

Gales-Kingscliff Pty Ltd

ABN: 75 093 540 080

Cudgen Lakes Sand Extraction Project

Market Assessment for Fine Sand and VENM

Prepared by

ECOROC Pty Ltd

April 2008

**Specialist
Consultant
Studies
Compendium**

Part 12

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COMMONLY USED ACRONYMS

KRA	Key Resource Area
LEP	Local Environmental Plan
LGA	Local Government Area
Mt	Million tonnes
NSW DWE	NSW Department of Water and Energy
PASS	Potentially Acid Sulfate Soils
QLD DNRM	Queensland Department of Natural Resources and Mines
SEQRP	South East Queensland Regional Plan
tpa	tonnes per annum
VENM	Virgin Excavated Natural Material

EXECUTIVE SUMMARY

FINE SAND MARKET ASSESSMENT

1. This report provides a market assessment for fine sand and Virgin Excavated Natural Material (VENM) within the Tweed and Gold Coast market areas.
2. The report has been prepared for R.W Corkery and Co. Pty Limited on behalf of Gales-Kingscliff Pty Ltd (“the Proponent”), who proposes to extend an approved sand extraction operation near Cudgen in the Tweed LGA by increasing the depth and area of fine sand extraction.
3. The site of the proposed sand extraction and its associated infrastructure is referred to as Cudgen Lakes (the ‘Project Site’). The fine-grained sand resources of the Project Site are technically suitable as an engineered fill material for raising the level of nearby low-lying land and as a fine aggregate in construction material applications such as concrete. An estimated 7.5 million tonnes of fine sand resources would be recovered during the proposed sand extraction operation approximately half of which is proposed for use as engineering fill with the remainder to be made available for use by the construction industry.
4. Extractive materials such as fine sand are fundamental to any developed society and are used to provide housing, roads and infrastructure on which the community’s economic prosperity and quality of life depends. Demand for fine sand is driven largely by population growth, building and construction activity and specific purpose funding for major projects (such as land development and highway and airport developments).
5. Within the market area of Northern New South Wales and South East Queensland, natural fine sand is used primarily in the building and construction industries as a construction material, either on its own as an engineered fill for land development (e.g. flood mitigation) where it imparts good infiltration characteristics, or as a filler and fine aggregate in construction materials such as concrete and asphalt.
6. Natural fine sand is also blended with loam and clayey sands to create mortar sands such as brickies’ loam and is also used in landscaping applications such as top-dressing recreational surfaces.
7. Concrete applications presently consume an estimated 60%-70% of washed fine sand production from quarries in South East Queensland and Northern New South Wales. Fine-grained sand accounts for about half of the fine aggregate content in concrete and has increased in line with the use of coarser manufactured sand, which is increasingly being used as a substitute for natural coarse sand in concrete. The fine sand is used to mitigate strength, workability and rheology problems, which can arise with manufactured sand usage.
8. The Tweed economy is inextricable linked to and part of the South East Queensland regional economy. This broader, cross border region which stretches from the Gold Coast City to Tweed is one of the fastest growing urban growth centres in Australia. Annual per capita consumption of natural sand is in the order of 2 tonnes of which 1.25 tonnes per year is estimated as being fine sand.

9. Over the period 2005 to 2020, the population of the combined Tweed, Byron and Ballina LGAs is expected to increase by 37,000 people, or 2,500 people per year. Within Gold Coast City, the population is expected to increase at the rate of 2% per annum (or by almost 11,000 people per year) from 485,000 in 2005 to 650,000 by 2020.
10. In the Tweed and coastal Northern New South Wales region, annual demand for fine sand is expected to increase from around 190,000 tpa (tonnes per annum) in 2005 to 235,000 tpa in 2020. Demand within Gold Coast City is expected to grow from 600,000 tpa to over 800,000 tpa by 2020. This represents a combined annual growth rate of 1.8% over the period 2005 to 2020 and will result in the cumulative collective consumption of 15 million tonnes (Mt) of fine sand over this 15-year period.
11. The principal market area for fine sand from the Tweed region extends from Ballina in Northern NSW to the Gold Coast in South East Queensland.
12. Customers purchasing fine sand from the general market make purchase decisions based principally on suitability for purpose, price, location of quarry, quality and capacity to consistently supply to customer's needs. The mix and economic radius of fine sand products supplied to the construction and building markets varies with source geology, quarry location, extent of vertical integration within a company, availability of specific project work, logistics capability, internal resources and ultimately the type of competitive strategy of a producer.
13. As there is only limited scope for product differentiation in high volume, commodity-type products, such as fine sand, quarry operators that are not vertically or horizontally integrated, must be canny and usually succeed in the industry over the longer-term by finding niche markets not easily serviced by others and where a sustainable competitive advantage exists.
14. The Project Site is close to the Pacific Highway and the growth urban markets of the Tweed and Gold Coast and thus strategically positioned to help reduce transport, and building and construction costs. The long awaited construction of the Pacific Highway Tugun bypass will further reduce transport costs of fine sand from the Tweed region to markets in southern Queensland.
15. The Project Site is situated within one of three (3) regionally significant fine sand precincts within the wider market area from Ballina to Brisbane. These precincts which are only partially developed for extractive industry have the collective capacity to provide the coastal regions of Northern New South Wales and the Gold Coast ~ Brisbane with their fine sand needs for many decades. The precincts comprise Tweed (Cudgen / Chinderah region of Northern NSW); Jacobs Well-Norwell - Carbrook area (South East Queensland); and Moreton Bay ~ Lytton (Brisbane metropolitan region).
16. The Tweed fine sand precinct has emerged as one of regional significance, not just to the Tweed and north coast markets of New South Wales, but also to Gold Coast City and southern Brisbane. Aside from the Project Site, which has conditional approval for fine sand extraction, there are two (2) operational sand quarries, Hanson Tweed Sand Quarry, adjacent to the Project Site, and Action Sands located some 1.5 km to the north. Both sites produce in excess of 200,000 tonnes per year of fine sand products including concrete fine sand for the Tweed and Gold Coast markets.

17. Hanson Tweed Sand Quarry is a regionally significant supplier of fine sand to national and multi-national concrete firms. It received approval from the NSW government in 2006 to extend the quarry and has reported fine sand reserves of 13 million tonnes (Mt).
18. Action Sands, a regionally significant fine sand supplier, conducts in-stream sand dredging from within licensed areas in the Tweed River and process the fine sand at their Chinderah processing facility. It has reserves of several million tonnes and is investigating other deposits of shoaled fine sand in the Tweed River.
19. The fine sand precinct at Jacobs Well near Beenleigh in South East Queensland is closest in distance to the Tweed fine sand deposits. Sand resources at Jacobs Well are generally not as thick as the land-based resources in the Tweed precinct, but the sand is not dissimilar in terms of particle size and technical attributes.
20. Only one operational pit now remains at Jacobs Well and will be depleted within two years. At least five (5) areas of known fine sand resources exist within the Jacobs Well-Norwell area with at least three proposals to develop new fine sand deposits under consideration. It is possible that the precinct may contain up to 100 Mt of fine sand and loam resources, but many of the sites are presently used for the cultivation of sugar cane.
21. The existing shortage of sources of fine sand including concrete sand and mortar sand within the Gold Coast and greater Brisbane market areas has occurred as a result of depletion of existing land-based sand reserves and the lack of approval for replacement resources.
22. In the foreseeable future, at least 95% of demand for extractive materials will need to be satisfied from primary aggregates produced from rock, sand/ gravel and fine-medium sand resources. New reserves of fine sand are therefore needed to satisfy existing and future market demand, particularly to service the Tweed ~ Brisbane corridor.
23. The fine sand resources such as those at the Project Site in the north east corner of the Tweed LGA are regionally significant and constitute a strategically important natural resource with the potential to help satisfy growing local and regional demand for fine sand in land development, building and construction material applications.

