

ASSESSMENT OF MINERAL AND EXTRACTIVE MATERIALS RESOURCES

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Forests Taskforce Department of Prime Minister and Cabinet, January 1999

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This project has been jointly funded by the Queensland and Commonwealth Governments. The work undertaken within this project has been managed by the joint Queensland / Commonwealth CRA RFA Steering Committee and overseen by the Social and Economic Technical Committee.

Optional further details about contributors and credits goes here.

ISBN 0 642 27378 2

Cover photo/s: n/a

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ACKNOWLEDGEMENTS

Assessments of mineral resources and the potential (undiscovered) mineral resources of Southeast Queensland were prepared by Berkman, D.A (1996) for minerals, and by Siemon, J.E. and Holmes, K.H. (1996) for extractive materials resources. These assessment reports were prepared for the Queensland Department of Mines and Energy. The two reports were consolidated in a single technical report by the Bureau of Resource Sciences and QDME. Mineral resource and mineral potential layers were then constructed in a Geographic Information System (GIS) environment using the maps and data provided in reports by Berkman and by Siemon and Holmes for use in the Regional Forest Agreement process.

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SUMMARY

This report has been prepared for the joint Commonwealth/State Steering Committee which oversees the Comprehensive Regional Assessment (CRA) of forests in the Southeast Queensland CRA region.

This agreement will determine the future of the region's forests and will define those areas needed to form a comprehensive, adequate and representative (CAR) reserve system and those available for ecologically sustainable commercial use.

This report was undertaken to assess known and potential (undiscovered) mineral and extractive resources of the region.

In the forested parts of the Southeast Queensland Region there are significant mining operations for heavy minerals and coal, as well as smaller mines for gold and industrial minerals. The region is of moderate to high potential for a number of mineral deposit types and is likely to contain undiscovered deposits (Berkman 1996; Siemon and Holmes 1996). For about two thirds of the region the mineral potential is either low, or is unknown due to insufficient data. Parts of the region are currently being geologically remapped which should reduce the areas of unknown mineral potential.

Forested areas were delineated from 1: 250 000 scale maps prepared by the Forest Assessment Section of the Resource Management Institute, that showed areas of forest interpreted from Landsat TM satellite imagery flown on 15 October 1991.

In 1996 there were 147 mining leases of total area 230 square kilometres within the 35 000 square kilometres of forested land within the region, which represent 0.65% of the forest areas. The committed exploration expenditure in the Southeast Queensland region was \$4.1 million in 1995-96 whereas the total mineral expenditure in Queensland in 1996 was \$180 million.

The forested parts of the region contain active mining operations at 19 centres, that produced coal, rutile-zircon-ilmenite, gold, sand, magnetite and other industrial minerals to a total value of \$199.2 million in 1996-97 (\$190.6 million in 1994-95 year) and total royalties for that year were \$6.02 million. Most of this value is accounted for by the two largest mines which are the rutile-zircon-ilmenite mining operations on North Stradbroke Island, and the coal mine at Tarong supplying the Tarong powerhouse. They are followed by the silica sand mining on North Stradbroke Island. The Burgowan coal mine closed in early 1997.

Berkman (1996) estimated that in 1994-95 there were 644 persons directly employed in mining and exploration activities in forested areas of the region. These figures do not take into account the multiplier effect of employment in primary production.

The cleared parts of the region contain the coal mines of the West Moreton (Ipswich to Amberley) district, a gold mine at Gympie, the Kingaroy kaolin workings and the Flinders dolomite operation. Total 1994-95 coal production from the West Moreton district was 4.3 Mt of saleable coal, worth \$187 million. Gold production at Gympie was about 10 000 oz for 1994-95, valued at \$5 million. The total value of production from mines in cleared areas was about \$192.5 million.

The value of mine production from the forested and unforested areas is about the same. However, the production from the forested areas was obtained from 19 centres, compared with four centres in the cleared land.

Extractive materials are vital for development of urban areas and infrastructure and are required within economical transport distance of major markets, in this case Brisbane, the Gold and Sunshine Coasts and major regional centres. Because of their relative low value compared to other commodities, extractives are not generally traded between regions and the opportunity costs of precluding access will depend on the location of other extractive resources in the region.

Supply of extractive materials is important for the more settled parts of the region. Most sources and known potential deposits are in cleared areas, but some important ones are in forested land. Some relevant statistics for production of extractive resources in the region include:

Quarry Rock from all major Quarries in region	Production 1994/95	>16.7million tonnes
Clay from Mining Leases in region	Production 1994/95	>1.45million tonnes

The region has Queensland's largest quarry, Hymix at Nerang, with more than one million tonnes produced in 1994/95. This quarry is partly in State Forest and total production of quarry rock from State Forest in the region in 1994/95 was in excess of 2.6 million tonnes as compared with a total quarry rock production of in Queensland in 1994-95 of about 22 million tonnes.

Known deposits which may be mined in forested parts of the region in future include the Agnes Waters-Middle Island-Hummock Hill Island heavy mineral deposits, where reserves exceed 2.4 Mt of ilmenite, rutile and zircon. The Mount Rawdon gold deposit, about 15 kilometres southeast of Mount Perry, has a resource of 22 Mt of ore of average grade 1.2 g/t gold and 4 g/t silver. Development of the Spring Mountain coal resource, southeast of Ipswich, could proceed by underground mining (at a rate up to 2 Mt/year) within 10 years. Other known deposits in forested parts of the region include the Ban Ban zinc deposit, about 30 km southerly from Biggenden and the Norton gold deposit.

The Stuart oil shale is a world class deposit located in unforested part of the region close to infrastructure at Gladstone. Other oil shale deposits are at Nagoorin south of Gladstone and Lowmead north of Bundaberg.

Berkman (1996) and Siemon and Holmes (1996) reported potential for 27 types of deposits. Mineral deposit types include 6 types of metalliferous deposits, 2 types of heavy mineral sand deposits, 4 types of coal deposits, oil shale deposits, 10 types of industrial mineral deposits, and 4 types of deposits for extractive materials.

1. INTRODUCTION

The National Forest Policy Statement recognises the need to consider access for mineral exploration, mining and extractive activities in deciding on land use for public native forests. Due to the incomplete nature of information on minerals resources and because exploration is a dynamic information-gathering process, continued access to land is a significant issue for the mining industry and for future mineral development.

Access for exploration, mining and extraction varies with land tenure. Access arrangements of such tenures have a large bearing on the level, and type, of exploration and mining that occurs in a region. Transparent and well-defined access arrangements reduce uncertainty and facilitate exploration and mining activities. Access provisions of relevant legislation are outlined below.

Before changes to land tenures or access arrangements are made, it is important to understand the current mining and extraction industry and assess the potential for new discoveries and production.

Assessments of the mineral and extractive resources of the Southeast Queensland Biogeographic Region ('Southeast Queensland region' or the 'region') were commissioned in 1996 by the Queensland Department of Mines and Energy and the results were reported in "The Mining Industry and Mineral Potential of the Forested Areas within the Southeast Queensland Biogeographic Region" by D A Berkman, and the associated "Assessment of Extractive Materials Potential for the Southeast Queensland Biogeographic Region" authored by J E Siemon and K H Holmes. In these assessments the term extractive materials refers primarily to quarry rock, sand and gravel not administered under the mining legislation, but also includes brick clay and building stone which are administered in that way. An assessment of petroleum resources was not originally undertaken due to low potential in forested parts of the region and the ability of petroleum explorers to access most land tenures.

The aim of this report is to draw together this information in a format and terminology consistent with previous studies of Regional Forest Agreement (RFA) to provide input of mineral resources data in the development of the RFA. In particular this assessment addresses the following questions:

- Production from current mining operations in forested areas
- Queensland State income from mining and exploration activities in forested areas
- Number of people employed in mining and exploration
- Level of annual exploration expenditure, and trends in mining and exploration activity
- Comparison of mining and exploration activities in forested and unforested areas

A broadscale qualitative assessment was also made of the potential (undiscovered) mineral and extractive resources in the region

The 'forested areas' of the region were identified from 1:250 000 scale maps prepared by the Forest Assessment Section of the Resources Management Institute, that showed areas of forest interpreted from Landsat TM satellite imagery, using bands 2, 3, 4 and 5, on scenes flown on 15 October, 1991. Boundaries were drawn to separate areas predominantly under forest from those predominantly cleared. Thus the 'forested areas' include some interspersed cleared land and vice versa, but a finer discrimination is not required for this study. Vegetation in forested areas may be

closed forest, eucalypt forest, woodland or heath, in various stages of disturbance, but the forest structure is still essentially present. Plantations of introduced species were excluded from the forested areas.

Since the assessments by Berkman (1996) and Siemon and Holmes (1996) the boundary of the Southeast Queensland Region was changed. This necessitated the deletion of 20 mineral potential tracts from the study by Berkman, minor alterations to several and the incorporation of one new tract to cover the Stuart Oil Shale deposit.

This report outlines: current operating mines, identified mineral deposits, the potential for several deposit types, indicators of the region's potential mineral value, factors affecting this value, as well as the potential for extractive materials deposits. The report considers identified mineral deposits in cleared parts of the region where such deposits signify the potential for the discovery of similar deposits in the forested parts.

The Southeast Queensland Region is moderately to highly prospective for a number of mineral deposit types and is therefore likely to contain undiscovered deposits. In forested parts of the region there are significant heavy mineral and coal mines, as well as smaller mines for gold and industrial minerals. There are several known but undeveloped deposits. Many old deposits and mineral occurrences have attracted on-going exploration interest. There are further major coal, gold and industrial mineral operations and undeveloped deposits in cleared parts of the region.

Supply of extractive materials is important for the more settled parts of the region. Most sources and known potential deposits are in cleared areas, but some important ones are in forested land.

It is important to note that no assessment of potential (undiscovered) mineral resources can ever be considered 'final'. New information, new concepts and better understanding of geological processes continually change the perceived prospectivity of a region and the availability, usefulness and implications of these can change over time. There are also dynamic aspects to market information that will affect perceptions of a region's prospectivity, for example mineral prices and extraction costs may change substantially over time.

2. LEGISLATION AND REGULATION RELEVANT TO EXPLORATION, MINING AND EXTRACTIVE MATERIALS

In Australia ownership of mineral resources and control of mineral exploration and development largely lies in the hands of the state and territory governments. The Commonwealth government has control over mining and exploration activities outside three nautical miles offshore and over radioactive substances in the Northern Territory. It also exercises its constitutional powers to exert control over the way states and territories access and use their mineral resources.

The principal legislation covering mineral exploration and mining in Queensland is the Mineral Resources Act 1989, which is the responsibility of the Minister for Mines and Energy and administered by the Department of Mines and Energy. Safety aspects are administered under the Mines Regulation Act 1968. Petroleum exploration and production, including pipelines, are administered by the same authorities under the Petroleum Act 1923, but there are few petroleum-related activities in the region.

All exploration and mining activities are subject to a range of environmental conditions. For exploration permits there are requirements to:

- conform to a code of conduct;
- lodge an Environmental Management Plan for any major disturbing activities and for activities in sensitive areas when required by the Minister; and
- submit a Final Rehabilitation Report on surrender.

For mining there are requirements to:

- lodge a satisfactory Environmental Management Overview Strategy (EMOS), as part of any application for a mining lease (for major projects an Environmental Impact Statement may be required);
- reach a Compensation Agreement with land holders (including those for leasehold land) before grant;
- lodge a security deposit against satisfactory environmental performance before grant;
- lodge a satisfactory Plan of Operations before commencing mining;
- submit to audits and inspections by Departmental officers and to take any remedial action when directed.

Environmental Protection Policies under the Environmental Protection Act 1994 are currently being negotiated for mining and petroleum.

Exploration and mining are not permitted in National Parks and Conservation Parks, which are gazetted under the Nature Conservation Act 1992. Exploration and production of petroleum are permitted under conditions decided by the Department of Environment. Such activities are possible in multiple-use Resources Reserves declared under the Nature Conservation Act 1992, with the consent of any Trustees gazetted. In mineralised areas the Trustees are usually the Department of Environment and the Department of Mines and Energy and consent is given in accordance with a management plan. In State Forests, Timber Reserves and other Crown Reserves, exploration and mining is possible with the consent of the owners or trustees, usually the Minister for Natural Resources. In practice conditions are usually imposed on such consent to protect the values of the Reserves.

The administration of quarry rock, sand and gravel on private land is controlled by Local Governments through provisions of their town planning schemes, although the degree of control varies. Some Cities and Shires have Extractive Industry zoning while in others extraction is a consent use in rural zonings. Sand and gravel extraction from in-stream sites in non-tidal and tidal areas is controlled by the Departments of Natural Resources, and Environment respectively. Processing of materials can not be undertaken in-stream. If processing is undertaken on shore, operators are required to have an approval under the Local Government town planning scheme and pay levies when using local roads. If no processing is undertaken then no Local Government approval or road maintenance levies are required. Hard rock resources within State Forests and Crown Land are now controlled by the Department of Primary Industries subject to approval from the Department of Natural Resources. Operations must also conform to the requirements of the relevant town plan.

