Ausrocks on behalf of Ecoroc completed an assessment of demand for quarry products from major projects in the Bowen Basin.

Over the period from 2012 to 2015 an estimated 15 Mt of crushed rock products will be consumed by coal mine and rail line development in the Bowen, Surat and Galilee Basins.

Whilst clearly this impacts on discretionary supply to TNRP projects, the supply capacity itself largely exists because of the foreseeable and sustained demand from coal mines and their infrastructure needs.

In contrast, port infrastructure projects tend to act as 'blackholes' consuming all available supply of quarry (crushed rock) products (eg Abbot Point, Gladstone).

CSG wells and pipelines consume considerably less crushed rock products.

KEY FINDINGS: COMPETING DEMAND FROM MAJOR PROJECTS FOR CRUSHED ROCK PRODUCTS

On behalf of Ecoroc, Ausrocks (2012) completed a review of the demand from major projects in the Bowen Basin (Mackay Region) for hard rock quarry materials and implications for quarry supply to TNRP projects. The findings, based on consultations with industry, quarries and contract crushing firms include:

1. A new coal mine development requires 250-350 kt of crushed rock products for mine development

2. A coal mine producing 10Mt/a of coal typically uses about 400 ktpa of crushed rock (quarry) materials for roadways, ramps, hardstand areas and stemming of blastholes. It is easier to meet the mines specification than DTMR specification.

3. The construction of a metre of rail line consumes approximately 12 tonnes of rail ballast. Quarries report that demand from major projects such as mining projects is much easier to schedule, whereas monthly DTMR project demands are variable and therefore more difficult to schedule.

4. A number of quarries are running close to peak output to supply coal mine demands in the Bowen Basin and are ramping up to supply increased demand. So peak monthly demands from DTMR may not be achievable, given the increase in base load supply for committed projects.

5. There is a shortage of mobile plant for crushing and screening - plant is being sourced from SEQ and WA, if available.

6. The premium to attract quarry operators results in a 30% increase in labour cost over SEQ quarries so increased supply to DTMR projects will cost more.

7. QR contracts (rail ballast) leave "rejects" that are good for road base and aggregates. Eg Undersize from ballast jobs can be used to make roadbase and aggregates but there is some wastage in the upper size of the undersized aggregate because of the pre-coat spec.

For the period 2012 to 2014, Ausrocks data suggests the following additional demand for crushed rock products from coal mining and related rail and port infrastructure:

- New coal projects = 2.7 Mt (majority from Mackay Whitsunday Region);
- Expanding coal mines = 2.6 Mt;
- Demand from major infrastructure projects (railway line, port development etc) ~ 4 Mt.

Collectively this equates to 9.3 Mt of additional crushed rock demand, over 3 years.

DEMAND FROM COAL MINES AND MAJOR PROJECTS – Ausrocks 2012

Total 'Black Hole' demand (eg mine, rail and port development) is estimated to require 15 Mt of crushed rock products over the period 2012-2015.

In the next four years, commencement of 15 new coal projects will occur generating additional crushed rock demand of 1.8Mt/a by 2015 for these projects.

The extra quarry material demand for 11 expanding coal mines in Queensland is 3.5 Mt from 2012-2015, mostly from the Mackay – Whitsunday region.

Extra demand in the Mackay-Whitsunday Region is in the range of 1.2-1.4 Mt/a in 2014-2015.

Demand for the Xstrata Wandoan project will be met by the new nearby Weringa Quarry, currently in Development Application stage.

Major infrastructure projects are commencing over the 2-year time frame 2013-2014. In most cases port and rail projects are not dependent on existing quarry supplies, except for specialist materials (concrete, ballast and capping rock). Demand from port and associated development is estimated at 4 Mt over the period 2012-2014.

