Minerals Core Strategy

Technical Paper MCS-G

Mineral Resources and Safeguarding

Version I - January 2008
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Section 1
Introduction

1. It is vitally important that the plans and proposals set out in the Minerals Core Strategy are founded on a robust and credible evidence base. Demonstrating how the evidence for the MCS was carefully considered and acted upon will be a key ‘test of soundness’ at the independent examination into the Core Strategy.

2. Consequently this report acts as part of the evidence base for the emerging MCS and in particular the strategy for safeguarding mineral resources in Gloucestershire. Its key focus is on introducing the county’s mineral resources that lead to the delineating Mineral Safeguarding Areas (MSAs) and Mineral Consultation Areas (MCAs) in the future.

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3. The first part of the report sets out the current national, regional and local policy for safeguarding minerals and in particular references the final, version of Minerals Policy Statement 1 (MPS1) and the submission draft of the South West RSS. It also acknowledges the guidance offered by the British Geological Survey (BGS) on implementing mineral safeguarding through the planning system.

4. The second part of this report provides a detailed review of the local geology and recorded mineral resources present in the county.

5. The third and final part of the report summarises the key issues for mineral safeguarding in Gloucestershire and headlines future actions and recommendations for successfully developing a mineral safeguarding strategy into the emerging MCS.

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* Test vii of the ‘Test of Soundness’ set out in PPS12, states that strategies, policies and allocations must represent the most appropriate in all circumstances, having regard to the relevant alternatives and they are founded on a robust and credible evidence base.
Section 2
The Context

6. Mineral resources are essential to the achievements of sustainable development. They are necessary in construction, industry, healthcare and energy production. However, they are finite in terms of their quality, quantity and availability.

7. Mineral resources can only be worked where they occur. This means they are subject to technical, environmental and other surface constraints, which may make them unworkable in the foreseeable future. However, whilst many constraints are irreversible or necessary, there are constraints, which could be avoided. These may include surface development such as housing, retail, commerce, or associated infrastructure projects that could feasibly be accommodated elsewhere.

8. Consequently, where proven and viable mineral resources are identified a sound policy framework is needed to ensure these resources are not lost to competing and / or incompatible surface development.

9. In this context a policy mechanism is required to safeguard mineral resources from potential sterilisation. Furthermore, a complementary and workable strategy is needed for those circumstances where prior mineral extraction before surface development could also be considered.

10. Safeguarding and prior extraction of mineral resources is addressed within mineral national policy. It is also translated through Regional Spatial Strategies (RSSs) for implementation within Local Development Framework (LDFs).

National Policy

11. National policy for minerals is set out in Minerals Policy Statement (MPS) 1. It provides a specific Government objective for mineral safeguarding:

- To safeguard mineral resources as far as possible;

12. In order to achieve this objective, MPS1 also includes a series of national policies to be carried forward by LPAs within their LDDs.

13. It states that Mineral Safeguarding Areas (MSAs) should be defined in LDDs, in order that proven resources are not needlessly sterilised by non-mineral development. However, it is stressed that this approach should not represent a presumption in favour of mineral extraction at a later date.

14. Where opportunities exist, MPS1 also encourages the practicable, prior extraction
of minerals within MSAs before non-mineral development takes place.

15. In two-tier planning areas, where County Councils act as the MPA and District Councils are the LPA, policies and proposals for safeguarding mineral resources should be included in the MDD prepared by the County. However, LDDs prepared by Districts should also clearly include the extent of the MSAs delineated in their area.

16. Two-tier planning areas also provide an opportunity for County Council’s to define Mineral Consultation Areas (MCAs). These areas should also be set out in the LDDs prepared by Districts Councils.

17. The purpose of MCAs is to ensure early and appropriate consultation between Districts and Counties in respect of non-mineral development designated within MCAs. Where planning applications are made, the respective District should consult with the County prior to determination.

18. The good practice guide to MPS1 sets out the detailed mechanism for using MSAs and MCAs to safeguard mineral resources.

19. It advises that mineral resources, which are, or may become economically important in the foreseeable future, should be considered for an MSA. However, these areas should be delineated based on the best available geological data and mineral resources information, including that provided by the British Geological Survey or made available by the mineral industry. Nevertheless, these areas may need to be refined in discussion with industry and other stakeholders.

20. For MCAs, it may prove beneficial to designate all, part of, or marginally more than the original MSA of the respective mineral resource. The function of MCAs is as a consultation tool between Districts and Counties. This consultation requirement falls on both minerals and non-mineral related planning proposals within MSA and MCA designations.

**Regional Policy**

21. The submission draft RSS includes a regional supply policy for aggregates and other minerals (Policy RE10). It states that MPAs and LPAs should identify and collaborate in the safeguarding of mineral resources of economic importance from sterilisation by other forms of development.

**Local Policy**


23. Policy M.6 of the Structure Plan 2nd Review, sought to safeguard potentially workable mineral resources across the county and promote prior extraction. Minerals Local Plan policies SE3 and SE4 highlighted the potential of an MPA objection to planning proposals within, or adjacent to, areas with underlying resources and criteria for considering the prior extraction of minerals.

24. The Minerals Local Plan also identified a Mineral Consultation Area (MCA) covering the Gloucestershire section of the Upper
Thames Valley area. Provision for this area was set out under paragraph 7 (3)(c) of schedule 1 of the Town & Country Planning Act (1990). The MCA laid down a requirement for Cotswold District Council (which covers the administrative area of Gloucestershire section of the Upper Thames Valley), to consult with the County Council on applications within the MCA.

