Plateway

Review of Quarry Products Distribution by Rail and Rail Logistics Options for Martins Creek Quarry

For

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1.2	25/05/2021	P.Imrie	Initial Issue

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1 Executive Summary

Martins Creek Quarry is one of a few rail served quarry facilities in NSW and the only rail served quarry in the Hunter Valley Region. Due to existing Environmental Protection Licence (EPL) Constraints and changes in the Rail Industry the amount of product despatched by rail has declined on average to just above 30,000 tonnes per annum. This represents a train load every 1 -2 weeks.

With the exhaustion of several historical sources of construction materials in the Sydney Basin and the increase in demand for construction materials generated by the Greater Sydney Regional Plan due to the development of the Aerotropolis in Western Sydney there is a future opportunity to rail 600,000 t per annum of Quarry Products from Martins Creek.

The current layout at Martins Creek is suitable for loading the ballast trains operated by ARTC in the Hunter Valley, but is too short for the operation of longer trains and modern aggregate trains serving non railway markets.

To allow for the expanded Quarry output the rail loading facilities at Martins Creek require remodelling to enable the operation of longer commercially efficient rail consists. To facilitate this the quarry design has been amended to allow extension of the tracks into the existing eastern quarry with provision for up to three tracks allowing loading using front end loaders rather than the current bin arrangement.

Future rail distribution into the Sydney Market is only possible with the ability to load trains on a 24 / 7 basis, upgrading the existing loading facility to accommodate commercially viable train consists, the ability to negotiate access to an existing unloading facility and suitable train paths. 600,000 kt per annum could be railed to a terminal in the Sydney area using rollingstock available for lease and operating a 24 hour return cycle between Martins Creek and a terminal in Sydney.

The use of direct rail delivery and distribution of ballast has the lowest environmental footprint of any ballast distribution logistics solution, but is becoming increasingly difficult as a result of availability of rail wagons, the cost of ad hoc locomotive hire, rail network congestion and restrictions on loading at rail served quarries which are increasing the use of road served temporary stockpiles.

The importance of maintaining a rail delivery option for ballast is especially significant for the portions of the rail network which are adjacent to waterways (Hawkesbury River – Woy Woy) and National Parks (Sandy Hollow – Coggan Creek).

Due to the intensity of passenger train services between Maitland and Newcastle and on the TfNSW electrified passenger network there is not significant spare capacity during hours of passenger train operation. The imposed Environmental Protection Licence #1378 restrictions on evening and night loading at Martins Creek is halving the utilisation of the ARTC ballast trains and doubling the fixed cost of rail ballast distribution. This provides an incentive for the rail networks to deliver the ballast by road to temporary stockpiles for distribution. If Martins Creek was used to load aggregate for the general construction industry, then evening and night time loading would be essential to produce a viable alternative for the rail logistics chain.

The North coast line has sufficient network capacity to support the current and possible increased use of rail transport of ballast and aggregates from Martins Creek Quarry.

The rail network congestion effectively limits the day time loading at Martins Creek to a single train per day.

The ability to transfer the current aggregate output from road to rail in the Hunter Region is not possible due to the large number of customers and small volumes being delivered to each. The ability to transfer aggregate to Sydney and the broader area is possible within the project life of the quarry, and requires access to an existing facility similar to the SADA facility at Glenlee.

To enable a rail based logistics option to be competitive in the Greater Newcastle area market against the road based logistics chains associated with other sources of aggregates suitable for construction purposes, the market share and size would have to allow a throughput in excess of the proposed production at Martins Creek Quarry.

The use of rail transport for aggregate distribution has several advantages mainly in terms of:

- lower line haul cost,
- high throughput, and;
- surge capacity

The commercial viability of rail transport for aggregate depends on:

- the throughput required;
- the cost of fixed plant; and
- availability of enough train paths to enable multiple cycles to be operated each day.

The current restriction on loading hours at Martins Creek Quarry, coupled with the available train paths, limits the rail throughput to a single train per day. This means that rail transport options become more expensive over short distances with small volumes and are not competitive with road transport.

2 Introduction

2.1 Scope

The scope of this study is to assess:

- The availability of access to the rail network for railing of products from Martins Creek;
- The market which could be served using rail logistics including an assessment of the likely market demand over the life of the Project; and,
- An order of magnitude cost estimate to provide rail access to potential rail unloading locations required to reduce the current road served market at Martins Creek with rail haulage.

This report includes options for the use of rail transport to distribute product from Martins Creek Quarry.

The total proposed quarry production (across all product types) will be 1,100,000 t per annum of which up to 500,000t will be distributed by road, and up to 600,000t will be distributed by rail.

2.2 Background and Experience

This report has been prepared by Phillip Imrie, BE Civil, MBA.

Phillip has over 35 years of experience in the Australian Railway Industry, having started as an engineering cadet with the then State Rail Authority of NSW. During the early 1990's Phillip was responsible for the track upgrading program for the northern region of CityRail between North Strathfield and Newcastle.

Subsequent to this, Phillip was responsible for track renewals throughout regional NSW. After leaving the State Rail Authority of NSW in 1997, Phillip has continued to work in the railway industry and has previous experience in rail logistics on several major assignments in the Hunter region and NSW including the following work dealing with aggregate / mineral transport:

- Boral (Sydney Hard Rock Project South Marulan to Sydney)
- Hume Coal Project
- Maldon to Dombarton Study
- GRA (Kevin to Thevenard gypsum haulage)
- Pacific National Metro Freight Studies
- Northern Energy Ashford Coal Logistics
- Delta Electricity

2.3 Glossary and Abbreviations

Table 1 Terms and their meanings.

Term	Meaning
ARTC	Australian Rail Track Corporation. A corporation owned by the federal government which has leased the interstate mainlines and the Hunter Valley Coal network.
Cycle	The entire bulk logistics operation including loading, transportation of product, unloading and empty return of vehicles to load.
EPL	Environmental Protection Licence
Throughput	Material transported by the logistics chain.
TfNSW	Transport for NSW the state government department which owns the rail network.
Mtpa	Million tonnes per annum.

2.4 Railway Assets and Current Operation at Martins Creek

The Quarry at Martins Creek is connected to the Main North Coast railway line. The former crossing loop (now Goods Siding) at Martins Creek provides direct access controlled from the ARTC Control Centre at Broadmeadow. Presently due to infrequent use, manual operation of 51 points is required if there are more than 72 hours between trains (refer to Figure1). Trains entering the quarry yard have to stop, operate the catchpoints at either end of the Corey St Level Crossing, and use manual traffic control to stop road traffic. Once road traffic has been stopped the train can proceed across the crossing.

Figure 1 Corey St Level Crossing viewed towards the west.

The Goods Siding can hold a train of up to 345 m in length. To work a longer train into the Quarry with the current arrangement, additional staff would be required to manually operate the catchpoints and stop road traffic.

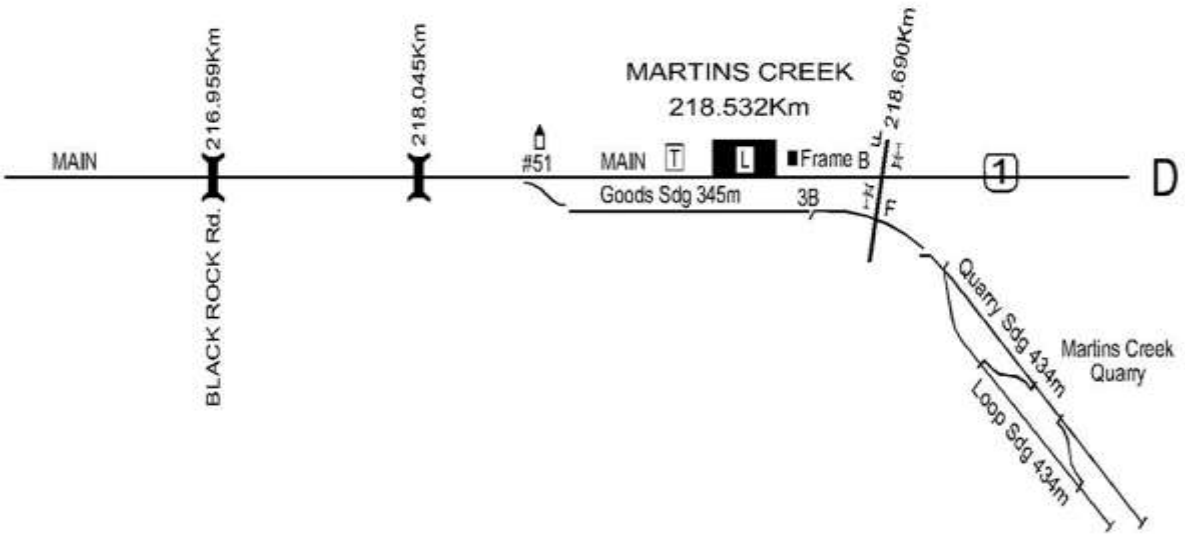

Figure 2 Current yard layout at Martins Creek.

The current ARTC ballast trains have a length of 332 m and fit into the Goods Siding with a wagon length to spare.

Once in the quarry yard, the train engines run around the train so that they are on the Newcastle end of the train. The train is then split for loading. The track beyond the loading bin can accommodate 210 m of wagons which is just over half of the wagons on ARTC's current 24 wagon trains. The train is pushed back underneath the loading bin and wagons are loaded one at a time. Each wagon takes around five minutes to load. The entire loading operation which includes entering the yard, running around, loading the train, splitting and joining the train and preparing to depart takes between 2.5 and 3 hours. All shunting is carried out by the train crew.

The railway facilities at Martins Creek Quarry are in reasonable condition (refer to Figure 2), suitable for the usage they receive at present. The current facilities do not allow for the operation of modern aggregate or ballast trains because of the shunting time involved in loading and the restricted train length. The plant can currently load out a single product type only by rail at a time. Altering product types requires manual reconfiguration of the conveyors and feed systems.

Figure 3 Railway loading facility at Martins Creek Quarry.

2.5 Modern Aggregate Loading Facilities

The two most recent loading facilities constructed in New South Wales for aggregate transport are at Lynwood and Peppertree Quarries in the Southern Highlands.

Both of these facilities have been constructed within the last ten years and are able to load a train between 800 to 1200 m long and load multiple product types without shunting and splitting the train. The capital investment in these rail facilities only is around $10 million each, without the investment in loading facilities.

Figure 4 below shows Holcim's siding at Lynwood. The aerial photo has captured a train with a locomotive either end loading. This train configuration would have no shunting moves and would position the first wagon under the load point and drive out.

Figure 4 Lynwood Quarry Siding source Google Maps.

