

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

**Hampshire (comprising Hampshire, City of Portsmouth and City of
Southampton)**

British Geological Survey Commissioned Report CR/02/129N

**F M McEvoy, A J Bloodworth, D G Cameron, N A Spencer, S F Hobbs, D J
Evans, C Simpson, G K Lott and D E Highley**



Keyworth, Nottingham 2003

BRITISH GEOLOGICAL SURVEY
TECHNICAL REPORT CR/02/129N
Mineral Resources Series

**Mineral Resource Information for
Development Plans:
Hampshire (comprising Hampshire, City
of Portsmouth and City of Southampton)**

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This report accompanies the 1:100 000 scale map:
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INTRODUCTION

This report is one of a series prepared by the British Geological Survey for various administrative areas in England for the Office of the Deputy Prime Minister's research project *Mineral Resource Information in Support of National, Regional and Local Planning*.

The accompanying map relates to the county of Hampshire and the unitary authorities of Southampton and Portsmouth and delineates the mineral resources of current, or potential, economic interest in the area and the sites where minerals are or have been worked. It also relates these to national planning designations, which may represent constraints on the extraction of minerals.

Three major elements of information are presented;

- the geological distribution and importance of mineral resources;
- the extent of mineral planning permissions and the location of current mineral workings; and
- the extent of selected, nationally-designated planning constraints.

This wide range of information, much of which is scattered and not always available in a consistent and convenient form, is presented on a digitally-generated summary map on the scale of 1:100 000. This scale is convenient for the overall display of the data and allows for a legible topographic base on which to depict the information. However, all the data are held digitally at larger scales using a Geographical Information System (GIS), which allows easy revision, updating and customisation of the information together with its possible integration with other datasets. The information will form part of a *Summary of the Mineral Resources of South East Region*.

The purpose of the work is to assist all 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. It provides a knowledge base, in a consistent format, on the nature and extent of mineral resources and the environmental constraints, which may affect their extraction. An important objective is to provide baseline data for the long term. The results may also provide a starting point for discussions on specific planning proposals for mineral extraction or on proposals, which may sterilise resources.

It is anticipated that the maps and report will also provide valuable background data for a much wider audience, including the different sectors of the minerals industry, other agencies and authorities (e.g. The Planning Inspectorate Agency, the Environment Agency, the Countryside Agency and English Nature), environmental interests and the general public.

Basic mineral resource information is essential to support mineral exploration and development activities, for resource management and land-use planning, and to establish baseline data for environmental impact studies and environmental guidelines. It also enables a more sustainable pattern and standard of development to be achieved by valuing mineral resources as national assets. The mineral resources covered are sand and gravel, chalk, brick clay, building stone, and hydrocarbons.

Resources and reserves

Mineral resources are natural concentrations of minerals, or bodies of rock that are, or may become, of potential economic interest as a basis for the extraction of a commodity. They will exhibit physical and/or chemical properties that make them suitable for specific uses and be

present in sufficient quantity to be of intrinsic economic interest. Areas that are of potential economic interest as sources of minerals change with time as new uses are developed, product specifications change, recover technology is improved or more competitive sources become available.

That part of a mineral resource, which has been fully evaluated and is commercially viable, to work is called a mineral reserve. In the context of land-use planning, the term mineral reserve should strictly be further limited to those minerals for which a valid planning permission for extraction exists (i.e. permitted reserves). Without a valid planning consent, no mineral working can take place and consequently the inherent economic value of the mineral resource cannot be released and resulting wealth created. The ultimate fate of mineral reserves is to be either physically worked out or to be made non-viable by changing economic circumstances.

Environmental designations

The map shows the extent of selected, nationally-designated planning constraints as defined for the purposes of this study. These are defined on a common national basis and therefore represent a consistent degree of constraint across the country. No interpretation should be made from the map with regard to the relative importance of the constraints, either in relation to mineral development proposals or in relation to each other. Users should consult policy guidelines issued by the relevant Government department, statutory agency or local authority.

The constraints shown on the map are:

- New Forest (part) and South Downs (part) National Parks, both of which are designated but not yet confirmed;
- North Wessex Downs, East Hampshire, South Hampshire Coast, Cranborne Chase and Chichester Harbour Areas of Outstanding Natural Beauty (AONB);
- National nature conservation designations – National Nature Reserves (NNR) and Sites of Special Scientific Interest (SSSI);
- International nature conservation designations – Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Ramsar sites;
- Scheduled Monuments.

