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Draft Report

Estimation of Rehabilitation Costs

AUSTRALIA

Yallourn Mine

19 August 2015
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Prepared for:
Department of Economic Development, Job, Transport and Resources

Prepared by URS Australia Pty Ltd

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TABLE OF CONTENTS

TABLES

CHARTS

APPENDICES

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ABBREVIATIONS

Abbreviation	Description
AMD	Acid Mine Drainage
BPEM	Best Practice Environmental Management
BWE	Bulk Water Entitlement
DEDJTR	Department of Economic Development, Jobs, Transport and Resources
DPI	Department of Primary Industries
EOD	External Overburden Dump
ERR	Earth Resources Regulation
ET	Evapotranspiration
Ha	Hectare
mAHD	Metres above Australian Height Datum
MRSDA	Mineral Resources (Sustainable Development) Act 1990
MT	Metric Tonnes
NPV	Net Present Value
PS	Power Station
RCB	Raw Coal Bunker
RL	Reduced Level
SECV	State Electricity Commission Victoria
URS	URS Australia Pty Ltd
YM	Yallourn Mine

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1 INTRODUCTION

Earth Resources Regulation (**ERR**), from the Department of Economic Development, Jobs, Transport and Resources (**DEDJTR**), engaged URS Australia Pty Ltd (**URS**) in March 2015 to provide an estimate of the rehabilitation (closure) costs for EnergyAustralia Yallourn Pty Ltd's Yallourn Mine (**YM**).

1.1 Aims and Objectives

The aim and objectives of the URS scope of works are:

- Provide an independent estimate of cost for closure based on the approved work plan and assumptions provided by ERR;
- Provide general advice to ERR to determine whether the existing Rehabilitation Bond lodged by the licence holder is appropriate to cover the cost of rehabilitation in accordance with the approved mine rehabilitation plan; and
- Support ERR in any negotiation for a change in the Rehabilitation Bond.

1.2 Exclusions

The work undertaken in generating closure costs does not include an assessment as to whether the closure strategy provided is viable or that it provides the best outcome to any of the various stakeholders.

The cost estimates generated herein uses the information contained within the various documents provided and assumes the conclusions and assessments made are valid and will be achieved. Furthermore, the URS brief for this work was a desk top study of the rehabilitation costs and therefore did not include the following:

- Site inspections;
- Discussions with the operator;
- Development of detailed closure data such as designs for final slopes, water quality modelling or closure criteria; and
- Collection of contractor quotations.

The estimate costs have been largely based on URS experience and judgement, as well as rates included in the ERR rehabilitation bond calculator. In some instances individual cost estimates have been provided to URS by ERR for specific closure related activities.

This estimate of closure costs is limited to areas within the current MIN and therefore excludes any power station or other operations or activities located outside the MIN.

It is also important to note that for the closure concepts costed URS has not considered the cumulative impacts or risks of the other Latrobe Valley coal mines closing at the same time and how this might impact concept and thus costs.

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2 SCOPE OF WORKS

2.1 Data Acquisition

2.1.1 ERR Briefing

ERR provided a briefing (20 April 2015) to confirm the scope and outline the data sources that would be made available. The core URS team and representatives from the ERR group attended the meeting.

The objective of the briefing was to present the draft project management plan which set out the key deliverables and milestones of the project. The output from the meeting was a project management plan document, which was issued as a final to ERR on 21 April 2015.

A subsequent meeting held with DEDJTR on 20 July 2015 further clarified assumptions to be used in the closure cost estimates and the scope of the deliverable.

2.1.2 Information Sources

ERR provided the following documents and information:

- Submission for a variation to the approved work plan for Mining Licences No 5003, No 5216 and No. 5304 to incorporate changes to mining as a result of batter failure in November 2007 and the Maryvale Mine Footprint redesign, TRUenergy, 5 May 2011;
- MIN5003 Work plan variation conditions (Final 17.05.2011);
- EnergyAustralia Yallourn Mine, 6 monthly Milestone Report, July to December 2014, for DEDJTR;
- Yallourn 2013_14 annual expenditure return;
- MIN5003 Bond calculator_na07_concept.xls
- Yallourn Energy Pty Ltd., May 2000, extract from Rehabilitation Master Plan (Page 12)
- TRUenergy Yallourn Pty. Ltd. Review of Yallourn Mine Rehabilitation Master Plan, 5 June 2012. MIN5003 Work Plan Variation.