Figure 5 below shows the layout of Peppertree Quarry load out. This layout is a very efficient load out arrangement using a loop so trains do not have to shunt or drivers reverse ends to load. The loop has the potential to load trains over 1 km long (although shorter trains are currently operated).

Figure 5 Peppertree Quarry Load Out source Google Maps

2.6 Required Yard Configuration at Martins Creek

To enable the efficient transport of products from Martins Creek by rail the sidings require extension in order to operate commercially viable train configurations. Figure 6 shows the proposed siding footprint that is capable of accommodating trains of up to 36 x 13.5 m wagons with a total length of wagons 486 m. This train consist would have a payload of over 2,760 t.

Once in the Quarry Yard the locomotives would run around the train and place half the train at a time for loading using front end loaders. Depending on the number and size of front end loaders used around an hour would be required to load each half of the train. The minimum turn around time at the Quarry would be around 3 hours which is similar to the current ballast train operation. However, nearly 3 times the amount of material would be loaded out in the same time period.

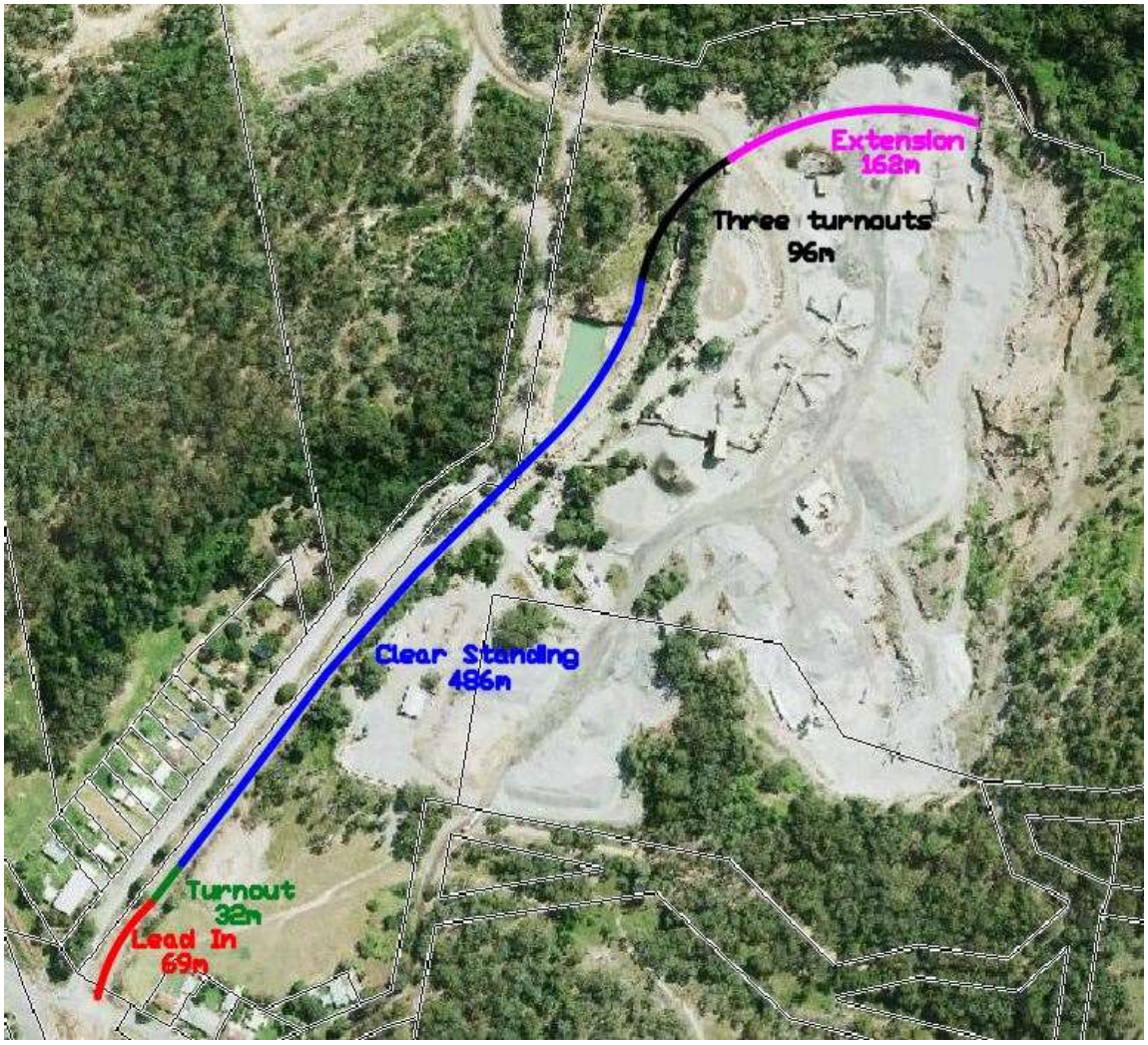

Figure 6 Martins Creek layout image source SixMaps

Compared with the current operation noise would reduce as the locomotives would be opposite houses in Station St for a shorter duration.

The configuration would also allow ballast trains of at least double the length currently operated with a payload of up to 2700 t per train. These would be far more commercially attractive in the longer duration track closures now being used by ARTC. Due to the tight curve radius the configuration requires the use of “special similar flexure curved turnouts”.

The costs associated with reconfiguration and ongoing maintenance of the existing rail loading facilities have not been included in the cost of rail transport neither has the ongoing connection fee as these are assumed to remain the same as current operations.

The order of magnitude capital cost of the extension would be between $5.8 and $7.1 million.

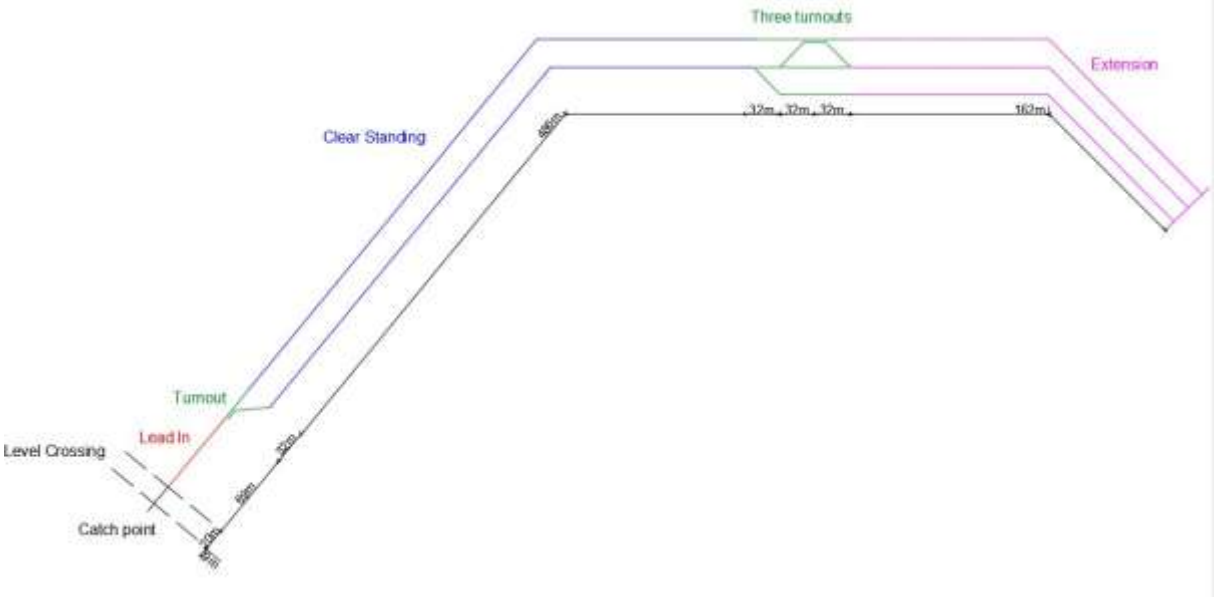

Figure 7 Martins Creek proposed rail facility extension line diagram

2.7 Ardglen Quarry

Daracon own a quarry at Ardglen which also has a rail siding.

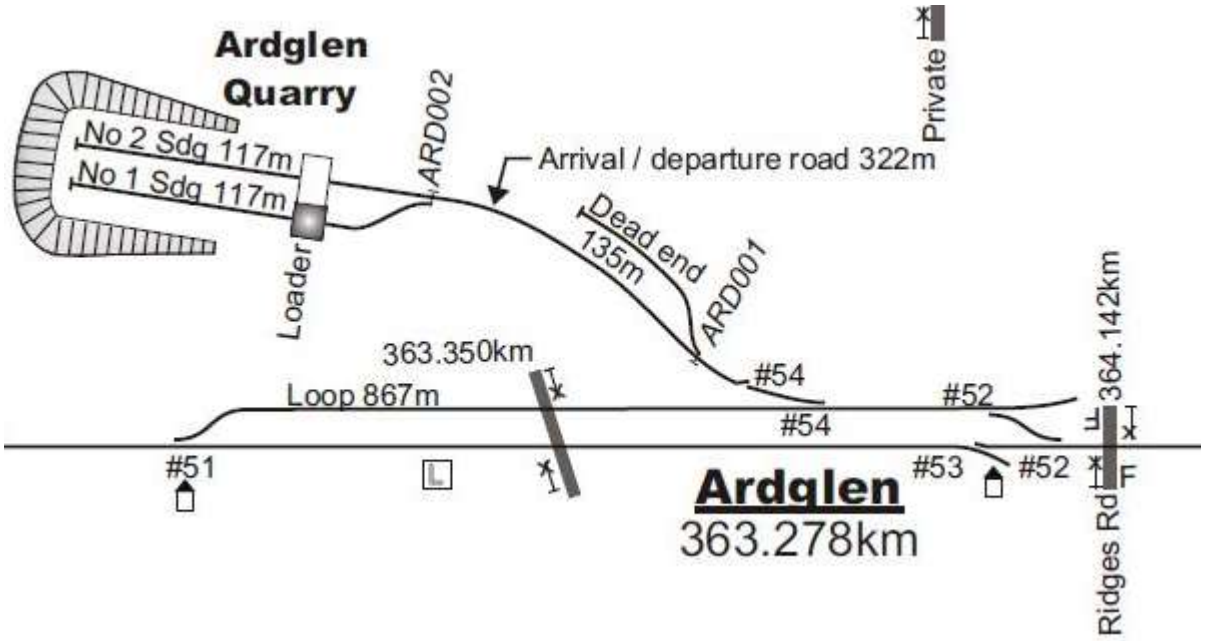

Figure 8 Previous track layout at Ardglen.