VENM (VIRGIN EXCAVATED NATURAL MATERIAL) MARKET ASSESSMENT

1. The high levels of current and anticipated building and construction activity along the lower lying coastal areas of the Tweed region mean that demand for VENM, particularly those materials derived from sandy substrates and which can be used as a substitute for primary aggregates, is high.
2. VENM from the Tweed region may be classified into three groups according to its utility as a 'secondary' aggregate. These groups are 'benign' clayey to clean sand and soil; potentially acid sulfate soil - loam and sand; and clay or marine mud with high acid potential.

3. The rate at which VENM becomes available for use as 'secondary aggregates' is very much project dependent and so supply varies according to the location and extent of building and construction activity occurring in the coastal sediments of the Tweed and Gold Coast.
4. Whilst there is no formal data collected on VENM quantities generated in the north coast of New South Wales or the Gold Coast, the supply of excavated fill as a source of secondary aggregates may be as high as 1 tonne per person per annum. Within the Tweed, Byron and Ballina regions this would equate to an annual supply rate of approximately 150,000 tonnes.
5. Sand materials (or VENM) recycled from excavations on building and construction sites constitute an important source of secondary aggregates in the NSW north coast and Gold Coast region but are already fully utilised and along with other recycled construction materials cannot satisfy anymore than a small percentage of demand for fine aggregates.
6. The principal agents of the removal of VENM off-site are cartage intermediaries who act as earthmoving contractors. Many earthmoving/trucking firms have their own storage facilities. Some firms are actual suppliers of aggregates and other earth materials and thus have vested interest in intercepting VENM that is suitable as a secondary aggregate.
7. The known occurrence of acid sulfate soils in the coastal regions of Tweed and Gold Coast suggests that a proportion of VENM used as secondary aggregates is most certainly potentially acid forming. The offsite disposal of such potentially acid sulfate soils (PASS) is not widely documented and indeed there is a general reluctance by construction entities, earthmovers and even regulators to openly discuss the manner and location of disposal.
8. Major project sites with a high regulatory profile that are developed in stages generally treat and use PASS VENM material and incorporate such material into the design landform of the site, so there is limited offsite removal of such material.
9. The principal supply sources of 'exported' PASS VENM are from smaller re-development sites and from civil infrastructure works projects on the coastal plain. The volume of PASS VENM material generated from within the Tweed region and in general proximity to the Cudgen Lakes Project Site is expected to increase substantially over the next 10 years as redevelopment of older and smaller housing lots within the coastal plain intensifies, along with an increase in the level of infrastructure support works.
10. The treatment and re-use of PASS VENM material with utility as secondary aggregates is preferred by industry and government alike, over the less desirable strategic reburial disposal solution. Nevertheless, for PASS VENM material such as marine muds and clays that cannot be used as secondary aggregates, there exists a local need for a dedicated and appropriately authorised disposal site for such material. In these instances, strategic reburial by sub-aqueous deposition in excavated sand lakes may provide a sustainable solution to a waste disposal problem where existing strategies and disposal solutions appear ineffective.

For the purposes of project planning,

an estimated 30,000m³ of PASS VENM (VENM(b)) could be received annually at the Project Site. On the assumption that 50% (eg sand, brickies loam, topsoil) was re-useable after treatment, this would generate a net inflow of approximately 20,000 m³ pa of material.

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1 INTRODUCTION

1.1 Background

This report provides a market assessment for fine sand and Virgin Excavated Natural Material (VENM) within the Tweed and Gold Coast market areas.

The report has been prepared by ECOROC Pty Ltd, Extractive Resource Management Consultants, for R.W. Corkery Pty Ltd on behalf of Gales-Kingscliff Pty Ltd ("the Proponent").

The Proponent proposes to extend its existing approved sand extraction operation near Cudgen by increasing the depth and area of fine sand extraction. The site of the proposed sand extraction and its associated infrastructure is referred to as Cudgen Lakes (Project Site). **Map 1** shows the location of the Project Site as well as nearby sand operations.

The fine-grained sand resources of the Project Site are suitable as an engineered fill material for raising the level of nearby low-lying land and as a fine aggregate in construction materials.

The Proponent also seeks to establish an understanding of the supply dynamics of VENM removed from building sites and civil construction works within a viable transport distance of the Project Site, and so determine the overall level of need for a local disposal venue for such material.

1.1 Scope

This report focuses on the market for fine sand and VENM within the Tweed ~ Gold Coast market area and addresses the following issues.

- An outline of the Cudgen Lakes sand resource and overview of recent sand extraction history in the Cudgen ~ Chinderah area of the Tweed LGA.
- Product descriptions and market uses for fine sand.
- Demand for fine sand and VENM.
- Analysis of market characteristics including market segmentation, industry structure and transport costs.
- Availability of supply of existing and potential sources of fine sand over the 15-year period 2005 to 2020 including site locations, production levels, duration of approvals and remaining quarry life.
- Review of current disposal/recycling projects accepting VENM and appraisal of the source, nature and quantities of VENM generated in the region that could be economically delivered to the Project Site.

Map 1
Project Site and Nearby Sand Operations

(A4 / Colour)

2 RESOURCE DESCRIPTION

2.1 Extraction Site and Resource Details

The Project Site consists of two (2) parcels of land described as Lot 2, DP 216705 and Part Lot 21, DP 1082482. Collectively, these parcels of land occupy an approximate area of 67ha, some 46ha of which is being considered for sand extraction. An existing sand quarry trading as Hanson Tweed Sand Quarry adjoins the Project Site to the west.

The stratigraphy of the Project Site consists of:

- a thin organic topsoil layer underlain by;
- 2m to 4m of loamy sand with some acid sulfate soil potential; and
- a nominal 20m of fine-grained sand with a particle size between 150 and 600 microns.

An estimated 7.5 million tonnes (approximately 5 million m³) of recoverable fine sand resources occur within the Project Site.

2.2 Sand Extraction in Project Site Locality

The Project Site is located in a fine sand precinct that has emerged as an important and regionally significant supplier of fine sand into the building and construction industries of the Tweed, northern NSW and Gold Coast regions.

The two major fine sand producers in the Tweed area are Hanson Construction Materials who operate a sand extraction and processing operation adjoining the Project Site to the west, and Action Sands who conduct in-stream sand dredging from the Tweed River and process the fine sand at their Chinderah processing facility, 1.5km to the north of the Project Site. **Map 1** shows their relative locations to the Project Site.

The fine sand resources of the region, which consist principally of sand of estuarine origin, are known to be relatively single-sized, homogeneous and eminently suitable as an engineered fill, or as a fine aggregate in concrete and other construction materials when screened and washed.

3 FINE-MEDIUM SAND USES

3.1 Product Uses - General Market Applications for Fine Sand

Within the Tweed ~ Gold Coast region, sand for building and construction purposes is derived from naturally occurring sand deposits formed from the weathering of rock and subsequent accumulation of durable sand particles and also from the purposeful crushing of hard rock (referred to as 'manufactured sand'). Manufactured sand has different characteristics to natural fine sand and so their market applications differ.

Within the market area of Northern NSW and South East Queensland, natural fine sand is used primarily in the building and construction industries as a construction material, either:

- on its own as an engineered fill for land development (e.g. flood mitigation) and/or bedding media; and
- as a filler and fine aggregate in construction materials such as concrete and asphalt.

Natural fine sand is also blended with loam and clayey sands to create mortar sands such as brickies' loam and is also used in landscaping applications such as top-dressing recreational surfaces.

