British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Office of the Deputy Prime Minister
Creating sustainable communities

GLOUCESTERSHIRE

(comprising Gloucestershire and South Gloucestershire)

Mineral Resource Information in Support of National, Regional and Local Planning

Mineral Resources

Scale 1:100 000

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This map comprises part of a summary of the 'Mineral Resources of the South-West England Region'. For further information see www.mineralsUK.com

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SAND & GRAVEL

Superficial deposits

- Sub-alluvial: Inferred resources
- Sub-alluvial: Indicated resources (only in area assessed by BGS)
- River terrace deposits
- Boundary of area assessed for sand and gravel at the indicated resource level

Bedrock deposits

- Bromsgrove Sandstone Formation (Triassic) and Bridgnorth Sandstone Formation (Permian)

LIMESTONE

- Limestone } Jurassic
- High purity limestone (>97% $CaCO_3$) } Carboniferous
- Limestone } Carboniferous
- Dolomite } Carboniferous

SANDSTONE

- Cromhall Sandstone Formation } Carboniferous

IGNEOUS ROCK

- Malvern Complex } Precambrian

COAL

- Shallow coal } Carboniferous
- Opencast: worked area

MINERAL PLANNING PERMISSION (as at 31/10/05)

Source: Mineral Planning Authorities

- Surface planning permission (valid and expired)
- Underground planning permission other than coal (valid and expired)

MINERAL WORKINGS

- Daglingworth — Active site
- *Tintern* — Inactive (including yet to be worked), worked-out and/or restored site

Cel	Celestite	Och	Ochre	SiS	Silica Sand
Cl	Clay & shale	San	Sand	SiR	Silica Rock
Co	Coal	Sg	Sand & gravel	Sst	Sandstone
Lst	Limestone				

▲ Active underground mine

ENVIRONMENTAL DESIGNATIONS (as at 31.12.05)

- National nature conservation designations (SSSIs and NNRs)
- International nature conservation designations (SACs, SPAs and Ramsar sites)
- Area of Outstanding Natural Beauty (AONB): parts of Wye Valley, Malvern Hills and Cotswolds
- + Scheduled Monument

ADMINISTRATIVE AREAS

- Mineral Planning Authority
- District

PLANNING PERMISSIONS FOR MINERAL EXTRACTION

The extent of all known extant and former planning permissions for mineral working is shown on the map, irrespective of their current planning or operational status. The polygons were digitised by BGS from Plotting Sheets and other documents supplied by the relevant authorities and in addition, digital data was supplied by Gloucestershire County Council. In addition, planning permission information was digitally acquired from Ministry of Housing and Local Government maps for the area and incorporated into the data. Any queries regarding the sites shown should be directed to these authority at the address shown below. The polygons cover active, former and restored mineral workings and, occasionally, unworked deposits.

Planning Permissions represent areas where a commercial decision to work mineral has been made, a successful application has been dealt with through the provisions of the Town and Country Planning legislation and the permitted reserve will have been depleted to a greater or lesser extent. The current planning status is not qualified on the map but is available in the underlying database.

Contact address:

Gloucestershire County Council, Environmental Department, Shire Hall, Gloucester GL1 2TH, Tel: 01452 425700, Fax: 01452 425356, Web page: www.gloucestershire.gov.uk

South Gloucestershire Council, Directorate of Planning, Transport and Environmental Services, Ridgewood, 244 Station Road, Yate BS37 4AF, Tel: 01454 868686, Fax: 01454 864473, Web page: www.southglos.gov.uk

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Digital SSSI, NNR, SPA, SAC and Ramsar boundaries © English Nature 2006
Contact address:
English Nature, Northminster House, Northminster, Peterborough, PE1 1UA, Tel: 01733 455000, Fax: 01733 455103, Web page: www.english-nature.org.uk

Positions of Scheduled Monuments at 25th September 2003 as supplied by English Heritage.
The majority of monuments are plotted using a certred NGR symbol. Consequently the actual area and/or length of a monument protected by the legal constraints of scheduling cannot be represented here. Monuments scheduled since that date are not accounted for. © Copyright English Heritage.
Contact address:
English Heritage, 23 Savile Row, London, W1 2ET, Tel: 020 7973 3132, Web page: www.english-heritage.org.uk

