# 2015-2024 Hunter Valley Corridor Capacity Strategy

July 2015


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# 1

# Introduction

On 5 September 2004, the Australian Rail Track Corporation (ARTC) commenced a 60-year lease of the interstate and Hunter Valley rail lines in New South Wales.

ARTC had previously controlled the interstate rail network within the area bounded by Albury on the NSW/ Victoria border, Kalgoorlie in Western Australia and Broken Hill in western NSW. The commencement of the NSW lease consolidated control of most of the interstate rail network under ARTC.

In early 2005, ARTC began to release annual Hunter Valley infrastructure enhancement strategies setting out how ARTC planned to ensure that rail corridor capacity in the Hunter Valley would stay ahead of coal demand.

This 2015—2024 Hunter Valley Corridor Capacity Strategy (the "Strategy") is the ninth of these annual strategies. It updates the 2014 - 2023 Hunter Valley Corridor Capacity Strategy (2014 Strategy).

In common with the earlier strategies, it identifies the future constraints on the coal network's capacity in the Hunter Valley, the options to resolve these constraints and a proposed course of action to achieve increased coal throughput.

The fundamental approach of ARTC in developing this Strategy has been to provide sufficient capacity to meet contracted volumes based on the principles of the ARTC Hunter Valley Access Undertaking (HVAU), while also having regard to and identifying those projects that would be desirable to accommodate prospective volumes that have not yet been the subject of a contractual commitment. In particular, this Strategy identifies a preliminary scope of work to accommodate prospective volumes of up to 282 mtpa which would require the proposed Terminal 4 (T4) on Kooragang Island.

Overall, there has been little change in the coal market environment over the past year and volume expectations remain closely aligned with those in the 2014 Strategy. Accordingly, the forward scope of work is also little changed.

It is important to note that the whole Hunter Valley coal supply chain is interlinked. The stockpiling and loading capability of the mines affects the trains required, the train numbers affect the rail infrastructure and so on. The capacity and performance of the system is entirely interlinked and the capacity of the rail network needs to be considered in that context.

In determining capacity ARTC makes certain assumptions which are generally covered in this Strategy. The delivery of throughput to align to capacity can be impacted by a range of performance issues across the supply chain. While some of these performance issues are covered in this document, it is not the key purpose of the Strategy.

## Volume Forecasts

Currently contracted export coal volumes are 182.9 mtpa in 2015, 191.8 mtpa in 2016 and 193.5 mtpa in 2017 where they approximately stabilize until they decline in 2023 to 189.5 mtpa and 177.6 mtpa in 2024. Forward contract volumes are in part dependent on completion of ARTC projects identified as conditions precedent to those volumes and the Coal Chain Capacity assessment by the Hunter Valley Coal Chain Coordinator (HVCCC).

In addition to contracted volumes, ARTC, in consultation with the HVCCC, has identified new and existing mines that producers may have plans to develop in the medium term. These projects have not proceeded to a stage where producers would want to commit to take-or-pay contracts, but to ensure that ARTC is able to plan appropriately for future growth are considered in this Strategy as a prospective volume scenario.

Under the provisions of the Hunter Valley Access Undertaking, it is a matter for the Rail Capacity Group (RCG) to determine the prospective volumes that are to be used for the purposes of this Strategy. The RCG comprises representatives of the coal producers, along with HVCCC and rail operators. At the April meeting the RCG was given a proposal for prospective volumes to consider. This maintained the accelerated rate of growth that the RCG selected as their preferred approach in 2013. The prospective volumes adopted are hypothetical and have been used for modelling purposes with no firm commitment that the prospective volumes will be realised. Under this scenario prospective volume is estimated at around 7.0 mtpa in 2016, 14.5 mtpa in 2017, 23.1 mtpa in 2018, 31.9 mtpa in 2019, 41.4 mtpa in 2020, 55.1 mtpa in 2021, 74.1 mtpa in 2022, 92.5 mtpa in 2023 and 96.2 mtpa in 2024. This rate of growth would require additional terminal capacity to be developed in advance of T4. Options for a modest increase in total terminal throughput capacity are currently being developed.

## Traffic Patterns

All but a very small proportion of the export coal shipped through Newcastle is transported by rail for shipping from Carrington (Port Waratah), or one of the two terminals on Kooragang Island.

Most of this coal comes from a series of mines and coal loaders dispersed along the Hunter Valley, conveyed to the terminals on the railway that runs between Muswellbrook and Newcastle. Coal also feeds onto this line from Ulan and the Gunnedah basin, west and northwest of Muswellbrook respectively, and, much closer to the terminal, from Stratford, Pelton and the southern suburbs of Newcastle (Figure 1).

Domestic coal is also transported over the same network. The largest volume is for Macquarie Generation at Antiene, which receives significant volumes of coal originating from mines on the Ulan line.

Export coal also arrives at the terminal from the Newstan and Teralba mines to the south of Newcastle, and in recent times in small volumes from mines in the Lithgow area. This traffic operates on the Sydney Trains network as far as Broadmeadow. There are no identified capacity issues for this coal on the short section of the


*Figure 1 - The general location of the Hunter Valley network on the east coast of Australia.*

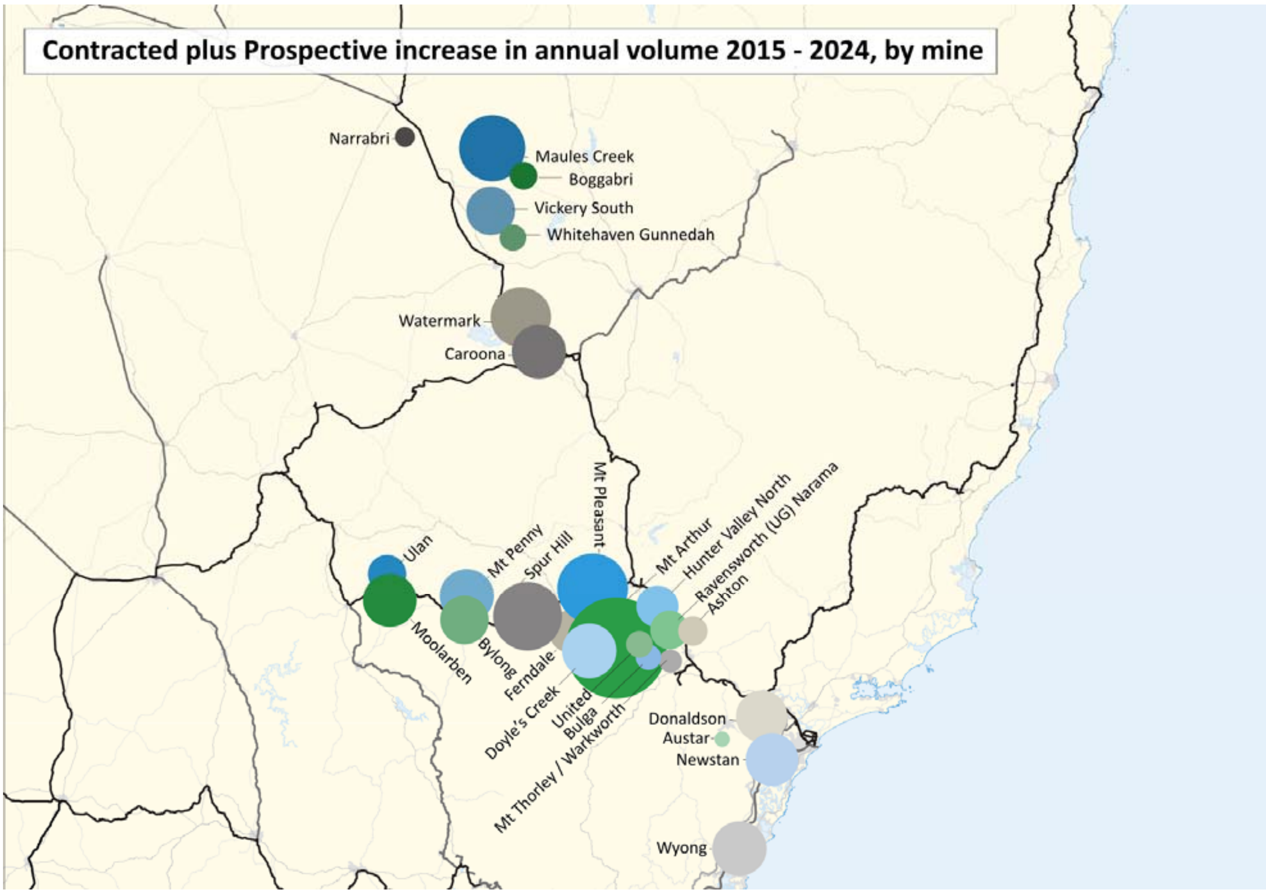

*Figure 2 - Volume forecasts by mine, contracted plus prospective. Note that growth is represented by diameter*

ARTC network which it traverses outside the port areas, and accordingly this Strategy does not discuss the network between the port terminals and Sydney.

The Hunter Valley coal network consists of a dedicated double track 'coal line' between Port Waratah and Maitland, a shared double track line (with some significant stretches of third track) from Maitland to Muswellbrook, and a shared single track with passing loops from that point north and west.

The heaviest coal volumes are at the lower end of the Hunter Valley. There is significant prospective growth from across the network (Figure 2 and Figure 3).

## Operations

Most of the Hunter Valley coal network is capable of handling rolling stock with 30 tonne axle loadings (i.e. 120 gross tonne wagons), but the North Coast line to Stratford is currently only rated for 25 tonne axle loads (100 tonne wagons). The privately owned railway to Austar can only accommodate 19 tonne axle loads (76 tonne wagons). The Gunnedah basin line has recently been cleared for operation at 30 tonne axle loads.

Weighted average coal capacity per train was 7,819 net tonnes in 2014. This compares to a figure of approximately 7,691 net tonnes in 2013. For the 2015 year to date, average train weight is 7,972 net tonnes. Average train size as contracted with ARTC is 8,009 tonnes (table 2) which suggests that contracted volumes are roughly consistent with actual train size where in recent years they had fallen behind the trend of increasing size. Further payload growth is expected with operators contemplating further increases.

At the 2015 Hunter Valley system capacity declared by the HVCCC, an average of around 60 loaded trains need to be operated each day, or one train every 24 minutes.

Train lengths vary from around 1,250 metres to 1,572 metres, apart from the approximately 600 metre trains servicing the Austar mine. Trains made up of '120 tonne' wagons are generally restricted to 60 km/h loaded and 80 km/h empty.

There are four above-rail operators in the Hunter Valley coal business: Pacific National (PN); Aurizon; Freightliner (as the operator in a joint venture with Glencore) and; Southern Shorthaul Railroad (SSR).

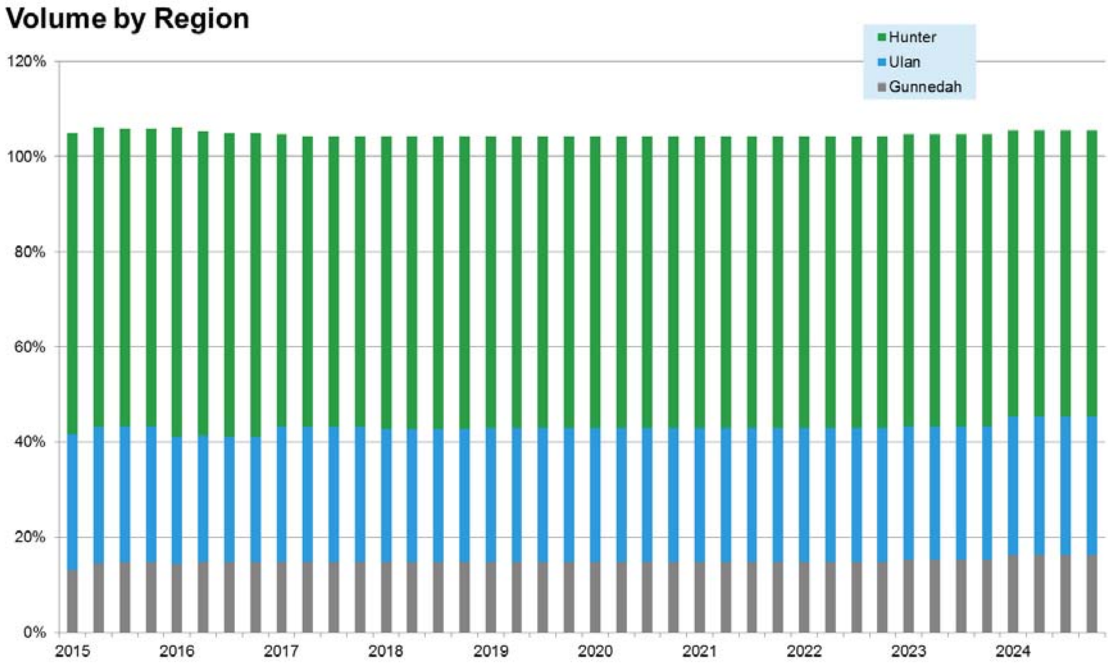


*Figure 3 - Percentage of Trains by Sub-Network by Year, including prospective volume (see Note 1)*

Note 1: Total train numbers in figure 3 are calculated as trains from each of the three zones as a proportion of all trains arriving at the port. The total number of trains exceeds 100% due to domestic coal.

## How this Strategy has been developed

The development of this Strategy retains the methodology of the 2014 Strategy.

In compliance with the HVAU, ARTC has undertaken a number of consultation steps to develop this Strategy. Specifically:

- The RCG, which is the official approval body representing access holders under the HVAU, has selected the prospective volume assumptions required to be used as the basis for the development of the Strategy.
- Consultation has been undertaken with PWCS and NCIG on terminal capacity alignment.
- Additional consultation has been undertaken with the HVCCC on system issues.

In common with the previous Strategies, coal capacity is analysed using a set of principles for the practical utilisation of track. Capacity is calculated using headways. On single track the headway is defined as the time the front of a train enters a section between loops until the time that the rear of the train clears the turnout for the loop at the other end of the section. The longest headway between two loops on a section of track defines the capacity limit for that section. This is then adjusted to reflect practical rather than theoretical capacity using an adjustment factor of 65%. On double-track, the headways are calculated on the basis of a ‘double-green’ principle. Under this principle both the next signal and the one after are at green, meaning that the driver will never see a yellow signal. This ensures that drivers should always be able to drive at full line speed.

On single track there is also a transaction time applied to recognise the time incurred by trains executing a cross, specifically signal clearance time, driver reaction time, acceleration and delays to the through train when it approaches the loop before the train taking the loop has fully cleared the mainline. Simultaneous entry loops and passing lanes reduce this transaction time by reducing both the probability and time delay from both trains arriving at the loop at around the same time. This Strategy has adopted a transaction time of 5 minutes for a standard crossing loop, 4 minutes where a simultaneous entry loop is involved and 3 minutes where a passing lane or the start of double track is involved.

After removing capacity lost to background (i.e. non-coal) trains, saleable paths are calculated as a percentage of practical coal paths. This adjustment covers maintenance, cancellations and a buffer.

Consistent with the Hunter Valley Access Undertaking, the buffer has been formalised in the form of the Target Monthly Tolerance Cap (TMTC). The RCG stated preference is for a 10% TMTC.

The consequent calculation of the adjustment factor, based on cancellation and maintenance loss assumptions as determined by the HVCCC for 2015, is shown in Table 1. Note that the adjustments are cumulative (that is, sequentially multiplied) rather than additive.

To the extent that cancellation or maintenance loss assumptions change in future years it will flow through to the required adjustment factor, which in turn may trigger the addition or deletion of projects.

The adjustment factor of 76.7% used in this Strategy compares to a value of 74.4% used in the 2014 Strategy. This slight increase has not had any material effect on the scope of work required for contracted volume given the modest forward program. It does have some effect on the program required for prospective volumes, allowing some projects to be deferred from the previous 'required by' timings.

| **Adjustment factor calculation** | **With TMTC at 10.0%** | |
|---|---|---|
| | **2014** | **2015** |
| Cancellations | 9.6% | 8.0% |
| Maintenance | 11.4% | 9.7% |
| TMTC | 10.0% | 10.0% |
| **Adjustment Factor** | **74.4%** | **76.7%** |

*Table 1 - Adjustment Factor*

## Terminal Capacity

Critical to the volume forecasts is Terminal capacity.

ARTC's understanding of port capacity is that nameplate capacity is now at 208 mtpa.

Significant growth beyond 208 mtpa is expected to be met by the PWCS development of Terminal 4 (T4). Development of T4 had been triggered by producers entering into contracts for the threshold volumes required to initiate the project and this was reflected in the 2012 Strategy. On 2 May 2013, PWCS announced that through a contractual handback process the requirement for Terminal 4 (T4) had been un-triggered. As a result it does not intend to proceed to construction at this stage, though it has continued to pursue environmental approvals for the project.

There is a prospect of modest increases in terminal capacity in advance of T4. At this stage there is no certainty around the scope and timing of such incremental enhancements, or the timing of construction of T4. For the purposes of this Strategy it has been assumed that incremental capacity would be available to meet 2017 prospective volume and that T4 would start to ramp up in 2020.