The previous track layout at Ardglen shown in Figure 8 is orientated to face northwards, consistent with its historical usage of supplying ballast to the portions of the New South Wales Rail Network bounded by Aberdeen, Moree, Armidale and Merrygoen. The rail siding output is limited to 250,000 t per annum by rail and its configuration limits the train length to the current length of ballast train operated by ARTC.

Figure 9 shows the current track layout at Ardglen. The connection to the quarry has been removed due to the changes in loop line geometry including a significant height difference due to ARTC's track upgrade. The siding will only be reinstated when required.

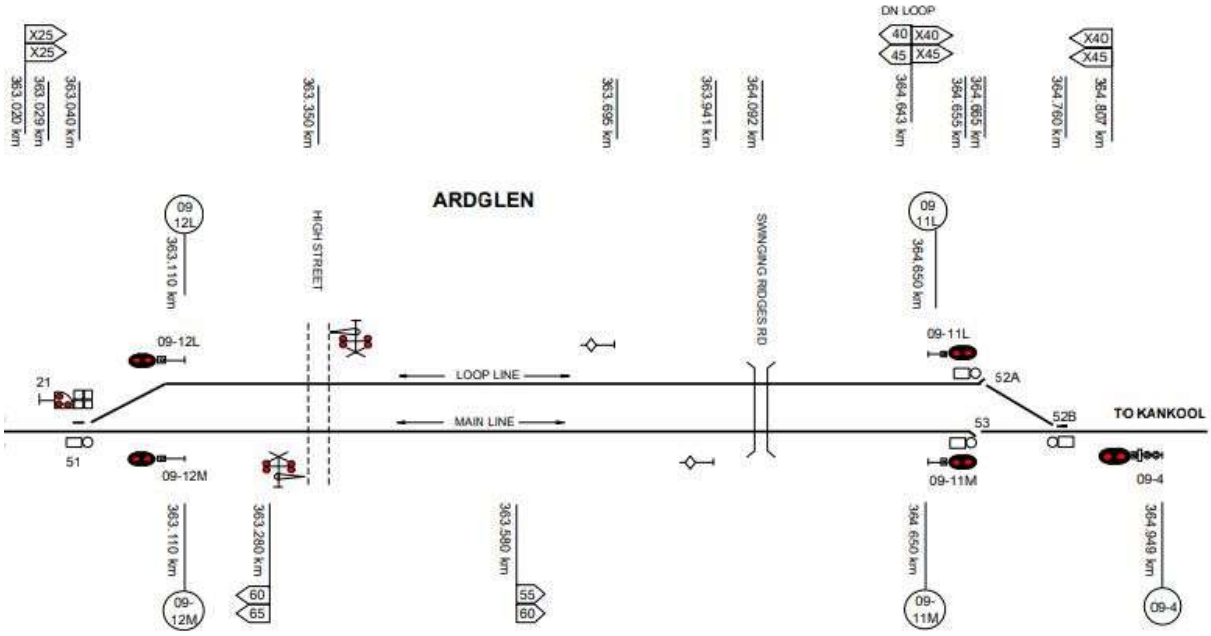

Figure 9 Current Track Layout at Ardglen source ARTC Network Information Book.

The network immediately south of Ardglen until the start of the double line at Muswellbrook is one of the most congested portions of the Hunter Valley Coal Chain on the New South Wales rail network and has limited growth available for new traffics such as aggregates. The latest release of ARTC's Hunter Valley Corridor Capacity Strategy (2020) in **Error! Reference source not found.** below shows that the delivered capacity of this section is at the existing known coal demand meaning that there are no more train paths available.

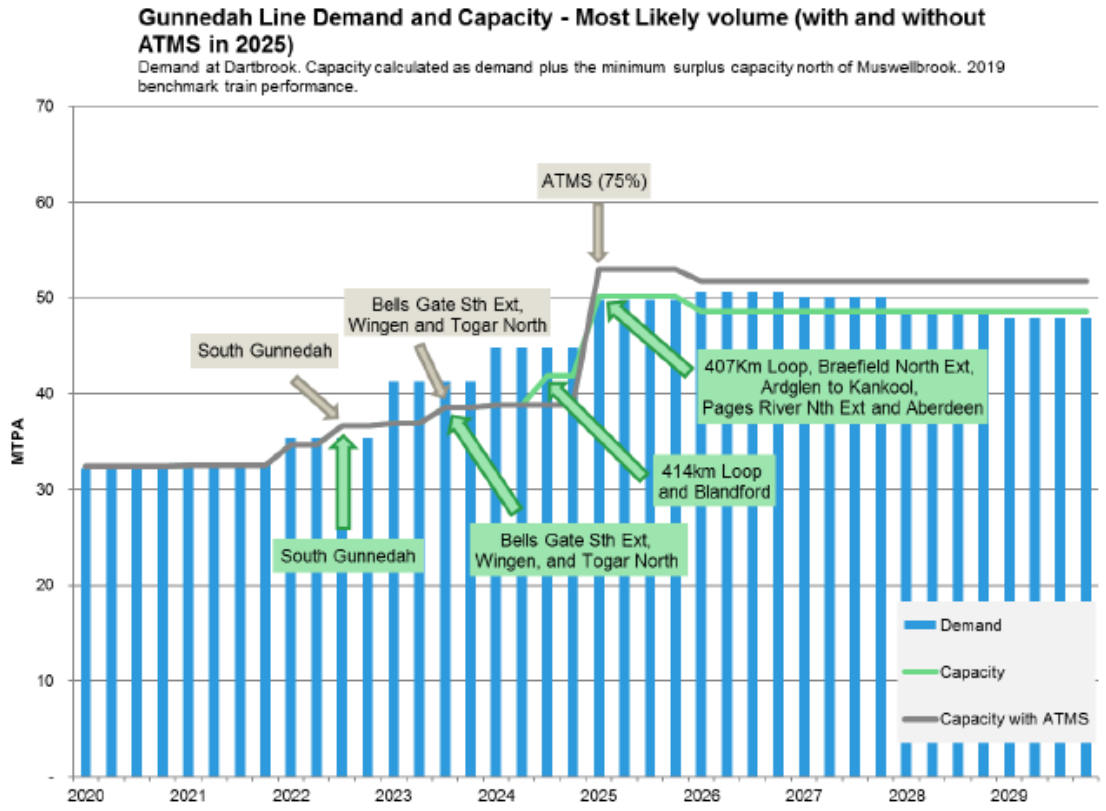

Figure 3-3 - Conceptual pathway for investment to meet the most likely volume scenario.

Figure 10 Extract from ARTC 2020 Hunter Valley Corridor Capacity Strategy, p27.

At 363 km from Sydney, the quarry is over 150 km further away than the new rail served quarries in the Southern Highlands, which are also competing for market share. Ardglen's potential market opportunities remain in the Liverpool Ranges, Gunnedah and Tamworth areas as well as future ARTC construction projects such as Inland Rail.

3 Rail Network Access

3.1 Current Rail Network Arrangements in the Hunter Region

Following the adoption of the competition principles in the mid 1990's, the rail network in NSW has been disaggregated with the aim of encouraging above rail competition by privately owned Rail Freight Operators such as Pacific National, Aurizon, SSR and Crawford's.

The ownership structure and business focus of the rail networks in the Hunter Region is as follows:

Table 2 Current rail industry structure in the Hunter Region.

Rail Network	Geographical Extent	Business Focus
ARTC – Hunter Valley	Newcastle coal ports to Gunnedah and Ulan.	Export coal haulage
ARTC - Interstate	Telarah to Brisbane	Supports long distance intermodal interstate freight trains.
Transport for NSW	Woodville Junction (near Broadmeadow) to Sydney	Operation of passenger services primary focus commuter services.
South Maitland Railways	East Maitland	Coal haulage
Other private lines	Various lines such as Saxonvale Branch, Draytons Branch serving mines.	Coal haulage
Newcastle light rail network.	Newcastle CBD	Light rail passenger services

Several different categories of trains operate over the networks managed by ARTC and TfNSW with the passenger services operated by NSW Trainlink using all of the networks and having the highest priority for scheduling closely followed by Sydney Trains services in the Metropolitan Area. This is a legislated requirement.

Path applications for Freight Services are accepted or rejected by TfNSW based on a process which includes consideration of "the requirement for Reasonable Passenger Priority in accordance with the *Transport Administration Act 1988*"

Freight trains have to be scheduled so as not to interfere with peak hour passenger trains. The current version of the Operations Protocol defines Peak Passenger Services as follows:

Peak Passenger Services means all suburban and intercity services that start or complete their journey on the RailCorp Network between 06:00 and 10:00 and between 15:00 and 19:00.

This in effect means for instance that to arrive in Sydney before the morning passenger peak period a train would have to leave Martins Creek before 1:30 am. The earliest a train from Sydney leaving after the afternoon peak could arrive in Martins Creek would be around 11 pm.

3.2 Rail Network Capacity

ARTC has invested a significant amount of money in increasing the capacity of both the Interstate and Hunter Valley networks. Both networks carry significant amounts of rail traffic and are currently congested particularly around the passenger peaks.

Ballast trains are operated as part of the maintenance effort of the rail network. They have a very low priority for scheduling and are added to the timetable after all other services have been scheduled. A consequence of this is that the time that ballast trains can be at the Quarry is not flexible, rather it is driven by wider Rail Network scheduling constraints. Revenue bulk trains have a higher priority for scheduling although on the ARTC network longer heavier trains are preferred because these generate more access revenue for ARTC.

3.2.1 North Coast Line Capacity.

Martins Creek Quarry is connected to the North Coast Line. Table 3 contains a summary of trains passing Martins Creek in September 2020.

Table 3 Summary of rail network use at Martins Creek.

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Number of XPT Services	6	6	6	6	6	6	6
Number of Passenger Services	10	10	10	10	10	6	6
Number of Freight Services	11	15	14	16	14	16	13
Total	**27**	**31**	**30**	**32**	**30**	**28**	**25**

The usage of the North Coast Line between Martins Creek and Telarah is low compared with ARTC's simplified capacity calculation which implies a practical capacity of 72 trains per day (or three trains per hour). However, all of the passenger services (and the majority of freight services) operate in between 04:00 – 20:00 with particular congestion in the morning and afternoon passenger peaks. The availability of train paths for quarry material is severely restricted during this time as the local passenger services connect with the XPT at Dungog blocking out over an hour around each XPT services.

Based on the current timetable, it is possible for Martins Creek Quarry to load two trains during the period from 20:00 to 05:00 and one during the period 09:00 to 15:00, indicating that the quarry has a capacity of three trains per day if loading during the night is permitted. A fourth train could be accommodated if the

train length was short and the shunting time at Martins Creek reduced by the use of additional ground staff.