Digital AONB boundaries © Countryside Commission 1986 (now Countryside Agency).
Contact address:
Countryside Agency, John Dower House, Crescent Place, Cheltenham, Gloucestershire, GL50 3RA, Tel: 01242 521381, Fax: 01242 584270, Web page: www.countryside.gov.uk

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Contact address:
The Coal Authority, 200 Lichfield Lane, Mansfield, Nottinghamshire, NG18 4RG, Tel: 01623 427162, Fax: 01623 638338

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CRUSHED ROCK AGGREGATES

A variety of hard rocks are, when crushed, suitable for use as aggregates. Their technical suitability for different applications depends on their physical characteristics, such as crushing strength and resistance to impact and abrasion. Higher quality aggregates are required for coating with bitumen for road surfacing, or for mixing with cement to produce concrete. For applications such as constructional fill and drainage media, with less demanding specifications, lower quality materials are acceptable. The area is important source of crushed rock aggregate.

Total production of crushed rock in 2003 in the area was 4.57 million tonnes, of which 62 per cent was from South Gloucestershire. Total permitted reserves of crushed rock in the area at the end of 2003 were 27.85 million tonnes (South West England Regional Aggregates Working Party). Limestone is the most important source of crushed rock aggregate in the area.

Limestone

Limestones are common rocks in Gloucestershire and range from Silurian to Jurassic in age; Carboniferous limestones are, however, the most important resource. Limestone aggregate is quarried predominantly from the steeply dipping Carboniferous limestones near Yate and Cromhall in South Gloucestershire and the saucer-shaped downfold in the Forest of Dean. However, significant quantities are also sourced from the Jurassic limestones of the Cotswolds.

Limestones of Carboniferous age in the area have important commercial differences from those in the adjacent Mendip Hills. The Black Rock Limestone, for example, is replaced by dolomite, and other limestone units also become locally of low or variable chemical purity. Quarries near Cromhall produce aggregate from the Black Rock Dolomite and the partially dolomitised Black Rock Limestone. The product has a high magnesium content and is significantly stronger than most Carboniferous limestones. At Wickwar, the Clifton Down Limestone is more siliceous (i.e. it is sandy) than in Somerset and this enables stone with a relatively high PSV (i.e. it is skid resistant) to be produced that can be used for road surfacing and for concrete products.

The Black Rock Limestone occurs near Chepstow and in the Forest of Dean where it forms an important resource. It is worked at the Drybrook and Stowfield quarries. To the west in Monmouthshire, the dolomite has been used as a metallurgical flux for iron making in South Wales, but in Gloucestershire it is mainly used for concrete aggregate, roadstone and for agricultural purposes. Thinner beds of Carboniferous limestone within the Avon Group are worked at Stowe Hill Quarry, near Lydney for aggregate use.

Jurassic limestone formations within the Inferior Oolite and Great Oolite groups are shown on the map to the east of the River Severn; the latter are the more extensive.

The Inferior Oolite Group occurs over a more restricted area although it thickens to reach a maximum of 100 m near Cheltenham. Most of the limestones within the Inferior Oolite are massive, coarse-grained, relatively soft and porous and contain little high-purity material. Their maximum thickness is less than 25 m. Limestones within the Inferior Oolite have been worked for many years on a small scale for building stone (e.g. 'Guiting Stone') or for low quality aggregates such as constructional fill.

The Great Oolite is worked mainly for aggregates and agricultural purposes with some used as a building stone. It includes a thin fissile stone known as "Stonefield Slate", formerly used for roofing but now worked for aggregate. The material is unusual among Jurassic limestones in that it is reputed to be frost resistant and suitable for use in concrete and roadstone.

Limestones of Silurian age - the Woolhope, Wenlock and Aymestry limestones – crop out to the east of the Forest of Dean, near Longhope. Although Silurian limestones are worked for aggregate further north in Herefordshire and Shropshire, they are generally only suitable for low-grade applications such as fill since the limestones vary in thickness and quality and are occasionally argillaceous. They are not worked in Gloucestershire and are not considered a resource and are not shown on the map.

Sandstone

Several formations in Gloucestershire are currently worked, or have the potential to be worked, for sandstone for use as a building stone, or in certain cases as aggregate.