In addition, the following URS reports were reviewed as part of the data acquisition task:

- Mine and Power Station Closure under Contract for Closure, Implications and Costs (June 2012); and
- Water Resource Options for a Sustainable Coal Industry (August 2007)

The latest version of the ERR bond calculator[1], which was developed to address the need for a consistent methodology for estimating rehabilitation costs for the extractive, exploration and mining operations, was used as a key reference document.

In addition to the reports, URS was allowed access to ERR personnel in order to clarify key assumptions in relation to the proposed closure concepts.

[1] Last updated – 24 February 2014.
http://www.energyandresources.vic.gov.au/earth-resources/licensing-and-approvals/minerals/guidelines-and-codes-of-practice/establishment-and-management-of-rehabilitation-bonds-for-the-mining-and-extractives-industries/bond-calculator

LIDAR data was provided to URS, however as it only covered a small portion of the mine licence area for Yallourn it was not used in the estimates for areas, slopes, and void volumes.

2.2 Work Plan Review

The data received from ERR was reviewed and a draft letter report entitled "Latrobe Valley Work Plan Review", dated 1 May 2015 was issued to ERR.

The review identified a number of data gaps in the work plans received and requested clarification on a number of queries in relation to various aspects of the data received.

Two members of the URS project team visited ERR representatives in Traralgon on 8 May 2015 and conducted an "outside the fence" site visit to verify some of the information provided in the mine work plans.

2.3 Progressive Rehabilitation

Based on the various sources of information obtained URS facilitated a workshop on 15 May 2015. The aim of the workshop was to allow the URS and ERR technical teams to reach agreement on the status of progressive rehabilitation which has occurred to date and assumed details for the closure of YM.

URS conveyed to ERR at the meeting that the scope and currency of the rehabilitation plan for YM has gaps compared to what is considered general practice for mine closure plans.

YM claims in the 2012 WPV that approximately 550ha of rehabilitation has been completed since 2001, although it is unclear whether these areas are fully completed and no further works would be required for closure. Additionally there is limited progressive rehabilitation carried out on site outside of Township Field.

2.4 Closure Cost Estimates

Cost estimates have been developed based on the 2012 WPV with two scenarios:

- End of Mine Life Closure – closure based on the predicted footprint for the approved mine plan with mining finishing in 2026.
- Early Closure - closure based on current footprint.

The costs items for closure are based on the closure domains outlined in Table 2-1 (below), which is generally consistent with the format of ERR's bond calculator. Where there are items, which are not considered in the bond calculator, a new domain has been developed: such as Domains 5, 6 and 7.

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Table 2-1 Domain Descriptions

DOMAIN	DESCRIPTION	INCLUSIONS/EXCLUSIONS
1	Infrastructure areas – includes the removal and demolition of conveyors, buildings, power lines	Includes: Mine Workshops, Administration buildings, Sediment dams, Fire reservoir, Conveyors, Fire services equipment and pipework, Access roads, Raw coal bunker (and associated batters), Flocculation Pond, Fire Services Pond. .
2	Tailings and coarse rejects – includes capping, reshaping and landscaping of ash ponds	Yallourn North Open Cut (YNOC) and associated batters.
3	Overburden and waste dumps – includes overburden dumps	YM has no external overburden dump
4	Active Mines and Voids – includes the backfilling of mine voids, slope reshaping, fencing and landscaping	Includes: Yallourn East Field, Yallourn East Field Extension, Yallourn East Field Overburden Dump, Maryvale Field, Yallourn Township Field including the northern, Hernes Oak, western, southwestern and southern batters, Yallourn Township Field Overburden Dump, Midfield Dump.
5	Execution management costs - including mobilisation and demobilisation	-
6	Fill pit with water - including all aspects of filling the pit with water	Includes: water licence acquisition (if necessary) and annual fees
7	Post execution maintenance and monitoring – including all costs to conduct monitoring and maintenance post closure	-

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3 MINE STATUS

3.1 Current Mine Status

EnergyAustralia Yallourn Pty Ltd has ownership of the mine, however, it is operated as an alliance with RTL – a joint venture between Thiess, Downer and Linfox. Mining operations are based on a dozer push / feeder breaker system.