25. The MCA was originally delineated in 1981. Its purpose was to promote the safeguarding of sand and gravel resources in the area through the planning system. The delineation of the MCA was based on information from the Institute of Geological Sciences (IGS), which is now known as the British Geological Society (BGS).

26. Under recent transitional arrangements, Policy M.6 of the Structure Plan 2nd Review, has become the only local mineral safeguarding policy within the development plan. This means it is a ‘saved’ policy that will remain in force until formally replaced by the RSS and / or by specific local policies within the Minerals and Waste Development Framework (MWDF). The Minerals Local Plan policies – SE3 and SE4 have ‘lapsed’ and no longer form part of the development plan. These policies are now seen as material considerations for use on a case-by-case basis with future development proposals.

27. However, in practice MPS1 supersedes any of these current or former development plan policies, which are therefore issues for consideration and review through the MCS process.

Other Spatial Considerations and Information

Emerging MCS – Issues & Options Consultation

28. The Issues & Options consultation provided stakeholders their first opportunity to debate the future of mineral safeguarding in Gloucestershire. The consultation presented stakeholders with three key options –

- The continuation of the existing local plan policies for safeguarding;
- The expansion of resource safeguarding, including additional MCA areas; and
- The removal of the existing MCA in Gloucestershire as a tool for resource safeguarding.

29. In summary stakeholders favour a continuation of the safeguarding policy used in the adopted Minerals Local Plan. However, notable support was also given for expanding the coverage of MCAs to other resource areas in Gloucestershire.

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2 Transitional arrangements are in place to help manage the change to the planning system. They involve the approval from the Secretary of state (SoS) to retain or ‘save’ existing adopted local planning policies until they are formally replaced by new style development plan documents. No local policies can be saved without SoS approval after Sept 2008 (three years from the new planning act) or after three years from the date of their original adoption within a particular local plan.
Emerging MCS – Initial Sustainability Appraisal and Appropriate Assessment

30. The initial Sustainability Appraisal (SA) interrogated the mineral safeguarding options presented within the Issues & Options consultation.

31. The most sustainable option, resulting from the SA process, was the: - ’expansion of safeguarding including the addition of new MCA areas’. This approach was considered to be broadly positive, particularly in terms of ensuring the sufficient availability of minerals to meet the needs of society. However, the positive scoring was tempered by a degree of uncertainty over the possible impacts of preventing other forms of development as a consequence of resource safeguarding.

32. The least sustainable option was the: - ‘complete removal of the county’s existing MCA’. Particular attention was paid to the uncertainty this may cause in terms of the availability of mineral resources to meet future needs of society.

33. An Appropriate Assessment (AA) of protected European sites was also carried out at with the Issues & Options consultation.

34. The purpose of AA is to screen for potential impact upon protected designations in and around the county so as to ensure that their future protection is integrated into the planning process at the local level. A total of 10 European sites have been recorded for Gloucestershire. These include – Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).

35. The conclusion to the AA advised that the: - ‘continuation of mineral safeguarding, including existing MCA coverage’, would unlikely result in significant effects on the 10 European sites. However, uncertainty was highlighted with those sites located within or near to the existing MCA. It was considered that safeguarding in this instance could pose either a lesser or greater likelihood of significant effects on the European sites, depending upon the type of development, which may or may not come forward instead of mineral working.

36. In terms of expanding mineral safeguarding through new MCAs, the degree of uncertainty for European sites increased. This was again due to the unknown impacts of preventing or enabling other forms of development as a consequence of mineral safeguarding by MCAs.

37. The removal of the existing MCA was also considered through the AA process. This option demonstrated the least degree of uncertainty on European Sites (although not necessarily the least impact), as the consideration of mineral safeguarding, potential extraction and other forms of development would be greatly diminished.

British Geological Survey (BGS) – Mineral Resource Information in Support of National, Regional and Local Planning

38. In 2003 the former Office of the Deputy Prime Minister (ODPM) commissioned BGS to prepare a series of geological reports and accompanying maps to identify the
occurrence of key mineral resources across the regions of England.

39. The purpose of the reports is to assist interested parties involved in the preparation and review of development plans, both in relation to the extraction of minerals and the protection of mineral resources from sterilisation. As previously advised in this report under paragraph 19, the information provided within each geological report, should form part of the baseline data and evidence base for emerging policy work for the MCS.

40. A report and resource map was been completed for Gloucestershire in 2006. The MPA assisted BGS in their production.


41. BGS has published a ‘Guide to Minerals Safeguarding in England’ to assist with the implementation of national policy set out in MPS1 and its associated practice guide. The guide was completed in October 2007 and is specifically focused upon the practical application of MSAs. This includes defining and delineation of mineral safeguarding designations by MPAs with the assistance of key mineral stakeholders.

British Geological Survey (BGS) - Mineral Planning Factsheets

42. A series of mineral factsheets have been provided by BGS that set out baseline information on the supply of minerals that are deemed to be of economic important to Britain.

43. The factsheets are referred to within the BGS publication – ‘A Guide to Minerals Safeguarding in England’, as potential data source for assessing the economic importance of mineral resources in the foreseeable future within an MPA area. The factsheets are also linked to the advice given in the practice guide to MPS1, which has already been highlighted in paragraph 19, and is concerned with defining MSAs using the ‘best available’ information on mineral resources as published or available from BGS.

ODPM Commissioned Report - Planning for the Supply of Natural Building and Roofing Stone in England and Wales

44. In 2004 ODPM (now part of DCLG) published a report on natural building and roofing stone in England and Wales. Its contents were focused upon planning issues affecting the future supply and demand of building stone resources. The report also provided background information on the state of different building stone resources and remaining reserves. This information will form part of the evidence base in assessing the value of Gloucestershire’s building stone resources (see section 3) for mineral safeguarding purposes.
Section 3
Minerals Resources of Gloucestershire

45. Developing a good understanding of the local geology and the availability of mineral resources is vital to achieving a deliverable mineral safeguarding policy. As a result this section of the report provides a review of Gloucestershire’s geology and its mineral resources.