The relationship between contractual volumes, prospective volumes as determined by the RCG, and terminal capacity as assumed for this Strategy, is shown in Figure 4.

## HVCCC Master Planning

The HVCCC is responsible for the co-ordination of coal chain planning on both a day-to-day and long term basis. It is continuously developing a Hunter Valley Master Plan that deals with the optimisation of capacity enhancements across all elements of the coal chain with a view to providing an integrated planning road map for all elements of the chain.

ARTC is strongly supportive of this master planning process. It sees this Hunter Valley Strategy as both needing to provide the supporting rail infrastructure analysis for the master planning process, and to respond to the investment options identified in the master plan.

## System Capacity

For 2015, the HVCCC determined a declared inbound throughput (DIT) that was less than track system capacity.

HVCCC has forecast that track system capacity will not constrain currently contracted rail volumes.

## Operational Initiatives

While this Strategy principally focuses on infrastructure upgrades, ARTC supports industry initiatives to deliver operational efficiencies. ARTC is driving or supportive of the following important initiatives within the Hunter Valley:

- The Live Run Integration Team establishment as proposed by the Live Run Management Group Steering Committee.
- Continued regular forums with rail operators, to jointly consider improvements to operational performance, in particular crew change practices and train velocity expectations.
- Continued consideration, jointly with the HVCCC, of a train park up strategy to provide for efficient management of excess rolling stock at lower demand periods.
- Implementation and assessment of the revised corridor shutdown program.
- Continued assessment of maintenance practices

- Continued assessment of maintenance practices to reduce the need for track based inspections and physical maintenance interventions.
- Completion of industry and ACCC consultation on incentive mechanisms to minimise coal chain capacity losses.
- Continued development of increased train payload initiatives.
- Development of dynamic pathing capability.
- Targeted, data driven, infrastructure reliability improvement initiatives.
- Path planning tool (TRIMS) alignment with HVCCC planning systems for planning and network efficiency benefits.
- Reviewing and updating of ARTC business continuity plans for the Hunter Valley.

## Network Control Optimisation

During 2008 ARTC implemented new train control systems and automated signalling systems through the Train Control Consolidation Project (TCC). Under the project all 28 of the 19th century manually operated signal boxes within NSW were fully automated to Phoenix train control system technology and consolidated to ARTC's two Train Control Centres, Network Control Centre North (NCCN) at Broadmeadow and Network Control Centre South (NCCS) at Junee. This project realised significant operational gains, both in improved train transit times through the use of technology in addition to reduced recurrent expenditure. More recently ARTC has completed the Proof of Concept phase of the Advanced Train Management System (ATMS) and following a series of live trials is in the process of deploying ATMS for revenue service operations between Port Augusta and Whyalla.

ARTC and the industry is acutely aware of the challenges associated with an integrated supply chain such as the Hunter Valley Coal Chain. ARTC is working on initiatives to enhance our decision making capability within our real time operation. This is exemplified by the introduction of the Hunter Valley Live Run Integration Team which consists of above and below rail service providers, NCIG, PWCS and HVCCC to overcome real time alignment issues with process inventions.

In the past 4 years the investment in track and signalling infrastructure has enabled a more agile and capable operating network in parallel to building robustness of forward capacity. The combination of increasing peak train flow in combination with multiple train management and routing options, in an environment with increasing volume and with increased intensity of supply patterns, will require real time support tools to enable informed decisions to be made in a live run environment in the future. In December 2013, the RCG approved Phase 1 of a project known as the ARTC Network Control Optimisation (ANCO) project to investigate and to attempt to resolve the current and potential future issues caused by these inefficiencies within the Coal Chain. This project phase was approved with an initial budget estimate of approximately $30 million, over a 5 year project timeframe.

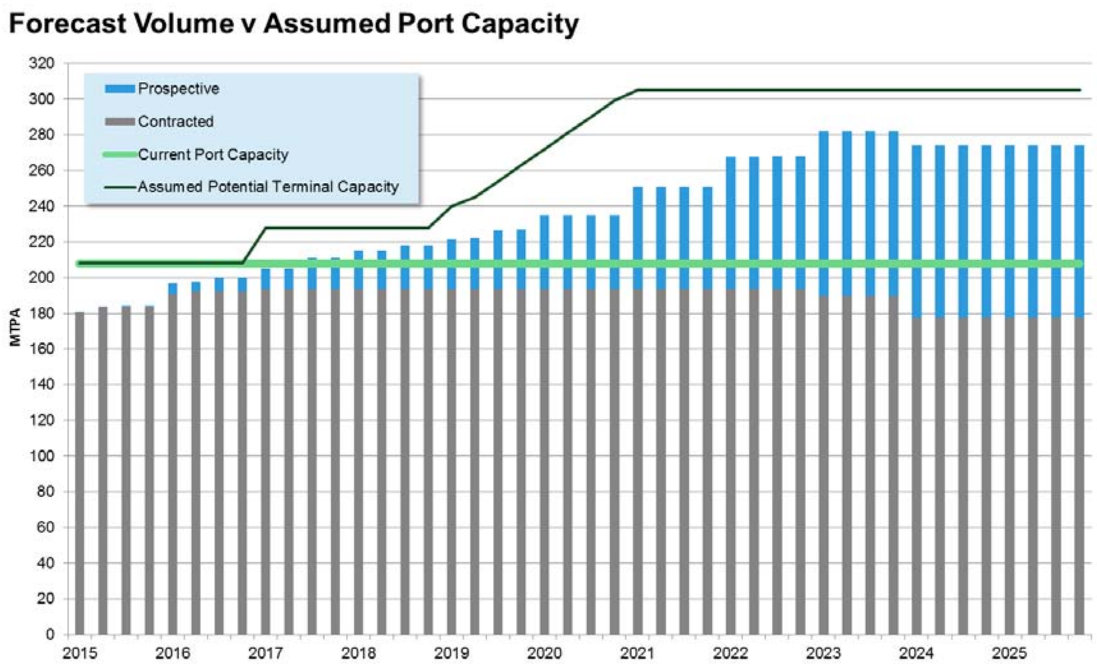


*Figure 4 - Forecast volume at Newcastle Port compared to assumed port capacity (mtpa)*

Phase 1 of this project was finalised in 2014 with feasibility options identified on methods and system enablers to address the operational context outlined. Phase 2 design of this integral project to create improved accuracy, repeatability and efficiency in train management through the Hunter Valley network is to be finalised in Quarter 2, 2015. Following Phase 1 findings, Phase 2 and beyond of the project now involves industry integration design requirements so the ANCO solution is implemented with defined dependencies and linkages with external and industry peer systems where required.

The purpose of the project is to provide a system enabler to support the increase in the capability and ultimately, the service provision of the Hunter Valley Network Control in increasing network and train running efficiencies and reducing variation within the Live Run.

The solution primarily allows real time data feeds across organisations inclusive of train forecast times which are deduced using live information, and provide the capacity to manage disruption through optimised scenario modelling.

As an element of the ANCO project, ARTC continues to explore how to increase network performance to enhance the coal chain's capacity, particularly in specific, high rail traffic intensity zones where operational improvements can be realised to offset potential infrastructure investment by way of additional train stabling sidings where valuable train hours are inefficiently utilised.

ARTC maintains the importance of the critical linkage and commitment to working with Coal Chain partners like HVCCC and our customers similarly, to ensure the final solution achieves the vision of the forward network capability to realise targeted and sustainable outcomes.

Inclusions planned for the system have been extended to include:

- Train Monitoring and Planning with train operative interaction
- High traffic intensity train flow management and routing options
- Live Run Disruption Management and Scenario Modelling
- Fixed and Rolling network operational asset Reporting
- Optimum Track work Planning and Possession Management

Types of systems/system enhancements covered by the investigation include:

- Train Flow Prediction and Balancing tools
- High traffic intensity zone headway management systems
- Electronic and Dynamic train graphs
- Long range optimisation/planning tools
- Automatic route setting

- Live run (short range) specific utility focused, optimisation tools

## Advanced Train Management System (ATMS)

The Advanced Train Management System (ATMS) is a communications based safeworking system being developed by ARTC to ultimately replace conventional lineside signalling systems across the network. The project has completed the proof of concept phase, and is now in a field trial phase between Port Augusta and Whyalla (SA) to demonstrate the functionality of the system in a live environment before finally commissioning the system for revenue service operations on this corridor. ARTC has previously identified that a commercial case existed for roll-out of the ATMS system in the Hunter Valley, where the capabilities of the system may both allow some projects to be deferred, and the construction cost of others to be reduced.

Previously much of the identified benefit of ATMS was associated with the ability to defer projects or to reduce their cost. With the reduced scope of work for prospective volumes, these benefits are unlikely to be as significant. However, ATMS is still likely to be a highly desirable initiative due to the system performance and productivity benefits that ATMS will offer especially when combined with improved decision making and planning tools.

ARTC confidence in ATMS continues to grow as the technology is consolidated and proven in the field. In 2014 ATMS was introduced into the Strategy program as a productivity initiative and ARTC continues to believe that the industry would see merit in considering implementation of ATMS.

On this basis, this Strategy retains the approach introduced in the 2014 Strategy of specifying the scope of work required for both contracted and prospective volumes under a 'with ATMS' scenario.

## Continuous Review

ARTC is continuously analysing and reviewing the available options to ensure that the value for money of projects is optimised. This process continues right up to the commencement of construction.

As such, this Strategy represents a snapshot in time. Although the formal written Strategy is only produced annually, in practice it is continuously reviewed internally to reflect the best available information and analysis.

| Average Train Capacity | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|
| Narrabri - Boggabri | 7,795 | 7,795 | 7,795 | 7,795 | 7,795 | 7,795 | 7,795 | 7,795 | 7,795 | 7,795 |
| Boggabri - Gunnedah | 7,635 | 7,630 | 7,639 | 7,639 | 7,639 | 7,639 | 7,639 | 7,639 | 7,639 | 7,639 |
| Gunnedah - Watermark Jct | 7,657 | 7,649 | 7,656 | 7,656 | 7,656 | 7,656 | 7,656 | 7,656 | 7,656 | 7,656 |
| Watermark Jct - Caroona Jct | 7,657 | 7,649 | 7,656 | 7,656 | 7,656 | 7,656 | 7,656 | 7,656 | 7,656 | 7,656 |
| Caroona Jct - Werris Creek | 7,657 | 7,649 | 7,656 | 7,656 | 7,656 | 7,656 | 7,656 | 7,656 | 7,656 | 7,656 |
| Werris Creek - Scone | 7,671 | 7,662 | 7,668 | 7,668 | 7,668 | 7,668 | 7,668 | 7,668 | 7,668 | 7,668 |
| Scone - Dartbrook | 7,671 | 7,662 | 7,668 | 7,668 | 7,668 | 7,668 | 7,668 | 7,668 | 7,668 | 7,668 |
| Dartbrook - Muswellbrook | 7,671 | 7,662 | 7,668 | 7,668 | 7,668 | 7,668 | 7,668 | 7,668 | 7,668 | 7,668 |
| Cobbora - Ulan | - | - | - | - | - | - | - | - | - | - |
| Ulan - Moolarben | 8,713 | 8,713 | 8,713 | 8,713 | 8,713 | 8,713 | 8,713 | 8,713 | 8,713 | 8,713 |
| Moolarben - Wilpinjong | 8,583 | 8,583 | 8,583 | 8,583 | 8,583 | 8,583 | 8,583 | 8,583 | 8,583 | 8,583 |
| Wilpinjong - Bylong | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 |
| Bylong - Ferndale | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 |
| Spur Hill - Mangoola | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 | 8,501 |
| Mangoola - Mt Pleasant | 8,566 | 8,570 | 8,570 | 8,570 | 8,570 | 8,570 | 8,570 | 8,570 | 8,570 | 8,570 |
| Mt Pleasant - Bengalla | 8,566 | 8,576 | 8,576 | 8,577 | 8,577 | 8,577 | 8,577 | 8,577 | 8,577 | 8,577 |
| Bengalla - Muswellbrook | 8,574 | 8,582 | 8,582 | 8,582 | 8,582 | 8,582 | 8,582 | 8,582 | 8,582 | 8,582 |
| Muswellbrook - Antiene | 8,276 | 8,273 | 8,266 | 8,266 | 8,266 | 8,266 | 8,266 | 8,266 | 8,266 | 8,266 |
| Antiene - Drayton | 8,276 | 8,273 | 8,266 | 8,266 | 8,266 | 8,266 | 8,266 | 8,266 | 8,266 | 8,266 |
| Drayton - Newdell | 8,491 | 8,465 | 8,457 | 8,457 | 8,457 | 8,457 | 8,457 | 8,457 | 8,457 | 8,457 |
| Newdell - Mt Owen | 8,387 | 8,376 | 8,371 | 8,372 | 8,372 | 8,372 | 8,372 | 8,372 | 8,370 | 8,371 |
| Mt Owen - Camberwell | 8,423 | 8,410 | 8,405 | 8,405 | 8,405 | 8,405 | 8,405 | 8,405 | 8,404 | 8,396 |
| Camberwell - Whittingham | 8,437 | 8,423 | 8,418 | 8,418 | 8,418 | 8,418 | 8,418 | 8,418 | 8,415 | 8,408 |
| Whittingham - Maitland | 8,473 | 8,459 | 8,454 | 8,444 | 8,444 | 8,444 | 8,444 | 8,444 | 8,442 | 8,436 |
| Maitland - Bloomfield | 8,234 | 8,235 | 8,233 | 8,224 | 8,224 | 8,224 | 8,224 | 8,224 | 8,220 | 8,299 |
| Bloomfield - Hexham | 8,235 | 8,236 | 8,235 | 8,226 | 8,226 | 8,226 | 8,226 | 8,226 | 8,221 | 8,299 |
| Hexham - Kooragang | 7,881 | 7,900 | 7,904 | 7,904 | 7,904 | 7,904 | 7,904 | 7,904 | 7,955 | 8,009 |
| Hexham - Carrington | 7,881 | 7,900 | 7,904 | 7,904 | 7,904 | 7,904 | 7,904 | 7,904 | 7,955 | 8,009 |

*Table 2 - Average Train Capacity under Contracted Volumes (tonnes)*

## Project Costs

This document is a strategy document and the indicative project costs are generally orders of magnitude only unless a project is in or close to construction. Costs are not ARTC's anticipated outturn costs as there are too many unknowns at the strategy phase to attach any reliability to the estimates. Scope and construction conditions are progressively better defined until a project cost is established for approval by the industry in accordance with the HVAU.

## Other Assumptions and Qualifications

The following additional qualifications apply to the analysis and proposals in this Strategy:

- Estimates of the numbers of trains required to carry the forecast coal tonnages are generally based on train consists nominated by producers under the contracting process. Assumed average train capacity by section by year is shown in Table 2. It should be noted that for the Gunnedah basin 30 tonne axle loads applied from Q1 2015.
- Trains are, on average, loaded to 98% of their theoretical capacity.
- Various ARTC initiatives including changes to the possession regime have enabled the HVCCC to reflect a lower maintenance loss rate for the 2015 capacity declaration.
- The project related capacity gains referred to in this Strategy take no account of the capabilities of loading and unloading interfaces, including the capabilities of private rail sidings and loops. In other words, at the conclusion of each project the identified rail capacity will be available, but this does not necessarily mean the coal supply chain will be able to make use of this capacity at that stage. This broader capacity analysis is undertaken by the HVCCC.
- Infrastructure is treated as being available for a quarter if it is projected to be available by the end of the first month of the quarter. If it is not expected to be available until later than the first month of the quarter it is treated as being available in the following quarter. For example, if a project is projected to be completed by 30 April, it is treated as being available for the second quarter. If it will not be completed until 1 May it would be treated as being available for the third quarter.

# 2

# What has changed between the last strategy and this one

This section summarises the key methodology, assumption and outcome changes between the 2014 Strategy and this 2015 Strategy to allow ready comparison between the two.

## Volume forecasts

Volume forecasts have been updated based on contracted volumes. This Strategy maintains the distinction between those volumes that are subject to a binding contract and those that are associated with projects that are moving forward but not yet at a stage where producers wish to commit to a contract. The latter category is referred to as prospective volumes.

Figures 5 to 8 compare the forecast volumes from the 2014 Strategy with the forecasts used for this Strategy. A comparison is made at the Newcastle terminals, at Muswellbrook, for the Bylong – Mangoola section (which is the majority of the Ulan line), and Werris Creek – Muswellbrook (which is representative of most of the Gunnedah basin line).

## Capacity Calculation Inputs

As outlined in Chapter 1, the capacity calculation methodology uses the industry nominated cancellation losses and non-aligned maintenance losses as determined by the HVCCC as inputs into the capacity calculation, together with the target monthly tolerance cap (TMTC) as nominated by the RCG. While the TMTC is now a constant, the forecast cancellation and maintenance rates will vary from year to year.

Ideally the HV Capacity Strategy would be based on forward estimates of cancellations and maintenance losses on a year by year basis. However, at this time the HVCCC only finalises these losses for the year ahead and only does so when determining the Declared Inbound Throughput (DIT). Accordingly this HV Strategy is based on the HVCCC estimates of cancellations and maintenance losses for 2015.