Mining began in the Maryvale (MF) in September 2012 and is able to continue until 2032 (2011 WPV), although MIN expiry is 2026.

The proposed extent of the Maryvale Field to the south is indicated in Figure 6 of the TRUenergy variation to the Mine plan report (2011 WPV). The Township Field and Maryvale Field are separated by a coal dyke, which contains the Morwell River Diversion (**MRD**).

The Mine Licence also includes the Yallourn North Open Cut (**YNOC**), which is an EPA licensed landfill comprising two ash dumps and an asbestos dump.

The Yallourn raw coal bunker which stores coal from the mine before transferring it to the Power Station is also included in the mine costing. It has a capacity of 30,000 tonnes.

The fire services pond collects all run-off from site. The water is then pumped through the FP and then into the Morwell River. Annually 14,000-18,000 ML of water is discharged to the Morwell River.

The YM is influenced by several geotechnical constraints – the Latrobe River borders to the north where the Yallourn East Field (YEF) batters failed in 2007. These batters are under geotechnical surveillance and will be progressively stabilised by the placement of material in the YEF from mining of the Maryvale Field.

Stabilisation works on the MRD batters were completed in October 2013, when uncontrolled flows were returned to the MRD. The southern batters of the Yallourn Township Field are located adjacent to V-Line track but no movement has been detected. The YNOC batters are also being monitored.

The MIN5003 expiry date is 9 April 2026.

3.2 Current Approved Rehabilitation Master Plan

The YM closure[2] strategy is as outlined in pg 48 of the 2012 Rehabilitation Master Plan:

…final rehabilitation by flooding of the mine to form a lake system with landscaping works to be undertaken around the lake perimeter.

…water supply to fill the final lake could be supplied, subject to approval, from flood events in the Latrobe River system by lowering the man-made protection flood levees or using current (or additional) power industry water entitlements...

[2] Submission for a variation to the Approved Work Plan. Version 5 – dated 5 May 2011

Alternatively, natural filling by immediate local area rainfall runoff, including currently diverted areas, could provide additional water resource.

The 2012 WPV[3] provides further details on the proposed pit filling plan for YM to achieve the closure objective outlined. It is based on a number of technical studies into the pit filling options: "full" flooding, a "partial" flooding and a "non-flooded". The preferred being a fully flooded mine to a water level of +37 m AHD and spill into Latrobe River.

The 2012 WPV also identified a number of benefits associated with the fully flooded mine option, which are relevant to the closure concepts to be assumed for this report. These include the fact that a fully flooded pit would provide the following as compared to a partial or no flooded pit option:

- Flood control;
- Potential water source for future industry;
- The best visual solution;
- Least ongoing maintenance;
- Source of water for fire suppression; and
- Potential recreation and conservation benefits.

[3] Review of Yalloum Mine Rehabilitation Plan. MIN5003 Work Plan Variation. Condition 7. 5 June 2012

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4 CLOSURE STRATEGY

4.1 Background

The closure concept for YM is to fill the void with water to form a lake that spills into Latrobe River.

The 2012 WPV provides limited details to many aspects of site closure. URS has therefore included a range of assumptions for the various domains which are considered necessary to achieve the nominated YM closure strategy. The assumptions used in the closure cost estimates are outlined below in Section 4.2.

4.2 Closure Activities Used as Basis for Closure Development

4.2.1 General Land Use

Final land uses are assumed to be:

- Focused access to pit lake; and
- Grazing across remainder of lease.