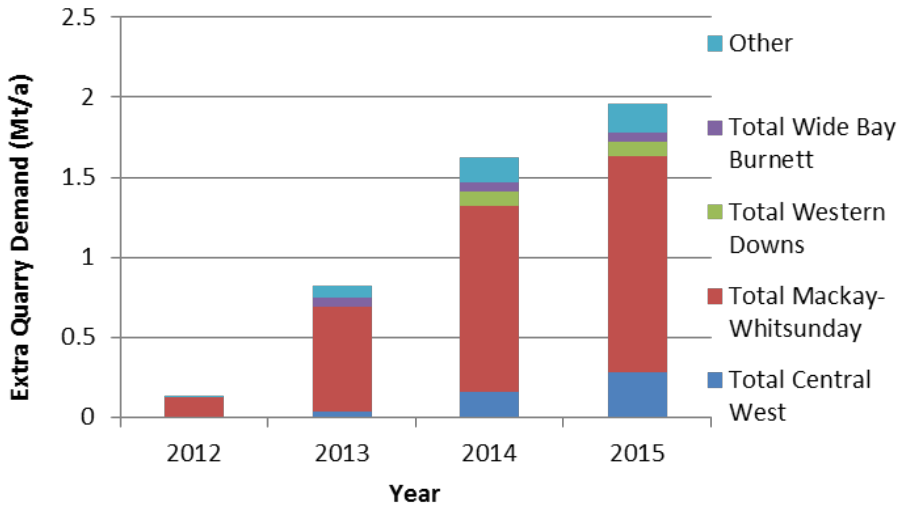


FIGURE 22: ESTIMATED ADDITIONAL DEMAND FOR QUARRY MATERIALS FROM NEW COAL PROJECTS IN QLD 2012 TO 2015

Source Ausrocks, market research Jan 2012

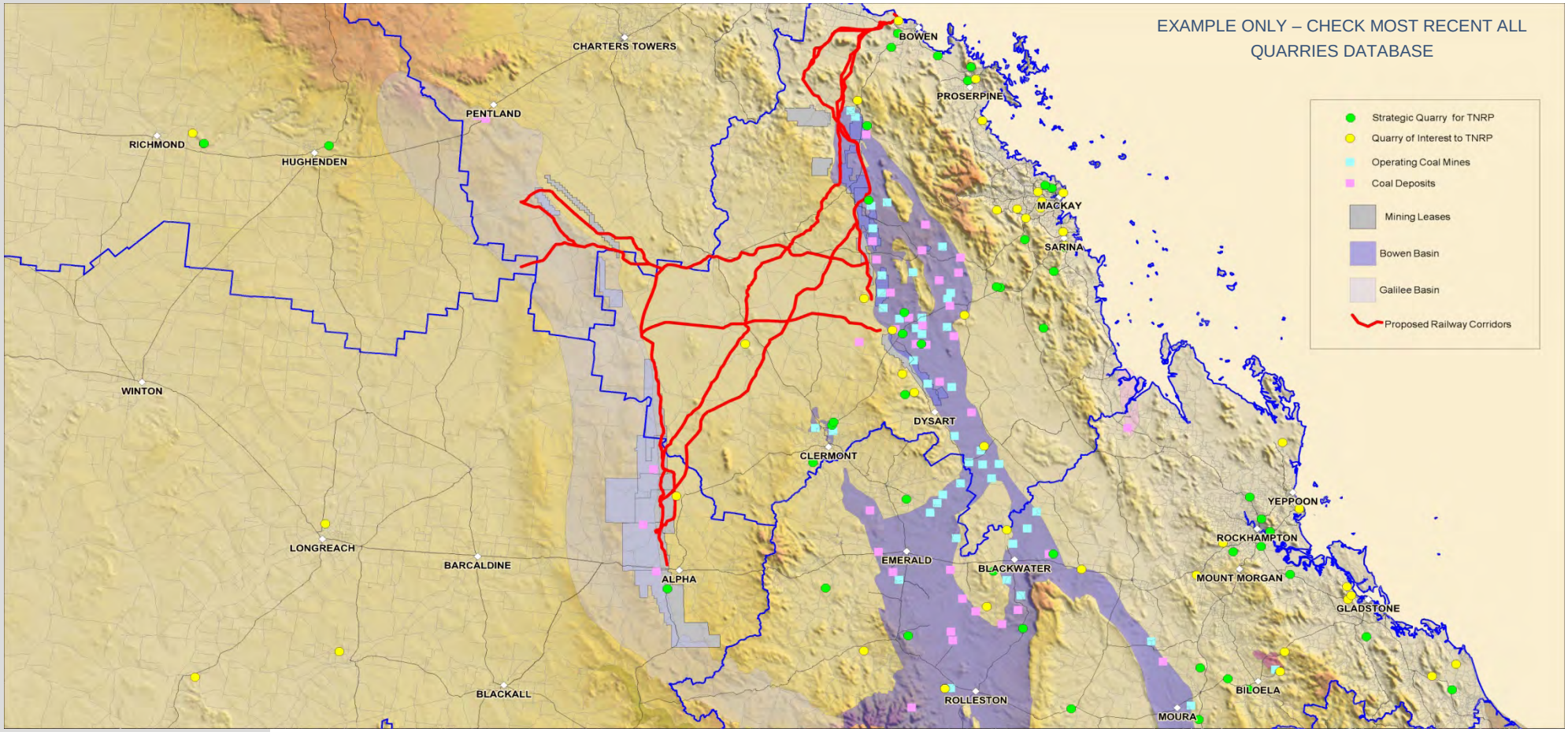


FIGURE 23 (a) BOW EN AND GALILEE BASINS – QUARRY LOCATIONS AND MAJOR PROJECTS (NEW AND EXISTING COAL MINES), PROPOSED RAIL LINE(S)

FIGURE 23a shows the location of Strategic Quarries and Quarries of Interest for the northern section of the Bowen and Galilee Basins along with operating coal mines, new coal deposits and various railway corridor options for the Galilee Basin.

