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REVISION OF INDUSTRIAL ROCK AND MINERAL RESOURCES OF GATTON SHIRE

by

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CONTENTS

Refer to Reconnaissance of Extractive Resources in Gatton and Laidley Shires Record 1979-4 for Maps for revisions to Maps listed above

SUMMARY

Gatton Shire is not well endowed with resources of industrial rocks and minerals, and existing sources are mostly only adequate for local demand for the short to medium term.

There are few potential sources of crushed aggregate because of widespread soft sedimentary rocks and deeply weathered basalt lavas. Only three basalt plugs, two of which already support quarries, offer potential. Lateritic ironstone gravels in the north of the Shire have provided road pavement gravels in the past, but sources are depleted and new accessible sites are difficult to acquire.

Deposits of sand and gravel suitable for aggregates are limited to a few lower terraces of Lockyer Creek upstream of Grantham, and very small deposits (chiefly of sand) associated with creeks north of Helidon and Gatton. An important deposit of bricklayers loam occurs west of Gatton. Gravel and sand in streams south of the Shire are unsuitable because of a considerable proportion of soft sandstone fragments.

Brickmaking clay is not worked in the Shire and the geological units present offer little potential.

Sandstone suitable for facing stone is well known from the Helidon district and from near Murphys Creek. Several old quarries have supplied stone in the past, and three are continuing on a small scale, together with two new pits. There has been a recent resurgence of interest in the stone for cut tiles. Sizeable areas are underlain by potentially suitable stone, but the quality of the material varies over short distances.

Production of diatomite from the Black Duck Creek mine in the south of the Shire has declined to minor amounts in recent years. Exploration for gold is occurring in the Alice Creek area.

Recommendations are given for the town planning protection of the known resources.

Keywords. Construction materials; quarries; pits; crushed screenings; concrete aggregate; road pavement gravels; gravel; sands; building stone; sandstone; brick clay; diatomite; gold; Queensland/Gatton Shire; SG 56-14; 9342; 9343.

INTRODUCTION

In 1979 the Geological Survey of Queensland of the Department of Mines compiled an unpublished reconnaissance report on the resources of extractive materials in the Gatton and Laidley Shires, as an aid to industry and the two Shire Councils (Zahawi, 1979).

In late 1986 the Gatton Shire Council requested assistance from the Department in the interpretation of this information for inclusion in a proposed Strategic Plan for the Shire. However, as eight years had elapsed since the collection of the original data, it was considered that a field review would be necessary to provide reliable advice. Consequently three weeks were spent by the author in early 1987 inspecting new operations and interviewing industry and government personnel regarding possible new deposits.

This report presents the results of the review in the form of a revision of the 1979 report of Zahawi. It is emphasised however, that the information remains at reconnaissance level and that deposits outlined have not been evaluated in detail; further investigations will be necessary to confirm their suitability. It is also unlikely that all suitable deposits have been located, particularly in the cases of lateritic gravel and sand and loam, which are difficult to locate without detailed local knowledge or expensive drilling programs.

Methods of investigation

The report and maps of Zahawi (1979) were used as a starting point. After discussions with government, council and industry personnel most current extractive operations were visited and possible new deposits examined. Some additional field traversing was carried out in the hills north of Helidon to locate general areas of fine to medium-grained sandstone of possible interest for building stone. Time and funding constraints did not allow further drilling of possible sand deposits, although this would have been desirable to supplement the data of Zahawi (1979). Further investigations of potential deposits of brick clay were not considered warranted as there has been little industry interest in such materials in the area.

Presentation of results

The locations of workings of quarry rock, sand and loam, building stone and other minerals are shown on the accompanying Helidon and Esk 1:100 000 maps (Plates 1 and 2), indexed by abbreviated Australian Map Grid co-ordinates. Brief notes on the workings are tabulated, and the more significant operations are also described in the text. The information is current as at February 1987.

Potential deposits of quarry rock, sand, gravel and clay are outlined on Maps 1 and 2 and classified in either of two categories, namely (i) significant sources and (ii) minor or possible sources, based on quality, reserves, and the level of available information. The reconnaissance level of the investigation allowed only a qualitative estimation of resources, using the terms large, moderate, and small. These refer to working lives at current production rates of more than a decade, a few to 10 years, or a few years only, respectively.

Acknowledgements

The assistance of officers of the Gatton Shire Council, the Queensland Water Resources Commission, the Department of Forestry and the Main Roads Department in providing information on workings and possible deposits is gratefully acknowledged. Mr D. Carmichael (Department of Mines) assist with his knowledge of the sandstones of the Helidon Sandstone unit.

GEOLOGICAL SETTING AND ITS INFLUENCE ON THE OCCURRENCE OF MATERIALS

The following discussion, which is taken chiefly from Zahawi (1979), outlines the extent of the various rock types of the Shire, and indicates their significance for extractive industries. A summary of the geological units is shown in Table 1, which has been modified from Cranfield & others (1976) and Zahawi (1975).

ROCKS OF PALAEOZOIC AGE

These rock units crop out within a small area in the far north of the Shire. They form the basement on which the subsequent sedimentary rocks of Mesozoic age, which underlie the greatest part of the Shire, were deposited.

Cressbrook Creek Group (Pc)

The Cressbrook Creek Group of Permian age includes the Biarraville Formation, the Box Gully Formation, the Buraba Mudstone, and an undivided unit.

The Biarraville Formation (Pcr) is about 45 m thick and consists of chert, hard sandstone, siltstone, and mudstone. It also includes rhyolite, sedimentary breccia, crinoidal limestone, and coarse-grained andesitic conglomerate. The unit crops out in a small area to the east of Mount Cross. The rocks in the area are generally weathered and have little potential for extractive industry.

The Box Gully Formation (Pcg) crops out to the east of Mount Cross and consists largely of sandy conglomerate and sandstone. The sandstone is black to grey, fine-grained, non-calcareous, and carbonaceous in places. Minor shale and andesite are interbedded.

This unit forms rugged topography with steep slopes strewn with boulders. The sandstone is unsuitable for quarry rock or building stone.

The Buaraba Mudstone (Pcb) consists predominantly of black and brown carbonaceous mudstone and shale. The mudstone is usually massive but in places it is rhythmically interbedded with sandstone. The unit crops out in a small area in the vicinity of Mount Cross and is usually weathered. It is of no significiance for extractive industry..

Undifferentiated Cressbrook Creek Group (Pc). This unit is confined to an area south and west of Mount Cross where it crops out mainly in the incised valleys of Alice Creek and other streams. The rocks consist of interbedded mudstone, massive dark grey to dark green chert, grey rhyolite, andesite, conglomerate, and light grey medium-grained sandstone. More recent geological mapping (Geological Survey of Queensland, 1980) suggests that some of these rocks are older than Permian and predate the Cressbrook Creek Group. The rhyolite could be suitable as road-base, but the constricted valleys and interbedding with other rocks would make exploitation difficult. Traces of gold have been recorded here in the past and are under investigation at present. Marble has reportedly been worked near Mount Cross.

TABLE 1. GEOLOGICAL UNITS OF GATTON SHIRE

	Age	Geological formation and letter symbol		Main rock types
CAINOZOIC	QUATERNARY	Alluvium (Qa)		Silt, clay, sand and gravel
		Colluvium (Qx)		Gravel, sand, silt
	TERTIARY	Intrusive plugs (Tv)		Basalt
		Main Range Volcanics (Tm)		Basalt, minor trachyte
MESOZOIC	JURASSIC	Walloon Coal Measures (Jw)		Sandstone, siltstone, shale, coal seams
		Bundamba Group	Marburg Formation (upper beds) (Jbm^2)	Quartz sandstone, conglomerate, siltstone, shale
			Marburg Formation (lower beds) (Jbm^1)	Lithic and feldspathic sandstone, siltstone, shale
	TRIASSIC TO JURASSIC		Helidon Sandstone (R-Jbh)	Quartz sandstone
	PERMIAN TO TRIASSIC	Undifferentiated intrusions (P-Rg)		Diorite, quartz diorite, microdiorite, granite, tonalite, aplite, granodiorite, gabbro
PALAEOZOIC	PERMIAN	Cressbrook Creek Group	Undifferentiated (Pc)	Mudstone, chert, rhyolite, andesite, conglomerate, sandstone
			Buaraba Mudstone (Pcb)	Mudstone, shale
			Box Gully Formation (Pcg)	Conglomerate, sandstone
			Biarraville Formation (Pcr)	Chert, sandstone, siltstone, mudstone, rhyolite, breccia, limestone, conglomerate

Undifferentiated Permo-Triassic intrusions (P-Rg).