4.2.2 Domain 1 – Infrastructure

The Domain 1 assumptions used in the closure costing are as follows:

- All major mining infrastructure including buildings, conveyors and dredgers will be decommissioned, decontaminated and demolished for sale as scrap. No salvage has been incorporated into the costs to off-set some or all of this task.
- All mobile plant and equipment will be decommissioned and decontaminated.
- Concrete structures will be decommissioned, decontaminated and demolished to a maximum depth of 1 m below ground. Cost for this task incorporates demolition, crushing and/or placement in an on-site location.
- Allowance for clean-up of localised zones of soil contamination of 500 m^3. Cost includes excavation and transport to local off-site facility.
- All haul and access roads that will not be subject to lake inundation will be ripped and seeded, unless the road is deemed necessary for post closure land uses.
- Some access roads will be retained for the duration of the maintenance and monitoring phase, after which they will be ripped and seeded.
- Firefighting services will be decommissioned after attainment of final lake level or until approved by relevant authority.
- All exploration bores will be decommissioned and capped prior to void filling. It is assumed this is done prior to closure and no additional cost has been incorporated into the closure cost estimates.

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4.2.3 Domain 2 – Ash Ponds

The only Domain 2 facility at YM is the YNOC. The closure costing assumptions for YNOC are as follows:

- Capping and closure in accordance with EPA Best Practice Environmental Management (BPEM) for landfills, including:
  - Evapotranspiration barrier;
  - Compacted inert fill cap of 0.75 to 1.0 m thickness;
  - Reshaping to slopes of >5%<20%;
  - Installation of growing medium and vegetation;
- The final closed structure will require a Financial Assurance, which is outside the closure cost estimates.
- Installation of an earth buttress to stabilise the northern batter of YNOC.

4.2.4 Domain 3 – Overburden Dumps

YM has no external overburden dumps that require rehabilitation.

4.2.5 Domain 4 – Pits

Township and East Field/Maryvale Field assumptions are as follows:

- Filling of the pit voids with water to +37m AHD within 17 years to produce a lake of acceptable water quality that spills into the Latrobe River.
- Final overall pit slopes of 1:3 (V:H).
- It is necessary for individual batter slopes to be re-shaped to approximately conform to the overall final slope.
- Installation of a track rolled cover layer over pit slopes above final lake level (+37m AHD) of inert material with nominal 0.75 m (minimum 0.5 m) thickness to enable a water shedding and reduce fire risk.
- Installation of 0.1 m thick topsoil or equivalent growing medium.
- Planting of slopes (above +37mAHD) with low maintenance native vegetation endemic to the region.
- Intermediate surface drainage works will be installed at 50 m vertical heights in the exposed final batters;
- A 0.75 m thick rip rap zone will be installed in the final slope as a rim around the lake within a range of 2 m above and 2 m below final lake level to control wave erosion.
- Access to lake:
  - Two zones of approximately 20 ha each where public access will be enabled and concentrated;
  - These will comprise flattened slopes of 1V:5H to enhance safety and enable launch of water craft.

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4.2.6 Domain 5 – Management

Domain 5 includes all the costs for the third party implementation of closure, such as:

- All necessary investigations, studies and detail design for closure
- Mobilisation and demobilisations of contractors
- Project management all on-site works
- Necessary audits at closure

Cost for Domain 5 has been generated from a combination of the following:

- Mobilisation – 5% of total execution costs
- Engineering, procurement and construction management – 15% of total execution costs

4.2.7 Domain 6 - Pit Water Filling

It is recognised that diverting the full flow of the Morwell River and ultimately spilling back into the Latrobe River may be a practical solution for how water is sourced, however, this is not outlined in the approved WPV. The following assumptions, based on the 2012 WPV, have been used in the costs for filling the pit voids with water:

- All water used to fill pit voids to +37m AHD will be from YM's Bulk Water Entitlement (BWE) of 36.5 GL/year. Further:
  - There will be no cost to transfer the BWE from the power station to the mine for closure;
  - The annual fees for use of the BWE will be the same as currently paid by the power station;
- End of Mine time taken to fill the pit voids to +37m AHD is as that outlined in YM water balance study[4], which is 17 years, assuming no flood events are captured.
- Early Closure time to fill the pit voids was not included in the water balance, thus an estimate of 21 years has been used based on an assumed pit void to +37m AHD and use of BWE only.

