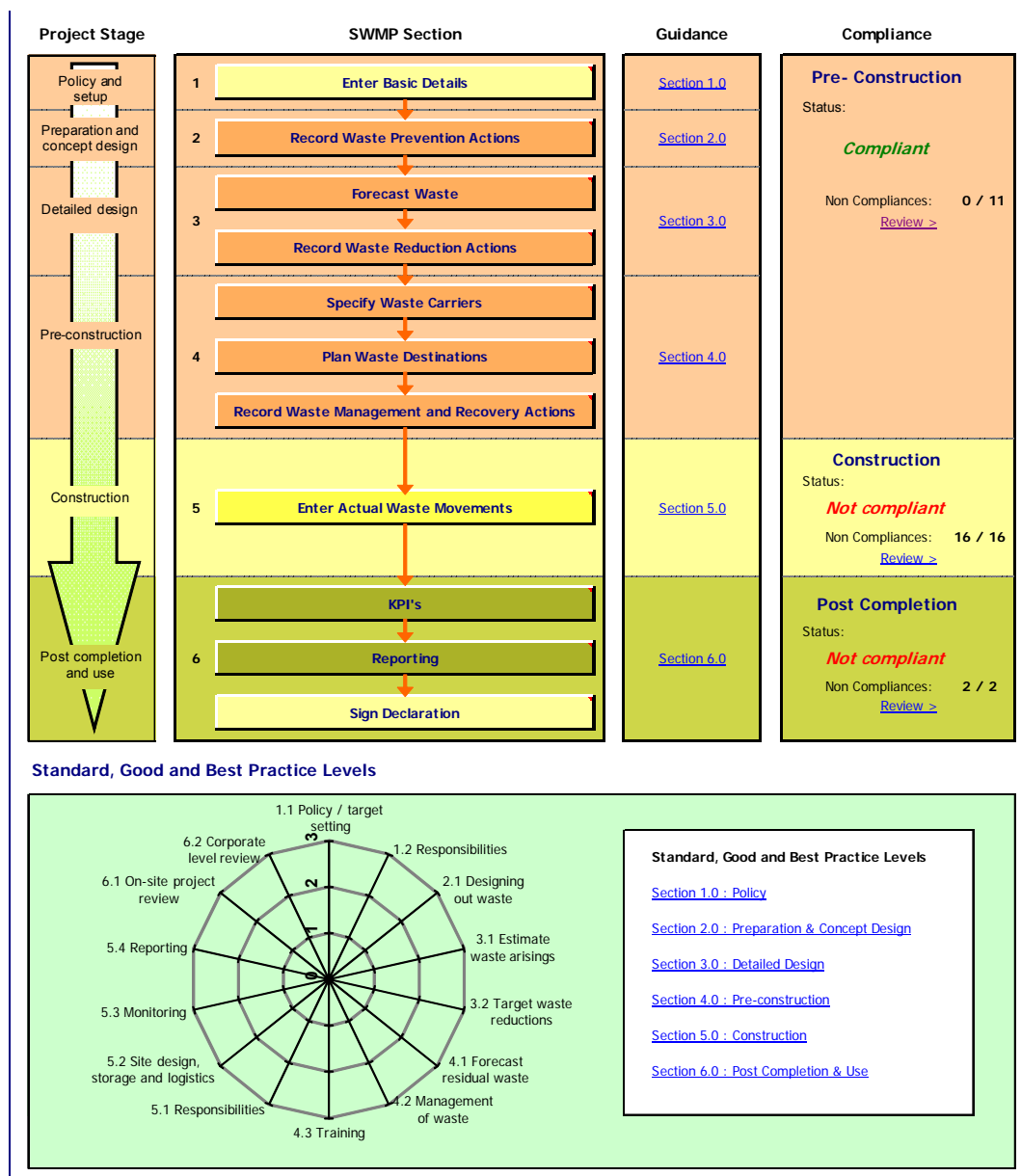
7 PSMWP Template for Bicester Eco development Exemplar Site

The Bicester Eco development Exemplar PSWMP Template (Appendix A) is an excel based SWMP Template that provides a focal point to collect waste data from construction-related activities on site. It also demonstrates that A2Dominion, P3Eco are committed to continuous improvement of waste management practices, to reduce the amount of waste going to landfill and to increase the extent of reuse and recycling.

7.1 PSWMP Template: Homepage

The SWMP Template Homepage (Figure 4) functions as the main navigation page and has three main interactive areas: SWMP Section, guidance (Standard Good and Best Practice Matrix); and compliance.

Figure 4 Bicester Eco development Exemplar SWMP Homepage Flowchart



7.1.1 Homepage: PSWMP Template Section

The flowchart shown in Figure 4 links the Bicester Eco development Exemplar PSWMP Template Sections and allows the Project Pre-start Team and the Project Team to navigate to all worksheets in the PSWMP Template. The buttons link to the respective areas in the PSWMP Template. A list of the PSWMP Template Sections is given in Table 1.

Table 1 Bicester Eco development Exemplar SWMP Template Sections

Stage	Section
	PSWMP Template Homepage, SGBP Levels, Compliance and Help
1	PSWMP Template Basic Project / Package Details
2	PSWMP Template Waste Prevention Actions
3	PSWMP Template Waste Reduction Actions
3	PSWMP Template Waste Forecast
4	PSWMP Template Waste Carriers
	PSWMP Template Waste Destinations and Waste Management and Recovery
5	PSWMP Template Actual Waste Movements
	PSWMP Template KPIs
	PSWMP Template Reporting

The project stage identifies the suggested stage in the Bicester Eco development Exemplar Site when the PSWMP Template Section should be completed. A2Dominion, P3Eco must, from a very early stage, look at how the waste produced can be minimised and thereby reduce the amount of waste that has to be removed from the project. The Project Teams, including the Project Pre-construction Team, Design Team, Construction Team, Suppliers and Subcontractors shall be encouraged to look at ways to minimise the amount of waste produced at the work face.

The project stages for defining and implementing the PSWMP Template are as follows:






- 1 Complete and update where necessary the PSWMP Template Basic Package Details Sheet (Stage 1);
- 7 Complete and update where necessary the PSWMP Template Waste Prevention Actions Sheet (Stage 2);
- 8 Complete and update where necessary the PSWMP Template Waste Reduction Actions and Waste Forecast Sheets (Stage 3);
- 9 Complete and update where necessary the PSWMP Template Waste Carriers, Waste Destinations and Waste Management and Recovery Sheets (Stage 4);
- 10 Complete and update where necessary the PSWMP Template Actual Waste Movements Sheet (Stage 5); and

- 11 Review the PSWMP Template KPIs and Reporting Sheets and sign the declaration at the end of your project (Stage 6).

Sheet Colour Key

The following colour codes are used to distinguish between the separate worksheets used in the Bicester Eco development Exemplar PSWMP Template; those that are to be used for general information, and those that are to be used for data entry.

Table 2 Sheet Colour Key

	PSWMP Template Informative Sheets
	PSWMP Template Data Entry Sheets (policy, setup stages and post completion stages)
	PSWMP Template Data Entry Sheets (preparation, conceptual design and pre-construction stages)
	PSWMP Template Data Entry Sheets (construction stage)
	PSWMP Template Data Entry Sheets (post completion and use stages)

The following colour codes are used to distinguish between the cells used in the Bicester Eco development Exemplar SWMP Template; those that are to be used for data entry, and those that are reference cells and will be populated automatically.

	PSWMP Template Data Entry Cells
	PSWMP Template Reference Cells

7.1.2 Homepage: Guidance Standard, Good and Best Practice

There are two Standard, Good and Best Practice areas on the homepage:

- **Guidance:** Links to the relevant section of the Standard Good and Best Practice Guidance Sheet. This sheet advises on what Standard, Good and Best Practice opportunities are available at each project stage. The Project Pre-construction Team has selected the performance level for each of the items listed.
- **Standard Good and Best Practice Levels:** This section shows Standard, Good and Best Practice performance based on the selections made in the Guidance sheet. The spider diagram represents the practice level where 0 is none, 1 is Standard Practice, 2 is Good Practice and 3 is Best Practice. The Bicester Eco development Exemplar Site Project Pre-construction Team has selected the Best Practice level.

7.1.3 Homepage: Compliance

This section of the homepage summarises the Bicester Eco development Exemplar PSWMP performance against the SWMP Regulations (2008) based on the information that the Project Pre-construction Team and Project Team have entered into the PSWMP Template. Figure 5 below shows the Bicester Eco development Exemplar Site compliance at concept stage.

Figure 5 Bicester Eco development Exemplar Site Compliance at Concept Stage

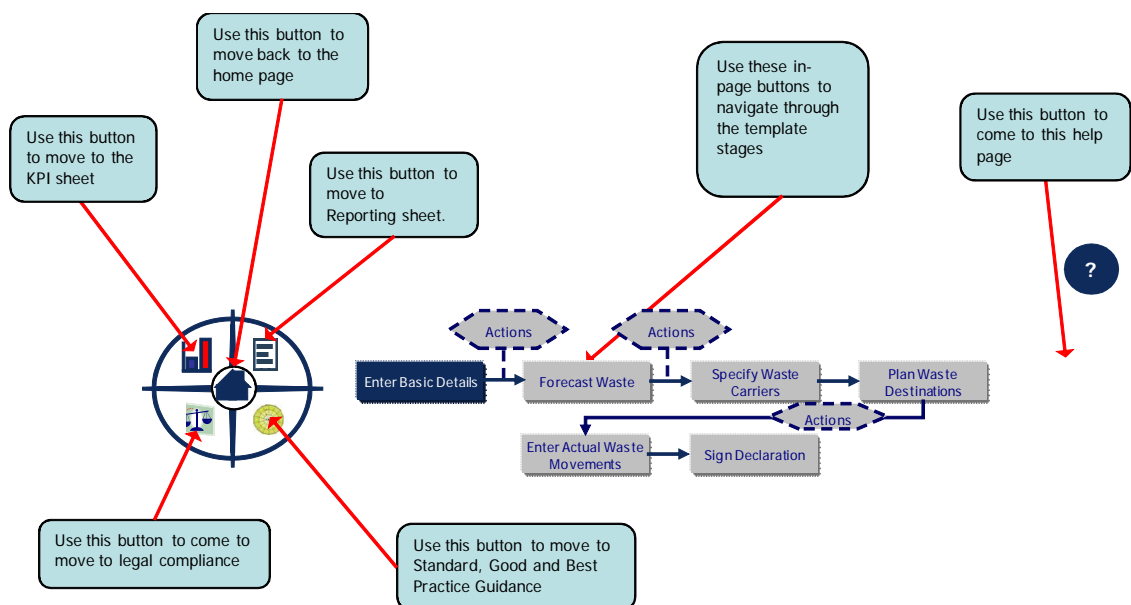
Pre-Construction	Compliance	
	Client identified	Yes
	Principal contractor identified	Yes
	Draftee identified	Yes
	Compliance	
	Location of site defined	Yes
	Cost of project estimated	Yes
	Compliance	
	Decisions taken before SWMP completed have been recorded	Yes
	Compliance	
	All waste types identified and quantities estimated	Yes
		Yes
	Waste management actions identified	Yes
	Compliance	
	All waste from site is dealt with in accordance with relevant guidelines	Yes
	Materials handling identified	Yes

Regulatory compliance is shown against project stages – as there are different requirements depending on the stage of the project. If the Project Pre-start Team or the Project Team have not satisfied any part of the regulatory requirements, follow the links from the Homepage to the Template ‘Compliance’ sheet. The Compliance sheet allows the review of the regulations in England and the Bicester Eco development Exemplar Site performance against them.

7.1.4 Homepage: Help

The help sheet provides information on how to navigate and complete the PSWMP Template. This includes information such as how to use the navigation bar as shown in Figure 6.

Figure 6 Explanation of the navigation bar found in the help sheet



7.2 PSWMP Template: Project Basic Details Sheet

The Basic Project Details has been completed by the Project Pre-construction Team in order that all the key project information, including any targets and metrics for measurement and KPIs have been included.

Figure 7 Bicester Eco development Exemplar Site Basic Details Sheet

Basic Details		
Client name :	A2 Dominion, P3Eco	
Principal contractor :	Willmott Dixon and Hill Partnership	
Owner of document :	Hyder Consulting	
Project title :	Bicester Eco-town Exemplar Site	
Project Reference :	Exemplar Site	
Project location :	Bicester	
Project postcode :	OX27 8TG	
Construction value :	£65,000,000.00	
Type of construction :	Mixed use developments	
Activity :	New construction	

Metrics		
Please select metrics applicable to your project. These metrics are then used in the KPI sheet to track your progress.		
Metric	Amount	Unit
Footprint (m2) of site	211,245	m2
Gross Internal Floor Area	1,280	m2

Project targets		
Please select project targets applicable to your project		
Target	Amount	Unit
Waste to landfill	0	t
Recycled content	20	%

Schedule		
Start date :	31/09/2011	dd/mm/yy
Completion date :		dd/mm/yy

7.3 PSWMP Template: Waste Actions Sheet

The Waste Prevention, Reduction and Management and Recovery Actions are to be identified and recorded at a different stages through-out the project. The Project Pre-construction Team has recorded the following decisions that were taken before the PSWMP was drafted to satisfy the SWMP Regulations (2008):

- design with modulatation in mind;
- maximise reuse of reclaimable materials on site. Avoid disposal of reusable materials and building elements, i.e. York brick and retained lintels;
- put in place pod units for all bathrooms and toilets within main development;
- Use recycle aggregates (either onsite or off site) in concrete mix, as fill, etc.;
- retain top soil, treat it onsite with compost (or other remediation) and use for soft landscaping, etc.;
- use existing soft landscape that can't be retained (trees, shrubs) as compost and soft landscape top mulch;
- reuse packaging by returning to supplier/manufacturer or using it for other purposes (e.g. Timber packaging pallets can be chipped and used for landscaping top mulch);
- put in place Materials Logistic Plan looking at supply routes, handling, storage and security for main construcion phase of the project;
- Supplier take back schemes to be set up with all pre-fabricated pods;
- setup an off cut area for plasterboard, all plasterboard to be sent to specific plasterboard recycling centre; and
- setup area for segregated skips with clear signage.

Figure 8 Screenshot of the Bicester Eco development Exemplar Site Waste Actions Sheet

Number	Type of Waste Action	Action Taken	Action owner	Reference to project document /	Waste stream	Material type	Estimated Cost Saving	Waste reduced	Date for completion (dd/mm/yyyy)	Status
								(m³) (tonnes)		
1	Waste Reduction Action	Retain top soil, treat it onsite with compost (or other remediation) and use for soft landscaping, etc.	Willmott Dixon and Hill Partnership		Inert - Soil & stones	soil and stones other than those mentioned in 17 05 03				Incomplete
2	Waste Reduction Action	Use existing soft landscape that can't be retained (trees, shrubs) as compost and soft landscape top mulch	Willmott Dixon and Hill Partnership		Wood	wood				Incomplete
3	Waste Prevention Action	Use recycle aggregates (either onsite or off site) in concrete mix, as fill, etc.	Willmott Dixon and Hill Partnership		Inert - mixture of concrete, bricks, tiles etc.	mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06				Incomplete
4	Waste Reduction Action	Reuse packaging by returning to supplier/manufacturer or using it for other purposes (e.g. Timber packaging pallets can be chipped and used for landscaping top mulch)	Willmott Dixon and Hill Partnership		Packaging	mixed packaging				Incomplete
5	Waste Reduction Action	Design with modulatation in mind								Incomplete
6										
7										
8										
9										
10										
11										

The Project Pre-construction Team shall also record any actions taken during the detailed design or pre-construction stages. The action type is colour coded so they can be easily identified and relate to the project stage. A sort function is available at the top of each column to create tailor action list by type, owner, date for completion, etc. To complete the Waste Actions Sheet the Project Pre-construction Team shall follow the steps outlined in Table 4.

Table 4 How to complete Waste Actions Sheet

Column	What the Project Pre-construction Team and Project Team need to record
Number	Use for reference only
Waste action	Select 'Waste Prevention Action, 'Waste Reduction Action' or 'Waste Management and Recovery Action' from the drop down list.
Action taken	Type in a description of the action identified.
Action owner	Type in name of person responsible for this action.
Reference to document drawing	Type in reference for use as an audit trail.
Waste stream	Select using drop down menu.
Materials type	Select using drop down menu.
Estimated cost saving	Type in any cost saving resulting from this action.
Waste reduced (tonnes)	Type in the reduction in waste that this measure will have.
Date of completion	Type in date in dd/mm/yyyy format. If the date has passed then the action will turn red.
Status	Select complete or incomplete from the drop down menu.

The Project Team shall record any decisions taken during the construction stage in order to eliminate certain wastes and reduce waste to landfill. To complete the Waste Actions Sheet the Project Team shall also follow the steps outlined in Table 4. Decisions that shall be recorded are on the nature of:

- project construction method and materials employed in order to minimise the quantity of waste produced on site;
- waste reduction actions included in the waste forecast; and
- decisions that the Project Team plan to take that relate to onsite waste management and recovery of waste e.g. establishing a plasterboard take back scheme with the Bicester Eco development suppliers.

7.4 PSWMP Template: Forecast Waste Sheet

The PSWMP Template Forecast Waste Sheet has been used by the Project Pre-construction Team before the project started to forecast the waste arisings from the Bicester Eco development Exemplar Site.