46. A wealth of technical and historic texts have been gathered to complete this section, which will also contribute to the wider evidence base for the MCS. The key sources of information and data used are provided in Appendix A.

Strategic Mineral Resource Areas

47. Gloucestershire is a geologically diverse and complex county, which gives rise to rich and varied mineral resources of local, regional and national significance. To help understand the distribution of its resources, a number of zones or areas of similar geology have been identified. These zones are considered by the MPA, as Strategic Mineral Resource Areas (SMRAs) and there are four covering the county -

- Forest of Dean;
- Severn Vale;
- The Cotswolds; and
- Upper Thames Valley,

48. The remaining paragraphs provide a geological review and assessment of the mineral resources found within each strategic mineral resource areas.

The Forest of Dean Strategic Mineral Resource Area – Geological Review

49. The western side of Gloucestershire is dominated by the geology of the Forest of Dean. This area forms an elevated mass mostly of sandstone and limestone sandwiched between the River Wye on the west and the widening River Severn to the south.

50. The main geological structure of the Forest of Dean is an upstanding, basin shaped syncline, which is faulted to the west. The outer most and oldest rocks present in the area (around 440 to 400 million years old) are known as the Silurian Ludlow Series and comprise of mudstones and limestones.

51. The next youngest rocks (around 400 million years old) are of Devonian sandstones called Brownstones. These rocks mainly outcrop on the eastern side of
52. A break in the geological record called an unconformity occurs following the Brownstones, where rocks from the middle Devonian period (around 380 to 400 million years ago) are missing. As a result, directly overlying the Brownstones, are younger sandstones from the Upper / Late Devonian period (around 360-250 million years ago). These are known locally as Tintern Sandstone.

53. Tintern sandstone is marked by a further unconformity, which introduces the next major geological period called the Carboniferous (around 330 to 290 million years ago). The rocks of this period form the core of the Forest's basin syncline and create a complex geology with unconformities and heavily folded strata. These rocks can be divided into two main groups based on age and composition –

- The Carboniferous Limestone Series, which is the oldest of the Carboniferous rocks in the Forest of Dean, creates a substantial sequence of interbedded sandstones; limestones, a similar carbonate rocks called dolomite, shales; and clays.

- The second group is called the Coal Measures. It includes sandstones, shales, and coal seams. The coal bearing rocks in this group, can be further divided into two sub-groups – the Lower and Upper Coal Measures. The Lower Coal Measures are mainly made up of sandstone and include one coal seam, whilst the Upper Coal Measures are constructed of sandstone and shale called the ‘Trenchard Group’, and sandstone known as the ‘Pennant Formation’. The Pennant Formation contains most of the major coal seams in the Forest of Dean.

The Forest of Dean Strategic Mineral Resource Area - Assessment of Mineral Resources

54. The geology of the Forest of Dean has provided for rich and varied mineral resources. The central area has been worked over many centuries with evidence of iron ore, coal, building stone and clay (for brick making) extraction. In contrast, the outer area of the Forest of Dean is made up of outcrops of dolomite, other limestone and sandstone, which have been worked as a local natural building stone and more recently as a crushed rock for aggregate purposes.

Iron Ore

55. Iron ore deposits in the Forest of Dean represent an historic mineral resource, with archeological evidence of exploitation dating back to the Roman times. There are two key time periods for iron ore working in the Forest of Dean – the 1600’s, when demand grew out of commercialising forges; and the 1800’s, with the introduction of mechanised water pumps and deep mining.

56. Due to the thinning of ore with depth, technical problems with pumping, and cheaper imports from Spain, the local iron ore industry all but closed down by 1900. Despite a short revival, which coincided with
the 1st and 2nd World Wars, all iron ore works had closed down by 1946.

**Coal**

57. Coal working has taken place in the Forest of Dean area for over 700 years. It is an influential local resource that has shaped the history and culture of the area. Coal working in the Forest of Dean is subject to its own unique mining tradition and law with local 'Freeminer Rights', dating back to at least the 14th century.

58. The origins of coal working in the Forest of Dean are unclear, although the industry probably grew out of small-scale workings, which started in Roman times. The most significant period of coal working occurred from the late 1700s to mid 1800s, which coincides with the Industrial Revolution.

59. However, Forest of Dean coal began to decline from the early part of the 20th century as a result of rising costs; depleting availability of easily workable resources, drainage problems and numerous employment disputes. Although there was a short-term boost in production during the 1st World War, most larger and deeper mines had closed down by the mid 1960s.

60. Small-scale coal mining, which produces a few thousands tonnes a year, continues in the Forest of Dean. This occurs through shallow drifts operated by local miners under ancient Freeminer rights. Between the 1960’s and the mid 1980’s a relatively small amount of coal was also worked by opencast methods.

61. Although the working of Forest of Dean coal is small-scale and extremely localised, coal itself remains a vital national resource. It is a primary source of energy used in electricity generation and during 2005, supported over $\frac{1}{3}$ of the country’s total electricity output.

62. The UK coal market is presently dominated (70%) by imports from Russia, South Africa and Australia. This is due to competitive global markets, high quality resources, and reduced pollution potential of non-UK coal.