3.2.2 Hunter Valley Network

The North Coast Line joins the Main Northern Line and Hunter Valley Coal Network at Maitland around 25 km south of Martins Creek. The section between Maitland and Newcastle is far more congested than the North Coast Line, with a regular passenger service as well as Hunter Valley coal services. In this section, there is a passenger curfew in operation which limits freight train operation during the passenger peaks. The rail network congestion effectively limits Martins Creek Quarry to a single train per day. For customers located north of Singleton requiring daytime unloading, this also limits the throughput for rail ballast to a train every two days. As identified in Section 4.4, the quantity of ballast required by the rail network for steady state activities is between 250,000 and 300,000 per annum (which equates to a train being loaded daily) and the current supply of material from Martins Creek Quarry by rail is only a fraction of that reflecting the constraints posed by the current restrictions on night loading at Martins Creek coupled with available train paths.

There is sufficient capacity on the ARTC networks for the operation of additional freight services outside the passenger peaks, particularly at night.

3.2.3 Sydney Trains (TfNSW) Network

The Sydney Trains Network starts at Islington Junction in Newcastle and includes the segments between Strathfield and Newcastle as well as extending to Lithgow in the west and Macarthur in the south.

This network operates an intensive peak and off peak passenger service limiting access for freight trains to very narrow time windows. Freight trains travelling to sites such as Glenlee and Rooty Hill have to contend with the passenger peak periods in multiple directions which constrain access even further. Adding to the congestion and further limiting the opportunities to run additional aggregate transport trains are the existing scheduled freight trains which include export and domestic coal trains, port container trains and interstate container trains. With the completion of Capacity Enhancement Works between Strathfield and Hornsby as of 2020 there are around 50 daily available freight train paths between Greater Sydney and Newcastle in each direction. Of these there are around 10 in each direction which are available for purchase. With the completion of Inland Rail Project in the mid 2020's it is likely that at least a further 2 daily freight train paths in each direction will become available.

Maintenance on this network is generally performed in weekend closedowns with ballast required on site during daylight hours and to support high production ballast cleaning multiple trips back to the Quarry to reload during the week end. This would require night time loading and under the current restrictions of the EPL, Martins Creek Quarry cannot supply these types of projects. As detailed in Section 4.1 the alternative to this is the creation of temporary stockpiles often located in densely populated residential areas.

3.3 Rail Logistics Success Factors

The use of rail transport for the distribution of aggregates has increased in recent years. To be successful commercially the operation should have:

- Low terminal operation costs (minimal shunting, high rates of loading) and high terminal throughput (in excess of 500 kt p.a.);
- High asset utilisation (a minimum of two cycles per day from the same set of equipment);
- Low "last mile" distribution costs, and;
- An economy of scale which offsets the cost of handling the materials several times during the delivery process.

Figure 11**Error! Reference source not found.** illustrates the difference in the aggregate distribution logistic chains using rail for the line haul or road for the line haul.

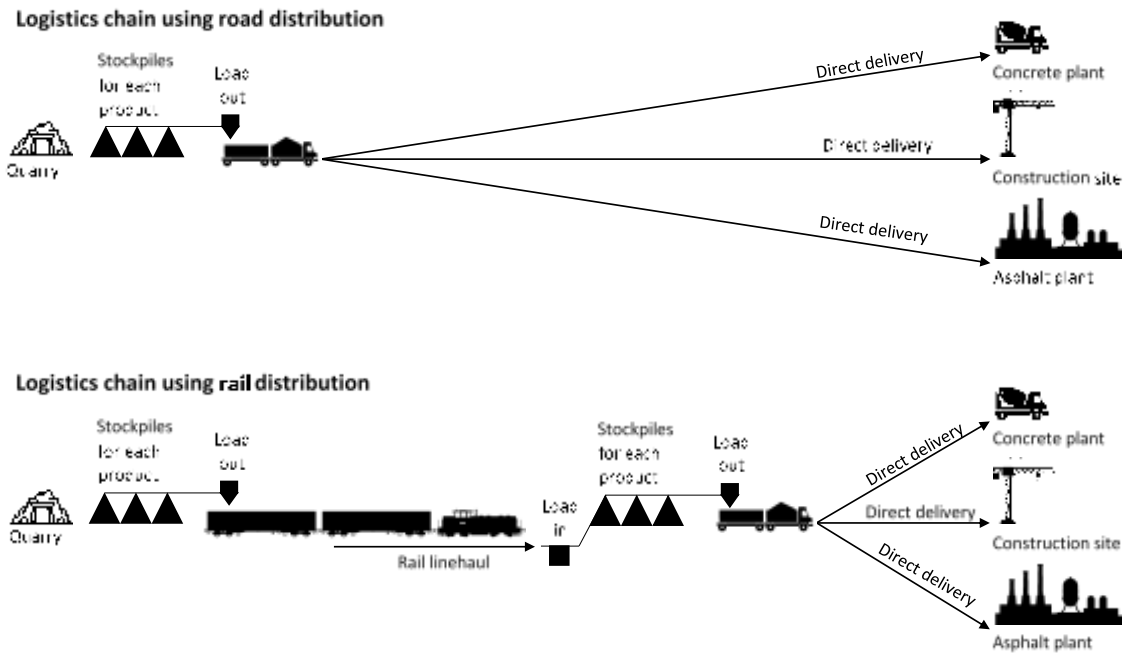

Figure 11 Comparison of Road and Rail Logistics Chains

The rail based logistics chain has the additional fixed costs compared to the road based logistics chain:

- a distribution hub with stockpiles, rail load in and road load out facilities;
- rail rollingstock; and
- a larger fixed load out facility.

There are also additional operational costs associated with double handling the material from the rail cars and into stockpiles at a distribution hub.

The road delivery option for long haul is very sensitive to:

- fuel price (National average is currently 134.6 cents/L (Australian Institute of Petroleum 2021));
- environmental considerations to reduce carbon emissions; and
- congestion on the freeway network and local distribution networks.

4 Ballast Supply Market

4.1 Functions of Ballast

The railway network fulfils an important role in the NSW Transport Network in providing the heavy lift capacity for passengers and freight. Were the railway network cease to function, there would be significant additional community and environmental impacts created by increased use of road transport.

Ballast fulfils several important functions on a railway line. Good clean ballast contributes to railway safety by:

- Distributing the load of the rail vehicles on the formation;
- Protecting the sleepers from damage and loss of function;
- Maintaining the track geometry within safe operating limits; and
- Preventing track movement during periods of hot weather.

Ballast which is in good condition and is fulfilling its function also contributes to lessening the environmental impact of the railway through:

- Lower energy consumption by rollingstock;
- Lower wear rates of steel and copper components;
- Less noise generated; and
- Reduced risk of formation failure and consequent soil particulate transportation.

The use of the former State Rail Authority of New South Wales quarries for rail ballast is preferred by the rail industry for technical reasons (chemical stability and resistance to abrasion) given the long history of use and consistent proven ability of these aggregate sources to meet the technical specification for railway ballast.

The use of rail logistics from a direct served rail quarry to supply ballast on a “just in time” basis also has significant benefits including reduced:

- Truck movements on local roads;
- Use of temporary stockpiles in residential areas and attendant dust and noise impacts; and
- Periods of line closure and use of alternative bussing arrangements.

Extended line closures for maintenance and the associated increased road traffic has been a significant source of complaint from communities surrounding railway lines over a long period time, especially the ongoing use of alternative bussing arrangements when the railway is closed. The community disruption and time the railway line is closed could be reduced by the ability to supply ballast by rail on a 24 / 7 basis which requires night time loading at the Quarry to enable the use of the train during daylight hours at the worksite.

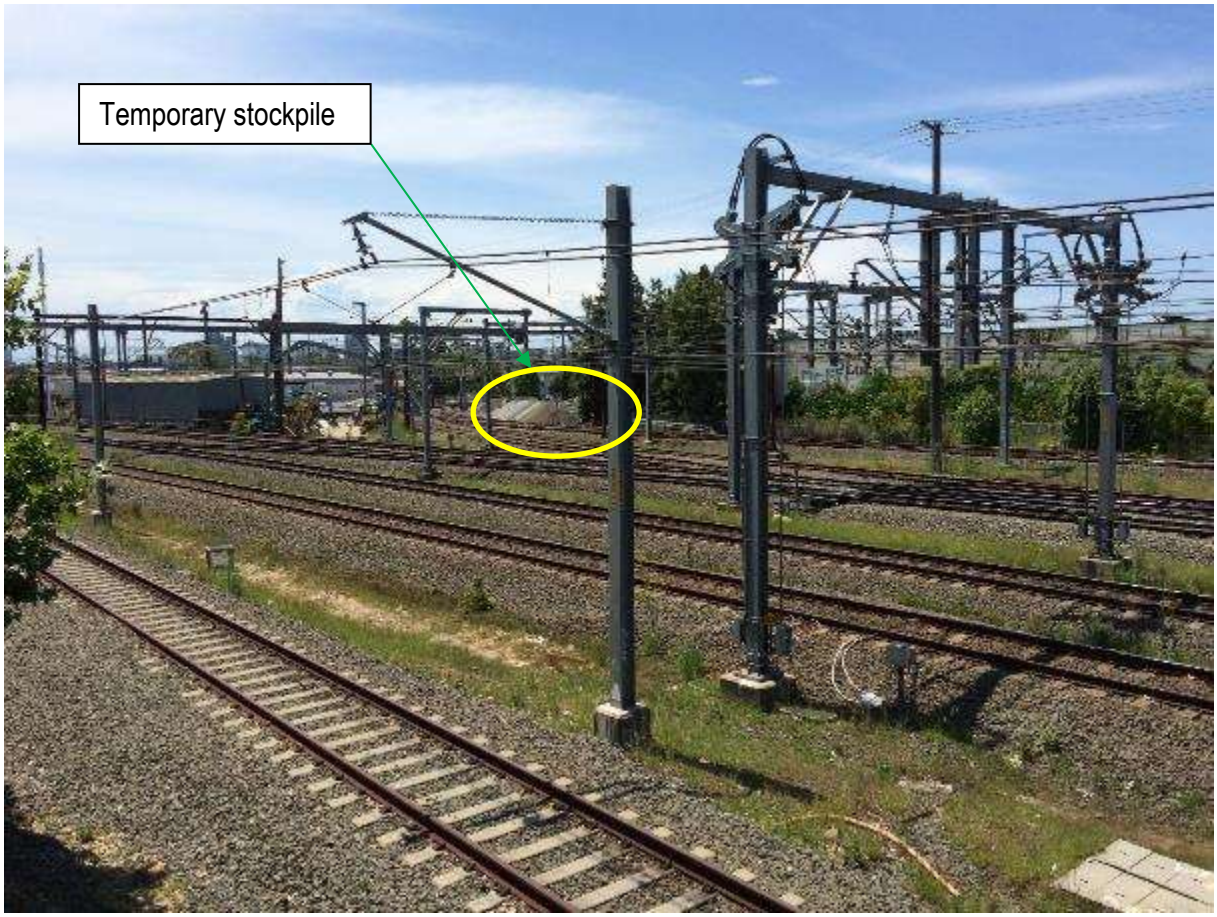

Figure 12 Temporary aggregate stockpile at Clyde November 2014.