Table 5 Forecasted waste by material type in tonnes

Construction Type	Gypsum (17 08 02)	Metals	Wood	Packaging	Inert - mixture of concrete, bricks, tiles etc.	Mixed Hazardous - C&D waste (17 09 03*)	Mixed C&D waste (17 09 04)	Segregated Haz Waste	Other C&D segregated waste				
									Canteen/ Office/ ad-hoc	Electrical Equipment	Furniture	Insulation	Plastics
Residential Units	233	93	229	216	1676	19	591	17	591	50	28	359	349
Primary School	3	3	7	3	12	0	20	0	20	2	0	4	4
Eco-Pub	1	3	3	1	10	1	5	0	5	1	0	2	2
Eco-Business Centre	5	5	11	6	11	0	16	0	16	2	1	9	5
Energy Centre	4	2	3	2	6	0	4	0	4	0	0	3	2
Multi faith centre - Community Centre	11	3	1	2	0	0	0	0	0	2	1	6	1
Convenience Store	2	4	4	2	15	1	7	0	7	1	0	2	3
Hairdresser	0	1	1	0	2	0	1	0	1	0	0	0	0
Visitor Centre / Tea-room	1	2	2	1	6	0	3	0	3	0	0	1	1
Nursery	1	1	2	1	4	0	6	0	6	1	0	1	1
Office	1	1	3	2	3	0	4	0	4	1	0	2	1
TOTAL	263	117	266	236	1745	22	658	17	658	59	31	390	370

Table 6 Forecasted waste by construction type

Construction Type	Average waste (m ³ /100m ²)	Development size (m ²)	Forecasted waste arising (m ³)	Forecasted waste arising (tonnes)*
Residential Units	15.28	38,369	5,862	8,794
Primary School	13.30	757	101	151
Eco-Pub 15.32		350	54	80
Eco-Business Centre	20.14	930	187	281
Energy Centre	20.06	400	80	120
Multi faith centre - Community Centre	13.76	455	63	94
Convenience Store	15.32	510	78	117
Hairdresser 15.32		77	12	18
Visitor Centre / Tea-room	15.32	220	34	51
Nursery 13.30		240	32	48
Office	20.14	250	50	76

* Based on 1.5 tonnes per cubic metre

Figure 9 Screenshot of the Bicester Eco development Exemplar Site Forecast Waste Sheet

Forecast Waste						Forecast Quantities		Calculated Quantities (Converting between m ³ and t)		Forecast provided by
C, D or E Activity	Waste Stream	Material Type	Further description of waste - optional	Suggested LOW Code	Waste or Re-Use	(m ³)	(tonnes)	(m ³)	(tonnes)	
Construction	Gypsum (17 08 02)			17 08 02	On-site re-use		263.31	797.91	263.31	Hyder Consulting
Construction	Metals			17 04 07	Off-site segregated		116.96	278.48	116.96	Hyder Consulting
Construction	Wood			17 02 01	Off-site segregated		265.76	781.65	265.76	Hyder Consulting
Construction	Packaging			15 01 06	Off-site segregated		235.77	1122.71	235.77	Hyder Consulting
Construction	Inert - mixture of concrete, bricks, tiles etc.			17 01 07	On-site recycled		1745.14	1407.37	1745.14	Hyder Consulting
Construction	Mixed Hazardous - C&D waste (17 09 03*)			17 09 03*	Off-site mixed		22.25	25.57	22.25	Hyder Consulting
Construction	Mixed C&D waste (17 09 04)			17 09 04	Off-site segregated		657.59	755.85	657.59	Hyder Consulting
Construction	Segregated Haz Waste	aqueous liquid wastes containing dangerous substances		16 10 01*	Off-site segregated		17.37	19.30	17.37	Hyder Consulting
Construction	Other C&D segregated waste	mixed municipal waste		20 03 01	Off-site segregated		158.73	755.86	158.73	Hyder Consulting
Construction	Other C&D segregated waste	discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35		20 01 36	Off-site segregated		16.96	67.84	16.96	Hyder Consulting
Construction	Other C&D segregated waste	Furniture and bulky items		20 03 07	Off-site segregated		6.45	35.83	6.45	Hyder Consulting
Construction	Other C&D segregated waste	Insulation materials other than those mentioned in 17 06 01 and 17 06 03		17 06 04	Off-site segregated		112.01	448.04	112.01	Hyder Consulting
Construction	Other C&D segregated waste	plastic		17 02 03	Off-site segregated		97.73	424.91	97.73	Hyder Consulting
Excavation	Inert - Soil & stones			17 05 04	On-site re-use		483.99	387.19	483.99	Hyder Consulting
								0.00	0.00	
								0.00	0.00	
								0.00	0.00	
								0.00	0.00	

The Project Pre-construction Team shall update the Forecast Waste Sheet at detailed design stage as set out in Table 5.

Table 7 How to complete Forecast Waste Sheet

Section	What the Project Pre-construction Team need to record
Construction, Demolition and Excavation Activity	Select whether the waste arising comes from construction, demolition or excavation activity. The information entered here is pulled through to 'Plan Waste Destination'.
Waste Stream	Select a waste stream from the pre defined list ¹ of wastes. The selection that the Project Pre-construction Team makes here narrows down the material type options in the next column 'Material Type'.
Material Type	Select a material type after you have selected a waste stream. The list is specific to the waste stream selected.
Suggested LOW ² Code	Based on your selections in the waste stream and material type columns, the Template suggests which LOW code applies to your selection.
Waste or Re-Use	Select an option from the drop down menu. This selection must be made to meet regulatory requirements. This allows you to select whether the waste forecasted will remain on site (reused, recycled or recovered) or go off-site (segregated or mixed). Data entered here pulls through to the 'Plan Waste Destinations Sheet'.
Section	What the Project Pre-construction Team need to record
Forecast Quantities	Enter mass (tonnes) for your forecast. The SWMP Template then uses industry agreed conversion factors to convert your number from tonnes → m ³ . This number should take into account any waste reduction actions identified and should be the estimated amount of material that will be produced on site.
Calculated Quantities	This column reports your total waste forecast. Data is shown in both volume (m ³) or mass (tonnes) using industry agreed conversion factors for each material type.
Forecast Provided by	Free text entry to record which project team member provided the forecast.

¹ The list has been developed with the BRE and their SMARTWaste list of wastes – providing common reporting metrics.

² LOW stands for List of Waste code. List of Waste (LOW) Codes are the same as European Waste Catalogue (EWC). The Environment Agency refers to EWC codes as LOW codes.

7.5 PSWMP Template: Waste Carriers Sheet

The PSWMP Regulations 2008 require that all waste removed from site is undertaken by a company that is authorised to do so. The PSWMP must include details of all those companies who remove waste from site. This must include the identity of the name of the waste carriers and / or waste management facilities removing the waste, all registration numbers and a copy of (or reference to) the written description of the waste. It also must identify the sites that the waste is being taken to and whether the operators of those sites hold a permit under the Environmental Permitting (England and Wales) Regulations 2007 or are registered under those Regulations as a waste operation exempt from the need for such permit.

The PSWMP Template Waste Carriers Sheet shall be used at detailed design by the Project Pre-construction Team to identify waste management companies that may provide services to the Bicester Eco development Exemplar Site project.

Table 8 List of Waste Carriers and waste management facilities in the area

Name of company	Location	Type of facility	Type of process	Type of waste (as described by the Waste Directory)
Dial-A-Skip Waste Management Ltd	NN13 5QY	MRF	Refuse, Recycles and disposal	Building waste, Glass, Green Waste, Hazardous Waste, Non-packaging Waste, Packaging
K J Millard Ltd	OX7 5PY	MRF	Refuse, Recycles and disposal	Building waste
Cawleys MK12	5NL	MRF	Refuse, Recycles and disposal	Building waste, Glass, Green Waste, Hazardous Waste
Farthinghoe Recycling and reuse centre	NN13 6AT	MRF	Refuse, Recycles and disposal	Building waste, Glass, Green Waste, Hazardous Waste
Grundon Waste Management Ltd	OX10 6PJ	MRF and Landfill site	Refuse, Recycles and disposal	Building waste, Glass, Green Waste, Hazardous Waste, Non-packaging Waste, Packaging
D & P Cairns Ltd	HP23 4QR	MRF	Refuse, Recycles and disposal	Building waste, Glass, Green Waste, Hazardous Waste, Non-packaging Waste, Packaging
A Day Recycling Group	NN12 8AA	MRF	Refuse, Recycles and disposal	Building waste
A G Evans Ltd	HP23 6JG	Scrap Metal Merchants	Refuse, Recycles and disposal	Building waste

Name of company	Location	Type of facility	Type of process	Type of waste (as described by the Waste Directory)
Warren's Scrap Metal and Waste Disposal	NN4 8HQ	Scrap Metal Merchants	Refuse, Recycles and disposal	Building waste
Bucks Recycling Ltd	HP18 9UN	WTS	Refuse, Recycles and disposal	Glass, Green Waste, Hazardous Waste
Camiers Waste Management Ltd	HP23 4QR	WMF	Refuse, Recycles and disposal	Glass, Green Waste, Hazardous Waste, Non-packaging Waste, Packaging
G Moore Haulage Ltd	MK43 9NT	WTS	Refuse, Recycles and disposal	Glass, Green Waste, Hazardous Waste, Non-packaging Waste
Phenix Security	RG5 4SL	MRF	Refuse, Recycles and disposal	Glass, Green Waste, Hazardous Waste, Non-packaging Waste, Packaging
Alan Hadley Ltd	RG7 4AJ	Landfill site, WTS, MRF	Refuse, Recycles and disposal	Glass, Green Waste, Hazardous Waste, Non-packaging Waste, Packaging
Biffa Waste Services Ltd	OX11 7RP	Landfill site	Waste managment and Landfill sites	Building waste, Glass, Green Waste, Hazardous Waste, Non-packaging Waste, Packaging
Waste Recycling Group Ltd	OX29 5BB	Landfill site & Energy Recovery Facility, MRF	Waste managment and Landfill sites	Building waste, Glass, Green Waste, Hazardous Waste, Non-packaging Waste, Packaging
Hackett Oxford Ltd	OX29 7PL Lan	dfill site	Waste managment and Landfill sites	Building waste, Glass, Green Waste, Hazardous Waste, Non-packaging Waste, Packaging
Energy Solutions	OX11 OQJ	Landfill site	Waste managment and Landfill sites	Building waste, Glass, Green Waste, Hazardous Waste, Non-packaging Waste, Packaging

The Project Team shall update it as and when other waste carriers and / or waste management facilities are commissioned to remove waste from the Bicester Eco development Exemplar Site. The Waste Carriers Sheet shall be updated as set up in Table 8.

Table 9 How to complete the Waste Carriers Sheet

Section	What the Project Team need to record
Answering the four questions	<p>There are four questions at the top of the page that must be answered using drop down menus to select yes / no answers.</p> <p>These questions link to the Compliance page that summarises your performance against the SWMP (2008) Regulations.</p>
Waste carrier	<p>Use free text entry in this section to record the name, licence number, expiry date and date checked with the Environment Agency for every waste carrier you intend to use.</p> <p>Information entered here is pulled through into drop down menus in Template Sheet 5 'Actual Waste Movements'. This allows you to quickly match a waste carrier to a waste stream, avoiding the need for repetitive data entry.</p>
Waste management facility	<p>Use free text entry and drop down menus to record the name, type of facility, reuse/recycling/recovery rates achieved at that destination and waste licensing information for that facility.</p> <p>If you know the individual reuse/recycling/recovery rates for a facility then enter them in columns J, K and L respectively. If you only know the recovery rate for the facility as a whole, enter this percentage in column M. If you do not know recovery rates for your intended facility, leave columns J, K, L and M blank and the Template will assume a recovery rate³ for the facility entered in column H. Only complete columns R and S if a facility takes more than one waste stream with a different recovery rate or there are two facilities used for the same waste stream.</p> <p>By completing the previous fields the construction, demolition or excavation activity and the waste stream will appear in a bracket next to the facility title in the list of destinations pulled forward to the 'Waste Destinations' and 'Actual Waste Movement' sheets.</p> <p>The red boxes must be completed so that an amount, cost and recovery rate can be calculated for the waste stream. Enter the percentage of the waste stream expected to be sent to each facility in column T and the £/t in columns U and V respectively.</p>

³ These assumed rates have been developed with the UK Contractors Group

7.6 PSWMP Template: Waste Destinations Sheet

The SWMP Template Waste Destinations Sheet shall be used by the Project Pre-construction Team to match up the forecasted waste streams (entered in 'Forecast Waste') with the expected waste management facilities (entered in 'Waste Carriers') as shown in Figure 10.

Figure 10 Screenshot of the Bicester Eco development Exemplar Site Waste Destinations Sheet

Construction								
Waste sent offsite	Forecast		Proposed Destination	% Diverted from landfill	Cost of waste disposal			Comments
	Estimated Volume (m³)	Estimated (t)			£/m³	£/t	Cost Forecast	
Metals	278.48	116.96		0%			FALSE	
Wood	781.65	265.76		0%			FALSE	
Packaging	1122.71	235.77		0%			FALSE	
Mixed Hazardous - C&D waste	25.57	22.25		0%			FALSE	
Mixed C&D waste	755.85	657.59		0%			FALSE	
Segregated Haz Waste	19.30	17.37		0%			FALSE	
Other C&D segregated waste	1732.48	391.88		0%			FALSE	
	4716.05	1707.58					£0.00	

The tables in the 'Waste Destinations Sheet' are ordered by construction, demolition and excavation phase. Each table shows the materials that have been identified in the forecaster and whether the waste is being sent off-site or is being reused onsite. The Project Pre-construction Team has also selected a waste management facility from the 'Waste Carriers Sheet' for each waste stream and estimated the cost of waste disposal in £/tonne to calculate the cost of waste disposal for Bicester Eco development Exemplar Site Project.

If Bicester Eco development Exemplar Site Project has more than one facility for a particular waste stream then the Project Pre-construction Team shall follow the steps outlined in Table 10 'How to complete the Waste Carrier Sheet'. After this the Project Pre-construction Team shall select multiple destinations in the Proposed Destinations column in 'Waste Destinations Sheet' and this will automatically calculate the recovery rate and cost of the waste stream using the values entered in the 'Waste Carriers Sheet'.

The Project Team shall update it as and when other waste carriers and / or waste management facilities are commissioned to remove waste from the Bicester Eco development Exemplar Site. The Waste Carriers Sheet shall be updated as set up in Table 10.

Table 10 How to complete the Waste Destinations Sheet

Section	What the Project Team need to record
Expected facility and cost of disposal	Use the drop down menu in proposed destinations to select a waste management facility. The waste management facilities listed are taken from the data entered in 'Specify Waste Carriers'. This speeds up the specification of which waste streams will be going to which waste management facility, avoiding the need to repetitively type in the same information. The cost of waste disposal is entered for either £/m ³ or £/tonnes in the free entry boxes. The Template will calculate the cost of waste disposal for your project based on the amount of waste forecasted and the cost entered in this sheet.
Multiple destinations	If the project has more than one facility for a particular waste stream then firstly following the steps outlined in section 8.0 'How to use the Template – 4 Specify Waste Carriers' for selecting multiple destinations. After this select multiple destinations in the Proposed Destinations column in 'Plan Waste Destinations'. This will automatically calculate the recovery rate and cost of the waste stream using the values entered in 'Specify waste carriers'.
Answering the three questions	There are three questions at the top of the page that must be answered using drop down menus to select yes / no answers. These questions link to the Compliance page which summarises whether the required

7.7 PSWMP Template: Actual Waste Movements Sheet

The SWMP Template Actual Waste Movements Sheet shall be used by the Project Team to record the Bicester Eco development Exemplar Site actual waste movements once the project team has mobilised to site. Each waste movement should be recorded as a line in the 'Actual Waste Movements Sheet' as outlined in Table 11 below:

Table 11 How to use the Actual Waste Movements Sheet

Section	What the Project Team need to record
Movement number	This is a reference for tracking the number of movements
CDE Activity	Select whether the waste arising comes from construction, excavation or demolition activity. This information must be entered because forecasting along these lines ties in with industry agreed methods.
Waste Stream	Select a waste stream from the pre defined list of wastes. The list you select from has been developed with the BRE and their SMARTWaste list of wastes – meaning many users will recognise the classifications used. The selection you make here narrows down the material type options you can make in the next column 'specify further segregation'.
Material Type - optional	Entering information here is optional. Select a material type after you have selected a waste stream. The list you select from has been developed with the BRE and their SMARTWaste list of wastes to provide a common classification. If you only wish to select a waste stream (and not select the more detailed material type), press the 'delete' key on your keyboard when the material type cell has been clicked on. The Template will then record your forecast at the waste stream, and not at the material type level.
Further description of waste – optional	Entering information here is optional. Use this free text entry cell to record a further description of the waste to include a more detailed explanation. This information can be used as part of the audit trail for your project if you wish.
LOW Code used	Based on your selections in the waste stream and material type columns, the Template suggests which LOW code applies to your selection. The LOW code can be overwritten by pressing the 'delete' key on your keyboard when the LOW Code cell has been clicked on. You can then enter an alternative LOW code if you wish.
On or Off-site destination	Select an onsite or off-site destination for your waste arising. If you select an onsite option, the Template records this and displays this information in the Waste Totals table and in 'Reporting'. If you select an off-site option, the Template allows you to complete the following two columns (off-site carrier and off-site destination).
Off-site carrier	You can make a selection here only if an off-site destination is selected in the 'on or off-site destination' column. Make a waste carrier selection using the drop down menu. The options displayed are based on the information you entered in 'Specify Waste Carriers'.
Off-site destination	You can make a selection here only if an off-site destination is selected in the 'on or off-site destination' column. Make a waste management facility selection using the drop down menu. The options displayed are based on the information you entered in 'Specify Waste Carriers' (waste management facility table).

