British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

OFFICE OF THE
DEPUTY PRIME MINISTER

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

East Sussex (comprising Brighton and Hove and East Sussex)

British Geological Survey Commissioned Report CR/02/126N

F M McEvoy, A J Bloodworth, D G Cameron, S F Hobbs, N A Spencer, D J Evans, G K Lott, E J Steadman, E L Bartlett and D E Highley

Keyworth, Nottingham 2002

TECHNICAL REPORT CR/02/126N
Mineral Resources Series

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BRITISH GEOLOGICAL SURVEY
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This report accompanies the 1:100 000 scale map: East Sussex (comprising Brighton and Hove and East Sussex) mineral Resources

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Tarring Neville Chalk Pit

BRITISH GEOLOGICAL SURVEY

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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 Ministers' research project *Mineral Resource Information in Support of National, Regional and Local Planning.*

The accompanying map relates to the county of East Sussex 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, gypsum, 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.

Mineral resources defined on the map delineate areas within which potentially workable mineral 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 individual 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 local or specific situations.

A SUMMARY OF THE INFORMATION PRESENTED ON THE MAP

Sand and Gravel

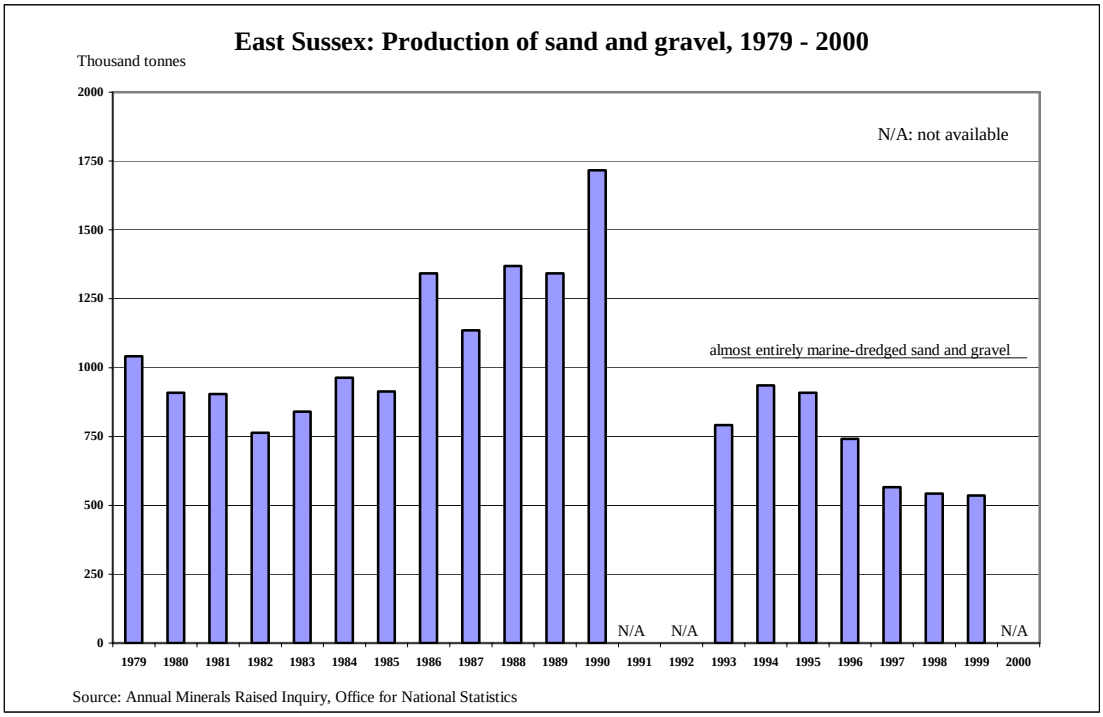
Sand and gravel are defined on the basis of particle size rather than composition. In current usage, the term ‘gravel’ is used for material that is coarser than 5 mm, with a maximum size of 40 mm, and the term sand for the material that is finer, but coarser than 0.075 mm. Most sand and gravel is composed 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. Substantial quantities of sand and gravel may also be used for construction fill. Production of land-won sand and gravel in East Sussex has declined substantially since 1990 and is now negligible. However, substantial quantities of marine-dredged sand and gravel are landed in the county amounting to 0.58 million tonnes in 2000.