The following sections outline a number of issues in sourcing the water to fill the pit voids and how these have been incorporated into the closure cost estimates.

Firstly, the creation of a large lake for closure means the long term water balance will be dominated by incident rainfall and evaporation as well as any local inflows. For maintenance of water levels a positive balance of rainfall and inflows over evaporation is required.

[4] Attachment No. 1 (Yallourn Mine – Final Land Rehabilitation Lake Filling Model – Revision 0 26Apr12) of: Review of Yallourn Mine Rehabilitation Plan. MIN5003 Work Plan Variation. Condition 7. 5 June 2012

Direct rainfall and evaporation

The closure water balance study included in the 2012 WPV appears to have considered the differential between rainfall and evaporation on a long term annual basis and concluded there is a slight positive balance, or an equivalence, in rainfall falling to the ground and evaporation leaving the ground. An annual comparison is problematic since it does not take account of the seasonal changes between rainfall and evaporation, or the effects of prolonged wet or dry periods. For this reason a closer examination of the rainfall – evaporation differential is necessary based on the use of daily SILO climate data for Morwell.

The appropriate measure of evaporation for this purpose is Morton's Lake Evaporation as other forms of evaporation reported in the SILO data set are for standard grasslands and crops, and required appropriate factors to be applied. Morton's Lake Evaporation does not require a 'pan factor' and is considered to be within +/- 15% of true evaporation from a lake surface depending on the volume in storage, depth of water body, turbidity and exposure to solar radiation and wind.

In this case - where deep, relatively clear water storages are likely - it is expected that Morton's Lake Evaporation should provide a good estimate of true evaporation from the lake surface.

Daily SILO point rainfall and evaporation data was differenced then aggregated to a monthly time step before averaging. The data shows a clear seasonal deficit in summer months with a smaller excess of rainfall over evaporation during the winter months.

The costs estimates generated herein have therefore assumed that annually, the sum of the monthly average point rainfall-evaporation deficit is -278 mm. The inter-annual range of this deficit is -652 mm to +202 mm. For example a lake with 20,000,000 m^2 surface area is equivalent to an average deficit of ~5.5 GL/year.

Local Catchment Inflows

Various methods have been used to assess local catchment inflows over time. Two main areas of uncertainty exist:

- Definition of catchment which will flow into any nominated pit; and
- Use of constant runoff coefficients instead of using local data.

For the purposes of generating a preliminary water balance URS has estimated catchment areas under current and future rehabilitation conditions using Nearmap. These catchments have largely been restricted to the mine boundary, although in some areas allowance has been made for limited urban runoff.

Most of the methods used to date have adopted a runoff coefficient approach. This is not preferred as it is difficult to defend both the magnitude of the runoff coefficient(s) chosen and the application of a constant runoff coefficient that does not reflect antecedent rainfall and soil wetness.

For the purposes of the current analysis a water yield per unit area from local stream gauging records and used these rates to estimate local catchment inflows to the mine based on the estimated catchment areas.

Where urban areas may contribute to pit water these have been identified separately and their yields have been assumed to be 80% higher than natural runoff based on observations of low flow changes due to urbanisation in Melbourne's eastern catchments.

The results of the preliminary water balance is that the net effect of direct rainfall/evaporation and local catchment inflows will be a small annual deficit of inflows during and following filling of voids. Even though there will be considerable variability in these numbers due to the climatic conditions in a given year, it is clear that the relative size of these annual deficits is small when compared with the annual rate of water delivery required to fill the void in 17 years (i.e. typically less than 2%).

A daily water balance model was run for 110 years incorporating delivery of water volumes equivalent to 10% of current licenced water requirements and daily rainfall and evaporation. The variability of rainfall-evaporation deficit was not found to significantly affect predicted water levels or the rate of void filling.