Section	What the Project Team need to record
Override facility recovery rate for individual skip	This column can be used to override the information recorded in 'Specify Waste Carriers' for the recovery rate of the waste management facility (See below). This may be required if the facility provides a rate for each lift on their transfer note.
Overall diversion from landfill / recovery	This data is displayed based on the information you entered in 'Specify Waste Carriers' (waste management facility table).
Date of movement	Use the drop down menu to select the month and year of the waste movement.
Waste totals (volume, tonnes, actual cost)	<p>Enter either the volume (m³) or mass (tonnes) waste totals for each waste movement. This data should be the total waste arising (e.g. before recovery rates are taken into account). Totals after recovery are shown in the table directly above 'Waste Totals'.</p> <p>In the actual cost column enter the total cost for the waste movement. A basic calculation is then made for the £/m³ or £/t.</p>

Summary Data: Waste totals

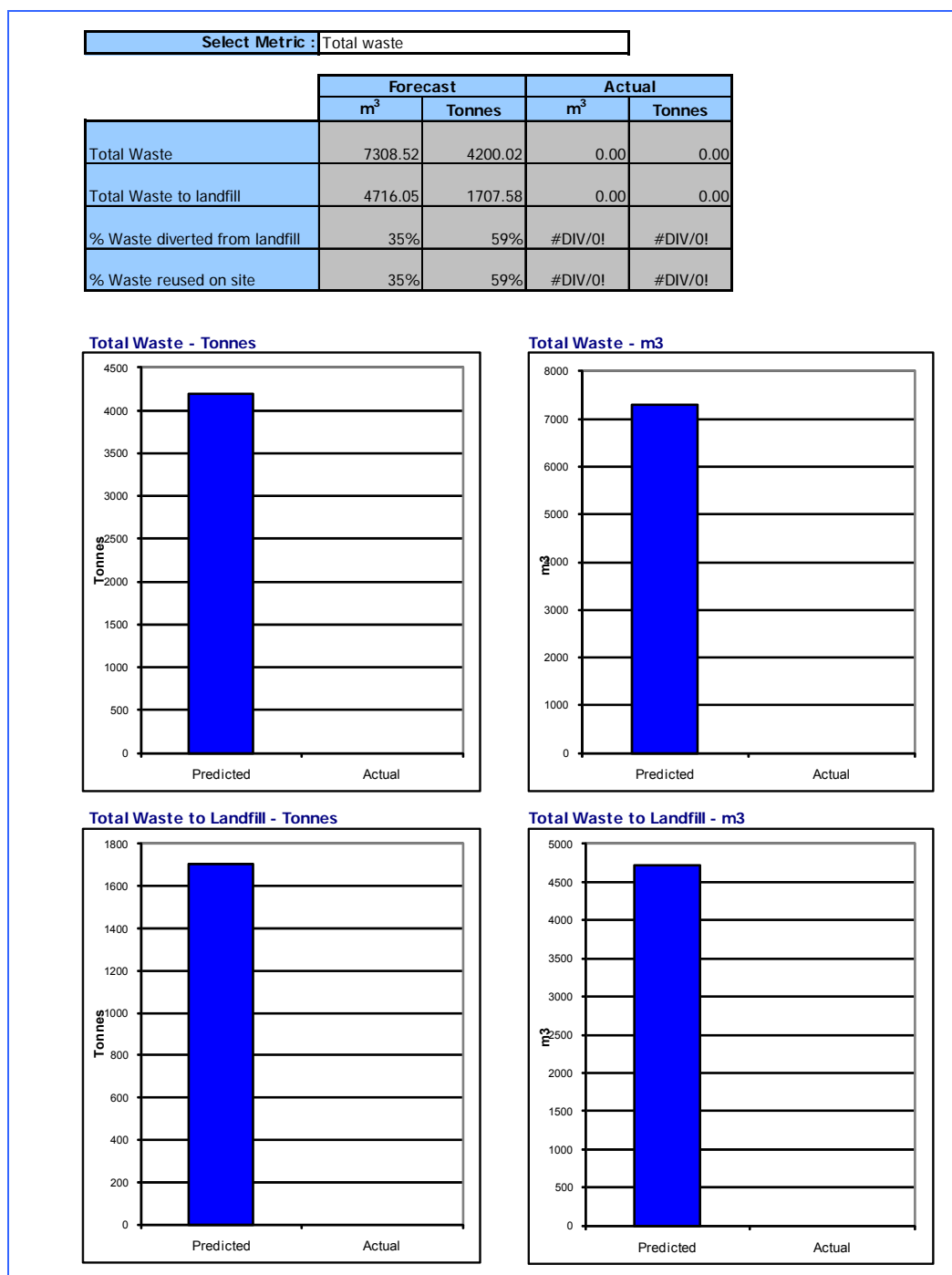
Once data has been entered into the 'Actual Waste Movements Sheet', this section displays a summary in tonnes. Use the drop down menu in cell B9 to toggle the display between tonnes and m³.

Note: a full breakdown of all data entered into the Bicester Eco development Exemplar PSWMP Template, including a comparison of forecast versus actuals data, is shown in the 'Reporting Sheet'.

7.8 PSWMP Template: Key Performance Indicators Sheet

The SWMP Template 'Key Performance Indicators (KPIs) Sheet' shall be used by the Project Team to review the results for the Bicester Eco development Exemplar SWMP Template. The graphs show total waste to landfill and total waste arisings, against the metrics selected (footprint (m²) of site and gross internal floor area).

Figure 11 Bicester Eco development Exemplar Site KPIs



The Bicester Eco development Exemplar PSWMP Template will also allow the Project Team to choose from the following two items:

- **Total waste:** showing total waste arisings for Bicester Eco development Exemplar Site project
- **Per £100k of construction value:** dividing waste totals by the construction value (entered in the 'Basic Details Sheet'). This gives the Project Team a relative value that can be compared across packages, irrespective of their size.

7.9 PSWMP Template: Reporting Sheet

The PSWMP Template 'Reporting Sheet' shall be used by the Project Team to compare the Bicester Eco development Exemplar Site forecast and actual waste measurements at regular intervals (at least once every 6 months) during the project and within 3 months of project completion. Figure 12 shows a screenshot of the combined construction and excavation report. There are four tables in total on this worksheet:

- totals for construction, demolition and excavation (forecast versus actuals);
- construction related waste arisings (forecast versus actuals);
- demolition related waste arisings (forecast versus actuals); and
- excavation related waste arisings (forecast versus actuals).

Figure 12 Screenshot of Bicester Eco development Exemplar Site Reporting Sheet

View data in: tonnes		Forecast		Actual	
		m ³	Tonnes	m ³	Tonnes
Reporting Combined stages C,D and E Construction Demolition Excavation	Total Waste	7308.52	4200.02	0.00	0.00
	Total Waste to landfill	1177.64	545.47	0.00	0.00
	% Waste diverted from landfill	84%	87%	#DIV/0!	#DIV/0!
	% Waste reused on site	35%	59%	#DIV/0!	#DIV/0!

Hyperlinks have been included on the left of the summary table for ease of navigation to each of the tables. The figures in these tables can be used to populate information in the Waste to Landfill Reporting portal: www.wrap.org.uk/reportingportal.

Cell C8 allows you to toggle the data shown between mass (tonnes) and volume (m³).

The page is printer friendly, although you may wish to print on A3 pages to view the data more easily.

7.10 PSWMP Template: Declaration

The PSWMP Template 'Declaration' shall be completed by a member of the Project Team at the end of the construction stage. The free entry cells shall be completed to confirm the plan has been monitored.

Figure 13 Screenshot of Bicester Eco development Exemplar Declaration Sheet

Confirmation that the plan has been monitored on a regular basis to ensure that work is progressing according to the plan and that the plan was updated in accordance with the SWMP Regulations (2008). Required for all projects	
Signed by:	
Organisation:	
Position:	
Date:	
Signed by:	
Organisation:	
Position:	
Date:	

The following information also needs to be provided:

- reasons for the differences between the forecast and actual waste volumes;
- explanation of any non-compliance(s) of the PSWMP and corrected actions; and
- key lessons learned.

7.11 References

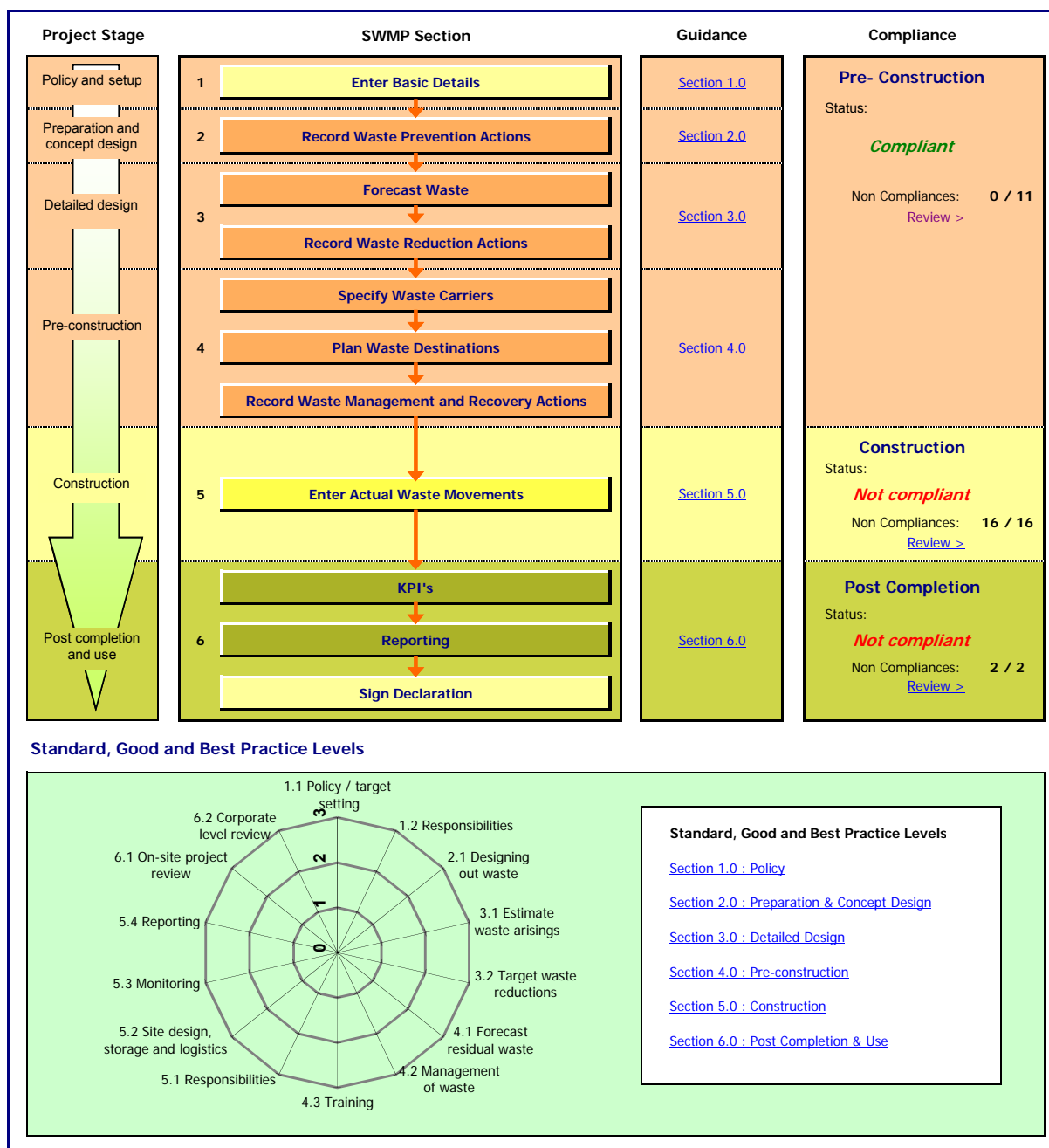
- A Guide to the Hazardous Waste Regulation: Consignment Notes HWR03 Ver 2.0, Environment Agency, (June 2006).
- A Guide to the Hazardous Waste Regulations: Record Keeping HWR05 Ver 2.0, (June 2006).
- The Construction (Design and Management) Regulations (2007 No.230)
- CLAIRE “The Definition of Waste: Industry Code of Practice”, Sept 2008.
- Council Directive 1999/31/EC, Office Journal of the European Communities (April 1999)
- Designing out Waste Tool, WRAP
- Environmental Protection Act (1990)
- Environmental Protection (Duty of Care) Regulations (1991)
- EU Waste Framework Directive (November 2008)
- European Waste Catalogue (ENWDC), Environmental Protection Agency (January 2002)
- Hyder Consulting SWMP Template 2007
- Hyder Consulting SWMP Guidance Document 2008
- Hyder Consulting Hazards and Risk Assessment, Conceptual Design Advice 2007
- Landfill (England and Wales) Regulations (2002)
- List of Wastes (England) Regulations 2005 (LoWR)
- Site Waste Management Template and User Guide, WRAP
- Site Waste Management Plan Regulations (2008).
- The Control of Pollution (Amendment) Act (1989)
- The Definition of Waste, Developing Greenfield and Brownfield Sites, Environment Agency, (April 2006).
- The Environmental Permitting (England and Wales) Regulations (2007)
- The Hazardous Waste (England and Wales) Regulations (HWR 2005)
- The Waste Electrical and Electronic Equipment Regulations (2006)
- Waste Management, the Duty of Care, A Code of Practice, DEFRA

Appendix A

Bicester Eco development Exemplar SWMP Template

Site Waste Management Plan

Version 2.2



Basic Details

Client name :	A2 Dominion, P3Eco
Principal contractor :	Willmott Dixon and Hill Partnership
Owner of document :	Hyder Consulting
Project title :	Bicester Eco development: Exemplar Site
Project Reference :	Exemplar Site
Project location :	Bicester
Project postcode :	OX27 8TG
Construction value :	£65,000,000.00
Type of construction :	Mixed use developments
Activity :	New construction

Metrics

Please select metrics applicable to your project. These metrics are then used in the KPI sheet to track your progress.

Metric	Amount	Unit
Footprint (m2) of site	211,245	m2
Gross Internal Floor Area	1,280	m2

Project targets

Please select project targets applicable to your project

Target	Amount	Unit
Waste to landfill	0	t
Recycled content	20	%

Schedule

Start date :	31/09/2011	dd/mm/yy
Completion date :		dd/mm/yy

Persons legally required to be identified (SWMP Regulations 2008 Section 6 (1))

Position	Name	Contact Details
Client	A2 Dominion, P3Eco	
Principal Contractor	Willmott Dixon and Hill Partnership	
Site Waste Management Plan Drafter	Hyder Consulting	5th Floor, The Pithay, All Saints Street, Bristol, BS1 2NL. Tel: 01173721289. natalia.fernandes-ferro@hyderconsulting.com
Others (not legally required)		
Client WM Representative (if applicable)		
Project Manager		
Waste Management Coordinator/Champion		

Design Coordinator		
Document Controller / Secretary		

Confirmation that the plan has been monitored on a regular basis to ensure that work is progressing according to the plan and that the plan was updated in accordance with the SWMP Regulations (2008). Required for all projects	
Signed by: Organisation: Position: Date:	
Signed by: Organisation: Position: Date:	
Explanation of any deviation from the plan. Required for all projects (Required for projects over £500,000)	
1	
2	
3	
4	
5	
6	
7	
Where relevant, drawing on any lessons learnt, an action plan to address these for the next project (Required for projects over £500,000)	
1	
2	
3	
4	
5	
6	
7	

Tell me about:

2 Waste Prevention Actions

3 Waste Reduction Actions

4 Waste Management and Recovery Actions

A2 Dominion, P3Eco

Willmott Dixon and Hill Partnership

Bicester Eco development: Exemplar Site

Exemplar Site

I have :

recorded any decisions taken before the Site Waste Management Plan was drafted, on the nature of the project construction method or materials employed in order to minimise the quantity of waste produced on site

Yes

Waste Actions

Enter actions in the next available row below

Number	Type of Waste Action	Action Taken	Action owner	Reference to project document /	Waste stream	Material type	Estimated Cost Saving	Waste reduced		Date for completion (dd/mm/yyyy)	Status
								(m ³)	(tonnes)		
1	Waste Reduction Action	Retain top soil, treat it onsite with compost (or other remediation) and use for soft landscaping, etc.	Willmott Dixon and Hill Partnership		Inert - Soil & stones	soil and stones other than those mentioned in 17 05 03					Incomplete
2	Waste Reduction Action	Use existing soft landscape that can't be retained (trees, shrubs) as compost and soft landscape top mulch	Willmott Dixon and Hill Partnership		Wood	wood					Incomplete
3	Waste Prevention Action	Use recycle aggregates (either onsite or off site) in concrete mix, as fill, etc.	Willmott Dixon and Hill Partnership		Inert - mixture of concrete, bricks, tiles etc.	mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06					Incomplete
4	Waste Reduction Action	Reuse packaging by returning to supplier/manufacturer or using it for other purposes (e.g. Timber packaging pallets can be chipped and used for landscaping top mulch)	Willmott Dixon and Hill Partnership		Packaging	mixed packaging					Incomplete
5	Waste Reduction Action	Design with modularisation in mind									Incomplete
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											

Tell me about:

2 Waste Prevention Actions

3 Waste Reduction Actions

4 Waste Management and Recovery Actions

A2 Dominion, P3Eco

Willmott Dixon and Hill Partnership

Bicester Eco development: Exemplar Site

Exemplar Site

I have :

recorded any decisions taken before the Site Waste Management Plan was drafted, on the nature of the project construction method or materials employed in order to minimise the quantity of waste produced on site

Yes

Waste Actions

Enter actions in the next available row below

Number	Type of Waste Action	Action Taken	Action owner	Reference to project document /	Waste stream	Material type	Estimated Cost Saving	Waste reduced		Date for completion (dd/mm/yyyy)	Status
								(m ³)	(tonnes)		
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
31											
32											
33											
34											
35											
36											
37											
38											
39											
40											
41											
42											
43											
44											
45											
46											
47											
48											
49											
50											

Tell me about:

2 Waste Prevention Actions

3 Waste Reduction Actions

4 Waste Management and Recovery Actions

A2 Dominion, P3Eco

Willmott Dixon and Hill Partnership

Bicester Eco development: Exemplar Site

Exemplar Site

I have :

recorded any decisions taken before the Site Waste Management Plan was drafted, on the nature of the project construction method or materials employed in order to minimise the quantity of waste produced on site

Yes

Waste Actions

Enter actions in the next available row below

Number	Type of Waste Action	Action Taken	Action owner	Reference to project document /	Waste stream	Material type	Estimated Cost Saving	Waste reduced		Date for completion (dd/mm/yyyy)	Status
								(m ³)	(tonnes)		
51											
52											
53											
54											
55											
56											
57											
58											
59											
60											

described each waste type expected to be produced in the course of the project:

Yes

Forecast Waste

[illegible]



Tell me about this sheet

A2 Dominion, P3Eco
Willmott Dixon and Hill Partnership
Chester Eco development: Exemplar Site
Exemplar Site

I have :

described each waste type expected to be produced in the course of the project:

Yes

Forecast Waste

[illegible]

Identified all persons removing the waste.	No
Identified all waste carriers and registration numbers.	No
A copy of, or reference to, the written description of the waste required by section 34 of the Environmental Protection Act 1990.	No
Identified that the sites that the waste is being taken to and whether the operators of those sites hold a permit under the Environmental Permitting (England and Wales) Regulations 2007 or are registered under those Regulations as a waste operation exempt from the need for such a permit.	No

[illegible]



Tell me about this sheet

I have :				
Identified all persons removing the waste.				No
Identified all waste carriers and registration numbers.				No
A copy of, or reference to, the written description of the waste required by section 34 of the Environmental Protection Act 1990.				No
Identified that the sites that the waste is being taken to and whether the operators of those sites hold a permit under the Environmental Permitting (England and Wales) Regulations 2007 or are registered under those Regulations as a waste operation exempt from the need for such a permit.				No

Specify Waste Carriers

Name	Contact Details	Date checked with Environment Agency (dd/mm/yyyy)	Registration Number	Expiry Date (dd/mm/yyyy)