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

- superficial or 'drift' deposits, subdivided into river and storm beach sand and gravel;
- bedrock, or ‘solid’ deposits represented by the Folkestone Formation.

Permitted reserves of workable sand and gravel are negligible in the county.



River Sand and gravel

These deposits occur in both raised river terrace sequences and as flood plain terraces associated with, and underlying, present day alluvium and are well-developed along the valleys of the rivers Ouse and Cuckmere. The river terraces vary considerably in lithology, reflecting the nature of the parent solid material. Generally, the river gravels consist of relatively poor quality ferruginous fine to medium gravels derived mostly from Wealden rocks, although the flint content progressively increases south of the Chalk escarpment. Most of these deposits are overlain by alluvium composed of clay and silt. Although these materials were worked in several locations in the past, there is currently no extraction of river sand and gravel in East Sussex.

Storm beach gravel

Storm beach gravel deposits occur at a number of locations along the coast of East Sussex. They consist primarily of flint gravels derived from the Chalk. 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.

Since the construction of a marine wharf in the early 1990s at Rye Harbour, production of storm beach gravel in East Sussex has declined substantially. Storm beach deposits are worked intermittently at Nook Beach near Rye. Further deposits in this area remain unworked. These are close to or within established nature conservation areas, extensive parts of which are designated as SSSIs, Special Protection Areas and candidate Special Areas of Conservation.

Bedrock deposits (sand)

In East Sussex, construction sand has been extracted on a small scale from the Folkestone Formation. These sands form a narrow and constrained east-west outcrop to the north-west of

Lewes, close to the county 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 finer towards the east and also tend to coarsen upwards. The formation is on average 20 m thick, although it becomes thinner to the east.

Chalk

Chalk is a relatively soft, fine-grained, white limestone, consisting mostly of the debris of planktonic algae. In East Sussex, it forms the prominent natural feature of the South Downs. Almost the entire outcrop of the Chalk is within the Sussex Downs AONB and the area around Beachy Head and Cuckmere Haven is within the Sussex Heritage Coast. The Chalk is divided into the Grey (formerly Lower Chalk) and White Chalk (formerly Middle and Upper Chalk) Subgroups and is up to 450 m in thickness in this part of South-East England. The White Chalk Subgroup is the most extensive with the Grey Chalk Subgroup forming a thin band, on average 35-60 m in thickness, along the base of the north-facing scarp. The Grey Chalk Subgroup is characterised by relatively high clay content, particularly toward the base, and is classified as 'low purity' (<93% $CaCO_3$). The overlying White Chalk Subgroup is of a higher purity (93-98% $CaCO_3$). Flints are common in the White Chalk Subgroup, particularly towards the top.

Although long established, limited quarrying of chalk now occurs in East Sussex. Historically chalk was extracted for use as a raw material in the manufacture of cement in the vicinity of the Ouse valley north of Lewes. Currently, chalk extraction is limited to one site in the upper part of the White Chalk Subgroup near Newhaven. At this site, a high quality chalk whiting is produced which is used in the production of specialised plasters.

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

Gypsum

Gypsum ($CaSO_4.2H_2O$) and anhydrite ($CaSO_4$) are forms of calcium sulphate. They are worked from natural evaporite deposits, but may also be derived as by-products of certain industrial processes, notably flue gas desulphurisation (FGD). FGD gypsum is currently produced by the neutralisation of sulphur dioxide contained in flue gases at coal-fired powered stations at two sites in Britain. The largest is the 4000 MW Drax power station in North Yorkshire and the other is the 2000 MW Ratcliffe-on-Soar station in Nottingham. The amount of natural gypsum extracted in Britain has declined in recent years due to the availability of substantial amounts of high quality synthetic gypsum obtained from these power stations. Gypsum has many applications but is used principally in the production of plaster and plasterboard. A mixture of gypsum/anhydrite is also used as a retarder in cement manufacture.