These rocks in the far north of the Shire consist mainly of grey-green to brown diorite, quartz diorite, and black fine-grained microdiorite. The rocks in the northern part of the outcrop area are less weathered than those in the south, and further investigations could locate microdiorite suitable for use as screenings and concrete aggregate. Much further south, a small outcrop of a coarse-grained granitic rock has been located adjacent to Sandy Creek north of Grantham; it is presumed to be of similar age.

SEDIMENTARY ROCKS OF MESOZOIC AGE

Bundamba Group

The Bundamba Group of Triassic to Jurassic age is the most extensive geological unit in the Shire. Its sedimentary rocks overlie the Palaeozoic basement in the north, and dip gently to south and southwest. The Group has been divided into the Helidon Sandstone (lowermost) and the Marburg Formation; the Marburg Formation has been further subdivided into two sequences: (i) lower beds of lithic sandstone, siltstone and shale, and (ii) upper beds of quartz sandstone with minor conglomerate, siltstone and shale. The terms Marburg Formation (lower beds) and Marburg Formation (upper beds), as used by Zahawi (1975), have been adopted in this report.

The Helidon Sandstone (R-Jbh) forms the forested hilly country in the north of the Shire. A broad plateau remains in places, but elsewhere this has been incised by streams to give narrow valleys with steep sides, and more isolated ranges and hills. The rocks are hard and massive, medium to coarse-grained quartz sandstone with a generally clayey matrix. Cross bedding is common, and pebble bands occur in some parts.

Massive, fine to medium-grained sandstone of this unit has been quarried for many years for the "Helidon Sandstone" or "Freestone" used as a facing and monumental stone in Brisbane, Toowoomba and elsewhere. This medium-grained material appears to occur towards the top of the unit (D. Carmichael, personal communication) and consequently crops out mainly in the southwest of the area of exposure of the unit. Coarser, medium-grained sandstone close to the top of the unit in the Murphys Creek area ("Murphys Creek Sandstone") was also quarried late last century.

Lateritic ironstone gravel has developed in the soil profile of the sandstone on some of the gently undulating plateau areas. The ironstone nodules are to to 20 mm in diameter, and occur in a sandy matrix in a layer up to 1 m thick; the proportion of gravel and the thickness of the layer vary markedly. In places the gravel layer merges into weathered ferruginised sandstone (cemented by iron oxides). The ironstone gravel and ferruginised sandstone have been used extensively for sub-base and base course gravels for local roads.

The Marburg Formation (lower beds) (Jbm^1) crops out in relatively subdued topography south of the Warrego Highway. It consists of fine to medium-grained, lithic and feldspathic sandstone, and siltstone and shale. The sandstone is generally soft and clayey and gives rise to subdued undulating relief. The rocks are of little use for extractive materials, although deeply weathered shale could be suitable for use by brick clay industries if beds of sufficient thickness are located. Completely weathered sandstone has been used as sub-base for local roads and for fill. Lateritic ironstone occurs locally on this unit also and is used in road construction.

The Marburg Formation (upper beds) (Jbm^2) crops out in the southern and western parts of the Shire, mainly in the hilly to mountainous country between the major stream valleys. The unit comprises of alternating beds of hard sandstone and soft sandstone, siltstone and minor shale. The hard sandstones are quartzose and medium to very coarse grained with calcareous or ferruginous cement. Crossbedding and pebble lenses are common. The soft beds comprise medium to coarse-grained clayey sandstone, siltstone and shale.

Because of its variable hardness, the sandstone is not suitable as a building stone.

Walloon Coal Measures (Jw)

The Walloon Coal Measures overlie the Marburg Formation. They crop out in scattered exposures in the southern part of the Shire where they lie between the Marburg Formation and overlying lavas of the Main Range Volcanics. The unit consists of fine to medium-grained sandstone, siltstone and shale, with minor coal seams. The sandstone is soft and friable.

Weathered shale may be suitable for structural clay products, but most outcrops are located at relatively high elevations and would be of difficult access. The unit contains economic coal seams to the east at Rosewood and to the west on the Darling Downs, but has no coal potential in the Gatton Shire because most of the strata were eroded from the area before the volcanics were erupted.

LAVAS AND INTRUSIVE ROCKS OF TERTIARY AGE

Main Range Volcanics (Tm)

The Main Range Volcanics consist of olivine basalt and minor trachyte. The basalt occurs in numerous flows which are exposed in the escarpment at the eastern flank of the Great Divide. They also form a number of high mountain peaks in the southern part of the Shire, for instance Mount Mistake, Mount Lowe and Mount Zahel. Generally, the basalt flows are deeply weathered and are located at relatively high elevations. They are of little significance for the extractive industries apart from some local use for road maintenance gravels.

The trachyte crops out only in rugged, elevated terrain in the southern extremity of the Shire. Although less weathered than the basalt, its inaccessibility makes extraction out of the question.

Intrusive plugs (Tib)

Several basalt plugs are scattered in the central part of the Shire, and could mark possible feeders of the Main Range Volcanics. These plugs are usually less weathered than the lavas, and some have been worked for crushed aggregate and high quality road gravels. The basalt contains some olivine crystals and is generally fresh to slightly weathered. The plugs display columnar jointing and occassionally are surrounded by steep talus slopes.

UNCONSOLIDATED CAINOZOIC SEDIMENTS

Colluvium (Qx)

Colluvial or hillwash deposits occur on lower slopes marginal to stream alluvium. These deposits consist of mixed gravel, sand and silt and are seldom very thick. They are of little significance for the extractive industry.

Alluvium (Qa)

Alluvium is found in association with all the major streams. The deposits generally consist of mixed gravels and sands at the base, succeeded by sandy loams, silts and clays in later layers.

The higher terraces adjacent to Lockyer Creek are mainly formed on silts and clays, but some lower terraces are in part underlain by sand under economical depths of overburden. Gravelly sand occurs in the bed of Lockyer Creek but extraction of remaining material is now prohibited to minimise erosion of the stream banks. Several creeks draining the hills of the Helidon Sandstone are lined by small alluvial flats underlain by sand and gravel. Bouldery gravel and sand occur in the beds of streams in the south of the Shire.

QUARRY ROCK

The term 'quarry rock' refers to hard rock broken from a face, weathered or soft rock broken, ripped or scraped from quarries or pits, and lateritic ironstone gravels scraped from shallow pits. Workings of building stone are described in a following chapter.

Clean concrete aggregate and bitumen screenings may be produced from crushed fresh, hard rocks, or screened from more weathered rocks. Road pavement gravels may be obtained from crushing of weathered rocks to produce a mixture of hard fragments set in a silty binder, or from ripping and scraping natural gravels, such as the ironstone layers in the north of the Shire. For high quality road gravels, blending of clean crushed aggregate with suitable non-clayey binders may be necessary. Road maintenance gravels are low quality materials used for the maintenance of unsealed roads and road shoulders.

Rock quarrying operations on freehold land are administered by the Shire Council. The extraction of quarry rock on Crown land is controlled by the Department of Forestry. Working practices in larger quarries may be controlled by the Department of Mines under the Mines Regulation Act to ensure operational safety.