The Carboniferous Cromhall Sandstone Formation (formerly the Drybrook Sandstone) is quarried at the Quartzite Quarry in South Gloucestershire near Cromhall. The rock has a high strength and resistance to polishing and is used as a roadstone throughout southern England.

Igneous rock

A very small part of the Precambrian Malvern Complex crops out in northern Gloucestershire and extends over the county border into Herefordshire and Worcestershire. This complex is composed mainly of intrusive rocks, which are a potential source of good quality aggregate. These rocks were worked outside the county until the 1980s and are shown to provide continuity across the regional boundary.

Production of crushed rock, 1999 - 2003

Crushed rock total permitted reserves = 27.85 million tonnes (as at 31.12.03)

OTHER MINERALS

Iron ore

Irregular bodies of limonite and hematite occur in limestones of Lower Carboniferous age in the Forest of Dean and have been mined at outcrop and at depth where the limestones dip beneath the Coal Measures on the flanks of the basin. The iron ores represent metasomatic replacement deposits in limestone and dolomite, the most important unit containing these deposits being the Gully Oolite Formation. The iron ores were worked from Roman times until the 1940s; recorded output between 1842 and 1940 being about 4.8 million tonnes of ore. Resources are effectively exhausted and the deposits are no longer of economic significance as a source of iron ore. However, very minor amounts of ochre (pigment) are sometimes recovered from old workings, which are now show caves.

Evaporite Minerals

Celestite

Celestite (strontium sulphate, SrSO$_4$) is the main source of strontium. The only deposits that were of commercial importance in the UK occur in South Gloucestershire and in the Bristol area. The most recent workings were at Yate, although production ceased in 1991 due to the exhaustion of reserves.

Nodular and disseminated celestite occurs as the 'Severnside Evaporite Bed' near the top of the Triassic Mercia Mudstone Group, at the unconformity of the Mercia Mudstone with the underlying Palaeozoic rocks (mainly Coal Measures). Celestite also occurs in veins and as infillings of redistributed celestite both in the Mercia Mudstone and underlying rocks. Further working of celestite in the area is unlikely and these resources are not shown on the map. However, former planning permissions for celestite are shown. (See also The Celestite resources of the area north-east of Bristol, *Mineral Assessment Report*, Institute of Geological Sciences, No 25, 1976).

BRICK CLAY

'Brick clay' is the term used to describe clay and shale used predominantly in the manufacture of bricks and, to a lesser extent, roof tiles and clay pipes. These clays may sometimes be used in cement making, as a source of constructional fill and for lining and sealing landfill sites. The suitability of clay for the manufacture of bricks depends principally on its behaviour during shaping, drying and firing. This will dictate the properties of the fired brick, such as strength and frost resistance and, importantly, its architectural appearance.

Most facing bricks, engineering bricks and related clay-based building products are manufactured in large automated factories. These represent a high capital investment and are increasingly dependent, therefore, on raw materials with predictable and consistent firing characteristics in order to achieve high yields of saleable products. Blending different clays to achieve improved durability and to provide a range of fired colours and textures is an increasingly common feature of the brick industry. Continuity of supply of consistent raw materials is of paramount importance.

There are three brickworks in the Gloucestershire (Broadmoor, Hawkwell Green and Wellacre), and one in South Gloucestershire, (Cattybrook) that currently work brick clay and produce bricks and related products for building purposes. Cattybrook brickworks, near Almondsbury is also supplied with brick clay from the Shortwood Quarry, near Pucklechurch. The clay worked at Broadmoor and Hawkwell Green in the Forest of Dean is from the Cinderford Member of the Carboniferous Grovesend Formation, whilst the Wellacre site, near Blockley, produces clay from part of the Jurassic Charmouth Mudstone Formation. In South Gloucestershire the Cattybrook site works Carboniferous South Wales Lower and Middle Coal Measures mudstones and fireclays, whilst the Shortwood Quarry works mudstones in the Farrington and Barren Red members of the Carboniferous Grovesend Formation. Both red and buff-firing bricks are produced at Cattybrook. Because of the variable nature of these clays they are not shown on the map.

COAL

Shallow coal resources in Gloucestershire occur within two areas; the Forest of Dean Coalfield and northern part of the Bristol-Somerset Coalfield.

