REVIEW OF DENDROBIUM EXTENSION PROJECT'S PROPOSED MINE PLAN

JULY 2020

REPORT TO:

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REPORT ON:

Review of Dendrobium Extension Project's Proposed Mine Plan

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EXECUTIVE SUMMARY

This report was commissioned by the Planning & Assessment Group (PAG) of the NSW Department of Planning, Industry and Environment to provide an independent appraisal of the economic impact of narrower longwall panels to the proposed Dendrobium mine extension project. The review considered panel width options of 300m to 150m (centre distance) in 25m increments.

This review was conducted as a desktop exercise using reference information on the Project, assumptions based on first principles and the author's expert knowledge. No site visit was conducted and no contact was made with the Project members. Information used for this review was primarily sourced from public domain, primarily the PAG website https://www.planningportal.nsw.gov.au/major-projects/project/9696 which contains the Project EIS and supporting documents.

In summary the impacts to the mine physicals from incrementally reducing panel width from 300m to 150m include:

- A reducing longwall productivity ranging up to 20kt per week (100kt to 80kt per week);
- A reduction in annual production ranging up to 1Mt per year (4.4Mt to 3.4Mt per year);
- An increase in development ranging up to 3km per year (14km to 17km per year);
- An increase in mine life ranging up to five years (20 years to 25 years).

The impact to the mine economics include:

- Reducing revenue from sales;
- Slight increase in overall mine operating costs (up to $20M per year).

The economic impact is measured by the NPV of the estimated project cash flows taking into account estimated production profiles, operating costs, distribution costs, capital costs, royalty payments and company taxation. In summary, reducing the panel width is shown to have a negative impact on the project NPV as shown in Table 1. While the NPV value is highly sensitive to coal sales pricing, the NPV difference between various panel width cases remains fairly constant at approximately $100M per 25m reduction in panel width. At panel widths less than 200m the NPV is shown to rapidly decrease.

It is highlighted that the absolute NPV values shown in this report are not expected to be a reflection of the actual Project NPV as the information used is not sufficiently precise. Rather they are used to demonstrate a comparison between options for various longwall panel widths.

Table 1
Net Present Value – Base Pricing

Panel Width	NPV
300m	$667M
275m	$568M
250m	$464M
225m	$368M
200m	$244M
175m	$27M
150m	-$125M

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1.0 INTRODUCTION

The Planning & Assessment Group (PAG) of the NSW Department of Planning, Industry and Environment has commissioned the services of MineCraft Consulting Pty Ltd (MineCraft) as an independent underground longwall coal mine planning expert to conduct a review of the underground longwall mining layout proposed in the Dendrobium Extension Project's Environmental Impact Statement (EIS).

This Project seeks the continued and extended operation of the Dendrobium Coal Mine, which operates beneath the Illawarra Escarpment, west of Wollongong.

PAG require the services of an appropriately qualified underground longwall coal mine planning expert to help PAG assess the opportunities and limitations (including costs and benefits) for varying the proposed layout and other geometry of the underground mine plan, and to enable it to provide a thorough and detailed assessment.

The EIS's Appendix A sets out that the Project's underground mine plan is based on longwall void width of (generally) 305m and tail gate pillar width of (generally) 45m. Depth of cover varies from 250m to 460m. Surface to seam cracking has been assumed throughout the two proposed mining areas.

1.1 Scope of Work

The requested work scope is for an initial review of the proposed underground mine plan for the Dendrobium Extension Project (as set out in section 3.5 and shown in Figure 3.9 of the EIS). This review should:

1. Recast the EIS's proposed mine plan for both Areas 5 and 6 based on longwall void widths of 150m, 175m, 200m, 225m, 250m, 275m and 305m;
2. In respect of each of these options, examine and report on the:
    a. Extent of additional gateroad development arising;
    b. Extent of any additional requirements for management of underground gas;
    c. Potential implications for "development float", mine sequencing and continuity of mining;
    d. Changes in total coal recovery (see section 3.1 of the EIS); and
    e. Changes in the Project's rate of return on capital and Net Present Value (NPV) and income to the State of NSW (see the EIS's Appendix L).
3. Report on the potential to either increase or reduce mining height, particularly in respect of the Wongawilli Seam; and
4. Make recommendations for any additional information required to inform the comprehensive assessment of the Project's proposed mine plan.

1.2 Data Sources and Methodology

This review was conducted as a desktop exercise using reference information on the Project, assumptions based on first principles and the author's expert knowledge. No site visit was conducted and no direct contact was made with the applicant for the Project.

The information used for this review was primarily sourced from public domain, primarily the PAG website https://www.planningportal.nsw.gov.au/major-projects/project/9696 which contains the Project EIS and supporting documents. Some confirmation information was provided by the applicant via an information request submitted via PAG, mainly related to the mine equipment, rosters and manning levels. Mine productivity and coal yield information was gained from production reports produced by Coal Services, NSW.

The adopted methodology was to utilise MineCraft's inhouse methods, systems and expertise to undertake the review including the use of MineCraft's Scheduling Module, Longwall Productivity Module and Operating Cost Module.

The adopted methodology was to:

- Recreate and then recast the mine layout design using AutoCAD for longwall panel widths of 300m, 275m, 250m, 225m, 200m, 175m and 150m (centre distances);
- Calculate the ROM reserves within each layout using the MineCraft Scheduling Module;
- Calculate the current longwall productivity kpi's using the MineCraft Longwall Productivity Module and then calculate the relevant kpi's for the different panel widths and extraction heights;
- Recreate a base mine schedule for the 300m layout using the derived LW productivity parameters and other parameters based on industry typical performance;
- Apply the base mine schedule to the alternate mine layouts using the derived LW productivity parameters and adjust the development requirements to ensure longwall continuity;
- Collate the production output parameters from each schedule;
- Establish an operating cost framework for the base case layout using the MineCraft Operating Cost Module and using industry benchmark cost kpi's as input data. Using the base production schedule, establish an annual operating cost profile for the base case;
- Using the alternate production schedules, establish annual operating cost profiles for the alternate panel width cases;
- Calculate the net present value of the annual cash from each case.

1.3 Report Qualifications

This review was conducted as a desktop exercise and is considered a comparative review rather than an absolute review. In this context it is acknowledged that the base case assumptions may not

precisely match the actual mine data in terms of performance and costs, however they are expected to be sufficiently approximate to allow a comparison of the economic impact from alternate mine plans.

The review included the calculation of net present value (NPV) which is based on estimated cash flows from the Project. It is highlighted that the NPV values shown in this report are not expected to be a reflection of the actual Project NPV as the information used is not sufficiently precise. Rather they are used to demonstrate a comparison between options. Several inputs to the cash flows have been kept constant across all options including capital cost and sales price. It is acknowledged that different panel width configurations could cause capital cost variations and different sales volumes may cause average sales prices to vary. However it was not considered feasible in this review to apply more accuracy in these regards and also the impact would be expected to be low.

NPV is highly sensitive to several factors including coal prices, marketing agreements, foreign exchange rates, taxation rates, etc for which exact details are not known. Therefore a consistent approach to this data has been used across all options.

1.4 Author Experience

The author of this report is a qualified mining engineer (BE mining, University of Qld), holder of a First Class Mine Managers Certificate, Chartered Professional Member of the AusIMM and Registered Professional Engineer (Qld). He has over 32 years of experience in the coal industry, 12 of which were in operations, 20 years in consulting as Principal and owner of MineCraft Consulting Pty Ltd.

In operational roles, he was employed at the German Creek mine and Kestrel mine in Queensland. Numerous consulting projects have been completed on underground projects and modern underground mines including Narrabri, Kestrel South, Grasstree, Ulan, Blakefield, Crinum and Oaky Creek. In the Illawarra region he has conducted assignments for the Appin*, Metropolitan and Tahmoor mines, and the Bargo and Hume Projects. *[Note * Engaged in a consulting project development capacity during the period 2004-06].*

2.0 BACKGROUND INFORMATION

The Project is described in detail in the EIS report Section 3. Dendrobium mine is a modern underground longwall coal mine extracting the Wongawilli seam at extraction heights between 3.7m and 3.95m. The mine has extracted Areas 1, 2, 3A, part of 3B and is intending to extract Area 5, 6 and 3C (refer Figure 2.1).

Historically the mine has produced 3.6Mt in FY2018 and 4.7Mt in FY2017 (Source Coal Services NSW) with a future target of 5.2Mtpa. The longwall itself produced 3.4Mt and 4.2Mt respectively with development production making up the remaining output. Development production appears to be around 32kt per month, which at 25t per metre equates to 1,280m advance per month or 300m per week. Generally three development places are operated using up to four continuous miners and the

equivalent of four development crews (comprising their own workforce and a Contract workforce). The weekly advance of 300m/week is expected to comprise gateroad advance rates of approximately 220m/week and main heading rates of approximately 80m/week. These rates appear typical of observed industry development rates.

The longwall equipment is supplied by Komatsu (previously Joy) and consists of a 300m long AFC rated at 3,000tph and LW supports with a maximum open height of 4.9m and an operating range of approximately 3.5m to 4.5m. The mine has historically operated in Uni Di mode but recently has reverted to the Bi Di mode of operation which is generally considered more productive. The mine site is space constrained with limitations on surface buildings and car parking. Coal stockpile room is also limited relying on regular train movements to Port Kembla in order to not constrain production.

The Project intends to extract the Bulli seam in Area 5 and the Wongawilli seam in Area 6. The Bulli seam thickness ranges from 2.1m to 3.1m which indicates the current LW equipment will not be compatible and therefore replacement supports, shearer and possibly other components will be required. The current LW equipment would be compatible with the Wongawilli seam extraction in Area 6 and allow extraction up to approximately 4.6m.