A list of typical market uses and a qualitative indication of relative market size for fine-medium sand within the market area is shown in **Table 1**.

Table 1
Typical Uses For Fine Sand In Gold Coast And Tweed Region

Building and Construction	Examples of Use	Market Size Indication
Pre-mixed concrete	Fine aggregate filler	Large
Concrete products	Fine aggregate filler	Large
Mortar & grout mixes	Fine aggregate filler, brickies' loam	Moderate
Plaster	Fine aggregate filler	Small
Roadbase	Fine aggregate in bound and unbound pavements	Moderate
Drainage media	Water filtration, sediment control	Moderate
Bedding media	Under slabs, pavers etc	Moderate
Asphalt	Fine aggregate filler	Moderate
Engineered fill	Subgrade for land development (eg transport infrastructure, flood mitigation for residential/commercial developments)	Large (project-based)
Landscaping		
Soil manufacture	Manufactured top soil – provides soil structure	Collectively moderate
Grassed, soft surfaces	Playgrounds, top dressing	
Recreational surfaces	Golf courses, sports fields	
Other applications		
Water filtration media	Filter, clean water	Small
Cement manufacture	Clinker ingredient, mineral additive	Small
Horticultural/potting mixes	Propagation media	Small
Foundry sand	Moulding material	Small
Absorbent	Spill cleanup/ control	Small
Filler in manufactured products	Rubber and plastic products	Small
Niche markets, emergent technology	eg Frac. Sand (propellant); grinding media; geopolymer aggregate.	Under development

3.2 Overview of Technical Specifications for Natural Fine Sand

Natural fine sand consists largely of quartz. The dominant mineral is silica which is the most common mineral in the earth's crust. Silica is very durable meaning that it is resistant to both chemical and physical erosion and therefore well-suited for construction material applications.

Other key determinants in the specific market application of natural sand are the size and sharpness of the sand particles. Particle shape and particle size distribution largely dictate what the sand can be used for. Sand is therefore frequently referred to as being fine, medium or coarse in size or grades in between eg. fine-medium.

One of the most common specifications in Australia for the use of sand in building and construction is Australian Standard AS 2758.1 - 1998, Aggregates and Rock for Engineering Purposes, Part 1 Concrete Aggregates. This sets minimum performance criteria and technical requirements for fine aggregate including natural sand for use in concrete.

The sand that underlies the extraction site will comply with AS 2758.1. It is fine-grained with particle sizes typically between 150 and 600 microns.

The upper stratum contains loamier material typically used in the manufacture of mortar sand which requires a higher clay content to impart to the sand its 'slip' and 'workability' characteristics, both desired attributes for applications such as concrete mortar.

4 DEMAND FOR FINE SAND AND VENM

4.1 Drivers of Demand

Aggregates such as fine sand can be used on their own to provide the subgrade material for land development or road infrastructure, or they can be mixed with binders to create construction materials such as concrete and asphalt.

Aggregates are not normally purchased directly, but rather the products or services they provide. The market for extractive materials or quarry products is therefore characterised by 'derived' demand. Demand is 'derived' by the demand for the goods or services that aggregates provide.

As the majority of aggregates in NSW and Queensland are used as inputs into construction materials for building and construction, their demand is driven largely by:

- population growth;
- economic activity; and
- major project activity (eg highway works, land development etc).

4.2 Population Growth

The Gold Coast and coastal regions of the Tweed LGA and Northern NSW are expected to undergo sustained increases in population, at a combined annual rate of approximately 1.8%.

Within the Richmond-Tweed region of Northern NSW, the north-eastern part of the Tweed LGA containing the urban centres of Tweed Heads and Kingscliff is expected to undergo the highest rate of population increase with an average annual growth rate of 2.0% over the period 2001 to 2031¹. Over the period 2005 to 2020, the population of the combined Tweed, Byron and Ballina LGAs is expected to increase by 37,000 people or 2,500 people per year.

¹ NSW Dept. of Infrastructure, Planning and Natural Resources (DIPNR), Population Projections, 2004 release

In South East Queensland, the majority of population growth has been occurring along the coast. Over the 17-year period to 2003 the fastest growing areas were Gold Coast City (grew by 240,500 people), Brisbane City (205,400) and the Maroochy LGA (75,000).

The projected 2026 population for South East Queensland is equivalent to the population of the whole of Queensland today. According to Queensland government forecasts, the population of South East Queensland is expected to grow by 50,000 people per year over the period 2001 to 2026, which equates to an overall annual growth rate of 1.7%. This will result in an increase in population from 2.4 to 3.6 million people.

Within Gold Coast City, the population is expected to increase at the rate of 2% per annum (or by almost 11,000 people per year) from 485,000 in 2005 to 650,000 by 2020².

These population estimates have been used to assist in the derivation of forecast demand for fine sand over the 15-year period 2005 to 2020.

4.3 Economic Linkages and Development Trends

The Tweed economy is inextricably linked to, and part of, the South East Queensland regional economy. This broader, cross border region which stretches from Robina in Gold Coast City to Tweed, is one of the fastest growing centres in the developed world, making it one of the largest urban growth centres in Australia³.

The South East Queensland Regional Plan (SEQRP), released in 2005 has been prepared by the Queensland government to guide regional planning and infrastructure development in the region. Of specific relevance is the urban consolidation initiative under the SEQRP, which advocates and supports higher-density development, thus creating a more compact urban form focussed around activity centres and public transport.

Coincident with the statutory planning initiatives of the SEQRP are changes in demography and psychographic consumer behaviour resulting in a greater demand for a diversity of housing forms to match the needs of the changing household structures, particularly an increase in one and two person households across all adult ages. To meet such demand, an estimated 550,000 new dwellings will be required in South East Queensland between 2004 and 2026.

Urban consolidation or 'infill development' is already evident on the Gold Coast and the urban areas of the Tweed LGA and has implications for the demand for fine sand and the supply of VENM from building and construction sites.

² Southeast Queensland Regional Plan (SEQRP) 2004, after the Dept. of Information, Local Government and Planning (2003), medium series population projections

³ Source: Tweed Economic Development Corporation (TEDC), quoting the Gold Coast/Tweed Aviation Transport Hub Project Draft Report October 2005;

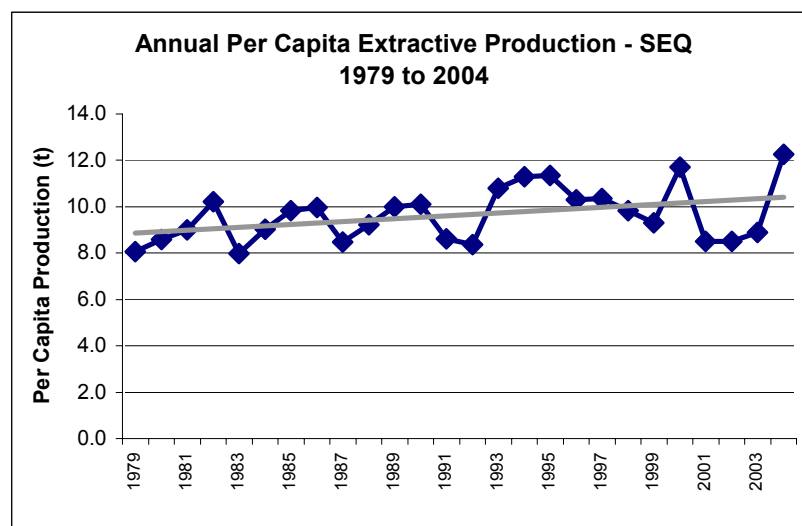
4.4 General Demand for Aggregates

The demand drivers of population growth, economic activity and civil infrastructure projects will continue to be major influences in generating ongoing growth and cumulative demand for extractive materials in Northern NSW and South East Queensland for at least the next 15 years.