For 2014 the estimated cancellations rate was 9.6% and the maintenance losses were 11.4%. For this 2015 Strategy these have been updated to 8.0% and 9.7% respectively. The 8.0% cancellation rate equates to the 7.4% loss rate as per the 2015 DIT assumptions released by the HVCCC, but is expressed as 8.0% as it is applied as an escalation rather than a reduction.

## Completed Projects

The projects completed during the 2014/15 financial year include Stage 1 of the Gunnedah Line 30 tonne axle load upgrade, Scone Reconfiguration, Gunnedah Yard Upgrade, Port Holding Roads (Hexham), KCT Arrival Road Signalling Optimisation, Drayton Relief Hub, Mt Thorley signalling changes and the NCIG flyover. Apart from one remaining signal which has been included in the Kooragang Arrival Roads Stage 2 project the Hexham-Kooragang Re-signalling project is also complete.

## Recommended projects and timing

A summary of the recommended projects comparing previous and new proposed delivery timeframes is shown in Tables 5 & 6 in Chapter 7, for both contracted and prospective volumes.

## Train Park-up

The potential need to invest in additional train park-up facilities has been discussed in past capacity strategies. The need for park-up is fundamentally a function of variability in the system. HVCCC has identified that there may be an opportunity to achieve whole-of-network efficiencies by reducing the causes of variability and is currently undertaking a study with an holistic view on supply chain system variability. While this investigation is being undertaken train park-up projects have been removed from the scope.

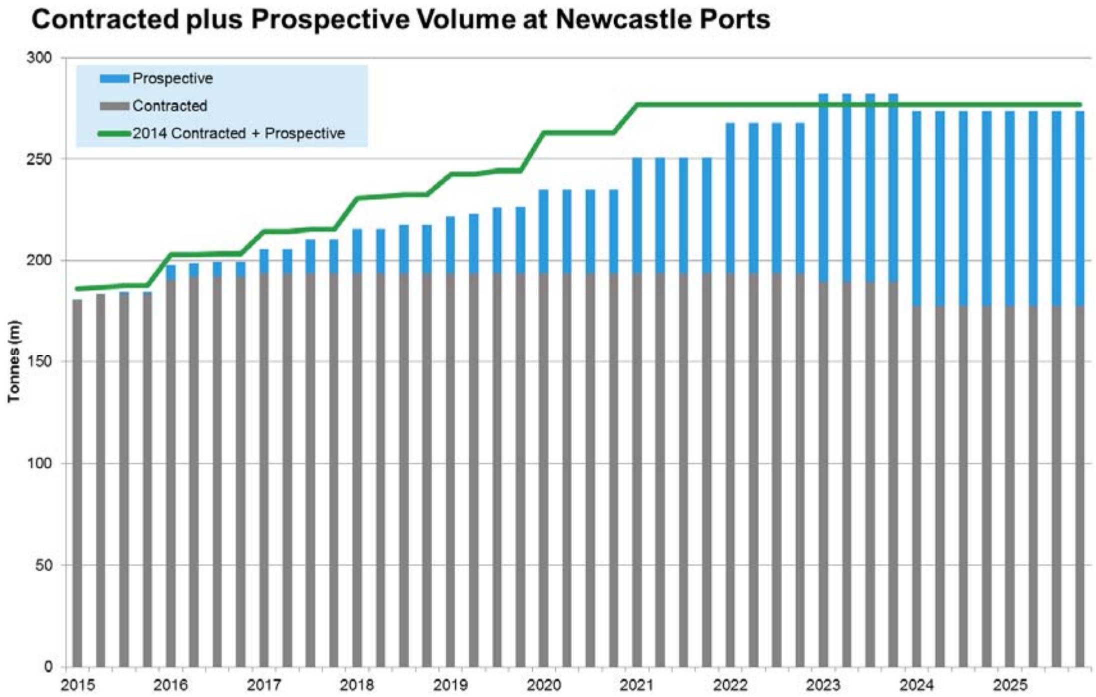


*Figure 5 - Current Volume Forecasts vs. 2014 Strategy Volume Forecast, Newcastle Terminals (mtpa)*

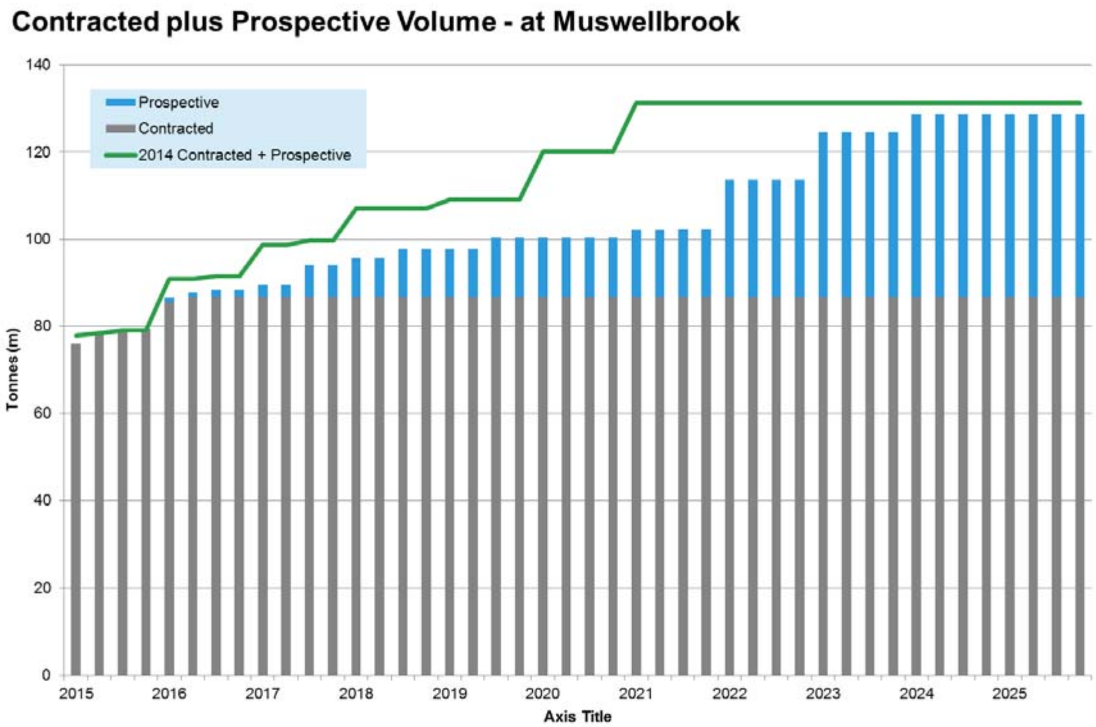


*Figure 6 - Current Volume Forecasts vs. 2014 Strategy Volume Forecast, Muswellbrook (mtpa)*

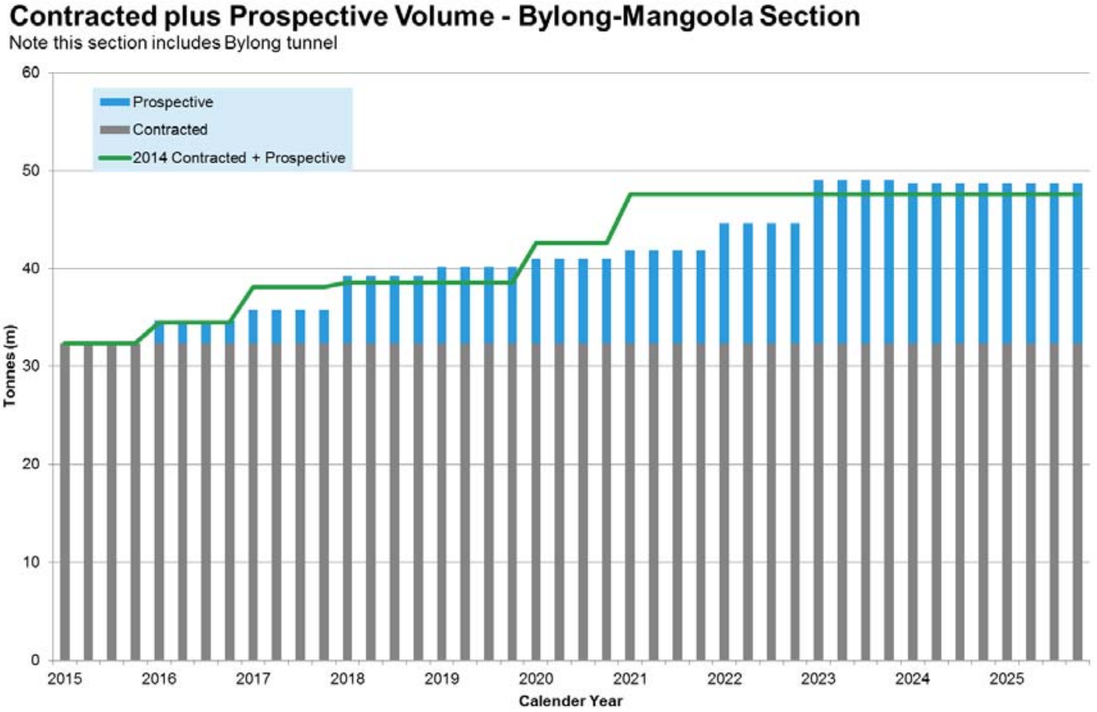


*Figure 7 - Current Volume Forecasts vs. 2014 Strategy Volume Forecast, Bylong—Mangoola (mtpa)*

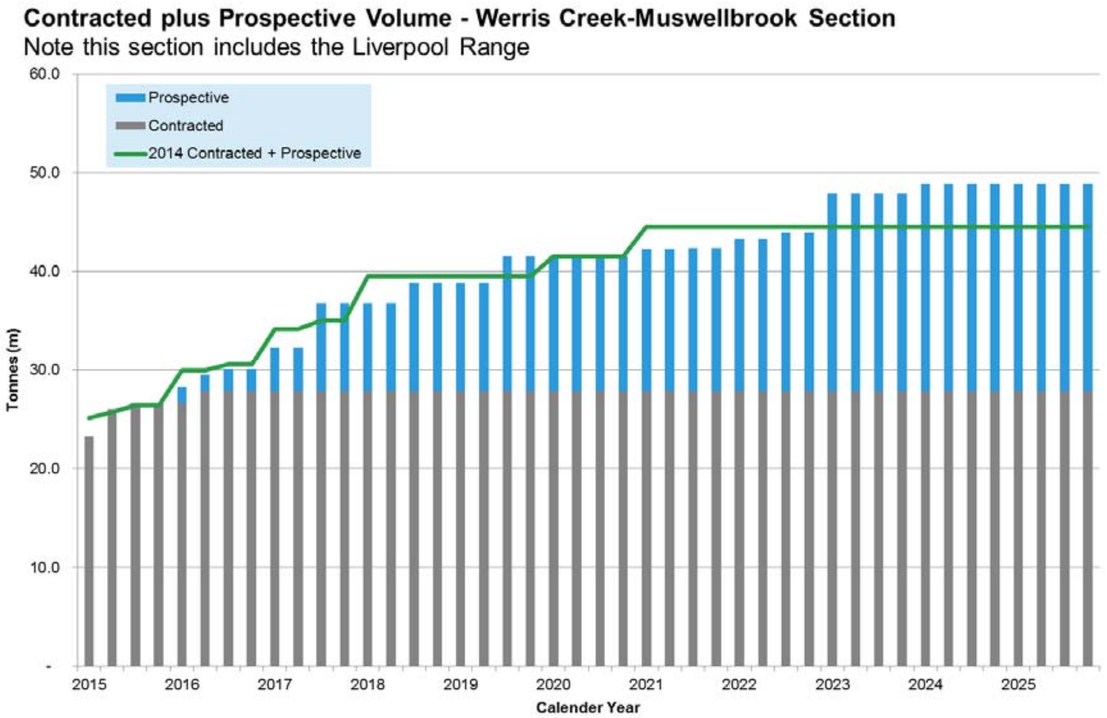


*Figure 8 - Current Volume Forecast vs. 2014 Strategy Volume Forecast, Werris Creek—Muswellbrook (mtpa)*

# 3

# Increasing Capacity between Narrabri and Muswellbrook

## Context

The Gunnedah Basin line extends from the junction for the Narrabri mine to Muswellbrook.

This single-track line is highly complex. In addition to its coal traffic, it carries passenger trains (CityRail services to and from Scone and CountryLink services to and from Moree / Armidale) and a proportionately high level of grain, cotton and flour train activity. This ‘background’ traffic is up to seven trains each way between Narrabri and Scone, and 10 trains each way per day south of Scone.

There are four coal train origins / destinations along the route, at Turrawan, Boggabri, Gunnedah and Werris Creek. Three major new mines are proposed for the Gunnedah basin: Vickery South, Caroona and Watermark.

Maules Creek is now operational and loads from a balloon loop on a new branch constructed and funded by Whitehaven and Idemitsu. The new branch connects to the rail network close to the existing Boggabri balloon loop. The Boggabri mine also utilises a balloon loop off this new branch. Vickery South is assumed to load in the vicinity of Gunnedah. It is understood that Watermark will load from a new load point north of Breeza, at approximately 443.5 km. The Caroona mine may now load from a balloon loop connecting to the Binnaway line, which runs west from Werris Creek.

The Ardglen bank, crossing the Liverpool Range, is a particular impediment on this corridor. The severe grades on the short section between Chilcotts Creek and Murrurundi dictate limits for train operations on the whole Werris Creek to Newcastle route. The need to use ‘banker’ locomotives for loaded coal and grain trains on this section means it carries greater train volumes than the rest of the line, because the return of the ‘banker’ locomotives adds a northbound train path for each southbound coal or grain train, though this is mitigated to some extent by the ability of bank engines to use the short loop at Kankool and the ability to bank from Chilcotts Creek following the opening of the new loop with purpose built bank engine sidings.

Passing loops on the Muswellbrook–Narrabri route had highly variable lengths when ARTC first started investing in capacity enhancement on this corridor. The majority of loops are now 1330 m – 1450 m with only a small number of short loops remaining. Of these short loops, Gunnedah, Quirindi, Kankool and Scone have specific challenges that make extension difficult.

All of the network carrying coal is Centralised Traffic Controlled (CTC).

## Axle Load Increase

The track north of Dartbrook was previously rated for 25 tonne axle loads (i.e. ‘100 tonne’ wagons). In late 2013 the Gunnedah basin producers approved a project to proceed with the necessary track upgrading north of Dartbrook to permit 30 tonne axle loads to allow the use of 120 tonne wagons and thus increase the carrying capacity of each train.

The replacement of high risk infrastructure was complete by Q1 2015 allowing the commencement of 30 tonne axle load operations. The remainder of the program of works will be complete by 30 June 2017. The operating trains are now being monitored to determine their actual performance in order to more accurately assess the track capacity. Depending on the outcome of this assessment there may be some adjustments to the program in the future.

In past modelling ARTC took a conservative position regarding train loads due to advice that 82 wagon trains at 120 tonnes may not be fully achievable in practice. However, operators are achieving the full train sizes and the assumptions have been updated accordingly. This has led to an increase in average train sizes and therefore a capacity increase.

## Liverpool Range

In 2007 ARTC completed a study looking at options for a new rail alignment across the Liverpool Range in the vicinity of Ardglen. This report assessed four tunnel options and two surface alignment options as well as duplication of the existing alignment.

In the 2011 Strategy ARTC indicated that its assessment of the costs and benefits of the options suggested that staged duplication of the existing line on the existing gradient was the best solution and that duplication would be treated as the default solution.

The Liverpool Range poses some particular complexities due to grades, curvature and geology.

However, the decision to proceed with, initially, additional loops, followed by progressive duplication, means that in practical terms the Liverpool Range will essentially see a similar approach to capacity enhancement as the rest of the corridor. As such the staging of the enhancements is discussed in the context of 'Loops & Passing Lanes' below.

## Gunnedah Yard

The Gunnedah Yard project was completed in Q1 2015. It was previously determined that in order to minimise the noise impact on surrounding residents, a 40km/hr speed limit in the down (empty) direction be adopted. While this solution provides the required capacity for contracted volumes it also minimised the scope and cost of noise mitigation required.

This track section will constrain further growth on the Gunnedah line. The potential to increase speed to the normal 80 km/h through Gunnedah as a capacity enhancement option will be assessed when considering future volume pre-applications.

## Train Lengths

ARTC has an approved train length of up to 1,329 metres in the Gunnedah basin. This represents a practical limit given current loop lengths and the need to allow a margin at the loop ends. There will be no further increase in length until the track configuration changes to facilitate it.

For various operational reasons ARTC has been building an increasing number of loops with a 'simultaneous entry' configuration. This configuration allows for a more efficient cross to occur when opposing trains arrive at the loop at around the same time, an event which becomes increasingly probable as the distance between loops decreases. A simultaneous entry configuration requires a minimum extra 300 metres 'overlap' to be added to the loop length, making the loops nominally 1,650 metres, though in the simultaneous entry configuration the extra length is not available to use for longer trains. However, if and when ATMS is introduced into the Hunter Valley it will be possible to allow simultaneous entry without the additional overlap, meaning that loops built in this style would immediately be available for trains of the standard Hunter Valley length of 1,543 metres.