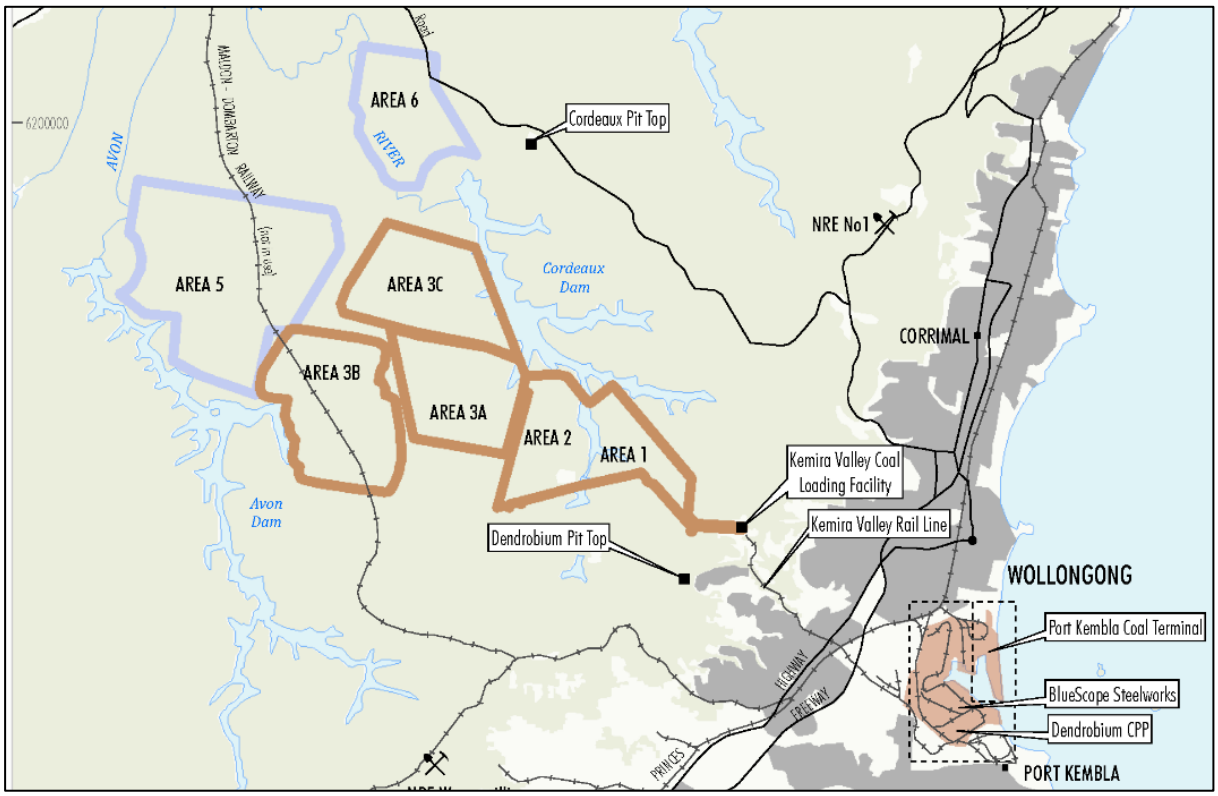

Figure 2.1
Dendrobium Mining Areas

2.1 Alternate Mine Layouts

The current proposed mine layout for Area 5 and 6 is based on a longwall panel width of 300m centres (305m total void) and is shown in Figure 2.2. Alternate mine layouts were created using AutoCAD for longwall panel widths of 275m, 250m, 225m, 200m, 175m and 150m (centre distances). For each alternate layout the same constraints were applied including lease boundaries, step arounds for identified key stream features in the NW and in the South. Where possible and prudent, panels of a reduced width have been included in the design (for example LW510 in the 250m design is 200m wide). It is noted that the proposed 300m layout and constraints were not provided in AutoCAD and were traced from the EIS report, hence the layout accuracies are approximate.

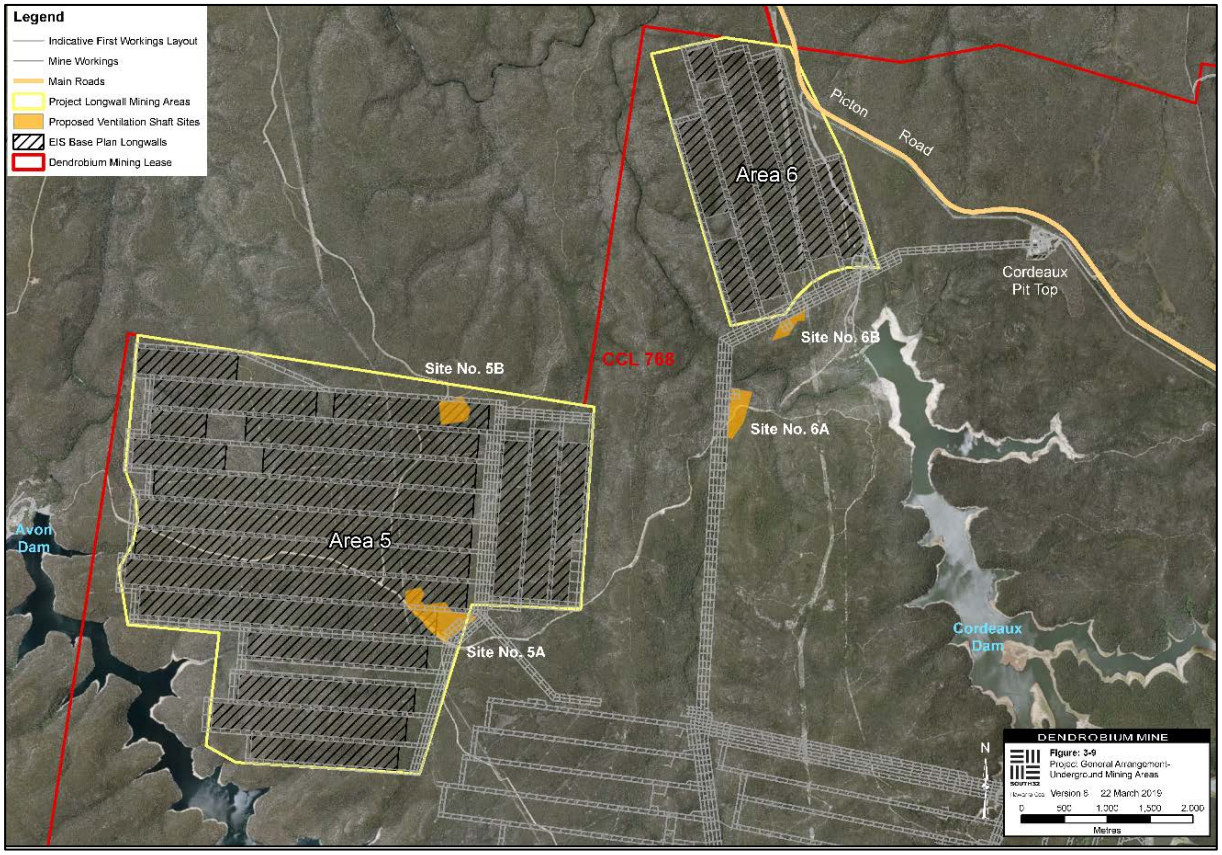

Figure 2.2
Proposed Dendrobium Mine Layout

The alternate width mine layouts are shown in Figures 2.3 to 2.9.