63. Nevertheless, there are still relatively healthy domestic resources available from deep and surface workings in England and Wales, and surface workings in Scotland. Furthermore, over recent years an increase in global demand, prices and the construction of pollution-reducing power stations (e.g. those able to filter out high-levels sulphur), has resulted in a resurgent domestic market for UK coal.

64. There is limited information as to the extent of remaining coal reserves in the Forest of Dean. Although it is estimates that around 12 million tonnes of potentially workable coal may exist via opencast and shallow underground working methods. In light of evolving domestic coal markets and industry interest, the remaining local resources of the Forest of Dean should not be tunneling straight downwards (shaft mining). Drift mines are characterised by horizontal entries into the coal seam from a hillside.

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3 Under ancient UK law, ‘Freeminer Rights’ broadly entitle men born within The Forest of Dean and over 21 years, who have also worked down a local coal mine for one year and a day, to mine for coal anywhere in that location "without tax or hindrance".

4 Drift mining is a method of accessing valuable geological material, such as coal, by cutting into the side of the earth, rather than tunneling straight downwards (shaft mining). Drift mines are characterised by horizontal entries into the coal seam from a hillside.
discounted for the foreseeable future. Nevertheless, any proposals to re-visit the county’s remaining coal will need to meet the strictest environmental and social standards as prescribed by both national and emerging local policy.

Building Stone

65. There is a long tradition of Devonian sandstone, and Carboniferous limestone and sandstone from the Forest of Dean, being quarried for natural building stone. These minerals have supported the local building industry as the main supply of walling and paving products.

66. Devonian sandstone, known locally as 'Brownstone', outcrops as a purple-red or green coloured stone. In the past it has been quarried around Soudley and Blakeney and towards the perimeter of the Forest of Dean, at Mitcheldean.

67. Carboniferous sandstone, particularly from the Pennant Formation, forms a very distinctive blue-grey and grey-green coloured stone, which sometimes include veins of haematite. Due to its unique colouring, this stone has been extensively worked, near to Barnhill.

68. Carboniferous limestone has also provided for a local building stone. However, the vast majority of this resource is now used as a crushed rock aggregate (see paragraphs 72 - 75).

69. Natural building stone from the Forest of Dean is a small but not less important local mineral resource. As at the end of 2005, it represented 9% of Gloucestershire’s total natural building output. The stone is presently marketed for architectural restoration and high quality new-build schemes. Key projects that have used Forest of Dean stone include; – Hampton Court Palace; St.John’s and Exeter Colleges at Oxford University; Cheltenham Ladies College; the British Empire Museum in Bristol; and Gloucester Docks.

70. As previously discussed in the geological review, local mineral deposits used as a building stone, demonstrate a varied and complex geology right across the Forest of Dean. Furthermore, there has been limited surveying of deposits beyond the exploration of existing operations.

71. Consequently, the longer-term potential of remaining mineral deposits is uncertain. However, the geological coverage in comparison to the current production levels, would suggest there are health quantities of mineral available for the future to supply local building stones.
Aggregate - Crushed Rock Limestone

72. Carbonate rocks of the Forest of Dean – Carboniferous limestone and dolomite\(^5\), represent a strategically important mineral resource of regional significance.

73. However, for many years these rocks have been quarried in a similar way to Forest of Dean sandstone and have contributed to the local supply of natural building stone. In addition, they have also have been used, following processing (e.g. by heating through limekilns and crushing) as an agriculture lime; mortar and waterproofing agent in building work; and as a hair remover in leather making.

74. Nevertheless, local carbonate rocks have developed over times, into a valuable crushed rock aggregate. Through crushing and / or mixing with cement, lime and, or bituminous binders, they have become an important modern construction material. The relative strength and sand content of the resource (in particular the dolomite rocks) demonstrates a high skid resistance, which has made it an attractive stone for road surfacing and specialist concreting purposes.

75. For a number of years, Forest of Dean limestone has supplied upwards of 70% of Gloucestershire’s total crushed rock aggregate output. This equates to nearly 7% of the total crushed rock output for the South West region. There are currently

three working crushed rock aggregate quarries in the Forest of Dean; two extracting dolomitised limestone (limestone that contains some magnesium carbonate) and one extracting Carboniferous limestone.

76. The long-term aggregate potential of carbonate rocks from the Forest of Dean has been established, with the distribution of remaining workable deposits relatively well surveyed and geologically mapped. However, this circumstance masks a growing policy concern over the medium to long-term acceptability of the resource as a provider of crushed rock aggregate. The local area is considered to be environmentally sensitive and is subject to longstanding infrastructure problems regarding the transportation of minerals. There are also a number of outstanding local and regional policy matters relating to the resource’s sustainability.

77. A more detailed policy discussion of aggregate resources from the Forest of Dean can be found within Technical

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\(^5\) Limestone and dolomite are very similar sedimentary rock. The key difference is that dolomite is made up of magnesium carbonate - \(\text{CaMg(CO}_3\text{)}\)\(_2\) rather than calcium carbonate in the case of limestone - \(\text{CaCO}_3\).
Evidence Paper MCS-B Crushed Rock Provision and Strategic Locations Report

Brick clay

78. Forest of Dean brick clays are derived from Carboniferous rocks of the Coal Measures (paragraph 47). Their resource potential coincides with the extraction of local coal and early extraction can be traced back to the height of the coal industry. Bricks at this time were used as the key building material for the infrastructure of the coal industry.

79. Despite the decline in local coal, brick making has continued in the Forest of Dean. This is down to the fairly extensive, remaining deposits and their relative easy of extraction compared to coal. The frost resistance properties and durability of Forest of Dean clay, which meet strict British Standards, has also enabled local bricks to be marketed for a range of building applications.