Given this opportunity to move progressively towards the introduction of the standard Hunter Valley train to the Gunnedah basin, ARTC is adopting an approach of building all new loops to the simultaneous entry configuration where this is cost effective, which provides short-term operational benefits and the ability to easily move to longer trains if and when ATMS is introduced.

Producers on the Gunnedah line have requested that ARTC investigate the feasibility and cost of increasing the existing passing loops to accommodate longer trains. Two train lengths of 1,420 metres and 1,543 metres are currently being assessed. Once capital costs are better understood the producers will be in a position to assess the benefit of operating more efficient longer trains against the capital cost.

The impact of increasing train length on capacity depends on the impact that longer, heavier trains have on section times as well as the increase in payload capacity of each train. Initial modelling suggests that some sections would see an increase in capacity with longer trains while others would see a reduction. Looking forward, this would mean that some loop projects may be able to be deferred in the event of prospective volumes becoming contracted, though other projects may need to be brought forward.

## Loops & Passing Lanes

Progressive lengthening of selected existing passing loops, and constructing additional passing loops, has been the primary mechanism for accommodating volume growth to date. However, only two loops (Aberdeen and Murrurundi) remain for potential extension. Opportunities to insert additional mid-section loops are becoming constrained due to the effects of grades and level crossings, while the increasingly short distances between loops mean that additional mid-section loops are of declining benefit due to the transaction times at the loop.

Notwithstanding this, concept assessments undertaken in 2012 on projects required to accommodate prospective volumes have tended to conclude that a mid-section loop remains the preferred solution. In some cases these new loops will be quite close to existing loops. However, where it is practical to construct a mid-section loop the additional cost associated with building a passing lane does not justify the additional benefit. As a result, passing lanes have only been recommended where there are physical constraints to a mid-section loop.

The passing lane / double-track sections on the Liverpool Range remain as it is not practical to stop trains on either the up or down grade across the range, while Bells Gate south extension is preferred to extending Quipolly loop due to the high cost of extending the loop given level crossing and environmental constraints. The length of each of these passing lanes is determined by physical constraints.

Table 3 shows the new loops, loop extensions and passing lanes proposed on the basis of addressing the capacity constraint on each local section as demand requires, for both contracted and prospective volume. The location of each of the projects is shown on Figure 9.

## HVCCC Modelling of Gunnedah basin operations

During early 2014 the HVCCC reported on modelling that it had undertaken on the Gunnedah and Ulan lines. The background to the modelling was the desire of HVCCC to be able to assess the need for relief hubs either at the main mine areas of each line (nominally Boggabri and Bylong) or at the junction at Muswellbrook.

It has been apparent for some time that the need to program trains onto fixed paths to the Gunnedah basin causes a loss of capacity. This could to some extent be mitigated by creating a timetable that incorporates as many paths as possible. However, the consequence of such a timetable is that, since not every path is used in practice, it creates 'phantom' crosses. These phantom crosses cause problems for live-run and in themselves artificially consume train hours.

The solution to this problem is 'dynamic' pathing, that is, adoption of a system that creates a daily timetable tailored to the requirements of the specific trains that will actually be running on that day.

HVCCC's modelling concluded that in a scenario where trains arrive at Muswellbrook off their designated path, in the absence of dynamic pathing there would be considerable congestion at Muswellbrook as trains may need to occupy the mainline for up to 2 hours waiting for the next timetabled path. These waiting trains would block the Ulan line. The HVCCC has suggested that an alternative to dynamic pathing would be the construction of one or more holding roads at Muswellbrook.

ARTC believes that dynamic pathing is technically possible and has significant potential to increase productivity, not just for the Gunnedah line, but for the entire coal chain. A project to develop a dynamic pathing system is now well underway.

The HVCCC modelling did not find a need for a holding track near Boggabri.

An additional output of the modelling was electronically generated timetables for the Gunnedah basin. These timetables demonstrated that it was possible to create theoretical timetables that achieved greater than the 65% utilisation ARTC currently adopts as the track utilisation threshold for calculating saleable paths. It should be noted though that ARTC's timetables already include path numbers that exceed the 65% utilisation levels. ARTC does not sell all of the paths as given natural variability the HVCCC would be unable to timetable a train onto every path.

ARTC is of the view though that dynamic pathing is likely to increase track utilisation. As the dynamic pathing project progresses ARTC will further assess the extent to which it may be possible to set a higher single track utilisation limit.

In the meantime ARTC will also continue to apply the principle that utilisation levels above 65% may be appropriate where projected utilisation would only exceed the threshold by a small amount and the projects required to keep utilisation below 65% are expensive. Any decision on whether to accept a higher utilisation level would be made in consultation with the relevant producers.

## Coded Track Improvements

A recent trial was undertaken on the Gunnedah line to measure the impact of enhanced design of coded track circuits, which are a key mechanism by which communication is undertaken in a CTC signalling system. The results of the trial show:

- For a crossing train utilising a passing loop, the time saving is forecast to be in the order of 80 seconds.
- For following trains the time savings are in the order of 10-15 seconds.
- Conversion of 13 coded track circuits between Werris Creek and Turrawan could deliver an improvement in the total section clearing time of 7.5 - 8.6 mins at a cost in the order of $0.5 m.

This system upgrade would provide a small increase in capacity at minimal incremental cost. However, the investment would become redundant if and when ATMS was installed. At this time there is no capacity constraint that would be addressed by the coded track circuit upgrade and accordingly no work is currently proposed.

| Project Name | Contracted | Prospective |
|---|---|---|
| Aberdeen loop extension | | Q3 2017 |
| Togar North Loop | | Q2 2016 |
| Wingen loop | | Q3 2016 |
| Blandford loop | | Q3 2017 |
| Kankool - Ardglen | | Q3 2017 |
| Bells Gate south extension | | Q3 2017 |
| 414 km loop (Werris Creek North) | | Q1 2022 |
| South Gunnedah loop (see note 1) | | Q3 2016 |

*Table 3 - Narrabri to Muswellbrook Loops - Timing that would be required under contracted and prospective volume scenarios*

*Note 1 - Empty train speeds through Gunnedah have been limited to 40 km/h to ensure predicted noise levels do not exceed standards. Train speeds could be lifted to 80 km/h either on the basis of actual noise levels being less than predicted, or through additional noise mitigation treatments. Lifting speeds to 80 km/h would increase capacity by approximately 1.9 mtpa. This would allow South Gunnedah loop to be deferred by 6 months in the prospective volume scenario used for this Strategy.*

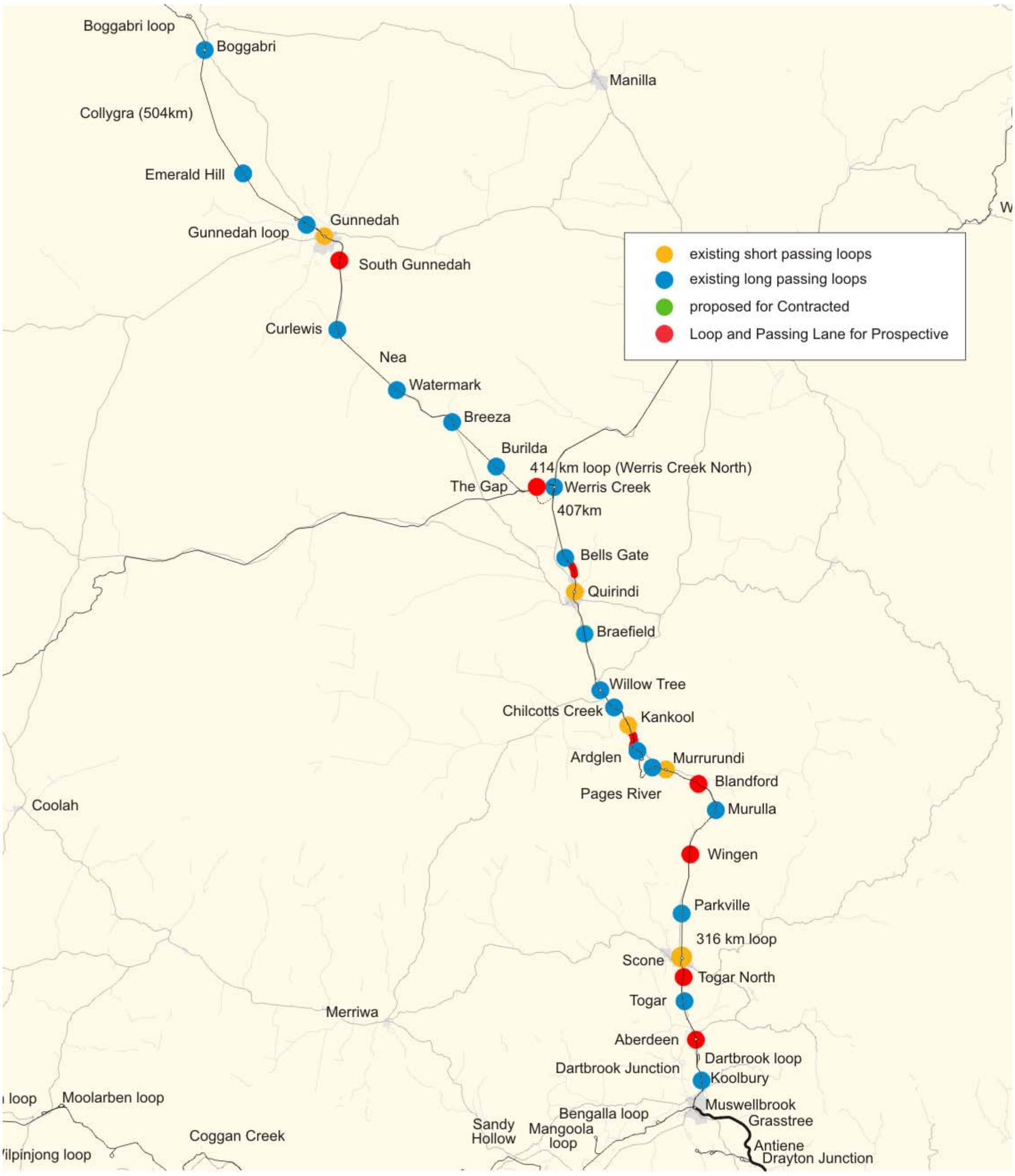


*Figure 9 - Muswellbrook to Narrabri Loops*

# 4

# Increasing capacity between Ulan and Muswellbrook

## Context

The Ulan line extends approximately 170 km, from Ulan, west of the dividing range, to Muswellbrook in the upper Hunter Valley. It is a single track line, with passing loops at Bengalla, Mangoola, Yarrawa, Sandy Hollow, Kerrabee, Baraemi, Murrumbo, Bylong, Coggan Creek, Wollar, Wilpinjong and Ulan (though the Ulan loop is only 980 m), and is CTC controlled.

Although the line is used mainly by coal trains, it is also used by one or two country ore and grain trains per day and occasionally by interstate freight trains that are bypassing Sydney during possessions. The line services long-standing mines at Bengalla and Ulan. The Wilpinjong, Moolarben and Mangoola mines have all commenced production in recent years.

Five new export coal mines are at various stages of the development and approval process and are included as prospective future volumes.

In the 2014 Strategy it was determined that a sixth mine, Cobbora, located approximately 33 km north-west of Gulgong, be excluded from the prospective volumes. The project was previously being developed by the NSW Government to produce coal suitable for domestic power generation. The probability of this occurring in the medium term is low and it has therefore been excluded from the prospective volumes.

The mines on this sector are clustered either at the start of the line near Muswellbrook (Bengalla, Mangoola, Mt Pleasant) or at the end of the line around Ulan (Ulan, Wilpinjong, Moolarben). This gives rise to a long section in the middle with homogenous demand.

The Ulan line has some difficult geography which constrains the location of loops. As sections become shorter, the scope to adjust the location of the loop declines. Accordingly, as investigation of nominal sites has progressed, it has become necessary to consider alternative solutions. Specifically, in some cases it has become necessary to construct “passing lanes”, which are effectively short sections of double track. These will necessarily be materially more expensive than straightforward loops.

This analysis of the Ulan line assumes that there is no change to the current pattern of limited background (non-coal) trains on this line.

## Tunnel Ventilation

An unusual capacity constraint is posed by the ventilation in the tunnels on the Ulan line, in particular the Bylong tunnel. Although the line only opened in 1982, the four tunnels were built as part of the original uncompleted construction of the line which commenced in 1915. Accordingly the tunnels were built to a relatively small outline and ventilation in the tunnels has been considered a problem. Train spacing and track maintenance has been limited by the ‘purge times’ for air in the tunnel. However, extensive monitoring and analysis has allowed the previous operating rule that limited trains to operating at an arbitrary 30 minute minimum frequency to be reduced to 20 minutes. This has largely addressed the ventilation issue.

In the event of significant increases in volume it would be necessary to extend the Bylong loop to the western tunnel portal. This extension would be built to a new vertical alignment, with the track cresting at a point around one kilometre before the portal so that trains are able to start on an acceptable gradient. This will also reduce the requirement for trains to be powering as they enter the tunnel, providing further mitigation of the air quality issue.

## Denman Bypass

The 2011 Strategy identified an option to construct a bypass of Denman, from just east of Sandy Hollow to just west of Mangoola, as an alternative to an additional loop (nominally at 324 km) on this section. The 11.5 km bypass would provide operational efficiencies (reducing route length by 8.7 km) as well as creating capacity by effectively making the section double track.

The HVCCC has identified the Denman bypass as a potential option for creating additional train park-up capacity. The bypass option will continue to be assessed in the context of all three of these potential sources of benefit noting that the likely trigger for such a project, the construction of a loop at 324 km, is no longer required under the prospective volume scenario.

## Increasing Train Length

ARTC continues dialogue with operators to explore the benefits of increasing the length of trains to circa 1,610 metres. Generally the preference would be to operate standard train sets across the network. To achieve this on the Ulan line it would require extensions to the Sandy Hollow and Kerabbi loops.

At this time there is adequate capacity for all contracted volume.  This proposal would therefore be primarily a productivity initiative which is not currently being pursued by operators or producers on the Ulan line.

## Additional Passing Loops/Passing Lanes

Additional passing loops, or where necessary passing lanes, represent the main mechanism to deliver further incremental increases in capacity on the line.

The currently identified scope is set out in Table 4. The location of existing and proposed loops is shown in Figure 10.

| Project Name | Contracted Volumes | Prospective Volumes |
|---|---|---|
| Mt Pleasant loop (previously Bengalla west extension) | - | Q1 2022 |
| Widden Creek loop | - | Q1 2023 |

*Table 4 - Ulan - Muswellbrook Loops, timing under contracted and prospective volume scenarios*


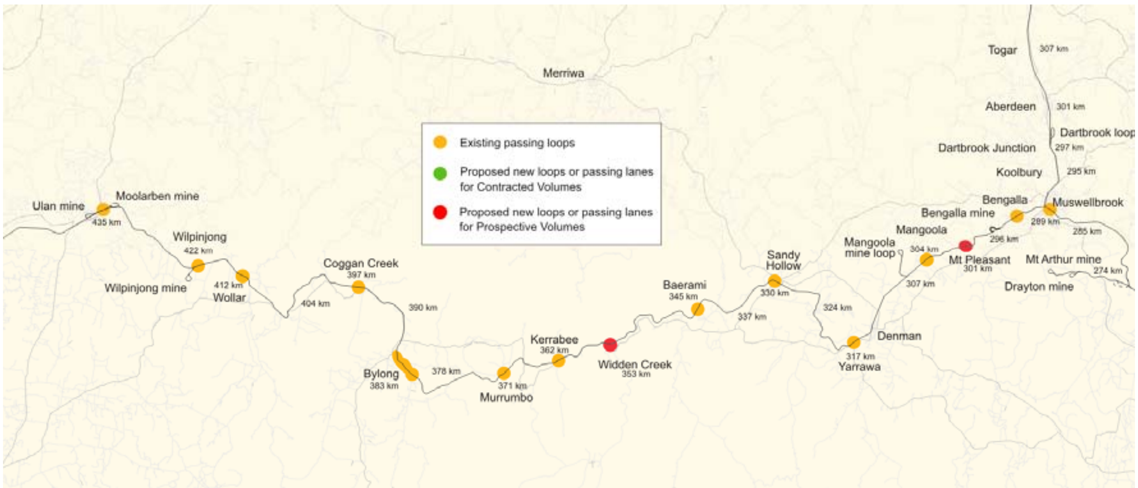


*Figure 10 - Ulan Loops*

# 5

# Increasing capacity between Muswellbrook and Hexham

## Context

The major issues affecting the line between Maitland and Muswellbrook are:

- Headways
- Junctions
- Continuous flow of trains

Headways are fundamentally a function of signal spacing and design. Drivers should ideally only ever see a green signal on double track, so that they do not slow down in anticipation of potentially encountering a red signal. To achieve this outcome, a train needs to be at least 4 signals behind the train in front so that the signal a driver encounters, and the next one beyond, are both at green. Signal spacing also needs to take into account train speed and braking capability. Signals need to be spaced such that a train travelling at its maximum speed and with a given braking capability can stop in the distance between a yellow and a red signal. In some cases these constraints start to overlap, in which case it becomes necessary to go to a fifth signal, with a pulsating yellow indication.