The extraction of clay, building stone, silica sand and foundry sand requires a Mining Lease administered by the Department of Mines and Energy.

Mining and exploration are currently excluded from significant mineralised parts of southeast Queensland because of Government decisions to create National Parks on Fraser Island, the

Cooloola sand mass and Moreton Island, and encroaching urban settlement around the Ipswich and West Moreton coalfields. The extractive industries face on-going difficulties in securing access to new deposits at economical distances from urban markets because of rapid urban and rural residential expansion in the coastal parts of the region.

3. GEOLOGICAL SETTING AND MINERAL DEPOSIT STYLES

The region contains five major geological domains (geotectonic provinces, (Maps 1, 2)), briefly described below in order of decreasing age. A more comprehensive description of the geology of the region is provided in Murray (1990, pp. 1431-1450), and in reports of the Queensland Geological Survey.

The **New England Fold Belt** is the basement throughout the region, and its rocks outcrop throughout its length. It was an active continental margin from Late Silurian to Middle Triassic time (about 415 to 230 million years ago), much like the western coast of South America today. Chains of active volcanoes parallel to the old coastline fed volcanic sourced sediment to the east into continental shelf and oceanic trench basins. These sediments were deformed and uplifted by earth movements associated with collisions of major crustal plates. Subsequent sedimentary basins formed by extensional faulting, and were in turn uplifted by earth movements. Towards the end of this period the fold belt was intruded by Permo-Triassic granitoids, from granite to diorite in composition.

The Gympie Province, along the present eastern edge of the Fold Belt, is a unique unit, containing Permian and Early Triassic volcanics and metasediments accreted to the Belt along a major thrust fault. It comprises a younger part of the New England Fold Belt. The Yarrol Province comprises the northwest part of the New England Fold Belt. The Gympie and Yarrol Provinces are not differentiated on the accompanying geological map.

Most of the mineral deposits in the Fold Belt are genetically related to the intrusion of the Permo-Triassic granitoids, and are of porphyry, skarn or structure-controlled vein type. The porphyry (copper or molybdenum) deposits were formed during the final stages of emplacement of the granitoids, and are associated with small plutons (of diameter around 5 kilometres) and areas of hydrothermal alteration. The largest examples are the Coalstoun and Mount Cannindah copper and the Anduramba molybdenum deposits. The skarn deposits are hosted by limy sediment near the margins of the intrusives, with the larger examples the Many Peaks and Glassford Creek copper-gold, the Mount Biggenden magnetite and Ban Ban zinc-lead deposits. The structure-controlled vein deposits were formed in fault planes or shear zones in the granitoids, along the granitoid-sediment contact, or in the sediment near that contact. The more important of these are clusters of deposits at the Gympie gold, Mount Perry copper-gold and Calgoa copper fields. Some vein-type deposits are distant from granitoid bodies, and may have been formed by metamorphic fluids. Limestone deposits occur in the rocks of shelf origin. Metasediments and metavolcanics of the Fold Belt are significant sources of quarry rock for the Brisbane and Gold Coast districts.

The **Triassic Volcanic Province** comprises several large areas of terrestrial acid-intermediate volcanics and minor sediment, along the northeastern edge and in troughs within the Fold Belt. These are younger than the main pulse of granitoid intrusion in the Fold Belt, and immediately precede or are contemporaneous with the coal measure sediment of the Callide, Tarong and Ipswich Basins, on the western edges of the Fold Belt.

Potentially commercial deposits of this age include the volcanogenic (epithermal) Mount Rawdon, Manumbar and North Arm gold. The volcanogenic gold areas are considered most likely to be the resource base for the largest future mines in the region. Triassic volcanics, hornfels associated with granites and the granites themselves are important sources of quarry rock in some districts, particularly the Sunshine Coast.

The succeeding **Triassic coal basins** are important for the coal mined at Ipswich and Tarong and shale mined for clay in Ipswich and Brisbane.

The **Clarence Moreton Basin**, near the southwestern edge of the region, contains continental sediment and coal, including the Jurassic Walloon Coal Measures. These contain large resources of steaming coal which are used in power stations within the region and for export, and also contain resources of bentonite. Sandstone is mined for building blocks, facings and tiles at Helidon.

The **Maryborough and Nambour Basins**, on the eastern edge of the region, contain Jurassic continental sedimentary successions, Early Cretaceous silicic to intermediate volcanics, plus marine and coal measure rocks, and isolated granitoid plutons.

There are no important metalliferous deposits in these basins. The Maryborough Basin contains the Cretaceous Burrum Coal Measures, which are considered to have some potential for further coal deposits in the Burrum Syncline. The Tiaro Coal Measures outcrop along the western edge of the Basin, but are considered to hold low potential for economic coal deposits. Important shale deposits mined for clay occur on the Sunshine Coast and near Maryborough and Bundaberg.

Tertiary and Quaternary sediment and volcanics cover much of the surface of the region. They include the Narrows Graben, Nagoorin and Lowmead Basins, in the north of the region, which are isolated basins of Tertiary sediment containing large resources of oil shale. Some dolomite resources are present in Tertiary sediments south of Ipswich, and small deposits of perlite and diatomite occur in Tertiary volcanic sequences at Numinbah (west of the Gold Coast) and Black Duck Creek (Gatton area). Kaolin clays occur in Tertiary sediments and volcanics near Kingaroy, and brick clays are mined in Brisbane, Ipswich and the Sunshine Coast. Tertiary basalts and intrusive trachyte plugs are important sources of quarry rock.

The Quaternary coastal sand plains and dunes contain major deposits of heavy minerals (ilmenite, rutile and zircon), silica sand and foundry sand. Older source areas of ilmenite in the Monto district, have weathered and eroded to produce eluvial and alluvial deposits of ilmenite in soil and river sediment. Bauxite and manganese deposits, formed by weathering of older rocks, are below commercial size and grade. Major streams draining the older rocks of the fold belt are sources of coarse sand and gravel, while other streams draining the sedimentary basins and Tertiary sediments are sources of finer sands.

4. CURRENT MINING AND EXTRACTIVE ACTIVITIES

4.1 Minerals

In 1996 there were 147 mining leases of total area 230 square kilometres within the 35 000 square kilometres of forested land in the region, which represent 0.65% of the forest areas. The lease number, area, owner's name, principal commodity, and number of employees are listed in Appendix 1 of Berkman (1996). Individual production in the 1994-95 year, value of this

production, and royalty and rents paid to the State have been recorded but remain confidential for commercial reasons. The producing mines, major prospects and mineral occurrences are shown on Map 2. Significant quarries for extractive materials are shown on Map 5 and listed in Appendix A. In 1994-95 the forested parts of the region contained active mining operations at 19 centres, that produced coal, rutile-zircon-ilmenite, gold, sand, magnetite and other industrial minerals to a total value of \$190.6 million. In 1996-97 the total production value amounted to \$199.2 million (Table 1). Royalty payments in 96/97 on mine production in forested areas amounted to \$6.022 million. The Burgowan coal mine closed in early 1997. The sites of the current mining operations are shown on Map 2. The two largest mines, namely the rutile-zircon-ilmenite mining operations on North Stradbroke Island, and the coal mine at Tarong supplying the Tarong powerhouse, account for most of the mine production value. They are followed by the silica sand mining on North Stradbroke Island.

The royalty returns show that in 1994-95 there were 603 persons employed on mining leases in forested areas, of which 586 were employed at the 19 operating mines. Employment on exploration activities (see below) is estimated at 41 persons. Thus the total direct employment in mining and exploration activities in forested areas is 644 persons. In 1996-97 at least 541 persons were employed at 19 operating mines but employment figures were not available for four of these mines. These figures do not take into account the multiplier effect of employment in primary production, by which the employment of each person in mining generates several other positions in other industries.

The cleared parts of the region contain the coal mines of the West Moreton (Ipswich to Amberley) district, the recently opened gold mine at Gympie, the Kingaroy kaolin workings and the Flinders dolomite operation. Production of coal for the 1994-95 year was dominated by the Ebenezer, Jeebropilly, and Wattle Glen Extended mines, with a combined output of about 3.8 Mt of saleable coal. The other six mines in this district produced a total of about 500 000 t of coal. Total 1994-95 production from the West Moreton district was 4.3 Mt of saleable coal, worth \$187 million. Gold production at Gympie was about 10 000 oz for 1994-95, valued at \$5 million. The total value of production from mines in cleared areas was about \$192.5 million.

The value of mine production from the forested and unforested areas is about the same. However, the production from the forested areas was obtained from 19 centres, compared with four centres in the cleared land.

4.2 Extractive materials

Extractive materials are vital for development of urban areas and infrastructure and are required within economical transport distance of major markets, in this case Brisbane, the Gold and Sunshine Coasts and major regional centres. Because of their relative low value compared to other commodities, extractives are not generally traded between regions and the opportunity costs of precluding access will depend on the location of other extractive resources in the region.

Description of the major quarries, sand, gravel and clay pits is beyond the scope of this report, but details can be found in Siemon and Holmes (1996). Most operations are in cleared land but some major rock quarries are in State Forest on the Sunshine and Gold coasts and clay workings are in State Forest near Maryborough and Bundaberg.

The importance of the extractive materials industry in the region can be gauged from the following statistics.

Largest Quarry in Queensland (Hymix at Nerang);	Production 1994/95	>1 million tonnes partly in State Forest)
Quarry Rock from State Forests in region	Production 1994/95	>2.6 million tonnes
	Value	>\$1.2 million
Quarry Rock from all major Quarries in region	Production 1994/95	>16.7million tonnes
Clay from Mining Leases in region	Production 1994/95	>1.45million tonnes
Total quarry rock production in Queensland	1994/95	≈ 22 million tonnes

O'Flynn (1992) indicated that the per capita consumption of quarry rock, sand and gravel for the Moreton Region was between 8 and 10.3 tpa per person. Information from local Governments in the rapidly expanding parts of the Sunshine Coast and Gold Coast indicated that the figure may be as high as 14 tpa per person, while in the less developed areas in the west of the region the figure is obviously quite low.

Mining leases held for clay within the region cover 5906 ha on which rentals paid to the Department of Mines and Energy total \$124 039. Production from the leases totalled 1.45 million tonnes in 1994/95 with royalties of approximately \$363 000. Because many of the current building stone operations (sandstone at Helidon) were current at the time of the introduction of the current Mineral Resources Act, few operations are required to pay a royalty to the Department of Mines and Energy and total production is not known.

5. POSSIBLE NEW MINES

5.1 Forested areas

The **Agnes Waters-Middle Island-Hummock Hill Island heavy mineral deposits** are in forested coastal land in Miriam Vale Shire, north and south of the Town of 1770. Mining Leases and Exploration Permits here contain reserves exceeding 2.4 Mt of ilmenite, rutile and zircon. This is the largest known unworked resource of heavy minerals on the Queensland coast outside of North Stradbroke Island which has not been alienated by other land uses. As with each of the potential mine developments mentioned below, development here is dependent on world prices (current prices and expectations of future prices), and on the capital and operating costs of mining and processing.

The **Mount Rawdon gold deposit**, about 15 kilometres southeast of Mount Perry, has a resource of 22 Mt of ore of average grade 1.2 g/t gold and 4 g/t silver. The deposit is in Perry Shire, and about 2 kilometres east of the eastern edge of Timber Reserve 296. A mine feasibility study undertaken recently assumed that ore would be produced at around 2 Mt/yr, thus allowing a mine life of about 11 years. The ore would be processed by heap leaching, to yield about 70 000 oz of gold per year. The project was expected to require a work force of about 100, and it was anticipated that many employees will be drawn from the region, and will live at Mount Perry or other townships nearby. Gross mine income was predicted to be about \$40 million per year. The project would have a major financial impact on Perry Shire, which had an estimated resident population of 404 in mid-1994 (Regional Statistics Queensland, 1995). In 1997 the majority company in the project decided not to proceed, but its interests have been purchased by another company and investigations are continuing.

Development of the **Spring Mountain coal resource**, southeast of Ipswich, could proceed by underground mining (at a rate up to 2 Mt/year) within 10 years. Although the development is in a forested area, underground mining is expected to have little effect on surface conditions.

The **Ban Ban zinc deposit** is about 40 kilometres southeasterly from Gayndah and 30 km southerly from Biggenden. The deposit is in Biggenden Shire, and about 2 km north of the northern tip of State Forest 259. It has a resource of 1.5 Mt at 7.5% zinc and 9 g/t silver; development is dependent on an increase in the price of zinc.