Forest of Dean Coalfield

The Forest of Dean Coalfield, located east of Monmouth, covers approximately 88 km^2 and was one of the earliest regions in Britain where coal and iron were worked. The Forest has always been Crown property and the rights to work coal in the area have been vested in the local inhabitants who can qualify as Freeminers. Only people born within the Forest of Dean area and who have already worked on a coal mine may qualify as Freeminers; the number of Freeminers within coalfield continues to fall.

The unusual feature of this coalfield is that is almost completely exposed at surface. It occurs in a raised asymmetrical syncline with a steeper eastern limb that crops in the area of Staple Edge and the Soudley Valley. The coal-bearing strata are divided into three formations; the Trenchard Formation, the Pennant Sandstone Formation, and the Grovesend Formation.

The late-Carboniferous age Trenchard Formation reaches up to 120 m thick in the north of the coalfield and forms the lowest division of the 'Upper Coal Measures', resting with angular unconformity on older strata beneath. The formation consists mainly of sandstones, mudstones and conglomerates with occasional coal seams. In the northeast of the Forest it consists of fire-grained mudstones, progressing to coarser sandstones in the southwest.

The late-Carboniferous age Pennant Sandstone Formation is also mainly sandstone but contains the economically most important coal seam in the area, the Coleford High Delf Seam. At least two other workable coal seams occur in this formation, and these are interpreted as being deltaic deposits with the main palaeocurrents indicating that rivers were flowing from a southeasterly direction.

The late-Carboniferous age Grovesend Formation has fine-grained sediments at its base but also includes as many as eight thin coal seams. The upper division of the formation is again composed of sandstones with some horizons of finer grained, shaley material.

Freemining in the Forest of Dean has seen a steady decline since the privatisation of the coal industry in 1994. There is only one drift mine (Monument Mine) steamfactly producing small amounts of coal (214 tonnes in 2006). There was no recorded production in 2005. Coal has also been produced by opencast mining in the past with approximately 0.75 Mt produced since World War Two, although opencast mining ceased in 1985. Historically many deep coal mines operated in the Forest of Dean, however, the last of these mines closed around the late 1960s and early 1970s.

The small Newent Coalfield is of no economic significance.

Bristol-Somerset Coalfield

The Bristol-Somerset Coalfield is mostly concealed beneath a variable Permian to Mesozoic cover. Part of this coalfield occurs in South Gloucestershire, and this has previously been exploited where the Coal Measures are exposed at or near surface and there has also been some deep mining up to the 1960s. The coalfield is structurally complex and the seams are generally thin and uneconomic to work. Prospecting areas for opencast coal have been identified in the past but it is unlikely that any significant future production will occur in this area. Small quantities of coal have been produced at the Cattybrook Quarry, near Almondsbury where Coal Measures are extracted for brickmaking. The extent of the coalfield is only shown on the inset map.

Oxfordshire-Berkshire Coalfield

The east of the county contains the western margin of the wholly concealed Oxfordshire-Berkshire Coalfield. The strata mainly consists Upper Coal Measures and the coal seams are comparatively thin and are not of current economic interest.