GEOLOGICAL SOURCES

The Shire is not well endowed with sources of rock materials, as most of the area is underlain by unsuitable rock types, such as the soft sediments of the Helidon Sandstone, Marburg Formation and Walloon Coal Measures, and the weathered and inaccessible lavas of the Main Range Volcanics.

The small intrusive basalt plugs (Tib) provide sources of hard rock suitable for clean crushed screenings and better quality pavement gravels, but only a few of these are known.

The lateritic ironstone gravels north of Helidon have been the main source of pavement gravels for local roads, but existing sources are being depleted. Additional resources are likely but these are in increasingly remote areas. Moreover, working of these shallow deposits necessitates the disturbance of relatively large areas in proportion to the volume of material obtained, resulting in rehabilitation problems and unpopularity with landholders.

Weathered basalt has been used for maintenance gravels for local roads near Rockside, and at Black Duck Creek where overburden from the diatomite mine is used.

PRESENT PRODUCTION

Routine requirements of crushed screening for the Shire are usually obtained from basalt quarries at Toowoomba or Mount Marrow to the east. Local production is mainly for road pavement gravels, which are won chiefly from shallow scrapings in the lateritic ironstone gravels in the north of the Shire. However, three quarries have been worked intermittently in intrusive basalt plugs for crushed pavement gravels for major road projects, and for some bitumen screenings, concrete aggregate and rip rap. There are plans for one of these to be re-opened to supply local needs.

The workings of quarry rock in the Shire are listed in Table 2 and their locations shown on Maps 1 and 2. The following are some of the more significant operations.

Basalt

Mount Whitestone quarry (1637). This sizeable quarry has been established in a small basalt plug (Tib) which forms part of a steep ridge adjacent to the Gatton-Clifton road about 20 km southwest of Gatton. It has been worked intermittently for many years by the Main Roads Department (who has control of the property), the Gatton Shire Council and contractors for those bodies. Early developments at the quarry were described by Shipway (1961).

The side of the ridge is very steep and this has inhibited development in the past, but a recent contractor has established several benches up to the summit, which if worked systematically in the future, should allow access to the moderate to large resources remaining in the mountain.

The basalt is slightly weathered to fresh and has minimal overburden; some olivine crystals are present throughout. The faces of the quarry exhibit columnar jointing with a column width of 20 to 40 cm.

The rock is suitable for crushed screenings and high quality pavement gravels. In 1986-87 Theiss-Watkins Constructions Ltd worked the quarry for crushed rock to blend with a sandy loam binder for pavement gravels for the new Gatton-Helidon bypass. F.H. Transport also worked the quarry for rip rap for a weir near Laidley; because of the narrow width of the columns only relatively small rip rap was obtained.

Ropely Road quarry (2743). A basalt plug (Tib) forming a low hill about 20 m high, 150 m long and 50 m wide above the alluvial flats of Deep Gully near Ropely Road supports this small quarry, which was commenced in recent years by Brooks Earthmoving and Quarries. A face about 40 m wide and 12 m high exposes moderately to slightly weathered basalt with minimal overburden, and well developed columnar jointing.

The rock is suitable for crushed screenings and high quality pavement gravels. Zahawi (1979) gave some test results. A crushing plant has been erected and stone is produced periodically for road building projects, but the operator hopes to commence more regular production in 1987 to supply a range of crushed rock products to the Gatton market.

Paradise Creek quarry (1937). This working was established in recent years in a scree slope of basalt boulders and cobbles, which have been shed from a basalt plug cropping out on a ridge to the east of Mount Whitestone. The Gatton Shire Council used a portable crusher to produce some bitumen screenings for local roads, but discovered that although the rock was suitable, the scree was contaminated with soil at disappointingly shallow depths. Some shallow resources remain which could be worked again for local use.

Laterite ironstone scrapings

A number of such scrapings have been worked in the past over the area of outcrop of the Helidon Sandstone in the north of the Shire, but only a few have been important in recent years. The material consists of a 1 m thick layer of sparsely developed ferricrete gravel and hardened ferruginised sandstone fragments set in a sandy soil profile. It is generally suitable for maintenance and sub-base gravels and for base course for secondary roads. For base course for major roads and highways, blending of crushed stone (eg. basalt) is usually necessary.

Montgomery's scrapings (1158), covering extensive areas near Lockyer siding northwest of Helidon, have been worked for many years by the Gatton Shire Council and the Main Roads Department. Some reserves remain, but many of the most accessible areas are now exhausted.

The Pistol Club scraping (1455) north of Helidon is a similar extensive area worked recently by the Gatton Shire Council, and contractors for the Main Roads Department for the new Gatton-Helidon bypass highway. Large quantities have been removed and remaining accessible reserves would now be limited.

Smith's pit (3461) on Kruger Road northeast of Gatton is a smaller pit worked occassionally by the Gatton Shire Council for maintenance and sub-base gravels for local roads. Additional reserves occur in adjoining areas, but the deposit is reportedly patchy in quality and rural residential settlement is increasing in the area. The Shire Council also obtains small amounts of ferruginised sandstone from the **Forestry pit (3160)** in State Forest at the end of Millers Road not far to the south.

Other sources

Weathered basalt overburden from the Black Duck Creek diatomite mine (1722) is screened by the Shire Council for maintenance gravels for local roads in that area. Similar weathered basalt is worked occassionally by the Council for that purpose from private property in the Rockside area (Portion 190). Coarse creek gravel is worked for maintenance gravels for local roads in the southern part of the Shire, but

TABLE 2. WORKINGS OF QUARRY ROCK

Working No. and name	1:100 000 Sheet and Grid Reference	Geological formation and rock type	Status	Operator	Uses	Comments
1158 (Montgomery's scrapings)	H 113577	Lateritic ironstone gravel on R-Jbh	Worked	GSC	Sub-base and base-course gravels for local roads.	Very extensive series of shallow scrapings.
1455 (Pistol Club scrapings)	H 144554	Lateritic ironstone gravel on R-Jbh	Occassionally worked	MRD, GSC, contractors	Sub-base and blending with crushed rock for base-course for highways.	Very extensive shallow scraping.
1637 (Mt Whitestone quarry)	H 162372	Tib - basalt	Occassionally worked	Contractors for MRD and GSC	Crushed rock for pavement gravels, bitumen screenings, rip rap.	Large quarry on very steep knob of hard rock; several benches.
1937 (Paradise Creek quarry)	H 187367	Tib - basalt scree slope	Disused	GSC	Bitumen screenings.	Site where boulders of scree slope processed by portable crusher.
2743 (Ropely Road quarry)	H 266432	Tib - basalt	Occassionally worked	Brooks Earthmoving and Quarries	Crushed rock for pavement gravels, bitumen screenings.	Moderate-sized quarry in low knob of hard rock.
3160 (Forestry pit)	E 307598	Lateritic ironstone gravel on R-Jbh	Occassionally worked	GSC	Sub-base gravels for local roads.	Small scraping, limited production allowed by Forestry Department.
3461 (Smith's pit)	E 337612	Lateritic ironstone gravel on R-Jbh or Jbm^1	Occassionally worked	GSC	Sub-base and base-course gravels for local roads.	Moderate-sized scraping.
9962 (Spring Bluff quarry) (not shown on maps)	O 993616	Tm - basalt	Abandoned	Railways Department	Ballast?	Very old steep face.

Abbreviations: Geological formations: R-Jbh - Helidon Sandstone, Jbm^1 - Marburg Formation (lower beds), Tib - Intrusive basalt plugs, Tm - Main Range Volcanics

Operators: GSC - Gatton Shire Council, MRD - Main Roads Department

Sheet areas: E - Esk, H - Helidon, O - Oakey

this material contains too many cobbles of soft sandstone to be suitable for better quality road gravels. Miscellaneous coarse gravels are worked from the creek at Mount Sylvia (2333) by Brooks Earthmoving and Quarries.

POTENTIAL DEPOSITS

The Shire is poorly endowed with deposits of good quality rock and no additional significant deposits have been located or reported since the last survey (Zahawi, 1979).