Mineral development may also be constrained by many other factors not shown on the maps, including local landscape designations, considerations relating to the protection of other resources, such as groundwater, and local amenity or environmental concerns, such as noise, traffic and visual impact. These have been excluded because the constraint is not defined on a national basis or the information is not generally available. The extent or degree of relevance of such constraints can be ascertained from the relevant statutory agency or the appropriate Mineral Planning Authority.

SAND AND GRAVEL

Sand and gravel are defined on the basis of particle size rather than composition. In current commercial usage, the term 'gravel' is used for material that is coarser than 5 mm, with a maximum size of 40 mm, and the term sand for the material that is finer, but coarser than 0.075 mm. Most sand and gravel is composed of particles that are rich in silica (quartz, quartzite and flint), but other rock types may occur locally.

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. Unwashed sand and gravel can also be used for construction fill and as ‘hoggin’ for surfacing tracks and paths. Total production of sand and gravel in Hampshire was 4.2 million tonnes in 2001, of which 1.8 million tonnes was landings of marine-dredged sand and gravel (Figure 1). At the end of 2001, the permitted reserves in Hampshire were 14 million tonnes, of which some 10 million tonnes were concreting sand and 4 million tonnes building sand.

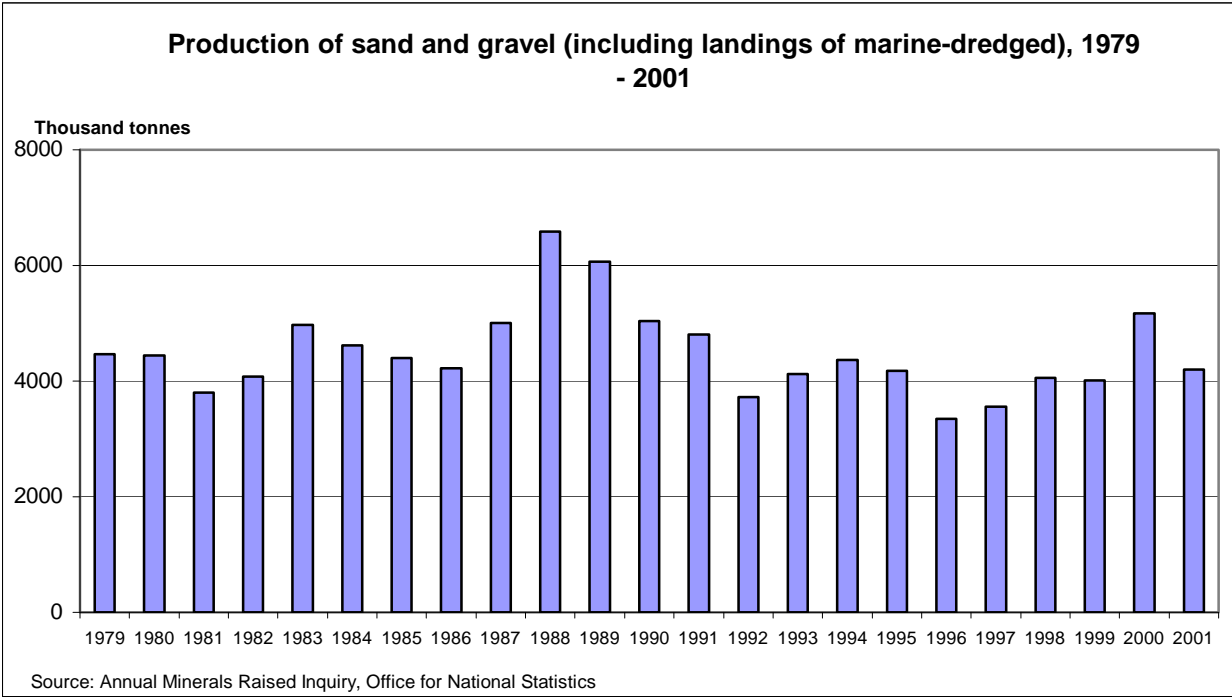


Figure 1 Production of sand and gravel from 1979 - 2001

Sand and gravel resources occur in a variety of geological environments. In Hampshire, these resources fall into two categories:

- superficial or 'drift' deposits of Quaternary age, subdivided into river sand and gravel, storm beach gravel and downwash gravel;
- bedrock, or ‘solid’ deposits represented by the Palaeogene Poole and Branksome Sand formations of the Bracklesham Group, the Palaeogene Whitecliff Sand Member of the London Clay Formation and the Cretaceous Folkestone Formation.