Specify Waste Management Facilities

Name	Type of facility	% reused if known	% recycled if known	% energy recovery if known	% total all forms of recovery	Overall diverted from landfill / recovery	Date checked with Environment Agency (dd/mm/yyyy)	Licence / Exemption Number	Location of relevant documentation, e.g. WTN	C, D or E Activity (Leave blank if same facility & recovery rate are used for different waste streams)	Waste Stream
						0%					
						0%					
						0%					
						0%					
						0%					
						0%					
						0%					
						0%					
						0%					
						0%					
						0%					
						0%					
						0%					
						0%					
						0%					

I have identified :

the waste management action proposed for each different waste type, including re-using, recycling, recovery and disposal.	Yes
---	-----

I have ensured that :

all waste from the site is dealt with in accordance with the waste duty of care in section 34 of the Environmental Protection Act 1990(3) and the Environmental Protection (Duty of Care) Regulations 1991(4); and	Yes
materials will be handled efficiently and waste managed appropriately	Yes

	Total (m³)	Total (t)
Total from Waste Streams	4716.05	1707.58
Total Reused on site	2592.47	2492.44

Sign declaration (Print sheet and sign declaration or copy electronic signature)

Signed By: _____ Signed By: _____
 Organisation: _____ Organisation: _____
 Position: _____ Position: _____

Plan Waste Destinations

[Construction](#)
[Demolition](#)
[Excavation](#)

Construction

Waste sent offsite	Forecast		Proposed Destination	% Diverted from landfill	Cost of waste disposal			Comments
	Estimated Volume (m³)	Estimated (t)			£/m³	£/t	Cost Forecast	
Metals	278.48	116.96	Dial-A-Skip Waste Management Ltd	80%			FALSE	
Wood	781.65	265.76	Dial-A-Skip Waste Management Ltd	80%			FALSE	
Packaging	1122.71	235.77	Dial-A-Skip Waste Management Ltd	80%			FALSE	
Mixed Hazardous - C&D waste	25.57	22.25	K J Millard Ltd	50%			FALSE	
Mixed C&D waste	755.85	657.59	K J Millard Ltd	50%			FALSE	
Segregated Haz Waste	19.30	17.37	Dial-A-Skip Waste Management Ltd	80%			FALSE	
Other C&D segregated waste	1732.48	391.88	Dial-A-Skip Waste Management Ltd	80%			FALSE	
	4716.05	1707.58					£0.00	

Retained on site	Forecast	
	Estimated Volume (m³)	Estimated (t)
Reused on site	797.91	263.31
Recycled on site	1407.37	1745.14
	2205.28	2008.45

Demolition

Waste sent offsite	Forecast		Proposed Destination	% Diverted from landfill	Cost of waste disposal			Comments
	Estimated Volume (m³)	Estimated (t)			£/m³	£/t	Cost Forecast	
	0.00	0.00					£0.00	

Retained on site	Forecast	
	Estimated Volume (m³)	Estimated (t)



Tell me about this sheet

I have identified :

the waste management action proposed for each different waste type, including re-using, recycling, recovery and disposal.	Yes
---	-----

I have ensured that :

all waste from the site is dealt with in accordance with the waste duty of care in section 34 of the Environmental Protection Act 1990(3) and the Environmental Protection (Duty of Care) Regulations 1991(4); and	Yes
materials will be handled efficiently and waste managed appropriately	Yes

	Total (m³)	Total (t)
Total from Waste Streams	4716.05	1707.58
Total Reused on site	2592.47	2492.44

Sign declaration (Print sheet and sign declaration or copy electronic signature)

Signed By: _____ Signed By: _____
Organisation: _____ Organisation: _____
Position: _____ Position: _____

Plan Waste Destinations

[Construction](#)
[Demolition](#)
[Excavation](#)

	0.00	0.00

Excavation

Waste sent offsite	Forecast		Proposed Destination	% Diverted from landfill	Cost of waste disposal			Comments
	Estimated Volume (m³)	Estimated (t)			£/m³	£/t	Cost Forecast	
	0.00	0.00					£0.00	

Retained on site	Forecast	
	Estimated Volume (m³)	Estimated (t)
Reused on site	387.19	483.99
	387.19	483.99

?
 Tell me about this
sheet

Waste Totals

Display summary as:

Tonnes

Waste Stream	Total waste arising (Tonnes)	Total waste retained on site (Tonnes)	Total waste sent offsite (Tonnes)	Total waste to landfill (Tonnes)	Total waste recovered offsite (Tonnes)	Cost of waste disposal
Inert - Soil & stones						£0.00
Hazardous - Soil & stones						£0.00
Non Haz (Non Inert) - Dredgings						£0.00
Segregated Haz - Soil & stones						£0.00
Gypsum						£0.00
Metals						£0.00
Wood						£0.00
Packaging						£0.00
Inert - Building rubble						£0.00
Inert - Glass						£0.00
Mixed Hazardous - C&D waste						£0.00
Mixed C&D waste						£0.00
Segregated Haz Waste						£0.00
Other C&D segregated waste						£0.00
Total						£0.00

Actual Waste Movements

Movement Number	C, D or E Activity	Waste Stream	Material Type	Further description of waste - optional	LOW Code used	On or off-site destination	Off-site carrier	Off- site destination	Override facility recovery rate for individual skip	Overall diversion from landfill / recovery (further detail on Sheet 4)	Date of Movement (dd/mm/yyyy)	Waste Totals				
												(m ³)	(tonnes)	Actual Cost	£/m ³	£/t
1										100%						
2										100%						
3										100%						
4										100%						
5										100%						
6										100%						
7										100%						
8										100%						
9										100%						
10										100%						
11										100%						
12										100%						
13										100%						
14										100%						
15										100%						
16										100%						
17										100%						
18										100%						
19										100%						
20										100%						
21										100%						
22										100%						
23										100%						
24										100%						
25										100%						
26										100%						
27										100%						
28										100%						
29										100%						
30										100%						
31										100%						

Actual Waste Movements

Actual Waste Movements												Waste Totals					
Movement Number	C, D or E Activity	Waste Stream	Material Type	Further description of waste - optional	LOW Code used	On or off-site destination	Off-site carrier	Off- site destination	Override facility recovery rate for individual skip	Overall diversion from landfill / recovery (further detail on Sheet 4)	Date of Movement (dd/mm/yyyy)	(m³)	(tonnes)	Actual Cost	£/m³	£/t	
32										100%							
33											100%						
34											100%						
35											100%						
36											100%						
37											100%						
38											100%						
39											100%						
40											100%						
41											100%						
42											100%						
43											100%						
44											100%						
45											100%						
46											100%						
47											100%						
48											100%						
49											100%						
50											100%						
51											100%						
52											100%						
53											100%						
54											100%						
55											100%						
56											100%						
57											100%						
58											100%						
59											100%						
60											100%						
61											100%						
62											100%						
63											100%						
64											100%						
65											100%						
66											100%						
67											100%						
68											100%						
69											100%						
70											100%						
71											100%						
72											100%						
73											100%						
74											100%						
75											100%						
76											100%						
77											100%						
78											100%						
79											100%						
80											100%						
81											100%						
82											100%						
83											100%						
84											100%						
85											100%						
86											100%						
87											100%						
88											100%						
89											100%						
90											100%						
91											100%						

Actual Waste Movements

Actual Waste Movements												Waste Totals					
Movement Number	C, D or E Activity	Waste Stream	Material Type	Further description of waste - optional	LOW Code used	On or off-site destination	Off-site carrier	Off- site destination	Override facility recovery rate for individual skip	Overall diversion from landfill / recovery (further detail on Sheet 4)	Date of Movement (dd/mm/yyyy)	(m³)	(tonnes)	Actual Cost	£/m³	£/t	
92										100%							
93											100%						
94											100%						
95											100%						
96											100%						
97											100%						
98											100%						
99											100%						
100											100%						
101											100%						
102											100%						
103											100%						
104											100%						
105											100%						
106											100%						
107											100%						
108											100%						
109											100%						
110											100%						
111											100%						
112											100%						
113											100%						
114											100%						
115											100%						
116											100%						
117											100%						
118											100%						
119											100%						
120											100%						
121											100%						
122											100%						
123											100%						
124										100%							
125										100%							
126										100%							
127										100%							
128										100%							
129										100%							
130										100%							
131										100%							
132										100%							
133										100%							
134										100%							
135										100%							
136										100%							
137										100%							
138										100%							
139										100%							
140										100%							
141										100%							
142										100%							
143										100%							
144										100%							
145										100%							
146										100%							
147										100%							
148										100%							
149										100%							
150										100%							
151										100%							

Actual Waste Movements

Actual Waste Movements												Waste Totals					
Movement Number	C, D or E Activity	Waste Stream	Material Type	Further description of waste - optional	LOW Code used	On or off-site destination	Off-site carrier	Off- site destination	Override facility recovery rate for individual skip	Overall diversion from landfill / recovery (further detail on Sheet 4)	Date of Movement (dd/mm/yyyy)	(m³)	(tonnes)	Actual Cost	£/m³	£/t	
152										100%							
153											100%						
154											100%						
155											100%						
156											100%						
157											100%						
158											100%						
159											100%						
160											100%						
161											100%						
162											100%						
163											100%						
164											100%						
165											100%						
166											100%						
167											100%						
168											100%						
169											100%						
170											100%						
171											100%						
172											100%						
173										100%							
174										100%							
175										100%							
176										100%							
177										100%							
178										100%							
179										100%							
180										100%							
181										100%							
182										100%							
183										100%							
184										100%							
185										100%							
186										100%							
187										100%							
188										100%							
189										100%							
190										100%							
191										100%							
192										100%							
193										100%							
194										100%							
195										100%							
196										100%							
197										100%							
198										100%							
199										100%							
200										100%							
201										100%							
202										100%							
203										100%							
204										100%							
205										100%							
206										100%							
207										100%							
208										100%							
209										100%							
210										100%							
211										100%							

Actual Waste Movements

Actual Waste Movements												Waste Totals					
Movement Number	C, D or E Activity	Waste Stream	Material Type	Further description of waste - optional	LOW Code used	On or off-site destination	Off-site carrier	Off- site destination	Override facility recovery rate for individual skin	Overall diversion from landfill / recovery (further detail on Sheet 4)	Date of Movement (dd/mm/yyyy)	(m³)	(tonnes)	Actual Cost	£/m³	£/t	
212										100%							
213										100%							
214										100%							
215										100%							
216										100%							
217										100%							
218										100%							
219										100%							
220										100%							
221										100%							
222										100%							
223										100%							
224										100%							



Tell me about this sheet

A2 Dominion, P3Eco
Willmott Dixon and Hill Partnership
Bicester Eco development: Exemplar Site
Exemplar Site

1.0 Policy

Step 1.1	Explanation	Practice Level	How to achieve	Guidance available to help
Policy / target setting	At this early stage it is advisable that high level targets are set which will govern and inform company strategy. These targets will then be incorporated into each construction project as they progress along the project lifecycle (and through the RIBA stages).	Standard	Set high level qualitative aspirational policy goals for company performance on reducing waste arisings and increasing waste recovery.	WRAP have produced a number of Model Procurement clauses which can be incorporated into procurement documents to help meet these requirements. The model wording relates to policy documents, invitation to tender documents, pre-qualification questionnaires or contractual appointment documents. Actions 1A, 1B and 1C contain model wording that helps clients and principal contractors to set corporate, high level and project specific targets for achieving resource efficiency in construction projects. The guidance can be found here: http://www.wrap.org.uk/construction/achieving_resource_efficiency/model_procurement_requirements/index.html
		Good	Insert quantified company wide targets for reducing waste arisings and increasing waste recovery into company policy documents.	
		Best	Process to insert quantified project specific waste reduction targets based on industry Best Practice benchmarks or previous project experience for reducing waste arisings and increasing waste recovery into company policy documents.	

Practice level targeted (please select)	Action (use to record more detail if you wish)
None	

Step 1.2	Explanation	Practice Level	How to achieve	Guidance available to help
Responsibilities (for the SWMP)	There are a number of required responsibilities for early stage coordination of the Site Waste Management Plan (SWMP). Responsibilities for the operation of the SWMP are listed below in section 5.1.	Standard	Meet requirements for identifying the client, principal contractor and person drafting the Site Waste Management Plan.	WRAP have produced a number of Model Procurement Requirements to help incorporate these requirements into prequalification questionnaires and invitation to tender documents The guidance can be found here: http://www.wrap.org.uk/construction/achieving_resource_efficiency/model_procurement_requirements/index.html
		Good	Involve all members of the project team and ensure everyone knows about SWMP and how it affects them.	
		Best	Include SWMP responsibilities as an agenda item at project team meetings, ensuring all team members are involved and contribute to project waste reduction and recovery actions.	

Practice level targeted (please select)	Action (use to record more detail if you wish)
None	

2.0 Preparation and Concept design

It is advisable that early on in the design process waste planning is included in the agenda of client and design team meetings. The design guidance document, Designing out Waste, identifies the process that can be applied to further achieve this aim:

Step 2.1	Explanation	Practice Level	How to achieve	Guidance available to help
Designing Out Waste	There are numerous opportunities to reduce waste during the design process. Designing out waste before it arises is one of the most efficient ways to reduce project waste arisings. However, as such decisions need to be taken early, engagement with the design team early on in the life of a project is key.	Standard	Capture decisions made that may have an impact on waste. These decisions may not have been taken with waste reduction in mind, but may have an effect on project waste arisings nonetheless.	WRAP provide regeneration and demolition guidance that can be found here: http://www.wrap.org.uk/construction/tools_and_guidance/regeneration.html WRAP provide guidance on Designing Out Waste, which can be found here: http://www.wrap.org.uk/construction
		Good	Discuss with the project team at an early design stage how it might be best to reduce waste arisings through making changes to the design.	
		Best	Systematically identify, prioritise and implement waste reduction actions at the design stage. Consider cost, programme and waste reduction potential.	

Practice level targeted (please select)	Action (use to record more detail if you wish)
None	

3.0 Detailed Design

Step 3.1	Explanation	Practice Level	How to achieve	Guidance available to help
Estimate waste arisings	Estimating waste arisings involves identifying and recording the amount and destination of each waste stream that will be generated on site. The earlier in the project lifecycle that waste streams are estimated, the more opportunity there will be to prevent their creation.	Standard	Standard practice is to estimate waste arisings at the pre-construction stage.	WRAPs freely available Net Waste Tool allows you to enter simple project details and forecast likely waste arisings, together with suggesting waste reduction and segregation opportunities and recycled content material substitutions. The Net Waste Tool can be accessed here: http://nwttool.wrap.org.uk/
		Good	Forecast waste arisings for each component using industry data.	
		Best	Forecast waste arisings for each component using modified wastage rates based on past company experience.	

Practice level targeted (please select)	Action (use to record more detail if you wish)
None	

Step 3.2	Explanation	Practice Level	How to achieve	Guidance available to help
Target waste reductions	This Step involves identifying and recording waste reduction methods to reduce the quantity of waste estimated in Step 3.2.	Standard	Identify waste management action for each of the different waste types forecast to arise on the construction project, including re-using, recycling, recovery and disposal.	WRAPs freely available Net Waste Tool allows you to enter simple project details and forecast likely waste arisings, together with suggesting waste reduction and segregation opportunities and recycled content material substitutions. The Net Waste Tool can be accessed here: http://nwttool.wrap.org.uk/
		Good	Target waste arisings for each construction component using industry standard actions	
		Best	Target waste arisings for each construction component. As an example these actions could be to target accurate ordering (accurate material requirements, realistic wastage rates), logistics planning (delivery strategy, adequate storage, efficient movement of materials to the workplace) or installation elements (efficient working and installation and storage of offcuts for reuse).	

Practice level targeted (please select)	Action (use to record more detail if you wish)
None	

4.0 Pre-construction

Step 4.1	Explanation	Practice Level	How to achieve	Guidance available to help
Forecast residual waste	In addition to designing out waste at (Step 2.1), and estimating outline waste arisings (Step 3.1), it is required to forecast residual waste arisings before going to site.	Standard	Forecast waste according to general estimates, fulfilling requirement to identify each waste type expected to be produced in the course of the project.	WRAPs freely available Net Waste Tool allows you to enter simple project details and forecast likely waste arisings, together with suggesting waste reduction and segregation opportunities and recycled content material substitutions. The Net Waste Tool can be accessed here: http://nwtool.wrap.org.uk/
	This final residual waste forecast is the last and most detailed waste forecast that is done before site mobilisation. Once this final waste forecast is completed, waste management and recovery options can be implemented to ensure the waste is recycled, reused or recovered.	Good	Good practice relates to forecasting waste arisings at the detailed design stage. Refer to Step 3.1. Good practice for Step 4.1 relates to forecasting residual waste arisings in conjunction with the principal contractor and agreeing the waste reduction and recovery standards to be achieved on the project.	WRAP have produced a number of Model Procurement Requirements to help incorporate these requirements into prequalification questionnaires invitation to tender documents, and appointment contracts. The guidance can be found here: http://www.wrap.org.uk/construction/achieving_resource http://www.wrap.org.uk/construction/achieving_resource/efficiency/model_procurement_requirements/index.html
		Best	Building on Good Practice, hold talks with the rest of the supply chain (waste management contractors, sub-contractors) to determine waste reduction and recovery actions for the project.	

Practice level targeted (please select)	Action (use to record more detail if you wish)
None	

Step 4.2	Explanation	Practice Level	How to achieve	Guidance available to help
Management of Waste	This step relates to the efficient management of waste once it has been created on site. Step 4.2 which deals with the management of waste on site should be implemented in line with any targets identified in sections 1.0, 2.0 and 3.0 above. As noted above in Step 2.1, off-cuts should be stored safely on site for reuse.	Standard	Identify waste management action for each waste stream	WRAPs freely available Net Waste Tool allows you to enter simple project details and forecast likely waste arisings, together with suggesting waste reduction and segregation opportunities and recycled content material substitutions. The Net Waste Tool can be accessed here: http://nwttool.wrap.org.uk/
		Good	Identify recycling and recovery options for each waste stream for which recycling and recovery is viable	WRAP also provide guidance on developing and implementing a material logistics plan. The logistics plan guidance can be found here: http://www.wrap.org.uk/construction/construction_waste_efficiency/materials_logistic_plan/index.html
		Best	Maximise opportunities for resource efficiency through following the waste hierarchy (prevention, minimisation, reuse, recycling, recovery, disposal)	WRAP also provides a Breman map which allows you to enter the postcode of your site and pin point waste management facilities and materials/products suppliers within a region or radius of your chosen distance. It can be found here http://www.breman.co.uk/breman/about_isp

Practice level targeted (please select)	Action (use to record more detail if you wish)
None	

Step 4.3	Explanation	Practice Level	How to achieve	Guidance available to help
Training	It is a requirement that all site workers are trained on the Site Waste Management Plan, providing information on how it affects them. Training prospects should be seen as opportunities to engage with the supply chain and gain buy-in from them – as it will be the supply chain who will be able to significantly contribute to any project resource efficiency targets.	Standard	The principal contractor should provide training to every construction worker needed for the particular work to be carried out within the terms of the site waste management plan. This can be in the form of toolbox talks.	WRAP provide a wealth of background information on waste reduction and recovery, including guidance documents, case studies and best practice guides. General WRAP construction guidance can be found here: http://www.wrap.org.uk/construction/tools_and_guidance/index.html
		Good	Building on standard practice, provide bespoke training to all subcontractors and identify waste reduction actions where they can contribute.	WRAP also provide a short guidance note for small and medium sized contractors on reducing construction waste. It can be downloaded here: http://www.wrap.org.uk/downloads/Reducing_your_construction_waste_-_a_pocket_guide_for_SME_contractors.e5bf6111.6667.pdf
		Best	Building on good practice and share experience from previous projects or sites. Use the training exercise to inform continual improvement.	