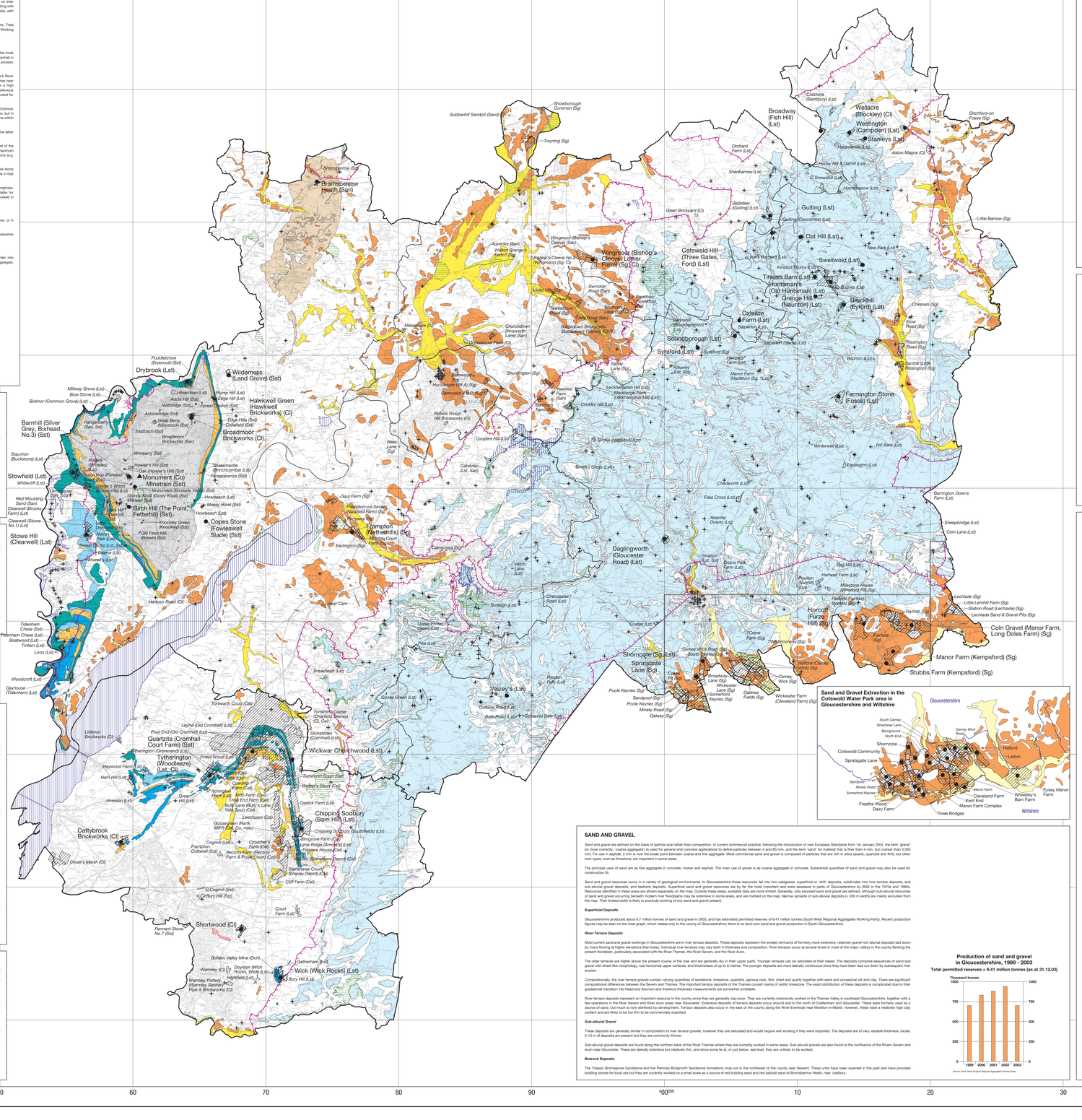
Aims and Limitations

The purpose of the maps in this series is to show the broad distribution of those mineral resources which may be of current or potential economic interest and to relate these to selected nationally-recognised planning designations. The maps are intended to assist in the consideration and preparation of development plans for mineral working and the protection of important mineral resources against sterilisation. They bring together a wide range of information, much of which is scattered and not always available in a convenient form.

The maps have been produced by collation and interpretation of mineral resource data principally held by the British Geological Survey. Information on the extent of mineral planning permissions has been obtained from the relevant Mineral Planning Authority (MPA). Some of these permissions may have lapsed or expired. The status of individual areas can be ascertained from the appropriate MPA. Location information on national planning designations has been obtained from the appropriate statutory body (Countryside Agency, English Nature and English Heritage). For further information the relevant body should be contacted.

The mineral resource data presented are based on the best available information, but are not comprehensive and their quality is variable. The inferred boundaries shown are, therefore, approximate. Mineral resources defined on the map delineate areas within which potentially workable minerals may occur. These areas are not of uniform potential and also take no account of planning constraints that may limit their working. The economic potential of specific sites can only be proved by a detailed evaluation programme. Such an investigation is an essential precursor to submitting a planning application for mineral working. Extensive areas are shown as having no mineral resource potential, but some isolated mineral workings may occur in these areas. The presence of these operations generally reflects very local or specific situations.