80. Production from the Forest of Dean stands at around 8 million bricks a year. Although this is a relatively small-scale production, the bricks have become important in building restoration due the range of colours available and the traditional brick-making method being employed.

Severn Vale Strategic Mineral Resource Area - Geological Review

81. The Severn Vale makes up the central section of Gloucestershire. It forms a north-southwest corridor dominated by the river valleys of the Severn and Avon between Tewkesbury and Gloucester. It also includes extensive, low-lying, floodplain land associated with the river Severn and its complex network of smaller river tributaries, as it widens into a broad estuary.

82. The solid geology of the Severn Vale represents an age transition from west to east. To the west are extensive and older Permo-Triassic formations (around 290 to 200 million years ago) mainly of sandstone, mudstone and conglomerates, known as Bromsgrove and Bridgnorth Sandstone. The rocks become younger in an eastward direction and are presented as Lower Lias Jurassic (around 200 to 180 million year old) beds, predominately composed of mudstone with a substantial clay component.

83. The geological development of the Severn Vale river systems can be seen in the widespread superficial deposits that lie upon the solid geology. These include river terraces, fan gravels, sub-alluvial gravels, and unconsolidated beds, which were laid down during higher water levels associated with interglacial periods of the last ‘Ice Age’ (300,000 and 10,000 years ago).

84. River terrace deposits occur at various levels and over a patchy distribution along the full extent of the Severn Vale. They are composed of varying quantities of sandstone, quartzite, igneous rocks, flint, chert and quartz, together with sand, silt and clay. They also include Oolitic limestone, although not to the same extent as river terrace deposits found elsewhere in the county.

85. More extensive river terrace deposits of up to 6 metres in thickness are found within Gloucester and Cheltenham, and in
particularly to the north of Cheltenham near to Bishop’s Cleeve. These deposits include notable quantities of medium grained quartz sand along with some limestone and mixed gravels.

86. Deposits of sub-alluvial gravels have also been recorded at the confluence of the Rivers Severn and Avon near Gloucester. Compositionally these deposits are similar to the river terraces. However, they are relatively thin and saturated as they lie below the existing river level.

Severn Vale Strategic Mineral Resource Area - Assessment of Mineral Resources

87. The mineral resources of the Severn Vale include Bromsgrove and Bridgnorth Sandstone that has provided for a local building stone and aggregate sand; clay-rich mudstones of the Lower Lias, worked as a brick clay and for civil engineering projects, and overtain superficial deposits, which present as a sand & gravel aggregate.

Building Stone

88. The relatively small outcrop of the Bromsgrove and Bridgnorth sandstone to the west of the river Severn has made for an attractive building stone in the past. This is due to the distinctive red colouring caused by a presence of hematite. However, local records indicate that this deposit has not been exploited in this fashion, for sometime.

Aggregate – Red Sand

89. Bromsgrove and Bridgnorth sandstone has also been used as an aggregate sand, following on-site crushing. It has been applied to general building, pipe bedding and has also been blended with other sands for more diverse construction uses. At present, it is worked on a small-scale mainly for blending purposes.

90. The long-term resource potential of Bromsgrove and Bridgnorth sandstone, remains relatively health, when remaining permitted reserves and resources are compared to current levels of production.

91. More information on the resource potential of Bromsgrove and Bridgnorth sandstone can be found within Technical Evidence Paper MCS-A – Sand & Gravel Provision and Strategic Locations Report.

Brick and Engineering Clays

92. The significant clay content of the Lower Lias Jurassic beds is noted as a local mineral resource for both brick clay and engineering purposes.

93. There is evidence of historic brick clay extraction in the Severn Vale, particularly around Cheltenham. However, there are no longer any local brickworks in operation.

94. Clay extraction for a range of uses has also taken place in the past, alongside sand & gravel working, although it is now seen as an ancillary operation to landfill and small-scale flood defence work.

95. Deposits of clay within the Severn Vale have never been widely exploited, although
their distribution and occurrence is extensive right across the wider strategic mineral resource area.

Aggregate – Sand & Gravel

96. The superficial deposits of the Severn Vale represent the most valuable local mineral currently being worked. These deposits provide variable qualities and quantities of sharp sands and gravels, which through washing and grading have been used in concrete manufacturing, block making and other low-grade aggregate uses. The working of uncontiguous and often isolated lens of soft sands has also taken place, for use as a building mortar within the Gloucester and Cheltenham areas.

97. A small number of sand & gravel extraction sites presently operate within the Severn Vale. These provide for a local supply of mineral used in concrete manufacturing, other low-grade aggregate applications and as a building mortar. During 2005, sand & gravel production was relatively small-scale and represented just 5% of the county’s overall sand & gravel supply.

98. Despite the current low-level of working, local superficial deposits may still provide for a long-term sand & gravel resource. It is noted that a number of unworked areas in the Severn Vale have been subject to industry interest in the past; albeit that no successful planning proposals have been granted to date.


The Cotswolds Strategic Mineral Resource Area - Geological Review

100. The Cotswolds dominate the eastern part of Gloucestershire and are characterised by an upland area that gradually dips in an east to southeasterly direction and is made up of massive Jurassic (around 200 to 130 million years old) limestone. They also include a steep, indented, wall-like escarpment that roughly runs north to south and marks the edge of the Cotswolds at its westerly extent.

101. Geologically the Cotswolds can be divided into two distinct groups - Inferior and Great Oolite, which are separated by age and location.

102. The Inferior Oolite is the older of the limestone groups (estimated at around 200 to 150 million years old). It is characterised by varied and complex sequences of distinctive local rock types, mainly constructed from Oolitic limestone. The group dominates the north and west of the
Cotswolds and is very prominent close to Cheltenham.