Demand forecasts for aggregates based on historical consumption patterns and projected population levels have proven to be quite accurate in predicting average long-term demand for aggregates in Northern NSW and South East Queensland. In South East Queensland, data collated by Queensland Department of Natural Resources and Mines provides an important and respected source of information for the consumption of aggregates.

Per capita consumption of aggregates, which has exhibited a long-term upwards trend since 1980 is expected to stabilise and flatten at an average of about 10 tonnes per year over the next 15 years. Shorter-term fluctuations from land development filling, periods of increased housing demand, engineering project activity and cyclical downturns mean that actual annual per capita consumption rates for total aggregates will range from about 7 to 15 tonnes.

These data and associated trends are shown in **Figure 1**, which is a time series of the per capita production of total aggregates (crushed & broken rock, natural sand and gravel, unprocessed or fill materials) in South East Queensland (Brisbane Statistical Division BSD and Moreton Statistical Division MSD).



Source data: QLD DNRM, Minerals & Extractive Planning Unit, 2004

Figure 1
Per Capita Production of Total Aggregates in South East Queensland

The per capita consumption rates for individual quarry material types within the South East Queensland and Northern NSW region is typically broken down as follows.

- Hard rock aggregates (those materials sourced from hard rock quarry operations) = 6.5 t

- Sand and Gravel (those materials sourced from alluvial, or similar, deposits containing essentially unbound depositional material) = 2.5t (gravel 0.5 t)
- Unprocessed material (material sourced from either hard rock or sand and gravel operations, but which is not processed through a fixed plant installation) = 1.0 t

Demand for all types of sand (including manufactured sand) within the region represents almost 30% of total demand for aggregates. Natural sand accounts for about 18% of current demand for total aggregates in South East Queensland⁴.

Within the market area for the Project Site, the present per capita consumption of natural sand is estimated to be about 2.0 tonnes per year with fine to medium grained sand accounting for the majority of this demand at about 1.25 tonnes per annum.

4.5 Demand for Fine Sand in the Market Area

The principal use of processed fine sand is as a 'fine aggregate' in concrete, the typical ingredients of which are shown in **Figure 2**.

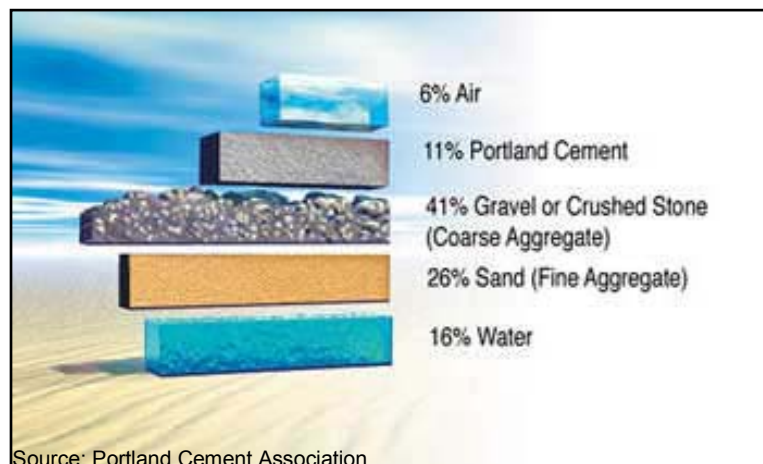


Figure 2
Typical Ingredients in Concrete

To satisfy demand for building and engineered infrastructure, per capita consumption of pre-mixed concrete in the market area is estimated by industry sources to be about 1.7 m³ per person per year.

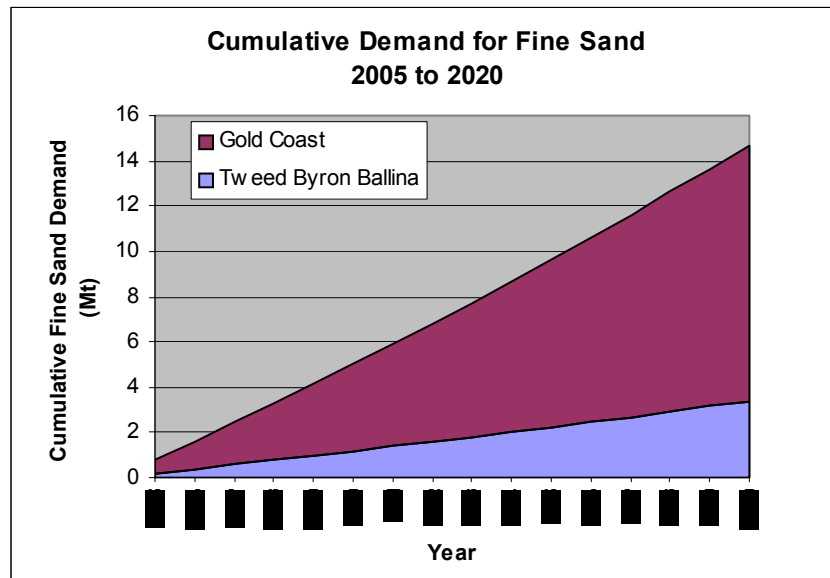
The increasing use of manufactured sand as a substitute for medium-coarse sand in concrete has also led to complementary increases in the use of fine sand because single-sized fine sand helps optimise rheology and maintain workability of concrete mixes made with manufactured sand.

Concrete applications presently consume an estimated 60%-70% of washed fine-medium sand production from quarries in South East Queensland and Northern NSW. Fine-medium sized sand accounts for about half of the fine aggregate content in concrete, with a coarser sand fraction making up the remainder.

⁴ Refer Queensland Minerals and Petroleum Review of 2004, Department of Natural Resources and Mines (published 2003), p 180

Engineered land fill, bedding sand, mortar sands and landscaping/topdressing markets account for the majority of the remainder of demand for fine sand.

Having regard to the demand drivers and consumption contingencies for fine sand over the next 15 years, the annual per capita consumption estimate of 1.25 tonnes is considered to be reasonable. This estimate and the projected population levels of the Gold Coast and Northern NSW regions of the Tweed, Byron and Ballina has been applied to provide an assessment of cumulative demand for fine sand for the market area. The results are shown in **Figure 3** as a time-series graph showing cumulative demand.



Source Data: DIPNR population projections (2004); QLD DILGP, Medium-level population series (2004)

Figure 3
Estimated Cumulative Demand for Fine Sand in the Gold Coast ~ Tweed Ballina region

Figure 3 shows that the cumulative consumption of fine sand within the wider market area for the Project Site is expected to be just under 15 million tonnes (Mt) over the 15-year period 2005 to 2020.

In the Tweed and coastal northern NSW region, annual demand for fine sand is expected to increase from around 190,000 tpa (tonnes per annum) in 2005 to 235,000 tpa in 2020. Demand within Gold Coast City is expected to grow from 600,000 tpa to over 800,000 tpa by 2020. Overall, average annual demand is anticipated to grow at the rate of 1.8% per year.

4.6 VENM Sources and Demand

In South East Queensland, VENM may sometimes be referred to as 'dig-out' materials or 'clean fill'. From a construction materials perspective VENM, as a waste product or by-product from the building and construction industries, is sometimes classified as a 'secondary' aggregate if it has market utility. The term 'secondary aggregates' is used to describe VENM such as earth materials excavated from building sites and civil infrastructure developments as well as materials derived from remedial dredging, ash from coal fired power generation, blast furnace slag and waste rock from mining operations. Secondary aggregates are used to augment supply of 'primary' aggregates, where primary aggregates describe processed sand, gravel and rock products purposefully won from quarries.

