LECG

Draft Report – Remaining Mine Life Hunter Valley coal network

Prepared for IPART

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Executive Summary

ARTC has proposed that the remaining mine life for the Hunter Valley coal system, which is used to calculate depreciation in the NSW Rail Access Undertaking, be shortened from its current value of 30 years to 22.8 years from 2009. The new estimate is derived from a study performed by Booz & Co on behalf of ARTC.

If approved, this proposed reduction to the remaining mine life would increase the annual depreciation charge and therefore, in the near term at least, lead to an increase in access prices. The NSW Minerals Council, representing the coal miners, opposes this change to the mine life. IPART has asked LECG to review the proposal, the underlying Booz model, and the submissions made by the parties.

The proposed 22.8 year mine life is derived from a model prepared by Booz which applies a production-weighted average to the predicted lives of individual mines. The Booz model assumes no change to coal prices. It takes some account of the role of infrastructure constraints on the life of mines—constraints tend to lengthen lives because they reduce the possible rate of coal extraction. It does not include prospective mines with start dates beyond 2014.

In my view, there are several shortcomings with the Booz approach:

- Infrastructure constraints have not been applied appropriately. In particular the 211 Mtpa constraint on the combined PWCS and NCIG port capacity is not taken into account by Booz.
- It is unreasonable to discount completely the output of prospective mines with a start date beyond 2014. It would be more in keeping with the accepted approach to uncertainty to use expected values for production rates and reserves.
- The production-weighted average methodology itself is not robust. In a range of plausible situations it will yield results that are demonstrably incorrect.
- A more appropriate methodology would be to use the life of the longest-lived substantial mine on a given section of railway. That methodology

yields a mine life of approximately 30 years, even when post-2014 prospective mines are excluded.

- The assumption of constant coal export prices is inconsistent with the forecast increase in export coal tonnage. An internally consistent approach to the price-output relationship would likely reduce coal extraction rates and extend the mine life, although it is difficult to say by how much.

When these shortcomings are rectified, a mine life of approximately 30 years from 2009 is shown to be a more reasonable central estimate for this uncertain parameter.

1 Background

The NSW Rail Access Undertaking (the Undertaking) requires IPART to review specific regulatory settings every five years. IPART is currently conducting a review of the remaining mine life of the Hunter Valley coal mines serviced by the rail network operated by ARTC and RailCorp.

The Undertaking provides that the depreciation of the regulatory asset base (RAB) of the rail infrastructure is to be calculated using a straight-line methodology and the estimate of the remaining useful life of the rail assets. The Undertaking further provides that the useful life of the relevant rail infrastructure should be determined with reference to the remaining mine life of the mines using the rail network. The revised remaining mine life is to be applied to the depreciation of the Hunter Valley coal network from 1 July 2009.

The remaining mine life was initially set by IPART at 40 years from 1999, implying a terminal year of 2039. IPART's 2004 review of the remaining mine life left the implied terminal year unchanged (IPART determined that the remaining mine life in 2004 was 35 years). IPART's 2004 decision was based largely on a consensus among stakeholders in favour of preserving the status quo.

ARTC has proposed a shortening of the remaining mine life to 22.8 years from 1 July 2009. This would bring the implied terminal year forward from 2039 to

2032.[1] ARTC's proposal is supported by a technical report it commissioned from Booz & Co.[2] Booz Allen and Hamilton, as the firm was then known, prepared technical reports for IPART in 2000 and 2004 on the remaining mine life estimates. The implied terminal year proposed by ARTC now is virtually the same as the terminal year implied by the 2004 Booz Allen report.[3]

RailCorp, being the other rail infrastructure owner in the Hunter Valley, has declined to make a proposal concerning remaining mine life.[4]

1.1 Importance of Mine Life

The Undertaking requires that:

> *'For any Access Seeker, or group of Access Seekers, Access revenue must not exceed the Full Economic Costs of the Sectors which are required on a stand alone basis for the Access Seeker or group of Access Seekers'*.

This is referred to as the ceiling test. IPART confirms that the rail infrastructure owners comply with the ceiling test each year.

The Undertaking also specifies that *Full Economic Costs* includes depreciation of the RAB which is to be calculated on a straight line basis over the useful life of the regulatory assets.

In reality the ceiling test only applies to the access revenue received from the group of mines referred to as the constrained group.[5] For the constrained group

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1 ARTC submission to IPART, 1 Dec. 2008.

2 Booz & Co., "Mine Life Assessment Hunter Valley Region," Appendix B to ARTC 1 Dec. 2008 submission.

3 In 2004 Booz Allen, who were then IPART's consultants, recommended a shortening of the remaining mine life. However, IPART did not accept this recommendation, given the consensus that had emerged in favour of maintaining the status quo.

4 RailCorp submission, 29 Oct. 2008.

5 It is important to note that the term "constrained" does not refer in this context to infrastructure capacity constraints. Rather, the constraint is a regulatory limit on the

of mines the access prices paid reach but are not allowed to exceed the ceiling test calculation of full economic costs (which includes the straight-line depreciation each year of the RAB).[6] For the mines in the unconstrained group access prices do not approach the ceiling test revenue limit.

The economic life of many types of infrastructure assets is determined by the physical wear and tear caused by usage. For these types of assets the engineering life is, for practical intents, the economic life. However, other types of assets become obsolete before they have deteriorated physically. The Hunter Valley coal railway network is of this type. The programme of major periodic maintenance keeps rails, sleepers and ballast renewed indefinitely. Concrete bridges may last for centuries. Nevertheless, barring the discovery of some other lucrative commodity in that area, the rail network will become virtually obsolete when the coal runs out—which it must eventually. Thus the mine life is, for practical intents, equal to the economic life of the Hunter Valley network.