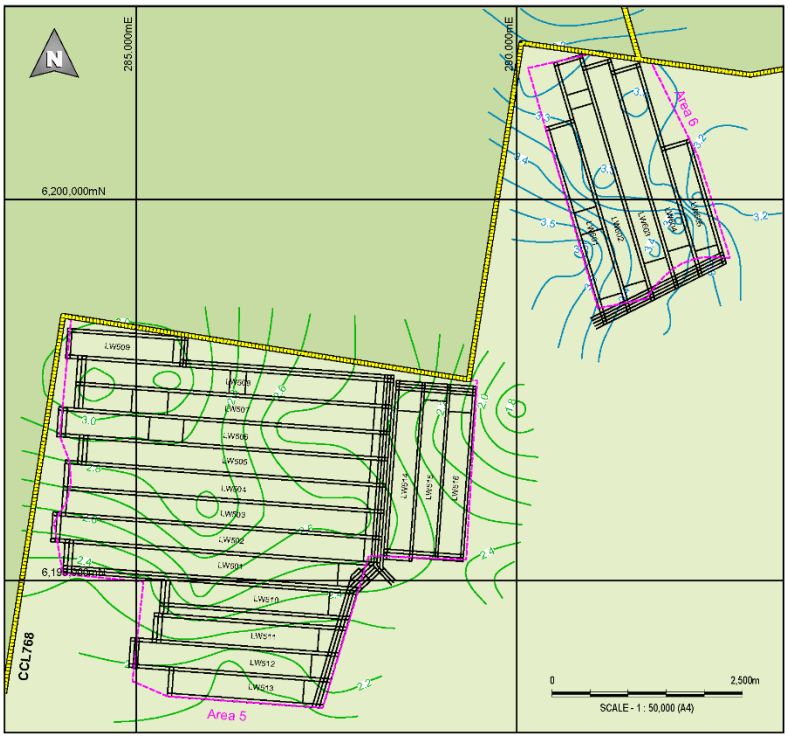

Figure 2.3
300m Mine Layout

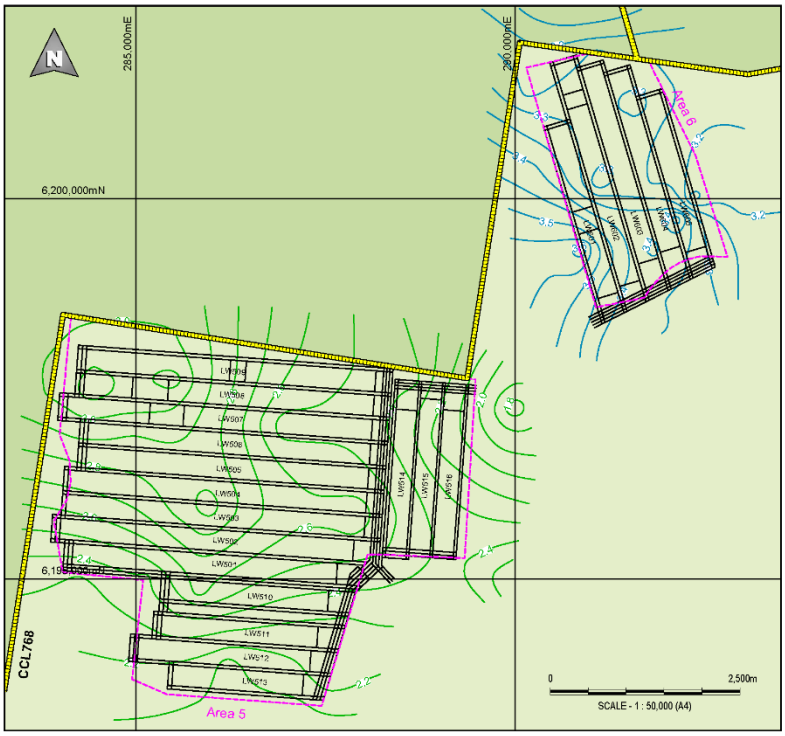

Figure 2.4
275m Mine Layout

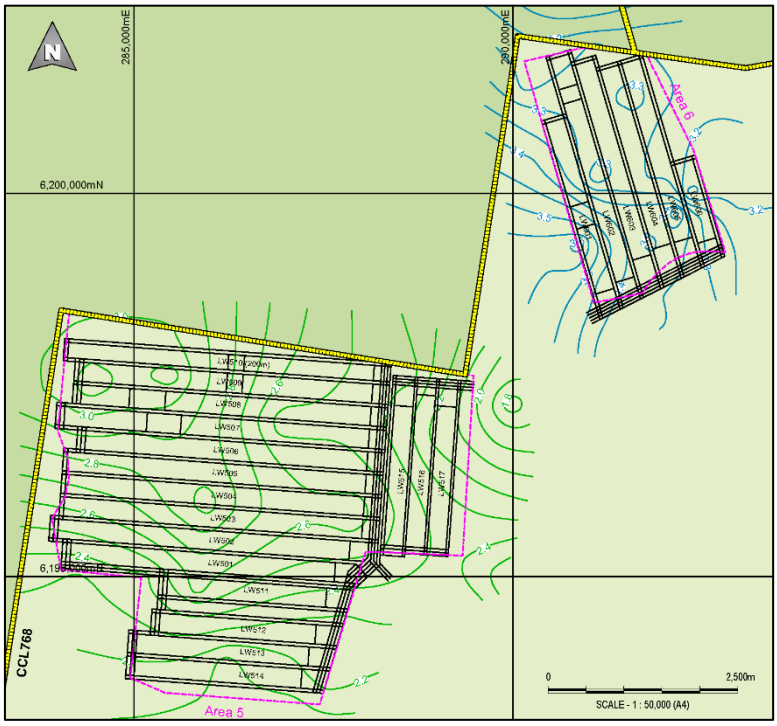

Figure 2.5
250m Mine Layout

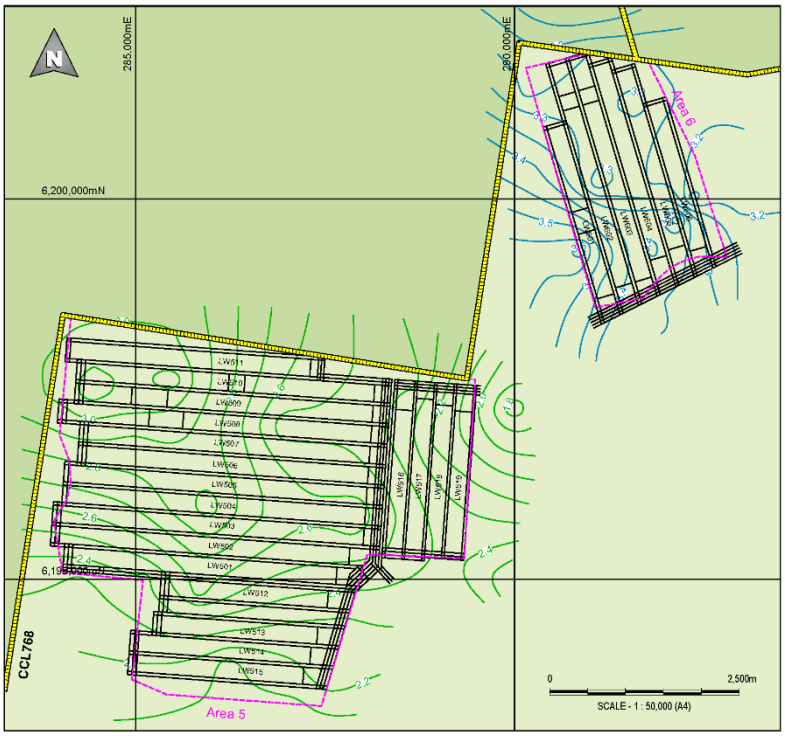

Figure 2.6
225m Mine Layout

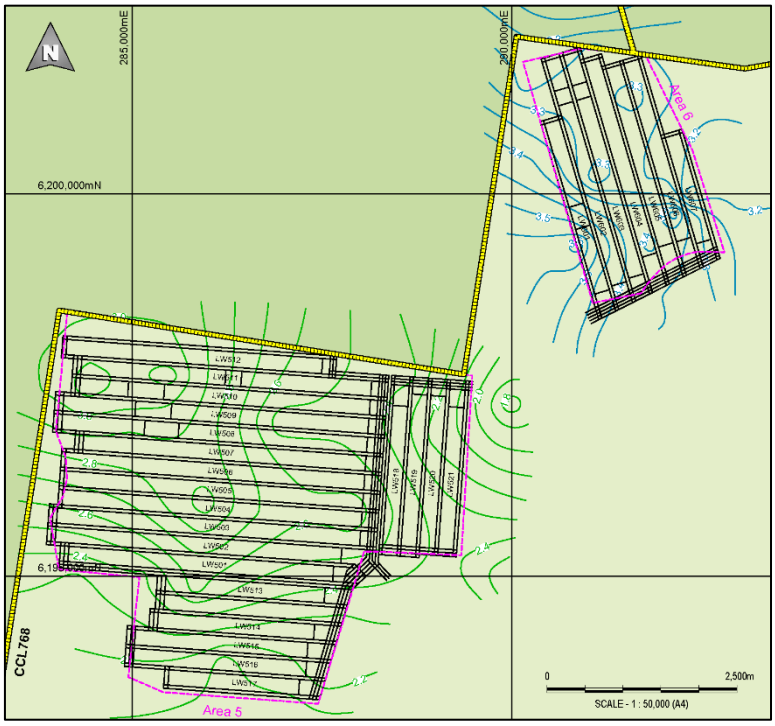

Figure 2.7
200m Mine Layout

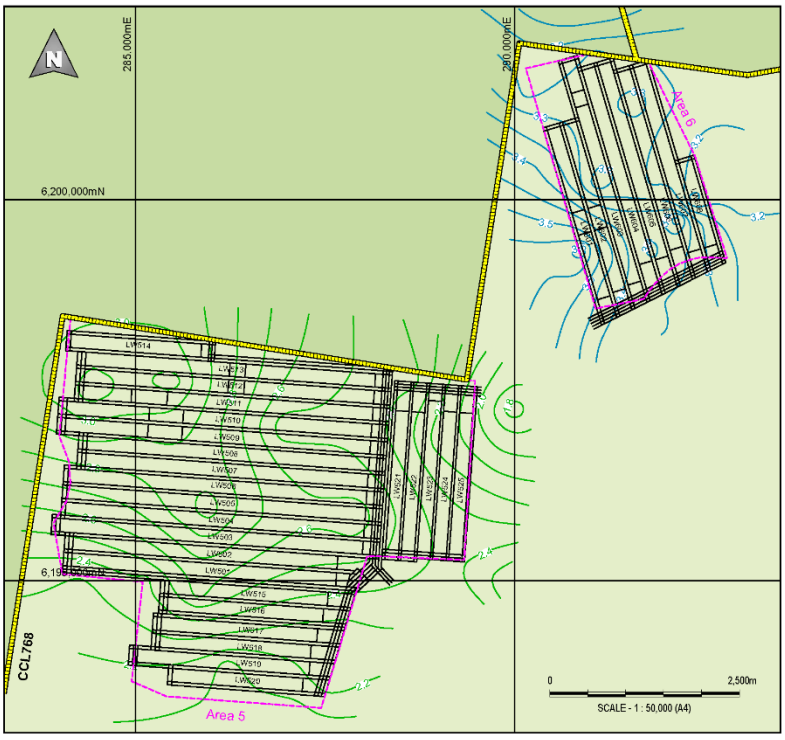

Figure 2.8
175m Mine Layout

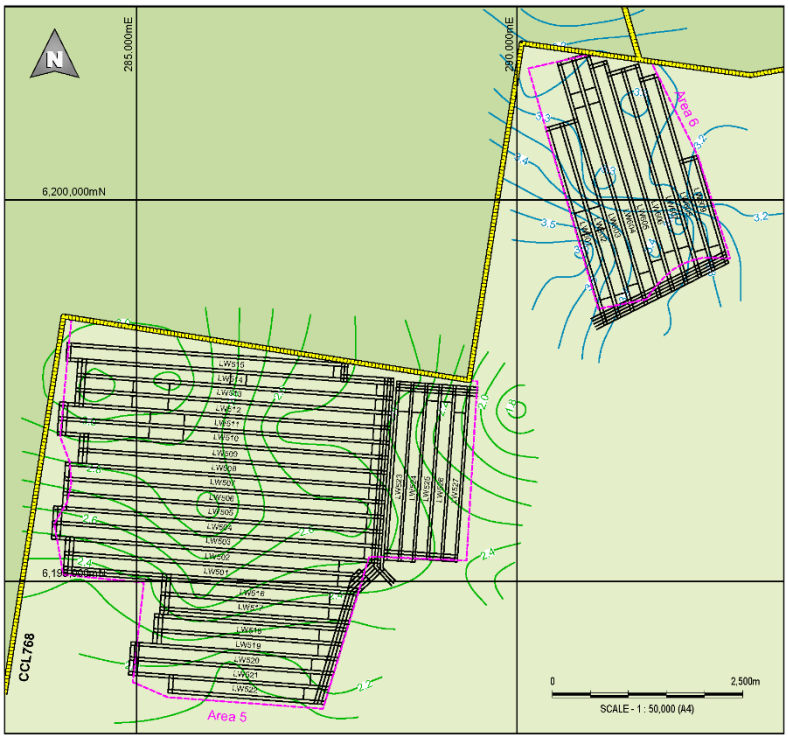

Figure 2.9
150m Mine Layout

2.2 ROM Reserves

The ROM reserves for each layout were calculated using the MineCraft Scheduling Module using first principle assumptions. The results are summarised in Table 2.1.