The maps are intended for general consideration of mineral issues and not as a source of detailed information on specific sites. The maps should not be used to determine individual planning applications or in taking other decisions on the acquisition or use of a particular piece of land, although they may give useful background information which sets a specific proposal within context.



SAND AND GRAVEL

Sand and gravel are defined on the basis of particle size rather than composition. In current commercial practice, following the introduction of new European Standards from 1st January 2004, the term 'gravel' (or more correctly, 'coarse aggregate') is used for general and concrete applications to define particles between 4 and 80 mm, and the term 'sand' for material that is finer than 4 mm, but coarser than 0.063 mm. For use in asphalt, 2 mm is now the break point between coarse and fine aggregate. Most commercial sand and gravel is composed of particles that are rich in silica (quartz, quartzite and flint), but other rock types, such as limestone, are important.

The principal uses of sand are as fine aggregate in concrete, mortar and asphalt. The main use of gravel is as coarse aggregate in concrete. Substantial quantities of sand and gravel may also be used for construction fill.

Sand and gravel resources occur in a variety of geological environments. In Gloucestershire these resources fall into two categories: superficial or 'drift' deposits, subdivided into river terrace deposits, and sub-alluvial gravel deposits, and bedrock deposits. Superficial sand and gravel resources are by far the most important and were assessed in parts of Gloucestershire by BGS in the 1970s and 1980s. Resources identified in these areas are shown separately on the map. Outside these areas, available data are more limited. Generally, only exposed sand and gravel are defined, although sub-alluvial resources of sand and gravel occurring beneath modern river floodplains may be extensive in some areas, and are marked on the map. Narrow spreads of sub-alluvial deposits (< 200 m width) are mainly excluded from the map. Their limited width is likely to preclude working of any sand and gravel present.

Superficial Deposits

Gloucestershire produced about 0.7 million tonnes of sand and gravel in 2003, and has estimated permitted reserves of 9.41 million tonnes (South West Regional Aggregates Working Party). Recent production figures may be seen on the inset graph, which relates only to the county of Gloucestershire; there is no land-won sand and gravel production in South Gloucestershire.

River Terrace Deposits

Most current sand and gravel workings in Gloucestershire are in river terrace deposits. These deposits represent the eroded remnants of formerly more extensive, relatively gravel-rich alluvial deposits laid down by rivers flowing at higher elevations than today. Individual river terraces may vary both in thickness and composition. River terraces occur at several levels in most of the major valleys in the county flanking the present floodplain, particularly associated with the River Severn, the River Avon, the River Severn, and the River Avon.

The older terraces are higher above the present course of the river and are generally dry in their upper parts. Younger terraces can be saturated at their bases. The deposits comprise sequences of sand and gravel with sheet-like morphology, sub-horizontal upper surfaces, and thicknesses of up to 8 metres. The younger deposits are more laterally continuous since they have been less cut down by subsequent river erosion.

Compositionally, the river terrace gravels contain varying quantities of sandstone, limestone, quartzite, igneous rock, flint, chert and quartz together with sand and occasional silt and clay. There are significant compositional differences between the Severn and Thames. The important terrace deposits of the Thames consist mainly of oolitic limestone. The exact distribution of these deposits is complicated due to their longitudinal transition into Head and Alluvium and therefore thickness measurements are somewhat unreliable.

River terrace deposits represent an important resource in the county since they are generally clay-poor. They are currently extensively worked in the Thames Valley in southeast Gloucestershire, together with a few operations in the River Severn and River Avon areas near Gloucester. Extensive deposits of terrace deposits occur around and to the north of Cheltenham and Gloucester. These were formerly used as a source of sand, but much is now sterilised by development. Terrace deposits also occur in the east of the county along the River Evenlode near Moreton-in-Marsh, however, these have a relatively high clay content and are likely to be too thin to be commercially exploited.

Sub-alluvial Gravel

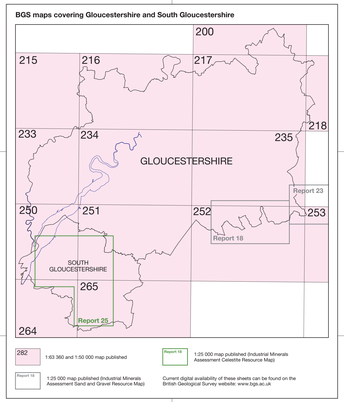
These deposits are generally similar in composition to river terrace gravels, however they are saturated and would require wet working if they were exploited. The deposits are of very variable thickness, locally 5-10 m of deposits are present but they are commonly thinner.