103. The younger, Great Oolite group *(estimated at around 150 to 130 million years old)* extends over the central and eastern part of the Cotswolds. It is made up of massive limestone strata, although is also distinguished by the presence of clay and mudstone. The base of the Great Oolite is known as Fullers Earth and is noted for its quantity of mudstone. The top of the group is made up of a distinctive bed of a very shelly, rubble-like limestone called Cornbrash.

104. Both the inferior and Great Oolite groups have been subject to detailed geological assessment by BGS in recent years. This has demonstrated significant variations in the local stratigraphy of both groups.

105. Away from the massive limestone geology, the Cotswolds include a network of rivers that contain fairly significant quantities of superficial fluvial deposits. These have been influenced over geological time by fluvio-glacial activity *(resulting from the last Ice Age)* and include broad tracts of till and sand & gravel deposits.

**Cotswolds Strategic Mineral Resource Area – Assessment of Mineral Resources**

106. The two Jurassic limestone groupings of the Cotswolds represent the most important mineral resources of the Cotswolds. They provided regionally significant natural building stones and are locally important for crushed rock aggregate and agricultural lime.

107. The superficial deposits in the east of the Cotswolds have also been worked in the past for sand & gravel and Lias clays located to the west and northeast have supplied the local brick making industry.

**Building Stone**

108. The two limestone groups of the Cotswolds have been worked for centuries. They have provided for a range of locally distinctive building stones classified by colour, shade, texture, and use. Many of these stones have become intrinsically linked to the vernacular architecture of the area with hamlets, villages and market towns, demonstrating a wide range of stone types and uses.

109. The Inferior Oolite is most famous as the building material behind the Regency architecture of Cheltenham. As result it has often been described as ‘Cheltenham Stone’ or ‘Cheltenham freestone’. It has also had a fairly wide application as a general building stone for both rough and, cut walling and paving uses. In the past, it has also been worked as a local natural stone roofing slate, although due to the stone thickness this has not been to any great extent.

110. The younger, Great Oolite is described as the typical ‘Cotswold stone’. This is due to its significant geological coverage across the Cotswold resource area and its much-varied use. One of the best known Great Oolite building stones is; ‘Taynton stone’, which was used for the internal decoration of St. Paul’s Cathedral in London and the
construction of Magdelen College, Oxford. Other important building stones include; ‘Forest Marble’ and ‘Stonesfield Slates’, which are celebrated natural stone roofing slates.

111. Collectively, the Jurassic limestone from the Cotswolds has consistently made up over 90% of Gloucestershire’s annual output of building stone. As of 2005 there were close to 20 permitted quarries of varying sizes, located throughout the resource area. However, not all of these operations were in production during the year.

112. As previously set out in the geological review, Jurassic limestone is an extensive mineral deposit that occurs right across the Cotswold area. As a result it presents a notable, long-term mineral resource for building stone.

113. However, a degree of caution must be shown when determining the viability of all Jurassic limestone from the Cotswolds, as a building stone. This is due to the local distinctiveness seen in the colour, texture, and application of many of the different stone types. Consequently, further investigation of the wider Jurassic limestone deposit will be necessary to determine, which parts of it could realistically contribute to the future supply of different building stones.

114. A detail policy review of Jurassic limestone for future building stone purposes can be found within Technical Evidence Paper MCS-C – Natural Building and Roofing Stone Report.

Aggregate – Crushed Rock Limestone

115. Jurassic limestone from the Cotswold area, has also been used as a local crushed rock aggregate. In particular the rocks of the Great Oolite, have been used in road surfacing. However, due to the relative softness and porosity of the mineral deposit, modern standards for road construction have generally prevented its widespread use for highways projects. Consequently, the mineral has been limited to low-grade aggregate applications; such as general construction fill and some pipe bedding.

116. Despite the limitation of the Jurassic limestone it has become a valuable commodity as a crushed rock aggregate and has consistently provided around 30% of Gloucestershire’s overall production. It has often been worked in conjunction with natural building and roofing stone and is seen by many operators as an important revenue stream.

117. The long-term potential of Jurassic limestone as a source of crushed rock, is similar to that of building stone. Although the mineral deposit is extensive, further investigation is necessary to determine its
realistic contribution to the future supply of crushed rock aggregate.

More information on the resource potential of Jurassic limestone as a crushed rock aggregate, can be found within Technical Evidence Paper MCS-B – Crushed Rock Provision and Strategic Locations Report.

Aggregate – Sand & Gravel

The superficial, river terrace deposits located in the east of the Cotswolds, are considered to be theoretical resource, although it is noted that a number of mineral workings did operate in the past, near to the market towns of Bourton-on-the-Water, Moreton-in-Marsh and Stow-on-the Wold.

Sand & gravel extraction has not taken place in this part of the county for some time as deposits have become substantially exhausted, uneconomic, or have been sterilised by the urban expansion of Bourton-on-the-Water and Moreton-in-Marsh.

Nevertheless, the potential resources may still exist within a small number of, as yet surveyed, river terraces. However, due to limited industry interests shown in this part of the county, it is unlikely existing deposits will be considered in the foreseeable future.

Brick Clays

The wide availability of natural stone for walling and roofing in Cotswolds has suppressed the demand for local bricks. Nevertheless, there is historic evidence of clay extraction from mudstone deposits near to Stroud, which provided for a local supply of bricks and tiles.

Currently, there is one clay extraction site in the north of the Cotswolds, close to Blockley. This operation, which exclusively supplies an on-site brickworks, is considered small-scale and focused upon traditional and hand-made bricks, marketed to the building conservation industry.