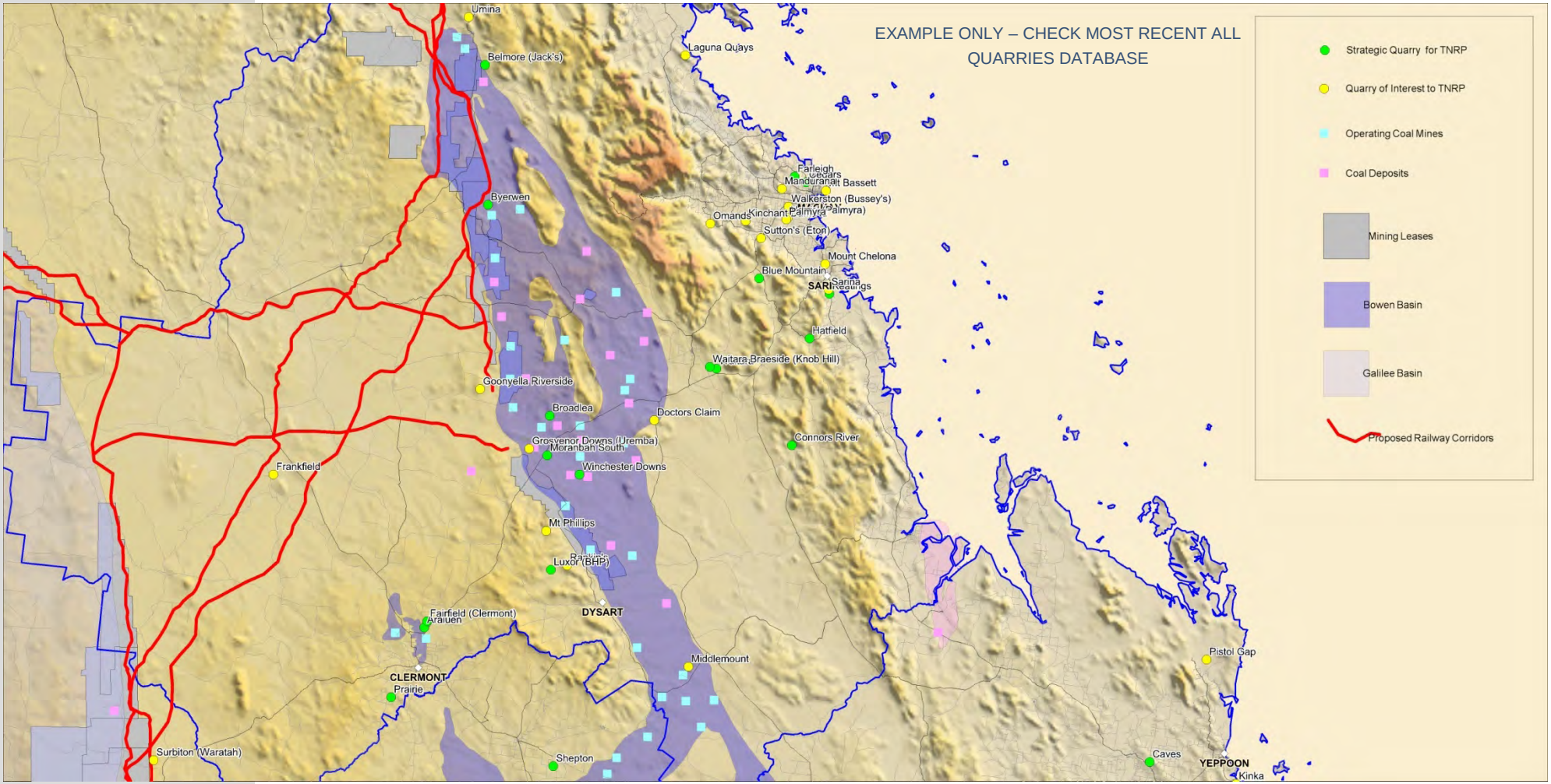


FIGURE 23 (b) BOWEN AND GALILEE BASINS – QUARRY LOCATIONS AND MAJOR PROJECTS (NEW AND EXISTING COAL MINES), PROPOSED RAIL LINE(S)

TRADITIONAL SUPPLY AND DEMAND CURVES

P indicates price
Q indicates quantity in a period of time (eg tonnes sold per year).