Superficial deposits

Parts of the areas assessed for sand and gravel by BGS resource surveys are identified on the map. Resources shown here are taken from these maps where available. In these areas, the possible extent of sand and gravel concealed beneath other material is shown. These indicated resources were defined by overburden to mineral ratios. Outside these areas, available data is more limited. Generally, only exposed sand and gravel is defined, although sub-alluvial inferred resources of sand and gravel occurring beneath modern river flood plains may be extensive in some places. Narrow (< 200 m) spreads of sub-alluvial deposits are mainly excluded from the map. Their limited width is likely to preclude economic working of any sand and gravel present.

River terrace deposits

Terrace deposits occur at several levels in most of the major river valleys in the county. These broadly comprise older, raised river terrace sequences (sometimes called 'Plateau Gravels') (Plate 1) and younger, flood plain terraces associated with, and underlying, present day alluvium. Other important tracts occur in the south of the county adjacent to the coast, particularly in the New Forest District and bordering the Solent.



Plate 1. Eversley Common Sand and Gravel Pit. Sand and gravel from the Quaternary 'Plateau Gravels' is extracted and graded.

Photo courtesy of Hampshire County Council. Copyright © Hampshire County Council 2002.

The younger, low-lying terraces are well developed along the valleys of the rivers Avon, Test, and Blackwater. The river terraces of the River Blackwater in the north-east of the county form extensive spreads of sand and gravel composed principally of flint gravels, with minor amounts of sandstone and quartz, and quartz rich sands. Low-lying terraces comprise the main spreads of terrace deposits enclosed by the present Avon valley. They form extensive terrace flats, ranging in thickness from 1.0 m to 7.8 m, which are coarser than the higher deposits. In the west of the county, extending from Southampton to Basingstoke, the terraces of the River Test, comprising flint gravels with minor amounts of sandstone line the valley sides up to 15 m above the present valley floor (Plate 2).



Plate 2. General view of Kimbridge Sand and Gravel Pit. Sand and pebble beds of the Reading Formation in the foreground. River terrace deposits of the River Test have almost been completely extracted on the bench above. Face height c. 3.5m. (GS 1079, P. M. Hopson)

The high terraces of the River Avon have proven thicknesses ranging from 0.4 m to 5.0 m and comprise well-bedded gravels with occasional thin-bedded sand units. In the south of the county, in the vicinity of the New Forest and the Solent, extensive spreads of older river terrace deposits have also been proven. These may have been deposited by the postulated 'Solent River' which flowed across this area during a period of the Quaternary when sea levels were lower than at present. These deposits consist of flint-rich gravel with an average thickness of 3.4 m that often has a clayey superficial layer.

Sub-alluvial gravel

Sub-alluvial gravels are encountered beneath the alluvium of the major valleys throughout the county and are compositionally similar to the river terraces deposits. The deposits rest on an irregular channelled surface and are thus of very variable thickness. These deposits are generally saturated and require wet working.

Head gravel deposits

These deposits are thin and irregularly distributed patches of clayey and sandy gravels thought to have formed by solifluxion during periods of cold climate during the Quaternary. They may also be known as 'downwash gravel'. The gravel is commonly mixed with other lithologies present on the slope and so the resulting lithologies are variable; most contain significant clay contents and many deposits have been worked in the past as 'hoggin'. The clast composition reflects that of the parent material. Head gravel is shown on the map in the north-east of the county where it has been assessed as an indicated resource by BGS. It is also shown in the Havant area where some is concealed by a thin covering of brickearth. The deposits in this area are the westward extension of the economically important gravels found in the Chichester area of West Sussex.

Storm Beach gravel

Storm beach gravels occur along the coast from Gosport eastwards to Hayling Island. These deposits consist almost entirely of flint, with a low proportion of sand. The form of these deposits is dictated by the east-west longshore drift which prevails along this coast. They are generally made up of fine to coarse flint gravels and grade seawards into sands and laminated silty clays. These deposits are not currently worked.