Practice level targeted (please select)	Action (use to record more detail if you wish)
None	

5.0 Construction

Step 5.1	Explanation	Practice Level	How to achieve	Guidance available to help
Responsibilities (on site)	Once the SWMP has been developed it must be implemented on site. This Step outlines how to assign responsibility for ensuring the SWMP is delivered.	Standard	Meet requirements for identifying the client, principal contractor and person drafting the Site Waste Management Plan.	WRAP have produced a number of Model Procurement Requirements to help incorporate these requirements into prequalification questionnaires and invitation to tender documents The guidance can be found here: http://www.wrap.org.uk/construction/achieving_resource_efficiency/model_procurement_requirements/index.html
		Good	Waste champion is appointed for the whole site.	
		Best	Building on Good Practice, individuals and sub contractors should be made responsible for specific waste streams, with the waste champion holding these project members to account.	

Practice level targeted (please select)	Action (use to record more detail if you wish)
None	

Step 5.2	Explanation	Practice Level	How to achieve	Guidance available to help
Site design, storage and logistics	Space permitting, key waste streams should be segregated. The segregation scheme should include appropriate training, monitoring and enforcement with clear signage and using the National Colour Coding Scheme.	Standard	Meet requirement that all waste from the site is dealt with in accordance with the Environmental Protection Act and Environmental Protection (Duty of Care) Regulations.	WRAP have produced a number of Model Procurement Requirements to help incorporate these requirements into prequalification questionnaires and invitation to tender documents The guidance can be found here: http://www.wrap.org.uk/construction/achieving_resource_efficiency/model_procurement_requirements/index.html
		Good	Before work starts on site consider layout and skip locations. Use segregated containers at the workplace.	
		Best	Ensure separate containers are provided for Hazardous Waste, material storage areas are clearly located and signed or arrange for just in time delivery and prevent double handling.	

Practice level targeted (please select)	Action (use to record more detail if you wish)
None	

Step 5.3	Explanation	Practice Level	How to achieve	Guidance available to help
Monitoring	<p>Monitoring progress against the actions in the site waste management plan more often than every six months can inform ongoing site achievement of the planned waste reduction and recovery actions. It can be part on the live review process and inform continual improvement.</p> <p>Once data is collected, it will form a baseline against which clients can evaluate and improve on resource efficiency performance. Step 5.3 should therefore be linked with Step 6.2.</p>	Standard	Monitor and update the Site Waste Management Plan not less than every six months	<p>WRAP provide guidance on measurement and reporting on construction projects. It can be found here: http://www.wrap.org.uk/construction/tools_and_guidance/reporting_portal.html</p>
		Good	Principal contractor to review the construction schedule and set appropriate project review and monitoring dates with the client.	
		Best	Building on Good Practice, review site progress against the Site Waste Management Plan and implement changes to revise site activities based on performance where necessary.	

Practice level targeted (please select)	Action (use to record more detail if you wish)
None	

Step 5.4	Explanation	Practice Level	How to achieve	Guidance available to help
Reporting	<p>Reporting is an integral part of the Site Waste Management Plan process. Good and best practice relate to recording and reporting waste arisings in increasing levels of detail.</p> <p>WRAP provide a method note that defines the standard by which the construction industry has agreed to record and report waste arisings. The link to this guidance is listed in the 'guidance'</p>	Standard	Ensure the Site Waste Management Plan is kept at the site, and that the Plan is available for two years after completion of the construction project.	<p>WRAPs Reporting Portal has been developed to allow the construction industry to report on its progress in implementing Site Waste Management Plans and record actual site achievements. It can be found here: http://www.wrap.org.uk/construction/tools_and_guidance/reporting_portal.html</p>
		Good	Report waste generation, recovery and disposal arising by construction phase (construction, demolition and excavation).	
		Best	Report lessons learnt through the project, including the good and best practice levels achieved.	

Practice level targeted (please select)	Action (use to record more detail if you wish)
None	

6.0 Post-completion

Step 6.1	Explanation	Practice Level	How to achieve	Guidance available to help
On-site project review	The on-site project review is an opportunity for the site project team to review their progress post completion. Good and best practice items relate to the process of continuous review and learning.	Standard	Meet requirements to compare Site Waste Management Plan forecast versus actual performance, and record any deviations from the Plan.	WRAPs National Reporting Portal has been developed to allow the construction industry to report on its progress in implementing Site Waste Management Plans and record actual site achievements. It can be found here: http://www.wrap.org.uk/construction/tools_and_guidance/reporting_portal.html
		Good	Building on Standard Practice, review the Site Waste Management Plan to identify any improvements that could have been made (e.g. to improve waste reduction or recovery, or the accuracy of the forecast).	
		Best	Building on Good Practice, hold a post completion project team meeting to debrief and learn lessons from the Site Waste Management Plan process that can be used to inform future practice.	

Practice level targeted (please select)	Action (use to record more detail if you wish)
None	

Step 6.2	Explanation	Practice Level	How to achieve	Guidance available to help
Corporate level review	The corporate level review uses the SWMPs produced on individual sites to compare construction projects against company baseline performance. If a baseline does not exist, then the first project will become the baseline against which performance in future projects will be measured against.	Standard	Meet requirements to compare Site Waste Management Plan forecast versus actual performance, and record any deviations from the Plan.	WRAPs Reporting Portal has been developed to allow the construction industry to report on its progress in implementing Site Waste Management Plans and record actual site achievements. It can be found here: http://www.wrap.org.uk/construction/tools_and_guidance/reporting_portal.html
		Good	Record project performance in the following areas: cost savings achieved, total waste arisings, total waste to landfill, total waste reductions achieved and recycled content used.	
		Best	Use data collected in Step 6.1 standard practice to benchmark performance across your portfolio of projects, using the data to inform continual improvement. Using the data gathered and lessons learnt, set company policy on expected metrics (cost savings, waste arisings, waste reductions, total waste to landfill) for similar project types going forward. Integrate lessons learnt into corporate construction procedures.	

Practice level targeted (please select)	Action (use to record more detail if you wish)
None	

"The Client and Principal Contractor Shall :

Develop and implement a Site Waste Management Plan (SWMP) in compliance with the Site Waste Management Plans Regulations 2008 No.314 and containing not less than the following information:

- the SWMP shall identify:
 - the Client;
 - the principal Contractor; and
 - the person who drafted it.
- the SWMP must describe the construction work proposed, including:
 - the location of the site; and
 - the estimated cost of the project.
- the SWMP must record any decision taken before the Plan was drafted on the nature of the project, its design, construction method or materials employed in order to minimise the quantity of waste produced on site.
- the SWMP must:
 - describe each waste type expected to be produced in the course of the project;
 - estimate the quantity of each different waste type expected to be produced; and
 - identify the waste management action proposed for each different waste type, including re-using, recycling, recovery and disposal.
- the SWMP must contain a declaration that the Client and the principal Contractor will take all reasonable steps to ensure that:
 - all waste from the site is dealt with in accordance with the waste duty of care in section 34 of the Environmental Protection Act 1990(3) and the Environmental Protection (Duty of Care) Regulations 1991(4); and
 - materials will be handled efficiently and waste managed appropriately
- update the SWMP when any waste is removed from site and state:**
 - the identity of the person removing the waste;
 - the waste carrier registration number of the carrier;
 - a copy of, or reference to, the written description of the waste required by section 34 of the Environmental Protection Act 1990; and
 - the site that the waste is being taken to and whether the operator of that site holds a permit under the Environmental Permitting (England and Wales) Regulations 2007 or is registered under those Regulations as a waste operation exempt from the need for such a permit.
- as often as necessary to ensure that the Plan accurately reflects the progress of the project, and in any event not less than every six months:**
 - review the Plan;
 - record the types and quantities of waste produced;
 - record the types and quantities of waste that have been:
 - re-used (and whether this was on or off site);
 - recycled (and whether this was on or off site);
 - sent for another form of recovery (and whether this was on or off site);
 - sent to landfill; or
 - otherwise disposed of; and
 - update the Plan to reflect the progress of the project.
- add the following to the SWMP within 3 months of the Works being completed:**
 - confirmation that the Plan has been monitored on a regular basis to ensure that work progressed according to the plan and that the plan was updated in accordance with the Regulations;
 - a comparison of the estimated quantities of each waste type against the actual quantities of each waste type;
 - an explanation of any deviation from the Plan; and
 - an estimate of the cost savings that have been achieved by completing and implementing the Plan.
- ensure that the SWMP is kept:**
 - at the site office, or
 - if there is no site office, at the site;
- ensure that every contractor knows where it is kept, and make it available to any contractor carrying out work described in the Plan;**
- keep the SWMP for two years after the completion of the project at the principal Contractor's principal place of business or at the site of the project;**
- ensure co-ordination of the work and co-operation among contractors at work during the construction phase;**
- ensure so far as is reasonably practicable that every worker carrying out the construction work is provided with:**
 - suitable site induction; and
 - any further information and training needed for the particular work to be carried out within the terms of the SWMP;
- make and maintain arrangements that will enable the principal Contractor and the workers engaged in the construction work to co-operate effectively in promoting and developing measures to ensure that any waste arising on site is managed within the terms of the SWMP and in checking the effectiveness of such measures;**
- ensure, so far as is reasonably practicable, that waste produced during construction is re-used, recycled or recovered;**
- take all reasonable steps to ensure that sufficient site security measures are in place to prevent the illegal disposal of waste from the site; and**
- review, revise and refine the SWMP as necessary, to ensure that any changes in roles and responsibilities are clearly communicated to those affected."**

		Compliance	
Pre-Construction	Client identified	Yes	Review
	Principal contractor identified	Yes	Review
	Draftee identified	Yes	Review
		Compliance	
	Location of site defined	Yes	Review
	Cost of project estimated	Yes	Review
Decisions taken before SWMP completed have been recorded		Yes	Review
		Compliance	
	All waste types identified and quantities estimated	Yes	Review
	Waste management actions identified	Yes	Review
		Compliance	
	All waste from site is dealt with in accordance with relevant guidelines	Yes	Review
	Materials handling identified	Yes	Review
Construction	All waste carriers identified	No	Review
	Waste carrier registration numbers identified	No	Review
	Written description of the waste as required by section 34 of the Environmental Protection Act 1990 identified	No	Review
	All sites and relevant permits acquired and confirmation of site registrations acquired	No	Review
Comments		Please Enter Compliance	
		No	
Post-Construction	Comments		Please Enter Compliance
			No
Construction	Comments		Please Enter Compliance
			No
Post-Construction	Comments		Please Enter Compliance
			No
Construction	Comments		Please Enter Compliance
			No
Construction	Comments		Please Enter Compliance
			No
Construction	Comments		Please Enter Compliance
			No
Construction	Comments		Please Enter Compliance
			No
Construction	Comments		Please Enter Compliance
			No
Construction	Comments		Please Enter Compliance
			No
Construction	Comments		Please Enter Compliance
			No

Additional Duties

Additional duties on the principal contractor

- The principal contractor must, so far as is reasonably practicable, ensure co-ordination of the work and co-operation among contractors at work during the construction phase.
- The principal contractor must ensure so far as is reasonably practicable that every worker carrying out the construction work is provided with-
 - (a) suitable site induction; and
 - (b) any further information and training needed for the particular work to be carried out within the terms of the site waste management plan.
- The principal contractor must make and maintain arrangements that will enable the principal contractor and the workers engaged in the construction work to co-operate effectively in promoting and developing measures to ensure that any waste arising on site is managed within the terms of the site waste management plan and in checking the effectiveness of such measures.
- The principal contractor must ensure, so far as is reasonably practicable, that waste produced during construction is re-used, recycled or recovered.
- Failure to comply with this paragraph is an offence.

Additional duties on the client

- The client must give reasonable directions to any contractor so far as is necessary to enable the principal contractor to comply with these Regulations.
- Failure to comply with this paragraph is an offence.

Additional duties on both the client and the principal contractor

- Both the client and the principal contractor must review, revise and refine the site waste management plan as necessary, to ensure that any changes in respective roles and responsibilities are clearly communicated to those affected.
- Both the client and the principal contractor must take reasonable steps to ensure that sufficient site security measures are in place to prevent the illegal disposal of waste from the site.
- Failure to comply with this paragraph is an offence.

These Regulations require any person intending to carry out a construction project with an estimated cost greater than £300,000 to prepare a site waste management plan.

The plan must be updated in accordance with the Regulations, with different requirements depending on whether the cost of the project is greater than £500,000.

The Regulations are enforced by the Environment Agency and the local authority.

Breach of the Regulations is an offence punishable-

- (a) on summary conviction, by a fine not exceeding £50,000, or
- (b) on conviction on indictment, by a fine.

An impact assessment of the effect that this instrument will have on the costs of business and the voluntary sector is available on the Defra website.

	Comments	Please Enter Compliance
Construction		No
		No
		No

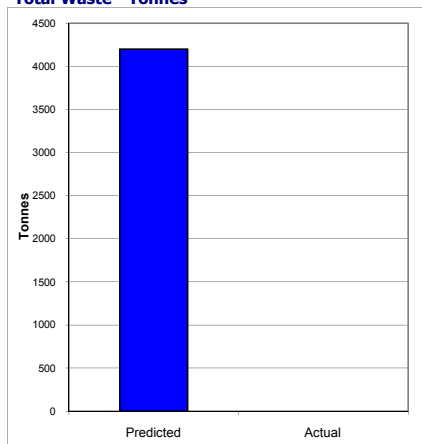


Tell me about this sheet

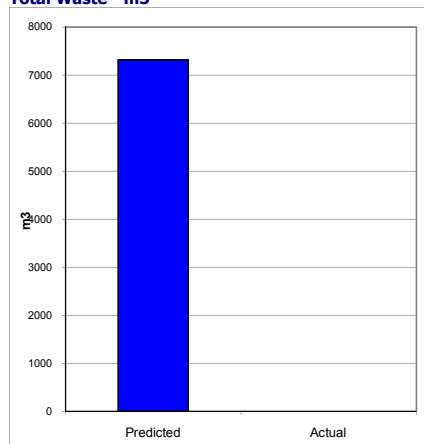
KPI Report

Select Metric : Total waste				
	Forecast		Actual	
	m ³	Tonnes	m ³	Tonnes
Total Waste	7308.52	4200.02	0.00	0.00
Total Waste to landfill	1177.64	545.47	0.00	0.00
% Waste diverted from landfill	84%	87%	#DIV/0!	#DIV/0!
% Waste reused on site	35%	59%	#DIV/0!	#DIV/0!

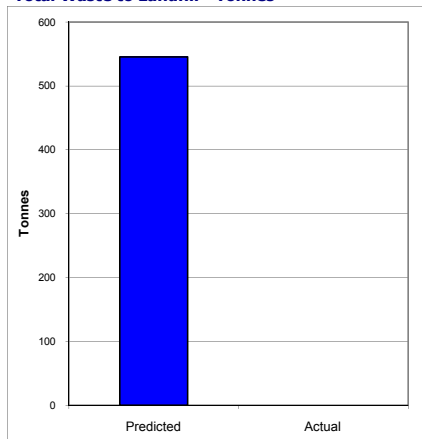
Total Waste - Tonnes



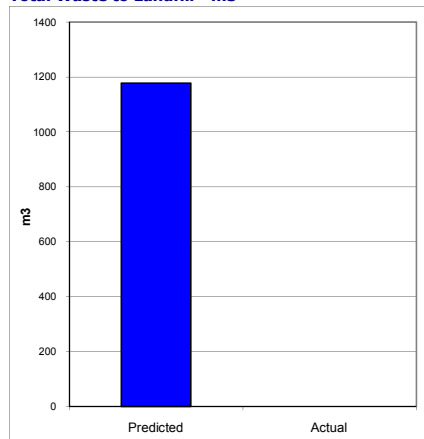
Total Waste - m3



Total Waste to Landfill - Tonnes



Total Waste to Landfill - m3



[illegible]

Forecast/Actual	
Unit	
Total	
Class	
Assigned Waste Stream	Non Haz (Inert)
	Haz
	Non Haz (Non Inert)
	Inert - Soil & stones
	Non Haz (Non Inert) - Soil & stones
	Non Haz (Non Inert) - Dredgings
	Segregated Haz - Soil & stones
	Gypsum
	Metals
	Wood
	Packaging
	Inert - Building rubble
	Inert - Glass
Mixed Hazardous & C&D waste	
Mixed C&D waste	
Segregated Haz Waste	
Other C&D nonrecyclable waste	

[illegible][illegible]