The terminal year is directly related to the remaining mine life:

Remaining mine life = (terminal year – present year)

The Hunter Valley network is valued on the basis of Depreciated Optimised Replacement Cost (DORC). Ignoring new investment, this falls annually in a straight line from the current value to zero in the terminal year (presently set at 2039). The slope of this line is the depreciation rate. The steepness of the DORC valuation line over time determines the amount of depreciation that can be recovered by ARTC through the ceiling revenue limit in each year. Shortening the estimated remaining mine life will make that line steeper, which

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revenue that may be earned from these mines. The constrained group of mines contains those situated along the mainline between the Port of Newcastle and a point near Muswellbrook. These mines, in combination, have an ability to pay that exceeds the full economic cost of the infrastructure required to serve them. The access revenue earned from other mines is constrained by their ability to pay, rather than the ceiling test.

6 The calculation of full economic costs is on a stand alone basis. The access owners' under and overs account policies ensure access prices do not exceed the ceiling test as any over-recovery of costs is returned to access seekers.

will increase the amount of depreciation that may be included in the ceiling revenue in any one year. Increasing the depreciation will increase the annual revenue limit, and this will increase access prices for a given coal tonnage.

While varying the mine life will alter the pattern of capital charges over time, it will not usually affect the asset owner's life-cycle return on investment. The current DORC valuation of the infrastructure can only be recovered once over its lifetime, whether that be done quickly (short remaining life) or slowly (long remaining life). The timing of depreciation should not usually affect the net present value of infrastructure returns within the Constrained Network.[7]

Nevertheless, the infrastructure owner may prefer to receive the depreciation more quickly because that would minimise the risks of asset stranding. If the mine life had been set artificially high, and demand for rail haulage suddenly ceased at, say, the year 2020, then the DORC value at that date may be unrecoverable, and the infrastructure owner would suffer a capital loss. To insure against this risk, the asset owner would rationally seek to "front-load" the depreciation profile over time. Obtaining a relatively short remaining mine life is one way to front-load the depreciation profile.

While asset stranding of this type may be construed as merely a transfer between rail infrastructure owner (whose asset may be stranded) and mine owners (who receive below-cost access as a result), aversion to stranding risk may deter some new infrastructure investments that could have succeeded commercially. Investment deterrence would represent a deadweight loss.

From the standpoint of the access customer, however, an artificially short mine life could have adverse consequences, too. Again, part of this consequence might simply be a transfer between miners (who pay too much) and infrastructure owners (who receive too much). However, there is a welfare issue as well. By increasing access prices in the early years, the shortened mine life estimate might make coal mine developments or output expansions unviable

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7 The Constrained Network is the set of track sectors that are required by the constrained group of mines.

that may otherwise have succeeded. These foregone opportunities would also represent a deadweight loss.

Thus, while small variations of the mine life may cancel out in the longer term, there are real risks to welfare created by substantially incorrect estimates.

1.2 ARTC proposal

ARTC submitted a proposal to IPART on 1 December 2008 to shorten the remaining mine life from 30 years to 22.8 years from 1 July 2009. ARTC argued that this shorter mine life was the most reliable and realistic estimate, based on new analysis performed on ARTC's behalf by Booz & Co.

Booz had been IPART's consultant on the two prior reviews of mine life, conducted in 1999 and 2004. As IPART's consultant in 2004, Booz Allen and Hamilton, as the firm was then known, also recommended a shortening of the mine life. At the time IPART did not agree with that recommendation, in light of the consensus that was emerging among stakeholders to retain the existing implied terminal date of 2039.

The analysis performed by Booz this time on behalf of ARTC is similar to their analysis from 2004, but with the following improvements:

- This time Booz has not used a single point estimate of current production to determine future mine life. Instead, the mine life is based on the production forecasts that are fed into ARTC's investment strategy;
- The inclusion of scenarios in which some prospective mines with start dates beyond the current regulatory period are considered;
- The inclusion of scenarios in which production is constrained by coal chain capacity;
- Mine production forecasts and capacity constraints are now consistent with those used by ARTC in developing the Hunter Valley Corridor Capacity Strategy (2008-2018).

The approach of taking a production-weighted average of the lives of individual mines to determine the overall mine life to be used in the ceiling test has been applied by Booz in all of its studies.

Four distinct scenarios were considered by Booz. The nature of these scenarios and the resulting estimated mine life from 2009 is shown in Table 1 below:

Table 1. Summary of Booz mine life estimates

Average mine life (years from 2009)	Unconstrained production	Production constrained by coal chain capacity
Only mines in currently in production or commencing by 2014	22.5	**22.8**
Include prospective mines commencing 2015 and beyond	25.2	25.5

ARTC and Booz preferred the option they call "Option B", which involves production constrained by coal chain capacity, and includes only those mines that are currently in production or scheduled to commence by 2014. Option B corresponds to a 22.8 year life.

The stated reasons for this preference were that it is more realistic to include the effect of capacity constraints, and that the commencement dates and tonnage forecasts for mines expected to start 2015 and beyond were too speculative to use in the mine life estimate.

1.3 Stakeholder Submissions

Submissions have so far been received by IPART from ARTC, QR National Coal, Asciano and the NSW Minerals Council. The QR National Coal submission[8] commented on the rate of return issue, but remained silent on the mine life question. The Asciano submission[9] indicated that, owing to the prevalence of direct contracting for access between coal owners and ARTC in the present era, Asciano no longer put itself forward as the access seeker's advocate in the debate. Consequently, Asciano did not make any specific comments on ARTC's proposals concerning the mine life issue.