Ideally, headways on the whole corridor from Muswellbrook to the Terminal should be consistent so that trains can depart at regular intervals, and as additional trains join the network they can slot in to a spare path without impacting a mainline train. This headway target needs to be around 8 minutes[3] once volume exceeds around an average of 84 paths per day, or 245 mtpa at current train lengths.

While this principle has been adopted in the signalling design for new works, there have not as yet been any projects directed specifically at reducing signal spacing. At this stage effective headway is at around 8 minutes south of Minimbah, but increases further up the line. Spacing is as high as 16 minutes in the vicinity of Drayton Junction.

It should also be noted that in a live operating environment, all trains will ideally operate at consistent speeds and achieve the section run time. To the extent that they do not it results in drivers encountering yellow signals, which causes them to slow, creating a cascading effect on following trains that will cause a loss of capacity.

There are three major banks (sections of steep grade) on the Muswellbrook - Maitland section that particularly affect the headways for trains; Nundah Bank, Minimbah Bank and Allandale Bank (Figure 11). The steep grades on these banks slow down trains to such an extent that it is not possible to obtain an adequate frequency of trains irrespective of how closely the signals are spaced. This requires a third track to be constructed at the banks. All three of the major banks are now on three track sections.

There are numerous junctions on the Hunter Valley rail network where train conflicts at the at-grade interfaces impact on capacity (Figure 12).

Low speed, high maintenance turnouts around Maitland have been approved for upgrade in 2015/16. This upgrade is being undertaken to reduce the future maintenance task. However, it may also result in minor increases in train operating speeds and thereby reduce pressure on capacity.

Whittingham junction turnout speeds were upgraded to 70 km/h in conjunction with the 80 km/h approach to Minimbah bank project, and the junction now has a three track configuration as a result of the Minimbah bank third track project. This allows loaded trains to exit the branch without needing to find a slot between loaded mainline trains. Accordingly this junction is now highly efficient.

Camberwell Junction was upgraded to high speed turnouts in conjunction with the Nundah bank third track project, though the speed on the balloon loop limits the practical speed.

Mt Owen Junction has slow speed turnouts. However, the volume from Mt Owen means that its junction does not have a significant impact on capacity.

Newdell and Drayton Junctions have been upgraded with high-speed, low maintenance turnouts. While this was primarily maintenance driven, the speed upgrade means that these junctions are now highly efficient.

3. Signal clearance times depend on the length and speed of trains, so there is no single absolute number for actual signal spacing.

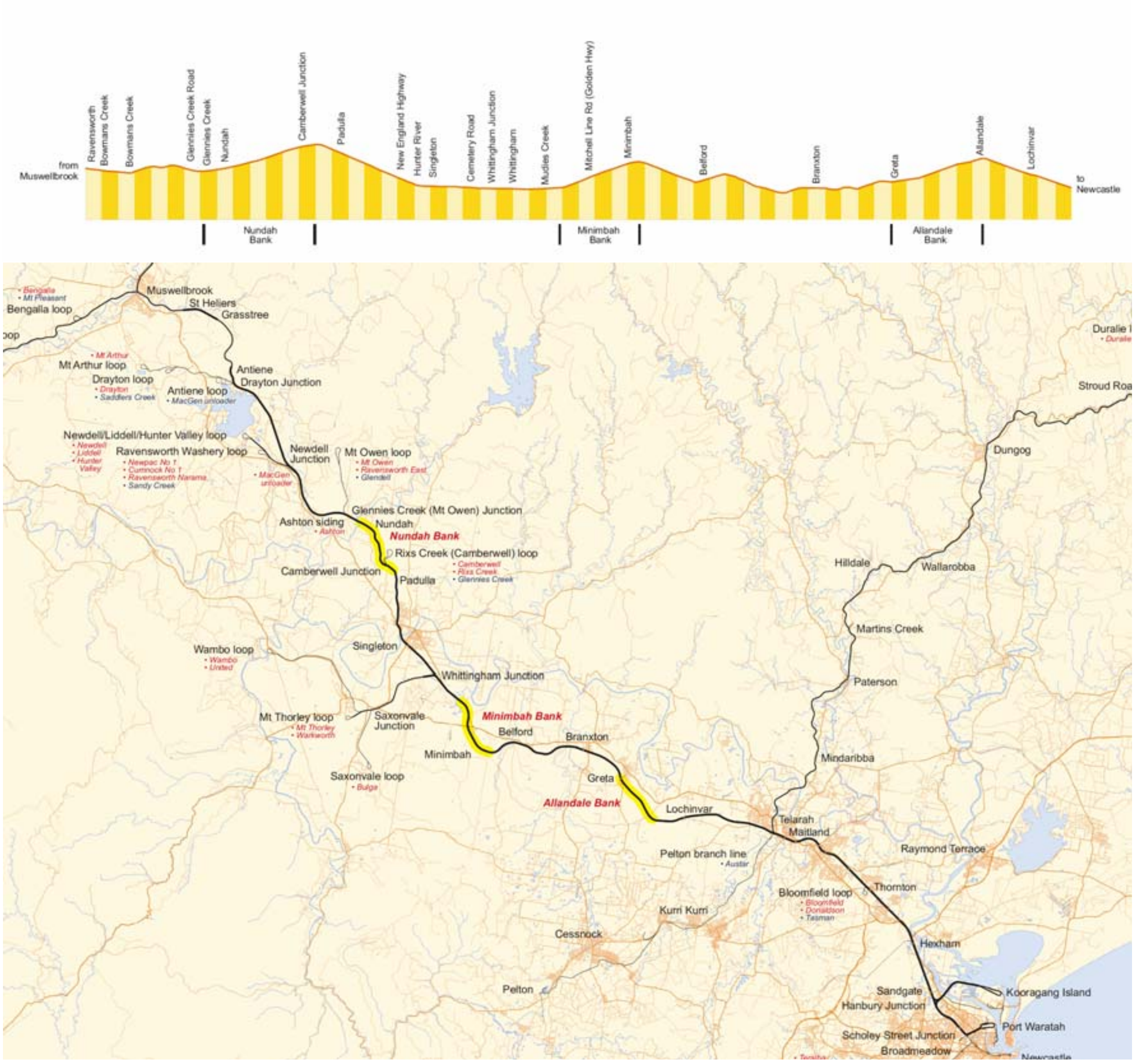


*Figure 11 - The Nundah, Minimbah and Allandale Banks.*

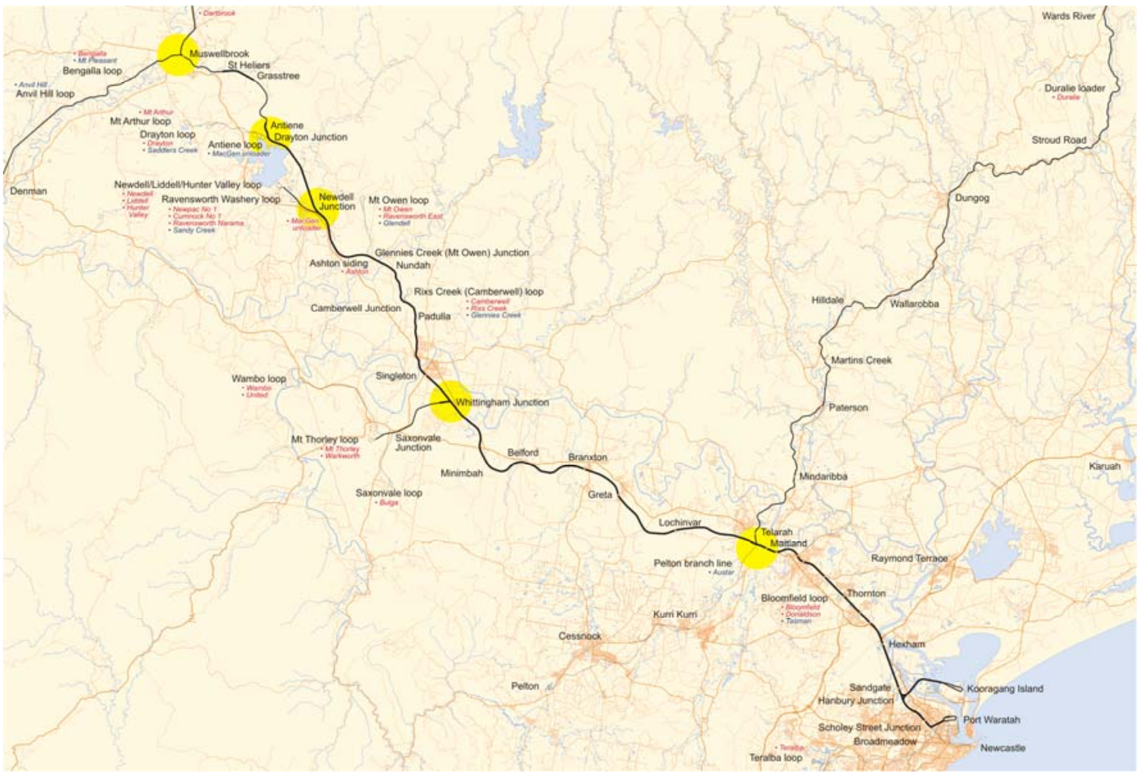


*Figure 12 - Maitland, Whittingham, Newdell, Drayton and Muswellbrook Junctions*

With the growth of coal volume from both the Ulan and Gunnedah basin lines, the junction of these lines at Muswellbrook will come under increasing pressure.

Ravensworth loop, which was previously integrated into the Newdell loop, was separated in 2013 and given a new junction with high-speed turnout at approximately the 259.9 km point, along with a holding loop.

A key issue for efficiency at the terminal is the need for the dump stations to receive a continuous flow of trains. When the flow of trains at the dump station is interrupted, this creates a direct unrecoverable loss of coal chain capacity, except to the extent that maintenance downtime of the terminal infrastructure can be aligned to the rail side disruption. A critical consideration for the coal chain as a whole is therefore maximising the continuity of trains rather than simply total track capacity.

The following sections discuss in turn each of the major projects arising from the need to address these issues:

## Muswellbrook Junction

In the medium term, prospective volume growth from both the Ulan and Gunnedah basin lines would mean that the capacity of the at-grade junction at Muswellbrook will come under pressure.

However, the level of congestion at Muswellbrook, while material under contracted volumes, is tolerable, and the work done to date on potential infrastructure solutions has identified significant construction and environmental challenges that would suggest that any solution is only worth pursuing once volume growth, and hence congestion, approach a level where a solution is unavoidable.

The best solution identified is a Third Track heading east from Muswellbrook, which offers the best operational outcome and value for money given the constraints.

ARTC has assessed the threshold where a solution is required at approximately 45 paths/day. This threshold is not reached until after 2024 under the prospective volume scenario.

As discussed in Chapter 3, HVCCC undertook modelling during 2013 that suggested there may be a need for a holding track at Muswellbrook assuming that trains arrive at Muswellbrook off their designated path but there are only a limited number of fixed paths on the Ulan and Gunnedah lines. With ARTC now looking at possible ways to reduce variability and progress being made on dynamic pathing, there is no apparent need for this project.

## Farley—Maitland and Maitland Junction

The primary issues at Maitland relate to the maintenance of the old slow-speed turnouts and accordingly the primary focus in the past has been the most effective way to replace these turnouts with low-maintenance high-speed units. Leveraging this renewal to increase capacity by improving train speeds and reducing crossing conflicts has been a secondary consideration, but the 2012 Strategy noted that under the prospective volumes it may be desirable to review the junction arrangement with the primary objective being to ensure that conflicts between Up coal services and Down non-coal services, which conflict to the west of Maitland, can be efficiently managed.

A concept assessment of the Farley—Maitland section has been undertaken and has identified that the most effective option would provide for a bi-directional third track between Farley and Maitland, which would allow both Up and Down non-coal trains to stand waiting for a path without blocking the flow of coal trains. Analysis to date has found that the path benefits of the reconfiguration are relatively modest and that the main benefit would be experienced in live-run. However, at this stage there has been no quantification of this benefit. This project is not considered to be required until volume exceeds at lest 208 mtpa with the appropriate timing in part dependent on the train speeds achieved by the maintenance upgrade of Maitland.

## Passenger Trains to Singleton

There has been recent lobbying by members of the community to provide an additional two train services per day to Singleton. There is a perception that ARTC limits passenger train paths on the Hunter line, and is preventing additional passenger services by not allowing space on the track.

ARTC's assessment is that there is sufficient capacity on the mainline to accommodate two additional train services to Singleton. The capacity issue relates to terminating a train at Singleton. An existing issue exists at Singleton due to the Down passenger train needing to cross to the Up line to use the single platform. Additional trains terminating at Singleton would further exacerbate this problem.

Potential infrastructure solutions include:

- Upgrading the Singleton platform to avoid the down train stopping on the up track at a preliminary cost estimate of $25 million
- Additional track to avoid the passenger train sitting stationary on the main at a preliminary cost estimate of $21 million, and
- Alternatively the passenger service could run all the way to Scone. As this consumes capacity in the Muswellbrook – Scone section, this would trigger projects earlier than currently assumed for prospective volumes.

ARTC will continue to work with the NSW Government to determine the infrastructure required to accommodate any additional passenger train services to Singleton. The capital cost for this infrastructure can be used as part of any business case prepared by the NSW Government.

# 6

# Terminals, Congestion and System Issues

## Context

The Hunter Valley coal industry is serviced by three coal loader terminals, PWCS Carrington (CCT), PWCS Kooragang Island (KCT) and NCIG Kooragang Island. While the coal loaders are owned by Port Waratah Coal Services (PWCS) and the Newcastle Coal Infrastructure Group (NCIG), much of the track in and around the terminals is leased by ARTC and all train operations are controlled by ARTC.

The Carrington loader is the oldest of the facilities and is located in the highly developed and constrained Port Waratah yard area, with extensive rail facilities servicing a variety of activities. This includes steel products for OneSteel, grain for the GrainCorp loader, ore for the Pasminco loader, general freight through Toll / R & H Transport and other minor customers. There are also locomotive and wagon servicing and maintenance facilities.

The Carrington coal facilities include 3 arrival roads and 2 unloaders. While there are nominally 10 departure roads, these range in length from 414 metres to 863 metres, all of which are shorter than all coal trains, other than the short trains used for Pelton services. Only two of the 3 arrival roads can accommodate 80 wagon and longer trains.

The Carrington facility has an environmental approval limit of 25 mtpa. There is some opportunity to expand this slightly, though there may be environmental challenges in doing so.

PWCS Kooragang Island is better configured for modern rail operations. It now has 9 departure roads for its four dump stations and fully signalled arrival roads.

Provisioning and inspection activity, which had historically contributed to congestion, has been moved out of the departure roads. Locomotives continue to shuttle between Kooragang and Port Waratah but this has a relatively minor impact on capacity.

With the opening of KCT dump station four (DS4), PWCS nameplate capacity as a whole is 143 mtpa.

NCIG has also completed all works required to achieve nameplate capacity of 66 mtpa, including the flyover of the Kooragang branch at NCIG Junction, which has eliminated conflicts between loaded NCIG trains and empty trains from KCT. NCIG has three arrival roads for its two dump stations.

## Congestion

ARTC's objective in its infrastructure strategies has been to provide track capacity ahead of demand. ARTC is in a good position to assess the track capacity required and to identify optimised solutions and timing to provide that capacity.

There are, however, a number of operational challenges that potentially constrain capacity and for which the provision of additional track is one potential mitigation. 'Congestion' became a common term used to describe these challenges, which include re-sequencing, provisioning, crew changes, brake tests, roll-by inspections, empty train holding and the management in general of peaks and troughs caused by the demand profile. These challenges are whole-of-chain issues that ARTC has not been in a good position to model and for which it has looked to the HVCCC to take the lead through its analysis of system capacity.

In seeking to mitigate congestion it is important to understand that these 'congestion' issues are system issues for which additional rail infrastructure is one option to enable the full capacity of the rail network to be realised. Equally, delivering improvements to network operations to ensure that utilisation of the network is optimised offers other potential solutions. Infrastructure solutions can offer a high degree of confidence in the outcome but usually require a much longer lead time and a higher cost than operational solutions.

For 2015 the HVCCC has confirmed an inbound throughput that exceeds contracted rail volumes and has identified that no further projects are required to achieve total contracted rail volumes.

The major outstanding congestion issue is the means by which variability in demand is managed. Infrastructure solutions to this challenge were the primary reason for the proposed relief hubs and train park-up projects.

ARTC will continue to work with the HVCCC on the volatility and variability of the coal supply chain and the implications for the rail network and the requirement for future operational capability. To the extent variability on the rail network can be reduced it may mitigate the requirement for relief hubs and train park-up.

It should be noted though that even if it is identified that the projects can be avoided there may still be a case for some projects to proceed as a cost efficiency initiative. This may in particular be the case where there are low demand days. While on such days it may be possible to manage all trains in the system by effectively reducing their velocity, it may be more cost effective to take trains out of the system to save on crew costs. This would be a matter for the RCG to consider once analysis is complete.