Forecast/Actual	
Unit	
Total	
Class	Non Haz (Inert)
	Haz
	Non Haz (Non Inert)
Assigned Waste Stream	Inert - Soil & stones
	No Haz (Non Inert) - Soil & stones
	Non Haz (Non Inert) - Dredgings
	Segregated Haz - Soil & stones
	Gypsum
	Metals
	Wood
	Packaging
	Inert - Building rubble
	Inert - Glass
	Mixed Hazardous - C&D waste
	Mixed C&D waste
	Soregated Haz Waste
	Other C&D segregated waste
	List of Waste (LOW) Code
08 01 11*	
08 01 12	
08 01 13*	
08 01 14	
08 01 18	
08 03 18	
13 01 12*	
13 01 13*	
13 05 01*	
13 05 03*	
13 05 06*	
13 07 01*	
14 06 01*	
14 06 02*	
14 06 03*	
14 06 04*	
14 06 05*	
15 01 01	
15 01 02	
15 01 03	
15 01 04	
15 01 05	
15 01 06	
15 01 07	
15 01 09	
15 01 10*	
15 01 11*	
15 02 02*	
15 02 03	
16 01 03	
16 01 07*	
16 02 09*	
16 06 01*	
16 06 02*	
16 06 03*	
16 06 04	
16 07 08*	
16 10 01*	
17 01 01	
17 01 02	
17 01 03	
17 01 06*	
17 01 07*	
17 02 01	
17 02 02	
17 02 03	
17 02 04*	
17 03 01*	
17 03 02	
17 03 03*	
17 04 01	
17 04 02	
17 04 03	
17 04 04	
17 04 05	
17 04 06	
17 04 07	
17 04 09*	
17 04 10*	
17 04 11	
17 05 03*	
17 05 04	
17 05 05*	
17 05 06	
17 05 07*	
17 05 08	
17 06 01*	
17 06 03*	
17 06 04	
17 06 05*	
17 08 01*	
17 08 02	
17 09 01*	
17 09 02*	
17 09 03*	
17 09 04	
19 13 01*	
20 01 01	
20 01 08	
20 01 11	
20 01 21*	
20 01 23*	
20 01 25	
20 01 35*	
20 01 36	
20 01 99	
20 02 01	
20 03 01	
20 03 03	
20 03 04	
20 03 06	
20 03 07	

[illegible][illegible]

Forecast/Actual		F	A	F	A	F	A	F	A	F	A
Unit		tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes
Total		483.99				483.99					
Class		483.99				483.99					
	Non Haz (Inert)										
	Haz										
	Non Haz (Non Inert)	483.99				483.99					
Assigned Waste Stream	Inert - Soil & stones										FALSE
	Non Haz (Non Inert) - Soil & stones										FALSE
	Non Haz (Non Inert) - Dredgings										FALSE
	Segregated Haz - Soil & stones										FALSE
	Gypsum										FALSE
	Metals										FALSE
	Wood										FALSE
	Packaging										FALSE
	Inert - Building rubble										FALSE
	Inert - Glass										FALSE
	Mixed Hazardous - C&D waste										FALSE
	Mixed C&D waste										FALSE
	Segregated Haz Waste										FALSE
	Other C&D segregated waste										FALSE
List of Waste (LOW) Code	06 01 11*										
	06 01 12										
	06 01 13*										
	06 01 14										
	06 01 18										
	06 03 18										
	13 01 12*										
	13 01 13*										
	13 05 01*										
	13 05 03*										
	13 05 06*										
	13 07 01*										
	14 06 01*										
	14 06 02*										
	14 06 03*										
	14 06 04*										
	14 06 05*										
	15 01 01										
	15 01 02										
	15 01 03										
	15 01 04										
	15 01 05										
	15 01 06										
	15 01 07										
	15 01 09										
	15 01 10*										
	15 01 11*										
	15 02 02*										
	15 02 03										
	16 01 03										
	16 01 07*										
	16 02 09*										
	16 06 01*										
	16 06 02*										
	16 06 03*										
	16 06 04										
	16 07 08*										
	16 10 01*										
	17 01 01										
	17 01 02										
	17 01 03										
	17 01 06*										
	17 01 07										

[illegible]

E-learning: A full e-learning module can be found on the WRAP website. This will show you how to complete the template and work through an example. http://www.wrap.org.uk/construction/tools_and_guidance/site_waste_management_planning/swmp_tools_and.html

Welcome to the WRAP Site Waste Management Plan Template. This short help page has been provided to guide you through how to use the template. You may find it easier to use Excel Full Screen view to navigate around the SWMP Template.

Project Homepage

1 **Enter Basic Details**

This is the main part of the SWMP Template and allows you navigate to all worksheets in the Template. The buttons on the homepage as shown here allow you to navigate through the document. Start at the top with Enter Basic Details and end at the declaration, each button is also accompanied by guidance as shown.

Project Stage

Policy and setup

The template follows the project stages to help you find where you are in your project.

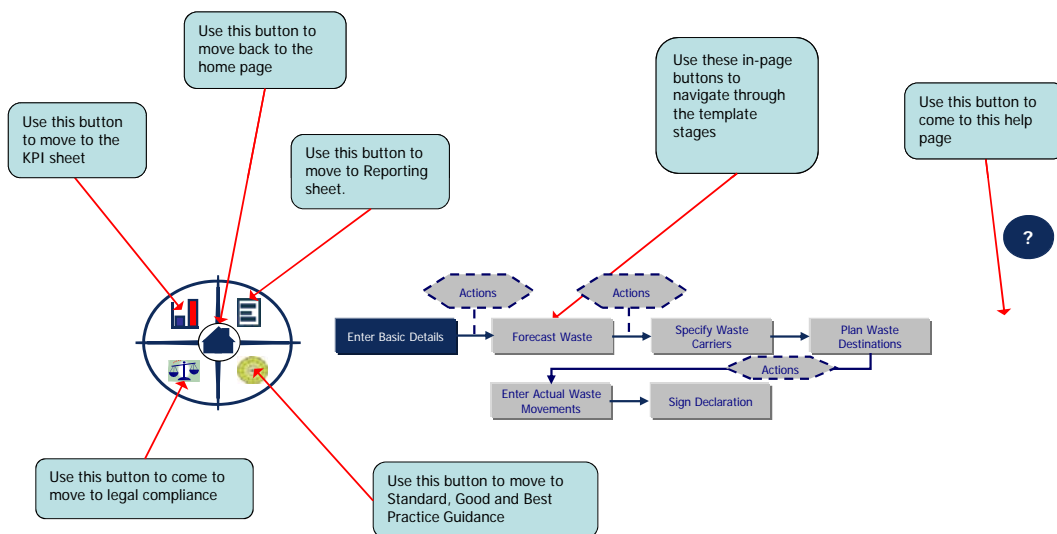
Guidance

Section 1.0

Each Step is accompanied by guidance that explains how to use an SWMP to achieve Good and Best Practice waste reduction and recovery on site.

Tell me about this sheet

The 'Tell me about your sheet' tab tells you what each sheet is for and how to use it. If you get stuck hover over the box and it will tell you what to do.



Expected Facility

There is more guidance on each sheet, hover over a box where you see a red triangle in the corner.

Please select project targets applicable to your project

Target	Amount	Unit
Total waste arisings	15	t
Total waste arisings	70	t
Waste recovery	45	%

When you click on a box you will see that some you enter using a drop down list and others use free entry. Look for the arrow on the right side of the box. If there is one there click it and select from the menu.

APPENDIX 16B

Sustainable Waste and Resources Plan (SWRP)



P3Eco (Bicester) Ltd & A2 Dominion Group

NW Bicester Eco Town

Sustainable Waste and Resources Plan (Exemplar Site)

PPS1 Requirement

Hyder Consulting (UK) Limited

2212959

5th Floor
The Pithay
All Saints Street
Bristol BS1 2NL
United Kingdom

Tel: +44 (0)117 372 1200

Fax: +44 (0)117 372 1508

www.hyderconsulting.com



P3 Eco (Bicester) Ltd & A2 Dominion Group

NW Bicester Eco Town

Sustainable Waste and Resources Plan (Exemplar Site)

PPS1 Requirement

Author	Carmel Griffith	pp Carmel Griffith
---------------	-----------------	--------------------

Checker	John Peake	pp John Peake
----------------	------------	---------------

Approver	Philip Harker	
-----------------	---------------	---

Report No	5502-UA001881-
------------------	----------------

Date	November 2010
-------------	---------------

This report has been prepared for P3Eco (Bicester) Limited & A2 Dominion in accordance with the terms and conditions of appointment for Sustainable Waste and Resources Plan (Exemplar Site) dated September 2010. Hyder Consulting (UK) Limited (2212959) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

CONTENTS

1	Overview	1
2	Introduction	2
3	Background	3
3.1	Eco-towns	3
3.2	The Exemplar Site development	3
4	Legislative Framework	4
4.1	National and European	4
4.2	Local	6
4.3	Eco-town specific	7
5	Existing system and performance	8
5.1	CDC Waste and recycling collection system	8
5.2	System performance	8
6	Targets	11
6.1	Targets to which the Eco-town is subject	11
6.2	Current performance against targets	11
6.3	Eco-town waste and recycling targets	12
7	How the targets will be achieved, monitored and maintained	14
7.1	Supplementary measures	14
7.2	Monitoring	17
8	Facilitating performance by design	18
8.1	Internal storage	18
8.2	External storage	18
8.3	Additional design requirements	18
8.4	Storage and collection of the priority waste materials	19
8.5	Code for Sustainable Homes	19
9	Consideration of waste to energy	23
10	Construction, demolition and excavation waste	23

This Sustainable Waste and Resources Plan (SWRP) forms part of the planning application for the NW Bicester eco development Exemplar Site, in accordance with the requirements of Planning Policy Statement (PPS1): Eco-towns (A supplement to PPS1), ET19 – Waste. It has been prepared in conjunction with the NW Bicester Eco-town Energy Waste and Water (EWW) Workstream working group.

This SWRP sets targets for recycling and residual waste levels for the Eco-development, the overall concept for waste management, and presents specific measures that should be implemented to enable these targets being achieved (as required by PPS1). Progression of these measures will require ownership and support; including support from Cherwell District Council / Oxfordshire County Council, particularly relative to maintaining segregated waste collection. There may be opportunities to partner with third party organisations to implement some measures as pilot projects in the future.

The EWW Workstream working group recognise the opportunity to design a showcase waste management system at the NW Bicester Eco-town in accordance with

- The requirements set out in PPS1
- The exiting high recycling performance achieved by Cherwell District Council (CDC)
- The forthcoming Review of UK Waste Policy which will emphasise waste prevention and reuse, incentivising participation, and continuing to increase recycling rates.

Against this context, this SWRP sets out ambitious waste and recycling targets:

- For the percentage recycled/composted/reused: 70% from initial occupation; 80% by 2020
- For residual waste levels: 300 kg per household per year from initial occupation; 200 kg per household per year by 2020

In accordance with the waste hierarchy, waste reduction and reuse will be strongly encouraged: a community reuse centre will be established; residents will be provided with home composters, and a community recycling project will be established.

The high recycling performance in CDC is achieved with an alternate weekly collection (residual waste is collected one week, and comingled recyclables and mixed organics are collected the other) and bring banks for glass. This service will be provided to all households on the Exemplar site and supplemented with a number of measures including a reuse centre, a community composting project and an incentive scheme. Commercial operations will be supported, through the eco development governance organisation, to develop their own waste minimisation action plans.

The EWW Workstream working group considered a performance based charging system to incentivise participation. It is recommended that this initiative is further investigated as it would require bins to be chipped and bin weighing equipment to be installed on vehicles servicing the Exemplar site to enable monitoring against the targets as well as agreement of a suitable incentive scheme including how this would be managed.

In addition to these measures, this SWRP plan sets out how best practice will be facilitated through the design of the Exemplar site, in accordance with the standards for waste in the Code for Sustainable Homes.

2 Introduction

This Sustainable Waste and Resources Plan (SWRP) forms part of the planning application for the NW Bicester Eco-town Exemplar Site, in accordance with the requirements of Planning Policy Statement (PPS): Eco-towns (A supplement to PPS1), ET19 –Waste. It has been prepared in consultation with the Energy Waste and Water (EWW) Workstream working group.

While this SWRP is for the Exemplar Site, it will also inform the context of waste management across the whole site.

ET19 requirements state that: Eco-town planning applications should include a sustainable waste and resources plan, covering both domestic and non-domestic waste¹, which:

- (a) sets targets for residual waste levels, recycling levels and landfill diversion, all of which should be substantially more ambitious than the 2007 national Waste Strategy targets for 2020²; it should be demonstrated how these targets will be achieved, monitored and maintained
- (b) establishes how all development will be designed so as to facilitate the achievement of these targets, including the provision of waste storage arrangements which allow for the separate collection of each of the seven priority waste materials as identified in the Waste Strategy for England 2007
- (c) provides evidence that consideration has been given to the use of locally generated waste as a fuel source for combined heat and power (CHP) generation for the eco-town, and
- (d) sets out how developers will ensure that no construction, demolition and excavation waste is sent to landfill, except for those types of waste where landfill is the least environmentally damaging option.

This SWRP sets targets for recycling and residual waste levels for the Eco-town, the overall concept for waste management, and presents specific measures that if implemented will facilitate these targets being achieved (as required by PPS1). Progression of these measures will require ownership and support; including support from Cherwell District Council / Oxfordshire County Council, particularly relative to maintaining segregated waste collection. There may be opportunities to partner with third party organisations to implement some measures as pilot projects in the future.

¹ This standard does not apply to health and social care services' medium and high risk waste, such as clinical and hazardous waste; these are covered by national regulations.

² The Waste strategy 2007 proposes national targets for waste for 2020 as follows:

- Residual waste reduction per person (amount left after reuse, recycling and composting) – from 370 kg in 2005 to 225 kg in 2020
- Household re-use, recycling and composting – from 27% in 2005 to 50% in 2020
- Residual waste recovery (recycling, composting and energy recovery) from 38% in 2005 to 75% in 2020.

3 Background

3.1 Eco-towns

Eco-towns are a programme of new towns, to relieve the need for new housing while achieving high standards of sustainability.

The standards for Eco-towns are set out in Planning Policy Statement (PPS): Eco-towns (A supplement to PPS1) and include requirements for green space, promoting healthy and sustainable environments through 'Active Design'³ principles and healthy living choices, use of technologies in energy generation and conservation in ways that are not always practical or economic in other developments; delivering a mix of housing type and tenure to meet the needs of all income groups and household size, creation of jobs within the towns; ambitious targets for and achieving high recycling standards.

3.2 The Exemplar Site development

The development site (subject to final confirmation) will comprise:

- up to 450 residential units;
- a primary school;
- B1(a) office accommodation;
- retail units (class A1 – A5);
- social and community facilities within class D with associated means of access;
- Eco - pub
- car parking;
- landscape;
- amenity space; and
- service infrastructure.

Currently, the Exemplar Site planning application is submitted in as a hybrid, in outline with all matters reserved, with full planning permission sought for the residential development, means of access thereto, and associated car parking, landscape, amenity space and service infrastructure.

All such development shall accord with the Application Plans and Development Parameters Schedule.

³ Active Design – www.sportengland.org/planning_active_design

4 Legislative Framework

Targets and measures for achieving them set out in this SWRP take into account current and emerging policies with direct relevance to the way in which waste must be managed at the Eco-town.

4.1 National and European

4.1.1 EU Landfill Directive

The main policy driver is the EU Landfill Directive, whose overall objective is to “*prevent or reduce as far as possible the negative effects on the environment, in particular the pollution of surface water, groundwater, soil and air, and on the global environment, including the greenhouse effect as well as any resulting risk to human health, from the landfilling of waste, during the whole life-cycle of the landfill*”.

The Directive sets out a number of wastes that must be excluded from landfill but perhaps the most challenging aspect of the Directive for the UK is the targets for the progressive reduction of biodegradable municipal waste (BMW) being sent for disposal in landfill. In England and Wales the directive is applied under the Landfill (England and Wales) Regulations 2002.

The outcome of the Landfill Directive has already resulted in major changes to the waste management industry and increased the diversion of BMW from landfill. The Directive has led to a realisation that there is currently a large deficit in the capacity available to treat this BMW which needs to be addressed as a matter of urgency.

4.1.2 Waste Strategy for England 2007

The key objectives of the Waste Strategy are to:

- Decouple waste growth (in all sectors) from economic growth and put more emphasis on waste prevention and re-use;
- Meet and exceed the Landfill Directive diversion targets for biodegradable municipal waste in 2010, 2013 and 2020;
- Increase diversion from landfill of non-municipal waste and secure better integration of treatment for municipal and non-municipal waste;
- Secure the investment in infrastructure needed to divert waste from landfill and for the management of hazardous waste; and
- Get the most environmental benefit from that investment, through increased recycling of resources and recovery of energy from residual waste using a mix of technologies.

4.1.3 Landfill Allowance Trading Scheme

To help local authorities achieve the challenging targets in the Waste Strategy for England 2007, the Landfill Allowance Trading Scheme (LATS) was introduced in 1995. Under this scheme local authorities are given set allowances regulating the amount of BMW that they can send to landfill in each year.

One of the results of LATS has been an increase in the number of local authorities arranging the collection of household food waste and subsequent treatment options.

The future of the scheme is presently under review as a result of the revised Waste Framework Directive consultation.

4.1.4 Landfill Tax

Landfill Tax is a fiscal mechanism employed in the UK to encourage diversion of waste from landfill. The previous chancellor announced an annual increase in the Landfill Tax escalator. The landfill Tax is presently £48 per tonne. The current escalator runs to 2013/2014, rising £8 per year. By 2014 landfill tax will reach £80 per tonne. Increasing the landfill tax makes investments in alternative non-landfill treatments more economically viable. It also addresses the issue of the declining availability of landfill space available.

4.1.5 Consultation on the revised Waste Framework Directive

Consultation is taking place on how to implement the revised EU Waste Framework Directive (2008/98/EC) in England and Wales.

In order to transpose the revised Waste Framework Directive (rWFD) into law the government has undertaken a two stage consultation exercise. The first was completed in October 2009; the second stage closed in September 2010. The rWFD brings together new and existing measures to promote waste prevention, recycling, and better use of resources while protecting human health and the environment

The consultation includes proposals on:

- A legal obligation for those producing waste (other than householders) to deal with their waste in the best way possible for the environment wherever practical, prioritising actions to prevent waste in the first place; then preparing any waste for re-use; recycling it; using other types of recovery such as energy from waste; and if all else fails disposing of it. This 'waste hierarchy' is already part of policy in many areas.
- A statutory target to recycle 50% of waste from households by 2020.
- A statutory target to recover 70% of construction and demolition waste by 2020. There is an existing joint Government and industry voluntary target to halve construction, demolition and excavation waste disposed of in landfill by 2012, compared to a 2008 baseline.
- Setting up where practical separate collections for: waste paper; metal; plastic; and glass by 2015. Separate collections can include co-mingled waste collection followed by separation at recycling facilities.

At the forefront of the consultation is the banning of certain biodegradable and recyclable waste materials from landfill. The consultation also question the contribution that eliminating materials such as metals, glass, wood, textiles, paper, food, green (garden) waste, small electrical goods and plastics could make to increasing recycling rates and reducing greenhouse gas emissions.