Historically, ballast trains have been loaded at rail served quarries on a 24 / 7 basis around the year as the key driving function has been to ensure that there is continuity of rail operations. The inability to access a rail served quarry is an incentive to use temporary stockpiles. These frequently have to be placed in locations in close proximity to residences and accessed from portions of the road network not designed for frequent heavy vehicle use. Figure 12 above shows a temporary stockpile located on the rail corridor in a location which compromises safe access and involves potentially adverse environmental impacts from excess noise and dust.

4.2 Characteristics of Railway Ballast

To be suitable for use as railway ballast, rock has to conform to a series of specific requirements which contribute to the ability of the ballast to fulfil its functions. These requirements are detailed in *AS 2758.7 – Aggregates and rock for engineering purposes Part 7: Railway ballast* as well as adaptions and applications of this standard published by ARTC and TfNSW as part of their standards set.

The ballast produced by Martins Creek Quarry is one of a few sources in New South Wales which complies with the current ARTC Ballast Specification ETA-04-01 Rev1.2 and the Asset Standards Authority of TfNSW Ballast Standard T HR TR 00192 ST V2.0 Issue 3 July 2018.

Table 4 Desirable ballast properties.

Attribute	Desirable Characteristics
Strength	The ballast must be strong enough to support the loadings at the bottom of the sleeper. In the Hunter Network this means that at the sleeper interface, an area of around 0.05 sq. metres has to support a load of up to 15 tonnes.
Grading	The ballast grading must be such that it can be packed but still contain sufficient voids to allow free drainage.
Particle shape	The particles must be angular and interlock.
Resistance to Abrasion	The ballast must retain its shape and the particles must be resistant to mechanical abrasion in both a wet and dry state.
Chemical stability	The stone has to be resistant to weathering once in contact with the atmosphere and rain water.

There are several environmental as well as commercial consequences of using inferior materials as railway ballast, including:

- Extended railway service disruption;
- Additional sediment as the particles break down and erode; and
- Potential change in water chemistry due to the breakdown of ballast.

The requirements of the following parts of AS2758 Aggregates and Rock for Engineering Purposes are compared in Table 5.

AS2758.1 Part 1 Concrete Aggregate
AS2758.5 Part 5 Coarse Asphalt Aggregate
AS2758.7 Part 7 Railway Ballast

From the comparison it can be seen that Part 7 Railway Ballast is the only part which specifies a wet attrition value, has a more stringent dry abrasion (Los Angeles Test value) has a higher particle density and bulk density.

As a consequence not all sources of rock are suitable for use as railway ballast. The choice of sources for railway ballast is therefore far more limited than the choice of sources for aggregates for construction materials. The cost of transport and distribution favours a location which is located on the railway network in a suitable central location with 24 /7 rail access and loading capability which further limits the available sources of rock.

Table 5 Characteristics of ballast versus concrete aggregate and coarse asphalt aggregate.

Aspect	Railway Ballast	Concrete Aggregate	Coarse Asphalt Aggregate
Bulk Density	>1350 kg/m^3 (>1400 kg/m^3 for NSW)	Lightweight; < 1.2 t/m^3	-
Particle Density	>2500 kg/m^3	Heavyweight; > 3.2 t/m^3 Normal; 2.1 < x < 3.2 Lightweight; 0.5 < x < 2.1 Ultralight; < 0.5 t/m^3	-

Aspect	Railway Ballast	Concrete Aggregate	Coarse Asphalt Aggregate
Shape; proportion of misshapen particles	Retained on the 9.5 mm test sieve; using a 2:1 ratio, shall not exceed 30%	Retained on the 9.5 mm test sieve, using a 3:1 ratio, shall not exceed 10%	Retained on the 9.5 mm test sieve, using a 3:1 ration, shall not exceed 10%, and using a 2:1 ratio shall not exceed 35%
Flakiness index[1]	< 30%	< 35%	< 35%
Los Angeles value[2]	< 25 (With an F or G grading)	30 – 40 (maximum)	25 – 40
Weak particles	< 5%	< 0.5%	< 1%
Wet strength		A1, A2: > 50 kN B1, B2: > 80 kN C: > 100 kN	>150 kN (open graded mixes) >100 kN (other mixes)
Wet attrition value[3]	Passing the 53.0mm test sieve and retained on the 37.5 mm test sieve shall not exceed 6%	N/A	N/A
Aggregate crushing value[4]	Passing 26.5 mm and retained on 19.0 mm, shall not exceed 25%. Passing 53.0 mm, retained on 37.5 mm, should not exceed 30%	-	-
Sodium sulphate soundness	-	A1, A2: < 12% B1, B2: < 9% C: < 6%	A weighted average loss not greater than 12%
Wet/dry strength variation	-	A1, A2: < 45% B1, B2: < 35% C: < 25%	< 35%
Unsound and marginal stone content	-	Unsound: < 5% Total of unsound and marginal: < 10%	Unsound: < 5% Total of unsound and marginal: < 10%

Notes:

[1] Flakiness index is the percentage by weight of particles in it, whose least dimension (i.e. thickness) is less than three-fifths of its mean dimension.

[2] Los Angeles value is a measure of degradation of mineral aggregates of standard gradings resulting from a combination of actions including abrasion or attrition, impact, and grinding in a rotating steel drum containing a specified number of steel spheres used to indicate aggregate toughness and abrasion characteristics.

[3] Wet attrition value refers to a measure of the resistance of a granular material to wear.

[4] Aggregate crushing value refers to the relative measure of the resistance of an aggregate to crushing under a gradually applied compressive load.

4.3 Operations for State Rail Authority of NSW

Martins Creek Quarry historically provided the main source of ballast and aggregates for an area bounded by Hawkesbury River in the south, to Aberdeen and Wauchope in the north and Ulan in the west. This represents about 10% of the NSW Rail Network and some of the busiest lines in NSW including the Main Newcastle to Sydney passenger lines and the Hunter Valley Coal Network.

Over 20 % of this length such as the sections between Hawkesbury River and Woy Woy, Sandy Hollow to Coggan Creek and Gloucester to Wingham, are not accessible by road relying solely on rail delivered ballast for all maintenance and renewal requirements. These areas are also in or directly adjacent to National Parks and sensitive waterways. To prevent pollution this means that the ballast used must be stable with good wearing properties, and have a long service life minimising repeated maintenance interventions. Ballast from Martins Creek Quarry is one of few sources which has met these requirements over a long period of time.

4.4 Current Market for Railway Ballast

Based on a simple model which looks at the amount of ballast required to replenish the track following resurfacing and ballast cleaning operations, it would appear that a steady state consumption of around 250 kt per annum is required for maintenance purposes for the rail network within the historical catchment of Martins Creek Quarry.

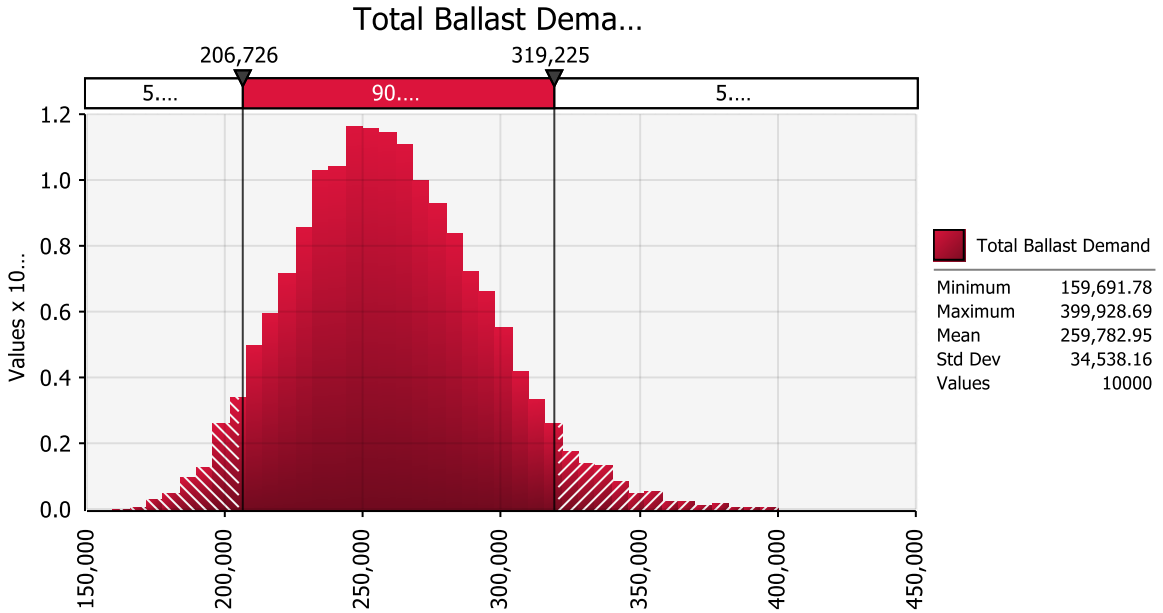

Figure 13 Theoretical annual ballast demand for major track maintenance activities within the area served by Martins Creek Quarry.

Less than 40kt per annum of ballast is currently being purchased and delivered by rail from Martins Creek Quarry by ARTC and TfNSW within this area. There are several reasons for this including the age of the asset with most of the track in the area being rebuilt in the past ten years (this favours road delivery due to the smaller maintenance quantities required), recycling of ballast, under investment in maintenance, and failing to supply sufficient new ballast with renewals.

In addition, there will be demand created by new construction projects although the outlook for these in the next five to ten years within the Hunter area is reduced compared with the activity in the recent past (such as the Hunter Expressway, NCIG export terminal, and additional track from Branxton to Whittingham).

Constraints to the supply of ballast by rail from Martins Creek Quarry include availability of train paths for ballast trains, the availability of suitable wagons to transport and distribute ballast, location of line closures, and timing of line closures.