Basalt

Sources of rock suitable for crushed aggregate are limited to resources remaining in the quarries at **Mount Whitestone** (1637) and **Ropely Road** (2743) and to a lesser extent in the scree slope at **Paradise Creek** (1937). With the small local demand for such products, and the availability of rock from the quarries at Toowoomba, these reserves should be adequate for the forseeable future. It is important however, that the steep Mount Whitestone quarry is worked in a professional manner so that its important reserves are not wasted by poor quarry design and development which could allow operations to become uneconomic.

Investigation of the basalt outcrop giving rise to the Paradise Creek scree slope may be warranted to determine whether quarrying is possible on the steep ridge.

Zahawi (1979) mentioned a scree slope adjacent to the Murphy's Creek-Toowoomba road, but it is considered of little significance because of its awkward location above the creek and its steepness.

Laterite ironstone gravels

Remaining reserves at **Montgomery's scrapings** (1158), which are mainly to the north towards Alice Creek, and the **Pistol Club scraping** (1455) are now limited, and those near **Smith's pit** (3461) on Kruger Road are patchy in quality. Recently the Gatton Shire Council has purchased portion 91 north of Helidon (GR 145585) for a future source of gravel.

Large parts of the area of outcrop of the Helidon Sandstone north of Helidon are covered by such gravels, but significant deposits appear limited to the broader ridge crests rather than steeper, rockier sections. Zahawi (1979) outlined several deposits, largely from airphoto interpretation or brief inspection, where further investigations may be warranted; the following is a brief summary.

About 8 km **northeast of Helidon** (GR 172582) a deposit approximately 500 x 50 m has been proved by backhoe trenching east of the Helidon-Ravensbourne road. West of the road, sporadic deposits appear to occur for some distance over a broad ridge crest between **Upper Sheep Station Creek** and Alice Creek (GR 151586). The best area appears to be that recently purchased by the Shire Council (portion 91, GR 145582) towards the western end; this is the area shown on the map.

West of the Gatton-Esk Road near Springdale (Kruger road, GR 335612) the deposit previously shown has been re-defined and expanded following the Council's experience with Smith's pit. However, the material is reportedly patchy over this area.

The Shire Council also reports a deposit on **Thomas's** property on portion 159 northeast of Helidon, east of the Helidon-Ravenswood road (GR 170545 approx.).

East of **Mount Perseverence** (GR 207666) cuttings of the Helidon-Ravensbourne Road show a thin laterite ironstone, suggesting that this area could be prospective for such materials.

The deposits on the broad ridge crests between **White Mountain** and Racecourse Creek (GR 128645) and west of **Mount Cross** between Alice and Paradise Creeks (GR 140625) were outlined on the basis of airphoto interpretation. However they are in relatively remote areas with poor access, and are situated in State Forests where the extensive surface disturbance involved in working these materials may not be tolerated.

A deposit was previously shown east of Murphys Creek between Fifteen Mile Creek and Murphys Creek (GR 098628), but re-inspection suggests it may be shallow and discontinuous and it has been deleted.

Decomposed granite

A small outcrop of coarse granite adjacent to Sandy Creek north of Grantham is decomposed, and the material disintegrates to a fine gravel when excavated. It may have use for lower quality pavement gravels, but it has a high content of soft, weathered feldspar grains which could deteriorate further to clay in service. Thorough testing of the material would be necessary.

SAND, GRAVEL AND LOAM

Sand and gravel are natural detrital materials derived from rocks and minerals by weathering and transport by creeks and rivers. The grain size of sand ranges from 0.06 to 2 mm and that of gravel from 2 to 60 mm. Loam is a mixture of fine sand, silt and clay. Loam with low clay and silt content is used as bricklayer's loam; with higher silt and clay contents it is suitable for top dressing in landscaping.

The extraction of sand and gravel on freehold land is administered by the Shire Council. The Queensland Water Resource Commission controls extraction from boundary watercourses. Extraction from Crown land is administered by the Department of Forestry.

GEOLOGICAL SOURCES

Well-graded fine to coarse-grained sand with minor gravel, suitable for concrete aggregate and other construction purposes, are present in the bed and adjacent alluvial flats of the upper parts of Lockyer Creek and its northern tributaries. These materials are mainly derived from the Helidon Sandstone to the north.

Loamy sand suitable for bricklayer's loam occurs in a residual soil profile on some lower slopes of the Helidon Sandstone west of Gatton.

In the south of the Shire deposits of coarse sand, gravel, cobbles and boulders of basalt and sandstone occur in the bed and adjacent alluvial flats of Flagstone, Ma Ma, Tenthill and Blackfellow Creeks and their tributaries. These are not particularly

useful because of the proportion of oversize material and the presence of fragments of unsuitably soft sandstone.

PRESENT PRODUCTION

The district's requirements for concrete and bedding sands are met from a major operation on an alluvial flat of Lockyer Creek near Grantham, several pits adjacent to Sandy Creek north of Grantham, a few small pits elsewhere in creeks in the northern part of the Shire, and from Buaraba Creek in Esk Shire to the north. Bricklayer's loam is won from a pit west of Gatton. These pits also supply a large proportion of their production to the Toowoomba market, where resources of sand are almost non-existent.

In the past sand has been won from the bed of Lockyer Creek, but this is usually no longer permitted by the Queensland Water Resources Commission because of undercutting of adjacent banks following deepening of the stream bed.

All workings in the Shire are listed in Table 3 and their locations are shown on Maps 1 and 2. The main current operations are described below. The workings on Buaraba Creek in Esk Shire are not included.

Martin and Sons' pit, Grantham (1850). F.J. Martin and Sons have been active in this area for many years, and since the withdrawal of permits to dragline the bed of Lockyer Creek, have excavated a deep pit in the adjacent alluvial flat. Overburden of dark silt 3-4 m thick covers 3-4 m of pebbly fine to coarse sand, which overlies more than 6 m of gravelly and bouldery coarse sand. This last material is excavated by dragline from below the water table; the resulting pit is progressively backfilled with oversize boulders and gravel, and covered with the silt overburden. An adjacent screening plant produces fine and coarse concrete sand, bedding sand, plaster sand and some bricklayer's loam. Some gravel of 10 mm and 20 mm size is screened off for packing, drainage and landscaping purposes but it is unsuitable for concrete screenings because of a high proportion of soft sandstone fragments, amongst otherwise mainly basaltic material. The company has proven large resources of similar material beneath the alluvial flat south of the pit, which should be sufficient for many years.

Roots' pit, Sandy Creek, Grantham (1851). This is essentially a widening of the bed of Sandy Creek by dragline operations of N.H. and R.M. Roots. Sand is won from the bed of the creek and the adjacent edge of the northern alluvial flat. It is relatively fine, and is used mainly for fine concrete sand and bricklayer's loam, with the intermittent production mainly destined for the Toowoomba market. Resources would now appear to be small, unless the sand extends beneath the alluvial flat at economical overburden depths; unfortunately no subsurface information is held for this area.

Sellars' old pit, Sandy Creek (1951). This extensive old working is immediately upstream of Roots' pit (1851) in similar material. The creek bed appears worked out and material on the alluvial flat quite clayey. The pit was inactive in early 1987 and resources would appear to be small.

Roots' new pit, Upper Sandy Creek (1952). When inspected in early 1987 this small dragline operation in and adjacent to the creek was inactive. Small amounts of fine sand had been excavated, presumably for concrete sand. Resources would appear to be small.

Sellars' new pit, Upper Sandy Creek (2053). F.J. Martin and Sons work this medium-sized shallow pit on an alluvial flat beside the creek, and process the excavated material, on behalf of Sellars Quarries. Medium to coarse gravelly sand is interbedded with layers of cobbles and boulders of sandstone, and lenses of orange clayey fine sand. The variability of the materials, and in places considerable overburden, make the deposit difficult to work. Production includes concrete sand, bedding sand, bricklayer's loam and top soil. Resources are small, being limited by the dimensions of the alluvial flat.