Because of the high levels of current and proposed building and construction activity along the lower lying coastal areas of the Tweed region, demand for VENM is high, particularly those materials derived from sandy substrates and which can be used as secondary aggregates. VENM from sand substrates has utility as a fill sand given that the ex-quarry or gate price for clean fill sand in the region is about \$10 per tonne (excl GST) and also because the sand materials allow for groundwater recharge by direct infiltration of rainwater.

Typical placement applications for sand VENM material in the Tweed area include:

- fill material for raising low-lying land;
- under slab bedding media;
- capping for land fill;
- binder for roadbase materials;
- raw material for re-processing into concrete grade fine sand or mortar sand;
- blending ingredient for manufacture of soils.

The principal agents of the off-site removal of VENM are trucking firms engaged by the construction firms to remove the 'dig-out' material and who act as earthmoving contractors. If the material has re-use potential as fill for land development or as a construction material, the earthmoving contractors/cartage firms may agree to take the material at little or no cost to the builder.

The capacity of these firms to remove this material quickly is important given the urgency of most development timeframes. Many earthmoving/trucking firms have their own storage facilities for this material. Some firms are actual suppliers of aggregates and other earth materials and thus have vested interest in intercepting VENM that is suitable as a secondary aggregate.

5 MARKET ANALYSIS

5.1 Market Area

The wider regional market area for fine sand from the Tweed region extends from Ballina in Northern NSW to Brisbane in South East Queensland. **Map 2** shows the approved fine sand quarries and equivalent potential resources within this regional market area.

A more localised market area, and that which consumes the majority of sand and soil products from the Cudgen ~ Chinderah sand extraction precinct including fill sand, extends from Murwillumbah and Pottsville through to Robina on the Gold Coast.

5.2 Market Segmentation

A typical market segmentation by area of customer activity for extractive material firms in the market area is listed below.

1. Local sales (non-account sales, COD)

2. Manufacturers (eg concrete, asphalt, filter media)
3. Re-sellers (eg landscape yards, trucking firms)
4. Civil contractors (housing, commercial, major projects)
5. Subcontractors (eg builders, landscapers, plumbers)
6. Land developers (eg subdivisions, engineered fill)
7. Local government (eg infrastructure, recreation grounds)
8. Others (eg agribusiness, equestrian, niche)

In terms of barriers to entry and market access for fine sand, the manufacturers segment (segment 2) comprising concrete and asphalt is vertically integrated so that quarries, concrete batching and/or asphalt plants are frequently owned by the same construction material firm and often have access to internal sources of sand.

If these integrated companies don't have such access to raw materials within certain geographical regions, then they purchase externally, from cartage contractors or independent sand producers.

Aside from the manufacturer's segment, the other customer types listed above purchase sand from the general market with purchase decisions based principally on suitability for purpose, price, location of quarry, quality and capacity to consistently supply to customer's needs.

The 'reseller', 'land development', 'subcontractor' and 'local government' segments are also important target markets for fine sand producers.

5.3 Industry Analysis

The ownership of extractive resources and quarries within the Tweed LGA differs slightly from the national profile of quarry ownership where large publicly owned national and multi-national companies dominate the supply of construction materials, with smaller independent operators ('independents') and sometimes local government owned quarries providing strong competition when strategically positioned geographically.

Australian construction materials companies including many independents exhibit varying degrees of integrated business structure including quarrying operations, pre-mixed concrete, concrete products, asphalt manufacture and civil construction. With vertically and/or horizontally integrated business structures, companies seek to minimize their risk exposure to the external market for raw materials by securing supplies under their controllership.

The mix of quarry products actually supplied to the market varies with source geology, quarry location, extent of vertical integration, availability of specific project work, internal resources and ultimately the type of competitive strategy.

There is only limited scope for product differentiation in high volume, commodity-type products, such as fine sand. Quarry operators, not vertically or horizontally integrated, must be canny and usually succeed in the industry by finding niche markets not easily serviced by others and where a sustainable competitive advantage exists. The companies that succeed frequently pursue focus strategies with product and/or service differentiation advantages.

Map 2
Sand Operations Within 80km Radius of the Project Site

(A4 / Colour)

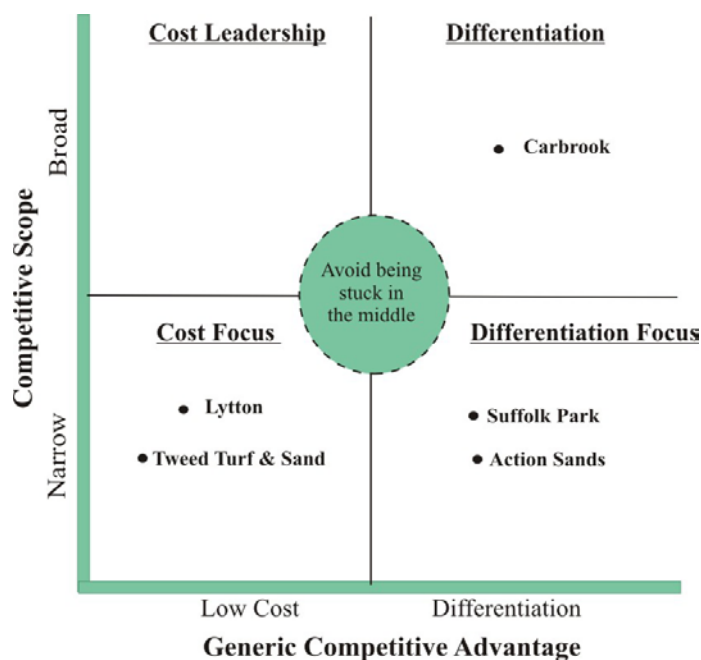


Figure 4
Generic Competitive Strategies

5.4 Transport Costs

Fine sand is a relatively bulky, low cost material and therefore very cost sensitive to the distance over which it is transported. Transport costs can therefore represent a considerable proportion of the total cost to the end user.

Industry reports typical haulage rate costs in 2005 for aggregates of between \$0.15 to \$0.20 per tonne kilometre for truck and dog trailer⁵. **Figure 4** shows typical direct transport costs (eg vehicle operating costs) for the transport of aggregates by road using truck and dog (trailer).

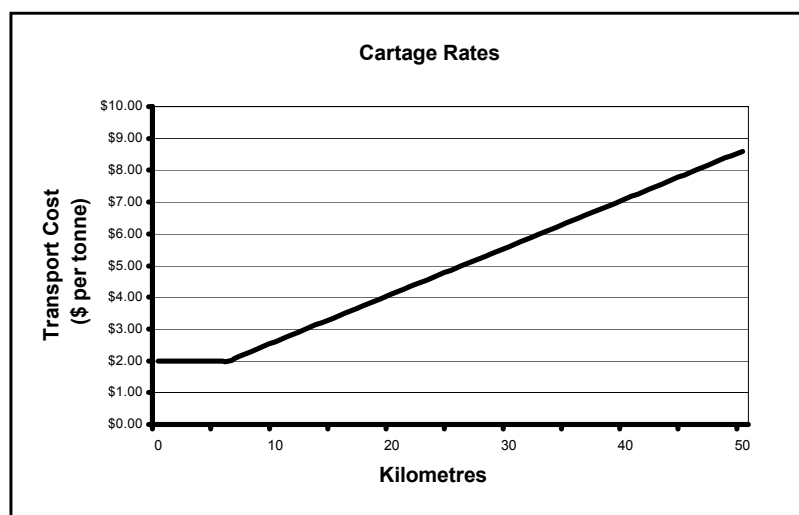


Figure 5
Typical Transport Costs for Extractive Materials

⁵ Measured in one direction - that is loaded in one direction and returning empty via the same route

The sensitivity of the transport cost of aggregates as a proportion of delivered price can be demonstrated from **Figure 4**.