Based on this analysis, a post-closure provision should be made of approximately 2-3 GL/year to make up the relevant annual deficit in local rainfall, evaporation and inflows so that the long term maintenance of void water levels can be secured.

It should also be noted that for the purpose of the water accounting, it was assumed that there is no seepage or other groundwater loss from the void as it fills.

4.2.8 Domain 7 – Maintenance & Monitoring

Domain 7 includes all the costs associated with maintaining the necessary infrastructure during closure and the various monitoring to assess the success of implementation.

- Maintenance. Cost to maintain the following for period of closure:
  - Rehabilitation areas, based on an assumed 15% vegetation fail over 5 years
  - Fire services until exposed coal is covered
  - Site security
  - Erosion repair
  - Council rates
  - Site services (buildings, power water etc)
- Monitoring. The scope of monitoring is assumed to includes the following: surface water (flow and quality), groundwater (level & quality), geotechnical stability, ecological (including rehabilitation) fire, dust, and odour.
- Management. To cover the costs for managing and procuring the contracts a sum has been generated based on 3% of total maintenance and monitoring cost.

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4.3 Timing of Closure

A costing has been generated for two closure timeframes:

- End of mine life – within the model this is referred to as EoM
- Early closure (closure based on tomorrow's current footprint) – within the model this is referred to as EC1

The main difference between the current and end of mine closure costings is the mine's footprint.

Based on available information regarding progressive rehabilitation on site, costings assume little or no additional rehabilitation will have been carried out by end of mine life.

4.3.1 Execution Phase

The closure execution phase is assumed to run for 5 years and commences in the year after production shutdown. It comprises the period of intense closure activity, including rehabilitation, slope shaping, slope soil cover, decommissioning, decontamination and demolition of infrastructure and general site clean-up.

4.3.2 Void Filling Phase

The void filling phase is the period over which the mine pit will fill with water based on the assumed water balance:

- EoM - a void filling phase of 17 years has been adopted
- EC1 – a void filling phase of 21 years has been adopted

4.3.3 Post Execution Maintenance and Monitoring Phase

This phase begins after the closure Execution Phase (ie Year 6), with the activities during this phase comprising the following:

- Ongoing monitoring of water level, surface water quality, groundwater quality, ecological, slope stability, fire risk and rehabilitation;
- Ongoing maintenance including erosion repair, replacement of failed rehabilitation areas, sediment dam and fire reservoirs maintenance, security, Council rates and upkeep of monitoring/maintenance infrastructure and equipment.

In the case of EoM and EC1 the pit void may take 17 – 21 years to fill and maintenance and monitoring will be required for all this time period and 3 years post pit water filling.

4.4 Summary of Assumptions

In preparing this costing for closure of the Yallourn Mine the following has been assumed:

- End of mine life of 2026, based on no extension to the current mining licence expiry date;
- None of the batters have yet been reshaped;

- 15% of the planned vegetation will fail within the first 5 years of the maintenance and monitoring phase;
- Final pit slopes of 1V:3H will have long-term geotechnical and erosional stability;
- No major cut-backs of slopes are required;
- Final pit water is suitable for discharge to the receiving body (Latrobe River);
- There is no groundwater contamination present which would present a human/ecological risk;
- No seepage or groundwater loss from the voids on filling;
- There is a low fire risk during the first five years of the maintenance and monitoring phase;
- Current power station bulk water entitlements can be used for void filling;
- Current groundwater pumping water can be used for void filling;
- The YNOC buttress will require approximately 2.5 million m^3 of in situ material to be sourced from within the MIN;
- Monitoring will confirm compliance with the closure criteria and performance assumptions.

4.5 Exclusions

The following items have been excluded from the closure cost estimates:

- Community cost associated with managing the closure transition;
- Asset recovery amounts from sale of scrap, recoverable metals, oils etc; and
- Reimbursement/sale of water allocation rights.

4.6 Key Risks

If the assumptions indicated above are not correct then they represent risks within the closure costing and have been incorporated into our closure costing as risk events with estimates of degrees of likelihood of occurrence and consequence.