The first Minerals Council's submission,[10] which was preliminary in nature, signalled a concern that the shortened mine life proposed by ARTC would lead to increased access prices. It also sought a wide range of substantiating information pertaining to the Booz report. Some of the requested information has subsequently been provided by ARTC at a highly aggregated level.[11] ARTC indicated that some of the detailed information sought by the Minerals Council was commercially sensitive and questioned the relevance of some other information that was requested.

On 1 April 2009, IPART held a public round-table meeting at which the stakeholders were represented. ARTC and the NSW Minerals Council each presented their viewpoints and answered the Tribunal's questions. On many questions the parties indicated they would provide full answers by way of follow-up submissions. The second Minerals Council submission,[12] discussed only the rate of return issue.

Supplementary to ARTC's 1 December 2008 proposal, ARTC made further submissions and replies to information requests on 15 February, 9 and 27 April 2009. ARTC provided IPART, on a confidential basis, with the spreadsheet

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8 Letter from Michelle Yeaman, QR National Coal, 8 April 2009.

9 Asciano submission, 30 Jan. 2009.

10 Minerals Council letter of 16 Jan. 2009.

11 Additional information provided by ARTC, 15 Feb. 2009.

12 Minerals council submission of 23 April 2009.

created by Booz to perform the weighted average mine life calculation for each of the four scenarios.

2 Booz Methodology

In simple terms, the expected life of a given mine can be estimated by dividing its current coal reserves[13] by the expected average rate of extraction. The present Booz report and its 2004 predecessor both employed a weighted averaging approach to derive, from individual mine lives, a point estimate of the economic life for the rail infrastructure. The weighted averaging approach involves the following steps.

1) estimate remaining life for each mine by dividing the remaining reserves by the expected average rate of extraction over time;

2) sum the product of (mine life X mine reserves) over mines;

3) divide this sum by the sum of reserves over all mines.

The resulting weighted average life is given succinctly by the formula:

$$\text{Wtd avg life} = \sum (\text{life}_m \times \text{reserves}_m) / \sum \text{reserves}_m$$

where the subscript, m, refers to mines.

Information on coal reserves for existing mines is in the public domain. The quantum of reserves at every mine will be influenced to some degree by the prevailing price of coal, as an increase in price makes more of the coal economic to extract (and vice versa). However, this effect, while acknowledged

13 The term “reserves” is used in a quite specific way here. It refers to the quantum of coal that has been identified as being economic to extract at current coal prices. It should not be confused with the term “resources”, which refers to the quantum of coal that has been either “measured”, “indicated”, or “inferred”. Resources are quantified without reference to the ability to extract economically. Reserves are a subset of resources.

in the Booz report, was not taken into consideration further in arriving at the estimates.

The current rate of extraction of coal is observable for every mine, but it is difficult to translate that figure into a robust forecast average over the life of the mine. The actual rate of extraction for a given mine depends on the future prospects for international sales, specific chemical properties of its coal, geological and industrial conditions at the mine, the financial health of the mining company, and infrastructure bottlenecks at the port and on the rail system. The mining company is probably best placed to assess these factors, but its assessment may be competitively sensitive. Therefore, these assessments are not generally available either to regulators or rail infrastructure providers.

Booz has applied producer forecasts and, where those were unavailable, its industry expertise to arrive at estimates of extraction rates for specific mines. It has distinguished two cases: production unconstrained by transport infrastructure, and production constrained by anticipated infrastructure bottlenecks. The presence of infrastructure bottlenecks has a relatively minor influence on Booz' estimates of average mine life—the constraints increase average mine life by 0.3 years. Further analysis on this issue is provided in section 3 below.

A greater uncertainty is created by the fact that coal deposits exist within the rail network's catchment area that have not yet been developed as mines. Some of these deposits represent hundreds of millions of tonnes of coal—a quantity that could conceivably extend the economic life of the rail network by many years. Booz considered two mine life scenarios that included an estimate for these as-yet undeveloped mines, but opted ultimately to rely on the mine life estimates that exclude them. Booz reasoned that the quantum of reserves in these locations, as well as the timing of mine commencement were highly uncertain. Further analysis on this issue is provided in section 4 below.

The production-weighted averaging methodology itself is critiqued in section 5, and a possible alternative methodology is evaluated in section 6.

3 Effect of capacity constraints

In s2.5 of its report, Booz considers the effect of future coal chain capacity constraints on the life of mines. Figure 3, on page 8 of the Booz report illustrates the coal chain capacity forecasts in Mtpa for each year from 2009 to 2024. Capacity increases from about 110 Mtpa in 2009 to around 160 Mtpa in 2012. This is followed by an abrupt increase in 2013 to about 230 Mtpa. Subsequent to that event, the forecast is for slow further expansion in capacity over the following 12 years. Booz analysis assumes that the NSW Government and the coal industry will ensure that the Hunter Valley coal chain capacity will expand such that it will be capable of meeting demand from 2012 onward. In other words, the capacity constraint indicated by Booz' figure 3, is not applied after 2012. Even in the constrained scenarios, Booz assumes a lack of constraint after 2012.

The constrained production scenario results in very little change in the estimated mine life when compared to the unconstrained production scenarios. For example, in section 4 of its report, Booz estimates that with no capacity constraints on the Hunter Valley coal network the average mine life would be 22.5 years (excluding prospective mines). But if capacity constraints are not removed, and therefore expected mine production transported on rail to the Newcastle Port is reduced, the average mine life only increases to 22.8 years (excluding prospective mines).

Given the stated importance placed by all stakeholders on increasing the coal chain capacity and eliminating bottlenecks, it seems unexpected that the inclusion of forecast infrastructure bottlenecks has such a small effect on the average mine life, which is only 0.3 years longer when bottlenecks are in place.