The **Goondicum ilmenite project** is about 30 kilometres east of Monto, and has a total resource, in eluvial and alluvial deposits, of 112 Mt of average grade 4.3% ilmenite. Some of the alluvial resource is in sediment of the Burnett River, outside the western boundary of the region. The portion of the resource within the region is in Monto Shire, and just north of State Forest 54. Monto Minerals NL was formed in January 1994 to develop these deposits, and plans (subject to the results of a detailed feasibility study) to produce 85 000 t of ilmenite in the first year of operations, increasing to more than 450 000 t in subsequent years. Marketing experts advised Monto Minerals that this quantity of ilmenite is saleable, at prices of \$103-122/t. Using \$100/t of ilmenite sold for simplicity of calculation, gross income is estimated to be \$8.5 million in the first year and \$45 million in full production. The development would have a small but significant impact on Monto Shire, which had an estimated population of 3005 in mid-1994 (Regional Statistics Queensland, 1995).

The **Norton gold deposit** is in Calliope Shire, about 40 kilometres southerly from Calliope, in a 'corridor' of timbered land between State Forests 645 and 719. Drilling in Mineral Development Licence 130, in part of the Norton Gold Field, has defined a resource of 120 000 t of average grade 6 g/t gold. Subject to the grant of mining title, and determination of mine feasibility, it is planned to mine this resource in an open pit and truck the ore to a treatment plant at Eidsvold (Australian Gold Annual, 1996, p. 78). The mining and transport operation commenced in early 1997 using local contractors. Initial reserves are adequate for only a short term (1-2 years), but there are hopes for extensions.

5.2 Cleared areas

The **Stuart oil shale** is a world class deposit situated close to infrastructure at Gladstone. The resource contains 3 billion barrels of oil in situ at an average grade of 93 litres per tonne (at zero moisture). Construction of the \$250 million Stage 1 of Stuart, a demonstration plant involving production of up to 4,500 barrels of oil per day, is under way and due for completion in mid 1999. Site preparation for the processing plant commenced in early August 1997 and the main infrastructure item, a \$40 million retort, has been ordered, with a 22 month construction time. Close-spaced geotechnical drilling on the initial entry for the open cut has been in progress since late July 1997. Stuart Energy (Management) Pty Ltd has been awarded "Major Projects Facilitation" status by the Federal Government, ensuring that all issues relating to the Commonwealth are addressed in a timely and efficient manner and that any unnecessary overlap between the Commonwealth and State Governments is avoided. The proposed mining operation at Stuart is a sunrise industry for Queensland and, if successful would pave the way for development of eight other proven oil shale resources in Queensland which contain more than 27 billion barrels of oil.

6. MINERAL EXPLORATION AND MINING ACTIVITIES

The exploration process starts with assessments of very large regions and is then systematically narrowed down as the exploration target becomes better defined. The direct costs facing explorers increase as the target area becomes smaller and exploration methods become more intense. The environmental impact associated with exploration also increases as the area being explored becomes smaller and the exploration methods used become more invasive (for example, drilling), unless special steps are taken to reduce such impacts.

Compared with exploration, mining generally covers relatively small areas involves greater disturbance to the land surface in the immediate area of the mine, and may leave changed landforms when mining is finished. Mining is generally seen as posing greater difficulties in terms of compatibility with other land uses.

Many potential environmental effects of mining activities can be eliminated or mitigated, though at a cost to the mining company. Given the relatively limited areas of land disturbed by the operation of a mine, water pollution often represents the major potential threat to the environment from mining. This can be controlled by using techniques such as impoundment and evaporation of tailings, sedimentation, filtration and pH neutralisation. Modern site rehabilitation, at the completion of operations, can restore many features of the landscape that existed before mining began, substantially, replacing and assisting the re-establishment of vegetation and reducing the potential for pollution from the former mine site.

Thus, part of the impact on the environment caused by exploration and mining activities can be eliminated or mitigated, although this increases exploration and mining costs and reduces the likely profitability of these activities. If it is feasible to avoid certain types of environmental damage, then an assessment is required of the nature of the environmental damage and the costs of avoiding this damage. If it is not feasible to avoid certain types of environmental damage, then the costs need to be assessed against the economic benefits of the exploration and mining activities.

It is important to gather information about the range of attributes and values of areas which offer alternative uses — such as environmental attributes and conservation values of an area as well as the mineral potential of the area and the mining options for those resources.

The information about environmental and mineral values is dynamic, and the availability, usefulness and implications of this information can change over time. Continuing advances of the kind seen in environmental research, exploration geoscience and mining technologies may render information obsolete, and previous land use decisions may need to be periodically reconsidered. There are also dynamic aspects to market information that will affect its relevance over time: mineral prices and extraction costs, for example, may change substantially. Similarly, the value of particular environmental resources may change over time.

Exploration companies manage the financial risk of exploration by a series of safeguards, which include:

1. Ore search in a number of regions, for a variety of commodities - which might be called 'spreading the risk';
2. Exploring in regions in which the legislative framework provides an assurance that a discovery can be mined, allows for an acceptable return from a discovery, and has precedents which suggest that the rules will not be capriciously changed; and

3. Selecting those regions in which exploration is perceived to have the highest chance of success.

Exploration proceeds in stages, in which each step involves an increase in the level of expenditure, but a decrease in the level of risk as the likelihood of success improves. The many stages may be simplified to :

1. Area selection - This stage comprises the choice of a prospective region, and then selecting the part(s) of that region with the best chance of success, by a study of published geological data and information from unpublished exploration reports, culminating in an application for an exploration title. Note that each geoscientist brings a personal bias to this stage, and often a different set of critical factors necessary for ore formation and exploration success - thus the same area may be prospected by many mining companies, over a long period of time, as different objectives or theories are used.

2. Reconnaissance exploration - This involves an examination of all of the area of the exploration title, using a mixture of exploration methods, which may include regional geochemical, geological and geophysical surveys. There is a multitude of techniques available for each of these three classes of survey, and every geoscientist and mining company has an individual preference. The objective of this stage is the reduction of the area of interest from hundreds of square kilometres to a number of targets, each a few square kilometres in area. As in the first stage, exploration potential is not exhausted by a few regional exploration surveys, and it is fallacious to assume that an area is 'completely' explored.

3. Prospect evaluation - This is a careful examination of each of the target areas, by a mixture of detailed geological, geophysical and geochemical surveys, culminating in drilling of some of the targets. As in stages 1 and 2, this procedure is not a conclusive test of the area, as some methods are not applied to some targets, all targets are not drilled, and in many programmes the targets drilled are only tested by a few shallow holes.

Most exploration programs are terminated, during any of the three stages, by a decision that results to date show that the chance of success is now unacceptably low. The information collected during each program is made available to other explorers, in 'open file' reports held by the Department of Mines and Energy. These provide an essential guide to the area selection process.

All of the factors which companies require before investing in an exploration programme - deposits of many minerals, a satisfactory legislative system, and zones of high mineral potential - are available in the region.

Figures for employment in exploration in the region are not readily available. Exploration companies are not required to provide statistics on the number of persons employed, but this can be estimated from the level of expenditure. The total expenditure commitment for exploration titles in forested areas for the 1995-96 year was \$4.148 million. In Berkman (1996) it was assumed that every \$100 000 represents a person's annual income, it is estimated that 41 persons are employed in exploration. By comparison, the total expenditure on mineral exploration in Queensland in 1996 was \$180 million.

As at February 1996 the Exploration Permits within the region, contained a total area of 11 054 square kilometres. All or parts of 82 of these titles, of area 6276 square kilometres, were in forested parts of the region. The extent of Exploration Permits and Mineral Development Licences in July 1996, (which may be somewhat different because of the volatility of these tenures) is shown in

Figures 3A, 3B, 3C in Berkman (1996). The area covered by the Exploration Permits does not indicate any particular bias towards exploring in either forested or cleared land.

7. ASSESSMENT OF POTENTIAL MINERAL AND EXTRACTIVE MATERIAL RESOURCES

7.1 Methodology

The mineral potential of the Southeast Queensland region was assessed by determining the types of mineral deposits likely to be found within the geological framework known or believed to exist there. The general methodology used is a modified version of one developed by the United States Geological Survey (USGS), and has been used successfully for mineral resource assessments of wilderness areas in North America and elsewhere. This approach identifies areas or zones (tracts) occupied by geological units that could contain particular types of mineral deposits. The qualitative assessment methodology is described in publications by Marsh, Kropschot and Dickinson (1984), Taylor and Steven (1983), and by Dewitt, Redden, Wilson and Buscher (1986). The method has been modified and extended by BRS for use in a GIS environment.

A qualitative assessment of the potential resources of an area is an estimate of the likelihood of occurrence of mineral deposits which may be of sufficient size and grade to constitute a mineral resource. The term 'mineral resource' is restricted to material, the extraction of which is judged to be potentially viable now or some time in the next 25 years. Only the deposit types judged to be most likely to constitute significant resources in the region have been assessed in detail.

In the Southeast Queensland region, zones of mineral potential were identified by Berkman (1996) and Siemon and Holmes (1996) for 27 different types of deposits. In addition the Maryborough and Clarence Moreton Basins have low potential for hydrocarbons, mainly gas.

The boundaries of the zones (or tracts) of mineral potential were identified from the distribution of the mineral occurrences, also taking into account geology and geophysical results (Berkman, 1996). Each zone contains mineral occurrences and deposits of the same metal or mineral, formed by the same process, in the same geological setting. Each zone contains evidence that the ore-forming process has operated, generally in the form of an ore deposit, and often has many examples of the genetic class. There are few zones of mineral potential defined on the basis of associated geoscientific criteria without direct evidence of mineralisation.

The zones were defined from the information and data available as at early 1996. Further exploration, or regional geological and geophysical mapping, will allow a more precise location of the zones, and will identify new zones. Users of this appraisal are advised to check the description and location of zones against geological maps and the latest exploration and mapping results.

The mineral potential of each zone (or tract) was assessed in the report by Berkman (1996) as:

- Likely, ie there is a strong possibility that the zone contains more deposits,
- Possible, indicating that there is some chance that the zone contains further deposits, or
- Alienated, including areas of known resources where closer settlement, environmental constraints or other interests effectively preclude development for the foreseeable future,
- Low or unknown, with only a slight or unknown chance of further deposits.

Only the areas of likely, possible and alienated potential were shown on maps. Areas of low and unknown potential are left blank and are not distinguished.

For the purpose of this report, Berkman’s categories for the levels of mineral potential (namely ‘likely’ and ‘possible’) were converted to the terminology used in other RFA areas (Figure 1). Each zone as defined and described in the report by Berkman (1996) was examined by a panel of DME and BRS geologists. As a general rule, areas with ‘likely’ potential were equated with ‘moderate-high’ potential and areas of ‘possible’ potential were equated with ‘low-moderate’ potential. Some

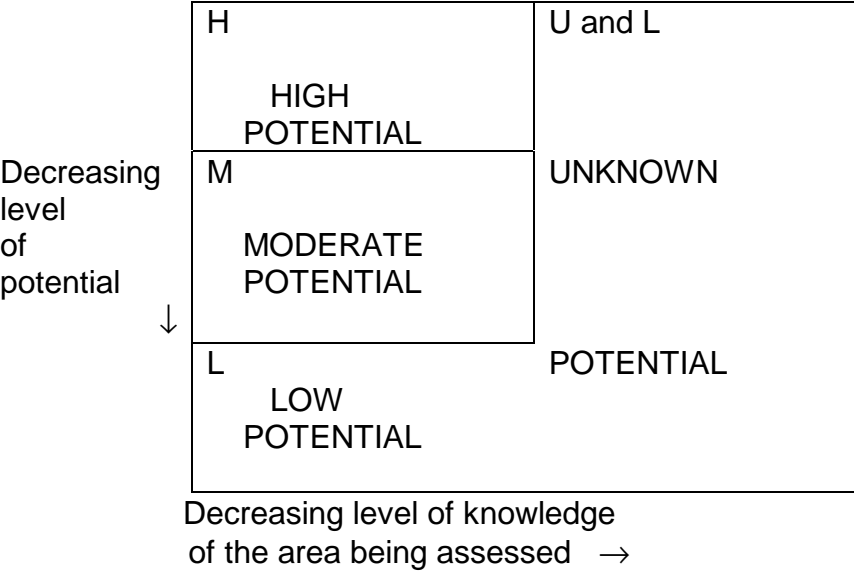


FIGURE 1. RELATIONSHIP BETWEEN LEVELS OF RESOURCE POTENTIAL AND LEVELS OF CERTAINTY

of the zones of ‘likely’ potential were equated with ‘high’ potential where Berkman’s descriptions indicated a higher level of potential.

For this report, ‘standard scores’ were allocated according to a subjective ranking of levels of mineral potential: 18 (for high potential), 12 (moderate-high), 6 (moderate), 2 (low-moderate), and 1 (low). Unknown potential is not scored. The subjective scores provide a very broad differentiation between different levels of mineral potential for processing and presentation in GIS environment. The assessment however is still qualitative, and the scores are not meant to be translated into quantitative probabilities of potential. Estimation of quantitative probabilities would require a full scale quantitative assessment of undiscovered mineral resources. The same standard scores were used for assessments of the other Regional Forest Agreement areas.