Bedrock Sand

Bracklesham Group (Poole Formation and Branksome Sand Formation)

The Poole Formation and the Branksome Sand Formation of the Palaeogene Bracklesham Group crop out in a small area in the vicinity of Ringwood. The Poole Formation consists of alternating layers of clay and fine- to coarse-grained, locally pebbly, sand. In Dorset, it is the principal sand resource and it is of regional importance as a source of concreting and asphalt sand. In Hampshire, however, these formations are only of local importance due to their limited outcrop area and are not currently exploited. The Bracklesham Group as a whole is shown on the map, as mapping in this area prior to 1990 did not distinguish individual horizons within the group.

Whitecliff Sand Member

The Whitecliff Sand Member occurs within the Palaeogene London Clay Formation as a thin discontinuous band from Romsey in the west of the county to Havant in the south-east. These sands are much finer grained (mean grain size typically about 0.2 mm) than those in the Poole Formation, which significantly limits their commercial use. They are of local importance and are currently only worked at Fair Oak, Eastleigh, for construction sand.

Folkestone Formation

The Cretaceous Folkestone Formation forms a north-south trending outcrop in the east of the county, close to the boundary with West Sussex. They consist of medium- to coarse-grained sands and weakly cemented sandstone with variable particle size both vertically and laterally. Generally, the sands become coarser eastwards and also tend to coarsen upwards. Currently, extraction occurs at Kingsley and Frithend (see cover photo) where it is dry screened and used as construction sand.

BRICK CLAY

The term 'brick clay' is used to describe clay 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 manufacture, as a source of construction fill and for lining and sealing landfill sites. The suitability of a 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.

Brick clay is produced on a relatively small scale in Hampshire. Historically, a variety of clays were extracted for brickmaking at many places in the Hampshire Basin, as well as in the north of the county on the margin of the London Basin and in the extreme east of the county on the flank of the Weald Basin. In 2000, five sites had planning permission for clay extraction, four of which were active. Two brickworks remain in operation at Michelmersh and Selborne, both with adjoining extraction pits. At Michelmersh, sand and anthracite dust are mixed with the clay from the Reading Formation to produce hand-thrown and soft-mud pressed facing bricks and fireplace briquettes. At Selborne, clay is extracted from the Cretaceous Gault Formation. Both brickworks are important producers of local, high quality, hand-made bricks and tiles, which are valuable for use where new construction is required to harmonise with older buildings. The Gault Formation is only of local importance and thus not shown on the face of the map.

Clay is extracted from the London Clay Formation at Rowlands Castle and from the Palaeogene Headon and Osbourne Beds at Lymington for use in landfill containment.

CHALK

Chalk is a relatively soft, fine-grained, white limestone, consisting mostly of the debris of planktonic algae. The chalk in Hampshire is Upper Cretaceous in age and forms the prominent natural feature of the Chalk Downlands. Approximately one third of the chalk outcrop lies within the North Wessex Downs and East Hampshire AONBs. The Chalk is divided into the Grey Chalk (formerly Lower Chalk) and White Chalk (formerly Middle and Upper Chalk) subgroups and is up to 450 m in thickness in this part of southern England. The White Chalk subgroup is the most extensive with the Grey Chalk Subgroup forming a thin band, on average 40-60 m in thickness in the east and north-west of the county.

The Grey Chalk Subgroup is characterised by relatively high clay content, particularly toward the base, and is classified as 'low purity' (<93% CaCO₃). The overlying White Chalk Subgroup is of a higher purity (93-98% CaCO₃). Flints are common in the White Chalk Subgroup.

Traditionally, chalk has been extracted on a small-scale for use as agricultural lime throughout the chalk areas of Hampshire. In more recent years chalk has also been extracted for use as a low-grade aggregate and for limited specialist industrial applications.

Chalk is produced in relatively small quantities from a few quarries within the Chalk Downlands and formerly from the smaller outcrop of chalk at Portsdown Hill (Plate 3). Extraction is almost entirely from the White Chalk Subgroup. Examples of extraction from the White Chalk Subgroup are at Monk Sherborne in the north and at Somborne Lime Quarry in the west of the county. At Monk Sherborne, the extracted chalk is crushed and sold as low-grade aggregate. At Somborne, chalk is extracted for agricultural use and low grade aggregate and the resultant voids are backfilled with inert waste (Plate 4).