Table 2.1
ROM Reserves

Parameter	300m	275m	250m	225m	200m	175m	150m
Gateroad Development (km)	190	196	207	228	242	273	294
Main Headings Development (km) *	52	53	53	55	57	62	67
Total Development (km)	242	249	260	283	299	335	361
Development ROM Mt	6.5	6.9	7.1	7.7	8.2	9.1	9.9
Longwall ROM Mt	71.9	69.2	68.2	67.8	66.6	63.9	61.7
Total ROM Mt	78.3	76.0	75.3	75.6	74.7	73.0	71.6
Development Ratio (dev km/LW kt)	3.4	3.6	3.8	4.2	4.5	5.2	5.9

It is noted that the differences between cases are not linear due to the geometry of the panels and ability to efficiently design the mine layout for maximum resource extraction. However a general trend

can be observed with reducing panel width where:

- The number of longwall panels increase (due to narrower width panels);
- The longwall ROM reserve decreases (due to a greater percentage of gateroads);
- The development metres increase (due to a greater amount of gateroads);
- The development ratio increases (due to a combination of the above two points);
- The total ROM reserve reduces (due to a combination of the above points).

2.3 Longwall Productivity

Longwall productivity is measured in terms of tonnes per hour (Actual Operating Rate) and operating hours per week (Operational Availability). The Actual Operating Rate is determined by various items including the LW Nameplate Capacity, cutting height, web depth, cutting method (eg Uni Di, Bi Di), panel width and Process Reduction Factor (measure of human skill and efficiency, and impact of difficult mining conditions).

Panel width impacts upon the longwall productivity as narrower panels reduce the time that the LW is operating at its most productive mode (its main cutting run) as opposed to the lower productive snaking operation (double shuffle at the end of each run). For example the snake distance is around 26m at each gate end, so 52m in total. For a panel width of 300m, this leaves 248m for the main, high productive cutting run. For a panel width of 150m, this reduces to 98m for the main cutting run.

Table 2.2
Longwall Productivity KPI's – Current Operation – Uni Di at 3.9m Extraction

Parameter	Value	Basis
LW Nameplate Capacity	3,000tph	Assumed
Panel width (centres)	300m	EIS Study
Cutting Height	3.9m	EIS Study
Cutting Web	0.8m	Internal database
Drum Diameter	2.3m	Assumed, industry typical
AFC Pan Width	1.75m	Internal database
Snake Length	26m	Assumed, industry typical
Operating Mode	Uni Di	Assumed
Process Cycle Capacity	2,170tph	Calculated
Actual Operating Rate	1,410tph	Calculated from PRF
PRF	65%	Assumed, industry typical for Illawarra style conditions
Planned Operating Hours per Week	120	Assumed, industry typical
Actual Operating Hours per Week	67	Calculated from availability
Operational Availability	56%	Assumed, industry typical for Illawarra style conditions
Weekly Production	94,870t/wk	Calculated
Longwall Move Duration	7 weeks	Assumed, industry typical, includes bolt up, ramp up

A Dendrobium longwall model was created using the data shown in Table 2.2 and calibrated to the typical 2017 monthly performances of around 410kt per month (source NSW Coal Services). The kpi's from this model calculate to a weekly productivity of 94,870 tonnes per week in Uni Di mode, or 101,140 tonnes per week in Bi Di mode.

2.3.1 Bulli Seam Longwall Productivity

A new longwall system will be required for Area 5 as the Bulli seam is significantly thinner than the current Wongawilli seam. The forecast longwall productivity has been estimated adopting similar kpi's as shown in Table 2.2 however with key differences:

- 2.8m extraction thickness;
- 1.0m web;
- Bi Di operation.

The estimated longwall productivities for varying panel widths in the Bulli seam are shown in Table 2.3.

Table 2.3
Longwall Productivity KPI's – Varying Panel Width – Bi Di at 2.8m Extraction

Panel Width (centres)	Process Cycle Capacity (tph)	PRF (%)	Actual Operating Rate (tph)	Actual Operating Hours (hrs/wk)	Weekly Production (tonnes/week)	Weekly Retreat (m)
300m	2,525	59.6	1,505	67	101,140	81
275m	2,490	59.3	1,475	67	99,105	87
250m	2,445	58.9	1,440	67	96,770	93
225m	2,395	58.4	1,400	67	94,050	101
200m	2,335	57.9	1,350	67	90,845	110
175m	2,265	57.2	1,295	67	87,015	121
150m	2,170	56.4	1,225	67	82,355	134

This demonstrates that the impact of reducing panel width:

- Will reduce the Process Cycle Capacity due to the lesser proportion of time spent in the main cutting run;
- Will reduce the PRF for the same reason;
- The combination of the above two will reduce the actual operating rate and (assuming no impact upon the weekly operating hours) will reduce the weekly production rate;
- Will increase the weekly retreat distance which will therefore require increased development.

The general consequences of the last two points will be an increased development ratio (more development required) and an increased LW move frequency. The actual impact of this can be determined by scheduling.

2.4 Production Scheduling

Each panel width scenario was scheduled in order to determine key metrics. The scheduling assumptions are listed in Table 2.4. It is noted that these are assumptions adopted for the review and have been developed from historical production levels as outlined in Section 2.9. The starting dates are arbitrary but for this review have assumed January 2021. The development schedule has been adopted from the EIS which indicates four and a half years of development prior to LW commencement, hence for a Project start date of January 2021, the LW start date will be October 2025.

Table 2.4
Scheduling Assumptions

Parameter	Value
Development Rate	320m/week from 3 dev units (4 x CM's)
Main Headings Rate	80m/week
Gateroad Rate	120m/week
Install Road Rate	80m/week
Panel Flit Delay	2 weeks
Install Panel Belt Delay	4 weeks
Longwall Extraction Rate	As per Table 2.2
Longwall Relocation	7 weeks (includes bolt up and commissioning)
Bulli Seam Yield	83%
Wongawilli Seam Yield	77.7%
Commence development of Access to Area 5	1 January 2021
Start date for Dev 1 & Dev 2 in LW501 main headings	1 January 2023
Start Date for Dev 3 in LW502 maingate	1 August 2023
Start date for LW501	21 October 2025

For each schedule longwall continuity is ensured by maintaining sufficient development units. For example, the 300m case commences with three development units which reduces to two units for a two year period then resumes back to three units in order to develop the tailgate and main headings for Area 6.

The 250m case requires three units all the time. The 200m case requires the introduction of a fourth unit to establish the main headings in Area 5 and then 6, but three units for the remainder.

The 150m case requires four development units for the majority of the time.

The production schedules completed for this review do not include the development of the access corridor to Area 5 or to Area 6. It is assumed this will be capital works carried out in parallel to other mine activities. It is noted that this will likely require the addition of another one or two development units to the mine for periods of time. Additionally, the production schedules for this review do not

include Area 3C. It is noted that the mining sequence outlined in the EIS incorporates the extraction of Area 3C between Area 5 and Area 6. For this review Area 3C is excluded.

As the panel widths reduce, the mine life is progressively extended due to the lower production rate. For each schedule case the entire ROM reserves are extracted with the result the mine life is extended ranging from 20 years (2021 – 2041) to 25 years (2021 – 2046). It is assumed that mine approvals would extend as required.

2.5 Operating Costs

In order to estimate the mine operating costs a generic underground operating cost model has been used. This model is an internal MineCraft model developed over the past twenty years and used for numerous projects. Costs are categorised by major cost and activity centres specific to underground longwall mining. Some costs are variable in nature (roof support consumables), some are fixed costs (eg staff labour) while many are a mixture of fixed and variable.

The model matches the various unit cost drivers to the annual production schedule to derive the annual operating cost. This includes offsite costs for transport, washing, port, marketing charges and royalty payments. It is noted that the royalty payment is driven by the coal sale price.

The unit cost information is considered generic but reflective of the industry. By way of comparison against actual Dendrobium costs, reference is made to the Economic Volume of the EIS (Appendix L, Economic Assessment Section 2.2.4) where site costs are indicated at approximately $300M per annum. This compares to approximately $370m estimated by the MineCraft model. From experience the higher cost is considered valid for this review.

An example of the operating cost breakdown for a typical year is shown in Table 2.5. This is for a 300m panel width, operating in the Bulli seam, with 1.5 longwall moves per year and a sale price of AUD157/t.

Table 2.5
Annual Operating Cost Estimate

Cost Centre	Annual Cost ($M)	Variable Cost ($/t)
Development	$47.5	
Longwall	$27.2	
Longwall Moves and Overhauls	$28.4	
Mining General	$52.7	
Gas Management	$10.3	
Business Support Overheads	$97.5	
Total Pit Top Cost	$263.6	$58.0/t
Coal Washing	$23.6	
Rail Freight	$18.9	
Port, Marketing & Sampling	$19.1	
Royalties	$39.0	
Total FOB Cost	$364.2	$88.7/t
Production Metrics	**Value**	
Development Advance	14,700m	
Total ROM Coal Production	4.5Mt	
Total Saleable Coal	4.1Mt	

3.0 RESULTS

A summary of the seven cases analysed is provided in Appendix A. This includes the annual production physicals and operating cost. Also included are capital expenditure, revenue and taxation. No allowance for depreciation or inflation has been included.

3.1 Capital Expenditure

Capital expenditure is included to the cash flow which is identical for each case in amount. This includes:

- $100M per year for three years to establish Area 5 from 2023;
- $100M per year for three years to establish Area 6 (from 2033);
- $30M per year for all other years.

3.2 Revenue

Revenue has been calculated by assuming a constant sale price for each year and each case. A sale price of USD110 has been applied with a conversion rate of 0.70 AUD/USD (AUD157). This reflects recent prices for Australian export coking coal and assumes all coal is either exported or sold

internally (to BlueScope) at export prices and at a discount to the benchmark premium hard coking coal price. It is noted that this may not reflect actual prices realised by Dendrobium however all cases are treated similarly. It is also noted that coking coal prices fluctuate over the years and this price represents a fairly low price in the cycle.

3.3 Taxation

The cash flow assumes company tax is payable on positive cash flow at a rate of 30%. Also that negative cash flows are accumulated as losses and carried forward until a net positive cash flow is achieved before taxation is applied. A project evaluation is applied whereby only the cash flow from the project is evaluated hence the cash flow from ongoing operations at Dendrobium while the project is being constructed are kept separate. It is noted that this will not reflect reality however is applied for comparative purposes.