Redbank Creek pit (2958). Small amounts of medium-grained sand are removed from the bed of Redbank Creek on an occassional basis by Brooks Earthmoving and Quarries. It is sold for local use in concrete aggregate, and bedding sand. Resources are small but probably sufficient for a few years at this low level of production.

Spring Creek pit (3561). Brooks Earthmoving and Quarries also remove small amounts of fine to medium sand from the bed of this creek on an occassional basis for similar uses to the Redbank Creek material. Resources are small because of the narrow width of the creek bed and dense vegetation along it.

Yellow Gully pit (3467). The bed and an adjacent small alluvial flat of this creek are worked by Brooks Earthmoving and Quarries on an occassional basis. Organic top soil overlies interlayered fine to medium sand and organic silt 2-3 m thick beneath the flat, and the creek bed contains gravelly medium to coarse sand. The creek sand is used for concrete aggregate, but that from the alluvial flat is too contaminated and would be useful mainly for bedding material. Top soil is also produced from the overburden. Resources are small, as the creek is being excavated primarily for a dam.

Lockyer Creek weir (3454). This is a temporary operation permitted by the Queensland Water Resources Commission to clean out accumulated sand behind a weir on Lockyer Creek during a dry season. The sand is contaminated with clay lumps, charcoal and shells, and is useful only for bedding material. In early 1987 it was being removed by Brooks Earthmoving and Quarries and stockpiled nearby on the northern side of the creek.

Brook's loam pit (2452). A gentle slope adjacent to the railway west of Gatton is the site of this shallow (1 m) scraping in fine loamy sand. The sand forms a layer about 0.5 to 0.7 m thick in the upper part of the soil profile, and its relatively high silt content makes it suitable for bricklayer's loam. The pit is worked by Brooks Earthmoving and Quarries for the Toowoomba market (for which it is an important source) and for local demand. As the loam appears to be residual and not related to stream deposition, large reserves could extend beneath similar gentle slopes in adjacent areas. Other areas have been scraped in the past by the company around GR 245530, and not far to the north, **O'Keefe's pit (2453)** works small amounts of similar loam for the Toowoomba market.

Tenthill Creek, Mount Sylvia (2333). Brooks Earthmoving and Quarries remove small amounts of gravel from this site for use as drainage, bore-packing and landscaping material. There are too many soft sandstone cobbles and the remaining basalt fragments are too rounded and tough, to allow crushing of the material for aggregate. The associated sand is also too dirty to be of use. Considerable amounts of similar material occur in most of the streams in the southern part of the Shire, but it is used only for maintenance gravels for local roads by the Shire Council.

TABLE 3. WORKINGS OF SAND, GRAVEL AND LOAM

Working No.	1:100 000 Sheet and Grid Reference	Material type	Status	Operator	Uses	Comments
1850	H 178497	Sand and gravel beneath alluvial flat	Worked	F.J. Martin and Sons	Fine and coarse concrete sand, bedding sand, plaster sand, miscellaneous gravel.	Large deep pit beneath alluvial flat.
1851	H 180505	Sand of creek bed and alluvial flat	Worked	N.H. Roots	Fine concrete sand, bricklayer's loam.	Dragline operation in creek bed and adjacent edge of alluvial flat.
1951	H 186510	Sand of creek bed and alluvial flat	Disused +Reestablished	Sellars Quarries Reestablished	Fine concrete sand, bricklayer's loam.	Old worked out area of creek bed and adjacent alluvial flat.
1952	H 194521	Sand of creek bed and alluvial flat	Disused	N.H. Roots	?	Small dragline operation in creek bed.
2053	H 199534	Sand beneath alluvial flat	Occassionally worked	F.J. Martin and Sons for Sellars Quarries	Concrete sand, bedding sand, bricklayer's loam, top soil.	Shallow end-loader operation on alluvial flat.
2333	H 232333	Gravel and sand of creek bed	Occassionally worked	Brooks Earthmoving and Quarries	Miscellaneous coarse gravel.	Gravel removed from creek bed by end-loader.
2450	H 237496	Alluvial soil	Occassionally worked	Brooks Earthmoving and Quarries	Garden soil.	Small pit.
2452	H 239524	Residual loam	Worked	Brooks Earthmoving and Quarries	Bricklayer's loam.	Moderate-sized shallow scraping.
2453	H 238530	Residual loam	Occassionally worked	Mr O'Keefe	Bricklayer's loam.	Small shallow scraping.
2958	H 287575	Creek bed sand	Occassionally worked	Brooks Earthmoving and Quarries	Concrete sand, bedding sand.	Small end-loader operation in creek bed.
3454	H 342537	Creek bed sand	Worked for limited period 1987	Brooks Earthmoving and Quarries	Bedding sand.	Temporary removal of sand accumulated behind weir; contaminated with impurities.
3467	E 340669	Sand of creek bed and alluvial flat	Occassionally worked	Brooks Earthmoving and Quarries	Concrete sand, bedding sand, top soil.	Small pit in alluvial flat and adjacent creek bed.
3561	E 354612	Creek bed sand	Occassionally worked	Brooks Earthmoving and Quarries	Concrete sand?, bedding sand?	Very small end-loader operation in creek bed.

Abbreviations: Sheet areas: E - Esk, H - Helidon

POTENTIAL DEPOSITS

Gatton Shire has few potential sources of sand and gravel of significant size and good quality. Those that are known fall into four categories, namely, alluvial flats adjacent to Lockyer Creek, the beds and adjacent alluvial flats of small creeks draining the Helidon Sandstone, gently sloping lower areas of the Helidon Sandstone with residual deposits of loamy sand, and the gravelly beds of streams in the southern part of the Shire.

Alluvial flats adjacent to Lockyer Creek

The experience in Martin and Sons' pit near Grantham (1850) shows that there is potential for sizeable deposits of sand and gravel beneath some of the lower alluvial flats of Lockyer Creek, providing significant amounts of overburden (in the order of 5 m) can be removed economically.

The most promising areas would appear to be lower flats adjacent to major bends of the stream, as is the case with Martin and Sons' pit. Various evidence suggests that several deposits may be present upstream of Grantham, but drilling results of the Queensland Water Resources Commission suggest that little sand is present beneath the flats of the major bends downstream of this point.

Extensions to Martin and Sons' pit (GR 177496). This company reports that drilling has shown extensive deposits beneath most of this alluvial flat (as shown on the map) to similar depths as in the existing pit (1850). These represent an important resource for the future.

South of Helidon (GR 136508). Drilling by the Geological Survey of Queensland during the previous program (Holes GNS 1-8, Cooper and Zahawi, 1979) has shown that a small lower terrace on the northside of Lockyer Creek in this locality consists of 1 to 3 m of sandy loam overlying 1 to 7 m of gravelly sand and sandy gravel. However, the terrace is relatively narrow and could be difficult to work without disturbance to the bed of the creek. The adjacent, much broader middle terrace to the north is underlain by up to 10 m of loam, clayey sand and clay, some of which may be workable at least for loam. However, the deposit is bisected by a main road.

South of Helidon (GR 132516). Reconnaissance drilling during the previous program (Holes GNS 9-13, Cooper and Zahawi, 1979) indicates the presence of medium to coarse gravelly sand 3 to 4 m thick beneath 4 to 6 m of finer grained sand and loam. The deposit lies on open farm land south of the Warrego Highway where there should be few constraints on extraction.

South of Lockyer siding (GR 092561). A broad lower terrace on the southern side of Lockyer Creek was seen to be formed on sand with minimal overburden, and some material was reportedly extracted in past decades. The terrace would flood regularly, and it is uncertain whether some parts could be considered as higher channels of the stream bed. Nevertheless at least some extraction from this area should be possible without detriment to the stream course.