Part of the explanation for this small capacity effect is the modelling assumption that production is unconstrained after 2012 in all scenarios. It does seem difficult to believe that infrastructure and port issues that limit exports to 160 Mtpa in 2012 would suddenly disappear entirely in the following year.

It is the case that 2013 corresponds roughly to the planned commissioning of the Newcastle Coal Infrastructure Group's (NCIG) third coal loading berth at Newcastle Port. The advent of this truly significant facility will profoundly alter coal chain capacity. It could, if everything goes according to plan, rapidly remove the port bottleneck for many years into the future.

That is not to say, however, that rail infrastructure bottlenecks, which have historically expanded at roughly the same pace as port bottlenecks, would also disappear in 2013. The practical difficulties of matching rail and port capacity are likely to mean that some infrastructure capacity constraints to persist beyond 2012, notwithstanding the expected NCIG commissioning event. This possibility was highlighted in the 27 April 2009 letter from ARTC,[14] which noted that in 2010 the planned capacity of the rail network falls marginally below the expected port capacity for Q4.

The possibility also exists that rollingstock capacity may be a bottleneck in the post-2012 period. In any case it is rather glib to simply assume away these capacity issues that have historically absorbed so much management time among all coal chain participants.

At the round table, Mr Andrews from the NSW Minerals Council stated that "*A future production rate of no more than the planned future capacity at PWCS and NCIG, which is potentially 211 million tonnes from 2013 onwards, should be used rather than ARTC Booz's assumed production of 240 to 260 million tonnes from 2013 and on.*"[15] ARTC's 27 April 2009 submission (p. 2) repeats this statement without contradiction.

If the future port capacity, including the NCIG facility, is no more than 211 Mtpa,[16] then this figure should be the upper limit of coal chain capacity,

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14 Confidential submission from ARTC, 27 April 2009.

15 Transcript, 1 April 2009, pp. 22-23.

16 211 mtpa is the sum of PWCS Carrington's 25 mtpa shiploading capacity, PWCS Kooragang's 120 mtpa shiploading capacity (after current expansion plans are complete), and NCIG's 66 mtpa planned eventual shiploading capacity. Note that PWCS Kooragang's current shiploading capacity is 77 mtpa. NCIG's stage 1 capacity is 30 mtpa, expected to be operating by Q1 2011. Further port expansions beyond the 211 mtpa will be hampered by space constraints along the Kooragang Island shoreline and narrowing of the South Channel of the Hunter River West of the NCIG site.

irrespective of rail infrastructure enhancements. Taking this information into account, I have constructed an alternative constraint path over time. The alternative path is shown in Chart 1 below, along with the constraint path assumed in the Booz analysis.

Chart 1. Alternative capacity constraint path v Booz path

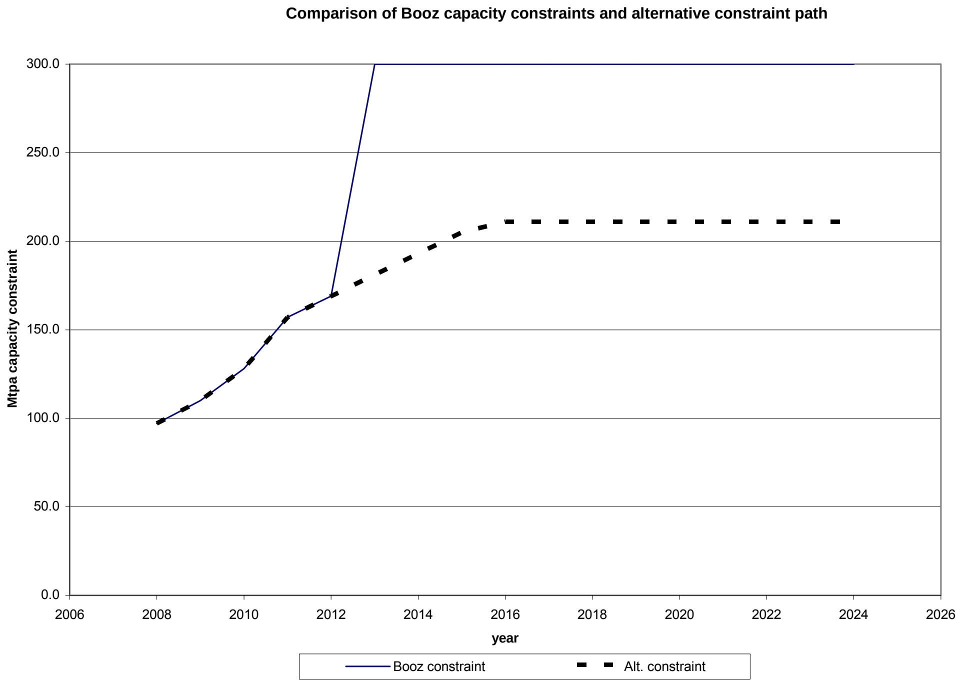

Chart 1 shows the Booz capacity constraints between 2008 and 2012. From 2013 onward, Booz assumes the absence of constraint. The alternative capacity path, shown here with a dashed line, continues at the same rate of growth as the Booz path between 2011 and 2012 until 2017, when it starts to taper off toward a target capacity limit of approximately 211 Mtpa. According to the NSW Minerals Council's statements at the round table, 211 Mtpa is the limit to port capacity, including both PWCS and the new NCIG terminals when operating at full capability.