One way in which companies manage to reduce net transport costs, and in effect increase the competitive market area for their products is through 'backloading' where trucks transport quarry products in both directions. In Northern NSW for example, where there is a shortage of hard rock aggregate sources for general market consumption, road trucks import aggregates from hard rock quarries on the Gold Coast and then 'backload' fine sand to concrete plants on the Gold Coast.

The Project Site is close to the Pacific Highway and the growth urban markets of the Tweed and Gold Coast and thus strategically positioned to help reduce transport, and building and construction costs. The long awaited construction of the Pacific Highway Tugun bypass will further reduce transport costs of fine sand from the Tweed region to markets in southern Queensland.

6 SUPPLY SOURCES

6.1 Strategic Assessment of Fine Sand Supply

In South East Queensland and Northern NSW, depletion and restrictions on access to natural sand and/or gravel deposits, particularly in fresh water riverine environments and coastal environments with over-riding environmental values, has led to diminishing reserves, and concerns of shortages in some market areas.

The need to ensure that the NSW North Coast maintains access to secure supplies of extractive materials for the 21st century was formally recognised in 1996 by the Mid North Coast Regional Organisation of Councils and NSW Department of Urban Affairs, who sponsored the formation of the North Coast Extractive Industries Standing Committee.

This committee reported its findings and recommendations in the 1999 publication 'Extractive Industries and Minerals on the North Coast', using a framework based on the application of Ecologically Sustainable Development (ESD) principles and a classification system for extractive sites.

The focus of the approach was to encourage the recognition of regionally significant extractive resources in regional and local environmental plans (LEP's) and to discourage incompatible development around known quarry sites. The report placed little emphasis on identifying potential extractive resources to satisfy future regional need.

In South East Queensland, similar depletion problems, land use conflicts and environmental constraints were occurring but were accentuated by the scale of demand for extractive materials and the rate of depletion of known resources.

Whilst the supply shortage situation for sand developed over a period of several decades, supply problems for natural sand became acute with the closure of the Brisbane River to in-stream sand and gravel extraction in 1998 and the depletion of several fine–medium sand sources in the Coomera River catchment and in the Jacobs Well area.

These circumstances led to recognition at State government level of the regional significance and community benefits that derive from ensuring there are available supplies of aggregates to satisfy need for building and construction materials.

After years of indifference and hostility, particularly from local government who found decision-making in relation to the protection and provision of extractive resources politically unpalatable, Queensland Department of Natural Resources and Mines (Qld DNRM) were charged in the late 1990's with developing a policy to support the identification and sustainable use of extractive resources in the region.

The result is a State Planning Policy for Protection of Extractive Resources that identifies and protects Key Resource Areas (or KRA's) from sterilisation by incompatible land uses. Qld EPA have also, after a five year study of the economic, environmental and social impacts of land and marine sand extraction, agreed to permit the ongoing controlled fine sand extraction from Moreton Bay for infrastructure development and construction material uses.

Despite these initiatives, chronic shortages of mortar sands and fine concrete sand in the Gold Coast region exist, resulting in rising prices and increased transport distances. New replacement reserves of land-based fine sand to satisfy existing and anticipated demand for fine sand and loam for the regional building and construction industries are currently the subject of development applications in both the Tweed Shire and Jacobs Well extractive precinct.

6.2 Existing and Potential Fine Sand Sources

Overview

Table 2 provides a summary of the known sand operations and fine sand resources within an 80 km radius of the Project Site. **Map 2** shows the general location of these resources including the three (3) most important fine sand precincts within the wider market area. These precincts, which have the collective capacity to provide the coastal regions of Northern NSW and the Gold Coast ~ Brisbane with their fine sand needs for at least several decades, are:

1. Tweed (Cudgen / Chinderah region of Northern NSW);
2. Jacobs Well-Norwell area (South East Queensland); and
3. Moreton Bay Middle Banks (Brisbane metro region).

Tweed Fine Sand Precinct

The Tweed fine sand precinct has emerged as one of regional significance, not just to the Tweed and north coast markets, but also to Gold Coast City and southern Brisbane. Aside from the Project Site, which has conditional approval to extract 400,000 m³ of fine sand for use as fill sand, the two (2) operational sand quarries described briefly in Section 2.2 both produce concrete fine sand and mortar sand (brickies loam) products for the Tweed and Gold Coast markets. Action Sands is also a supplier of fill sand and topsoils.

Hanson Tweed Sand Quarry (formerly Tweed Turf and Sand) presently produces at least 200,000 tonnes per year of sand products focussing principally on sales of washed fine sand for concrete and mortar sand. The company is a regionally significant supplier of fine sand to national and multi-national concrete firms. The Minister for Planning approved the extraction of a further 4.5 million m³ of sand from the quarry and extending the operational life for a further 30 years in July 2006.

Actions Sands was established in 1990 to dredge and process sand from shoaled areas of estuarine fine sand in the downstream and tidal sections of the Tweed River. The company currently produces in excess of 200,000 tonnes per year of concrete fine sand, fill sand and soil products at its off-stream sand processing and sedimentation pond facility adjacent to the Tweed River at Chinderah.

Action Sands started life as a supplier of hydraulically placed dredged fill for local land development. Between 1994-1996 it successfully supplied 900,000m³ of dredged fine sand for the Pacific Highway bypass of Chinderah. By early 2000, the hydraulic placement of such materials for local land development had fallen out of favour with the then NSW Department of Land and Water Conservation, because of concerns about saline contamination of groundwater.

In response, the company re-positioned as a concrete sand supplier and is now a major supplier of washed fine sand to concrete companies on the Gold Coast and Northern NSW.

Action Sands' in-stream sand extraction leases granted by NSW Department of Lands generate considerable royalty income and help fund local environmental management and improvement projects in the Tweed River catchment under the auspices of the Tweed River Committee. Action Sands also has a licence from NSW Department of Lands to explore an area of the Tweed River immediately downstream of the Barney's Point Bridge for fine sand.

Several kilometres to the south of the Cudgen Lakes Project Site, Southeast Excavations operate the Duranbah sand pit in an indurated fine sand deposit. In 2004 the company secured the contract to supply, via hydraulic placement, the fill sand for the SALT development just south of Kingscliff. The resource was virtually depleted at the conclusion of the SALT development project.

Other deposits of fine sand with similar stratigraphy to the Project Site are likely to exist under low-lying agricultural (sugar cane) land near the coastal regions of the Tweed LGA. For example, an application to the Minister of Planning has recently been made by Ramtech Pty Ltd to dredge, process and transport by road up to 200,000 cubic metres of sand a year for 26 years from a site near Mooball (Dunloe Park Sand Project), approximately 20km south of Cudgen.

Jacobs Well, South East Queensland

At Jacobs Well near Beenleigh in South East Queensland, large resources of fine sand and loams are known to occur beneath agricultural (sugar cane) land within the eastern and southern areas of the Rocky Point sugar-growing district.

These resources, though generally shallower, are closest in distance to those of the Tweed precinct and not dissimilar in terms of particle size and technical attributes.

Fine sand and brickies loam extraction has occurred from the estuarine and beach ridge Holocene and Pleistocene fine sand deposits in the Jacobs Well region for over two decades, but only one operational pit (Wholesale Sands) now remains and will be depleted within two years. At least five (5) areas of known fine sand resources exist within the Jacobs Well-Norwell area and investigations to develop new fine sand deposits are underway. It is possible that the precinct may contain up to 100 Mt of resources, but many of the sites are presently used for the cultivation of sugar cane.