Clay deposits are fairly extensive across the Cotswolds and coincide with the massive limestone geology. The immediate availability of permitted reserves of brick clay is also considered to be health, when compared with the current low production of bricks.

Upper Thames Valley - Geological Review

The Upper Thames Valley is situated in the far south east of Gloucestershire. It is an area of low-lying land where the river Thames and its interconnecting tributaries have a strong hydrological influence.

Geologically this area comprises of limestone, sandstone and mudstone from the Upper Jurassic period. It represents a succession from older limestone known as Cornbrash along its northern flank, to younger Kellaway beds and Oxford clay.

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6 It is noted that during the preparation of the Minerals Local Plan (MLP) an omission site near to Moreton-in-Marsh (Little Barrow Farm) was promoted and subsequently considered within the MLP Inspector Report (2001). However, it was not recommended for inclusion in adopted Minerals Local Plan and to date no further interest has been pursued in this part of the county.
(around 135 million year old) moving in a southerly direction. This succession creates a watertight layer, which forms the bedrock for the vast majority of the Upper Thames Valley area.

127. Overlying the solid geology is a substantial covering of superficial, river terrace deposits. These represent the remnants of more extensive, alluvial deposits laid down under periods of high water levels and river flows associated with phases of glaciation (i.e. The Ice Age) between 300,000 and 10,000 years ago. The terrace deposits occur at several levels along the Upper Thames Valley, flanking the present floodplain of the river Thames and its tributaries.

128. The higher terraces, which tend to sit above the current course of the river, are generally dry in their upper parts. However, the lower and younger terraces can become saturated at their base depending on the level of the water table. These deposits are comprise of multiple sequences of sands and gravels and in places can be several meters thick. The lower deposits appear to demonstrate a greater degree of continuity in their lateral extent due to limited erosion by subsequent river flows over time.

129. The composition of river terrace deposits is variable, although they contain quantities of Oolitic limestone, sandstone, quartzite, igneous rocks, flint, chert and quartz, together with sand, silt and clay. A key characteristic of the Upper Thames Valley deposit is its notable content of Oolitic limestone.

130. The river terraces throughout the area are of varying thicknesses and composition. Their exact distribution is also extremely complicated to measure due to the gradational transition into Head and Alluvium.

131. Sub-alluvial gravel deposits are also present within the Upper Thames Valley. These are found along the northern bank of the river Thames and are similar in content to the river terrace gravels. However, these deposits are saturated and require wet working if they are to be exploited.

**Upper Thames Valley Strategic Mineral Resource Area - Assessment of Mineral Resources**

132. The superficial deposits of the Gloucestershire Upper Thames Valley are considered inter-regionally significant as a sand & gravel aggregate resource. During 2005 the area contributed over 14% of the region’s total sand & gravel supply. Gloucestershire’s local deposits become even more significant when viewed alongside the adjoining deposits found within Wiltshire and Oxfordshire.

133. The underlying solid geology has also been identified as a local mineral resource and has supported the county’s supply of low-grade crushed rock aggregate.

**Aggregate – Sand & Gravel**

134. The superficial, river terrace deposits of the Upper Thames Valley are a key source of sharp sand and gravel, which after washing and grading, has been used by the construction industry for concrete manufacturing and block making.
Unwashed or “as-raised” sharp sand and gravel has also been applied as a general fill material and for low-grade surfacing projects such as tracks and paths.

135. For many years the supply of sand & gravel from the Upper Thames Valley has been considerable with upwards of 90% of the overall annual output for Gloucestershire.

136. In terms of remaining resources, geological evidence suggests there are still notable deposits to be worked in the area. However, the level of permitted reserves to be worked currently stands at just less than 6.5 years.

 Aggregate – Crushed Rock Limestone

137. The underlying Jurassic limestone geology and in particular Cornbrash limestone, has been worked as a low-grade, crushed rock aggregate. It has been marketed locally for general construction fill and as a decorative surfacing stone for landscaping, drives and paths.

138. However, the availability of this mineral deposits has very much depended upon the extraction of overlying sand & gravel. A high-water table and other complex hydrological issues have also complicated it working. This has resulted in a limited ‘windfall’ mineral resource that has only ever been worked on a small-scale.
Section 4
The Future for Mineral Safeguarding in Gloucestershire

139. Mineral safeguarding involves the identification and subsequent protection of mineral resources from unnecessary sterilisation by surface development. The policy mechanisms for achieving this have been considered in some depth within sections 2 of this report.

140. A geological review and resource assessment for Gloucestershire has also been provided by this report, within section 3. Table 1 below summaries the findings of this exercise and headlines the key mineral resources identified for the county: –

<table>
<thead>
<tr>
<th>Mineral &amp; Resource Potential</th>
<th>Strategic Mineral Resource Area within Gloucestershire</th>
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<tbody>
<tr>
<td>Carboniferous Limestone as a crushed rock aggregate</td>
<td>Forest of Dean</td>
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<td>Carboniferous Limestone as a building stone</td>
<td>Forest of Dean</td>
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<tr>
<td>Carboniferous Sandstone as a building stone</td>
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<td>Carboniferous Clay for brick making</td>
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<td>Devonian Sandstone as a building stone</td>
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<td>Jurassic Limestone as a crushed rock aggregate</td>
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<td>Jurassic Limestone as a building stone</td>
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<td>Jurassic Clay for brick making and engineering purposes</td>
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<tr>
<td>Superficial deposits as Sand &amp; gravel Aggregate</td>
<td>Severn Vale Upper Thames Valley</td>
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</tbody>
</table>

141. However, delivering mineral safeguarding will require more than a simple review of known mineral resources. The technical and economic resource viability for the foreseeable future of each mineral must be established and expressed in the form of Minerals Safeguarding Areas (MSAs). This exercise will involve likely further investigation of site-surveying work, specific consultation with interests parties and industry and GIS mapping.