The intersection of the demand curve **D1** with the supply curve **S1** shows the prices (**P1**) that users are willing to pay for quarry products, at a 'normal' level of supply (**Q1**).

If 'new' extractive resources could be quickly brought into production in CDA's, then the supply curve would shift from **S1** to **S2**.

But at the higher levels of demand, the supply side response becomes more limited. Lead times to gain approvals for new quarries can take years and cost hundreds of thousands of dollars.

Under such conditions, incumbent quarries have a choice of discretionary supply and customers must 'compete' for remaining production.

With the mining and related infrastructure boom, the demand curve shifts to **D2** (current position) and to **D3** (caused by additional TNRP, Qld RA and 'major project' demand).

If 'new' extractive resources could be quickly brought into production, then the supply curve would shift from **S1** to **S2,** thus increasing the quantity of materials available, and moderating the price.

However, the supply-side (industry) response is more limited than this, and it is not of itself, a feasible solution to resolve quarry material shortfalls in CDA's.

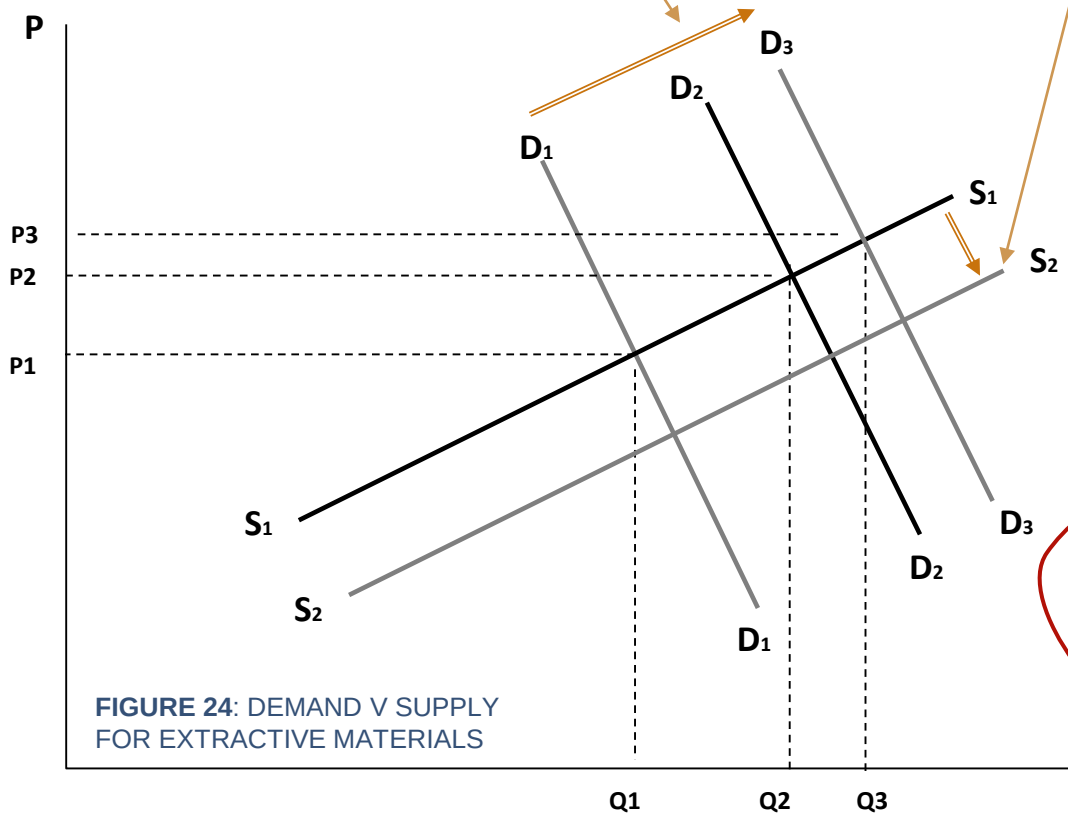


FIGURE 24: DEMAND V SUPPLY FOR EXTRACTIVE MATERIALS

Source: Ecoroc (2012)

LIMITS IN CDA'S TO INCREASING SUPPLY FROM NEW RESOURCES

In the Critical Demand Areas of Qld, the supply curve is pushing upwards (becoming more "inelastic") as demand intensifies and there are limits to the quarrying industry's capacity to respond.