When this alternative capacity constraint path is used in the Booz mine life calculation, the Option B weighted average mine life becomes 27.0 years, compared to the Booz figure of 22.8 years for Option B. Replacing the unrealistic Booz assumption that capacity constraints vanish in 2013 with a more realistic capacity path over time increases the weighted average mine life by 4.2 years. Relative to the Option A mine life of 22.5 years, with no constraint, this more realistic alternative capacity path increases the mine life by 4.5 years.

4 Inclusion of mines not yet in operation

Booz and ARTC have adopted the approach of ignoring any prospective mine that is not scheduled to come into operation before 2015, when calculating the remaining mine life for the Hunter Valley overall. Discussing methodology, the Booz report notes, p. 10, that

> "*'Prospective Mines' will be included in the evaluation on a provisional basis as there are concerns about:*
>
> - *The "Prospective mines" have a start date of 2015 and beyond which is outside the current study timeline of 2009-14.*
> - *Production levels are not based on operator information but on ARTC/HVCCLT estimates.*
> - *The estimation of Resource volumes and how they can be meaningfully converted to Mineral Reserves will affect the validity of "Prospective mines" to be included in the analysis.*"

The decision of ARTC ultimately to exclude these longer-term prospective mines (after considering them on a provisional basis) rests on two points of principle. The first is that the mine life estimate employed in the current regulatory period should take into account only those events that will take place during that period. The second is that information about these post-2015 prospective mines is incomplete: the start dates, reserves and future production rates are uncertain.

Regarding the first principle, in my view, an artificiality is introduced by restricting the field of view to the current study timeline of 2009-2014. The reason for selecting this particular window of time is that it is the new regulatory period for the Rail Access Undertaking. The trouble with this principle is that the economic life of the rail infrastructure is not determined by the production of mines that will commence within this regulatory period.

The second principle, which is tantamount to assigning zero probability to uncertain future events, is statistically invalid because it introduces a downward bias to the mine life estimate. At the practical level, there has been a historical pattern of significant coal production in the Hunter Valley coming from relatively new mines. For example, the Mt Arthur North mine, which commenced operation as recently as 2004, is intended to produce 20 Mtpa (ROM) when it reaches full production. Ten years ago, the Booz-ARTC approach might have considered this mine too uncertain to include.

Economists, not to mention miners and railway managers, frequently deal with uncertainty by estimating a probability distribution for important decision variables. Almost certainly the estimated reserves, commencement dates, and production rates for these post-2015 prospective mines that Booz has employed in its analysis represent values toward the centre of probability distributions that were estimated by the mining firms that hold the rights to these deposits. Both the central estimates and the probability distributions themselves would have been subjected to outside scrutiny from bankers, investment analysts, and a range of interested parties.

It seems inappropriate to discount those estimates, as Booz has effectively done, and treat the coal in these deposits as though it will never be mined. Uncertainty is most appropriately treated by employing best estimates of the uncertain variables. For this reason, the Booz Options C and D, which include best estimates for these post-2015 prospective mines should be preferred to the Option B that was eventually selected. Relative to Option B, Option D (which also applies capacity constraints) adds 2.7 years to the mine life.

It might seem counterintuitive that the addition of 3 mines with combined reserves[17] of approximately 700 million tonnes would only add 2.7 years to the

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[17] There is some ambiguity as to whether the amount of coal in the ground at Caroona, Maules Creek and Watermark represents resources or reserves. The Booz spreadsheet model treats these amounts as “Mine Reserve”.

overall mine life. Part of the explanation is that Booz assumes the absence of coal chain capacity constraints during the years in which these mines are expected to be operating (i.e., post-2014). It is conceivable, therefore, that the more realistic coal chain capacity constraint arising from port limitations that is discussed in the prior section of this report would lead to a greater effect on the mine life of including these mines.

To test this proposition, I have re-run the Booz model Option D using the alternative capacity constraint path instead of the Booz constraint path. The result is a 33.9 year production-weighted average mine life across all three regions. The weighted average mine life for region 2 only (including mines West of Muswellbrook) would be 28.5 years under Option D with the alternative capacity constraint path.

5 Appropriateness of Booz-ARTC methodology

The production-weighted averaging methodology has some positive features. It gives greater importance to the mines with larger reserves. It avoids the situation in which a small mine that extracts coal at a slow rate over a long time might artificially inflate the estimate of the overall mine life.

Nevertheless, it has some inherent weaknesses, too. Consider a situation in which there are two mines: one which has a 5 year remaining life and one which has a 75 year remaining life. If these mines had equal reserves, then the weighted average life would be 40 years. The railway line serving these mines would need to be in use for 75 years, not 40. The weighted average life would be an inappropriate proxy for the rail infrastructure life in this case.

The weighted average mine life will differ depending on the ownership arrangements. To see this point, consider again the example of two mines with different lives. Under separate ownership, the weighted average life would be 40 years. If, however, the two mines were situated on the same loading loop and were owned by the same company, then the life of this combined "mine" would be 75 years.

Some further examples are given to illustrate the extent of these shortcomings in more detail. The Booz methodology will tend to underestimate the true economic life of the rail infrastructure, even in the simple case wherein all mines are located at the same place (and therefore all use the entire line). The simple hypothetical example in Table 2. below illustrates the problem.

Table 2. Hypothetical example of weighted average mine life calculation

Location 1			
	reserves MT	extraction rate (mtpa)	life
mine 6	100	20	5.0
mine 7	300	20	15.0
mine 8	400	20	20.0
mine 9	250	20	12.5
mine 10	50	10	5.0
wtd avg life	1100	90	12.2

In this example, the calculated production-weighted average life is 12.2 years, but three of the five mines will continue to produce coal well beyond the terminal date implied by that life estimate. The reason for the distortion is that the production-weighted average life effectively divides the total reserves by the total rate of extraction in year 0. As mines close, however, that overall rate of extraction will fall. The correct life estimate can only be obtained by dividing the total reserves by the average rate of extraction across all mines over the entire relevant time period.