An undeveloped fine-medium sand deposit (~5Mt) with town planning approvals is situated at Marks Rd., Jacobs Well near the mouth of the Logan River. Several development applications for new sand pits or extensions to existing workings in the Jacobs Well region have been lodged with the Gold Coast City Council.

The fine sand resources within the Jacobs Well fine sand precinct have been identified as a Key Resource Area under Qld DNRm's State Planning Policy for Protection of Extractive Resources. Several of the deposits also contain brickies loam for the manufacture of mortar sand. The development of new Jacobs Well fine sand resources is expected to commence within the next few years, subject to the resolution of any land use conflicts with the sugar cane industry.

Moreton Bay

The Queensland Government announced in April 2005 that they will permit the extraction of sand (up to 20 million m³ over 20 years) from certain sections of Moreton Bay to provide fill sand for vital infrastructure (Brisbane Airport extension) and sand for construction purposes.

The decision follows from a multi-disciplinary five-year study that showed that sand extraction would also result in a safer and more efficient major shipping channel. The decision suggests that in the foreseeable future some 30% to 40% of fine sand demand for building and construction in South East Queensland, particularly in the Brisbane metropolitan region, could be met from marine extraction of fine sand from Moreton Bay. This would leave 60% to 70% of fine-medium sand demand to be met from land-based sources.

Moreton Bay sand is presently dredged and barged to an unloading facility on the south side of the Brisbane River at Lytton operated by a Hanson ~ Boral joint venture. The sand is screened to remove oversized contaminants but because it is very clean does not require additional washing, prior to its use in pre-mixed and pre-cast concrete.

Other fine sand products including concrete sand are produced by River Sands Pty Ltd from large river terrace deposits beside the Logan River, near Carbrook, approximately 10km east of Logan City.

Two companies also produce fine to coarse sand from the washing of weathered sandstones at Clutha Creek and Mundoolun in the Beaudesert region, west of the Gold Coast. Weathered sandstones may become an increasingly important source of natural sand in the Gold Coast region if other terrestrial sources of fine sand are sterilised, but transport costs, water shortages and the significant quantities of clay and silt fines are problematic.

Fine sand is also sporadically produced from materials excavated from building and construction works in the coastal areas of Gold Coast and the north coast of NSW.

6.3 Alternatives to Natural Fine Sand

Partial substitutes for natural fine sand in some fill, drainage, bedding media and roadbase binder applications include certain types of recycled construction and demolition waste, concrete waste and crusher dust and scalps materials from crushing and screening of hard rock.

Because most recycled aggregates are a mixture of rock and other binder materials, it is difficult to predict their strength and durability, so they tend to be used in lower value applications or blended in small proportions with primary aggregates to make higher performance materials.

In Queensland, an estimated 1,200,000 tonnes (1.2 Mt) of concrete and brick construction and demolition waste is generated annually⁶ with an estimated 70% generated in South-East Queensland. Lesser quantities of rock-based waste materials are generated from industrial processes (such as pipe manufacturers, roof tile waste, precast concrete manufacturers etc).

Waste rock from mines is frequently remote from high consumption markets or contains contaminants or deleterious materials that preclude the use of such materials without considerable re-processing for use in even low quality applications. For example, the stockpiled waste rocks from the Ipswich coal mines, have a limited application as substitutes for primary aggregates because of their fine grained sedimentary nature, poor durability and variable nature.

Whilst there is clearly scope for further interception of construction and demolition waste prior to committal as landfill even under a full recovery scenario, total recycled aggregates are not likely to be able to satisfy any more than about 5% of total demand for aggregates in Northern New South Wales and South East Queensland.

Novel technologies such as the use of waste fly ash and clay materials to manufacture geopolymer cements and the use of recycled glass as a fine aggregate offer new opportunities to reduce reliance on natural resources but their contribution to satisfying primary demand is negligible.

For the foreseeable future, at least 95% of demand for extractive materials in the market area will need to be met from primary aggregates produced from rock, sand/ gravel and fine-medium sand resources.

In summary, recycled construction and demolition waste and secondary aggregates, whilst able to satisfy a small proportion of demand, cannot be considered as suitable alternatives to the development of known extractive resources such as the fine sand resources in the Tweed region.

⁶ QLD EPA (2003) The State of Waste and Recycling in Queensland, 2003.

Table 2 Sand Operations Within 80km Radius of the Project Site (Regionally Significant Operations are shaded)

Quarry Node (Annual fine sand production)	Location	Operator	Principal Material	Quarry Products	Approved Reserves (Mt)	Reserve Life (Yrs)	Probable/ Proven Resources (Mt)	Comment
1. Byron, Ballina, Lismore (0.2 Mtpa)	Suffolk Park, 5km south of Byron Bay	Batsons	Sand, weathered sandstone	Sand & (minor) gravel	4.5	22		Med-coarse sand & gravel; Estimated production 200 Kt pa
	Lismore, Wyrallah	Boral	Medium sand	Medium sand	In-stream	In-stream	Not known	Ballina concrete plants; back loading
	Ballina	Airport pit, BSC	Fine sand	Fine sand		N/O	Perhaps 0.5Mt	Currently disused
2. Tweed region (0.4Mtpa)	Hanson Tweed Sand Quarry	Hanson Construction Material	Fine sand, Loam	Concrete sand Brickies Loam	13	30		Quarry extension approved in 2006
	Chinderah	Action Sands	Fine sand	Concrete sand; Fill sand Brickies Loam, Topsoil	3.0	10	1.0 Mm³ Area 5 (1.5 Mt)	Tweed River in-stream + future dredging of Area 5
	Cudgen Lakes	Gales-Kingscliff	Fine sand, Loam	Fill sand; Concrete sand; Brickies Loam	0.6	1	7.5 Mt	Adjacent to TT&S; extraction not yet commenced
	Cudgen Pit	SE Excavations (Turner)	Fill sand	Fill sand, land development (SALT Project)	Depleted	0	0	Indurated sand being pumped as fill for SALT development
	Currumbin	Currumbin Minerals	Fine sand	Concrete Sand	Waste product from mineral sands beneficiation; sporadic supply			
3. Northern Gold Coast (0.1 Mtpa)	Coomera, Charlies Crossing	Readymix	Med sand, gravel	Med-coarse concrete sand, aggregates	5	10	0	Med-coarse river sand and river gravel
	Sand digout material	Boral Jabiru Island	Fine Sand	Concrete sand	0.05 Mtpa	Trans-shipment of sand from digouts / dredging from Broadwater in abeyance; supply is sporadic		
		Hope Island Canal	Fine sand	Concrete sand	0.1 Mt	2	Unprocessed fine sand from canal development	
4. Carbrook/ Jacobs Well (0.5 Mtpa)	Carbrook	River Sands	Fine -med sand	Concrete sand, filter media	>10	+ 20		Wet and dry processing; specialist sand products
	Jacobs Well	Wholesale Sands	Fine sand	Washed sand, loams	0.7	<5	0	Mortar sand, bedding fine sand
	Marks Road, Jacobs Well	Neumann Contractors	Fine Sand	Concrete sand, bedding sands	5	N/O	0	Approved for sand extraction; expected to commence in 2008
	KRA 65, Areas 5 a-f	Various owners	Fine Sand, Loam	Concrete sand; Fill sand; Mortar sand / brickies loam	0	N/O	> 20Mt	Sugar Cane land; three (3) DA's before planning authorities
5. Beaudesert (0.35Mt)	Tamborine	Clutha Creek Sands	Weathered sandstone	Concrete sands, loams	> Mt	+20		Large resources exist; silt generation; different sand type
	Mundoolun,	Mundoolun Sands	Weathered Sandstone	Concrete sands, loams	> 10 Mt	+20		Large resources exist; new operations underway; different sand type
6. Moreton Bay	Moreton Bay → Lytton	Lease then tender by 2007	Fine sand	Concrete sand	30	20	100 Mt	Qld EPA approved up to 1 Mm³ pa for next 20 years

6.4 Supply of VENM

For the purposes of this supply analysis, VENM from the Tweed region may be classified into three groups according to their utility as a secondary aggregate, namely:

1. benign clayey to clean sand and soil;
2. potentially acid sulfate soil - loam and sand; and
3. clay or marine mud.