The adjacent landowner reports that a somewhat higher middle terrace immediately to the south (GR 091560) is also underlain by sand, but no drilling results are available. A low terrace on the northside of the creek at GR 086564 has also been worked in the past and may have some resources remaining.

Because of the considerable areal extent of these deposits, they could represent a major resource for the future.

Creeks draining the Helidon Sandstone

Sandy Creek, Grantham: Resources adjacent to existing pits along this creek would now appear limited. A few additional small alluvial flats and sections of the creek bed may have some potential, but volumes would not be large.

The main area of potential appears to be low alluvial terraces and the creek bed between Roots' new pit (1952) and Sellars' new pit (2053). Landowners also report small sand deposits at GR 200550. No subsurface information on the depth and quality of these deposits is known.

Redbank Creek: This stream system would seem to have only minor future potential. Small deposits may occur in the stream bed downstream of existing working (2958) but access to them across farmland and increasing rural residential settlement is becoming difficult. Although no subsurface information is available, it would seem that the small adjoining alluvial flats are mainly underlain by clayey loam materials.

In the lower reaches of the creek northeast of Gatton, drilling has shown patches of sand beneath alluvial flats around GR 311545, 320540, 320535, and 315533, presumably occurring in old stream courses (Wolff, 1966, 1971). However, these sands are tapped for groundwater for the supply of Gatton and the Lawes Agricultural College, and probably would not be available for extraction. Small farms and rural residential settlement are also increasing in these areas.

Spring Creek and Yellow Gully: As with Redbank Creek, there would seem to be only minor deposits along these streams, chiefly in the narrow stream beds. Obtaining access from landowners to such small deposits is also commonly difficult.

Residual deposits of loam: Clayey loam soils are commonly developed on sandstone-dominant formations, but those with a sufficiently low clay content and a high content of quartz appear to be restricted to lower, gentle slopes on the Helidon Sandstone. Such topography on this unit is rare, and only one major area is known west of Gatton surrounding the pit of Brooks Earthmoving and Quarries (2452). This area is shown on the map as a possible deposit, although it should be realised that the material could be patchy within it, and further investigation would be required to delineate workable deposits.

Gravel and sand along streams in the southern part of the Shire

Sandy gravel with boulders occurs in the beds of many of these streams and beneath adjacent low level alluvial flats. However, no deposits have been outlined on the map as the material is of limited use due to soft sandstone fragments and impurities in the sand.

CLAY MATERIALS

Clay materials include clay and weathered shale suitable for the manufacture of ceramic products by the application of high temperature. "Structural clay" is a term used for material suitable for bricks, pipes and common pottery. Many clays can be used for such purposes, particularly if blended to obtain the best mix of properties. "Special purpose clays" are those suitable for more sophisticated uses such as pottery, whiteware, fire bricks and lightweight aggregates.

Clays are not being worked at present in Gatton Shire, and materials available hold little promise for future establishment of ceramic industries in the district. The nearest clay pits are at Toowoomba and south of Ipswich.

The geological units with some possible potential for clay in the Shire are described below.

Walloon Coal Measures: Although clay materials from this unit are the main source for brickworks at Kleinton north of Toowoomba, in the Gatton Shire the unit outcrops only in the south at high elevations, with difficult access and long transport distances. Utilisation is unlikely.

Marburg Formation (lower beds): Siltstones and shales of this unit are probably too thinly interbedded with sandstone beds to be easily exploited.

Alluvium: Generally the suitability of alluvial clays for ceramic use is impaired by the presence of carbonate material (calcite nodules) and by the high drying and firing shrinkages which cause cracking of the fired ware.

Results of firing tests undertaken for some clay materials from the district are given by Zahawi (1979) and Cooper & Zahawi (1979).

BUILDING STONE (SANDSTONE)

Sandstone for building purposes has been quarried from the Helidon and Murphys Creek districts for over 100 years. A number of quarries have been worked, but production declined drastically after the 1950s with increasing labour costs and new building techniques. However, two quarries near Helidon have continued production on a modest scale.

Over the last three years there has been a renewed interest in the Helidon stone, particularly for rough landscaping applications and for cutting into tiles, which are reportedly being exported. Three new quarries have been established during this period.

PRESENT SOURCES

"Helidon Sandstone"

This stone is obtained from thick beds of fine to medium-grained sandstone within the Helidon Sandstone unit north of the town. It is variable in colour, ranging from light brown through pink and mauve to white-grey; variagated concentric banding is common in places, speckled "pepper and salt" material in others. Light brown stone with or without slight banding has been the most popular. White material appears to be more common close to the surface and to be a result of weathering, but overall the distribution of colour is unpredictable even after faces are exposed. Because of the subdued topography the quarries have been developed mainly as deep pits; problems encountered have been the variability of colour and hardness, some closely spaced sets of joints, indistinct and irregular bedding planes, and drainage of pits (Morton, 1927; Denmead, 1945). In the past when sizeable blocks of consistent

colour were required there was a high wastage rate, but much of the discarded material is suitable for rough use and cutting for tiles. Richards (1918) and Wolff (1957) gave physical properties and chemical analyses of the stone.

Wright's quarry (1756): This series of pits was one of the major quarrying operations that supplied stone for buildings around Brisbane, as detailed by Wolff (1957). Since the mid-1970s it has been operated by J.H. Wagner and Sons Pty Ltd of Toowoomba, who have produced small amounts of monumental stone and occasional lots of cut stone for specific contracts. At the face currently worked, overburden of about 2 m has been stripped by bulldozer, and 2 m x 2 m x 2 m blocks of the exposed massive sandstone are cut and separated from the face by a large arm chain saw, and broken from the floor by wedge and feathers. After some reduction in size the blocks are trucked to the company's works in Toowoomba where they are sawn and trimmed as required. Recent contracts have supplied Jupiters Casino at Surfers Paradise and the Hayman Island resort. Reserves on company land are still large, and additional material extends into adjacent State Forest.

Old State quarries (1257a&b): This other major historical source of stone for Brisbane, also consisting of several pits, has had a succession of owners. Originally Millers quarry, it was purchased by the State Works Department in the early 1920s, and later sold to P.J. Lowther and Sons. From the 1960's it has passed in succession to J.H. Wagner and Sons, R.C. Ziegler Quarries, and T. Spratt. These later owners continued to produce small amounts of monumental stone and occasional cut stone. In 1986 the property was subdivided, with the southern pits (1257a) passing to Mr T. Comerford, and the northern (1257b) retained by Mr Spratt.

Since 1986 Mr Comerford has been removing previous reject boulders for sale to the Helidon Sandstone Co. Pty Ltd at Beenleigh for tiles and thin wall slabs, as well as for rough landscaping work. He hopes to re-establish a quarrying operation in one of the old pits in the future. Mr Spratt is selling only small amounts for rough landscaping work but would also like to re-establish quarrying operations. Resources in both areas are still large.

Ziegler's new quarry (1158): R.C. Ziegler Quarries of Toowoomba work these three shallow pits in a worked-out section of Montgomery's road gravel scrapings. Most production occurs as rough-shaped slabs for retaining walls and other landscaping, but some blocks are removed to the company's works in Toowoomba for cutting and shaping for monumental purposes. At present white stone seems to predominate in the faces, but brown areas also occur. Older quarrying operations (Stronach's) may have occurred in this general area (see below and Denmead, 1945).

"Corrigan's quarry" (1555): The Lockyer Sandstone consortium headed by Mr W. Corrigan has recently commenced this quarry consisting of two faces on opposite sides of a gully, on portion 92 north of Helidon. Its aim is to supply blocks for cutting into tiles and wall slabs at a works established in Gatton. In the main face a layer of fine to medium-grained sandstone 2 to 3 m thick is sandwiched between overburden of 3 to 4 m of weathered coarse sandstone, and other unsuitable coarse sandstone beneath.