At ARTC's current charge out rates for ballast wagons, the annual lease cost of a train used by ARTC with the required locomotive power (2 x 2400 kW locomotives) based on long term locomotive hire rates is $2.65 million per annum. Unless the worksite to which ballast is being delivered is in close proximity to Martins Creek and has suitable track possession times the current restriction on loading at night time at Martins Creek Quarry means that this train can only deliver a load of ballast every two days rather than a daily load of ballast with additional trains to cover closedown periods. Over a twelve month period, this means that about half the ballast which would have been historically loaded onto rail is no longer able to be loaded onto rail, and the effective cost per tonne of rail delivered ballast is double what it would have been. This provides a major commercial incentive for the use of road transport and temporary stockpiles for ballast distribution.

The railway quarries, such as Martins Creek Quarry, have historically provided a 24 / 7 source of emergency materials for the rail network to repair tracks following derailments, floods and landslips. This function is of vital importance in timely restoration of rail services following natural disasters. If the rail distribution of aggregate was unavailable, it would potentially create an added source of community disruption in periods of civil emergency as the road network would have to be used to transport aggregate required to restore services.

The current rail industry structure does not provide the same emphasis on the use of the railway network to support infrastructure rebuilding following periods of civil emergency. This has historically been the case, however, the rail network is built to a higher flood resistance standard than the road network and the ability to use the network in times of emergency remains an important community resource.

For instance, if NSW was to be subjected to a major flooding event such as the 1955 flood, then the rail network may become the main source of supply for a large part of NSW until road rebuilding could occur. This situation could occur again, recently in the aftermath of the 2011 Christchurch earthquake in New Zealand, rail services were restored to the city several days earlier than alternative transport options became available and rail logistics played a major role in keeping the city supplied.

In the recent 2021 flood event the quarry supplied ballast to restore the track following a derailment at Nana Glen on a section of line washed away. For parts of this period the Pacific Motorway was closed and local roads were blocked resulting in the only available source of supply being ballast transported by rail.

5 Market Conditions

5.1 Current Aggregates Market Served by Martins Creek Quarry

Due to market demands the quarry operation has supplied around 10 % of its output for railway purposes for many years and at present only 4 % of its output by rail. Total ballast production is currently around 90,000 t per annum or around 12% of the quarry output.

The remainder of the production travels to disparate sources (mostly asphalt and concrete batching plants) in the lower Hunter Region, Newcastle, the Central Coast and northern Sydney.

The majority of the output by road travels to the Newcastle, Lake Macquarie, Port Stephens, Singleton, Cessnock, Maitland and Rutherford areas.

Currently, the quarry does not have an opportunity to use a hub stockpile away from the quarry. This would require a significant land area due to the multiple varieties of products requiring storage.

5.2 Market Viability of a Remote Rail-Served Distribution Centre

Key factors which make a rail served distribution centre and logistics chain shown in **Error! Reference source not found. Error! Reference source not found.** commercially viable are that:

- the annual production rate from the quarry;
- the size of the market can support the capital investment required;
- there are no alternative sources of supply with lower distribution costs; and
- the competing road based logistic chains are at a cost disadvantage as a result of haul distance and suffer from poor reliability due to road congestion.

As an example, Boral's rail based logistics aggregate distribution operation from the Illawarra and Southern Highlands as well as Holcim's rail based logistics operation are viable as they achieve all of these outcomes.

None of these conditions exist for the local and regional markets currently served by the Martins Creek Quarry which:

- has a lower output;
- operates in a much smaller local and regional market;
- has several competing alternative sources of supply; and
- has a road logistics chain which operates in an uncongested road network.

5.3 Potential Train Types

In assessing the potential for rail haulage of product from Martins Creek Quarry, a series of train types (consists) were analysed. These consists conform to the requirements in the current Train Operating Conditions Books published by ARTC and TfNSW and assume that a "L4" type locomotive is used. This type of locomotive is commonly used for aggregate hauls and on ballast trains in NSW. The lease rates

for rollingstock have been based on quoted rates from ARTC and a long term rates from a major supplier of leased rollingstock.

An additional consist has been added to reflect current locomotives used on this type of service and available on the lease market.

These configurations reflect the historical configuration of aggregate trains. Due to the gradients between Hawkesbury River and Cowan, additional motive power is required for trains operating south of the Hawkesbury River.

Table 6 Train consists analysed.

Train Consists	No. of Locos	Wagon Type #1	No of Wagons	Wagon Type #2	No of Wagons	Train Length (m)	Train Payload (tonne)	Comments
Ballast Train	2	NDFF	22	NDOF	2	332	1296	Current operation.
Sydney Aggregate Efficient	4	CHAY	40			820	3381	Similar consist to that planned by Holcim for its operations from Lynwood to Rooty Hill.
Sydney Aggregate Efficient Current	3	RHKY	45			677	3450	Similar consist to that operated from the Southern Highlands to Sydney
Sydney Aggregate Small	2	CHAY	24			402	1656	
Sydney Aggregate in Containers	2	CQKY 80t	24			393	1032	
Newcastle Aggregate Small	1	CHAY	19			306	1311	Smaller consist suitable for short hauls
Newcastle side dump wagons	1	NDSF	23			341	966	
Aggregate Containers Newcastle	1	CQKY 80t	22			342	946	

Legend:

	Train able to fit in proposed layout at Martins Creek when fully developed.
	Train able to fit into Martins Creek with the current layout.

There is a significant impact on fixed costs associated with rollingstock utilisation. As a minimum given the high capital cost of the plant involved and rollingstock it would be desirable to operate on at least 300 days per annum.

This is less than most coal haulage operations in NSW, which would be achieving in excess of 330 days per annum operation and at least 2 cycles per day over the short distances involved.

However, operating in this manner means that significantly more rail throughput is required than that available from the current operation at Martins Creek. This level of rail throughput is also well in excess of likely market capture in the Newcastle Area.

In addition to traditional bottom dump style hopper wagons Plateway has assessed the use of different wagon types, such as side dump wagons, or loading aggregates into containers which would reduce the receival plant fixed cost. The side dump wagons are expensive to maintain and operate. They also

generate product wastage as well as potential dust generation in handling and reloading the product onto trucks for final distribution. The containers require a container terminal to load and reload the product.

5.4 Rail Transport of Aggregates

Railways have historically found the aggregates haulage market difficult to compete in because aggregate used for construction purposes has a relatively low value when compared to other commodities such as minerals and general freight. Therefore it cannot sustain a large haulage cost because of the multiple competing sources of supply. A relatively high volume of product is required to be transported on an annual basis to offset the cost of providing/utilising a rail receival and distribution facility.

Table 7 Quarries in New South Wales with a currently active rail connection.

Location	Distance (km) from Sydney by Rail	Distance (km) from Martins Ck by Rail	Use	Comments
Martins Creek	218	0	Railway ballast, commercial aggregate	Former railway quarry now leased by Buttai Gravel Pty Ltd.
Ardglen	363	197	Railway ballast, commercial aggregate	Former railway quarry now owned by Buttai Gravel Pty Ltd. Historically served network segments the area covered by the former Werris Creek Division of SRA of NSW.
Bombo	118	337	Railway ballast.	Current railway quarry. On Illawarra line near Kiama. Surrounded by residential development.
Dunmore	110	329	General construction aggregates.	Current railway quarry. On Illawarra line near Shellharbour. Residential development encroaching.
Peppertree	197	391	General construction aggregates.	Newly completed loading facility capable of loading trains of up to 1200 m in length. Quarry owned and operated by Boral. This quarry was developed to supply the Sydney market to replace the exhausted quarries on the Nepean River at Emu Plains. Product railed to a variety of existing receival points owned by Boral in the Sydney metropolitan area.
Lynwood	195	389	General construction aggregates.	Newly completed loading facility capable of loading trains of up to 900 m in length. Quarry owned and operated by Holcim. This quarry was developed to supply the Sydney market to replace the exhausted quarries on the Nepean River at Emu Plains. Product railed to new receival point at Rooty Hill in western Sydney.

5.5 Current Rail Aggregate Haulage Operations

There are currently two major companies successfully operating a rail logistics chain for aggregate distribution in New South Wales. These have scaled up in recent years due to the closure of quarries in the Emu Plains area supplying sand and gravel to the Sydney market.

Figure 14 Boral facility at Maldon source Google Maps.

Figure 14 above shows the Boral plant at Maldon. This was constructed on an existing industrial site owned by Boral, and has approval to rail 1.75 million tonnes of aggregate per annum. The site contains just under 6 ha of stockpile space which fits around the existing plant footprint. The current train paths advertised in ARTC's timetable allow for this level of throughput. The current train paths in ARTC's timetable also allow for an additional 1.75 million tonnes of aggregate to be delivered to Boral's Inner Sydney terminals at Enfield and St Peters (Cooks River), which were previously supplied by other Boral Quarries. The Maldon site is situated in close proximity to the South Western Priority Growth Area.

Figure 15 Holcim's plant at Rooty Hill source Google Maps.

Figure 15 above shows the layout of Holcim's plant at Rooty Hill. The current train paths allow for a throughput of 3.663 million tonnes per annum. This plant is located in close proximity to the M7 and is sited to serve the North West Priority Growth Area. Being a purpose built facility, the plant is laid out in an optimal manner and has a total storage footprint of around 3 ha.

5.6 Distribution Hub (Rail Receival Facility) Requirements

A rail served aggregate distribution hub location would require:

- a facility to unload aggregates from bottom dump wagons which can discharge at rates of over 1000 t per hour;
- the ability to stack and store products in several different segregations;
- rail access to and from the facility without impacting through rail services;
- road access to the freeway network;
- suitable buffers from residential zones and neighbours which allows for 24 hour a day seven days a week operation; and

- bulk storage areas for each segregation of product for a minimum of one weeks production (approx. 25,000 t). Note that demand is weather dependent, but the rail logistics supply chain is not, leading to the facility risking becoming stock bound during periods of wet weather.

Note that the two newer facilities at Maldon and Rooty Hill have over 3 ha of storage space. The older facilities at Cooks River and Enfield are co-located with asphalt and concrete batching plants rather than being a stand alone distribution facility.

5.7 Likelihood / Viability of a Rail Receival Facility in the Newcastle / Hunter Region

There are currently no suitable and existing operating rail receival terminals for aggregate in the Hunter Region.

The table below summarises the indicative costs for the development of a new rail receival location. The most likely locations in the lower Hunter area which could support rail receival of aggregates are in the vicinity of the Port Waratah complex in Carrington (approximately 55 km from Martins Creek by rail and 40 km from competing quarries at Seaham by road) and around the Sulphide Junction / Teralba (approximately 70 km from Martins Creek by rail and 55 km from Seaham by road) area which connect with existing or former industrial rail lines. Both of these areas have disused industrial lines which could be used to reconnect to at a lower cost than a new connection. On average, these two locations combined would have the capacity to take around 300,000 tonnes per annum of product from Martins Creek Quarry. This would represent the largest single point sources in the current market served by Martins Creek Quarry.