In addition, views have been sought on:

- The options for a new interpretation of the definition of municipal waste;
- Changes to baseline values and targets; and
- The reporting and monitoring obligations necessary to enable the UK to fulfil its reporting responsibilities under EU law.

Currently across most of the EU the definition of municipal solid waste (MSW) includes household waste and waste which resembles household waste in composition i.e. commercial and light industrial waste (C&I). In the UK what we count as MSW is mainly household waste. C&I waste in the UK totals at 68 million tonnes a year and accounts for more than twice as much waste as household waste.

4.1.6 Review of Waste Policy

In June the Coalition Government announced there will be a full review of waste policy in England, looking at the most effective ways of reducing waste, maximising the money to be made from waste and recycling, and how waste policies affect local communities and individual households.⁴

The overarching aim of the review will be to ensure that the right steps towards a 'zero waste' economy are taken, setting new goals for 2014, 2020 and beyond.

Of particular relevance to the way waste will be managed at the Eco-town, the review will place emphasis on:

- Concentrating on waste prevention and reuse – stopping waste at source;
- Continuing to increase recycling rates, when it's the best option
- Incentivising households and businesses to take action.

4.2 Local

Oxfordshire Waste Partnership's (OWP) vision to maximise waste prevention across the county for the period 2010 - 2020. is set out in the Waste Prevention Strategy. It forms part of the wider OWP Joint Municipal Waste Management Strategy, which was adopted in 2006.

Oxfordshire's key targets are currently to:

- Reduce the growth of municipal waste to 0% per person per annum by 2012
- Achieve a 45% recycling & composting rate by March 2011.
- By March 2020, to recycle or compost at least 55% of household
- Reduce the amount of waste sent to landfill to no more than 81,000 tonnes by 2012/13 and 56,700 tonnes by 2019/20
- Reduce the amount of residual waste collected to 715 kg per household or less by 2010/11.

⁴ Press release <http://ww2.defra.gov.uk/2010/06/15/waste-policy-review/> [accessed 05/08/2010]

4.3 Eco-town specific

The requirements for the management of waste at Eco-towns are set out in Planning Policy Statement (PPS): Eco-towns (A supplement to PPS1), see section 1.

5 Existing system and performance

The targets in this SWRP and measures to achieve them take into account the existing waste management system provided by Cherwell District Council and its performance.

5.1 CDC Waste and recycling collection system

Cherwell District Council (CDC) provides an alternate weekly collection system for the properties in the district (approx 59,000).

For households, residual waste is collected on one week and co mingled dry recyclables and mixed organics are collected the following week. Blue bins are provided for co mingled dry recyclables (food tins and drinks cans, plastic bottles and containers, newspapers, directories and magazines, paper and card and aerosol cans). Brown bins are provided for mixed organics (food: waste cooked and uncooked, prunings, pet straw and sawdust, grass cuttings, plants and leaves). Glass is not collected at the kerbside, instead residents are encouraged to use bring banks for glass.

Residents of flats are provided with communal bin stores which typically comprise of blue co mingled recycling bins which are emptied one week, and green residual bins which are emptied the next. Brown bins are also provided for mixed organics. Some developments also have black wheeled bins for the collection of glass bottles and jars.

A chargeable bulky waste collections service is provided to all residents for items such as furniture and white goods.

Most dry recyclables are currently delivered to Enstone Community Waste Materials Recovery Facility (MRF) in West Oxfordshire (approx 90%). The other 10% to Helmdon transfer station from where it is transferred to Milton Keynes Community Waste MRF. (This has about 6-18 months before it needs to be re-tendered).

Cherwell District Council rolled out food collection services in October 2009, with everyone in the district being served by April 2010. The mixed garden waste and food waste goes to an in vessel composting facility (IVC) at Ardley (operated by Agrivert). This is in yr 1 of a 15 year agreement.

Most residual waste goes to Ardley Landfill. Residual waste generated in the north of the district goes to Banbury Waste Transfer station and then to Calvert in Buckinghamshire.

5.2 System performance

5.2.1 Recycling rates

2008/09 recycling rate

According to WasteDataFlow in 2008/09 (the most recent complete years worth of data), Cherwell DC achieved a recycling rate of 50%, compared to 42% in Oxfordshire and 38% across the rest of England.

2009/10 recycling rate

Cherwell DC recycling rates are already well above the UK average. According to Cherwell District Council data in 2009/10 14,078 tonnes was sent for dry recycling, (10,579 from the kerbside and 3,498 from bring banks), 15,002 tonnes of mixed organics was sent for composting, and 28,042 tonnes of residual waste was collected.

Taking into account rejects and a small amount of commercial waste, this equates to total waste arising of 57,621, or 970 kg per household of waste material per year, and a recycling rate of 51%, with a dry recycling rate of 25% and an organics recycling rate of 26%

Expected recycling rate for 2010/11

Since 2009 performance data was published on WasteDataFlow, all households have been provided with a food collection service.

Data collected by Cherwell District Council for the first quarter of 2010/2011 compared to the same period in 2009/10 indicate an increase in overall recycling rates by approximately 7%. Dry recycling rates increased by 1% during this period, while organics recycling has increased by 6%, which is strong evidence for the effect of the food collection on overall recycling rates.

Based on the performance in the first quarter of 2010/11, Cherwell District Council expect a recycling rate of 58% in 2010/11.

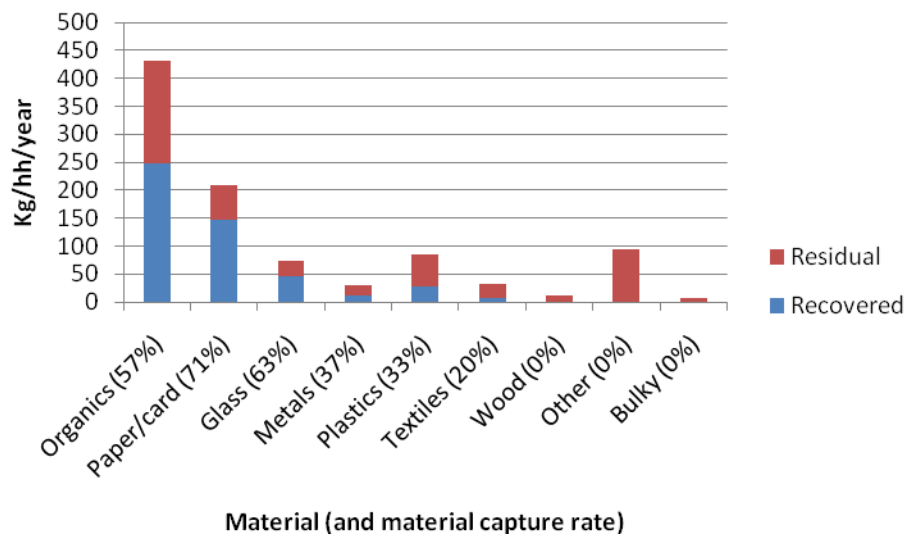
5.2.2 Material recovery

An estimate of individual material capture rates has been put together using actual waste and recycling data provided by Cherwell District Council and WasteDataFlow and compositional data for Cherwell District Council in a recent audit⁵. The estimate is based on 2009 material capture data as it is the most recent full years data in WasteDataFlow.

Materials are listed according to the seven priority materials listed in the WSE 2007, bulky waste (which could highlight opportunities for reuse) and other waste (which includes non recyclables items such as nappies, household hazardous waste etc).

⁵ Oxfordshire Waste and Partnership two Season Waste Composition Report, prepared by SKM Enviros (2010).

Figure 1 Material capture rates



6 Targets

PP1 requires that waste and recycling targets set for Eco-towns should be substantially more ambitious than the 2007 national Waste Strategy targets for 2020. Targets should be set for waste levels, recycling levels and landfill diversion.

There are currently uncertainties relating to the treatment of residual waste in Oxfordshire due to the proposal of Energy from Waste as a treatment option. Residual waste treatment will affect the proportion of residual waste that is diverted from landfilled and it may be pertinent to set targets based on recovery of residual waste. Due to these uncertainties this SWRP sets targets for a recycling rate, and residual waste levels only – at this stage landfill diversion is directly linked to the recycling rate. The recycling rate will include dry recycling, composting / in vessel composting and reuse.

6.1 Targets to which the Eco-town is subject

WSE 2007

- 40% recycling rate by 2010.
- 45% recycling rate by 2015
- 50% recycling rate by 2020
- 450kg per person of residual waste by 2010.
- 225kg per person of residual waste by 2020.

Oxfordshire Waste Partnership

- 45% recycling & composting rate by 2011.
- 55% (at least) recycling & composting rate by 2020

6.2 Current performance against targets

In 2009/10 Cherwell District Council achieved the following for household waste:

- **a recycling and composting rate of 51% comprising a composting rate of 26% and a dry recycling rate of 25%.**

Not only does current recycling and composting performance exceed the WSE 2007 target for 2010 (40%) and the OWP target for 2011 (45%), it also now exceeds the WSE 2007 target for 2020 (50%) and is on track to exceeding the OWP target for 2020 (55%)

- **479 kg per household of residual waste, or 200 kg per person.**

Again performance is well in excess of the WSE 2007 residual waste target for 2010 (450kg per person), the OWP target for 2010/11 (300kg per person) and it also exceeds the WSE 2007 target for 2020 (225 kg per person)

6.3 Eco-town waste and recycling targets

To maintain its high sustainability credentials as an Eco-town, the development must not only meet and exceed the WSE 2007 and OWP targets, but must be ambitious enough to stand out from the high performance already being achieved by CDC.

A number of material capture scenarios were investigated to assess potential performance.

Scenario 1

This is estimated to be the current scenario: with all material recovery rates as per Table 1 and food waste recovery increased to achieve the overall recycling rate. (To allow for the recent improvement to the food waste collection service).

Scenario 2

This scenario assumes material capture rates equivalent to the current maximum dry recyclables capture rate (65%) are achieved, with the exception of garden waste where capture remains at 92%, and 'other' (which includes WEEE and household hazardous wastes) where capture is increased to 10%

Scenario 3

This scenario assumes a 100% participation, and that both organics streams achieve 92% capture (as estimated to be the current capture rate for garden waste), and that 'other' waste achieve a 20% capture rate. A capture rate of 80% is assumed for all other scenarios.

Table 1 Material capture rate scenarios

Material	2009	Scenario 1 (Current)	Scenario 2	Scenario 3
Garden waste	92%	92%	92%	92%
Food	15%	64%	65%	92%
Paper/card	65%	65%	65%	80%
Glass	36%	36%	65%	80%
Metals	37%	37%	65%	80%
Plastics	30%	30%	65%	80%
Textiles	20%	20%	65%	80%
Wood	0%	0%	10%	80%
Other	0%	0%	65%	20%
Bulky	0%	0%	65%	80%
Recycling rate	51%	58%	73%	80%
Total recycling (kg/hh)	500	560	700	770
Total residual (kg/hh)	470	410	270	200

Following consultation with the WWE Workstream Working Group, and based on current recycling performance of CDC, and the analysis of potential capture of individual materials, the following ambitious targets have been set:

For the percentage recycled/composted/reused

- 70% from initial occupation
- 80% by 2020

For residual waste levels

- 300 kg per household per year (120kg per person per year) from initial occupation
- 200 kg per household per year (80kg per person per year) by 2020

Reducing waste levels

In addition to the scenarios detailed above for recycling targets, measures to reduce and reuse quantities of recyclable materials will have a significant impact on total waste production. Initiatives that focus on waste minimisation strategies are extremely difficult to quantify, however future sustained communications drives and education programmes conducted by CDC and the Ecotown community governance company are likely to further reduce the residual fractions in all three scenarios that are sent to landfill.⁶

While the majority of waste from the development will be household waste, the reuse, recycling and composting targets will apply to all sources of municipal waste across the development including: schools waste, and commercial waste.

⁶ http://www.wrap.org.uk/local_authorities/research_guidance/monitoring_and_evaluation_guidance/

7 How the targets will be achieved, monitored and maintained

The kerbside collection services and bring bank for glass, currently provided by CDC, will be extended to all residents across the eco development. Commercial facilities will need to arrange their own collections, and will be supported to develop their own waste strategy action plans to minimise waste and improve recycling.

7.1 Supplementary measures

In order to further increase performance beyond current CDC levels, and achieve and maintain the targets set out above, the service will be supplemented by a number of measures

- Kerbside and bring bank recycle bins
- A community re-use centre
- Home/community composting
- Ongoing awareness and education campaigns
- Incentive schemes
- Weight based monitoring system relative measuring performance against the targets.

7.1.1 Community reuse centre

Ongoing awareness and education campaigns will emphasise the importance of waste prevention and reuse. A community reuse centre will be established either within the Eco business centre or as part of the Community Facility building. Alternative, a remote reuse service for bulky goods, operating virtually via the community information network, may be established. Discussions with a Social Enterprise are ongoing relative to establishing and managing this service.

Social enterprise / Local Authorities partnerships are becoming increasingly successful in the provision of bulky waste collection services. They often provide more than simply a waste collection service and in addition provide repair services and training / volunteering opportunities thus linking to PPS1 E10 which requires job creation within the town.

The role of reuse as a contributor to waste reduction is often hard to quantify. It is recommended that this service is provided which could also act as a trial pilot data gathering programme.

It is anticipated that in addition to bulky waste, the organisation is the focal point for any irregular wastes (with the exception of healthcare waste) generated at the site and will provide drop off points or arrange collections for: textiles, non bulky wood waste, books, toys and any household

hazardous waste. The organisation would then arrange onward distribution or removal of any items that are not reused in the eco development.

7.1.2 Home and community composting

Composting of green waste will be encouraged. A free home composting unit will be available to residents as they move in for anyone wishing to participate. Regular mixed organics collections will also be provided.

Community composting will also be developed, and land will be available at the allotments to accommodate a small scale community composting project. This would need to be 'championed' by a residents group. The eco development governance organisation would initially facilitate this, which may in the future be taken over by a Social Enterprise.

7.1.3 Kerbside collection service

Households

Households will be provided with CDC's three bin alternate weekly system:

- A brown 240 litre wheeled bin for mixed organics
- A blue 240 litre wheeled bin for co-mingled recyclables
- A green 180/190 litre wheeled bin for residual waste. Currently a 240 litre bin is provided but CDC are looking to move to 180/190 litre size from 2011. The smaller residual bin size is provided to residents at the Eco-town.

Kitchen caddies will be provided to all residents for food waste, which can then be emptied into the brown wheelie bin.

Space for internal storage of material, prior to depositing in outside wheeled bins will be provided for three waste streams: comingled recyclables; glass and residual waste.

Adequate space for external storage has been incorporated into the design of the Exemplar site.

Flats

Flats will be provided with CDC's system for flats:

- Brown 240 litre wheeled bins for mixed organics
- Blue 240 litre wheeled bins for co-mingled recyclables
- Green 240 litre wheeled bins for residual waste.

Kitchen caddies will be provided to all residents for food waste, which can then be emptied into the brown wheelie bin.

Space for internal storage of materials, prior to depositing in outside wheeled bins will be provided for three waste streams: comingled recyclables; glass and residual waste. Reusable bags will be provided for transporting recyclables to the communal facilities.

Adequate external storage space to accommodate these bins has been incorporated into the Exemplar design.

7.1.4 Bring banks

Provisions for glass collection will be equivalent to those already provided by CDC: appropriate bring banks for glass will be located within the centre of the development for use by all residents.

Bring banks can also be supplied for textiles although it is anticipated that this service will be provided by the bulky waste service provider (see section 7.1.1).

7.1.5 Performance based charging

The WWE Workstream Working group supported the concept of itemised charging for waste management. This section outlines the discussions, however, further investigation and agreement as to its appropriateness and workability is needed.

A number of different charging models have been discussed: and a performance based charging system was favoured to incentivise recycling as opposed to charging for residuals disposal.

A performance based charging scheme would require bins to be chipped and for the CDC waste collection vehicles servicing the Exemplar site to be fitted with bin weighing equipment. CDC have confirmed that this is possible, and that bin weighing equipment could be installed at minimal additional cost.

For households the performance based charging system would be applied individually, and to flats, where communal facilities will be provided, an average charge will be applied (dependant on communal performance and the number of residents per household).

While the details for such a system are beyond the requirements of this plan, the following is elements may form the basis of such a scheme (further investigation and discussion pending):

- Charges based on residual waste and co-mingled recyclables so as not to dissuade home /community composting.
- That the charging system is in place of, rather than in addition to, the waste management component of council tax.
- Performance is linked to the percentage of dry recycling of the total kerbside collected material (not including organics), as opposed to direct quantity, so as not to 'penalise' those not generating as much recyclable waste
- The system is accompanied by a comprehensive education programme to ensure that amounts of contaminants in the recyclable stream does not increase

For a scheme of this nature to be implemented, CDC would need to commit to installing the additional bin weighing devices on their collection lorry and the necessary administrative and council tax reduction/rebate mechanism. This option should therefore be maintained for future consideration pending further investigation and discussion.

7.1.6 On-going education and support campaigns

Fundamental to the achievement of the targets set out in this SWRP is community awareness through appropriate publicity and education which will be organised by the eco development governance organisation established by the developer. Residents will be actively encouraged to participate in achieving the targets, which are significantly higher than previously

experienced. To facilitate this all new residents will be met by the waste/sustainability officer, funded by the governance organisation, who will explain the waste management system, the targets and provide advice on how to minimise waste.

Education, support and awareness will need to be ongoing and should be reported back to residents through community forums and information portals; to enable residents to monitor the eco developments performance.

7.1.7 Commercial waste

Commercial premises will be required to meet the same recycling target as households. Each commercial operation will be supported to produce a waste management plan to identify how the targets are to be achieved.

Bin types and sizes will be allocated according to the type of premise. Commercial waste reduction will be undertaken based on the type of enterprise and the type of waste produced. Retail / business units and the proposed primary school are likely to have a high percentage of paper and card which is able to be accommodated. The eco pub and proposed service industry developments will have a larger amount of food waste. Due to the introduction of food waste collections throughout the Eco-town exemplar site these needs will be catered for by the wider recycling collection services for the private sector.

Commercial facilities will also be encouraged to utilise the reuse centre in events such as office fit outs.

Private arrangements will be made for ad hoc wastes such as small quantities of hazardous waste and medical waste.

7.2 Monitoring

The EWW Workstream working group discussed a performance based charging system to incentivise participation. This would require bins to be chipped and bin weighing to be installed on vehicles servicing the Eco-town and would provide the mechanism for monitoring against the targets. The scheme would apply to both households and commercial premises.