Despite some hard brown and mauve material, the rock being worked is mainly white, bleached and relatively soft, but this may improve as the face is advanced westward into the hill, as the present face is not far in from the side of the gully. However, overburden is likely to increase in this direction. Resources are small to moderate, as further south the workable band is too close to the surface and weathered, and the property boundary is not far west of the present face. Nevertheless, supplies should be sufficient for some years at current production levels.

Cleary's quarry (0963b): A small pit was recently opened by Mr E. Cleary in the Helidon Sandstone about 3 km northeast of Murphys Creek village. Only preliminary work in establishing a face has been undertaken, and some of the sandstone exposed so far is still relatively soft. The quarry was inactive when visited in early 1987, and is reported to have been abandoned.

Pearson's quarry (1757): The site of this once major quarry which supplied considerable amounts of stone to Brisbane is about 1.5 km north of Wright's quarry at about GR 166574. Its two high faces in massive, medium-grained sandstone adjacent to a gully have been abandoned for many years and are now overgrown by forest. Large heaps of waste blocks are present. Considerable reserves would appear to remain. Another quarry (the **Waterfall quarry, 1657)** is reportedly not far to the west; the quality of stone from this was apparently suspect (Anon., 1888).

Jude's quarry and Phippard's quarry: These old operations are mentioned by Richards (1918) but they have not been located. Phippard's quarry was apparently close to Wright's quarry and may be one of the pits around that operation. A few other small quarries are mentioned in Anon. (1888), including one towards Grantham.

"Lockyer Sandstone"

Stone with this name was worked briefly from two adjacent quarries (Stronach's) reportedly one mile northwest of Lockyer siding (Denmead, 1945). The material was apparently similar to that in other quarries of the Helidon Sandstone. The reported location seems incongruous as no prominent sandstone is evident in this area west of Lockyer Creek, which is moreover underlain by the Marburg Formation (lower beds) consisting of lithic sandstones interbedded with shale and siltstone. A location one mile **northeast** of the siding is more likely, as several old sandstone pits are marked in this area (near Ziegler's new quarry, 1158) on the 1936 Military map (1:63 360). Thus the "Lockyer Sandstone" would seem to be little different from the "Helidon Sandstone".

"Murphys Creek Sandstone"

This was worked from at least three quarries in the Murphys Creek area between 1870 and 1900 (Anon., 1888; Richards, 1918). The rock is a medium but variably grained white or light grey quartz sandstone, much lighter and coarser than the "Helidon Sandstone" and lacking the concentric colour bands. Small scale trough cross-bedding is evident in most places and is characteristic. It has performed well in several public buildings in Brisbane and elsewhere, including part of Parliament House, and is regarded as one of the best sandstones of the region.

As reports in the literature (Anon., 1888; Richards, 1918; Wolff, 1957) have not been clear as to the locations of the quarries and none of the stone has been produced for many decades, knowledge of the quarries has largely been lost. Cameron's quarry was reportedly on Fifteen Mile Creek 4 miles from Murphys Creek railway station and Montgomery, McLachlan and Sheddon's quarry was 1 1/2 miles from the station.

However, enquiries during this survey have revealed four very old quarries and a smaller pit in a sandstone which closely resembles that in the public buildings in Brisbane reportedly made from Murphys Creek Sandstone, although it is difficult to correlate the workings with those named in the old reports. The quarries appear to be in a layer or layers close to the top of the Helidon Sandstone unit, just below the Marburg Formation.

TABLE 4. SANDSTONE QUARRIES

Quarry No. and name	1:100 000 Sheet and Grid Reference	Geological formation	Status	Operator	Products	Comments
"Helidon Sandstone"						
0963b (Cleary's quarry)	E 093632	Helidon Sandstone	Disused	Mr E. Cleary	?	New small pit.
1158 (Ziegler's new quarry)	H 107575	Helidon Sandstone	Worked	R.C. Ziegler Quarries	Landscaping blocks, some monumental blocks.	Three shallow pits.
1257a (Comerford's quarry, previously part of old State quarries)	H 119565	Helidon Sandstone	Working of previous waste blocks	Mr T. Comerford	Blocks sold for cutting for tiles and thin slabs.	Large old quarries previously worked for blocks for building facings, monumental work etc.
1257b (Spratt's quarry, previously part of old State quarries)	H 120567	Helidon Sandstone	Disused	Mr T. Spratt	Landscaping blocks.	
1555 ("Corrigan's" quarry)	H 154550	Helidon Sandstone	Worked	Lockyer Sandstone consortium	Cut tiles and thin slabs.	Small new quarry with two faces on either side of gully.
1657 (Waterfall quarry)	H 158571 (approx.)	Helidon Sandstone	Abandoned	-	?	?
1756 (Wright's quarry)	H 168556	Helidon Sandstone	Worked	J.H. Wagner and Sons Pty Ltd	Cut slabs and blocks for building facings etc., monumental stone.	Large old quarries worked for blocks for building facings, monumental work etc.
1757 (Pearson's quarry)	H 166574	Helidon Sandstone	Abandoned	-	-	Large old quarry previously worked for blocks for building facings etc.
Jude's quarry / Phippard's quarry	Not located	Helidon Sandstone	Abandoned	?	Cut blocks for building facings etc.	Little known.
"Lockyer Sandstone"						
Stronach's quarries	Not located, possibly near Ziegler's new quarry	Helidon Sandstone	Abandoned	?	?	Little known.

TABLE 4 (continued)

Quarry No. and name	1:100 000 Sheet and Grid Reference	Geological formation	Status	Operator	Products	Comments
"Murphy's Creek Sandstone"						
0960	E 094603	Helidon Sandstone	Abandoned	?	)Blocks for building)facing.)	Medium-sized quarry with 3 to 4 m face.
0962a	E 090616	Helidon Sandstone	Abandoned	?	))	Small quarry with 3 m face.
0962b	E 091615	Helidon Sandstone	Abandoned	?	)	Small quarry with 3-4 m face.
0963a	E 086626	Helidon Sandstone	Abandoned	?	?	Small quarry with 2 to 3 m face, little removed.
0965 (possibly Cameron's quarry)	E 087652	Helidon Sandstone	Abandoned	?	?	Small pit beside creek.
"Highfields Sandstone"						
Quarries near Spring Bluff	Not located. Main quarry 1½ miles west of Spring Bluff beside rail-way line	Marburg Formation (upper beds)	Abandoned	?	Cut blocks for building facings.	Stone performed poorly in service.

Quarry 0960, adjacent to the railway line southeast of Murphys Creek, has a face about 3 to 4 m high over a length of about 50 m, and appears to have produced a considerable volume of material. The rock in the face seems relatively fresh, and overburden is not great. Appreciable resources could be present to the north, but unsuitable very coarse sandstone crops out to the east.

Quarries 0962a and 1962b are two small faces about 3 m to 4 m high and 40 m long on either side of Murphys Creek east of the village. A bed of medium-grained sandstone 1-2 m thick appears to have been the material of interest, but it is underlain by unsuitable coarse sandstone. The area does not appear to have any future potential.

Quarry 0963a is a small to medium sized face about 2 to 3 m high beside a creek. A considerable number of boulders have been stockpiled in several heaps, but the amount of stone actually removed from the site could not have been large. The stone is likely to continue into the hill to the east and downstream, but its quality is difficult to assess from the present exposures.

Quarry 0965 is only a shallow pit about 1 m deep in the bank of Fifteen Mile Creek. Some of the rock appears to be more thinly bedded than elsewhere and overburden away from the creek could be considerable. Only small amounts of stone have been removed. This may have been Cameron's quarry, which was reported to have been on Fifteen Mile Creek four miles from Murphys Creek.

Some of these old quarries could be of interest in the future for restoration of historic buildings, if not for renewed production of the stone in its own right. However, the bland colour of the stone, while very effective when used for facing a whole building, makes it of lesser interest than the "Helidon Sandstone" for decorative walls, tiles and monumental uses.