## Hexham to Terminals Train Performance

The Hexham Holding Roads were commissioned in November 2014. The key objectives of the Hexham Holding Roads were to manage the sequencing of trains and, in conjunction with the Arrival Roads Signalling Optimisation project and better operational management, to reduce both the run time and the level of variability in the run time between Hexham and the terminals.

Figure 13 shows the ‘actual run times’ for both the mean and median expressed in minutes from Sandgate to KCL from 2012 to 2015. In conjunction with the arrival roads signalling works the timing point for this data was shifted closer to KCT in early 2015 increasing the section time by two to three minutes. In order to compare the actual run times year on year as shown in figure 14, the mean and median figures for 2015 have been reduced by 2 minutes.

In 2012 it is apparent that with a median time of 35.7 minutes and a mean time of 21.0 minutes that there is significant variability in this section of track. It can be clearly seen over the next 4 years, including 2015 year to date, not only does the median time reduce by over 21 minutes from 35.7 minutes to 14.5 minutes but that the mean and median times converge. This demonstrates that not only has the section time decreased but importantly the variability has reduced significantly over this time period to almost negligible levels.

HVCCC has determined that in order to achieve 185 mtpa system capacity section run time variability of less than 100% is required. Actual performance is easily exceeding this level of variability while expected section run time for planning purposes has been reduced from 37 minutes to 27 minutes. HVCCC has indicated that capacity of at least the current maximum contracted volume of 193.5 mtpa is achievable subject to adequate management of variability.

Conflicts at the NCIG Junction are the last remaining major source of delay on this section and it is expected that with completion of the NCIG flyover there will be a further small improvement both in the average section time and the level of variability.

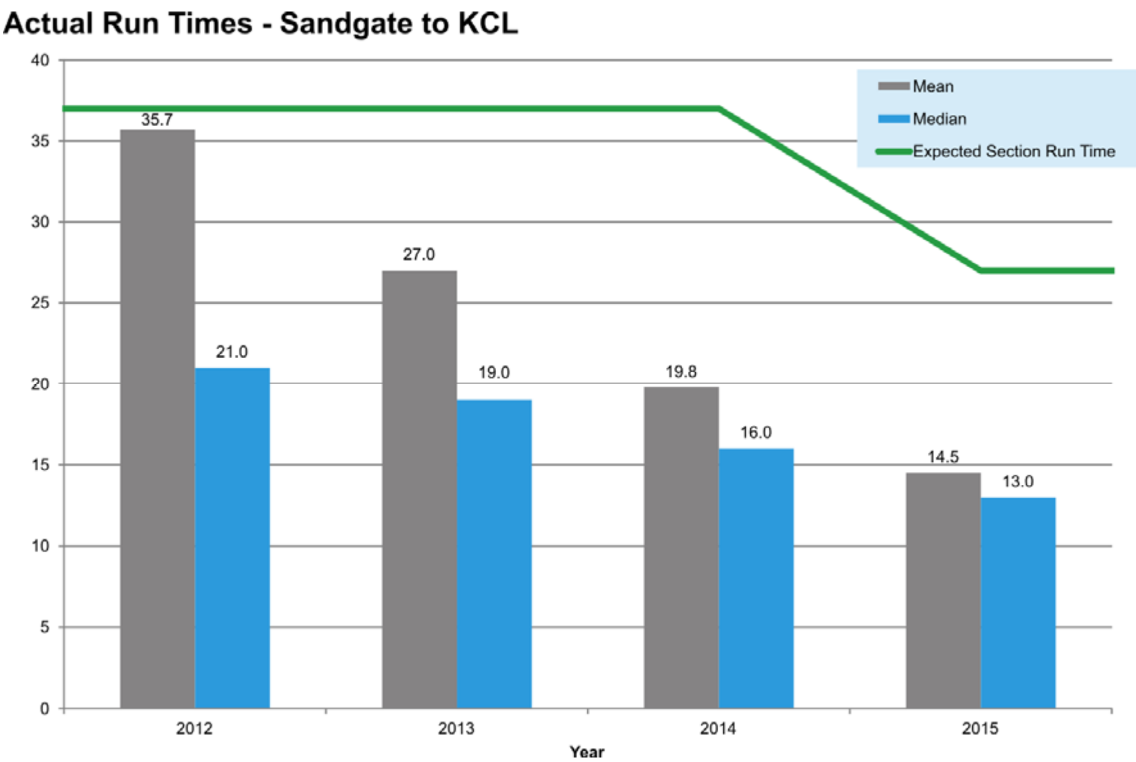


*Figure 13 - Actual Run Times—Sandgate to KCL*

## Kooragang Arrival Roads

In February 2015 the RCG approved construction of the Kooragang Arrival Road Stage 2 project on the basis of advice from the HVCCC that it provided broader system benefits noting that it was not strictly required for capacity.

Stage 1, which was completed in 2012, was a minor reconfiguration that allowed for two tracks to split 650 metres sooner, which together with management of train departures from Hexham ensures that trains should never need to stop in advance of being fully clear in an arrival road. Stage 2 extends this arrangement by a further 1,000 m, which allows two trains to be held in parallel in advance of the arrival roads. Stage 2 is currently due for completion by Q2 2016.

Stage 3 was proposed by HVCCC to provide for all four tracks to effectively be extended to allow 2 trains to be held clear in each arrival road. In the 2014 Strategy it was noted that the HVCCC had advised that Stage 3 was no longer required to accommodate volumes up to the current capacity of the Kooragang terminal. This project has now been removed from the program.

## Down Relief Hubs

An issue that was first highlighted in the 2012 Strategy is empty train management. This issue is essentially one of what to do with empty trains while they await departure for their next outbound trip. This wait can either be a matter of minutes, or at the extreme, a period of days, particularly when there is a major close-down.

On a day-to-day basis, the key issue is that there is regularly a mismatch between the time a train becomes

available for its next trip and the time that that train can depart given path constraints (particularly on the single track sections), load point constraints, coal availability constraints and limitations on which load points a train type / operator can service.

To ensure that the departure roads at KCT and NCIG are kept clear to allow trains to dump, the HVCCC reports against a target that all trains should depart within one hour. Essentially the issue that arises is where these trains go to if there is no load point ready to receive them. HVCCC identified a proposal for a number of down relief hubs to address this issue.

Drayton Down Relief Hub, which was completed in Q1 2015, is a single holding track adjacent to the mainline immediately before the Drayton Branch and connecting directly to both the mainline and the Drayton branch.

Whittingham Down Relief Hub is a proposed set of up to two holding tracks adjacent to the Whittingham branch between the junction and the Golden Highway overbridge. The Whittingham facility has had concept design completed. ARTC has also completed a minor signalling reconfiguration on the balloon loops joining the Whittingham branch which has increased the flexibility of operations in this area and by extension the capacity.

The signalling reconfiguration together with the initiatives discussed elsewhere to reduce system variability levels may obviate the need for the relief hub. As such the project is currently on hold and will be reviewed once the HVCCC completes its work on system variability.

## Train Park-up

The HVCCC previously identified the need for additional train park-up options as among the measures to help address congestion. These options would be for the medium term (3 hours to 3 days) stowing of trains (that is, locations where a train can be left uncrewed), particularly on low demand days when it is preferable to remove trains from the system.

ARTC has identified locations to construct up to 15 train park-up tracks ranging in cost per track from $8.6 m to $40 m.

Recognising the significant potential capital investment, it is important that all options for operational management of these excess trains using current and planned infrastructure are explored with a view to finding pragmatic solutions that minimise total cost to the coal chain. As discussed under ‘congestion’, HVCCC is working on options to reduce system variability. This may negate the need for train park-up for system capacity reasons, though analysis may also identify that it provides a lower total system cost if some trains can be removed from the system.

These projects are currently on hold pending the completion of the HVCCC analysis.

## Proposed Projects

The projects proposed between Muswellbrook and Hexham as discussed in Chapter 5, and those to mitigate congestion as discussed in this Chapter, are shown in Figure 14.

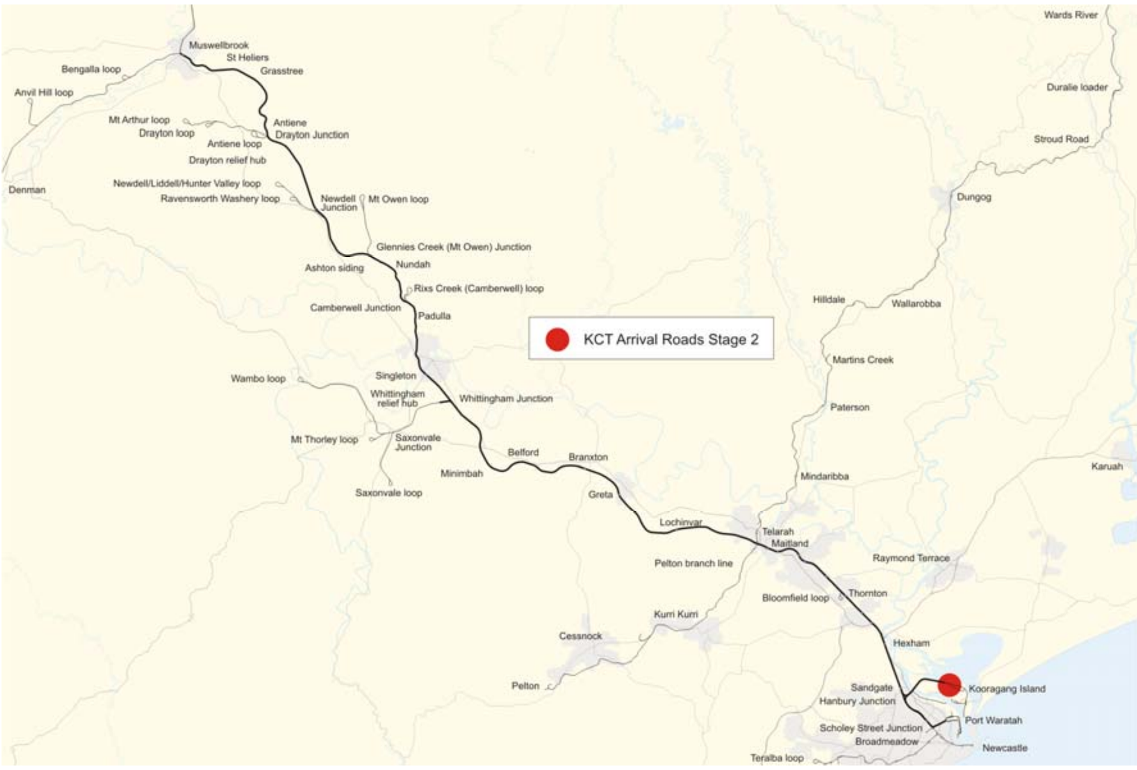


*Figure 14 - Muswellbrook—Terminal Projects*

# 7

# Maintenance strategy

## Context

The Corridor Capacity Strategy has not previously included commentary in regard to ARTC's Hunter Valley maintenance strategy. However, consistent with a changing emphasis from delivering capacity to operating that capacity at least cost to the industry, this Strategy for the first time includes as discussion of the ARTC forward maintenance program.

The development of the Hunter Valley Corridor Maintenance program is an iterative process using various inputs and analysis methodologies to arrive at a program of works that is considered to deliver ARTC's customer requirements in the most efficient manner.

Figure 15 outlines the basics of the process with respect to the Hunter Valley coal customers.

## Works Summary

The yearly program of works is divided into three main areas of expenditure; Routine Corrective and Reactive Maintenance (RCRM), Major Periodic Maintenance (MPM) and Corridor Capital (CAP). RCRM and MPM programs are considered an operating expense and as such these programs are not subject to the Regulated Asset Base (RAB) treatment, whereas the CAP program of works is subject to this treatment under Section 9 of the Hunter Valley Access Undertaking (HVAU).

The forward ten-year program of works is presented in the following sections. The graphs highlight an upper and lower confidence limit in terms of the volume of expenditure. This limit diverges over time as the level of confidence in a) the requirement for the works and b) the future budget associated with these works, changes. The graphs include the total Net Tonne Kilometres (NTK's) and the total coal volumes for the Hunter Valley network. The trend in maintenance expenditure can be compared to the trend of both historic and future NTK's and coal tonnes.

To provide further context to this forward maintenance spending profile, the previous four years of maintenance expenditure is also shown.

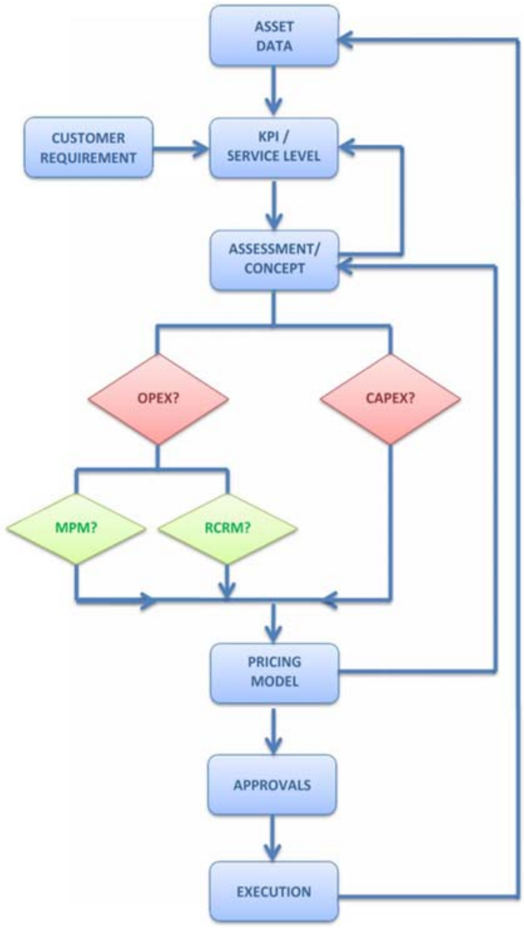


*Figure 15 - Maintenance Development Process*

## Corridor Capital

The current forecast of the ten-year corridor capital program for all zones is shown in Figure 16.

This includes the 30 tonne axle load suite of works being delivered in Zone 3 which concludes in the 2016/17 year. At the conclusion of this program the corridor capital spending profile shows a modest sustaining program

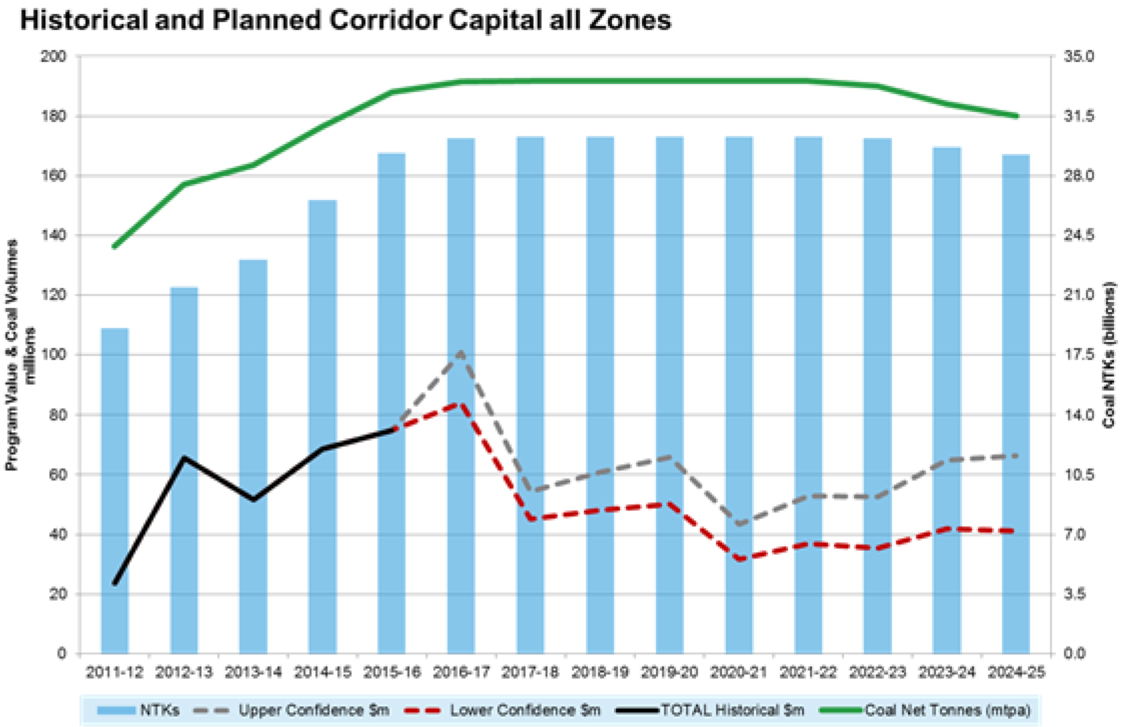


*Figure 16 - Historical and Planned Corridor Capital*

across all zones with a few of the departures to this trend being significant asset replacements (e.g. bridges).

The significant activities under the corridor capital program of works and a brief description of the development and asset risk are provided below. These activities typically represent over 50% of the annual corridor capital spend in any given year.