142. Furthermore, the county’s existing delineated mineral resource area, known as the Upper Thames Valley Mineral Consultation Area (MCA) will need to be carefully reviewed so as to reflect recent changes to national and regional policy and local circumstances resulting from recent mineral working.

143. As Gloucestershire is a two-tier planning area, careful consideration will also need to be given to extension of MCA coverage, to other parts of the county. It is noted that this policy option has already received support from stakeholders during the Issues & Option consultation of 2006 (see section 2, paragraph 28).
Consequently, this report recommends that the emerging Minerals Core Strategy (MCS) is committed to additional mineral safeguarding work, which will lead to the delineation of new Minerals Safeguarding Areas (MSAs) and Mineral Consultation Areas (MCAs) for the county. This may be achieved through the aspirations of the MCS spatial strategy and strategic objectives, and/or as part of appropriate core policy that covers the management of mineral resources for the future.
**Glossary**

**AGGREGATES** – Sand, gravel, crushed rock and other bulk materials used by the construction industry

**ALLUVIAL DEPOSITS** – Layer of broken rocky matter, or sediment, formed from material that has been carried in suspension by a river or stream and dropped as the velocity of the current decreases

**BUILDING STONE** – Naturally occurring rock, which is sufficiently consolidated to enable it to be cut or shaped for use as a walling, paving or roofing material

**BROWNSTONE** – A type of sandstone used for building stone purposes. In Gloucestershire it occurs as a purple-red and green stone and outcrops in the Forest of Dean

**CARBONIFEROUS** – A major division of geological time. It approximately covers the period between 330 and 290 million years ago

**CORE STRATEGY** – Sets the long-term spatial vision and strategy for the local planning authority area and provides the strategic locations for future development opportunities

**CRUSHED ROCK** – Generic term used to describe mechanically fragmented rock, which can then be used as an aggregate mineral (see aggregates)

**DEVONIAN** – A geological period from around 400 million years ago.

**DEVELOPMENT PLAN** – Sets out the policies and proposals for development and the use of land within the local planning authority area

**DOLOMITE** – A carbonate rock rich in Magnesium Calcium Carbonate CaMg(CO₃)₂

**FLUVIAL / FLUVIAL GLACIAL DEPOSITS** – Material laid down within a river environment, or as a result of a river environment created by glacial melt water

**FREESTONE** – A stone that can be freely worked in any direction.

**GLACIATION** – the condition of being covered with glaciers or masses of ice

**ICE AGES** – A cold period marked by episodes of extensive glaciation alternating with episodes of relative warmth

**JURASSIC** – A major division of geological time. It covers the period between 200 and 130 million years ago

**LIAS** – The term to describe the lowest of the three divisions of the Jurassic period (see Jurassic). In England and Europe it mainly covers marine sediments and clays that underlie Oolitic limestone (see Oolitic limestone).

**LIMESTONE** – A carbonate rock made up of Calcium Carbonate (CaCO₃).

**MINERAL PLANNING STATEMENTS (MPS)** – Guidance documents, which set out national policy for minerals

**OOLITIC LIMESTONE** – A carbonate rock made up mostly of ooliths (or ooids), which are sand-sized carbonate particles that have concentric rings of CaCO₃ (Calcium Carbonate). These rings are formed around grains of sand or shell fragments that were rolled around on the shallow sea floor, gathering layer after layer of limestone

**PENNANT SANDSTONE** – The term used to cover all sandstone quarried from the Carboniferous period that outcrop in South Wales and the Forest of Dean in Gloucestershire

**PERMIAN** – A relatively short period of geological time between approximately 290 and 250 million years ago

**RESERVES** – Known mineral deposits with the benefit of planning permission for extraction

**RESOURCES** – A potential mineral deposit where the quality and quantity of material has not been fully tested. Resources do not benefit from planning permission

**SAND & GRAVEL** – A finely divided rock, comprising of particles or granules that range in size from 0.063 to 2mm for sand, and up to 64mm for gravel. It is used as an important aggregate mineral

**SHARP SANDS** – coarser sands used in the construction industry for products such as concrete

**SOFT SANDS** – finer sands used in the production of mortar and asphalt

**SUPERFICIAL DEPOSITS** – refer to all geological deposits of Quaternary age (approximately 3 million years ago to the present day)

**TILL** – An unstratified, unconsolidated mass of boulders, pebbles, sand, and mud deposited by the movement or melting of a glacier. The size and shape of the sediments that constitute till vary widely

**TRIASSIC** – A relatively short geological period from roughly 250 to 200 million years ago
Appendix A
Evidence Base

The following texts and information sources have contributed to the geological review and mineral resource assessments carried out in section two of this report:


British Geological Society (BGS) Minerals Planning Factsheets:
- Brick Clay;
- Building and Roofing Stone;
- Construction Aggregates;
- Coal and Coalbed methane

British Geological Society (BGS) Minerals Profiles:
- Coal;
- Building and Roofing Stone


Department for Business, Enterprise and Regulatory Reform (BERR) Overview of the work of the UK Coal Forum (2006-2007)

Gloucestershire County Council (GCC) Minerals Local Plan (1997-2006)


J. A. Howe The Geology of Building Stones (2001)

Local Heritage Initiative Programme (LHI) The Forest of Dean Local History Society Project Articles (2001-2006)


T. Oldham The Mines of the Forest of Dean and Surrounding Areas (1999)