In addition, each deposit type was assigned a ranking. The rankings of deposit types were determined by a panel assessment by persons familiar with the geology of the area, the reports by Berkman (1996) and Siemon and Holmes (1996), the relative values of the commodities of the region and the type of assessment methodology being used. The panel comprised geologists of the Queensland Department of Minerals and Energy, Brisbane and of the Bureau of Resource Sciences, Canberra.

In assigning a rank to a deposit type the panel first considers the relative significance of the deposit type by comparing it with other types of deposits. For example, in similar circumstances a major economic limestone deposit, in most cases, is going to be less significant and have a lower rank

(say 2) than a major economic coal deposit (say 8). Secondly, the panel then evaluates the rank of the deposit type by considering the area in question. For example in Southeast Queensland the available evidence suggest that more coal deposits of world scale significance will be found (Walloon type coal) and the rank is adjusted upwards from 8 to 9. A limestone deposit near a major population centre, with a high demand for limestone, like Southeast Queensland could have its rank adjusted upwards from 2 to 3 whereas a similar deposit limestone type near Tennant Creek may be adjusted downwards from 2 to one. On the other hand a type of coal of variable quality and limited mineable seam widths like the Burrum coal has a rank of only 1.

‘Weighted scores’ for mineral potential tracts were derived by multiplying the standard scores with mineral deposit rankings. The values were then used to produce a weighted composite mineral potential map (Map 6) to define the areas of highest mineral potential for the most important types of mineral deposits. The tracts were weighted in this way to differentiate tracts with potential for significant types of deposits like Walloon coal and gold from less significant types of deposits like limestone. The weighted mineral potential map provides a broad guide to the relative significance of mineral potential tracts for different types of deposits. But as stated previously, this is still a qualitative assessment and the ranking of levels of mineral potential and deposit types is subjective. The assessment is not a quantitative economic analysis of different types of deposits.

Several petroleum wells have been drilled in the Clarence-Moreton Basin, however no zones of petroleum potential have been identified and potential is unknown.

TABLE 2: SUMMARY OF POTENTIAL MINERAL RESOURCES AS AT SEPTEMBER 1997

Mineral deposit class	Deposit type	Ranking of deposit type (Index)	Mineral potential	Standard score	Weighted score	Area of tract (sq km)	% of region covered by tract
Gold deposits	Volcanogenic (epithermal) gold deposits	7	H	18	126	215	0.35%
		7	M-H	12	84	408	0.66%
		7	L-M	2	14	4,380	7.12%
			Alienated			223	0.36%
	Structure/Vein-hosted gold deposits	4	H	18	72	1,822	2.96%
		4	M-H	12	48	5,043	8.20%
		4	L-M	2	8	448	0.73%
Other metalliferous deposits	Porphyry copper-molybdenum	7	H	18	126	65	0.11%
		7	M-H	12	84	228	0.37%
		7	L-M	2	14	81	0.13%
	base metal skarn deposits: copper-gold-lead-zinc; copper-gold-magnetite; zinc-lead-gold	2	M-H	12	24	302	0.49%
	Volcanogenic hydrothermal deposits: mercury; copper-lead-zinc-gold	2	M-H	12	24	539	0.88%
	Base metal vein deposits: copper-gold; copper-lead-zinc; copper-gold-silver; lead-silver	2	M-H	12	24	430	0.70%
		2	L-M	2	4	207	0.34%
Shoreline and alluvial/eluvial placer deposits	Coastal heavy mineral sand deposits (ilmenite-rutile-zircon)	10	H	18	180	128	0.21%
		10	M-H	12	120	71	0.11%
			Alienated			1,128	1.84%
	Alluvial/eluvial placers: ilmenite-gold	4	M-H	12	48	39	0.06%
Coal deposits	Burrum	1	M-H	12	12	155	0.25%

		1	L-M	2	2	274	0.45%
	Walloon	9	H	18	162	289	0.47%
		9	M-H	12	108	15	0.02%
		9	L-M	2	18	1,740	2.83%
	Tarong	7	H	18	126	50	0.08%
		7	M-H	12	84	90	0.15%
		7	L-M	2	14	355	0.58%
	Ipswich	5	H	18	90	53	0.09%
				Alienated			129
Oil shale deposits	Oil shale deposits	8	H	18	144	21	0.03%
		8	M-H	12	96	196	0.32%
Industrial mineral deposits	Limestone	3	M-H	12	36	132	0.21%
	Magnetite	3	M-H	12	36	2	0.00%
	Glass/silica sand	5	H	18	90	21	0.03%
		5	M-H	12	60	24	0.04%
	Foundry sand	3	H	18	54	29	0.05%
		3	M-H	12	36	67	0.11%
	Dolomite	2	M-H	12	24	7	0.01%
	Diatomite	1	M-H	12	12	6	0.01%
	Perlite	1	M-H	12	12	6	0.01%
	Kaolin	3	H	18	54	11	0.02%
	Bentonite	2	M-H	12	24	10	0.02%
	Graphite	1	M-H	12	12	7	0.01%
Extractive materials	Quarry rock	3	H	18	54	128	0.21%
		3	M-H	12	36	295	0.48%
		3	L-M	2	6	445	0.72%
	Sand and gravel	3	H	18	54	42	0.07%
		3	M-H	12	36	143	0.23%
		3	L-M	2	6	326	0.53%
	Brick clay	3	H	18	54	64	0.10%
		3	M-H	12	36	202	0.33%
	Building stone	4	H	18	72	36	0.06%

7.2 General comments on extractive materials potential

The extractive materials study by Siemon and Holmes (1996) has attempted to identify areas where rock of a suitable nature occurs in close proximity to a major consumer market or in close proximity to a major transport system (preferably railway line) to allow easy access to markets. These are generally near to areas with large growing populations. The future trend is for a few large quarries to supply virtually all high quality aggregate requirements and smaller quarries and scrapings to be abandoned. Little information is known about many of the deposits outlined and further work would be required to confirm their absolute suitability. Past and present investigations have shown that many rock types throughout the region can be utilised as construction materials. Construction specifications and the requirement for quality assurance has forced the closure of many small pits and scrapings, except those which are utilised for maintenance of local gravel roads and general fill. The majority of Local Government pits have been closed due to the above factors, cost pressures and the need to comply with the requirements of the Environmental Protection Act.

Apart from the Sunshine Coast and southern Gold Coast areas, where current and potential resources in State Forests are important, sufficient potential resources of quarry rock exist on cleared land outside of State Forests and Crown Land which can be utilised to supply current and

future markets. However, there are some resources of rock possibly important for the longer term in State Forest near Maryborough (see p29 RM2, Siemon and Holmes, 1996)

While sand and gravel resources may occur in forested areas, no significant resources were recorded in native forest in State Forests. However some sand resources are known in plantation State Forests south of Caloundra. As a consequence potential resources have been defined primarily along major streams or in areas of known coastal sediments. A major impediment to many resources being extensively worked is the presence of feldspar, which prevents the sand being utilised for high strength concrete. This is a major problem along the Burnett and Kolan Rivers and in some resources derived from the Marburg Formation.

Most potential resources within stream beds will be increasingly difficult to access due to environmental concerns regarding stream stability. At off-stream workings along major streams strict controls are likely to prevent extensive erosion of bund walls.

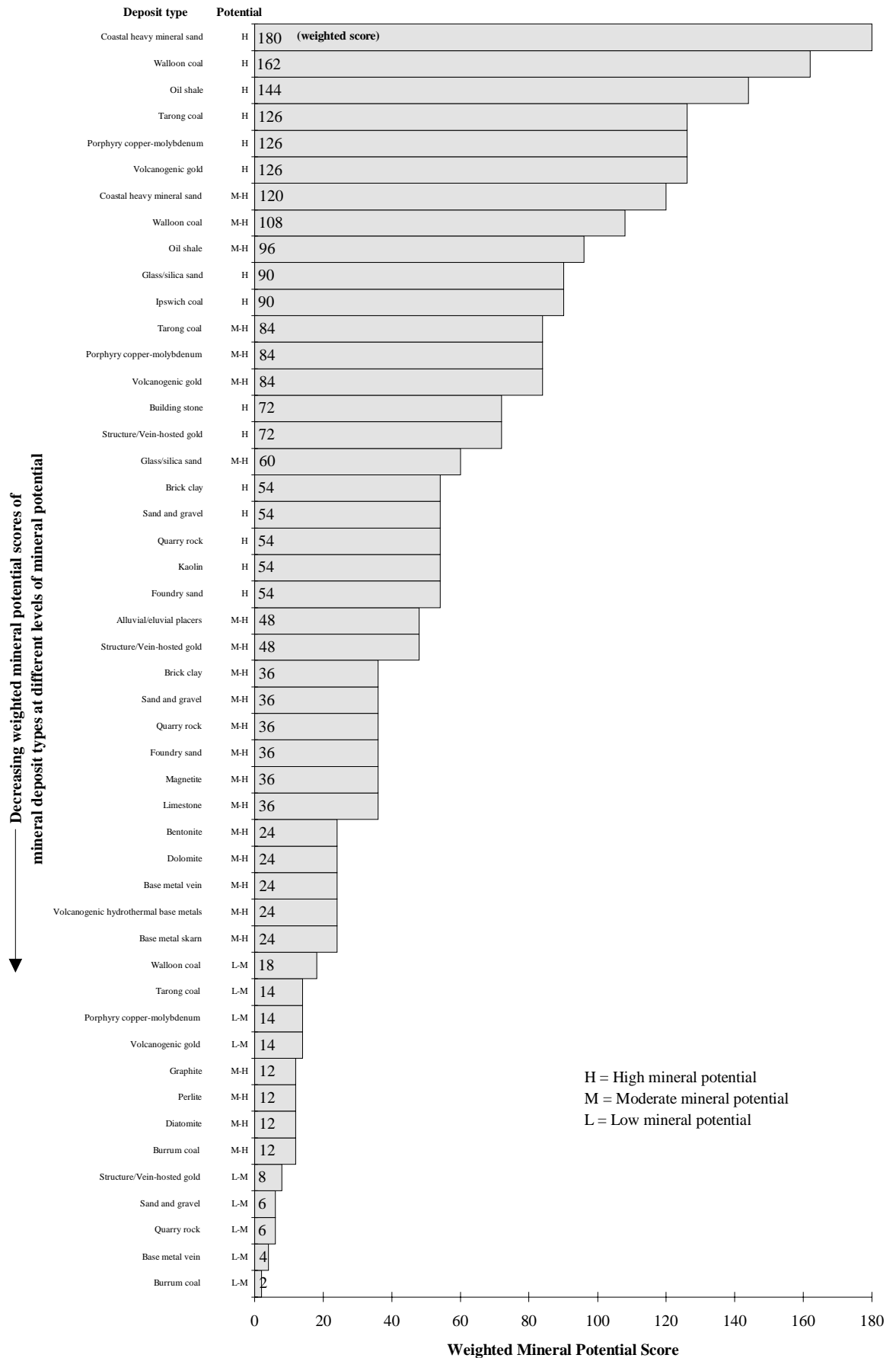


FIGURE 2: WEIGHTED MINERAL POTENTIAL SCORES OF MINERAL DEPOSIT TYPES AT DIFFERENT LEVELS OF MINERAL POTENTIAL

Manufactured sand can be derived from many of the large rock quarries operating within the region, but some rocks are more useful than others. A major problem for their use in concrete is the presence of clays that are extremely difficult to wash from sand size-fractions. As a consequence only fresh rock can be used to produce manufactured sand, otherwise disposal of effluent will be a major problem in the industry.

The industry is now beginning to look at using coarse sandstone of the Woogaroo Subgroup in the Helidon area west of Ipswich as a raw material for manufactured sand. Although distant from the major markets along the coast the area is conveniently located close to major road and rail corridors. Significant parts of this resource are located within State Forest north and east of Helidon.

Clay resources in the Brisbane region do not occur in State Forests although some occur within the broad forested zone. Supplies of clay for the Cooroy brickworks are mainly derived from pits located adjacent to areas of State Forest north of Cooroy, with dark firing materials extracted from a pit in State Forest near Imbil. Near Bundaberg and Maryborough, where substantial areas of potential clay bearing units are utilised for sugar cane (considered as prime agricultural land) potential resources adjacent to existing leases are considered to be of major importance to the brick industry. Some of these areas are within State Forest.

Building stone (sandstone) is important north of Helidon to supply both domestic and export markets. Resources currently worked are located on freehold land, but resources extend into State Forest nearby. Although the Helidon Sandstone extends east toward Gatton and Esk, no workings are known in this area and from recent investigations the potential of the eastern area appears low.