Sub-alluvial gravel deposits are found along the northern bank of the River Thames where they are currently worked in some areas. Sub-alluvial gravels are also found at the confluence of the Rivers Severn and Avon near Gloucester. These are laterally extensive but relatively thin, and since some lie at, or just below, sea level, they are unlikely to be worked.

Bedrock Deposits

The Triassic Bromsgrove Sandstone and the Permian Bridgnorth Sandstone formations crop out in the northwest of the county near Newent. These units have been quarried in the past and have provided building stones for local use but they are currently worked on a small scale as a source of red building sand and red asphalt sand at Bromsberrow Heath, near Ledbury.

BGS maps covering Gloucestershire and South Gloucestershire



BUILDING STONE

A wide range of rock types is used as a source of building stone. The suitability of particular rock types depends not only on aesthetic qualities, such as colour and textural consistency but also on factors such as strength and durability, and commercial considerations such as the size of block or slab that can be extracted. A continuing supply of building stone from a variety of sources is important for new building and restoration work. Building stone operations range from small sites supplying local markets, to large concerns that trade across Britain and sometimes overseas.

Historically the area has produced and used a wide range of stones for building purposes and these are summarised below. Many different rock units are still of importance today with Jurassic limestones being the most important source of building stone and worked at many quarries in the Cotswolds. Devonian and Carboniferous sandstones (Pennant Sandstone Formation) are worked on a small scale in the Forest of Dean area. However, almost all crushed rock aggregate quarries produce, or have the capacity to produce, building stone as an ancillary product.

The oldest rocks, in the west of the area, are the metasedimentary, sedimentary and associated intrusive igneous rocks of the Cambrian to Silurian inlers of Tortworth, May Hill and the southern Malvern Hills. Each area was extensively quarried for a variety of materials including building stone. Downton Castle Sandstone was quarried at Clifford Mesne and around Gorsley.

The purple-red and green sandstones of the overlying Devonian Brownstones Formation were quarried around the Forest of Dean near Mitcheldean, Soudley and Blakeney. Building standstones are worked at Wilderness and Copes Stone quarries. The distinctive Quartz Conglomerate Formation was once an important source of millstones for the cider and milling industries and was used locally for building at Tintern.

The Carboniferous limestones and Pennant sandstones of the Carboniferous of the Forest of Dean include some of the oldest and most extensive building stone quarries/mines in the area at Bixhead and Bixslade. The Permian age Hartfield breccia was also worked locally for building stone. Today building stone is often provided from the larger aggregate quarries in the Forest of Dean.

Red and green coloured sandstones of the Triassic age Sherwood Sandstone Group were worked on a small scale near Huntley, Blyforde Farm and Newent. The Arden Sandstone 'aerry' from the overlying Mercia Mudstone Group was quarried for local building purposes along parts of its outcrop as at Corse House Farm.

Grey limestones of the Lower Jurassic, Blue Lias Formation (Lias Group) were extensively quarried along much of its outcrop for lime and local building stone e.g. Hatfield, Ashleworth.

The ferruginous limestones of the Marlstone Rock Formation were used locally close to the outcrop as at Carn, Alderton, Langley Hill and Burhill.

The oolitic and shelly limestones of the Middle Jurassic Inferior Oolite and Great Oolite groups are the most characteristic and important building stones of the county. Quarries are numerous across the outcrop. Some of the better-known quarries are associated with specific towns and villages including, in the Inferior Oolite Group, those at Cleeve Cloud, Coscombe, Guiting, Bourton on the Hill, Longborough Stanway, Painswick, Naibworth, Leckhampton, Whittington, Westington and Rodborough. In the Great Oolite Group important quarries operated at Minchinhampton, but the succession was better known as a source of Cotswold roofing slates, with quarries at Through, Brockhill, Sevenhampton, Naunton and Kineton. The shelly limestones of the Forest Marble Formation were also extensively worked for heavier roofing slates at Tetbury. The extent of Jurassic limestones is shown on the map.