The following key risks have been identified for YM for each closure concept:

- Seepage of acid mine drainage (AMD):
  - AMD and/or other contaminants impact on groundwater to the extent that clean-up and treatment are required under audit.
- Batter failure in an area where infrastructure is affected;
  - A slope failure occurs on a batter where there is major public/private infrastructure that requires stabilisation. The consequence includes both stabilisation of batter for long term and rehabilitation/compensation items.
- Batter failure in an area where no infrastructure is affected;
  - A slope failure occurs on a batter where there is no major public/private infrastructure. The consequence is stabilisation of batter for long term and rehabilitation of slope.

- Coal fire;
  - A coal fire during the full closure period that requires management and land requires subsequence rehabilitation.
- Pit water quality is of a standard unsuitable for discharge;
  - The water quality of final lake does not meet standard for discharge into Latrobe River and requires pre-treatment.
- Inability to secure existing water licences;
  - The existing BWE is not able to be used in filling the pit void and all water sources need to be purchased on open market at commercial rates.
- Requirement for water sources to maintain lake level:
  - The 2012 WPV water balance is inaccurate and there are significant periods post shutdown where there is a net water deficit, and thus purchase of water is needed to maintain the final lake level.

It is considered that the risks for the YM early and end of mine life closure scenarios are similar in terms of likelihood and consequence.

Each closure concept has been costed and the predicted risk cost has been listed in addition to the cost estimates for proposed closure activities.

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5 COST ESTIMATES FOR CLOSURE

5.1 Methodology

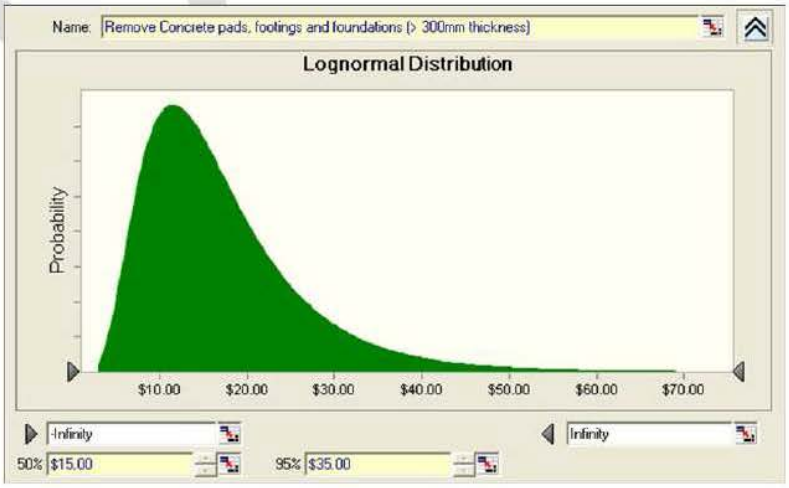
A probabilistic costing model was developed in Excel using URS' previous experience of mine closure costings and the information from the documents provided by ERR. The costing model built upon the costing work, which was conducted in 2012 for the former Department of Primary Industries (DPI). The costing model incorporated Monte Carlo simulation, which is a statistical technique that uses random numbers to account for uncertainty in a mathematical model. URS uses the spread sheet add-in, Crystal Ball™, to run the Monte Carlo simulation.

The basis of Monte Carlo simulation is that it recognises variables (in this case the cost of individual mine closure items) as probability distributions rather than single numbers. The probability distribution chosen for cost estimates is lognormal as this assumes the following conditions in relation to costs and other variables such as length, area and volume:

- Costs are strongly skewed towards high values;
- Variable (cost) can increase without bound but is confined to a finite value at the lower limit i.e. the costs cannot be less than $0; and
- the distribution can be defined by two cost estimates (the P50, or 50% confidence level estimate and a P95, or 95% confidence level estimate) provided by a relevant specialist; the P50 estimate is a best estimate (50% chance that the given cost would not be exceeded) and the P95 is a very conservative estimate (95% chance that the indicated cost would not be exceeded, or conversely, a 5% chance that the cost would be exceeded).