Plate 3. Warren Farm. A small quantity of chalk is extracted from the White Chalk Subgroup at Portsdown Hill. The pit is also used for recycling and waste disposal. (GS 334, P.M. Hopson)



Plate 4. Somborne Lime Quarry. Chalk from the White Chalk Group is extracted for agricultural lime and low-grade aggregate. (GS 1098, P.M. Hopson)

Approximately 20,000 tonnes of chalk are produced annually in Hampshire (2000), three-quarters of which is used as constructional fill material, the remainder is used as agricultural lime and for industrial purposes. Approximately 12 million tonnes of permitted chalk reserves currently exist.

The Chalk is a major aquifer and is the most important source of groundwater in the county.

BUILDING STONE

Hampshire has no commercially significant building stone resources, hence their absence from the face of the map. However, there has been extensive use of a number of local stones for building in the past.

Chalk from the Upper Cretaceous was quarried as a local source of building stone across much of the outcrop. As elsewhere in southern England, flint (also obtained from the Chalk) has been widely used as a local building material (Plate 5).

Historically, sandstones were worked for building stone from the Cretaceous, Lower Greensand Group at Passfield. Sandstones from the Upper Greensand Formation (also Cretaceous) were quarried at Old Burghclere-Kingsclere, Upper Froyle and Selborne. Quartz-cemented sandstone, known as 'Sarsen' Stone, and iron-cemented sandstones or ferricretes such as Burley Rock, were quarried from Palaeogene age rocks for local building purposes.

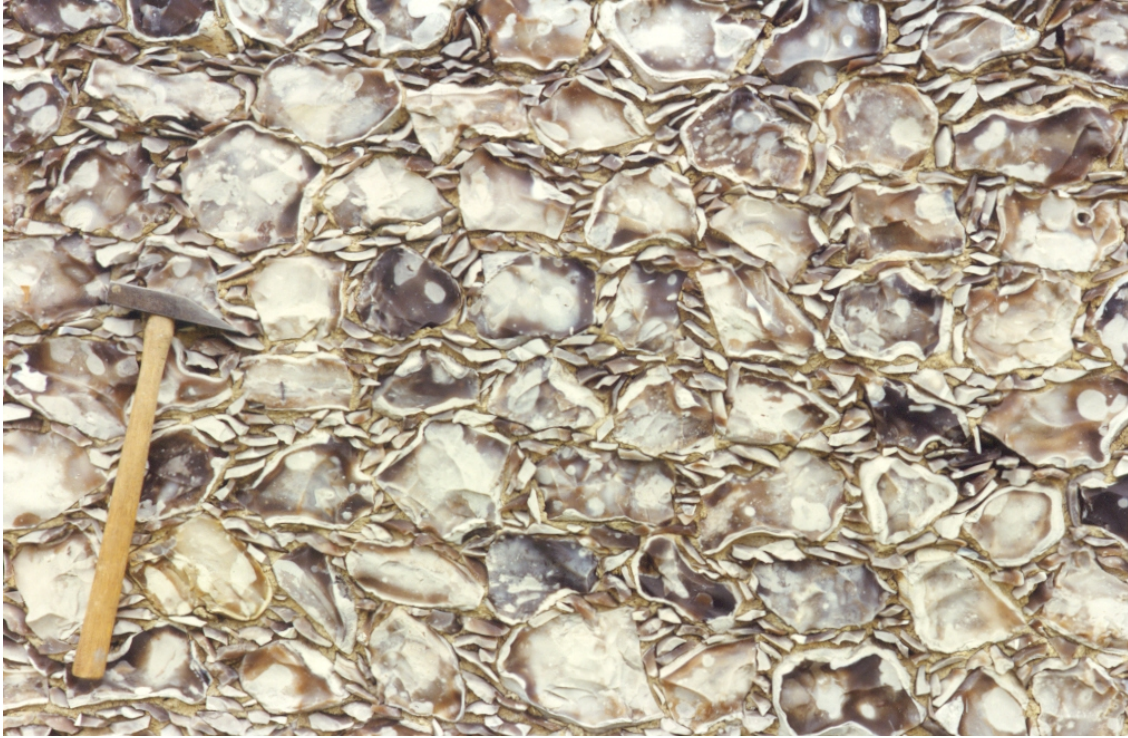


Plate 5. Flint galleting: typical use of local materials. (GS 473, P.M. Hopson)