When the mines are not all located at the same place, however, this simple production-weighted average formula encounters further difficulties. Consider a line with two separate mine locations:

- Location 1, approximately half-way between the port and the end of the line; and
- Location 2, at the end of the line.

For the sake of illustration, let us assume the mines, reserves, and extraction rates at these two locations shown in Table 3. below:

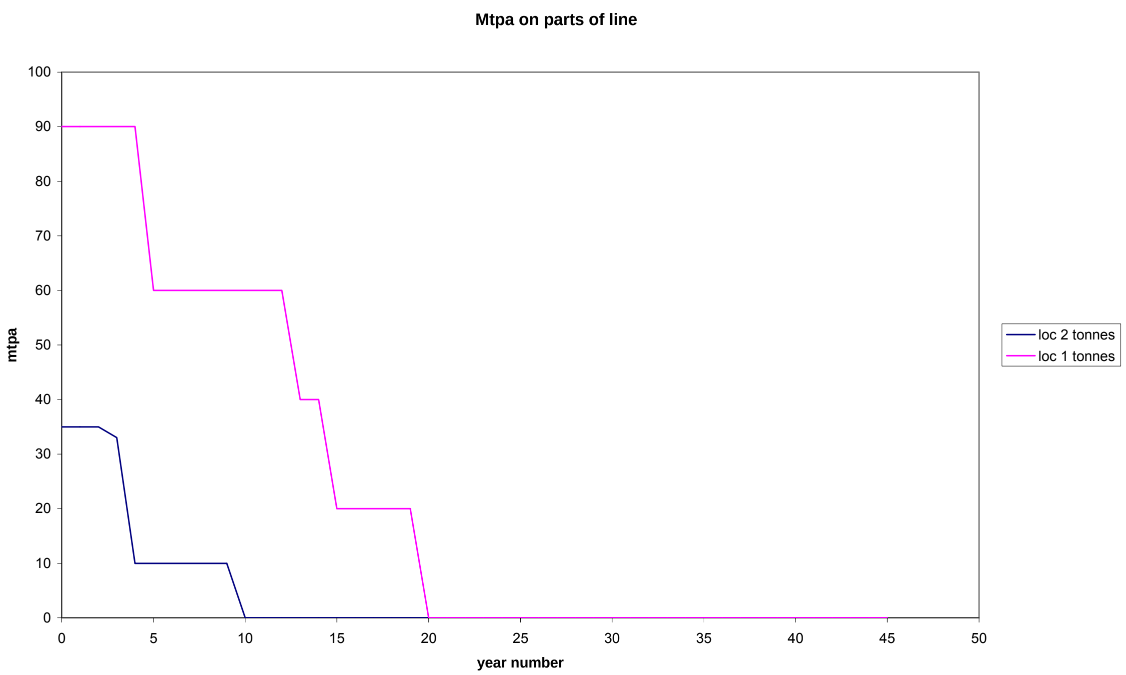
Table 3. Hypothetical weighted average mine life with two locations

Location 2			
	reserves MT	extraction rate (mtpa)	life
mine 1	5	2	2.5
mine 2	100	10	10.0
mine 3	20	5	4.0
mine 4	50	15	3.3
mine 5	10	3	3.3
wtd avg life	185	35	5.3

Location 1			
	reserves MT	extraction rate (mtpa)	life
mine 6	100	20	5.0
mine 7	300	20	15.0
mine 8	400	20	20.0
mine 9	250	20	12.5
mine 10	50	10	5.0
wtd avg life	1100	90	12.2

The pattern of tonnage over time for each of these two locations is shown in the Chart 2. below.

Chart 2. Hypothetical production over time with two locations



As in the example with the single location, the production-weighted average life understates the useful life of the infrastructure. An additional problem has arisen in this two-location example. The useful life of the line from location 2 (at the end of the line) to location 1 (part-way to port) has ended after 10 years, but the useful life of the innermost part of the line extends for a further 10 years. One part of the line becomes obsolete sooner than the other part under these particular illustrative assumptions about mine reserves and extraction rates.

Given these problems with the simple application of a production-weighted average life, there may be a case for adopting the longest life among mines instead as the period over which rail infrastructure assets are to be depreciated. If such an approach were adopted, a linear depreciation schedule may no longer be appropriate.

An obvious solution to these problems is to adopt the life of the longest-lived substantial mine on a line as the economic life of that line. Arguably, the railway infrastructure cannot be decommissioned until that longest-lived mine has stopped producing. This longest-lived mine methodology is tested in the next section against the data employed in the Booz study.

6 Alternative methodology

The alternative methodology that is considered in this section is that the economic life of a section of rail infrastructure would be established by the life of the longest-lived mine of substantial size that requires that rail line to transport its product. The emphasis on the substantial size of the mine arises because a long rail line would not be kept operational to serve only the requirements of a trivially small mine, even if it had a very long life. As long as the long-lived mine is a substantial mine, however, then the railway line would remain operational for the balance of that life.

In what follows, I discuss the Booz mine life calculation model in some detail. Much of the input data used by the Booz model is confidential, so this discussion is structured in such a way that confidential material is not disclosed.

Confidential annual production forecasts for every year from 2008 to 2024 are employed in the calculation for each mine. The production rate after 2024 is presumed to be the same as the rate in 2024 while reserves last.

The Booz model classifies mines into three regions, which broadly correspond to:

1) Mines closer to port than Muswellbrook, including the Central Hunter mines and the mines South of Newcastle on the electrified mainline;

2) Mines West of Muswellbrook near Ulan or Bengalla; and

3) Mines North of Muswellbrook situated in the Gunnedah basin.