In East Sussex, gypsum is found within a series of small 'inliers' of Jurassic-age rocks in the Robertsbridge area. The gypsum occurs at the base of the Purbeck Limestone Group, directly above the Portland Sandstone. Until 1990, gypsum was worked underground at the mines at Mountfield and Brightling. Mountfield Mine has now closed and production is centred on the mine at Brightling. This mine is the only operating deep mine in South-East England. Natural gypsum and anhydrite occur as beds or nodular masses up to a few meters thick. Gypsum is formed by the hydration of anhydrite at or near surface, but passes into anhydrite generally at depths of more than 100 m.

Four consistent evaporite seams occur in the lower 15 m of the Purbeck Limestone Group, separated by mudstone beds. These seams are numbered 1 to 4 in descending order. Production at the Brightling Mine is from both the No. 3 and No. 4 seams, with the majority extracted from the latter. The seams are on average 4-5 m in thickness and are extracted using the room and pillar mining method. Previously, run-of-mine material from the Brightling Mine was blended with FGD gypsum brought by rail from the Drax Power Station in North Yorkshire for the production of plasterboard at the nearby Robertsbridge Works. Recently, the Works switched to using solely FGD gypsum (from Yorkshire and continental Europe) for plasterboard manufacture. The sole use of the natural gypsum produced at Brightling Mine is as a retarder in Portland cement. The reject run-of-mine gypsum stone is crushed, screened and sold as material for farm tracks or building bases.

Gypsum resources extend beneath overlying Cretaceous cover. Trial boreholes have confirmed the presence of basal Purbeck evaporites at depth around the inliers and elsewhere in the district. In general, at depths greater then 150 m below the surface, anhydrite rather than gypsum is present. Approximately 20 year proven reserves of gypsum have been reported in the Brightling/Mountfield area with the possibility of reserves from the Mountfield Mine being exploited from the Brightling Mine.

Building Stone

Historically, East Sussex has produced and used a wide range of indigenous stones for building purposes. None of these sources are currently exploited for building stone in the county.

Building Sandstone

Harder sandstone beds in the Lower Cretaceous Hastings Group bordering Kent and the Ashdown and Tunbridge Wells Sand (Ardingley Sandstone) formations located throughout East Sussex, were important sources of vernacular building material. Within the Ashdown Formation, the terms ‘Cuckfield’ and ‘Tilgate’ stone were often applied to harder calcareous sandstone beds. The Lower Cretaceous Hythe Formation, which elsewhere includes the Kentish Ragstone, is poorly developed in East Sussex. At Eastbourne the green, glauconitic sandstones of the Upper Greensand Formation were quarried for local building stone.

Building Limestone

Although limestone is not currently quarried, limestones from the Upper Jurassic Purbeck Limestone Group were once quarried and used locally for building purposes close to their outcrops. Thin fossiliferous limestone beds within the Lower Cretaceous Weald Clay Formation, known variously as small and large Paludina limestones or Bethersden, Petworth, Laughton and Sussex marbles, were once the basis of an important decorative/paving stone industry. Locally, blocks of Cretaceous Chalk are used in some buildings but the unit was never extensively quarried for building purposes.

East Chiltington Church. The church walls are built mainly of undressed blocks of large 'Paludina' limestone from the Weald Clay. The perimeter walls are built mainly of flint.

Flint

Flints, both beach cobbles and knapped varieties, from the Chalk have been extensively used locally for building purposes particularly in the south of the county.**Hydrocarbons**

Conventional Oil and Gas

One of the first recorded hydrocarbon discoveries in England occurred in 1836 on the East Sussex/Kent border when gas was observed bubbling through water during the digging of a water well at Hawkhurst. In 1896, a well drilled close to the railway station at Heathfield encountering gas in large volumes. This was used to provide both the lighting at the station and pump water for the locomotives. Total production to 1963 was estimated at 20 million ft^3. Although interest in the Heathfield gas continued into the 1950s, costs were deemed too high to justify further development. However, the discoveries at Heathfield provided the impetus for subsequent hydrocarbon exploration in southern Britain.