Currently there are five sandstone quarries operating in the area - Copes Stone and Wilderness quarries working the Devonian Brownstones Formation and Barnhill, Minetrain and Birch Hill working the Carboniferous Pennant Sandstone Formation in the Forest of Dean. The extent of these formations is not shown of the map because their suitability for use as building stone may be localised due to factors such as bed thickness and extent, and discontinuities and degree of cementation.

HYDROCARBONS

Conventional Oil and Gas

Gloucestershire lies to the north of the Variscan Front, where Variscan Basement lies at shallow depths and across which thin and variable Permian and overlying Mesozoic sequences were deposited. This impacts on the quality and extent of potential reservoir and source rocks across the county. Any source rocks present within this succession will be neither thick enough nor likely to have been buried deep enough for the generation of hydrocarbons.

Palaeozoic strata lie concealed beneath the Permian and Mesozoic cover across the county. Sequences of Westphalian Carboniferous-Devonian age, representing the western margins of the Oxfordshire-Berkshire Coalfield, occur in a N-S belt up to 7 km inside the county's eastern boundary. However, this province is prospective under Palaeozoic cover elsewhere in Gloucestershire adjacent to the major Malvern Fault line, having little or no hydrocarbon potential.

British Gas drilled a series of boreholes for exploration and also the potential for gas storage in the period 1961-2 at Stow-on-the-Wold in the east of the county (see Table below). Further exploration wells were drilled at various points around the county between 1975 and 1989. Six exploration wells were drilled within the area of Coal Measures subcrop, the most recent being Ash Farm (BP) in 1981. All wells have proved dry and were abandoned, although Leighbrook, drilled by Altana in 1989, was plugged and abandoned with minor gas shows.

Currently, PEDL087 is the only active hydrocarbon exploration or production licence in the county reflecting limited hydrocarbon prospectivity in the county. High-risk plays, requiring Westphalian (Coal Measures) gas sources may exist in the east of the county. The minor gas shows in the Leighbrook No.1 well drilled in the north and centre of the county are enigmatic and difficult to explain.

Well	Drilling date	Original operator	Current licence area and operator	Status
Ash Farm 1	1981	BP Exploration UK Ltd	Open acreage	Plugged & abandoned, dry
Guiting Power	1979	Bearcat Exploration (UK) Ltd	Open acreage	Plugged & abandoned, dry
Leighbrook 1	1989	Altana	Open acreage	Plugged & abandoned, minor gas shows
Sherborne 1	1975	Shell UK Exploration (UK) Ltd	Open acreage	Plugged & abandoned, dry
Stow-on-the Wold 1	1961	BP & Gas Council	Open acreage	Plugged & abandoned, dry
Stow-on-the Wold 2	1962	Gas Council	Open acreage	Gas storage evaluation
Stow-on-the Wold 3	1962	Gas Council	Open acreage	Gas storage evaluation
Stow-on-the Wold 4	1962	Gas Council	Open acreage	Gas storage evaluation
Windrush 1	No details	No details	Open acreage	No details

Abandoned Mine Methane (AMM) and Coalbed Methane potential

The Oxfordshire-Berkshire Coalfield covers an area of some 3327 km^2, and lies at depths of between 300 and 1500 m. It contains mainly thin, high volatile bituminous coals preserved in synclines with an interveing anticline. The average gas seam content is 0.4 m^3 CH$_4$ per tonne. No coal has been mined. The small Forest of Dean Coalfield covers an area of just 88 km^2 and contains Upper Coal Measures up to 610 m thick. Nineteen seams are present. Coal rank is high, volatile bituminous, non-coking and although the total coal thickness is low (5.75 m), the area has been heavily worked. No data exist for the gas content, but gas was absent in most mines, although most areas are now flooded. The small coalfield at Newent provides no potential within county.

The gas content of the seams in the Bristol and Somerset Coalfield is not known, but is believed to be low.

Abandoned Mine Methane (AMM)

The prospects for AMM are negligible because of low gas levels, flooding and the lack of extensive workings.

Coalbed Methane (CBM)

CBM refers to methane extracted via boreholes from coal seams other than in abandoned or active coal mines. It includes extraction from coal seams above or below abandoned or working mines. There is little potential for CBM in the county due to the low gas levels encountered.

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