Table 8 Typical costs of rail receival facilities.

Type of Facility	Indicative Capital Cost (M)
Large high production aggregate handling facility suitable for volumes up to 5 M t pa. Assumed life 20 years.	$ 100
Moderate facility on a new rail connection from an existing siding. Assumed life 20 years.	$ 20
Minimalist facility on an existing rail connection requiring no upgrades. Assumed life 10 years.	$ 4

Whilst rail transport has a clear operating cost advantage over road transport, the capital cost of the rail receival plant and the inability to achieve multiple Cycles in a 24 hour period (due to rail network congestion, passenger priority and loading / unloading site operating restrictions) makes rail transport expensive over short distances with small volumes.

The fixed cost of ownership associated with the construction of the rail receival facilities at Teralba and Port Waratah and a train capable of delivering the aggregate to these locations would be around about

$2.3 million per annum. The fixed cost component alone is about the same as the road transport cost of delivering aggregate to these locations. This does not include the rail operating costs or the cost of the short road haul from the central rail receival location to the end use location. When these costs are added in, the cost of using rail line haul is around 30 % more expensive than the road haul rate from Martins Creek Quarry. In the case of Teralba, there is a competing quarry (Metromix) located in the area and the higher transport cost associated with the offering from Martins Creek would ensure that the market capture would be minimal.

To compete with road transport over this distance, the fixed costs have to be spread over a throughput of in excess of 1 million tonnes per annum or around four times the current level being sold from Martin's Creek Quarry into the Greater Newcastle area. This assumes that train paths are available to achieve this and would require a total cycle time of under five hours. It would also require a reduction in loading time at Martins Creek which would incur additional capital cost to reduce the time spent shunting.

5.8 Sydney Market Opportunities

The economical use of rail transport for the Sydney Market is based on significant volumes which support the investment in a high productivity terminal. The recently completed Holcim terminal at Rooty Hill has, according to the Environmental Assessment (Holcim (2010)), an initial volume of 2 million tonnes per annum rising to 4 million tonnes per annum. The throughput is delivered in trains of between 42 and 50 wagons, carrying between 3150 and 3750 t each and are up to 805 m in length. This throughput supports the capital investment of $100 million in this facility at throughput volumes in excess of 2 million tonnes per annum.

Error! Reference source not found. summarises the likely costs of several rail transport options based on 250 days a year operation. The table indicates that transport of aggregates to the existing bottom dump facilities at Rooty Hill and Boral Cooks River is likely to be uncompetitive compared with the current hauls from Peppertree and Lynwood Quarries in the Southern Highlands region as additional motive power is required from Martins Creek. It is likely that the additional motive power cost increases the price from Martins Creek Quarry by about $1.50 / t. It should also be noted that 2 cycles per day are possible from the Southern Highlands to Cooks River but this cannot be achieved from Martins Creek to Cooks River due to passenger priority and the peak hour curfews for freight trains over a long section of the journey.

The competitiveness of the option to transport aggregates in containers to Cooks River is product dependent being suitable for high value material such as gabion rock only, and possible if the rail service was shared with an existing Newcastle to Botany Service.

An unloading facility constructed on the SADA site at Glenlee would provide a potential market opportunity to expand into Western Sydney which is a major market for construction materials. As this is a multi user site the development and operating costs of this facility would be spread over several users. This reduces the cost for an individual user such as Daracon. The site has an existing rail connection and can be developed for a minimal cost. The area is economically served by road based competition but is in proximity to other distribution hubs using rail transport at Maldon and Rooty Hill, and as demand increases with the Greater Western Sydney plan markets will grow in this area.

An unloading facility at Vales Point (owned by Delta Electricity) may also be possible. This would require modifications to the existing stockpiles storage and handling facilities and a commercial agreement for use. It is likely that a road transport cost of between $9 - $17 / t in addition to the estimated rail transport cost of between $5.45 and $6.25 / t would be price competitive for locations such as the Sydney CBD, and Sydney north side concrete plants such as Artarmon, Brookvale and Thornleigh. However, this market is not growing and unlikely to produce the level of demand required. The site is too far south to effectively service the Hunter Region.

A throughput of well in excess of 1.2 million tonnes per annum would be required for this to be viable which is well in excess of the rail throughput currently available from Martins Creek Quarry with the existing plant and hours of operation, and required by the market.

5.9 Specific Site Assessments

Six specific sites have been assessed. These sites are:

- The proposed redevelopment of the former coal mine site at Glenlee by SADA (Southern Sydney).
- The Sydney Trains Material handling site at Chullora (Inner Western Sydney).
- Walsh Point on Kooragang Island (the site of the former woodchip terminal).
- South Maitland Railways Exchange Sidings at Telarah.
- Bloomfield Colliery Balloon Loop at Thornton.
- The Vales Point power station site.

A summary of these sites and the two most recently completed aggregate unloading facilities at Maldon (Boral) and Rooty Hill Holcim follow. The two Sydney options would compete directly with these existing facilities.

The options in the Newcastle area have no direct rail based competition. However, they are subject to road based competition.

Table 9 Information on Glenlee Site.

Site:	Glenlee Rail Bulk Materials Facility SADA Multi User Site		
Street Address	Glenlee Road, Menangle Park NSW	**Coordinates**	-34.082087, 150.747947
Cycle Time	24 hours	**Haul Length**	256km
Lot Name	Lot 38, DP1098588	**Lot Zoning/ Area**	RU1 - Primary Production : (pub. 2010-09-03) RU2 - Rural Landscape : (pub. 2017-11-17)
Lot Name	Lot 1102, DP883495	**Lot Zoning/ Area**	RU1 - Primary Production : (pub. 2010-09-03) RU2 - Rural Landscape : (pub. 2017-11-17) RU2 - Rural Landscape : (pub. 2015-12-11) SP2 - Infrastructure : Local Road (pub. 2015-12-11)
Council	Camden, Campbelltown	**Potential Stockpile Area (Total Combined)**	42.34 ha
Distance to nearest residential structure	1.1km	**Road Haul**	N/A
Land Access	Available with commercial agreement with land owner.	**Max Train Length**	900
Site Viability	This site has a good fit in terms of available land and zoning. However, rail access is limited as trains from Martins Creek would have to traverse the entire Sydney Metropolitan System to access the site. Even so, given its distance from Martins Creek the site does have a lower calculated rail haulage rate than the road haulage rate from Martins Creek. However, the site is in close Geographical proximity to Boral's site at Maldon which has a far cheaper rail haulage rate due to the ability to achieve two cycles per day to the Southern Highlands, a far shorter rail haul and a more efficient train consist with fewer locomotives whereas with the current operating restrictions at best a rail haul from Martins Creek could only achieve a single cycle per day or more likely a cycle every two days.		

Site Map

Table 10 Information on Chullora Site.

Site	Sydney Trains Material Handling Facility		
Street Address	2 Worth Street, Chullora	**Coordinates**	-33.885259, 151.059411
Cycle Time	24 hours	**Haul Length**	210km
Lot Name	Lot 1, DP883526	**Lot Zoning/ Area**	IN1 - General Industrial : (pub. 2013-03-15) IN1 - General Industrial : (pub. 2015-03-05)
Council	Canterbury – Bankstown, Strathfield	**Potential Stockpile Area (Total Combined)**	2.3 ha
Distance to nearest residential structure	280m	**Road Haul**	N/A
Land Access	RailCorp – currently used to store spoil from Metro projects.	**Max Train Length**	600 m
Site Viability	The site has a good viability from an environmental and land use perspective. The stockpile areas on site are far smaller than the stockpile areas available at competing sites. The products railed would compete with products railed to the Boral Terminals at Enfield and Marulan and the Holcim Terminal at Rooty Hill. As these operations have a far larger volume and use larger more efficient train sets this option would have a disadvantage in terms of price.		

Site Map

Table 11 Information on Walsh Point Site.

Site	Walsh Point		
Street Address	43/45 Greenleaf Road, Kooragang	**Coordinates**	-32.887533, 151.778834
Cycle Time	11 hours	**Haul Length**	57km
Lot Name	Lot 1, DP1117013	**Lot Zoning/ Area**	SP1 - Special Activities : (pub. 2014-05-31)
Lot Name	Lot 2, DP1117013	**Lot Zoning/ Area**	SP1 - Special Activities : (pub. 2014-05-31)
Lot Name	Lot 3, DP1117013	**Lot Zoning/ Area**	SP1 - Special Activities : (pub. 2014-05-31)
Council	Newcastle	**Potential Stockpile Area (Total Combined)**	38.6 ha
Distance to nearest residential structure	1.3 km	**Road Haul (Martins Ck Quarry)**	58km
		Road Haul (Boral Quarry Seaham)	37km
Land Access	Vacant - purchase	**Max Train Length**	800 m
Site Viability	This site has a good fit being in an Industrial area. However the rail haulage rate calculated at $9.85 / t with a minimum throughput of 330 kt pa is above the likely road haulage rates from the nearest competing source of between $3 -$5.5 /t noting that the rail delivered aggregate would still require a road haul to get to the final user. This site also has extremely constrained rail access as it is shared with 3 other active users (Boral, Cargill's and Mountain Industries) and requires access shared with the coal loaders. Rail Access Constraints probably make this site too difficult.		

Site Map

Table 12 Information on SMR Yard Telarah Site.

Site	South Maitland Railway Yard		
Street Address	Junction Street, Telarah	**Coordinates**	-32.735902, 151.54168
Cycle Time	9 hours	**Haul Length**	28km
Lot Name	Lot 1001, DP1212784	**Lot Zoning/ Area**	RU1 - Primary Production : (pub. 2017-08-25) SP2 - Infrastructure : Railway (pub. 2014-05-30)
Lot Name	Lot 12, DP738348 - Flood Risk	**Lot Zoning/ Area**	RU1 - Primary Production : (pub. 2017-08-25)
Lot Name	Lot 11, DP738348 - Flood Risk	**Lot Zoning/ Area**	RU1 - Primary Production : (pub. 2017-08-25)
Council	Maitland	**Potential Stockpile Area (Total Combined)**	10.35 ha
Distance to nearest residential structure	300m	**Road Haul (Martins Ck Quarry)**	29km
		Road Haul (Boral Quarry Seaham)	34km
Land Access	Would require commercial agreement with owner.	**Max Train Length**	
Site Viability	This site is not viable due to the close proximity to residences and the stockpiles being in a flood prone area. The viability of the rail haul proposed is also questionable due to the need to cross four busy mainline tracks to gain access to the sidings. The site has a calculated rail haulage rate of $9.28/t with a minimum throughput of 330 kt pa which is well above the likely road haulage rates from a competing quarry of between $2.75 to $5.1 / t noting that the rail hauled aggregate will incur further road delivery costs to the final user.		