Some hard rock quarries under development (or approval pending) will provide new supply sources, but the vast majority of TNRP demand will need to be satisfied from existing hard rock quarries.

SUPPLY AND DEMAND CURVES -EFFECT OF CONSTRAINED SUPPLY OF QUARRY PRODUCTS

P indicates price

Q indicates quantity in a period of time (eg tonnes sold per year).

With the mining and related infrastructure boom, the demand curve shifts to **D2** (current position) and thence to **D3** (anticipated from additional TNRP and Qld RA demand).

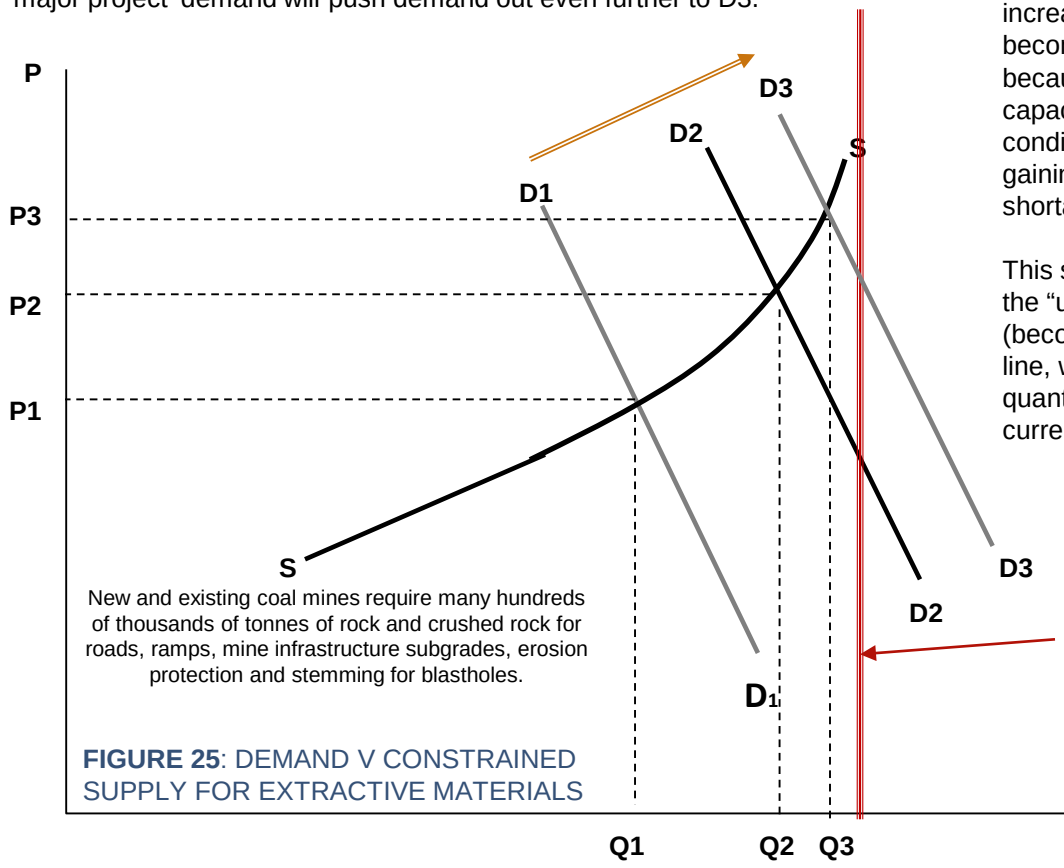
The quarrying industry supply response (shown by curve **S-S)** trends upwards, as various factors combine to limit production at quarries.

Customers must 'compete' for any remaining discretionary supply capacity from quarries.

Quarries in coal mining regions report a preference to supply roadbase and aggregate to the mines, because the specifications are not as tight, margins are good, supply is long-term and there is less commercial risk.

In Critical Demand Areas such as the **Bowen Basin** (Mackay ~ Fitzroy Region), demand for extractive materials from port, mine and railway projects is occurring on top of underlying construction, road-building and housing demand. Annual per capita consumption of crushed rock in coastal Qld averages about 8 tonnes – in the Mackay/Whitsunday region it is almost 15 tonnes. The supply of quarry materials is therefore constrained as quarries reach or approach maximum output - with limits set by (i) processing plant capacity, (ii) stockpile constraints (no stock or no room), (iii) production limits set by license conditions, (iv) difficulty in gaining development approvals, (v) labour (accommodation) shortages and (vi) truck shortages during periods of peak demand. Quarrying costs in the Bowen Basin are typically 30% higher than those in metropolitan areas. In Gladstone, total quarrying costs are reportedly 20% higher than 'normal'.