Ignoring mines that each account for 1 Mtpa or less production, one of the three longest-lived mines on the Central Hunter mainline has an estimated life of just under 30 years from 2009, and the other two have estimated lives of between 30 and 40 years. The model's estimate of the 2024 extraction rate for these three mines combined is approximately one third of the 2008 tonnage produced by all Region 1 mines.

The Mount Pleasant mine has the longest life of the mines West of Muswellbrook. The life of the Mount Pleasant mine is estimated to be approximately 30 years from 2009. The model's estimate of Mount Pleasant's 2024 rate of extraction is more than 90% of the tonnage moved on the Ulan line in 2008.

The Bickham mine has the longest life of all the Gunnedah basin mines (in the conservative scenario where Caroona, Maules Creek, and Watermark mines are left out of the calculation). The life of the Bickham mine is calculated to be slightly more than 30 years from 2009. The model's estimate of Bickham's 2024 rate of extraction is approximately 40% of the tonnage moved on the line from Gunnedah to Muswellbrook in 2008.

This alternative methodology yields a significantly different result than the Booz production-weighted average mine life methodology. Even in the conservative case where the large new mine projects near Gunnedah are excluded, it yields an infrastructure life of approximately 30 years from 2009.

These observations argue strongly for a 30 year mine life, as a conservative estimate, for the Central Hunter system from Muswellbrook to port. Similarly, they argue for a 30 year mine life from Bickham to the port. It should be noted, though, that the Bickham mine site is approximately half-way to Gunnedah. If this logic were applied and if the post-2015 prospective mines were not included, then the life of the rail infrastructure between Gunnedah and Bickham might be shorter than 30 years.

A similar issue arises with respect to the line from Ulan to Mt Pleasant. While Mt Pleasant mine has a long life, it is situated quite close to Muswellbrook. Its continued operation would not, by itself, necessarily justify the continued operation of the remainder of the line to Ulan, which has a shorter life as estimated by Booz. Under the alternative coal chain capacity assumptions that were explored in section 3 of this report, however, the Wilpingjong mine's life is increased to 30 years by virtue of these more stringent capacity constraints. Wilpingjong is a substantial mine with reserves in excess of 200 Mt, situated near Ulan at the end of the line. The continued operation of Wilpingjong may well, by itself, justify the continued operation of the remainder of the line to Ulan.

On balance, the alternative methodology yields an overall mine life of approximately 30 years from 2009, and a similar mine life for each of the three major sections of the rail network, even under relatively conservative assumptions about prospective mines.

7 Coal price impacts

Booz explicitly ignored the effect of future export coal prices on the quantum of marketable reserves held by each of the mines in their study. Booz stated (p. 7) that actual future production is likely to be closely related to issues of price and demand, and that the effect of increased thermal coal prices has led to actions to improve both mine output and coal chain system performance. Nevertheless, Booz opined that as the Hunter Valley produces mainly thermal coal used for electricity generation in Japan, Taiwan and Korea it would be relatively immune from the effects of the global economic slowdown.

This proposition is debatable, although an argument could be made that in the absence of superior information about future coal prices a projection of the current price into the future represents the current best guess.

It should be noted, however, that the exports from Newcastle port are projected by Booz to increase from less than 100 Mtpa in 2008 to 260 Mtpa in 2024. This quantum of increase, 160 Mtpa, is significant in relation to the total quantum of seaborne coal traded in the Pacific Rim. In 2006, the Pacific seaborne coal trade was 459 Mt.[18] The projected increase in Hunter Valley exports is 35% of the entire Pacific coal trade in 2006.

It does not appear plausible that a supply increase of this magnitude could occur with no downward influence on the price of export coal in the Pacific. Rather, it seems more plausible that the increasing supply capability in the Hunter Valley would lead to price reductions which would lead, in turn, to reductions in the rate of coal extraction from Hunter Valley mines. These price-based reductions could extend the life of most of these mines beyond what Booz has predicted[19] on the basis of their implausible assumption of constant coal prices.

8 Implementation issues

8.1 Implementation of any change to mine life

It has been proposed by ARTC that the current implied terminal year for the Hunter Valley rail network be changed from its current setting of 2039 to an earlier year (approximately 2032). Since the inception of the NSW Rail Access Regime and Undertaking, there has been no change to this implied terminal year.

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18 "Coal Facts 2008 edition with 2007 data", World Coal Institute, http://www.worldcoal.org (accessed 7 May 2009).

19 Large, sustained coal price falls might make some of the reserves counted by Booz uneconomic. To the extent these price falls were large and sustained, it might shorten the life of some of the more marginal mines.

In the event that such a change were made as a result of the current review, there are some questions of equity that should be considered. Would a shortening of the remaining life lead to over-recovery of ARTC's investment in the network? Would a lengthening of the remaining life lead to under-recovery of ARTC's investment?

As this draft report recommends no change to the current implied terminal date, these questions are moot.

8.2 Treatment of lines recently joining the Constrained Group

This section deals with the potential for different depreciation treatment of different parts of the Hunter coal network, focusing on a group of mines and the associated line sectors that form what is known as the "constrained group".[20] Simply put, this group is the set of mines that pay access charges at the regulatory ceiling.[21] They are price-constrained by the ceiling test, which is binding for them. Historically, this group of mines was also known as the "Category I" mines.

The remainder of the Hunter Valley is unconstrained as to price, meaning that the regulatory ceiling is effectively far above the limit of the unconstrained mines' ability to pay. One consequence of this fact is that the rail infrastructure owner does not recover the full economic costs on track sectors that form part of the unconstrained group.