Site Map

Table 13 Information on Bloomfield Site.

Site	Bloomfield Coal Loop		
Street Address	Four Mile Creek Rd, Four Mile Creek	**Coordinates**	-32.792330, 151.584491
Cycle Time	11 hours	**Haul Length**	51km
Lot Name	Lot 4, DP11988	**Lot Zoning/ Area**	E3 – Environment Management : (pub. 2011-12-16 RU2 – Rural Landscape : (pub. 2011-12-23) RU2 – Rural Landscape : (pub. 2017-08-25)
Lot Name	Lot 4, DP1045720	**Lot Zoning/ Area**	RU2 – Rural Landscape : (pub. 2011-12-23)
Lot Name	Lot 1, DP58967	**Lot Zoning/ Area**	RU2 – Rural Landscape : (pub. 2011-12-23)
Lot Name	Lot 31, DP755237	**Lot Zoning/ Area**	RU2 – Rural Landscape : (pub. 2011-12-23)
Council	Cessnock, Maitland	**Potential Stockpile Area (Total Combined)**	19.35 ha
Distance to nearest residential structure	1km	**Road Haul (Martins Ck Quarry)**	35km
		Road Haul (Boral Quarry Seaham)	36km
Land Access	Would require commercial agreement with owner: Bloomfield Group	**Max Train Length**	750
Site Viability	The viability of the rail haul proposed is low and requires a run around movement at Morandoo (Port Waratah) in each direction to access the existing rail loop as the balloon loop entrance is orientated towards the south in the opposite direction to Martins Creek. This involves using the congested coal network. The site has a calculated rail haulage rate of $10.10/t with a minimum throughput of 330 kt pa which is well above the likely road haulage rates from a competing quarry of between $2.90 to $5.4 / t noting that the rail hauled aggregate will incur further road delivery costs to the final user.		
Site Map			

Table 14 Information on Carrington Site.

Site	Carrington		
Street Address	Robertson St, Carrington	**Coordinates**	-32.911737, 151.7687
Cycle Time	11 hours	**Haul Length**	54km
Lot Name	Lot 3, DP1218150	**Lot Zoning/ Area**	SP1 – Special Activities : (pub.2014-05-31)
Lot Name	Lot 19, DP1190232	**Lot Zoning/ Area**	IN2 – Light Industrial : (pub. 2012-06-15)
Council	Newcastle	**Potential Stockpile Area (Total Combined)**	2.10 ha
Distance to nearest residential structure	50m	**Road Haul (Martins Ck Quarry)**	55km
		Road Haul (Boral Quarry Seaham)	37km
Land Access	Would require commercial agreement with owner.	**Max Train Length**	750
Site Viability	The viability of the rail haul proposed is low. The site has a calculated rail haulage rate of $10.26/t with a minimum throughput of 330 kt pa which is well above the likely road haulage rates from a competing quarry of between $2.96 to $5.55 / t noting that the rail hauled aggregate will incur further road delivery costs to the final user.		

Site Map

Table 15 Information on Vales Point Site.

Site	Vales Point Coal Unloader		
Street Address	Ruttleys Rd, Wyee	**Coordinates**	-33.149578, 151.492671
Cycle Time	12 hours	**Haul Length**	100km
Lot Name	Lot 327, DP755242	**Lot Zoning/ Area**	E2 – Environmental Conservation : (pub. 2014-09-12) SP! – Special Activities : (pub. 2014-09-12) SP2 – Infrastructure : (pub. 2014-09-12)
Council	Lake Macquarie	**Potential Stockpile Area (Total Combined)**	1.77 ha
Distance to nearest residential structure	1.2km	**Road Haul (Martins Ck Quarry)**	88km
		Road Haul (Boral Quarry Seaham)	77km
Land Access	Would require commercial agreement with owner.	**Max Train Length**	900
Site Viability	Site not economically viable for Hunter Valley with low volume single daily cycle operation. Calculated rail haulage rate for 330 kt per annum volume is $11.30 /t plus road delivery costs compared with road haulage rates of between $7.28 /t and $13.65 /t.		

Site Map

Table 16 Information on Teralba Site.

Site	Teralba		
Street Address	Powerhouse Rd, Teralba	**Coordinates**	-32.943161, 151.607329
Cycle Time	12 hours	**Haul Length**	69km
Lot Name	Lot 25, DP1110268	**Lot Zoning/ Area**	E2 – Environmental Conservation : (pub. 2014-09-12) E3 – Environmental Management : (pub. 2014-09-12) RU2 – Rural Landscape : (pub. 2014-09-12) SP1 – Special Activities : (pub. 2014-09-12)
Lot Name	Lot 1, DP728986	**Lot Zoning/ Area**	SP1 – Special Activities : (pub. 2014-09-12)
Council	Lake Macquarie	**Potential Stockpile Area (Total Combined)**	8.5 ha
Distance to nearest residential structure	760m	**Road Haul (Martins Ck Quarry)**	63km
		Road Haul (Boral Quarry Seaham)	52km
Land Access	Would require commercial agreement with owner.	**Max Train Length**	
Site Viability	The viability of the rail haul proposed is low. The site has a calculated rail haulage rate of $10.86/t with a minimum throughput of 330 kt pa which is well above the likely road haulage rates from a competing quarry of between $5.36 to $10.05 / t noting that the rail hauled aggregate will incur further road delivery costs to the final user.		

Site Map

Table 17 Information on Boral Cement Works Facility.

Site	Boral Cement Works Facility		
Street Address	Maldon Bridge Rd, Maldon	**Coordinates**	-34.195198, 150.633898
Cycle Time	24 hours	**Haul Length**	275km
Lot Name	Lot 2, DP231892	**Lot Zoning/ Area**	IN3 – Heavy Industrial : (pub. 2011-02-23)
Lot Name	Lot 1, DP608195	**Lot Zoning/ Area**	IN3 – Heavy Industrial : (pub. 2011-02-23)
Lot Name	Lot 3, DP748675	**Lot Zoning/ Area**	IN3 – Heavy Industrial : (pub. 2011-02-23)
Lot Name	Lot 31, DP602144	**Lot Zoning/ Area**	RU2 – Rural Landscape : (pub. 2011-02-23)
Lot Name	Lot 2, DP748675	**Lot Zoning/ Area**	RU2 – Rural Landscape : (pub. 2011-02-23)
Council	Wollondilly	**Potential Stockpile Area (Total Combined)**	6.71 ha
Distance to nearest residential structure	500m	**Road Haul**	
Land Access	This facility has been developed for the sole use of Boral.	**Max Train Length**	700 m
Site Viability	This site is owned by a competitor and is part of a very efficient aggregate distribution operation. Details have been provided for comparison purposes.		

Site Map

Table 18 Information on Holcim Australia Regional Distribution Centre.

Site	Holcim Australia Regional Distribution Centre		
Street Address	Kellogg Rd, Rooty Hill	**Coordinates**	-33.764911, 150.853090
Cycle Time	24 hours	**Haul Length**	242km
Lot Name	Lot 1, DP1150066	**Lot Zoning/ Area**	IN1 – General Industrial : (pub. 2015-05-26)
Council	Blacktown	**Potential Stockpile Area (Total Combined)**	2.97 ha
Distance to nearest residential structure	700m	**Road Haul km**	
Land Access	This facility is owned by Holcim and used exclusively by them. Third party access is unlikely.	**Max Train Length**	800 m
Site Viability	This site was initially developed as a "common user" distribution hub. The cost of rail delivery from Martins Creek however is in excess to the cost of delivery from the Southern Highlands due to the longer haul length and less efficient consist. This makes this site unviable for rail delivery from Martins Creek. Once in operation the site has been used exclusively by Holcim.		

Site Map

5.10 Summary of Site Viability multi criteria

Table 19 below summarises the viability of the additional sites reviewed. None of these sites are likely to have a commercial viability in the current market due to the proximity of lower cost alternatives.

Table 19 Summary of Site Viability.

Site	Transport Cost Competitive Against Southern Highlands Rail Options	Cost Competitive Against Quarries Delivering by Road	Significant Environment and Community Constraints	Access Available from Facility Owner
Glenlee (SADA)	No	Yes	No	Yes
Chullora	No	Yes	No	No
Walsh Point	N/A	No	No	No
SMR Yard Telarah	N/A	No	Yes	Maybe
Bloomfield	N/A	No	No	Maybe
Carrington	N/A	No	Yes	Maybe
Vales Point	N/A	No	No	Maybe
Teralba	N/A	No	No	Maybe

6 Conclusions and Recommendations

6.1 Conclusions

The Martins Creek Quarry is the only operating rail-served quarry within the Hunter Valley and northern areas of the greater Sydney Region. There are far fewer sources of aggregate suitable for use as ballast in heavy haul and passenger rail networks than sources of aggregates for the general construction market, and the resource at Martins Creek Quarry has a proven provenance for use on the rail network.

The current limitation on loading at the quarry in the evening and at night time is restricting its ability to compete in the delivery of product by rail. This has a negative commercial impact since only one Train Cycle every 2 days is possible leading to an increased use of onsite stockpiling.

The ability of the quarry to increase rail distribution of aggregates within its current distribution area is limited by the lack of suitable rail unloading facilities, large number of product destinations and types, short haulage distances and a number of competing quarries which are supplied by road serving the same markets with logistic chains.

There is currently no feasible opportunity to use rail logistics to expand the local and regional market currently served by Martins Creek Quarry. This will involve significant investment and coming to a suitable commercial arrangement with the owners of existing potential rail unloading sites, but there are no current existing unloading facilities in the local and regional area.

Distribution into the Sydney market via the SADA site appears to be viable noting that:

- the unloading site has a good rail connection
- the unloading site may be shared with other uses which reduces the fixed cost.
- the leased rollingstock assumed in the cost model can also be used for ballast distribution also reducing the fixed cost.
- the competing road haul from quarries in the Southern Highlands is of sufficient length that rail may have a price advantage.

To make this operation commercially viable the rail facilities at Martins Creek Quarry require expansion and rail and loading operations need to be carried out 24/7 to ensure that reliable train cycles can be achieved.

6.2 Recommendations

In order to encourage the ongoing use of Martins Creek Quarry by rail networks to supply ballast to the rail network, it is recommended that the practice of evening and night time train loading be available, which should enable the productivity of rail ballast and associated quarry product distribution to increase.

7 References

7.1 Reference Listing

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