HYDROCARBONS

Conventional Oil and Gas

The county of Hampshire extends across two major Mesozoic sedimentary and hydrocarbon producing basins in southern England. In the south and south-west of the county, the Wessex Basin is the main feature. This is separated by the Hampshire-Dieppe High from the Weald Basin which underlies the centre and north of the county. Both of these basins have produced hydrocarbons. The significant number of exploration wells (see inset map) and the existence of a dense network of seismic reflection surveys, illustrates that much of Hampshire has been intensively explored for oil and gas since the late 1960s.

Led by Carless Exploration, the early 1980s proved to be the most successful phase of exploration in Hampshire, with a number of discovery wells and the development of three producing oil fields. A number of the oil discoveries are either yet to be developed or are of sub-economic value. The small Herriard and Hester's Copse accumulations are commonly grouped as two satellite structures to the Humbly Grove Oilfield. The total production for each field is shown in Table 1.

Name of field	Field Type (oil or gas)	Operator at time of discovery	Current operator	Discovery date	Production started	Status at 2002	Total production (million tonnes/barrels) – up to end 2000
Humbly Grove, including Hester's Copse and Herriard	Oil	Carless Exploration Ltd.	Star Energy	1980	1985	Still producing	716,000/5,441,600
Horndean	Oil	Carless Exploration Ltd.	Star Energy	1982	1984	Still producing	201,000/1,527,600
Stockbridge	Oil	Amoco (UK) Exploration Co.	Pentex	1984	1984/5	Still producing	742,000/5,639,200

Table 1. Summary of major oil and gas shows in Hampshire

In the Wessex Basin, no oilfields have been discovered to date although it contains Britain's largest onshore oilfield at Wytch Farm in Dorset, only 10-15 km to the south-west of the county boundary. No major hydrocarbon discoveries have been made over the area of the Hampshire-Dieppe High. As a consequence, it appears that there is limited oil and gas prospectivity in the southern half of the county.

In contrast, it is clear from exploration successes to date that the county of Hampshire occupies some of the most productive tracts of the Mesozoic Weald Basin. This basin suffered mild inversion during the Palaeogene compression, with the formation of the Wealden Anticline. Commercial hydrocarbon accumulations have been encountered in the limestones and sandstones of the Jurassic Great Oolite Group within faulted Jurassic fault blocks. The distribution of these discoveries shows they are located on the northern and southern limbs and around the western closure of the anticline, the majority of which lie in Hampshire. Since these initial discoveries there has been little success, and from the 1990s, smaller focussed operators such as Star Energy (UK) Ltd came to dominate hydrocarbon exploration and development across both the Wessex and Weald basins. They developed large acreage positions resulting in substantial tracts in the centre and north of the county being currently licensed for oil and gas exploration (see inset map). Given the present understanding of this hydrocarbon system, it is likely that future oil and gas discoveries will only be small in nature and likely to be satellite structures to the main discoveries in the central and northern parts of the county.

Coal Mine Methane, Mine Gas Drainage and Coalbed Methane (CBM) potential

No potential exists for mine gas drainage, coal mine methane and coalbed methane development in Hampshire, due to the absence of coal-bearing strata.

Licensing

The Department of Trade and Industry grants licences for exclusive rights to explore and exploit oil and gas onshore within Great Britain. The rights granted by landward licences do not include rights of access, and the licensees must obtain any consent under current legislation, including planning permissions. Licensees wishing to enter or drill through coal seams for coalbed methane and abandoned mine methane must seek the permission of the Coal Authority.

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 plan policies in respect of mineral extraction 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 reflect 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.

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 (Figure 2). The polygons were supplied as digital files by Hampshire County Council and also digitised by BGS from Plotting Sheets and other documents supplied by Hampshire County Council. Any queries regarding the sites shown should be directed to the authorities at the addresses 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.