As demand for crushed rock products in CDA's increases, the demand curve shifts out to the right eg from D1 to D2. TNRP, Qld RA and 'major project' demand will push demand out even further to D3.



New and existing coal mines require many hundreds of thousands of tonnes of rock and crushed rock for roads, ramps, mine infrastructure subgrades, erosion protection and stemming for blastholes.

FIGURE 25: DEMAND V CONSTRAINED SUPPLY FOR EXTRACTIVE MATERIALS

As production of crushed rock products increases, additional further supply becomes limited (or severely constrained) because of limits to processing plant capacity, stockpile capacity, licence conditions which restrict output, difficulty in gaining approvals and labour and truck shortages.

This situation is illustrated in the model by the "upwards" curving supply curve S-S (becoming "inelastic") and the vertical red line, which represents the maximum quantity that the industry can supply under current conditions.

The quarrying industry supply response is limited unless constraints to further supply of hard rock quarry materials in CDA's can be overcome.

Source: Ecoroc (2012)

MOST INFLUENTIAL SUPPLY-SIDE CONSTRAINTS

Economic, market, processing, distribution and approval /licensing factors are likely to exert the most influence on the capacity of quarries to provide discretionary supply to TNRP works over the period 2012 to 2014.

These factors are highlighted in FIGURE 26: QUARRY ASSESSMENT FRAMEWORK – SUPPLY SIDE CONSTRAINTS for the Critical Demand Areas.

The factors In FIGURE 26 highlighted in 'Red' are the most influential (Economic; Markets), followed by next most influential 'Orange' (Approvals/Licensing; Processing; and Distribution) and then 'Yellow' (Resource; Social/Cultural and Governmental).