Exploration wells and a network of seismic reflection surveys illustrates that the county has seen sporadic and sometimes intensive exploration for hydrocarbons. Despite minor surface seepages around the county, including important oil shows in the south near Pevensey [NGR 5637 1060] and at the Horns [NGR 5619 1063], exploration results have to date proved disappointing. Further discoveries to early 2002 have not been forthcoming, and whilst producing fields exist in West Sussex, there are no producing oil or gas fields in East Sussex.

The oil and gas shows in boreholes drilled in East Sussex are summarised in table. Both clastic and carbonate rocks provide potential reservoirs. The main targets are within the Middle Jurassic Great Oolite Group, most notably the Great Oolite Limestone. The most notable results have been the oil and gas shows in one of several exploration boreholes drilled at Ashdown. The best potential for the discovery of commercial hydrocarbon accumulations lies in northern parts of the county, along a prospective east-west trend on the northern margin of the Mesozoic Weald Basin. This area is the focus of current exploration, as indicated by the licensed areas and acreage awards. In contrast, there appears to be very limited oil and gas prospectivity in the southern part of the county.

Name of borehole	Drilling date	Type of borehole	Type of show (oil or gas)	Current licence area and operator	Total production (mmcf/tonnes)
Netherfield	1875	Water	Gas	Open acreage	
Heathfield	1895	Water	Gas	PEDL27; Independent	20
Ashdown	1955	Hydrocarbon exploration	Oil & minor gas	PEDL96-1; Midmar	Production tests, but not developed

Table 1. Summary of major oil and gas shows in East Sussex.

Coal Mine Methane, Abandoned Mine Methane and Coalbed Methane (CBM) potential

There is no potential for these forms of methane as coal-bearing strata are absent.

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 any rights of access, and the licensees must also obtain any consent under current legislation, including planning permissions.

Brick Clay (including Brickearth)

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.

There are several brick and tile manufacturing sites in East Sussex, which use a variety of clay raw materials. The main brick clays in the county are the Cretaceous Weald and Wadhurst clays. The Weald Clay crops out in the south west of the county and consists of a sequence of mudstones and silty mudstones up to 450 m in thickness. They are often interbedded with thin beds of sandstone and limestone, which brick makers tend to avoid. The clays consist predominantly of kaolinite and illite, a combination which is ideal for the manufacture of facing bricks. The Weald and Wadhurst clays are also important brick clay resources in the adjacent counties of West Sussex and Surrey where these clays form the basis for a number of large-scale brick making sites which are of regional importance. Weald Clay is extracted at Chailey near Lewes for the manufacture of facing bricks.

The Wadhurst Clay, crops out extensively in the north east part of the county and is up to 70 m thick. It is worked for brick clay at two localities. At Aldershaw Farm in Battle, the Ashdown Formation is worked for the manufacture of roofing tiles. At Ashdown near Bexhill, the Wadhurst Clay is used in conjunction with the Tunbridge Wells Sand Formation for the manufacture of facing bricks. The Wadhurst Clay is extracted on site while the Tunbridge Wells Sand Formation is extracted at Little Standard Hill Farm, Ninfield.

Guestling Brickworks Ltd., Three Oaks, near Hastings. Looking W. 1967
Description: View of working face of brick-pit. The brickearth is a deposit of brown silty loamy Head on the valley side. It is excavated from the face by a mechanical digger and then stacked for air-weathering for approximately 12 months before being used to mould bricks.

Quaternary 'brickearth' is worked on a small scale in the Hastings area (see photo above) for the production of handmade bricks. 'Brickearths' are generally thin (less than 2 m), silty loams that are usually found in association with river gravels. They are of little value to the modern brickmaking industry and are not shown as a resource on this map.