The Queensland Department of Minerals and Energy has been working on a detailed report on the building stone, coarse sandstone and quarry rock resources (and the needs of explosives industry) of the Helidon Hills as part of the 'Sustainable Management of the Helidon Hills' planning project of the Western Regional Organisation of Councils (WESROC). This work is undertaken with funding from the National Heritage Fund and DME's report is almost complete. The more detailed data of this work may be available for the integration process of the Southeast Queensland RFA.

7.3 Summary of potential mineral and extractive materials resources

The mineral resources of the Southeast Queensland region were assessed by Berkman (1996) and by Siemon and Holmes (1996) for 27 types of deposits. Areas of mineral potential for these types of deposits are outlined on maps in technical reports by these authors. These deposit types are listed in Table 2 of this report and indicate various levels of potential for:

- 6 types of metalliferous deposits,
- 2 types of heavy mineral sand deposits,
- 4 types of coal deposits,
- oil shale deposits,
- 10 types of industrial mineral deposits, and
- 4 types of deposits for extractive materials.

The mineral potential tracts for metalliferous and heavy mineral sand deposit types are grouped together on Map 3. Most of the tracts are labelled to indicate the types of deposits the mineral potential was assessed for. For additional detail the reader is referred to the report by Berkman

(1996). The potential for metalliferous deposits is confined to the rocks of the New England Fold Belt with the most significant being those for volcanogenic gold and structure/vein controlled gold deposits. Tracts of high potential for volcanogenic deposits are near the most significant known volcanogenic gold deposit of Mount Rawdon, near Mount Perry. Tracts of high potential for structure/vein controlled gold deposits include these type of gold occurrences in the Gympie gold district. Tracts of moderate-high potential for structure/vein type gold deposits are quite extensive around Gympie and to the southwest and also northwest of Mount Perry. South of Mount Perry there is a large tract of low-moderate potential for volcanogenic gold deposits. Although being assessed as having only low-moderate potential, this tract was considered by Berkman (1996) to be of obvious interest to the exploration industry for volcanogenic gold deposits.

The New England Fold Belt also has small areas of high and moderate-high potential for porphyry type copper-molybdenum deposits, and moderate-high potential for base metal skarn, base metal vein, and base metal/mercury hydrothermal deposits.

High potential for coastal heavy mineral sand deposits is confined to North Stradbroke Island. There are several additional tracts of potential for heavy mineral sands north of North Stradbroke Island but these areas have been alienated by other land uses, mainly by various types of parks. In the northern part of the region, tracts of moderate-high potential for coastal heavy mineral sands include the Agnes Waters-Middle Island-Hummock Hill heavy mineral sand deposits. There is also a small tract of potential for alluvial/eluvial heavy mineral sand deposits north-west of Mount Perry, which includes the known Goondicum ilmenite deposit.

Mineral potential tracts for deposits of coal and oil shale are grouped on Map 4. Tracts of low-moderate, moderate-high and high potential for Walloon coal are confined to the Clarence-Moreton Basin south of Ipswich. South of Ipswich there is a small tract of high potential for Ipswich type coal with part of the tract being alienated due to other land uses. There are tracts of low-moderate, moderate-high and high potential for Tarong coal south of Kingaroy and two tracts of low-moderate and moderate-high potential for Burrum type coal between Bundaberg and Maryborough in the Maryborough Basin. A tract of high potential for oil shale is just north-west of Gladstone which includes the Rundle deposit with two other tracts of moderate-high potential for oil shale south-east of Gladstone.

The mineral potential for 10 types of deposits of industrial minerals and 4 types of extractive materials are shown on Map 5. The size of many of these tracts are too small to be shown at a scale of 1:1.5 million as they are often restricted to sites around pits and quarries. For this reason the location of about 177 major quarries are also shown on Map 5. Most of the tracts on Map 5 are also labelled with the relevant type of mineral deposit, but for additional detail the reader is referred to the technical report by Siemon and Holmes (1996). The most widespread tracts are those for extractive materials (quarry rock, sand and gravel, and brick clay).

Map 6 shows the weighted composite mineral potential for the region as assessed by a panel of geoscientists in September 1997. This method of mineral potential assessment makes some allowance for the relative economic significance between different types of mineral deposits. In this approach, different types of mineral deposits are ranked for their relative economic significance. For example, Walloon type coal deposits were allocated a ranking of 9 out of 10, whereas brick clay deposits were given a ranking of only 3 out of 10. The economic significance of the world class coastal heavy mineral deposits in this part of Australia were allocated the highest ranking of 10 out of 10. The rankings for the various deposit types are listed in Table 2. 'Standard potential scores' were allocated according to a subjective ranking of different levels of mineral potential as follows: 18 (for high potential); 12 (moderate to high); 6 (moderate); 2 (low to

moderate) and 1 (low). The weighted composite score is calculated by multiplying the deposit ranking by the standard potential score. For example, heavy mineral sands tract (ranking of 10) with high potential (18) will have a weighted composite score of 180. Where there are *overlapping tracts with different weighted scores, the highest of these scores is assigned to the area of overlap*. Areas of unknown or alienated potential are not scored. Similarly, no scores are allocated to areas where low and unknown potential have not been differentiated. The weighted scores at all levels of mineral potential for all of the deposits assessed are tabulated in Table 2 and are also presented in a sorted list in Figure 2.

Weighted mineral potential scores of tracts on Map 6 range from 2 to 180 and occupy about 30% of the region. About 2.2% of the region is occupied by areas with alienated tracts and about 67% of the region comprise areas of low and unknown potential which have not been differentiated.

Tracts with weighted scores of 108 to 180 cover about 1.4% of the Southeast Queensland region and include deposits with a rank of 7 to 10 (Table 2). These areas comprise tracts of high potential and moderate-high potential for coastal mineral sands (weighted mineral potential score of 180 for high potential and 120 for moderate-high) and Walloon type coal deposits (162 for high potential and 108 for moderate-high). All of the other tracts in this weighted mineral potential class range are for high potential for Tarong type coal (weighted mineral potential score of 126), oil shale (144), volcanogenic gold (126) and porphyry type copper-molybdenum deposits (126). As stated previously these tracts include known major deposits of Walloon and Tarong coal, the North Stradbroke Island and Agnes Waters-Middle Island-Hummock Hill heavy mineral sand deposits, oil shale deposits and the Mount Rawdon volcanogenic gold deposit.

Tracts with a weighted score of 48 to 96 cover about 10.9% of the region and indicate mineral potential for deposit types with a rank of 4 to 8. At the top of this range are tracts of moderate-high potential for oil shale (rank of 8 and a weighted potential score of 96 (Table 2)) and for Tarong type coal (rank of 7 and score of 84). Tracts for metalliferous deposits include moderate-high potential for volcanogenic gold (rank of 7 and weighted potential score of 84); moderate-high potential for porphyry copper-molybdenum deposits (7 and 84) and high and moderate-high potential of structure/vein hosted gold deposits (rank of 4 and a weighted potential score of 72 for high potential and 48 for moderate-high). Other tracts in this class range include high potential for deposits of industrial and extractive minerals with silica glass sand (rank of 5, weighted mineral potential score of 90), and building stone (4 and 72) near the top of this range (Table 2).

The tracts with a weighted mineral potential score of 2 to 36 occupy about 17.6% of the region and include deposits with rankings in the range of 1 to 7. This weighted score range is dominated by tracts with moderate-high and low-moderate potential for deposits of industrial and extractive commodities with rankings of 1 to 3. The weighted mineral potential of 36 at the top of this weighted score interval is represented by deposit types with a rank of 3 having tracts of moderate-high potential for industrial and extractive type commodities (limestone, magnetite, foundry sand, quarry rock, gravel). Deposit types with higher rankings (eg 7 for volcanogenic gold and porphyry type copper-molybdenum and 9 for Walloon type coal) in this range of weighted scores are restricted to tracts of low-moderate potential.

The weighted composite mineral potential map provides a broad indication of the relative significance of mineral potential tracts for different types of deposits. For example it provides a comparison of the relative significance of a tract with high potential for kaolin and a moderate to high potential for porphyry copper-molybdenum deposits. The weighted mineral potential scores are expressed in numerical terms so that the results can be readily processed and displayed visually

in GIS environments using various cut offs of weighted scores to analyse and compare the spatial distribution of mineral potential with other land values in the integration process. However, as stated previously, the assessment of mineral potential is qualitative and subjective and it is not possible to make a direct comparison mineral potential with other land values in dollar terms. A general appreciation of the economic value of the various types of deposits may be gained by reference to similar deposit being mined in Australia or elsewhere in the world.

Apart from presenting a weighted composite potential map, it is also possible to produce weighted cumulative maps in areas with overlapping mineral potential tracts. The weighted scores of the overlapping tracts are added to provide a cumulative score. A cumulative mineral potential map was not prepared because areas with overlapping tracts are not common in the Southeast Queensland region.

8. APPLICATION OF RESULTS OF MINERAL RESOURCE ASSESSMENT IN RESERVE DESIGN FOR SOUTH EAST QUEENSLAND REGION

Elements of the mineral resource assessment which should be considered in reserve design and the integration process for the Southeast Queensland region include GIS layers showing:

- locations of existing mining and quarrying operations,
- known mineral deposits,
- existing mineral tenements, and
- areas with mineral potential tracts of significant importance.

As stated previously, various cut-off scores of weighted mineral potential may be used to analyse the distribution of mineral potential with other land use values. Ultimately however, decisions on reserve design will have to be made in a consultative environment on case by case basis.

9. CONCLUSIONS

- The Southeast Queensland region includes major population concentrations of Brisbane, Gold Coast and Sunshine Coast which represent some of the fastest growing areas in Australia. These communities will require continued access to resources of extractive materials for building purposes.
- State Forests in the Gold Coast and Sunshine Coast hinterlands supply an important proportion of the quarry rock used in those markets, making up about one-sixth of the total rock produced in the region. There are also important resources of clay and rock in State Forests near Bundaberg and Maryborough.
- The region also has significant mines for coal, heavy mineral sands and gold. Total production of mineral commodities and extractive materials in 1994/95 amounted to about \$383 million and about half of this production was derived from forested areas.
- Mineral deposits known to occur in forested parts of the region and which may be mined in future include heavy mineral sands, gold and coal.
- Tracts of mineral potential for 27 different types of mineral deposits have been delineated over about one third of the region; discoveries of volcanogenic type of gold deposits would be the most significant of the metalliferous deposit types.

- Over two thirds of the area the mineral potential is either low, or is unknown partly due to the lack of modern regional mapping and the lack of high resolution airborne geophysical data; current geological mapping programs in the region should reduce some of the areas of unknown mineral potential.
- The assessment of potential mineral resources will need to be reviewed as data become available from current detailed regional geological mapping, high resolution airborne geophysical surveys and ongoing exploration.

10. APPENDICES

APPENDIX A: EXTRACTIVE MINERAL DEPOSITS AND QUARRIES (as shown on Map 5)

MAP LOCATION No.	NAME OF DEPOSIT/QUARRY	EASTING	NORTHING	COMMODITY
1		350500	7328400	Gravel
2		381800	7314300	Agglomerate
3		358600	7308200	Rhyolite
4		366600	7302400	Rhyolite
5		337700	7294300	Chert
6	Chowey	389500	7287000	Sand
7		400500	7280400	Laterite
8		389900	7275800	Gravel
9		426000	7266600	Gravel
10		429000	7263000	Sand
11	Flagstone Ck	417000	7260300	Sand
12		430500	7257000	Sand
13		433500	7255800	Sand
14		413000	7254000	Sand
15		406700	7250800	Sand
16	Tomato Island	429000	7249000	sand
17		446200	7250200	Basalt
18		446000	7249200	Basalt
19		446400	7247900	Basalt
20		444300	7237300	Sandy Loam
21	McCormack	397100	7235800	Claystone
22		381700	7233900	Metasiltstone
23		389500	7228800	Mudstone
24		452800	7223200	Sand
25		451000	7222800	Sand
26		414800	7218000	Mudstone ?
27		364000	7216000	Biotite Schist
28		363600	7213700	Hornfels
29		365600	7208200	Biotite Schist
30		428000	7209900	Rhyolitic Tuff
31		436300	7216300	Basalt
32		436800	7216300	Laterite
33		466800	7206500	Sand
34		469700	7205300	Sand
35		471000	7201600	Sand
36	Dundowran	475100	7202400	Basalt
37		479000	7202300	Sand
38		479200	7202400	Sand
39		479700	7202500	Sand
40		374200	7194000	Schist
41		360400	7187400	Conglomerate
42		362200	7186200	Conglomerate
43	Port Wine	390000	7183400	Mudstone
44		374200	7180800	Rhyolite
45		369300	7178200	Agglomerate
46		382000	7175000	Chert
47		359400	7166200	Conglomerate
48		362600	7165400	Gravel
49		432100	7178300	Mudstone
50		446600	7176800	Gravel
51		425300	7168300	Mudstone
52		454600	7165000	Andesite
53		454700	7158500	Gravel
54		459300	7158300	Andesite ?
55		454400	7155600	Sand
56		461400	7148500	Siltstone
57		448500	7142600	Sand
58	Coynes	458400	7138700	Sandstone
59		474800	7135900	Quartzite
60		481200	7134700	Laterite
61		451900	7132500	Gravel
62		461000	7129200	Siltstone
63		448500	7128500	Sand
64		485000	7125500	Laterite
65		487800	7117000	Laterite
66	Curra Quarry	457200	7113100	Limestone
67		454600	7112900	Sand