Flatted properties will have access to communal recycling facilities: performance will be monitored per block of flats as opposed to per unit.

However, prior to any such system as described above being implemented CDC waste and recycling collection vehicles are currently fitted with weighing equipment for the purpose of monitoring the load of each vehicle. As an alternative to chipping bins and monitoring performance on a household level, waste and recyclable arisings will be monitored on a development-wide basis: readings will be taken before and after servicing the Eco-town. It is likely that this would happen periodically as opposed to each service.

In addition, periodic residual waste audits, organised and funded by the governance organisation, will be carried out to identify opportunities to increase material capture.

8 Facilitating performance by design

The achievement of the targets set out in this plan will be facilitated through the design of the development, both at the kerbside and for communal facilities. Also considered are the design requirements of the Code for Sustainable Homes.

8.1 Internal storage

Kitchens will incorporate storage for three waste streams: comingled recyclables; glass, and residual waste. Kitchen caddies will be provided for food waste: these will not require fixed storage space.

8.2 External storage

Kerbside properties will be provided with external storage space for three wheeled bins, as in accordance with the existing CDC kerbside collection scheme:

- 1 x 240 litre wheeled bin for mixed organics
- 1 x 240 litre wheeled bin for co-mingled recyclables
- 1 x move to 180/190 wheeled bin for residual waste. Currently a 240 litre bin is provided but CDC are looking to move to 180/190 litre size from 2011. Residents at the Eco-town will be provided with the smaller size.

Flats will be provided with communal facilities consisting of 240 litres wheeled bins for each material stream.

8.3 Additional design requirements

8.3.1 Bring facilities

Communal facilities will be provided for glass; textiles, and bulky waste (to include wood). The exact locations will be determined at a later stage and in conjunction with CDC and the bulky waste service provider.

8.3.2 Composting

Land at the allotment areas has been designated to accommodate a community composting. In addition, every home will be provided with a composting unit available for residents that wish to undertake green waste recycling at home.

8.3.3 Community reuse centre

A unit in the Eco-business centre, appropriate space within the Community Facility building or one of the commercial units along the Exemplar High Street will be designated to accommodate the reuse centre and associated storage, repair and training facilities.

8.4 Storage and collection of the priority waste materials

PPS1 requires the provision of waste storage arrangements which allow for the separate collection of each of the seven priority waste materials as identified in the Waste Strategy for England 2007: organics, plastics, glass, metals, paper/card, wood and textiles.

In order to utilise the already high performing waste collection system provided by CDC, this SWRP proposes to store and collect **plastics, glass, metals and paper/card** as co-mingled recyclables.

Food and garden waste would be collected as mixed **organics** and stored/collected separately. Residents will have the opportunity to home compost organics, and it is anticipated that a community composting scheme will be established at a later stage of the project.

It is anticipated that a Social enterprise will operate the bulky waste collection service and swap shop. In addition to bulky waste it is recommended that this service is the focal point for any non regular wastes (with the exception of healthcare waste) and would therefore include any non bulky **wood waste**, and **textiles**, in addition to any household hazardous waste.

8.5 Code for Sustainable Homes.

The Code for Sustainable Homes (CSH) provides a comprehensive measure of the sustainability of new homes, ensuring that sustainable homes deliver real improvements in key areas including waste.

Dwellings are rated on a scale from Level 1 to level 6, where level 6 is the highest. For each design category there are mandatory standards, on top of which each scores a number of percentage points.

The Code assigns one or more performance requirements (assessment criteria) to all of the environmental issues. When each performance requirement is achieved, a credit is awarded (except the four mandatory requirements with no associated credits). The total number of credit available to a Category is the sum of credits available for all the issues within it.

Mandatory minimum performance standards are set for some issues. For four of these, a single mandatory requirement is set which must be met, whatever Code level rating is sought. Credits are not awarded for these issues. Confirmation that the performance requirements are met for all four is a minimum entry requirement for achieving a level 1 rating.

Further credits are available on a free-choice or tradable basis from other issues so that the developer may choose how to add performance credits (converted through weighting to percentage points) achieve the rating which they are aiming for.

Storage of non-recyclable waste and recyclable household waste is one of the unaccredited issues, for which a maximum number of tradable credits is four. Composting, is also allocated one tradable credit.

Table 1 sets out how the development design meets the CSH standards⁷ and includes comments for how these standards will be met, or where an alternative will be provided.

Table 2 CSH Standards and comments

Criteria	Credits available	Comment
<p>Storage of household waste</p> <p>The space allocated for waste storage should be able to accommodate containers with at least the minimum volume recommended by British Standard 5906 (British Standards, 2005) based on a maximum collection frequency of once per week. This is 100 litres volume for a single bedroom dwelling, with a further 70 litres volume for each additional bedroom.</p> <p>A Local Authority recycling scheme offering containers equal to or greater than this volume would meet the requirement, providing adequate external space is allocated to accommodate them.</p> <p>If the Local Authority provides containers with a smaller volume, or if no Local Authority scheme exists, the developer will need to ensure and demonstrate that the minimum volume according to BS 5906 2005 and defined above, is met.</p> <p>All containers must be accessible to disabled people (checklist Was 1), particularly wheelchair users, and sited on a hard, level surface. To ensure easy access, the containers must not be stacked.</p>	<p>Mandatory</p> <p>No credits available</p>	<p>The minimum performance standard for Storage of non-recyclable waste and recyclable household waste would be met through providing the CDC waste and recycling system, which meets this standard.</p>
<p>Storage of recyclable household waste</p> <p>Dedicated internal storage for recyclable household waste can be credited where there is no (or insufficient) dedicated external storage capacity for recyclable material, no Local Authority collection scheme and where the following criteria are met:</p> <p>At least, three internal storage bins:</p> <ul style="list-style-type: none"> • all located in an adequate internal space • no individual bin smaller than 15 litres • with a minimum total capacity 60 litres 	<p>Credits available: 2</p>	<p>Not applicable</p>

⁷ Code For Sustainable Homes Technical Guide Version 2, Communities and Local Government (2009)

<p>A combination of internal storage capacity provided in an adequate internal space, with either:</p> <ul style="list-style-type: none"> • a Local Authority collection scheme; or • No Local Authority collection scheme but adequate external storage capacity. <p>Local Authority Collection Scheme In addition to a Local Authority Collection Scheme (with a collection frequency of at least fortnightly) at least one of the following requirements must be met:</p> <ul style="list-style-type: none"> • where recyclable household waste is sorted after collection and at least a single 30 litre bin is provided in an adequate internal space. • where materials are sorted before collection and at least three separate bins are provided with 30 litres total capacity. Every bin must have a capacity of at least 7 litres and be located in an adequate internal space. • an automated waste collection system which collects at least 3 different types of recyclable waste. <p>No Local Authority collection scheme but adequate external storage capacity For houses and flats, there must be at least 3 identifiably different internal storage bins for recyclable waste, located in an adequate internal space:</p> <ul style="list-style-type: none"> • with a minimum total capacity of 30 litres • where every bin has at least 7 litres capacity <p>AND</p> <p>For houses, an adequate external space must be provided for storing, at least, three external bins for recyclable waste:</p> <ul style="list-style-type: none"> • with a minimum total capacity of 180 litres • with no bin smaller than 40 litres • all bins should be located within 30m* of an external door <p>For blocks of flats, a private recycling scheme operator must be appointed to maintain bins and collect recyclable waste regularly. Recycling containers must:</p> <ul style="list-style-type: none"> • be located in an adequate external space • be sized according to the frequency of collection, based on guidance from the recycling scheme operator • store at least 3 types of recyclable waste in identifiably different bins • be located within 30m* of an external door <p>* Where strategic reasons outside the control of the developer make it impossible to meet this requirement, the maximum allowable distance is 50m, and a written justification must be provided to the Code Service Provider.</p>	<p>Credits available: 4</p>	<p>The CDC collection scheme will be provided</p> <p>Comingled recyclables will be sorted after collection. Internal storage will be provided for comingled recyclables in both houses and flatted propertied and will accommodate a minimum of a total capacity of 30 litres</p> <p>Glass will be sorted before collection. Internal storage for glass will accommodate a minimum container size of 7 litres.</p> <p>Food waste will also be sorted prior to collection. Internal storage will be in kitchen caddies which will not require fixed storage.</p> <p>External storage will be provided for 2 x 240 litre bins for recyclables (comingled and mixed organics). In place of a third bin, glass will be taken to bring facilities.</p> <p>Flats will be serviced as per the CDC flats waste and recyclables service.</p>
---	---------------------------------	---

<p>Composting</p> <ul style="list-style-type: none"> • Individual home composting facilities. <p>OR</p> <ul style="list-style-type: none"> • A local communal or community composting service, which the Local Authority runs or where there is a management plan in place. <p>OR</p> <ul style="list-style-type: none"> • A Local Authority green/kitchen waste collection system (this can include an automated waste collection system). <p>All facilities must also:</p> <ul style="list-style-type: none"> • be in a dedicated position • be accessible to disabled people • have an information leaflet that is delivered to each dwelling 	<p>Credits available: 1</p>	<p>Space will be allocated for a community composting project</p> <p>All houses with gardens and/or allotments will be provided with home composting units in addition to a kerbside green waste collection service.</p>
<p><u>Definitions</u></p> <p>Adequate External Space Refers to outdoor space supplied for storing non-recyclable waste and recyclable materials. External recycling bins should be located on level hard standing and must be covered and within a reasonable distance of the external door to the dwelling / block of flats.</p> <p>Adequate Internal Space Refers to indoor space supplied for storing non-recyclable waste and recyclable materials. Internal recycling bins should be located in a dedicated non obstructive position. This should be in a cupboard in the kitchen, close to the non-recyclable waste bin, or located adjacent to the kitchen in a utility room or connected garage. Free-standing recycling bins placed directly on the floor or in a cupboard do not comply.</p>		

9 Consideration of waste to energy

PPS1 requires that consideration has been given to the use of locally generated waste as a fuel source for combined heat and power (CHP) generation for the eco-town.

An Energy Report (ref 4502-UA001881) analysis has been carried out which considers the use of food waste in an on-site anaerobic digestion facility. The analysis identifies the potential for anaerobic digestion to be considered for the supply of renewable energy to the Bicester Eco-town development when the Masterplan, phasing and the respective loading schedule are finalised. Relative to the Exemplar development in isolation, the quantities of food / organic waste generated are unlikely to be sufficient to enable an anaerobic digestion facility to operate commercially.

10 Construction, demolition and excavation waste

PPS1 requires that the SWRP must set out how developers will ensure that no construction, demolition and excavation waste is sent to landfill, except for those types of waste where landfill is the least environmentally damaging option. This requirement will be satisfied by the Site Waste Management Plan (SWMP)

The Site Waste Management Plan (SWMP) is used to plan, implement, monitor and review waste minimisation and management on construction sites. In April 2008 the Site Waste Management Plans Regulations 2008 came into force in England for construction projects costing more than £300,000 excluding VAT.

The SWMP is used to record how waste is reduced, reused, recycled and disposed of on a construction site. This effectively means:

- Recording decisions taken to prevent waste through concept and design.
- Forecast waste produced on site.
- Plan how to reduce, reuse and then recover the forecasted waste.
- Implement and monitor the planned activity.
- Review the SWMP and record lessons learnt.

The SWMP is a live document recording how waste is managed and is updated regularly during the course of the project. Preparing a SWMP encourages the review of current waste reduction and recovery practice levels, highlighting areas where Good and Best Practice can be achieved. The SWMP facilitates the identification and implementation of waste minimisation at the design stage and reuse and recycling opportunities during on site operations, reducing the quantities of construction waste sent to landfill.

APPENDIX 17A

18-hour and 24-hour Traffic Flows

A detailed map of the Bicester area in Oxfordshire, UK, showing the locations of six Air Traffic Control (ATC) units. The map includes a key indicating that blue lines represent ATC locations. The roads are color-coded: blue for major roads (M40, A4095, A4421) and yellow for other roads (B4100, B4030). The ATC locations are marked with blue squares and labeled ATC 1 through ATC 6. The map also shows various landmarks, including Bucknell, Caversfield, Bicester, and the Cooper School. The road network is shown with labels for major roads like M40, A4095, A4421, and B4100, as well as local roads like Lord's Ln, Southwold Ln, and Skimmingdish Ln.

Table 1: Base 2010 Link Flows

Base 2010 Two-Way Link Flows							24hr mean speed (mph)
ATC Site(s)	18 hour AAWT			24 hour AADT			
	Total	Cars/LGVs	HGVs	Total	Cars/LGVs	HGVs	
Site 1	5,572	5,110	461	5,223	4,851	373	49
Site 2	5,708	5,380	328	5,291	5,032	260	43
Site 3	4,381	4,129	252	4,250	4,040	210	31
Site 4	7,915	7,568	347	7,583	7,273	310	30
Site 5	9,418	8,979	439	9,389	8,978	411	45
Site 6	10,853	9,787	1,067	10,138	9,218	920	47

Table 2: Forecast 2016 (WITHOUT development) Link Flows

1.236

Growth

Forecast 2016 (WITHOUT Development) Two-Way Link Flows							24hr mean speed (mph)
ATC Site(s)	18 hour AAWT			24 hour AADT			
	Total	Cars/Lights	HGVs	Total	Cars/Lights	HGVs	
Site 1	6,886	6,316	570	6,456	5,995	461	49.0
Site 2	7,055	6,650	405	6,540	6,219	321	42.9
Site 3	5,415	5,103	311	5,253	4,994	259	30.5
Site 4	9,783	9,354	429	9,373	8,989	383	30.0
Site 5	11,641	11,098	542	11,604	11,097	508	44.5
Site 6	13,415	12,096	1,318	12,530	11,393	1,137	46.9

Table 2a: 2016 Exemplar Site Development Traffic Generations

2016 Exemplar Site Two-Way Development Traffic Generations							24hr mean speed (mph)
ATC Site(s)	18 hour			24 hour			
	Total	Cars/Lights	HGVs	Total	Cars/Lights	HGVs	
Site 1	8	8	0	8	8	0	49.0
Site 2	1,131	1,086	45	1,131	1,086	45	42.9
Site 3	241	231	10	241	231	10	30.5
Site 4	656	617	39	656	617	39	30.0
Site 5	1,509	1,449	60	1,509	1,449	60	44.5
Site 6	2,656	2,550	106	2,656	2,550	106	46.9

Table 3: Opening 2016 (WITH development) Link Flows

Opening 2016 (WITH Development) Two-Way Link Flows							24hr mean speed (mph)
ATC Site(s)	18 hour AAWT			24 hour AADT			
	Total	Cars/LGVs	HGVs	Total	Cars/LGVs	HGVs	
Site 1	6,894	6,324	570	6,464	6,003	461	49.0
Site 2	8,186	7,736	451	7,671	7,305	366	42.9
Site 3	5,656	5,334	322	5,495	5,225	270	30.5
Site 4	10,439	9,971	468	10,029	9,606	422	30.0
Site 5	13,150	12,547	603	13,114	12,546	568	44.5
Site 6	16,071	14,646	1,424	15,186	13,943	1,243	46.9

Table 3a: %age Increase

%age Increase							24hr mean speed (mph)
ATC Site(s)	18 hour			24 hour			
	Total	Cars/Lights	HGVs	Total	Cars/Lights	HGVs	
Site 1	0%	0%	0%	0%	0%	0%	49.0
Site 2	16%	16%	11%	17%	17%	14%	42.9
Site 3	4%	5%	3%	5%	5%	4%	30.5
Site 4	7%	7%	9%	7%	7%	10%	30.0
Site 5	13%	13%	11%	13%	13%	12%	44.5
Site 6	20%	21%	8%	21%	22%	9%	46.9

Table 4: Forecast 2026 (WITHOUT development) Link Flows

Table 4: Forecast 2026 (WITHOUT development) Link Flows							1.358	Growth
Forecast 2026 (WITHOUT Development) Two-Way Link Flows							24hr mean speed (mph)	
ATC Site(s)	18 hour AAWT			24 hour AADT				
	Total	Cars/Lights	HGVs	Total	Cars/Lights	HGVs		
Site 1	7,566	6,940	627	7,093	6,587	506	49.0	
Site 2	7,752	7,306	445	7,185	6,833	352	42.9	
Site 3	5,949	5,607	342	5,772	5,487	285	30.5	
Site 4	10,749	10,277	472	10,298	9,877	421	30.0	
Site 5	12,790	12,194	596	12,750	12,192	558	44.5	
Site 6	14,739	13,290	1,448	13,767	12,518	1,249	46.9	

Table 4a: 2026 Exemplar Site Development Traffic Generations

2016 Exemplar Site Two-Way Development Traffic Generations							24hr mean speed (mph)
ATC Site(s)	18 hour			24 hour			
	Total	Cars/Lights	HGVs	Total	Cars/Lights	HGVs	
Site 1	7	7	0	7	7	0	49.0
Site 2	1,051	1,009	42	1,051	1,009	42	42.9
Site 3	224	215	9	224	215	9	30.5
Site 4	609	585	24	609	585	24	30.0
Site 5	1,403	1,347	56	1,403	1,347	56	44.5
Site 6	2,469	2,370	99	2,469	2,370	99	46.9

Table 5: Design 2026 (WITH development) Link Flows

Design 2026 (WITH Development) Two-Way Link Flows							24hr mean speed (mph)
ATC Site(s)	18 hour AAWT			24 hour AADT			
	Total	Cars/LGVs	HGVs	Total	Cars/LGVs	HGVs	
Site 1	7,573	6,947	627	7,101	6,594	507	49.0
Site 2	8,803	8,315	488	8,237	7,842	395	42.9
Site 3	6,173	5,822	351	5,996	5,702	294	30.5
Site 4	11,359	10,862	496	10,907	10,462	446	30.0
Site 5	14,193	13,541	652	14,153	13,539	614	44.5
Site 6	17,207	15,660	1,547	16,235	14,888	1,347	46.9

Table 5a: %age Increase

%age Increase							24hr mean speed (mph)
ATC Site(s)	18 hour			24 hour			
	Total	Cars/Lights	HGVs	Total	Cars/Lights	HGVs	
Site 1	0%	0%	0%	0%	0%	0%	49.0
Site 2	14%	14%	9%	15%	15%	12%	42.9
Site 3	4%	4%	3%	4%	4%	3%	30.5
Site 4	6%	6%	5%	6%	6%	6%	30.0
Site 5	11%	11%	9%	11%	11%	10%	44.5
Site 6	17%	18%	7%	18%	19%	8%	46.9