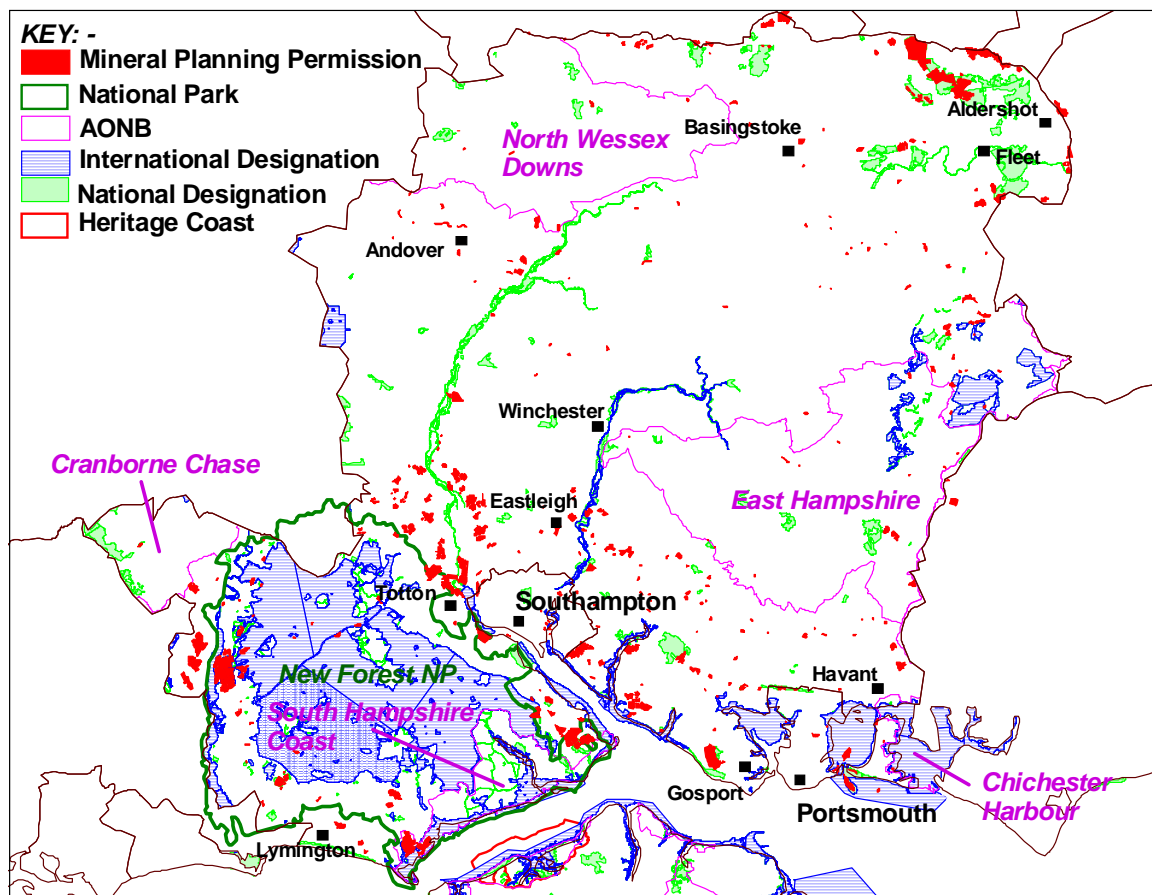


Figure 2. Hampshire surface planning permissions with National Park, AONB and Heritage Coast boundaries and other National (SSSI, NNR) and International (SAC, SPA, Ramsar) designations

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Portsmouth City Council, Planning Department, Civic Offices, Guildhall Square, Portsmouth PO1 2AJ. Tel: 02392 822251, Fax: 02392 834660, web address: www.portsmouthcc.gov.uk

Southampton City Council, Development Control Services, Local Services Division, Civic Centre, Southampton SO14 7LS. Tel: 02380 223855, Fax: 02380 832607, web address: www.southampton.gov.uk

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English Nature - Digital SSSI, NNR, SPA, SAC and Ramsar boundaries © English Nature 2002.

Contact address: English Nature, Northminster House, Northminster, Peterborough, PE1 1UA, Tel: 01733 455000, Fax: 01733 455103, Web page: www.english-nature.org.uk

English Heritage - Positions of Scheduled Monuments at 15 August 2001.

The majority of monuments are plotted using a centred 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. © English Heritage.

Contact address: English Heritage, 23 Savile Row, London, W1S 2ET. Tel: 020 7973 3132, Web page: www.english-heritage.org.uk

Countryside Agency - Digital AONB boundaries © Countryside Commission 1986.

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