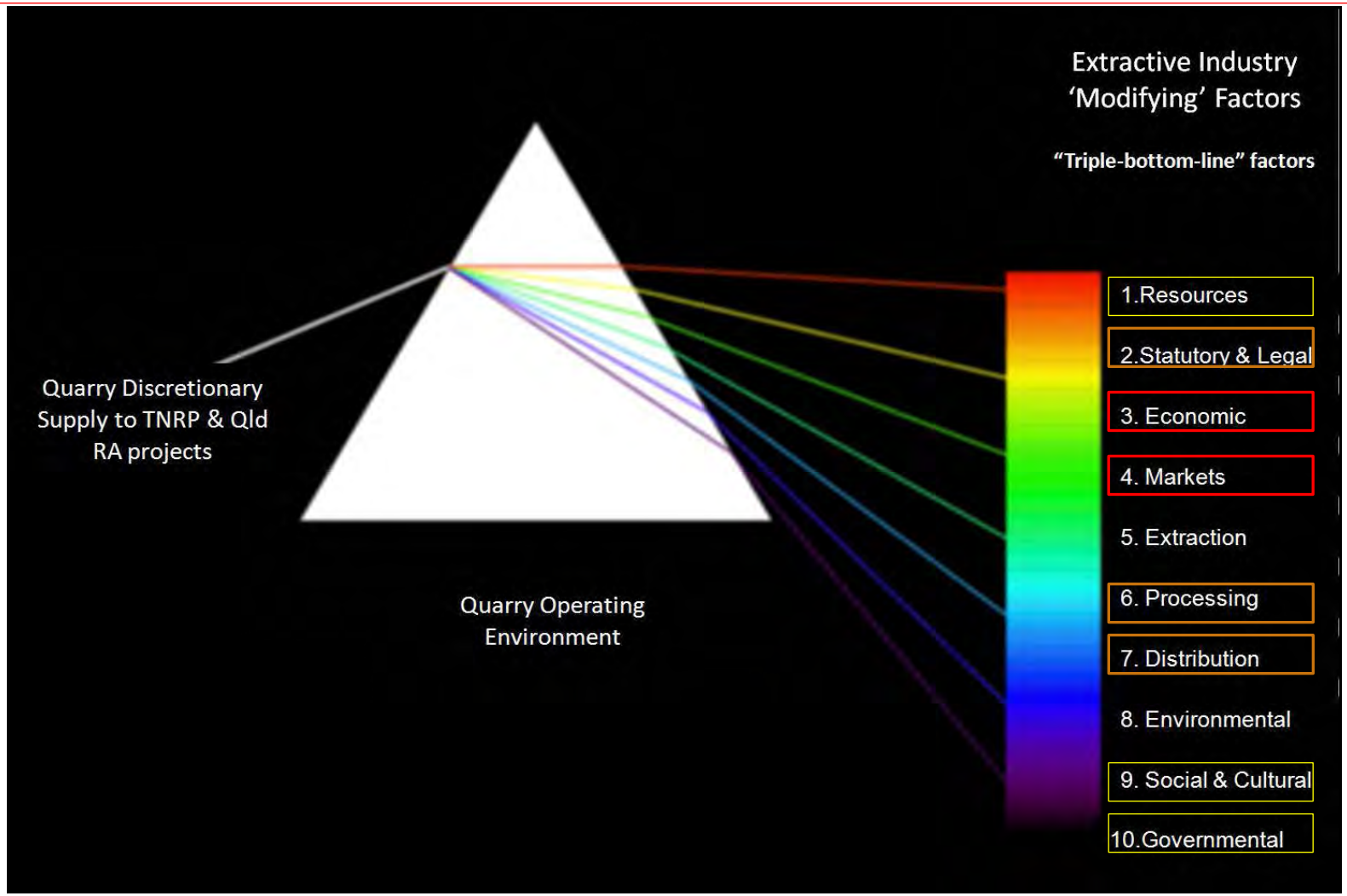


FIGURE 26: QUARRY ASSESSMENT FRAMEWORK – CONSTRAINTS TO DISCRETIONARY SUPPLY TO TNRP IN CRITICAL DEMAND AREAS

Source: Ecoroc (2011)

The factors that impact on discretionary supply capacity to TNRP interact and change. Monthly tonnages for production of Type 2.1 (2.2) roadbase have been estimated assuming constraints could be reasonably addressed or overcome. Similarly, the discretionary supply/production of aggregates has also been assessed, but the yield is low for a particular size fraction.

MWR Discretionary Supply
Constraints Addressed
Type 2.1 Roadbase
Jan 2012 – Scenario Only

Strategic Quarry	t/month
Mt Chelona	
Waitara	
Winchester Downs	
Blue Mountain	
Cedars	
Farleigh	
Hatfield	
Keatings	
Belmore (Jack's)	
Gordon's	
Longford Ck (Eden Lassie Ck)	
Byerwen	
Luxor (BHP)	
Prairie	
Foxdale Proserpine	
North Gregory	
Araluen	
Broadlea	
Fairfield, Clermont	
Moranbah South	
Waitara Braeside	
West Euri Creek (BQC)	
Total	**212,000**