68		455800	7111300	Sand
69	Ringtail	496000	7085500	Trachyte
70	Forestry No1	387700	7083500	Quartzite
71	Council Pit	508900	7077800	Sand
72	Toolborough	503400	7065000	Tuff
73	Moy Pocket	474400	7064700	Trachyandesite
74		435700	7063700	Arenites
75	Gheerulla Ck	476000	7062000	Sand
76		472800	7059400	Sand
77	Kenilworth Pit	473300	7058200	Sand
78	Image Flat	494000	7058000	Rhyolite
79	Bli Bli	497800	7056800	Rhyolite
80	Hodgleigh	394900	7054400	Hornfels
81		419300	7049800	Sand
82		468600	7051300	Loam
83		468800	7050200	Loam
84		468700	7047000	Sand
85	Eudlo Ck	500500	7049200	Sand
86	Marshalls	500200	7048700	Sand
87	Mooloolah	502000	7038300	Sand
88	Mooloolah	502800	7038300	Sand
89		435400	7030100	Sand
90		429600	7029000	Sand
91		438600	7026500	Sand
92		458500	7023200	Sand
93	Glasshouse Exsel	492000	7023000	Trachyandesite
94	Sunrock	497000	7022000	Trachyte
95	Villeneuve	462100	7017600	Meta-siltstone
96		442700	7015300	Arenites
97		441100	7013300	Sand
98		438700	7012400	Sand
99	Bracalba	481800	7014000	Granodiorite
100	Moodlu	490700	7006400	Trachyte
101		508600	7004600	Sand
102		508900	7004300	Sand
103		507800	7003600	Sand
104		501900	6995700	Sand
105	Whiteside	492300	6986800	Greenstone
106	Petrie	493000	6986000	Greenstone
107		499200	6983000	Sand
108		500300	6982200	Sand
109		501300	6981400	Sand
110		499900	6980500	Sand
111	South Pine	501000	6980300	Sand
112		499300	6977900	Sand
113		499300	6977600	Sand
114		419400	6977000	Sand
115		438200	6972400	Sand
116		443200	6970700	Sand
117		440000	6970300	Sand
118		440000	6969700	Sand
119	Rous Channel	540700	6971400	Sand
120	Levitt Rd	493300	6967300	Granite
121		495200	6966500	Granite
122	Krugers	433800	6961200	Sand
123		430700	6959700	Laterite
124		410700	6956400	Laterite
125		414400	6954300	Gravels
126		419400	6952100	Sand
127		417800	6949700	Sand
128	Mt Whitestone	416200	6937200	Basalt
129	Mt Cootha	497200	6960500	hornfels
130	Brisbane River	502000	6960800	Sand
131	Pine Mtn	508300	6956700	Quartzite
132	Mt Marrow Quarry	462700	6947500	basalt
133		503000	6946000	Sand
134		500000	6943600	Sand
135		500500	6942800	Sand
136		500000	6941800	Sand
137		500000	6941000	Sand
138		487700	6939100	Basalt
139		486200	6938800	Trachyte
140	Kingston Bega Rd	511000	6939800	Quartzite
141		512200	6936200	Sand

142	Carbrook	524300	6936800	Sand
143		531500	6934200	Sand
144	Stonemaster	523500	6934200	Quartzite
145	Reedy Ck	524100	6932200	Quartzite
146	Stapylton	525000	6931300	Quartzite
147		465500	6929700	Basalt
148	Purga	475000	6930000	dolerite
149		534000	6927200	Sand
150		532800	6926900	Sand
151		531600	6925000	Sand
152	Beenleigh	521800	6925600	Greywacke
153	Wolffdene	520400	6925500	Greywacke
154		500600	6924500	Sand
155	Jimboomba	501900	6922900	Basalt
156	Bluerock	518500	6921600	Greenstone
157	Ormeau	521000	6922000	Greywacke
158		511500	6918500	Sand
159		510600	6917300	Sand
160		494900	6918500	Sand
161		488000	6919300	Sand
162		491100	6918900	Sand
163		489400	6918500	Sand
164		490800	6917300	Sand
165	Coomera	530000	6915800	Sand
166	Coomera	529000	6915000	Sand
167	Coomera	529000	6914000	Sand
168		514400	6912600	Sand
169	Coomera	527700	6912400	Sand
170		493100	6909000	Sand
171		491300	6908000	Sand
172	Hymix	531800	6906500	Greywacke
173	Old Coach Road	534300	6904800	Greywacke
174	Birnam Range	502200	6905200	Basalt
175		489800	6890400	Sand
176	Burleigh	540800	6890700	Argillite
177	Burleigh West	542300	6890000	Greywacke

11. METADATA

GENERALISED GEOLOGY, SEQ BIOGEOGRAPHIC REGION

Dataset

Title: Generalised Geology, SEQ Biogeographic Region

Jurisdiction:

Custodian: Qld Dept of Mines and Energy (DME)

Description

Abstract: Generalised geological map of the SEQ Biogeographic Region

Search word(s): Geology, Tectonic Map, Southeast Queensland Biogeographic Region

Attribute List: Generalised geological units

Geographic Extent Name(s): Qld-NSW border to Gladstone

Geographic Extent Polygon(s): Southeast Queensland Biogeographic Region as supplied by Dept of Natural Resources

Data Currency

Beginning Date: 30-8-97

Ending Date: 30-9-97

Dataset Status

Progress: Completed

Maintenance and Update Frequency: Not planned in this format

Access

Stored Data Format(s): Digital -ArcInfo/Arcview

Available Format Type(s): ArcInfo, Arcview shape files

Access Constraint: Licensed

Data Quality

Lineage: Combines generalised geology from DME's current 1:100 000 Southeast Queensland geological mapping project, and older DME/AGSO 1:250 000 mapping of the Rockhampton, Mundubbera and Bundaberg Sheet Areas

Scale:

Cell Size:

Positional Accuracy:

Attribute Accuracy:

Logical Consistency:

Completeness:

Contact Information

Contact Organisation: 1. Geological Survey of Queensland, DME;
2. Bureau of Resource Sciences, Canberra

Contact Position: 1. Project Leader, Southeast Queensland Project, GSQ, DME.
2. Manager Mineral Potential and Exploration, BRS

Contact Person: 1. Len Cranfield, GSQ, DME
2. Yanis Mieзитis, BRS

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Facsimile: 1. (07) 3235 4074 2 (02) 6272 4161

Electronic Mail Address: 1. lcranfield@dme.qld.gov.au
2. Yanis.Mieзитis@brs.gov.au

Metadata Date

Metadata Date: 30-10-97

Additional Metadata

MINERAL POTENTIAL TRACTS (27 MAPS)

Dataset

Title: Mineral Potential Tracts

Jurisdiction:

Custodian: Bureau of Resource Sciences

Description

Abstract: Mineral potential tract of a deposit type defines areas that are assessed to have geological environment favourable for the formation of that type. The tracts are drawn based on the reports by D. A. Berkman and J. E. Siemon and K. H. Holmes. A panel of experts translated levels of potential into a six-fold classification used in other CRA regions. Delineation of tracts and the assessment of mineral potential is carried out by following the methodology of qualitative assessment developed by the United States Geological Survey. For a description of deposit models and tracts, see reports by D. A. Berkman and J. E. Siemon and K. H. Holmes.

Search word(s): Mineral potential tracts.

Attribute List: Important attributes are:

Map_code – code representing zone delineated on the tract map (for details see report by D. A. Berkman)

Prob – potential expressed as probability (for details see report by D. A. Berkman)

Revprob – probability in Prob translated into the six-fold classification (low, low to moderate, moderate, moderate to high, high, unknown).

Accuracy – a measure of the accuracy of the location of zone boundary (for details see report by D. A. Berkman).

Revprobval – probability in Revprob expressed in numerical symbols (low = 1, low to moderate = 2, moderate = 6, moderate to high = 12, high = 18, unknown = 0).

'Tract name'_pot – the same as Revprobval.

Geographic Extent Name(s):

Geographic Extent Polygon(s): Bounding Co-ordinates: 150.787, -28.370, 153.577, -23.581

Data Currency

Beginning Date: 1996

Ending Date: 1998

Dataset Status

Progress:

Maintenance and Update Frequency: Irregular

Access

Stored Data Format(s): Digital – ArcInfo

Available Format Type(s): ArcInfo, Arcview shape files, ArcInfo grids

Access Constraint: licensed

Data Quality

Determined by that of primary datasets such as geology and the accuracy of assessments in the reports of D. A. Berkman and J. E. Siemon and K. H. Holmes.

Lineage:

Scale: 1:250,000

Cell Size:

Positional Accuracy:

Attribute Accuracy:

Logical Consistency:

Completeness:

Contact Information

Contact Organisation: Bureau of Resource Sciences

Contact Position: Chief Geologist

Contact Person: Yanis Mieзитis

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Metadata Date

Metadata Date: April 1998

Additional Metadata

Additional Metadata:

COMPOSITE MINERAL POTENTIAL (3 MAPS)

Dataset

Title: Composite Mineral Potential

Jurisdiction:

Custodian: Bureau of Resource Sciences

Description

Abstract: Composite mineral potential map is a collation of mineral potential tracts of individual deposit types. The three maps are for Gold, basemetals and heavy minerals; Coal and oil shales; and Industrial mineral and extractive materials. The maps are created by using Spatial Analysis if Arc View 3. Maps represent the highest level of mineral potential assessed (in August 1996 and April 1998) for any specific area in the CRA region.

Search word(s): Composite Mineral potential.

Attribute List: Important attributes are:

Grid_code – numerical code representing levels of mineral potential (low = 1, low to moderate = 2, moderate = 6, moderate to high = 12, high = 18, unknown = 0).

Geographic Extent Name(s):

Geographic Extent Polygon(s): Bounding Co-ordinates: 150.787, -28.370, 153.577, -23.581

Data Currency

Beginning Date: 1996

Ending Date: 1998

Dataset Status

Progress:

Maintenance and Update Frequency: Irregular

Access

Stored Data Format(s): Digital – ArcInfo

Available Format Type(s): ArcInfo, Arcview shape files

Access Constraint: licensed

Data Quality

Determined by that of primary datasets such as geology and the accuracy of assessments in the reports of D. A. Berkman and J. E. Siemon and K. H. Holmes.

Lineage:

Scale: 1:250,000

Cell Size:

Positional Accuracy:

Attribute Accuracy:

Logical Consistency:

Completeness:

Contact Information

Contact Organisation: Bureau of Resource Sciences

Contact Position: Chief Geologist

Contact Person: Yanis Mieзитis

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Metadata Date

Metadata Date: April 1998

WEIGHTED COMPOSITE MINERAL POTENTIAL

Dataset

Title: Weighted Composite Mineral Potential

Jurisdiction:

Custodian: Bureau of Resource Sciences

Description

Abstract: Weighted Composite mineral potential map is a collation of mineral potential tracts of individual deposit types (27 maps). The data set/map is created by using Spatial Analysis if Arc View 3. It represents the highest weighted level of mineral potential assessed (in August 1996 and April 1998) for any specific area in the CRA region. Each deposit type is assigned a weighting (score/index) on a scale of 1 to 10 by a panel of experts. The weighting reflects the relative importance of deposit types. For weightings of deposit types see the summary report.

Search word(s): Weighted Composite Mineral potential.

Attribute List: Important attributes are:

Grid_code – numerical code representing weighted levels of mineral potential.

Geographic Extent Name(s):

Geographic Extent Polygon(s): Bounding Co-ordinates: 150.787, -28.370, 153.577, -23.581

Data Currency

Beginning Date: 1996

Ending Date: 1998

Dataset Status

Progress:

Maintenance and Update Frequency: Irregular

Access

Stored Data Format(s): Digital – ArcInfo

Available Format Type(s): ArcInfo, Arcview shape files

Access Constraint: licensed

Data Quality

Determined by that of primary datasets such as geology and the accuracy of assessments in the reports of D. A. Berkman and J. E. Siemon and K. H. Holmes.