The 2004 Booz Allen Hamilton report recommended different remaining mine lives for the portion of the network managed by ARTC and the portion managed by RailCorp. At the time, IPART did not accept that part of the recommendation, maintaining instead a single mine life for the entire Hunter Valley.

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20 It is important to note that the term "constrained" does not refer in this context to infrastructure capacity constraints.

21 Access revenue must not exceed the Full Economic Costs of the sectors which are required on a stand alone basis.

In this iteration of the mine life estimates, a different version of this separate life question arises. It is possible that for the 2008 year the Ulan mine will become part of the constrained network, owing to increased tonnages from mines in that area. While it has been anticipated for some time, this is the first time that there has been a change to the boundaries of the constrained network.

A change of this sort raises some questions of the regulatory approach, on which IPART consulted stakeholders at the round table event. For the rail infrastructure from Bengalla to Ulan, which has not previously formed part of the constrained group, ARTC and the previous infrastructure owner would not have recovered the full economic costs through access charges to date. Now that this line appears likely to become part of the constrained group (because tonnages have improved markedly relative to the costs of the line) the regulatory ceiling will start to restrict access prices for these sectors. This raises the issue of whether the ceiling test should be based on current DORC values or whether allowance should be made for past under recovery (for example via an unders and overs account).

Putting this question in another way, should bygones be bygones, or should the track owner be permitted to apply some of the forward-looking access revenues towards past under-recoveries? It is possible that such an approach may not be allowed under the present Undertaking as it may imply access revenue exceeding the Full Economic Costs.

The depreciation policy becomes relevant in this context. To the extent that past access prices on the Ulan line did under-recover full economic costs, the expected return of capital did not fully materialise. That being the case, the mechanical application of a time-based depreciation schedule to the regulatory asset base would be inappropriate—the invested capital was not fully returned to the asset owner.

One way to address this problem would be to delay depreciation of the RAB for the non-constrained sectors until the access revenue was sufficient to recover the depreciation charge. That approach would ensure financial capital maintenance for the asset owner. In practical terms, what that means is that the DORC valuation for sectors newly added to the constrained group would be calculated by applying essentially near zero depreciation to the optimised replacement cost until the year in which the sectors joined the constrained group.

From that point onward, the DORC valuation would decline so as to reach a value of zero in the same terminal year as applies to the rest of the constrained group.

This issue was put to stakeholders at the round table through the following question:

> "How should the mine life treatment apply to lines such as the Ulan line which is joining the constrained group for the first time?"

The responses were as follows. Mr Edwards from ARTC (transcript, p. 30) stated,

> "*It seems to have some alignment with the approach that we are proposing to put forward to the ACCC which we have titled – it's a new approach but it's called lost capitalisation where an investor is compensated over the long term for investments that might initially not recover full economic cost. We think that's something that would be very useful in the Hunter Valley because it does provide fairly strong incentive to invest ahead of demand, knowing that you are going perhaps make losses but not recover your full return in those early years but you might be compensated in later years, assuming the market can afford it, so we do see some merit in that perspective.*"

Mr Ormsby, also of ARTC, (transcript, p. 31) stated,

> "*I don't think it is any secret ARTC has been concerned about this concept that under a regulated framework once you forego return on depreciation that's it, you can never get it back even though you have actually invested the money. It seems logical that you should be able to recover that return of depreciation some time in the future if it made investment and if the market conditions would allow – make it affordable.*"

Mr Andrews of the NSW Minerals Council (transcript, p. 31) stated,

> "*I would just make the comment that I thought your question was heading towards depreciation by one segment or groups of segments and I think the direction of that is where we will head over time. I'm not sure it's necessary here as opposed to having just one average mine life.*"

These comments suggest a degree of interest in pursuing this approach on ARTC's part, with an apparent willingness to discuss further on the part of the Minerals Council.

9 Conclusions

The following conclusions follow from the analysis presented in this draft report.

1. The Booz approach to modelling the effect of coal chain capacity constraints on mine life understates the likely influence of these constraints and therefore underestimates the mine life. Imposing a more realistic constraint on capacity would increase the mine life to 27 years. This result is an increase of 4.2 years over the preferred Booz scenario involving capacity constraints, making no other changes to the Booz methodology.

2. The exclusion of large new mine projects in the Gunnedah basin, such as Maules Creek, Caroona, and Watermark is justified by Booz on a basis that appears inappropriate for an estimate of the rail infrastructure's economic life. Including these mines would add 2.7 years to the mine life, under the Booz methodology.

3. The weighted average mine life would be 33.9 years if both the alternative, more realistic capacity constraints were applied, and the post-2015 prospective mines were included. This result, 11.1 years more than the ARTC-recommended mine life, is obtained without modifying the Booz production-weighted average methodology.

4. The production-weighted average mine life methodology employed by Booz is not a robust methodology. In a range of plausible situations it could yield results that are clearly incorrect.

5. An alternative methodology, determining the rail infrastructure's economic life with reference to the life of the longest-lived substantial mine on the line, would be more appropriate.

6. Employing this alternative methodology yields a mine life of approximately 30 years from 2009, even when the new large mine projects in the Gunnedah basin are excluded from the calculation.

7. The Booz assumption of no impact on coal extraction rates or reserves of future coal price changes does not appear reasonable in light of the magnitude of the output expansions contemplated in their mine life model. While future price changes could either lengthen or shorten mine life, it seems more probable that the large supply increases contemplated would serve to extend the mine life.

8. In light of these points, I conclude that a 30 year mine life from 2009, implying a terminal date of 2039, would be the most reasonable central estimate for the purposes of the NSW Rail Access Undertaking.