Import from Other Regions	
Shepton Quarry	Fitzroy
After FY 2012	

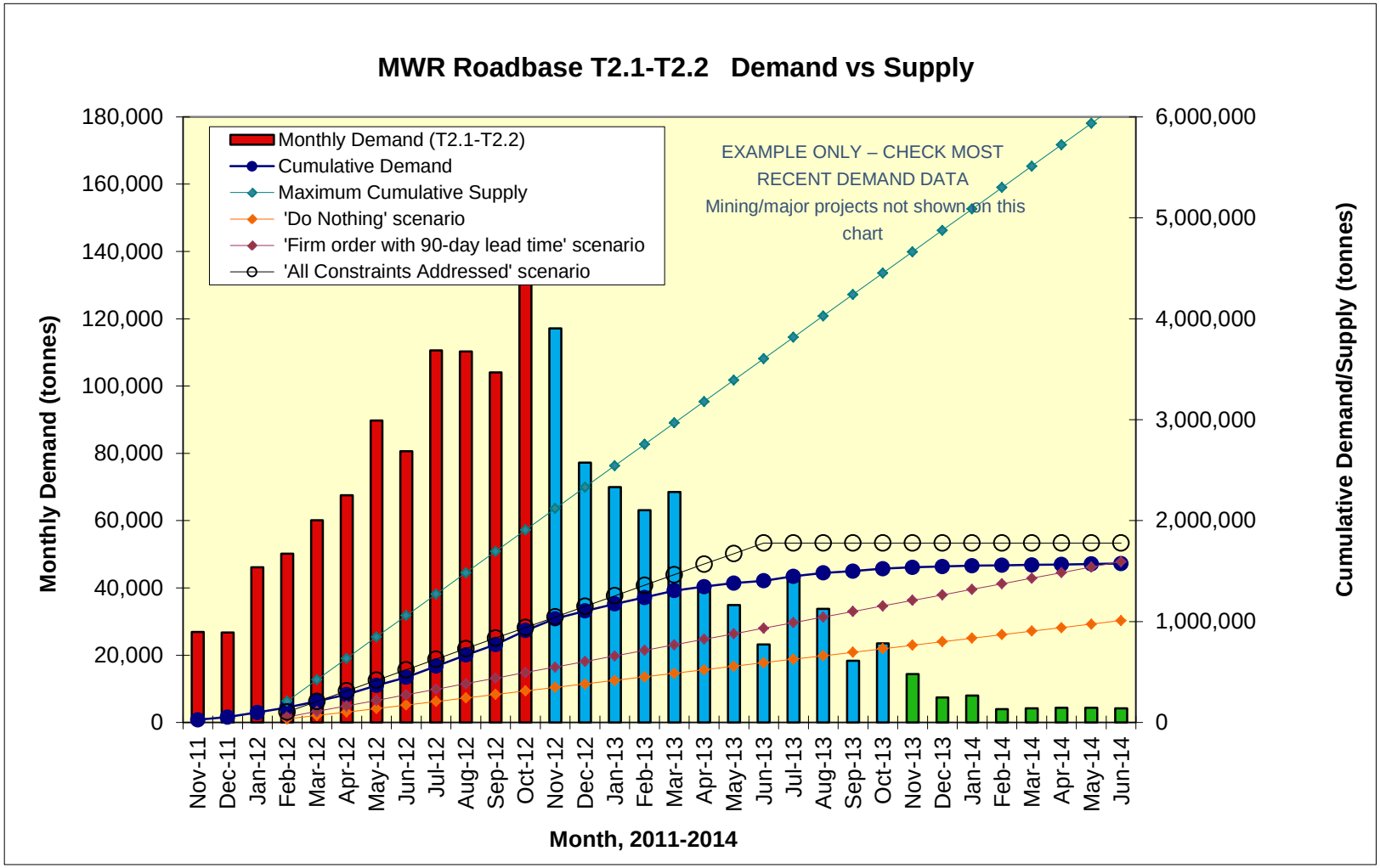


FIGURE 27: DEMAND V STRATEGIC QUARRIES' TNRP DISCRETIONARY SUPPLY FOR ROADBASE – MACKAY WHITSUNDAY REGION

Supply Side Constraints

There are five (5) dominant areas where supply side constraints are acting in the CDA's:

1. **Market Related** – sustained demand in some regions within CDA's means quarries could only supply if they have time to schedule and plan for the TNRP and Qld RA work.
2. **Truck Transport** – insufficient truck availability during peak demand, driver shortages, cartage rate increases.
3. **Approvals and Licensing** – inertia in DA process; exceedance of DERM ERA thresholds and IDAS trigger provisions; Wild Rivers declaration in Cooper Creek Basin; desperate need for ease of approval requirements for accommodation camps.
4. **Processing** – need for mobile crushing plants, operational labour and managers; shortage of pre-coat/CTB plants.
5. **Resources & Extraction** – Pit plans; blast logistics; product testing.

TABLE 6: SUMMARY OF SUPPLY-SIDE CONSTRAINTS FOR MACKAY WHITSUNDAY REGION

	Mackay / Whitsunday Region	Scenarios		
Constraints Area (Modifying Factor & no.)	**Constraints Description**	**Do Nothing**	**Advance Warning only**	**Constraints Addressed**
1. Resource & Extraction	Lack of pit planning (eg campaign sites); Quarry dev. plans (DEEDI OH&S requirement); blast logistics; O/B or stripping ratio; Variability of basalt quality (SMC etc; efficacy of specs.); Poor sampling/testing knowledge in CDA's amongst quarries and some labs	0.06	0.06	0.04
3/4. Market (Customer) & Competitive Choice	Lack of Forewarning/Communication - Quarries in CDA's with discretionary supply capacity need forewarning (eg 3 months advanced notice for TNRP supply); Little or no stock; Quarries say they can satisfy TNRP peak demand needs provided they are given adequate notice - eg Can add extra shift, schedule campaign crushing, help secure access to HR and C&S plant, arrange road haulage contractors etc	0.43	0.10	0.10
6. Processing	Reliance on mobile plant and campaign crushing (cf fixed plant); Capabilities of contract crushing firms (labour; skills; expertise); Most quarries don't have pre-coat plants	0.30	0.30	0.15
7. Truck Transport	Insufficient truck availability during peak demand; Problem reduces with production and delivery in advance of projects; Cartage price increases during term of supply contracts; Access for road trains; Haulage restrictions (eg Koumala Range); Driver experience / driver fatigue	0.27	0.27	0.20
2. Approvals & Licensing	Access to reserves; DERM ERA thresholds; DA's currently under assessment; DA's for accommodation camps; Extended hours of operation; Sale of quarry materials from mining leases; Access road/entrance requirements; Native title requirements and exemptions	0.40	0.40	0.16

These 'loss efficiency' factors have been applied (in the demand ~ supply modelling) to demonstrate the effect of addressing / partially overcoming constraints to discretionary supply in the CDA's.