3.4 Net Present Value

A NPV calculation is applied to the annual cash flow after tax with a discount rate of 7% for each case. It is noted that the EIS used a discount rate of 7%. The results are shown in Table 3.1.

Table 3.1
Net Present Value – Base Pricing

Panel Width	NPV_7
300m	$667M
275m	$568M
250m	$464M
225m	$368M
200m	$244M
175m	$27M
150m	-$125M

A sensitivity to coal sale pricing is shown in Table 3.2 where the NPV is calculated assuming either a minus 10% or plus 10% price factor (price range of AUD141 to AUD173). As shown, the relativity between NPV values for panel width remains similar.

Table 3.2
Net Present Value – Sensitivity to Pricing

Panel Width	NPV_7 (-10%)	NPV_7	NPV_7 (+10%)
300m	$329M	$667M	$1,002M
275m	$238M	$568M	$897M
250m	$139M	$464M	$785M
225m	$45M	$368M	$687M
200m	-$73M	$244M	$556M
175m	-$304M	$27M	$328M
150m	-$496M	-$125M	$173M
Sale Price	**(-10%)**	**Base**	**(+10%)**
Sale Price USD/t	99	110	121
Sale Price AUD/t	141	157	173

4.0 SPECIFIC WORK SCOPE QUESTIONS

The specific work scope questions as listed in Section 1.1 are discussed as follows.

4.1 Additional Gateroad Development

Reducing the panel width results in more LW panels required to extract the same area. One gateroad is required for each panel (one gateroad consists of two parallel roadways connected by cut throughs at regular spacing, typically 100m apart), hence additional panels results in additional gateroads. The ROM Reserves and related statistics for each alternate panel width are shown in Table 2.1 showing the increase in gateroad development requirements as the panel width decreases. As shown, reducing the panel width from 300m to 275m will require 6km of additional gateroad development. Reducing the panel width from 300m to 150m will require 104km of additional gateroad development. As the panel width reduces, the increased development requirements becomes more of an exponential than linear relationship. Therefore small reductions in width from 300m cause less impact than large reductions.

4.2 Management Of Underground Gas

The impact of panel width on gas management has not been reviewed in detail as the exact gas management practices at Dendrobium have not been provided, hence general comments are made.

Gas management at Dendrobium is undertaken via a combination of capture by gas drainage or dilution by ventilation.

Gas drainage is assumed by inseam drilling methods whereby flanking holes are drilled from gateroads across the future LW panel. In seam drilling costs are part variable and part fixed. As panel widths reduce, the hole lengths will reduce and the ratio between variable cost and fixed cost will change resulting in a general cost increase, the extent of which would need detailed review to determine. Additionally fixed infrastructure requirements such as main lines, valves, etc will increase. Also at some point additional gas drilling crews and drill rigs may be required.

The ventilation requirements for varying panel widths would need detailed review however in general the ventilation requirements will relate to the number of working faces. Where the panel width reduction creates the need for an additional development unit, an increased circuit capacity in the order of 50m^3/s to 70m^3/s could be envisaged. Ventilation simulations would be required to determine the overall impact upon the mine ventilation infrastructure. Possibly new fan and shaft installations would need to be brought in earlier, or worst case, additional shafts and fans. Again small reductions in panel width would be expected to pose a small impact.

4.3 Potential Implications For Continuity Of Mining

Mining continuity refers to the ability for development to advance in front of LW production and have an additional panel fully developed prior to the completion of the current panel. The time difference is termed 'development float'. Ideally development float will be no less than three months, however shorter periods down to one month can be tolerated infrequently. Where the development float reduces to less than a month, longwall continuity will be impacted resulting in a loss of LW production.

Mine scheduling using accurate forecasting is required to manage development float and identify arising situations well in advance so mitigating actions can be applied early. Assuming productivity cannot be instantly increased, the usual solutions are to add additional resources, including Contract labour and equipment.

For this review, additional resources have been applied to ensure LW continuity for each panel width case. As development float increased to over 12 months, these resources would then be reduced. The required number of annual development faces for each case is shown in the production profiles (Appendix A).

4.4 Changes in Total Coal Recovery

The changes in total coal recovery for each case are shown in Table 2.1. As shown, reducing the panel width from 300m to 150m reduces recovery from 78.3Mt to 71.6Mt. This recovery assumes mine approvals are extended to suit the life of the reserve. If the mine was restricted to 20 years then the recovery from the 150m panel width case would reduce to 57Mt.

4.5 Changes in the Project's Rate of Return on Capital

The comparative NPV for the project at reducing panel widths is shown in Table 3.1. As shown the NPV reduces with reducing panel width primarily due to the reduced revenue from reduced production. While operating costs increase with the increased development requirement they are generally offset by reduced coal washing, distribution and royalty costs from the reduced production. Again small reductions in panel width from the proposed 300m appear to present smaller NPV reductions, increasing with large reductions in panel width.

4.6 Changes in the Income to the State of NSW

Royalty payments to the State of NSW are related to coal price and saleable production. The calculated cumulative royalty payment for each case is shown in Table 4.1. This is based on a royalty rate of 6.2% less a discount for coal washing at $3.50/t.

Table 4.1
Coal Royalties

Panel Width	Cumulative Sales	Cumulative Royalty	Royalty NPV
300m	66.0Mt	$626M	$305M
275m	64.0Mt	$608M	$298M
250m	63.4Mt	$602M	$292M
225m	63.7Mt	$604M	$289M
200m	63.0Mt	$597M	$281M
175m	61.5Mt	$584M	$269M
150m	60.3Mt	$572M	$260M

4.7 Potential to Increase or Reduce Mining Height

The Wongawilli seam is reported in the EIS as between 9m and 11m in thickness. Currently the basal section is extracted ranging between 3.7m and 4.0m, typically 3.9m. The information suggests Area 6 will be extracted at 3.9m however the basal section contours indicate a thickness of 3.2m to 3.6m in Area 6.

Several factors will impact the selection of extraction height including coal quality, presence of seam plies and partings, coking qualities, strata competence (coal, roof and floor) and mining equipment. Subject to a review of full seam thickness in Area 6, the possible extraction range may extend from 3.2m to 9m or 11m. The current LW equipment can extract up to 4.5m. New equipment could possibly extract up to 5m (highest extraction in Australia) while alternate mining methods (eg top coal caving) could extract the full seam up to 9m or 11m.

Further information would be required in order to review this in more detail.

5.0 CONCLUSION AND COMMENTS

5.1 Conclusion

In conclusion this review has found that reducing panel widths would impact upon the following aspects of the proposed project:

- The longwall productivity is predicted to reduce as the shearer spends less time in its most productive cutting cycle. Weekly production is estimated to reduce between 2% and 5% for every 25m reduction in panel width (increasing impact with reducing panel width to 150m);
- The number of longwall panels will increase which increases the development requirement;
- The amount of coal contained in each panel will reduce thus enabling a faster panel extraction. This will both increase the frequency of LW moves (leading to less annual production) and increase the development requirement;
- These issues will result in a reduced annual production and reduced saleable production leading to reduced revenue;
- The development costs will increase however they are predicted to be generally offset by reduced coal handling, distribution and royalty costs (due to reduced volumes) resulting in operating costs remaining approximately constant albeit with reducing revenues;
- The net impact is a reduced cash flow, reflected by reducing project NPVs (increasing impact with reducing panel width to 150m);
- Depending upon the sales price forecast, panel widths less than 200m could lead to negative NPV values.

It is highlighted that the absolute NPV values shown in this report are not expected to be a reflection of the actual Project NPV as the information used is not sufficiently precise. Rather they are used to demonstrate a comparison between options for various longwall panel widths.

5.2 Comments

The following aspects are considered additional factors relating to the review and are mentioned for completeness.

5.2.1 Costs

The evaluation does not incorporate any capital costs for additional development or drilling equipment, or any additional operating costs for hire equipment, or surface infrastructure costs associated with increased manning levels at the site.

The evaluation does not incorporate increased gas drainage or ventilation costs that may be caused by reducing panel widths and increased development activities.

5.2.2 Sensitivity to Capex

In order to indicate the sensitivity to capital expenditure the capex in year three was increased from $100m to $200m. The NPV impact is shown in Table 5.1.

Table 5.1
Net Present Value – Capex Sensitivity

Panel Width	NPV Base Case Capex	NPV +$100M Capex
300m	$667M	$604M
275m	$568M	$505M
250m	$464M	$401M
225m	$368M	$305M
200m	$244M	$180M
175m	$27M	-$39M
150m	-$125M	-$198M

5.2.3 Sale Pricing

The review does not incorporate any contractual supply agreements that Dendrobium may have with BlueScope or others that may impact upon the average sale price.

5.2.4 Productivity Improvement

The review does not incorporate any productivity improvements over current performance. It is noted that several other Australian LW mines produce at elevated levels to Dendrobium (at varying panel widths including 150m) however it is considered that Dendrobium's productivity is constrained by their unique circumstances. Therefore it is assumed that any productivity improvements would impact all panel width cases equally.

The review assumes the current operation is generally unconstrained by surface coal handling and rail loading restrictions and that the LW operates to its nameplate capacity.

5.2.5 Life of Mine

The mine life is shown to vary according to the panel width and respective productivity to between 20 and 25 years. It is assumed mine approvals would extend to suit. If this was not the case and the mine was restricted to operate to a finite period then this would impact negatively upon the project NPV for narrower width panels.

5.2.6 Varying Panel Widths

Due to the various mine constraints and geometry of the resource, certain panel width configurations could result in either increased or decreased resource recovery. In certain situations the use of

variable panel widths for some panels may assist increase resource recovery. Panel widths can generally be decreased incrementally by the width of an AFC pan (1.75m) if required for a special purpose. Some additional costs may be incurred due to cabling and hosing changes, etc. However it is not considered good practice to constantly change panel widths as this will lead to operational and systems changes (work procedures, training, etc). However occasionally reduced panel widths could be tolerated, for example at the end of a domain or to fit around a dyke, etc.

5.2.7 Additional Information

The following information could be sought and used to further inform on the Project's proposed mine plan as certain aspects may have a material impact upon the project economics and or pose major constraints:

- Production constraints. Information detailing the main constraints to production, i.e. face conditions (gas, water, labour, structure), conveyor issues, stockpile issues, train issues, their main causes and what measures could be used to reduce their impact;
- Seam gas content, gas drainage plans, proposed methods, predicted constraints;
- Surface infrastructure constraints relating to increased workforce.