"Highfields Sandstone"

Several quarries in the upper Murphys Creek valley produced this stone from the upper beds of the Marburg Formation. The most significant was adjacent to the railway line 1 1/2 miles west of the Spring Bluff siding. However, the stone performed poorly as can be seen in the William Street wing of the Treasury Building in Brisbane.

POTENTIAL DEPOSITS

"Helidon Sandstone"

A study of the sedimentology of the Helidon Sandstone unit currently in progress (Carmichael, personal communication) suggests that the fine to medium-grained "Helidon Sandstone" of interest for quarrying occurs mainly towards the top of the unit. As this is dipping gently to the southwest or south, the area of interest consequently lies over the southwestern part of the area of outcrop (see maps). The sandstone further east (north of Gatton) would appear too coarse to be of interest.

From the distribution of existing quarries and outcrops in roads and gullies, it would seem that a major layer, or sequence of layers, of fine to medium-grained sandstone caps the sloping forested 'plateau' north of Helidon in the vicinity of Wright's quarry (1756). A slightly higher similar layer may occur a short distance to the north. It was not possible during this survey to accurately delineate the extent of the outcrop

of these layers, or to examine the consistency of the sandstone within it. However, an approximate area is shown on the map as a general guide to where additional deposits of sandstone could be found.

South of this area, apparently underlying beds of sandstone seem to be mainly medium, coarse or very coarse-grained, with only a few thin beds of fine to medium grained material present, such as occurs in "Corrigan's" quarry (1555). Prospecting for suitable sandstone on the property adjoining "Corrigan's" (Portion 8v) has revealed chiefly coarse material. Overall this area is not prospective for additional deposits, but some thin beds may be present.

Northwest of Helidon another area is underlain by a layer or layers of fine to medium sandstone; this supports the old State quarry (now Comerford's and Spratt's) and Ziegler's new quarries. Carmichael (personal communication) suspects a north trending fault along the eastern margin of this sandstone, with a downthrow on its western side. This suggests the layer may be the same as that exposed further east at Wright's quarry. A general area where this layer appears to crop out is shown on the map. From limited traversing it does not appear to extend north of Alice Creek, but it seems to re-appear near Cleary's pit (0963b) east of Murphys Creek; a third area of potential is consequently shown on the map in this locality.

Within the areas of potential outlined, investigation of any deposit should include outcrop mapping and drilling to determine if beds of unsuitable coarse sandstone are present, and to gain some idea of colour, hardness and joint spacing.

"Murphys Creek Sandstone"

This sandstone appears to be restricted to layers at the very top of the Helidon Sandstone unit, just below the Marburg Formation. Without further detailed mapping, it is difficult to ascertain its area of outcrop with any certainty. However, areas around some of the identified quarries may have potential. The deposit shown on the map around the old quarry 0960 is on rural land currently remote from closer settlement, and has a well developed existing face; it is probably the best prospect for redevelopment if required.

DIATOMITE

Diatomite is a sedimentary rock composed largely or wholly of the siliceous skeletons of microscopic aquatic plants called diatoms, which are a type of algae. These proliferate in small lakes which develop in active volcanic terrains, presumably after streams have been dammed by lava flows. The rock may be contaminated by organic matter and sedimentary particles such as clay, carbonates and sand. The properties of diatomite of high porosity, high bulk, chemical inertness, mild abrasiveness, and low conductivity make it of use for a variety of industrial purposes.

Diatomite is being worked under mining lease near Black Duck Creek (working 1722) in the south of the Shire by the Mount Sylvia Mining Company. It occurs in a layer 0.6 to 6 m thick, with an average thickness of 2 m, interbedded between two basalt flows near the base of the Main Range Volcanics. It crops out over 2 km on the eastern and western slopes of the spur separating Black Duck and Rocky Scrub Creeks (Bonner, 1951; Krosch, 1976; Sawers & Cooper, 1985). The diatomite is

generally white and massive with little evidence of bedding. Rare joints are either vertical or horizontal and may be clay filled. Thin layers of clay and carbonaceous shale are interbedded in places.

Bonner (1951) estimated the deposit was continuous over 30 ha and contained about 600 000 tonnes of inferred reserves, with potential for exploration to disclose more. Originally worked by underground methods, it is now an open cut operation. The material is calcined, sized and packaged on site. Towards the end of the 1970s when the deposit was worked by Industrial Minerals Limited, production was over 2000 tonnes a year, mainly for use as a ceramic liner for molten metal crucibles in foundaries, but dropped to 600 tonnes in 1983 with the downturn in the foundry casting industry. Since the sale of the mine to the present syndicate, only minor production has continued for miscellaneous uses, but the deposit still has potential for the future.

OTHER MINERALS

Few occurrences of metallic minerals have been recorded in the Gatton and Laidley Shires. Small amounts of **gold** in association with pyrite and arsenopyrite have been reported in the Alice Creek area 5 km northeast of Lockyer railway siding (Cribb, 1937). In 1987, a small old gold mine (1459) adjacent to Alice Creek at GR 141594 was being re-opened by Mr R. Endean and associates, and crushing machinery was being installed. The gold seems to occur in thin quartz veins in andesitic rocks. There is also evidence of pyrite and chalcopyrite in the surrounding rocks (D. Carmichael, personal communication). An area nearby (GR 145596) was also being explored by trenching and drilling by Pancontinental Mining.

In the early part of this century, **chalcopyrite** was mined in an area approximately 7 km north-northeast of Murphys Creek (Saint-Smith, 1920). Some thin veins of lead and silver were associated with the copper. The deposits proved to be small and mining operations became uneconomical.

Olivine crystals of gem quality were recorded by Cameron (1910) in Tertiary basalt at the Spring Bluff railway station. Some red garnet and topaz has been reported to occur in alluvium north of Withcott.

Pink **marble** was reportedly worked many years ago in the Mount Cross area (possibly from Snake Gully on the western side) but no details are available on the operation or its exact location. Presumably it occurred as a layer within sediments of the Cressbrook Creek Group or unnamed older rocks.

PLANNING RECOMMENDATIONS

As resources of quarry rock, gravel, sand and loam within Gatton Shire are quite limited, it is important for those that are known to be protected from other land uses which may preclude their exploitation in the future. Although large volumes of sandstone suitable for building stone appear to be present north of Helidon, and current demand is small, this resource could again become of considerable interest in the future, making protection of a significant part of the resource advisable.

To these ends, the following town planning recommendations are made:

1. The three existing rock aggregate quarries at Mount Whitestone (1637), Paradise Creek (1937) and Ropely Road (2743), and trucking routes to them, be protected from close settlement in their vicinity (Residential, Rural Residential or small scale Rural).

2. a) The four known sand and gravel deposits on lower terraces of Lockyer Creek upstream of Grantham be protected from closer settlement.

   b) Council give sympathetic consideration to the commencement of any new operations on these deposits.

3. Council give sympathetic consideration to any new sand operations on remaining deposits of Sandy Creek north of Grantham, and protect this valley from further closer settlement which might impinge on the sand workings until they are substantially worked out.

4. To protect important resources of bricklayer's loam, Council limit further closer settlement over and adjacent to the deposit of this material shown west of Gatton.

5. To protect remaining deposits of lateritic ironstone gravels, no further closer settlement be permitted over those areas considered by Council to be economically accessible in the future.

6. To protect resources of the "Helidon Sandstone" for continued production and possible expansion of the sandstone industry, no further closer settlement be permitted by Council over those potential areas outlined on the map northeast and northwest of Helidon. Although these areas are extensive compared to the small volumes of sandstone actually produced, they are needed because:

   a) within an area of geologically suitable material, investigation may prove only a very small proportion actually suitable for production of stone, due to variability of colour, hardness, fracturing and other deleterious effects.

   b) areas with a variety of colours are required

   c) areas for new producers to enter the industry are required, as well as for expansion of existing operations.

7. To protect resources of the "Murphy's Creek Sandstone" for possible renewed production or use in restoration of historic buildings, no further closer settlement be permitted over or adjacent to the potential areas shown on the map east of Murphy's Creek.

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