## Rerailing

The reailing program is developed using a model which uses the historical observed rail wear rates and the forecast tonnage volume in each section. This model then estimates the quantity of rerailing required in the network over the next ten years.

Rerailing is essential to the rail operation for two distinct reasons; a) to ensure that the rail has adequate structural capacity to carry the specified axle loads and b) to reduce the risk of rail breaks as defects in the rail propagate over time.

## Track Strengthening

The track strengthening program generally consists of track reconditioning (removal of all ballast and subgrade) greater than 200m in length. The identification and development of the scope utilises various sources of information including; temporary speed restriction (TSR) performance, tamping effort required, geotechnical investigations and local teams' knowledge.

The vast majority of the Hunter Valley rail network is built on formation which was constructed during the early 1900's. The running of 30 tonne axle load rolling stock would not have been envisaged by design work done during this period. Due to the current design of track some sections do progressively fail and the replacement is performed with a formation design using contemporary modelling.

## Turnout Renewal

The turnout renewal program is derived through a balance of; turnout performance, age, location risk and current maintenance effort. The scope of works under this activity generally provides an upgrading of the existing turnout and underlying formation with any design optimisation performed in the investigation phase of the project.

Turnouts constructed with timber bearers and older style steel work are considered an operational risk to the coal network as this style of turnout is prone to failure and a high maintenance effort. The majority of turnout replacements performed in the Hunter Valley are replacing turnouts of this design with turnouts designed to withstand the demands required of the asset in moving the volumes forecast.

## Major Periodic Maintenance

The current forecast of the ten-year MPM program for all zones is shown in Figure 17.

This figure indicates a strong correlation to tonnage, which is expected due to the majority of the MPM program being cyclic in nature, and tonnage driven.

The significant activities under the MPM program of works and a brief description of the development and asset risk are provided below. These activities typically represent over 50% of the annual MPM spend in any given year.

## Ballast Cleaning

The ballast underneath the sleepers must be free draining for the track asset to function properly. Over time the free draining nature of ballast is adversely affected through the degradation of the ballast and the development of fines throughout the track profile. This degradation is due to many factors including; tonnage, amount of tamping effort, coal debris and formation failures.

Ballast cleaning is performed to remove these fines that build up over time. This process includes screening of the in-situ ballast with ballast that is of correct size returned to track, with fines removed to spoil. As ballast degradation is highly correlated to tonnage; the ballast cleaning program is cyclic in nature and sensitive to future coal tonnages (noting that in the early years there is a legacy that ARTC is attempting to rectify).

## Resurfacing (Tamping)

Resurfacing (or tamping) is a process where the track geometry is reinstated to a standard at which trains can move through a track section at full design track speed. Over time track geometry is affected mainly due to tonnage across the line, weather conditions and the underlying track formation.

The resurfacing programme is a cyclic program based on tonnage and track performance (TSR, track defects etc).

## Rail Grinding

The rail grinding programme is a cyclic program based on tonnage, track curvature and rail performance (internal/external defects). The process of rail grinding involves grinding the surface of the rail to reinstate the rail shape to a profile which best suits the rollingstock wheel profiles. If there is a mismatch in these profiles, excess stresses are transferred into the rail section, creating defects which may lead to TSRs or broken rails.

It is an essential part of any rail operation to maintain the rails through rail grinding. This program of works is correlated to tonnage and track curvature (with the shaper curves getting ground more often than straight track).

## Drainage and Mudhole Rectification

Drainage and Mudhole rectification is considered to be an essential part of the maintenance program. This scope of works is variable from site to site however the maintenance of an effective drainage system is critical to ensuring that track geometry faults and the development of TSRs are kept to an acceptable level.

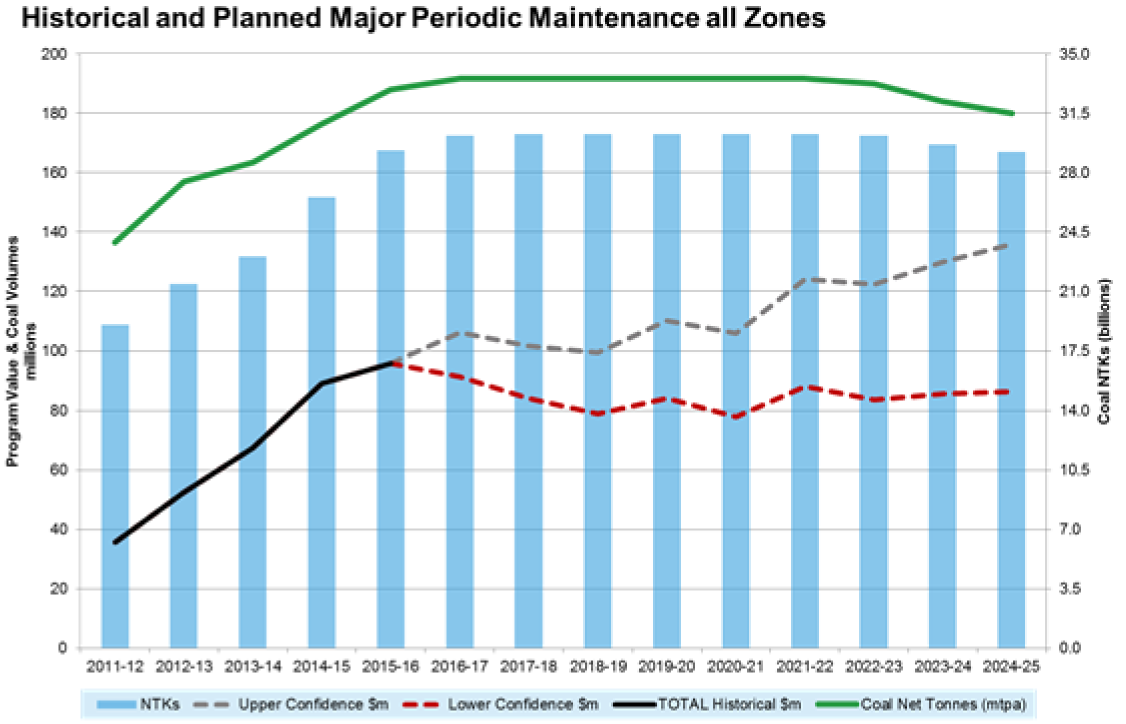


*Figure 17 - Historical and Planned Major Periodic Maintenance*

# 8

# Overview of the recommended projects

A summary of the recommended projects for contracted volumes comparing previous and new proposed delivery timeframes, together with estimated costs at a P75[4] level, is shown in Table 5.

Table 6 shows the same detail as Table 5, for the scope of work required for prospective volumes. In Table 6, costs are shown as both un-escalated and escalated based on the 'proposed by' delivery dates.

As noted in Chapter 6, technology projects such as ATMS, Network Control Optimisation, Dynamic train pathing, a new train planning and live-run management system, and options to reduce system variability, have allowed the following projects previously identified as required for contracted or prospective volumes to be put on hold pending further work on non-infrastructure solutions:

- Whittingham Relief Hub
- Kooragang Arrival Roads Stage 3
- Train-Re-sequencing; and
- Muswellbrook relief track

4 A P75 value indicates the project has been assessed as having a 75% probability of being delivered for the identified cost, or less.

| Contracted Volume | 2014 Strategy – Proposed by | 2015 Strategy – Required by | 2015 Strategy – Proposed by | Change 2014 to 2015 | Estimated Cost ($m, escalated P75) |
|---|---|---|---|---|---|
| **Port—Muswellbrook** | | | | | |
| Nil | | | | | |
| **Ulan Line** | | | | | |
| Nil | | | | | |
| **Gunnedah Line** | | | | | |
| Nil | | | | | |
| **Congestion Projects** | | | | | |
| Kooragang Arrival Roads Stage 2 | Q2 2016 | see note 1 | Q2 2016 | - 3 months | $36 |
| Kooragang Island CBI | Q2 2016 | | Integrated into KCT Stage 2 | | |
| Hexham—Kooragang Re-signalling | Q2 2016 | | Integrated into KCT Stage 2 | | |
| **Productivity Projects** | | | | | |
| Dynamic pathing | Q1 2017 | Q4 2016 | Q4 2016 | | <$1 |
| ARTC Network Control Optimisation (ANCO) | Q1 2019 | n/a | Q4 2016 | see note 2 | $30 |
| ATMS | Q1 2020 | n/a | Q1 2020 | see note 3 | $260 |

*Table 5 - Recommended Projects, Delivery Schedule and Costs for Contracted Volumes*

General Notes: All the above projects (including scope, timing, and funding arrangements) are subject to consultation with and endorsement by the industry.

Dollar estimates are based on current known: Scope; survey and geotechnical knowledge; legislation and tax regimes. Project dollars are order of magnitude estimates only and do not represent concluded project dollars.

Note 1—Whilst KCT Stage 2 is not strictly required for ARTC contracted capacity, the RCG has endorsed the project proceeding on the basis of advice from HVCCC that it provides broader system benefits.

Note 2 - ANCO will be a phased roll out starting in Q4 2016.

Note 3—The cost estimate for ATMS includes the roll out for the whole of the Hunter Valley. There are options to implement the project partially and incrementally over a longer period of time reducing this estimate significantly.

| Contracted plus Prospective Volume | 2014 Strategy – Required by | 2015 Strategy - Required by | Estimated Cost ($m) un-escalated 2015, order-of-magnitude | Estimated Cost ($m) escalated, order-of-magnitude |
|---|---|---|---|---|
| **Port—Maitland** | | | | |
| Nil | | | | |
| **Maitland - Muswellbrook** | | | | |
| Nil | | | | |
| **Ulan Line** | | | | |
| Mt Pleasant | Q1 2021 | Q1 2022 | $23 | $28 |
| Widden Creek | Q1 2021 | Q1 2023 | $39 | $49 |
| **Gunnedah Basin Line** | | | | |
| Aberdeen | Q1 2017 | Q3 2017 | $16 | $17 |
| Togar North Loop | Q1 2016 | Q2 2016 | $20 | $21 |
| Wingen loop | Q1 2016 | Q3 2016 | $19 | $20 |
| Blandford loop | Q1 2017 | Q3 2017 | $32 | $34 |
| Kankool—Ardglen | Q3 2017 | Q3 2017 | $78 | $83 |
| Bells Gate south extension | Q1 2018 | Q3 2017 | $40 | $44 |
| 414 km loop (Werris Creek North) | Q1 2021 | Q1 2022 | $26 | $32 |
| South Gunnedah loop | Q1 2016 | Q3 2016 | $22 | $23 |
| **Congestion Projects** | | | | |
| Train Parkup | See Note 1 | TBD | | |

*Table 6 - Recommended Projects, Delivery Schedule and Costs for Prospective Volumes*

General Notes:

All the above projects (including scope, timing, and funding arrangements) are subject to consultation with and endorsement by the industry.

Dollar estimates are based on current known: Scope; Survey and geotechnical knowledge; legislation and tax regimes. Project dollars are order of magnitude estimates only and do not represent concluded project dollars.

Note 1: ARTC continue to work with HVCCC to identify the requirements for this project

# 9

# Network capacity with revised project scope and timing

Demand and capacity by sector, based on the project timings recommended in this Strategy, and using the calculation methodology set out in Chapter 1, is shown in figures 18, 19 and 20. These charts show both contracted and prospective volumes.

Saleable coal train capacity and coal tonnage capacity by sector for the contracted volume scenario is shown in tables 8 and 9 respectively. Tables 10 and 11 show the equivalent information for prospective volumes, for train numbers and tonnage respectively.

The HVAU also requires that the Capacity Strategy provide details of net capacity - that is, total capacity less contracted coal and non-coal volumes. This is shown in general in figures 18, 19 and 20. It is not possible to provide both total capacity and net capacity by line section as this would allow volume by load point to be back solved.

To give an indication of net capacity table 7 provides net capacity for 3 key line sections for contracted volumes and is intended to complement figures 18, 19 and 20.

| Net Capacity (paths) | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|
| Pricing Zone 3 (at Werris Creek) | 2.4 | 1.2 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| Pricing Zone 2 (at Bylong) | 4.6 | 4.6 | 4.6 | 4.6 | 4.6 | 4.6 | 4.6 | 4.6 | 4.6 | 4.6 |
| Pricing Zone 1 (at Whittingham) | 48.4 | 45.0 | 44.1 | 44.0 | 44.0 | 44.0 | 44.0 | 44.0 | 44.3 | 46.6 |

*Table 7 - Surplus coal path availability (total capacity less contracted volume) for indicative line sectors for each zone.*

| | 2015 | | | | 2016 | | | | 2017 | | | | 2018 | | | | 2019 | | | | 2020 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Narrabri - Boggabri | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 |
| Boggabri - Gunnedah | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 |
| Gunnedah - Watermark Jct | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 |
| Watermark Jct - Caroona Jct | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 |
| Caroona Jct - Werris Creek | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 |
| Werris Creek - Scone | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 |
| Scone - Muswellbrook | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 |
| Cobbora - Ulan | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 |
| Ulan - Moolarben | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 |
| Moolarben - Wilpinjong | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 |
| Wilpinjong - Bylong | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| Bylong - Ferndale | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 |
| Ferndale—Spur Hill | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 |
| Spur Hill - Mangoola | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 |
| Mangoola - Mt Pleasant | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Mt Pleasant - Bengalla | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 |
| Bengalla - Muswellbrook | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 |
| Muswellbrook - Antiene | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 |
| Antiene - Drayton | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| Drayton - Newdell | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 |
| Newdell - Mt Owen | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| Mt Owen - Camberwell | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 |
| Camberwell - Whittingham | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 |
| Whittingham - Maitland | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| Maitland - Bloomfield | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 |
| Bloomfield - Sandgate | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 |

*Table 8 - Saleable capacity in coal train numbers (round-trips per day) for contracted volume*

| | 2015 | | | | 2016 | | | | 2017 | | | | 2018 | | | | 2019 | | | | 2020 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Narrabri - Boggabri | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 |
| Boggabri - Gunnedah | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 |
| Gunnedah - Watermark Jct | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 |
| Watermark Jct - Caroona Jct | 46.1 | 46.1 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 |
| Caroona Jct - Werris Creek | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 |
| Werris Creek - Scone | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 |
| Scone - Muswellbrook | 29.1 | 29.1 | 29 | 29 | 29 | 29.1 | 29.1 | 29.1 | 29.1 | 29.1 | 29.1 | 29.1 | 29.1 | 29.1 | 29.1 | 29.1 | 29.1 | 29.1 | 29.1 | 29.1 | 29.1 | 29.1 | 29.1 | 29.1 |
| Cobbora - Ulan | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Ulan - Moolarben | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 |
| Moolarben - Wilpinjong | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 |
| Wilpinjong - Bylong | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 |
| Bylong - Ferndale | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 |
| Ferndale—Spur Hill | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 |
| Spur Hill - Mangoola | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 |
| Mangoola - Mt Pleasant | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 |
| Mt Pleasant - Bengalla | 66.7 | 66.7 | 66.7 | 66.7 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 |
| Bengalla - Muswellbrook | 198 | 198 | 198 | 198 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 |
| Muswellbrook - Antiene | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 |
| Antiene - Drayton | 287 | 287 | 286 | 286 | 287 | 287 | 287 | 287 | 287 | 287 | 287 | 287 | 287 | 287 | 287 | 287 | 287 | 287 | 287 | 287 | 287 | 287 | 287 | 287 |
| Drayton - Newdell | 258 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 257 |
| Newdell - Mt Owen | 362 | 361 | 361 | 361 | 361 | 361 | 361 | 361 | 361 | 361 | 361 | 361 | 361 | 361 | 361 | 361 | 361 | 361 | 361 | 361 | 361 | 361 | 361 | 361 |
| Mt Owen - Camberwell | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 |
| Camberwell - Whittingham | 279 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 |
| Whittingham - Maitland | 294 | 294 | 293 | 293 | 294 | 294 | 294 | 294 | 294 | 294 | 293 | 293 | 293 | 293 | 293 | 293 | 293 | 293 | 293 | 293 | 293 | 293 | 293 | 293 |
| Maitland - Bloomfield | 461 | 461 | 460 | 460 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 |
| Bloomfield - Sandgate | 461 | 461 | 460 | 460 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 | 461 |