APPENDICES

Appendix No.	Description
A	Economic Analysis Summary Tables
B	Glossary and Abbreviations

Appendix A

Economic Analysis Summary Tables

MINECRAFT CONSULTING PTY LTD
VALUATION MODEL - OPERATING COST
K2001 - Dendrobium Extension Review

		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	TOTAL
Output Tab	300m																											
Dev m		10.8	17.6	16.4	15.4	15.5	16.1	15.1	15.4	15.0	9.9	10.7	11.5	15.6	16.7	15.6	12.3	9.7	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	242
Dev t		0.3	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6
LW t		0.0	0.0	0.8	4.4	4.5	4.5	4.5	4.5	3.8	3.9	4.3	4.0	3.8	3.8	3.8	3.9	3.9	4.5	4.5	4.5	0.2	0.0	0.0	0.0	0.0	0.0	72
LW Moves		0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	1.3	1.8	2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	26
ROM t		0.3	0.5	1.2	4.8	4.9	4.9	4.9	4.9	4.3	4.1	4.6	4.3	4.2	4.2	4.3	4.2	4.1	4.6	4.5	4.5	0.2	0.0	0.0	0.0	0.0	0.0	78
Product t		0.3	0.4	1.1	4.1	4.2	4.2	4.2	4.2	3.6	3.5	4.0	3.7	3.6	3.6	3.6	3.5	3.3	3.7	3.6	3.6	0.1	0.0	0.0	0.0	0.0	0.0	66.0
No Dev Units		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.78
Opex		216	230	261	368	370	371	371	372	373	351	352	368	374	374	375	366	347	329	238	193	41	0	0	0	0	0	6,639
Revenue		41	65	166	645	656	658	655	656	573	554	621	582	570	566	570	547	520	575	567	567	20	0	0	0	0	0	10,374
Royalties		2	4	10	39	40	40	40	40	35	33	38	35	34	34	34	33	31	35	34	34	1	0	0	0	0	0	626
Capex		100	100	100	30	30	30	30	30	30	30	100	100	100	30	30	30	30	30	30	10	0	0	0	0	0	0	1,000
Cash Flow Before Tax		-275	-265	-195	247	256	257	254	254	169	173	170	114	96	162	166	151	143	217	298	364	-21	0	0	0	0	0	2,735
Cum Cash Flow		-275	-539	-734	-487	-231	25	254	254	169	173	170	114	96	162	166	151	143	217	298	364	-21	-21	-21	-21	-21	-21	
Tax Payable	30%	0	0	0	0	0	8	76	76	51	52	51	34	29	49	50	45	43	65	90	109	0	0	0	0	0	0	827
Cash Flow After Tax		-275	-265	-195	247	256	249	178	178	118	121	119	80	67	113	116	106	100	152	209	255	-21	0	0	0	0	0	1,908
NPV before Tax	7%		**1,007**																									
NPV after Tax	7%		**667**																									

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		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	TOTAL
Output Tab	275m																											
Dev m		10.7	16.9	16.1	15.2	15.4	15.2	14.9	15.5	15.1	13.7	15.6	11.7	10.4	14.3	16.0	9.7	10.0	8.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	250
Dev t		0.3	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.3	0.3	0.4	0.4	0.3	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7
LW t		0.0	0.0	0.8	4.3	4.4	4.4	4.4	4.4	3.8	3.8	4.0	3.9	3.9	3.8	3.8	3.8	3.8	4.4	4.4	3.4	0.0	0.0	0.0	0.0	0.0	0.0	69
LW Moves		0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	1.5	1.8	1.7	2.0	2.0	2.0	2.0	1.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	26
ROM t		0.3	0.5	1.2	4.7	4.8	4.8	4.8	4.8	4.2	4.1	4.5	4.2	4.3	4.2	4.2	4.0	4.0	4.6	4.5	3.4	0.0	0.0	0.0	0.0	0.0	0.0	76
Product t		0.3	0.4	1.0	4.0	4.1	4.1	4.1	4.1	3.6	3.6	3.9	3.6	3.6	3.6	3.6	3.3	3.2	3.7	3.6	2.8	0.0	0.0	0.0	0.0	0.0	0.0	64.1
No Dev Units		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0	3.0	3.0	2.0	2.0	2.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.78
Opex		215	228	260	366	368	368	369	370	372	370	373	367	351	372	375	345	345	338	318	231	19	0	0	0	0	0	6,719
Revenue		41	62	163	635	643	642	642	644	563	558	606	571	573	559	564	514	509	577	567	435	0	0	0	0	0	0	10,069
Royalties		2	4	10	38	39	39	39	39	34	34	37	34	35	34	34	31	31	35	34	26	0	0	0	0	0	0	608
Capex		100	100	100	30	30	30	30	30	30	30	30	100	100	100	30	30	30	30	30	30	10	0	0	0	0	0	1,030
Cash Flow Before Tax		-275	-266	-197	239	245	245	243	244	161	158	203	105	122	88	160	140	134	209	219	174	-29	0	0	0	0	0	2,320
Cum Cash Flow		-275	-540	-737	-499	-253	-8	235	244	161	158	203	105	122	88	160	140	134	209	219	174	-29	-29	-29	-29	-29	-29	
Tax Payable	30%	0	0	0	0	0	0	70	73	48	47	61	31	37	26	48	42	40	63	66	52	0	0	0	0	0	0	705
Cash Flow After Tax		-275	-266	-197	239	245	245	173	171	112	111	142	73	85	61	112	98	94	146	154	121	-29	0	0	0	0	0	1,615
NPV before Tax	7%		**867**																									
NPV after Tax	7%		**568**																									

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VALUATION MODEL - OPERATING COST
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		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	TOTAL
Output Tab	250m																											
Dev m		10.7	17.1	16.0	15.2	15.0	15.3	15.4	15.2	13.8	12.3	14.7	15.5	16.0	15.0	17.6	14.0	14.5	5.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	260
Dev t		0.3	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.5	0.5	0.4	0.5	0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7
LW t		0.0	0.0	0.8	4.2	4.3	4.3	4.3	4.3	3.7	3.4	3.6	3.5	3.7	4.1	3.5	3.5	3.7	4.3	4.3	3.7	1.5	0.0	0.0	0.0	0.0	0.0	68
LW Moves		0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	2.0	2.5	2.2	2.3	2.0	1.3	2.3	2.4	2.0	1.0	1.0	2.0	1.0	0.0	0.0	0.0	0.0	0.0	29
ROM t		0.3	0.5	1.2	4.6	4.7	4.7	4.7	4.7	4.0	3.7	4.0	4.0	4.1	4.5	3.9	3.8	4.1	4.4	4.3	3.7	1.5	0.0	0.0	0.0	0.0	0.0	75.3
Product t		0.3	0.4	1.0	4.0	4.0	4.0	4.0	4.0	3.5	3.2	3.4	3.4	3.5	3.8	3.4	3.2	3.3	3.5	3.4	3.0	1.2	0.0	0.0	0.0	0.0	0.0	63.4
No Dev Units		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.79
Opex		215	228	259	364	365	366	367	368	369	368	372	373	374	367	376	367	364	319	312	237	175	0	0	0	0	0	6,907
Revenue		41	63	160	623	628	629	630	628	545	502	535	532	557	601	528	498	512	555	542	464	192	0	0	0	0	0	9,966
Royalties		2	4	10	38	38	38	38	38	33	30	32	32	34	36	32	30	31	33	33	28	12	0	0	0	0	0	602
Capex		100	100	100	30	30	30	30	30	30	30	30	100	100	100	30	30	30	30	30	30	10	0	0	0	0	0	1,030
Cash Flow Before Tax		-274	-265	-199	229	233	233	232	230	146	104	133	59	83	134	122	102	118	206	200	197	6	0	0	0	0	0	2,029
Cum Cash Flow		-274	-539	-738	-509	-276	-43	189	230	146	104	133	59	83	134	122	102	118	206	200	197	6	0	0	0	0	0	
Tax Payable	30%	0	0	0	0	0	0	57	69	44	31	40	18	25	40	36	31	36	62	60	59	2	0	0	0	0	0	609
Cash Flow After Tax		-274	-265	-199	229	233	233	175	161	103	73	93	41	58	94	85	71	83	144	140	138	4	0	0	0	0	0	1,421
NPV before Tax	7%		**718**																									
NPV after Tax	7%		**464**																									

MINECRAFT CONSULTING PTY LTD
VALUATION MODEL - OPERATING COST
K2001 - Dendrobium Extension Review

		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	TOTAL
Output Tab	225m																											
Dev m		10.5	21.1	16.4	16.9	14.4	16.1	15.1	15.4	14.9	13.0	16.0	14.8	15.1	16.7	14.5	14.8	15.5	13.0	5.5	2.9	0.0	0.0	0.0	0.0	0.0	0.0	283
Dev t		0.3	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	8
LW t		0.0	0.0	0.7	4.1	4.1	4.1	3.6	4.1	3.6	3.6	3.6	3.8	3.4	3.9	3.2	3.6	3.0	3.6	4.1	4.1	3.5	0.0	0.0	0.0	0.0	0.0	68
LW Moves		0.0	0.0	0.0	1.0	1.0	1.0	2.0	1.0	2.0	2.0	2.0	1.6	2.3	1.4	2.7	2.0	3.0	2.0	1.0	1.0	2.0	0.0	0.0	0.0	0.0	0.0	31
ROM t		0.3	0.6	1.2	4.6	4.5	4.6	4.0	4.6	4.0	3.9	4.0	4.2	3.9	4.4	3.6	4.0	3.4	3.9	4.3	4.2	3.5	0.0	0.0	0.0	0.0	0.0	75.6
Product t		0.3	0.5	1.0	3.9	3.9	3.9	3.4	3.9	3.4	3.4	3.4	3.6	3.3	3.8	3.1	3.4	2.7	3.1	3.4	3.4	2.8	0.0	0.0	0.0	0.0	0.0	63.7
No Dev Units		3.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	2.95
Opex		214	250	259	366	363	365	368	365	368	365	371	367	372	370	372	367	368	359	317	310	267	0	0	0	0	0	7,122
Revenue		40	78	159	617	609	617	534	614	535	531	540	570	521	591	480	528	431	494	540	532	444	0	0	0	0	0	10,005
Royalties		2	5	10	37	37	37	32	37	32	32	33	34	31	36	29	32	26	30	33	32	27	0	0	0	0	0	604
Capex		100	100	100	30	30	30	30	30	30	30	100	100	100	30	30	30	30	30	30	30	30	30	10	0	0	0	1,090
Cash Flow Before Tax		-275	-272	-200	221	216	222	136	219	137	136	70	103	49	190	78	131	33	105	193	192	147	-30	-10	0	0	0	1,792
Cum Cash Flow		-275	-547	-746	-525	-308	-87	50	219	137	136	70	103	49	190	78	131	33	105	193	192	147	-30	-40	-40	-40	-40	
Tax Payable	30%	0	0	0	0	0	0	15	66	41	41	21	31	15	57	23	39	10	32	58	58	44	0	0	0	0	0	550
Cash Flow After Tax		-275	-272	-200	221	216	222	121	153	96	95	49	72	34	133	55	91	23	74	135	134	103	-30	-10	0	0	0	1,243
NPV before Tax	7%		**586**																									
NPV after Tax	7%		**368**																									