Lineage:

Scale: 1:250,000

Cell Size:

Positional Accuracy:

Attribute Accuracy:

Logical Consistency:

Completeness:

Contact Information

Contact Organisation: Bureau of Resource Sciences

Contact Position: Chief Geologist

Contact Person: Yanis Mieзитis

Mail Address 1: Bureau of Resource Sciences, P O Box E11, Kingston, ACT 2604

Mail Address 2:

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Metadata Date

Metadata Date: April 1998

EXTRACTIVE INDUSTRIES SEQ RFA

Dataset

Title: Sand and Gravel Resources, SEQ Biogeographic Region

Jurisdiction:

Custodian: Qld Dept of Mines and Energy (DME)

Description

Abstract: Potential sand and gravel resource areas defined as polygons, for the SEQ Biogeographic Region.

Search word(s): Extractive Industry, Sand and Gravel, Southeast Queensland Biogeographic Region

Attribute List: Resource Label, Map Code, Principal Commodity, Revised Probability, Revised Probability Value, Ranking, Symbol.

Geographic Extent Name(s): Qld-NSW border to Gladstone

Geographic Extent Polygon(s): Southeast Queensland Biogeographic Region as supplied by Dept of Natural Resources

Data Currency

Beginning Date: 30-8-97

Ending Date:

Dataset Status

Progress: Completed

Maintenance and Update Frequency: Not planned in this format

Access

Stored Data Format(s): Digital –ARC/INFO/ArcView

Available Format Type(s): ARC/INFO Coverages, ArcView shape files

Access Constraint: Licensed

Data Quality

Lineage: The resource potential polygons were translated from MapInfo tables that formed a part of the report “Assessment Of Extractive Materials Potential Of The Southeast Queensland Biogeographic Region” (Siemon and Holmes). The original resource potential polygons were digitised from interpretations that used data from:

District reviews of workings of Construction Materials - Queensland Government Mining Journal

Industrial rock and mineral surveys - 100 000 Sheets - Geological Survey of Queensland Publications

Industrial rock and mineral surveys – Shires - Geological Survey of Queensland Records

Other reports utilised included:

Geological Sheet Reports- Geological Survey of Queensland Reports,
Queensland Department of Mines Map commentaries

Reviews of river sand and gravel resources – Department of Primary Industries - Water Resources

TABLE 1 PRINCIPAL DATA SOURCES

Report	Author	Date	Reference
Dalby-Millmerran-Chinchilla	O'Flynn	1984	QGMJ February 84, p49
Toowoomba	O'Flynn	1980	QGMJ September 80, p447
Gladstone	Holmes	1980	QGMJ May 80, p267
Pialba 1:100 000	Robertson	1981	QGMJ March 81, p131
South Burnett	Martin & Neville	1981	QGMJ October 81, p491
Nambour & Caloundra 1:100 000	Martin	1985	GSQ Pub 385
Brisbane & Caboolture 1:100 000	O'Flynn, Holmes & Trezise	1983	GSQ Pub 382
Ipswich 1:100 000	Willmott, Cooper & Martin	1979	GSQ Pub 373
Beenleigh & Murwillumbah 1:100 000	Willmott, Martin, O'Flynn & Cooper	1976	GSQ Pub 368
Beaudesert Shire	Martin	1975	GSQ Rec 1975/27
Laidley & Gatton Shires	Zahawi	1979	GSQ Rec 1979/04
Laidley & Gatton Shires	Zahawi	1979	GSQ Rec 1979/04
Warwick - Stanthorpe	O'Flynn	1983	QGMJ September 83, p339
Gympie	O'Flynn & Graham	1987	QGMJ July 87, 240
Noosa Shire	Trezise	1989	GSQ Rec 1989/21
Maryborough 1:100 000	Robertson	1981	QGMJ Dec 81, 591
Biloela - Mt Morgan	Trezise	1982	QGMJ August 82, p364
Bundaberg 1:100 000	Robertson	1980	GSQ Rec 1980/1
Central Burnett	Trezise	1984	QGMJ May 84, p167
Upper Burnett	Trezise & Graham	1984	QGMJ June 84, p208
Southern Esk Shire	Holmes	1979	GSQ Rec 1979/18
Gatton Shire	Willmott	1987	GSQ Rec 1987/30

Scale: 1: 250 000

Cell Size:

Positional Accuracy:

Attribute Accuracy:

Logical Consistency:

Completeness:

Contact Information

Contact Organisation: 1. Geological Survey of Queensland, DME
2. Bureau of Resource Sciences, Canberra

Contact Position: 1. Project Leader, Southeast Queensland
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2. Manager Mineral Potential and Exploration, BRS

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Metadata Date

Metadata Date: 30-10-97

Additional Metadata

Additional Metadata:

Dataset

Title: Sand and Gravel Workings, SEQ Biogeographic Region

Jurisdiction:

Custodian: Qld Dept of Mines and Energy (DME)

Description

Abstract: Point localities for medium to large sand and gravel workings, for the SEQ Biogeographic Region.

Search word(s): Extractive Industry, Sand and Gravel Working, Southeast Queensland Biogeographic Region

Attribute List: Easting, Northing, Longitude, Latitude, Name, Sheet, Symbol, Rock_type_1, Rock_type_2, Rock_type_3, Weathering, Working, Size, Point Size, Status, Operator, Designated, Local_Authority, Land_Tenure, Land_Use, Production, Use_1, Use_2, Use_3, Comments, Report, Map Symbol

Geographic Extent Name(s): Qld-NSW border to Gladstone

Geographic Extent Polygon(s): Southeast Queensland Biogeographic Region as supplied by Dept of Natural Resources

Data Currency

Beginning Date: 30-8-97

Ending Date:

Dataset Status

Progress: Completed

Maintenance and Update Frequency: Not planned in this format

Access

Stored Data Format(s): Digital - ARC/INFO, ArcView

Available Format Type(s): ARC/INFO Coverages, ArcView shape files

Access Constraint: Licensed

Data Quality

Lineage: The “workings” locality and attribute data formed a part of the report “Assessment Of Extractive Materials Potential Of The Southeast Queensland Biogeographic Region” (Siemon and Holmes). They were compiled as Excel spreadsheets from the following sources:

District reviews of workings of Construction Materials - Queensland Government Mining Journal

Industrial rock and mineral surveys - 100 000 Sheets - Geological Survey of Queensland Publications

Industrial rock and mineral surveys – Shires - Geological Survey of Queensland Records

Other reports utilised included:

Geological Sheet Reports - Geological Survey of Queensland Reports,
Queensland Department of Mines Map commentaries

Reviews of river sand and gravel resources – Department of Primary Industries - Water Resources

TABLE 1 PRINCIPAL DATA SOURCES

Report	Author	Date	Reference
Dalby-Millmerran-Chinchilla	O'Flynn	1984	QGMJ February 84, p49
Toowoomba	O'Flynn	1980	QGMJ September 80, p447
Gladstone	Holmes	1980	QGMJ May 80, p267
Pialba 1:100 000	Robertson	1981	QGMJ March 81, p131
South Burnett	Martin & Neville	1981	QGMJ October 81, p491
Nambour & Caloundra 1:100 000	Martin	1985	GSQ Pub 385
Brisbane & Caboolture 1:100 000	O'Flynn, Holmes & Trezise	1983	GSQ Pub 382
Ipswich 1:100 000	Willmott, Cooper & Martin	1979	GSQ Pub 373
Beenleigh & Murwillumbah 1:100 000	Willmott, Martin, O'Flynn & Cooper	1976	GSQ Pub 368
Beaudesert Shire	Martin	1975	GSQ Rec 1975/27
Laidley & Gatton Shires	Zahawi	1979	GSQ Rec 1979/04
Laidley & Gatton Shires	Zahawi	1979	GSQ Rec 1979/04
Warwick - Stanthorpe	O'Flynn	1983	QGMJ September 83, p339
Gympie	O'Flynn & Graham	1987	QGMJ July 87, 240
Noosa Shire	Trezise	1989	GSQ Rec 1989/21
Maryborough 1:100 000	Robertson	1981	QGMJ Dec 81, 591
Biloela - Mt Morgan	Trezise	1982	QGMJ August 82, p364
Bundaberg 1:100 000	Robertson	1980	GSQ Rec 1980/1
Central Burnett	Trezise	1984	QGMJ May 84, p167
Upper Burnett	Trezise & Graham	1984	QGMJ June 84, p208
Southern Esk Shire	Holmes	1979	GSQ Rec 1979/18
Gatton Shire	Willmott	1987	GSQ Rec 1987/30

The spreadsheets were translated to Dbase files then to ArcView shapefiles using the add event theme command.

Scale: 1: 100 000

Cell Size:

Positional Accuracy: +/- 100m to +/- 1000m

Attribute Accuracy: variable with some fields a subjective/ relative judgement according to the data's author. Inconsistent naming of sites.

Logical Consistency: no spatial joins to check point/poly relationships

Completeness: Inconsistent due to time constraints

Contact Information

Contact Organisation: 1. Geological Survey of Queensland, DME
2. Bureau of Resource Sciences, Canberra

Contact Position: 1. Project Leader, Southeast Queensland
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2. Manager Mineral Potential and Exploration, BRS

Contact Person: 1. Len Cranfield, GSQ, DME
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2. Yanis.Mieзитis@brs.gov.au

Metadata Date

Metadata Date: 30-10-97

Additional Metadata

Additional Metadata:

Dataset

Title: Quarry Rock Resources, SEQ Biogeographic Region

Jurisdiction:

Custodian: Qld Dept of Mines and Energy (DME)

Description

Abstract: Potential quarry rock resource areas defined as polygons, for the SEQ Biogeographic Region.

Search word(s): Extractive Industry, Quarry Rock, Road Metal, Southeast Queensland Biogeographic Region

Attribute List: Resource Label, Map Code, Principal Commodity, Revised Probability, Revised Probability Value, Ranking, Symbol.

Geographic Extent Name(s): Qld-NSW border to Gladstone

Geographic Extent Polygon(s): Southeast Queensland Biogeographic Region as supplied by Dept of Natural Resources

Data Currency

Beginning Date: 30-8-97

Ending Date:

Dataset Status

Progress: Completed

Maintenance and Update Frequency: Not planned in this format

Access

Stored Data Format(s): Digital –ARC/INFO/ArcView

Available Format Type(s): ARC/INFO Coverages, ArcView shape files

Access Constraint: Licensed

Data Quality

Lineage: The resource potential polygons were translated from MapInfo tables that formed a part of the report “Assessment Of Extractive Materials Potential Of The Southeast Queensland Biogeographic Region” (Siemon and Holmes). The original resource potential polygons were digitised from interpretations that used data from:

District reviews of workings of Construction Materials - Queensland Government Mining Journal

Industrial rock and mineral surveys - 100 000 Sheets - Geological Survey of Queensland Publications

Industrial rock and mineral surveys – Shires - Geological Survey of Queensland Records

Other reports utilised included:

Geological Sheet Reports- Geological Survey of Queensland Reports,
Queensland Department of Mines Map commentaries

Reviews of river sand and gravel resources – Department of Primary
Industries - Water Resources

TABLE 1 PRINCIPAL DATA SOURCES

Report	Author	Date	Reference
Dalby-Millmerran-Chinchilla	O'Flynn	1984	QGMJ February 84, p49
Toowoomba	O'Flynn	1980	QGMJ September 80, p447
Gladstone	Holmes	1980	QGMJ May 80, p267
Pialba 1:100 000	Robertson	1981	QGMJ March 81, p131
South Burnett	Martin & Neville	1981	QGMJ October 81, p491
Nambour & Caloundra 1:100 000	Martin	1985	GSQ Pub 385
Brisbane & Caboolture 1:100 000	O'Flynn, Holmes & Trezise	1983	GSQ Pub 382
Ipswich 1:100 000	Willmott, Cooper & Martin	1979	GSQ Pub 373
Beenleigh & Murwillumbah 1:100 000	Willmott, Martin, O'Flynn & Cooper	1976	GSQ Pub 368
Beaudesert Shire	Martin	1975	GSQ Rec 1975/27
Laidley & Gatton Shires	Zahawi	1979	GSQ Rec 1979/04
Laidley & Gatton Shires	Zahawi	1979	GSQ Rec 1979/04
Warwick - Stanthorpe	O'Flynn	1983	QGMJ September 83, p339
Gympie	O'Flynn & Graham	1987	QGMJ July 87, 240
Noosa Shire	Trezise	1989	GSQ Rec 1989/21
Maryborough 1:100 000	Robertson	1981	QGMJ Dec 81, 591
Biloela - Mt Morgan	Trezise	1982	QGMJ August 82, p364
Bundaberg 1:100 000	Robertson	1980	GSQ Rec 1980/1
Central Burnett	Trezise	1984	QGMJ May 84, p167
Upper Burnett	Trezise & Graham	1984	QGMJ June 84, p208
Southern Esk Shire	Holmes	1979	GSQ Rec 1979/18
Gatton Shire	Willmott	1987	GSQ Rec 1987/30

Scale: 1: 250 000

Cell Size:

Positional Accuracy:

Attribute Accuracy:

Logical Consistency:

Completeness:

Contact Information

Contact Organisation: 1. Geological Survey of Queensland, DME
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Metadata Date

Metadata Date: 30-10-97

Additional Metadata

Additional Metadata:

Dataset

Title: Quarry Rock Workings/Quarries, SEQ Biogeographic Region

Jurisdiction:

Custodian: Qld Dept of Mines and Energy (DME)

Description

Abstract: Point localities for large quarry rock (road metal) workings/quarries, for the SEQ Biogeographic Region.