*Table 9 - Saleable capacity in tonnes for contracted volume*

| | 2015 | | | | 2016 | | | | 2017 | | | | 2018 | | | | 2019 | | | | 2020 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Narrabri - Boggabri | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 | 5.8 |
| Boggabri - Gunnedah | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 | 9.6 |
| Gunnedah - Watermark Jct | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 9.8 | 17.5 | 17.5 | 17.5 | 17.5 | 17.5 | 17.5 | 17.5 | 17.5 | 17.5 | 17.5 | 17.5 | 17.5 | 17.5 | 17.5 | 17.5 | 17.5 | 17.5 | 17.5 |
| Watermark Jct - Caroona Jct | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 | 16.5 |
| Caroona Jct - Werris Creek | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 |
| Werris Creek - Scone | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 10.7 | 12.3 | 12.3 | 12.3 | 12.3 | 17.6 | 17.6 | 17.6 | 17.6 | 17.6 | 17.6 | 17.6 | 17.6 | 17.6 | 17.6 | 17.6 | 17.6 | 17.6 | 17.6 |
| Scone - Muswellbrook | 10.4 | 10.4 | 10.4 | 10.4 | 10.4 | 12 | 12 | 12 | 12 | 12 | 23.7 | 23.7 | 23.7 | 23.7 | 23.7 | 23.7 | 23.7 | 23.7 | 23.7 | 23.7 | 23.7 | 23.7 | 23.7 | 23.7 |
| Cobbora - Ulan | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 | 4.7 |
| Ulan - Moolarben | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 |
| Moolarben - Wilpinjong | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 | 19.6 |
| Wilpinjong - Bylong | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| Bylong - Ferndale | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 | 15.1 |
| Ferndale—Spur Hill | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 |
| Spur Hill - Mangoola | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 | 22.7 |
| Mangoola - Mt Pleasant | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Mt Pleasant - Bengalla | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 |
| Bengalla - Muswellbrook | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 | 63.4 |
| Muswellbrook - Antiene | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 | 49.1 |
| Antiene - Drayton | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 |
| Drayton - Newdell | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 |
| Newdell - Mt Owen | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 | 118 |
| Mt Owen - Camberwell | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 |
| Camberwell - Whittingham | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 | 90.5 |
| Whittingham - Maitland | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 | 95.1 |
| Maitland - Bloomfield | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 |
| Bloomfield - Sandgate | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 | 153 |

*Table 10 - Saleable capacity in coal train numbers (round-trips per day) for prospective volume*

| | 2015 | | | | 2016 | | | | 2017 | | | | 2018 | | | | 2019 | | | | 2020 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Narrabri - Boggabri | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 | 16.4 |
| Boggabri - Gunnedah | 26.6 | 26.6 | 26.6 | 26.6 | 26.6 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 | 26.7 |
| Gunnedah - Watermark Jct | 27.4 | 27.4 | 27.4 | 27.4 | 27.4 | 27.5 | 48.9 | 48.9 | 48.9 | 48.9 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 |
| Watermark Jct - Caroona Jct | 46.1 | 46.1 | 46 | 46 | 46.1 | 46.1 | 46.1 | 46.1 | 46.2 | 46.2 | 46.3 | 46.3 | 46.3 | 46.3 | 46.3 | 46.3 | 46.3 | 46.3 | 46.3 | 46.3 | 46.3 | 46.3 | 46.3 | 46.3 |
| Caroona Jct - Werris Creek | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.4 | 40.5 | 40.5 | 40.5 | 40.5 | 40.6 | 40.6 | 40.6 | 40.6 | 40.6 | 40.6 | 40.6 | 40.6 | 40.7 | 40.7 | 40.7 | 40.7 | 40.7 | 40.7 |
| Werris Creek - Scone | 29.9 | 29.9 | 29.9 | 29.9 | 29.9 | 30 | 34.4 | 34.4 | 34.4 | 34.4 | 49.4 | 49.4 | 49.4 | 49.4 | 49.4 | 49.4 | 49.4 | 49.4 | 49.5 | 49.5 | 49.5 | 49.5 | 49.5 | 49.5 |
| Scone - Muswellbrook | 29.1 | 29.1 | 29 | 29 | 29.1 | 33.5 | 33.6 | 33.6 | 33.6 | 33.6 | 66.7 | 66.7 | 66.7 | 66.7 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 | 66.8 |
| Cobbora - Ulan | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Ulan - Moolarben | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 | 62.4 |
| Moolarben - Wilpinjong | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.4 | 61.3 | 61.3 | 61.3 | 61.3 | 61.3 | 61.3 | 61.3 | 61.3 | 61.3 | 61.3 | 61.3 | 61.3 | 61.3 | 61.3 | 61.3 | 61.3 |
| Wilpinjong - Bylong | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 | 55.8 |
| Bylong - Ferndale | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 | 46.7 |
| Ferndale—Spur Hill | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.4 | 70.4 | 70.4 | 70.4 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 |
| Spur Hill - Mangoola | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.4 | 70.4 | 70.4 | 70.4 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 | 70.3 |
| Mangoola - Mt Pleasant | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.7 | 62.6 | 62.6 | 62.6 | 62.6 | 62.6 | 62.6 | 62.6 | 62.6 |
| Mt Pleasant - Bengalla | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 | 66.7 |
| Bengalla - Muswellbrook | 198 | 198 | 198 | 198 | 198 | 198 | 198 | 198 | 198 | 198 | 198 | 198 | 198 | 198 | 198 | 198 | 198 | 198 | 198 | 198 | 198 | 198 | 198 | 198 |
| Muswellbrook - Antiene | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 147 | 147 | 148 | 148 | 148 | 148 | 148 | 148 | 147 | 147 | 147 | 147 | 147 | 147 |
| Antiene - Drayton | 287 | 287 | 286 | 286 | 287 | 287 | 287 | 287 | 286 | 286 | 286 | 286 | 286 | 286 | 286 | 286 | 286 | 286 | 285 | 285 | 285 | 285 | 285 | 285 |
| Drayton - Newdell | 258 | 257 | 257 | 257 | 257 | 257 | 257 | 257 | 256 | 256 | 255 | 255 | 256 | 256 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 | 255 |
| Newdell - Mt Owen | 362 | 361 | 361 | 361 | 361 | 361 | 361 | 361 | 360 | 360 | 360 | 360 | 360 | 360 | 359 | 359 | 360 | 360 | 359 | 359 | 359 | 359 | 359 | 359 |
| Mt Owen - Camberwell | 278 | 278 | 278 | 278 | 278 | 278 | 277 | 277 | 277 | 277 | 277 | 277 | 277 | 277 | 276 | 276 | 277 | 277 | 276 | 276 | 276 | 276 | 276 | 276 |
| Camberwell - Whittingham | 279 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 277 | 277 | 277 | 277 | 277 | 277 | 277 | 277 | 277 | 277 | 277 | 277 | 277 | 277 |
| Whittingham - Maitland | 294 | 294 | 294 | 294 | 294 | 293 | 293 | 293 | 293 | 293 | 292 | 292 | 292 | 292 | 292 | 292 | 292 | 292 | 292 | 292 | 292 | 292 | 292 | 292 |
| Maitland - Bloomfield | 461 | 461 | 460 | 460 | 460 | 460 | 460 | 460 | 460 | 460 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 |
| Bloomfield - Sandgate | 461 | 461 | 460 | 460 | 461 | 460 | 460 | 460 | 460 | 460 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 | 459 |

*Table 11 - Saleable capacity in tonnes for prospective volume*

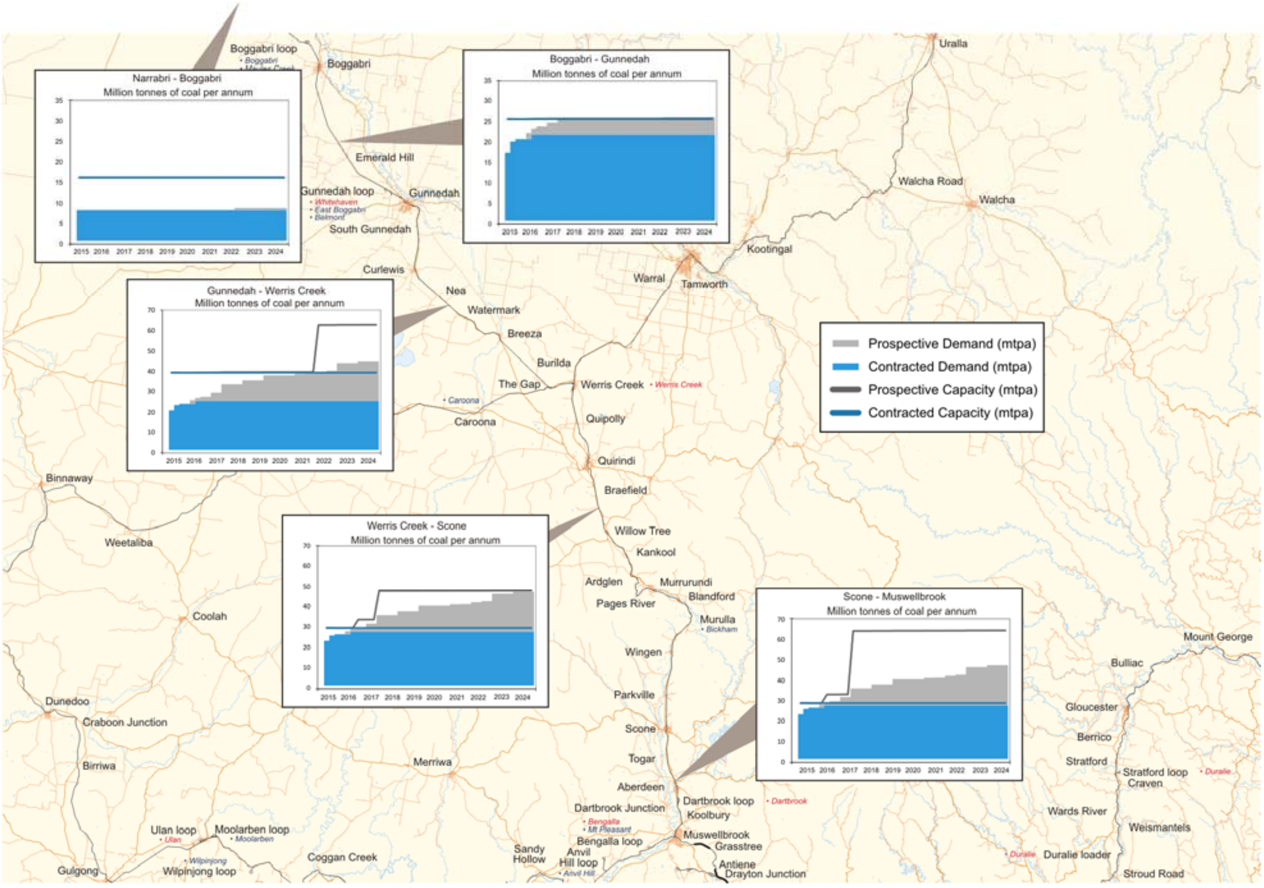


*Figure 18 - Volume and capacity on the Gunnedah basin line.*

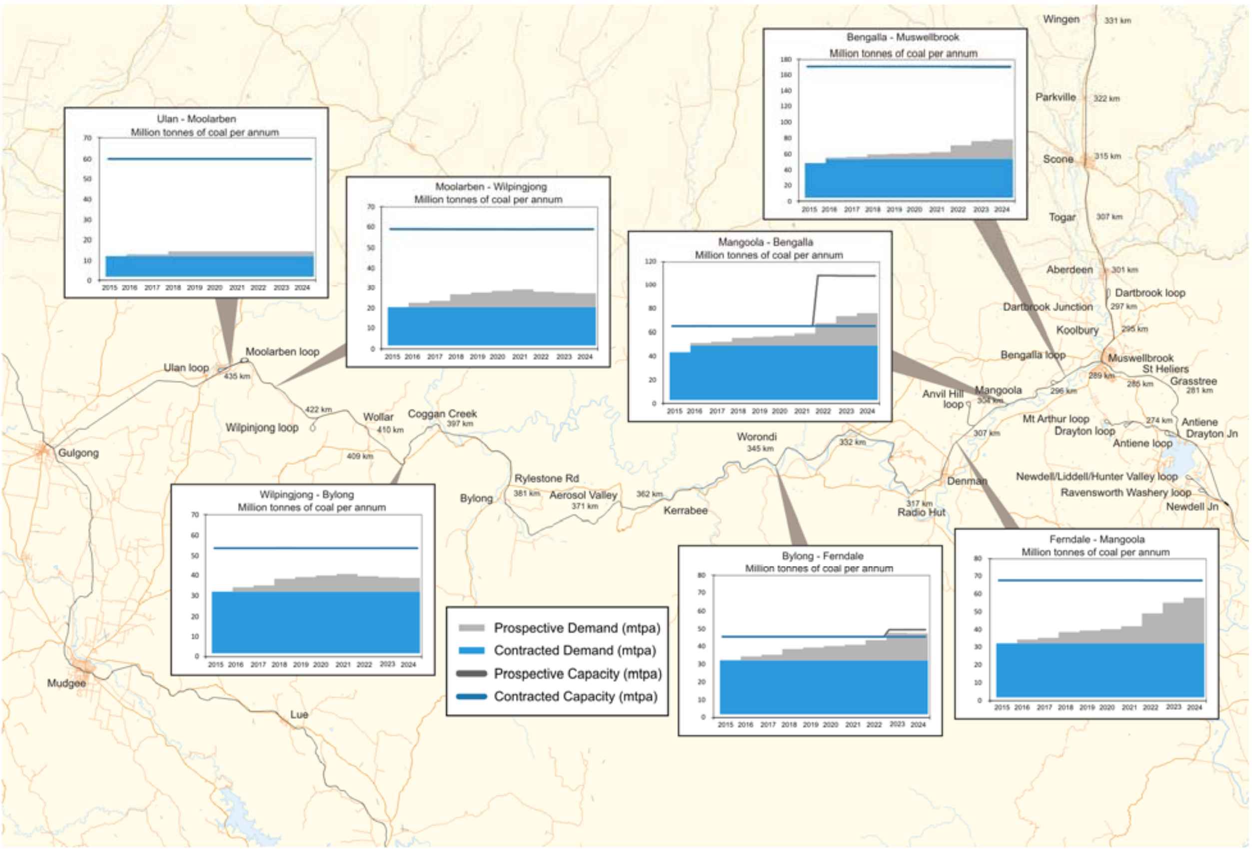


*Figure 19 - Volume and capacity on the Ulan line*

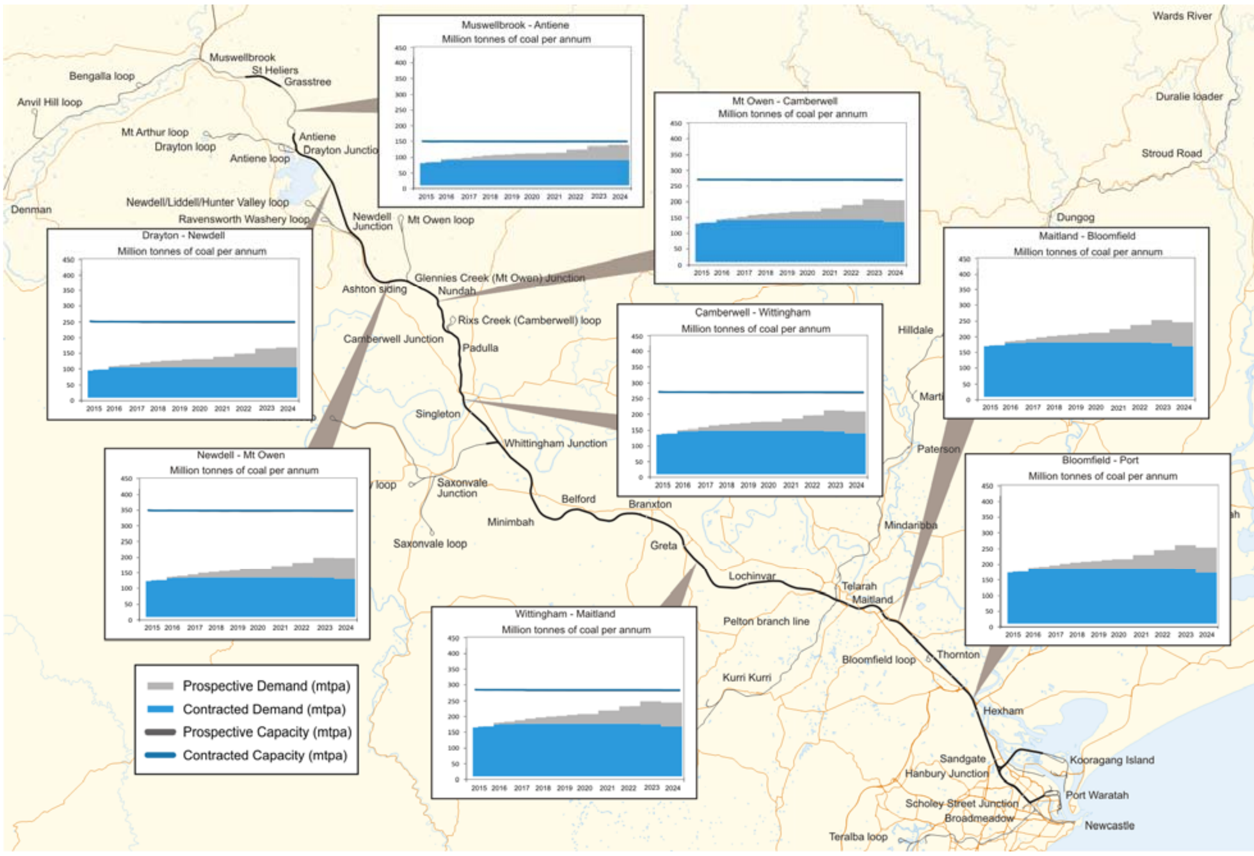


*Figure 20—Volume and capacity Muswellbrook—Newcastle*