MINECRAFT CONSULTING PTY LTD
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		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	TOTAL
Output Tab	200m																											
Dev m		10.4	22.0	17.2	17.9	12.9	18.0	14.1	16.5	15.8	12.3	14.8	15.5	14.8	19.4	19.1	16.5	15.8	8.7	10.3	4.1	3.0	0.0	0.0	0.0	0.0	0.0	299
Dev t		0.3	0.6	0.5	0.5	0.4	0.5	0.4	0.4	0.4	0.3	0.4	0.5	0.4	0.6	0.6	0.5	0.4	0.2	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	8
LW t		0.0	0.0	0.7	4.0	3.7	3.7	4.0	4.0	3.3	3.0	3.5	3.5	3.5	3.5	3.1	3.2	3.4	3.2	3.2	4.0	4.0	2.1	0.0	0.0	0.0	0.0	67
LW Moves		0.0	0.0	0.0	1.0	1.5	1.5	1.0	1.0	2.3	2.7	2.0	2.0	2.0	2.0	2.6	2.4	2.1	2.4	2.5	1.0	1.0	2.0	0.0	0.0	0.0	0.0	35
ROM t		0.3	0.6	1.2	4.5	4.1	4.2	4.4	4.4	3.7	3.4	3.9	3.9	3.9	4.0	3.7	3.7	3.8	3.5	3.5	4.1	4.1	2.1	0.0	0.0	0.0	0.0	74.7
Product t		0.3	0.5	1.0	3.8	3.5	3.6	3.7	3.8	3.2	2.9	3.3	3.3	3.3	3.4	3.2	3.1	3.1	2.8	2.8	3.3	3.3	1.7	0.0	0.0	0.0	0.0	63.0
No Dev Units		3.0	4.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	4.0	4.0	3.0	3.0	2.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	2.90
Opex		214	251	274	365	358	367	359	365	367	365	366	368	368	390	392	371	365	338	341	312	287	209	0	0	0	0	7,391
Revenue		40	81	159	601	553	562	588	599	500	458	520	526	524	538	496	490	490	437	437	518	514	262	0	0	0	0	9,894
Royalties		2	5	10	36	33	34	36	36	30	28	31	32	32	33	30	30	30	26	26	31	31	16	0	0	0	0	597
Capex		100	100	100	30	30	30	30	30	30	30	30	100	100	100	30	30	30	30	30	30	10	0	0	0	0	0	1,030
Cash Flow Before Tax		-274	-270	-215	206	165	165	199	204	102	63	125	58	57	49	75	89	94	69	67	176	218	53	0	0	0	0	1,473
Cum Cash Flow		-274	-544	-760	-553	-389	-223	-24	180	102	63	125	58	57	49	75	89	94	69	67	176	218	53	0	0	0	0	
Tax Payable	30%	0	0	0	0	0	0	0	54	31	19	37	17	17	15	22	27	28	21	20	53	65	16	0	0	0	0	442
Cash Flow After Tax		-274	-270	-215	206	165	165	199	150	72	44	87	41	40	34	52	63	66	48	47	123	152	37	0	0	0	0	1,031
NPV before Tax	7%		**411**																									
NPV after Tax	7%		**244**																									

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		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	TOTAL
Output Tab	175m																											
Dev m		10.5	22.0	18.5	18.0	14.8	16.9	14.7	17.2	19.2	18.8	19.8	17.9	15.2	15.5	16.3	16.4	14.3	16.3	9.5	10.5	9.6	3.1	0.0	0.0	0.0	0.0	335
Dev t		0.3	0.6	0.5	0.5	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.4	0.4	0.3	0.3	0.2	0.1	0.0	0.0	0.0	0.0	9
LW t		0.0	0.0	0.2	3.7	3.3	3.8	3.8	3.3	3.3	3.3	2.8	3.3	2.8	3.3	3.1	3.0	3.0	3.1	2.8	3.4	3.8	3.7	1.1	0.0	0.0	0.0	64
LW Moves		0.0	0.0	0.0	1.0	2.0	1.0	1.0	2.0	2.0	2.0	3.0	2.0	3.0	2.0	2.4	2.6	2.6	2.4	2.9	1.9	1.1	1.3	1.7	0.0	0.0	0.0	40
ROM t		0.3	0.6	0.7	4.2	3.7	4.3	4.2	3.8	3.8	3.8	3.3	3.8	3.2	3.8	3.6	3.5	3.4	3.5	3.1	3.6	4.0	3.7	1.1	0.0	0.0	0.0	73.0
Product t		0.3	0.5	0.6	3.6	3.2	3.7	3.6	3.2	3.3	3.3	2.9	3.3	2.8	3.2	3.1	3.0	2.9	2.8	2.5	2.9	3.2	3.0	0.9	0.0	0.0	0.0	61.5
No Dev Units		3.0	4.0	4.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	3.24
Opex		213	251	264	358	361	360	357	380	386	384	393	383	370	366	369	370	366	363	352	335	309	271	109	0	0	0	7,671
Revenue		40	81	96	565	499	576	568	506	514	516	448	513	434	507	480	465	449	443	388	460	507	473	143	0	0	0	9,670
Royalties		2	5	6	34	30	35	34	31	31	31	27	31	26	31	29	28	27	27	23	28	31	29	9	0	0	0	584
Capex		100	100	100	30	30	30	30	30	30	30	100	100	100	30	30	30	30	30	30	30	30	30	10	0	0	0	1,090
Cash Flow Before Tax		-274	-270	-269	177	108	185	182	96	98	101	-45	30	-36	111	81	65	54	50	5	94	167	172	24	0	0	0	909
Cum Cash Flow		-274	-543	-812	-634	-526	-341	-159	-63	36	101	-45	-15	-50	61	81	65	54	50	5	94	167	172	24	0	0	0	
Tax Payable	30%	0	0	0	0	0	0	0	0	11	30	0	0	0	18	24	20	16	15	2	28	50	52	7	0	0	0	273
Cash Flow After Tax		-274	-270	-269	177	108	185	182	96	88	71	-45	30	-36	93	56	46	37	35	4	66	117	120	16	0	0	0	636
NPV before Tax	7%		**113**																									
NPV after Tax	7%		**27**																									