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

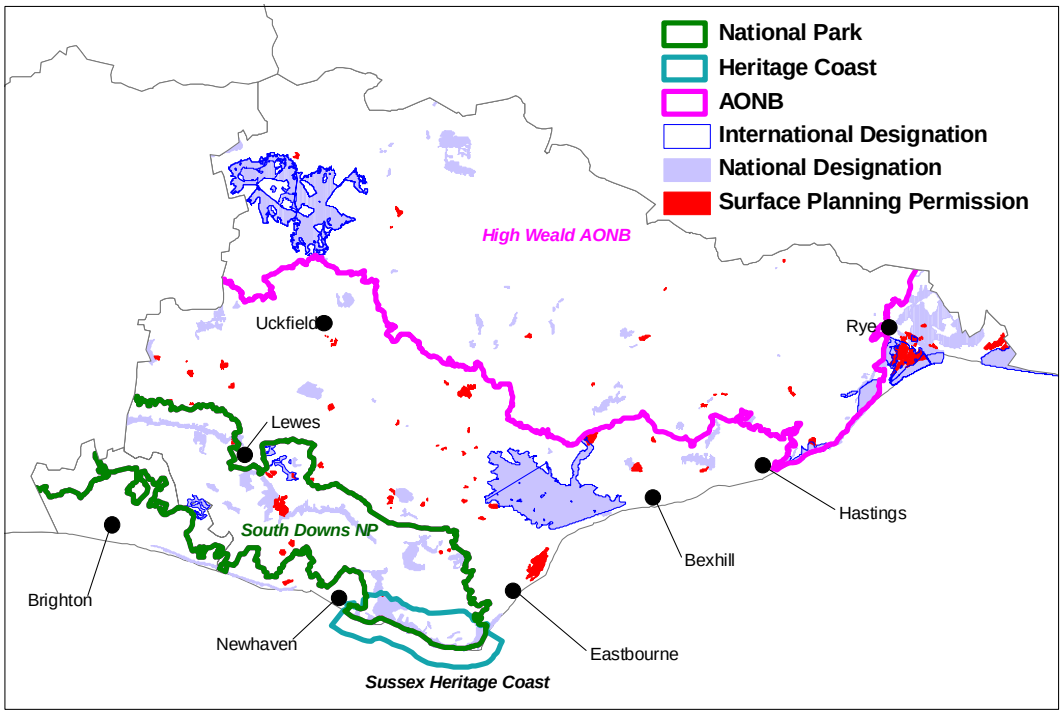
workable minerals may occur. These areas are not of uniform potential and also take no account of planning constraints that may limit their working. The economic potential of specific sites can only be proved by a detailed evaluation programme. Such an investigation is an essential precursor to submitting 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 the extraction of minerals

The extent of all known extant, and non-extant planning permissions for the extraction of minerals 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 East Sussex County Council and Brighton and Hove Borough Council and any queries regarding the sites shown should be directed to these 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.



East Sussex surface planning permissions with National Park, AONB and Heritage Coast Boundaries and other National (SSSI, NNR) and International (SAC, SPA, Ramsar) designations

Contact addresses:

East Sussex County Council, Transport and Environment Department, County Hall, St Annes Crescent, Lewes, BN7 1UE, Tel: 01273 481000, Fax: 01273 479040.

Brighton and Hove Borough Council, Environment Services Department, Bartholomew House, Bartholomew Square, Brighton, BN1 1JP, Tel: 01273 290000, Fax: 01273 292351.

Topographic base

Constraint information published on the accompanying map has been provided from the various agencies listed below, any enquires on this information should be addressed to the relevant agency:

English Nature - Digital SSSI and NNR boundaries © English Nature 2000.

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 15th 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. © Copyright English Heritage.

Contact address: English Heritage, 23 Savile Row, London, WS1 2ET, Tel: 0207 973 3132, Web page: www.english-heritage.org.uk

Countryside Agency - Digital ANOB boundaries © Countryside Commission 1986.

*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