Search word(s): Extractive Industry, Quarry, Quarry Rock, Road Metal, Southeast Queensland Biogeographic Region

Attribute List: Easting, Northing, Longitude, Latitude, Name, Sheet, Symbol, Rock_type_1, Rock_type_2, Rock_type_3, Weathering, Working, Size, Point Size, Status, Operator, Designated, Local_Authority, Land_Tenure, Land_Use, Production, Use_1, Use_2, Use_3, Comments, Report, Map Symbol

Geographic Extent Name(s): Qld-NSW border to Gladstone

Geographic Extent Polygon(s): Southeast Queensland Biogeographic Region as supplied by Dept of Natural Resources

Data Currency

Beginning Date: 30-8-97

Ending Date:

Dataset Status

Progress: Completed

Maintenance and Update Frequency: Not planned in this format

Access

Stored Data Format(s): Digital - ARC/INFO, ArcView

Available Format Type(s): ARC/INFO Coverages, ArcView shape files

Access Constraint: Licensed

Data Quality

Lineage: The “quarry” locality and attribute data formed a part of the report “Assessment Of Extractive Materials Potential Of The Southeast Queensland Biogeographic Region” (Siemon and Holmes). They were compiled as Excel spreadsheets from the following sources:

District reviews of workings of Construction Materials - Queensland Government Mining Journal

Industrial rock and mineral surveys - 100 000 Sheets - Geological Survey of Queensland Publications

Industrial rock and mineral surveys – Shires - Geological Survey of Queensland Records

Other reports utilised included:

Geological Sheet Reports - Geological Survey of Queensland Reports,
Queensland Department of Mines Map commentaries

Reviews of river sand and gravel resources – Department of Primary
Industries - Water Resources

TABLE 1 PRINCIPAL DATA SOURCES

Report	Author	Date	Reference
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Toowoomba	O'Flynn	1980	QGMJ September 80, p447
Gladstone	Holmes	1980	QGMJ May 80, p267
Pialba 1:100 000	Robertson	1981	QGMJ March 81, p131
South Burnett	Martin & Neville	1981	QGMJ October 81, p491
Nambour & Caloundra 1:100 000	Martin	1985	GSQ Pub 385
Brisbane & Caboolture 1:100 000	O'Flynn, Holmes & Trezise	1983	GSQ Pub 382
Ipswich 1:100 000	Willmott, Cooper & Martin	1979	GSQ Pub 373
Beenleigh & Murwillumbah 1:100 000	Willmott, Martin, O'Flynn & Cooper	1976	GSQ Pub 368
Beaudesert Shire	Martin	1975	GSQ Rec 1975/27
Laidley & Gatton Shires	Zahawi	1979	GSQ Rec 1979/04
Laidley & Gatton Shires	Zahawi	1979	GSQ Rec 1979/04
Warwick - Stanthorpe	O'Flynn	1983	QGMJ September 83, p339
Gympie	O'Flynn & Graham	1987	QGMJ July 87, 240
Noosa Shire	Trezise	1989	GSQ Rec 1989/21
Maryborough 1:100 000	Robertson	1981	QGMJ Dec 81, 591
Biloela - Mt Morgan	Trezise	1982	QGMJ August 82, p364
Bundaberg 1:100 000	Robertson	1980	GSQ Rec 1980/1
Central Burnett	Trezise	1984	QGMJ May 84, p167
Upper Burnett	Trezise & Graham	1984	QGMJ June 84, p208
Southern Esk Shire	Holmes	1979	GSQ Rec 1979/18
Gatton Shire	Willmott	1987	GSQ Rec 1987/30

The spreadsheets were translated to Dbase files then to ArcView shapefiles using the add event theme command.

Scale: 1: 100 000

Cell Size:

Positional Accuracy: +/- 100m to +/- 1000m

Attribute Accuracy: variable with some fields a subjective/ relative judgement according to the data's author. Inconsistent naming of sites.

Logical Consistency: no spatial joins to check point/poly relationships

Completeness: Inconsistent due to time constraints

Contact Information

Contact Organisation: 1. Geological Survey of Queensland, DME
2. Bureau of Resource Sciences, Canberra

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2. Manager Mineral Potential and Exploration, BRS

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Metadata Date

Metadata Date: 30-10-97

Dataset

Title: Structural Clay Resources, SEQ Biogeographic Region

Jurisdiction:

Custodian: Qld Dept of Mines and Energy (DME)

Description

Abstract: Potential structural clay resource areas defined as polygons, for the SEQ Biogeographic Region.

Search word(s): Extractive Industry, Clay, Southeast Queensland Biogeographic Region

Attribute List: Resource Label, Map Code, Principal Commodity, Revised Probability, Revised Probability Value, Ranking, Symbol.

Geographic Extent Name(s): Qld-NSW border to Gladstone

Geographic Extent Polygon(s): Southeast Queensland Biogeographic Region as supplied by Dept of Natural Resources

Data Currency

Beginning Date: 30-8-97

Ending Date:

Dataset Status

Progress: Completed

Maintenance and Update Frequency: Not planned in this format

Access

Stored Data Format(s): Digital –ARC/INFO/ArcView

Available Format Type(s): ARC/INFO Coverages, ArcView shape files

Access Constraint: Licensed

Data Quality

Lineage: The resource potential polygons were translated from MapInfo tables that formed a part of the report "Assessment Of Extractive Materials Potential Of The Southeast Queensland Biogeographic Region" (Siemon and Holmes). The original resource potential polygons were digitised from interpretations that used data from:

District reviews of workings of Construction Materials - Queensland Government Mining Journal

Industrial rock and mineral surveys - 100 000 Sheets - Geological Survey of Queensland Publications

Industrial rock and mineral surveys – Shires - Geological Survey of Queensland Records

Other reports utilised included:

Geological Sheet Reports- Geological Survey of Queensland Reports,
Queensland Department of Mines Map commentaries

Reviews of river sand and gravel resources – Department of Primary Industries - Water Resources

TABLE 1 PRINCIPAL DATA SOURCES

Report	Author	Date	Reference
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Gladstone	Holmes	1980	QGMJ May 80, p267
Pialba 1:100 000	Robertson	1981	QGMJ March 81, p131
South Burnett	Martin & Neville	1981	QGMJ October 81, p491
Nambour & Caloundra 1:100 000	Martin	1985	GSQ Pub 385
Brisbane & Caboolture 1:100 000	O'Flynn, Holmes & Trezise	1983	GSQ Pub 382
Ipswich 1:100 000	Willmott, Cooper & Martin	1979	GSQ Pub 373
Beenleigh & Murwillumbah 1:100 000	Willmott, Martin, O'Flynn & Cooper	1976	GSQ Pub 368
Beaudesert Shire	Martin	1975	GSQ Rec 1975/27
Laidley & Gatton Shires	Zahawi	1979	GSQ Rec 1979/04
Laidley & Gatton Shires	Zahawi	1979	GSQ Rec 1979/04
Warwick - Stanthorpe	O'Flynn	1983	QGMJ September 83, p339
Gympie	O'Flynn & Graham	1987	QGMJ July 87, 240
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Maryborough 1:100 000	Robertson	1981	QGMJ Dec 81, 591
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Upper Burnett	Trezise & Graham	1984	QGMJ June 84, p208
Southern Esk Shire	Holmes	1979	GSQ Rec 1979/18
Gatton Shire	Willmott	1987	GSQ Rec 1987/30

Scale: 1: 250 000

Cell Size:

Positional Accuracy:

Attribute Accuracy:

Logical Consistency:

Completeness:

Contact Information

Contact Organisation: 1. Geological Survey of Queensland, DME
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Metadata Date

Metadata Date: 30-10-97

Additional Metadata

MINERAL OCCURRENCE DATA SEQ RFA

Dataset

Title: Mineral Occurrences, SEQ Biogeographic Region

Jurisdiction:

Custodian: Qld Dept of Mines and Energy (DME)

Description

Abstract: Mineral occurrence localities defined as points, for the SEQ Biogeographic Region.

Search word(s): Mineral Occurrence, Southeast Queensland Biogeographic Region

Attribute List: X_coord, Y_coord, Number, Map, Name, Major_production, Minor_production 1, Minor_production 2, Minor_production 3, Easting, Northing, Host_formation, Age, Genetic_co, Symbol

Geographic Extent Name(s): Qld-NSW border to Gladstone

Geographic Extent Polygon(s): Southeast Queensland Biogeographic Region as supplied by Dept of Natural Resources

Data Currency

Beginning Date: 30-8-97

Ending Date:

Dataset Status

Progress: Completed

Maintenance and Update Frequency: Not planned in this format

Access

Stored Data Format(s): Digital – Oracle, ARC/INFO, ArcView

Available Format Type(s): Excel or comma delimited text, ARC/INFO coverage, ArcView shape files

Access Constraint: Licensed

Data Quality

Lineage: data compiled from company reports, Geological Survey Reports and Publications, field observations. Data points plotted onto cadastral or topographic map sheets then digitised, or GPS locations. ArcView shape file generated from dBase file using add event theme command.

Scale: 1: 100 000

Cell Size:

Positional Accuracy: +/- 50m to +/- 300m

Attribute Accuracy: relative to field observations and geological/mineralogical interpretations

Logical Consistency:

Completeness: subset of a much larger data set

Contact Information

Contact Organisation: 1. Geological Survey of Queensland, DME
2. Bureau of Resource Sciences, Canberra

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2. Manager Mineral Potential and Exploration, BRS

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Metadata Date

Metadata Date: 30-10-97

Additional Metadata

Additional Metadata:

Dataset

Title: Producing Mines and Major Prospects, SEQ Biogeographic Region

Jurisdiction:

Custodian: Qld Dept of Mines and Energy (DME)

Description

Abstract: Location of producing mines and major prospects defined as points, for the SEQ Biogeographic Region.

Search word(s): Mineral Occurrence, Producing Mine, Major Prospect, Southeast Queensland Biogeographic Region

Attribute List: Name, Commodity, Environment, Status, Symbol

Geographic Extent Name(s): Qld-NSW border to Gladstone

Geographic Extent Polygon(s): Southeast Queensland Biogeographic Region as supplied by Dept of Natural Resources

Data Currency

Beginning Date: 30-8-97

Ending Date:

Dataset Status

Progress: Completed

Maintenance and Update Frequency: Not planned in this format

Access

Stored Data Format(s): Digital –Oracle, ARC/INFO, ArcView

Available Format Type(s): Excel or comma delimited text, ARC/INFO coverage, ArcView shape files,

Access Constraint: Licensed

Data Quality

Lineage: : A combination of MINLOC data and data compiled from company reports, Geological Survey Reports and Publications, field observations. Data points plotted onto cadastral or topographic map sheets then digitised, or GPS locations. ArcView shape file generated from dBase file using add event theme command.

Scale: 1: 100 000

Cell Size:

Positional Accuracy: +/- 50m to +/- 300m

Attribute Accuracy: relative to field observations and geological/mineralogical interpretations

Logical Consistency:

Completeness: specific subset of a much larger data set

Contact Information

Contact Organisation: 1. Geological Survey of Queensland, DME
2. Bureau of Resource Sciences, Canberra

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Additional Metadata

12. REFERENCES

- Berkman, D.A., 1996. The mining industry and mineral potential of forested areas within the southeast Queensland biogeographic region. Queensland Minerals and Energy Review Series, Department of Mines and Energy, Queensland.
- Cox, A., Beil, S. and Waring, T., 1994. Exploration, mining and resource access policy, an economic perspective on environmental and native title issues. Paper presented at the 6th Minerals and Energy Forum, Beijing, 16 March .
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- Murray, C. G., 1990. Tasman Fold Belt in Queensland, pp. 1431-1450 in Geology of the Mineral Deposits of Australia and Papua New Guinea, AusIMM Monograph 14.
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- O'Flynn, M.L., 1992. Resources of extractive materials in the eastern Moreton Region. Queensland Resource Industries Review Series. Department of Resource Industries, Queensland.
- Siemon, J.E. and Holmes, K.H., 1996. Assessment of extractive materials potential of the southeast Queensland biogeographic region. A report prepared for the Queensland Department of Mines and Energy.
- Taylor, R.B. and Steven, T.A., 1983. Definition of mineral resource potential. Economic Geology, vol. 78, pp. 1268-1270.