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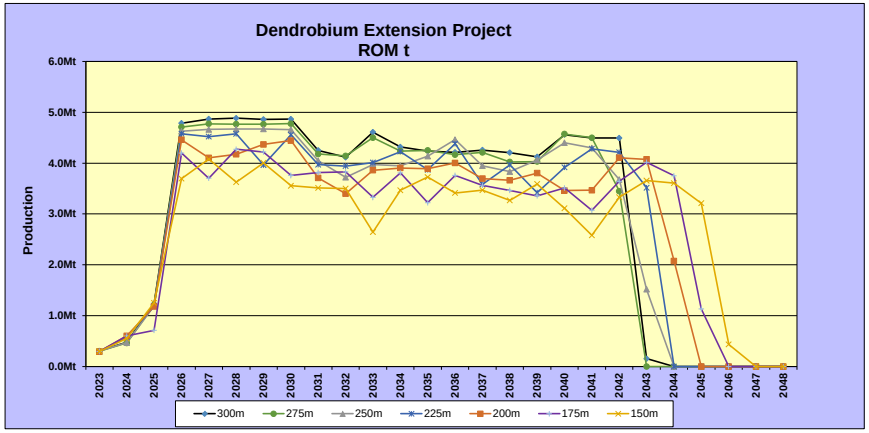
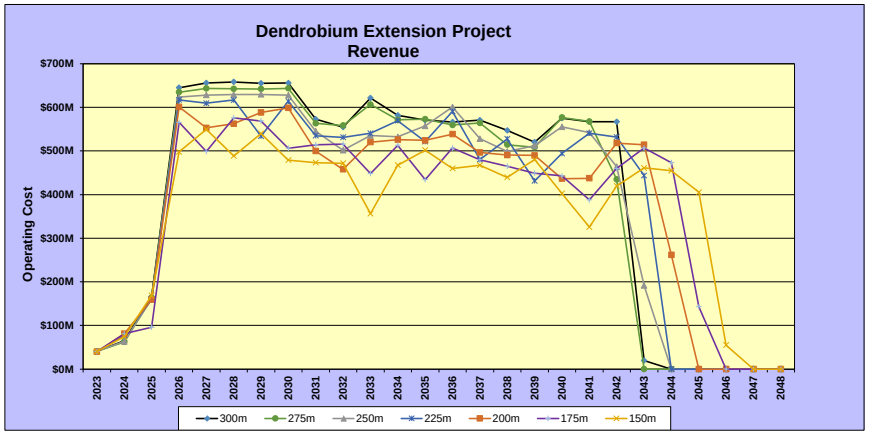
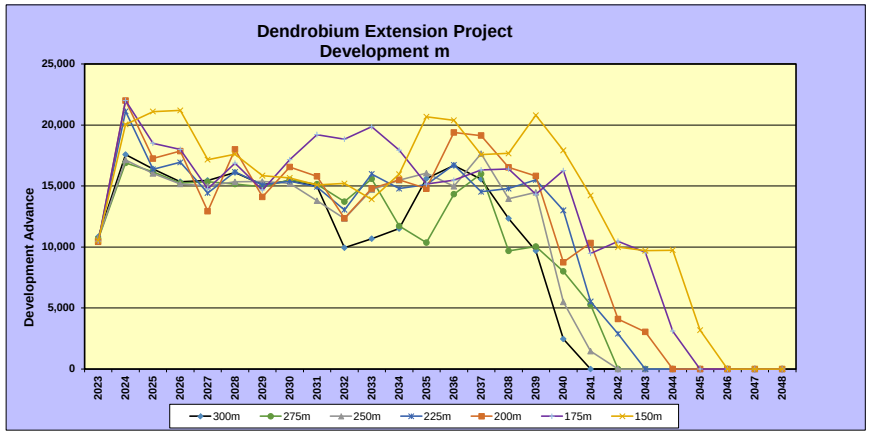
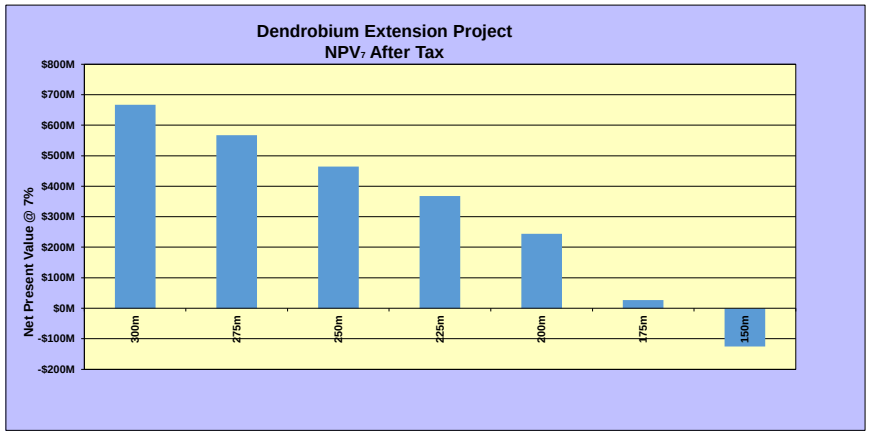
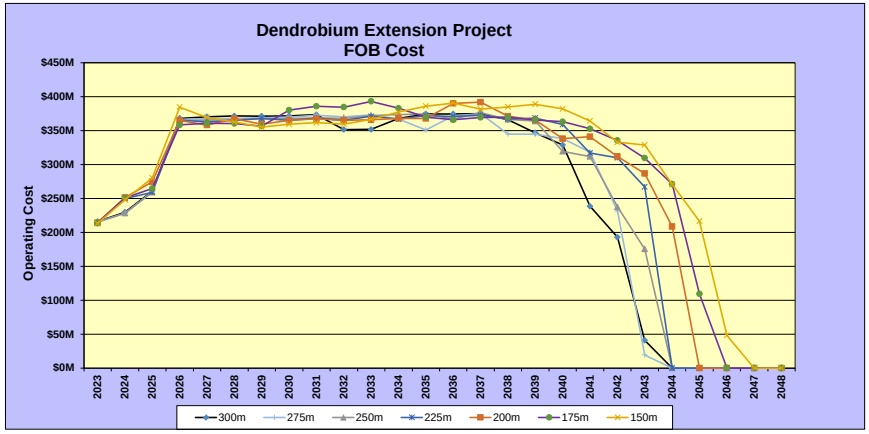
		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	TOTAL
Output Tab	150m																											
Dev m		10.5	20.1	21.1	21.2	17.2	17.6	15.8	15.7	15.1	15.2	13.9	16.0	20.7	20.4	17.6	17.7	20.8	17.9	14.2	10.0	9.7	9.7	3.2	0.0	0.0	0.0	361
Dev t		0.3	0.6	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.6	0.6	0.5	0.5	0.6	0.5	0.4	0.3	0.3	0.3	0.1	0.0	0.0	0.0	10
LW t		0.0	0.0	0.7	3.1	3.6	3.2	3.6	3.1	3.1	3.1	2.3	3.0	3.1	2.8	3.0	2.8	3.0	2.6	2.2	3.1	3.4	3.4	3.1	0.4	0.0	0.0	62
LW Moves		0.0	0.0	0.0	2.0	1.0	1.9	1.1	2.0	2.0	2.1	3.7	2.2	2.0	2.7	2.3	2.8	2.2	3.0	3.9	2.1	1.5	1.5	2.0	1.0	0.0	0.0	45
ROM t		0.3	0.6	1.3	3.7	4.1	3.6	4.0	3.6	3.5	3.5	2.6	3.5	3.7	3.4	3.5	3.3	3.6	3.1	2.6	3.3	3.7	3.6	3.2	0.4	0.0	0.0	71.6
Product t		0.3	0.5	1.1	3.2	3.5	3.1	3.4	3.0	3.0	3.0	2.3	3.0	3.2	2.9	3.0	2.8	3.1	2.6	2.1	2.7	2.9	2.9	2.6	0.4	0.0	0.0	60.3
No Dev Units		3.0	4.0	4.0	4.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2.0	2.0	2.0	2.0	0.0	0.0	0.0	3.30
Opex		213	248	280	384	369	362	355	359	362	359	367	377	386	390	382	385	389	382	364	333	329	270	216	48	0	0	7,910
Revenue		40	74	169	498	549	488	540	479	473	472	356	467	502	460	467	440	481	402	325	420	461	455	405	55	0	0	9,480
Royalties		2	4	10	30	33	29	33	29	29	28	22	28	30	28	28	27	29	24	20	25	28	27	24	3	0	0	572
Capex		100	100	100	30	30	30	30	30	30	30	100	100	100	30	30	30	30	30	30	30	30	30	10	0	0	0	1,090
Cash Flow Before Tax		-273	-274	-211	84	150	96	155	90	82	82	-110	-10	16	40	56	25	62	-9	-69	57	102	155	179	7	0	0	480
Cum Cash Flow		-273	-546	-758	-674	-524	-428	-273	-183	-102	-19	-130	-139	-124	-84	-28	-4	58	-9	-78	-21	81	155	179	7	0	0	
Tax Payable	30%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	24	46	54	2	0	0	144
Cash Flow After Tax		-273	-274	-211	84	150	96	155	90	82	82	-110	-10	16	40	56	25	44	-9	-69	57	78	108	125	5	0	0	336
NPV before Tax	7%		**-92**																									
NPV after Tax	7%		**-125**																									


Dendrobium Extension Project
ROM t
Production
6.0Mt
5.0Mt
4.0Mt
3.0Mt
2.0Mt
1.0Mt
0.0Mt
2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048
300m 275m 250m 225m 200m 175m 150m


Dendrobium Extension Project
Revenue
Operating Cost
$700M
$600M
$500M
$400M
$300M
$200M
$100M
$0M
2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048
300m 275m 250m 225m 200m 175m 150m


Dendrobium Extension Project
Development m
Development Advance
25,000
20,000
15,000
10,000
5,000
0
2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048
300m 275m 250m 225m 200m 175m 150m


Dendrobium Extension Project
NPV7 After Tax
Net Present Value @ 7%
$800M
$700M
$600M
$500M
$400M
$300M
$200M
$100M
$0M
-$100M
-$200M
300m 275m 250m 225m 200m 175m 150m


Dendrobium Extension Project
FOB Cost
Operating Cost
$450M
$400M
$350M
$300M
$250M
$200M
$150M
$100M
$50M
$0M
2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048
300m 275m 250m 225m 200m 175m 150m

Appendix B

Glossary and Abbreviations

Actual Operating Rate	LW output in tph measured as an average
AFC	Longwall Armoured Face Conveyor – Chain conveyor
AUD	Australian dollars
Average Capacity	The average tonnes per hour rate as measured over an extended period (shifts, weeks, months, etc) of longwall operating time.
Bi Di	Bi directional cut. Refers to LW cutting mode where the entire seam is cut during each run from gate end to gate end. Most common mode of operation in Australia
Centre distance	Distance between roadway centrelines
CM	Continuous Miner
Development	Term for the construction of underground roadways
Development float	Time difference between the completion of development of a longwall panel and the commencement of longwall extraction. If the float is negative (i.e. development is not completed in time), then the LW must wait (i.e. production loss).
EIS	Environmental Impact Statement
Gateroad	Term for the roadways that 'block out' a longwall panel. Each gateroad consists of two parallel roadways connected by cut throughs at regular spacing, typically 100m apart. At the end of each gateroad, another road – called the Installation Road, will be driven perpendicular to join to the adjacent gateroad thus completely 'blocking out' the LW panel,
Goaf	Area of collapsed roof behind the LW face
Kpi's	Key performance indicators
LW	Longwall
Longwall Nameplate Capacity	The average tonnes per hour rate discharged from the longwall armoured face conveyor whilst the shearer is producing at its design capacity. Measured during the period when the shearer is traversing 80% of the longwall face length on the main cutting run. (Between snakes)
Longwall Process Cycle Capacity	The average tonnes per hour rate discharged from the armoured face conveyor as measured over a complete shearer cutting cycle.
Maingate	Term for the gateroad that houses the LW conveyor and serves as the main access into the LW panel
NPV	Net Present Value
PRF	Process Reduction Factor. Measure of efficiency and reflects the percentage that the LW is operated at its Process Cycle Capacity.
ROM Reserves	The calculated tonnage of ROM coal contained within the mine plan. This is not the same as JORC Reserves for which a strict definition and reporting method is required.
ROM	Run of Mine. Refers to the coal mined and conveyed out of the mine and will be a blend of coal, stone dilution and moisture.
Snake	Describes the method of advancing the AFC at the gate ends. The AFC is routinely pushed forward behind the shearer forming a 'snake' at the gate end (curve in the AFC) which requires a double shuffle movement of the shearer in order to straighten out. This is results in lower productivity during this activity.
Tailgate	Term for the gateroad on the opposite side of the LW panel to the maingate. The tailgate generally handles the exhaust air from the panel.
tph	Capacity - Tonnes per Hour
Uni Di	Uni directional cut. Refers to LW cutting mode where only a portion of the entire seam is cut during each run from gate end to gate end, hence takes two runs to extract the full seam height. This cutting mode commonly used in difficult conditions.
USD	United States dollars
Web	Thickness of coal cut by one pass of the LW shearer. Generally between 0.8m and 1.0m
$	Australian dollars