The rate at which VENM becomes available for use as 'secondary aggregates' is very much Project dependent and so supply varies according to the location and extent of building and construction activity occurring in the coastal sediments of the Tweed and Gold Coast.

Whilst there is no formal data collected on VENM quantities generated in the north coast of NSW or the Gold Coast, previous investigations by ECOROC within South East Queensland suggest that the supply of excavated fill (equating to categories 1 and 2 above) as a source of secondary aggregates may be as high as 1 tonne per person per annum.

Within the Tweed, Byron and Ballina regions this would equate to an annual supply rate of approximately 150,000 tonnes. Builders and construction firms that encounter and need to remove VENM (eg for a unit development basement car park) have little difficulty in finding 'markets', provided the sand is relatively clean.

The known occurrence of acid sulfate soils in the coastal regions of Tweed and Gold Coast suggests that a proportion of VENM used as secondary aggregates is most certainly potentially acid forming. The offsite disposal of such potentially acid sulfate soils (PASS) is not advertised and indeed there is a general reluctance by construction entities, earthmovers and even regulators to openly discuss the matter of how and where these materials are disposed of.

From market enquiries by ECOROC, the following points in relation to the supply and disposal of VENM, and particularly PASS VENM have established the following.

- Soil or sand with a PASS classification that leaves an excavation is deemed by Tweed Shire Council as potentially contaminated and must be received, stored, treated and disposed at an appropriately credentialed facility. There is no such approved public facility in the Tweed region.
- The nearest licensed disposal facility for PASS material is at Carbrook near Beenleigh in Queensland at the northern end of the Gold Coast, where PASS material such as marine muds which are not suitable as secondary aggregates are disposed of via strategic reburial underwater (in lakes created from fine sand extraction).
- Most of the coastal developments in the Tweed region require the importation of fill, and so on major land development projects where there is sufficient operating room, offsite transport and disposal of PASS materials is minimal and PASS materials are increasingly being treated on site and incorporated into the design landform.

- In addition to general civil works for urban infrastructure, there is active and growing re-development (or 'infill' development) of older residential housing blocks in the coastal areas of South Tweed, Kingscliff/Pottsville, - particularly into 2/3 storey unit type developments with basement car-parking. These excavations require dewatering which increases the risk of acid generation from PASS materials. NSW DWE are taking an increasing interest in the ASS implications of dewatering on such sites.
- The development footprint of these smaller sites often takes up the whole site and so there is insufficient room for treatment of PASS materials before leaving site, despite this being the nominated solution in approved environmental management plans.
- The volumes of VENM (at least some of which is likely to be PASS) excavated from a single unit redevelopment can be in the order of 5,000 to 10,000m³. Annual quantities of PASS VENM from these sources alone may therefore amount to over 100,000m³ with this annual output expected to increase over the next 10 years in line with re-development activity.
- Foreseeable works by government entities such as Gold Coast City and Tweed Shire Council are expected to increase and over the next 12 to 18 months are likely to generate tens of thousands of cubic metres of PASS VENM.
- The Stotts Creek landfill facility operated by Tweed Shire Council report that they will only receive benign VENM or treated VENM provided a soils certificate has been issued by Tweed Shire Council. The cost of disposal of treated VENM is set by Tweed Shire Council but may range from \$30 to \$70 per tonne.

In summary, there is strong and sustained demand for VENM that can be used as a secondary aggregate, with the supply chain primarily controlled by earthmoving contractors/ cartage intermediaries who 'intercept' such materials at the excavation sites.

Major project sites with a high regulatory profile that are developed in stages generally treat and use PASS VENM material and incorporate such material into the design landform of the site, so there is limited offsite removal of such material.

The principal supply sources of 'exported' PASS VENM are from smaller re-development sites on the coastal plain and from civil infrastructure works projects. The volume of PASS VENM material generated from within the Tweed region and in general proximity to the Cudgen Lakes Project Site is expected to increase substantially over the next 10 years as redevelopment of older and smaller housing lots within the coastal plain intensifies, along with an increase in the level of infrastructure support works.

The treatment and re-use of PASS VENM material with utility as secondary aggregates is preferred by industry and government alike, over the less desirable strategic interment disposal solution. Nevertheless, for PASS VENM material such as marine muds and clays that cannot be used as secondary aggregates, there exists a local need for a dedicated and appropriately authorised disposal site for such material. In these instances, strategic interment by sub-aqueous deposition in excavated sand lakes may provide a sustainable solution to a waste disposal problem where existing strategies are demonstrably ineffective.

6.5 Conclusions on Supply Sources

The principal market area for fine sand from the Tweed region extends from Ballina in Northern NSW to the Gold Coast in South East Queensland and is expected to consume 15 million tonnes of fine sand over the next 15 years.

The existing shortage of sources of fine sand including concrete sand and mortar sand within the Gold Coast and greater Brisbane market areas has occurred as a result of depletion of existing land-based sand reserves and the lack of approval for replacement resources.

The nearest fine sand resources of regional significance to those of the Tweed region are situated beneath sugar cane land in the Jacobs Well key resource area, near Beenleigh at the northern end of Gold Coast City. The sole remaining fine sand quarry at Jacobs Well is close to depletion.

Development applications for new sand quarries in the Jacobs Well area are presently under consideration but there are conflicts with the Gold Coast planning scheme for sand located under land classified as good quality agricultural land. Queensland EPA has committed to the ongoing extraction of fine sand from the marine sand resources of Moreton Bay, which will help satisfy demand for concrete sand in Brisbane.

Whilst sand materials (or VENM) recycled from excavations on building and construction sites constitute an important source of secondary aggregates in the NSW north coast and Gold Coast region, these materials are already fully utilised and along with other recycled construction materials cannot satisfy anymore than a small percentage of existing and future demand for fine aggregates.

In the foreseeable future, at least 95% of demand for extractive materials will need to be satisfied from primary aggregates produced from rock, sand/ gravel and fine-medium sand resources. New reserves of fine sand are needed to satisfy existing and future market demand, particularly to service the Gold Coast ~ Brisbane region where demand for fine sand continues to outstrip supply.

This shortfall in approved fine sand reserves is leading to increased haulage of sand over longer distances and attendant price rises. The fundamental drivers of fine sand demand consisting of unprecedented Queensland state government expenditure on transport, water, freight and energy infrastructure projects in South East Queensland and commercial and residential development activity, are expected to remain strong for the foreseeable future.

The fine sand resources such as those at the Project Site in the north east corner of the Tweed LGA are regionally significant and constitute a strategically important natural resource with the potential to help satisfy the high level of regional demand for fine sand in major projects, land development, building and construction material applications.

For the purposes of project planning, the an estimated 30,000m³ of PASS VENM (VENM(b)) could be received annually at the Project Site. On the assumption that 50% (eg sand, brickies loam, topsoil) was re-useable after treatment, this would generate a net inflow of approximately 20,000 m³ pa of material.