Chart 5-1 shows an example cost distribution where the specialist judged that a best estimate of the cost to remove relatively thick concrete pads etc. would be $15/m^2, and a very high estimate that would have around a 5% chance of being exceeded would be $35/m^2. The relatively large difference between the P50 and P95 shows that the specialist considered that there is a high degree of uncertainty in the potential cost outcome. The spread of potential costs across the chart also shows that although there is no theoretical upper limit to the cost, the specialist also considered that a practical upper limit to the cost could be $60 to $70/m^2.

Chart 5-1 Example Probability Distribution for Infrastructure Cost Item



For each closure concept and for both of the closure scenarios (close tomorrow and end of mine life) expert judgement was used to derive cost estimates at a 50% probability (best estimate) and 95% probability (very conservative, high estimate), for each cost component. The decisions were informed by discussions with ERR technical staff at the site visit and the workshop on the 15 May 2015. The inputs for each of the mine closure concepts are provided in Appendix C.

The Monte Carlo simulation was run 2,000 times and a curve of total project costs was obtained for each closure option.

The time value of money was factored into the model using net present value (NPV) calculations. NPV is the net present value of an investment over a period of time, calculated using a discount rate and a series of future payments and incomes. The discount rate adopted is a real NPV discount rate of 3% as instructed by ERR.

5.2 Model Results

5.2.1 Overall Costs

The results of the Monte Carlo simulation for total project costs for end of mine and early closure concept at a range of confidence levels are provided in **Chart 5-2** and **Chart 5-3**. A summary of the 50%, 80% and 95% Confidence Level outputs for each closure concept are provided in **Table 5-1**.

Chart 5-2 End of Mine Closure Liability and Risk Costs

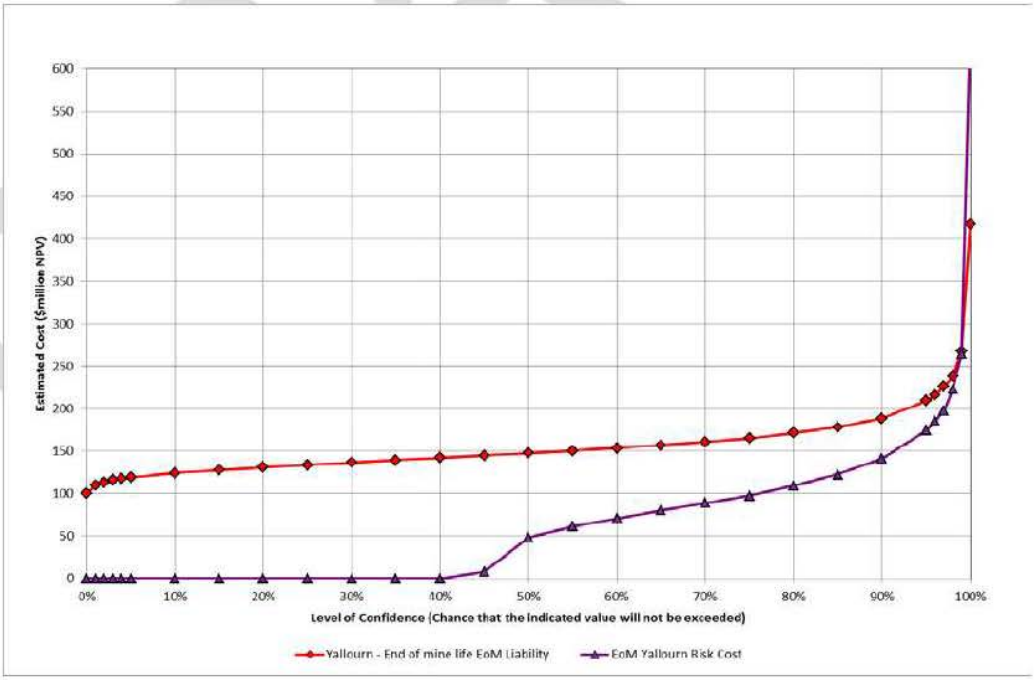


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Chart 5-3 Early Closure Liability and Risk Costs

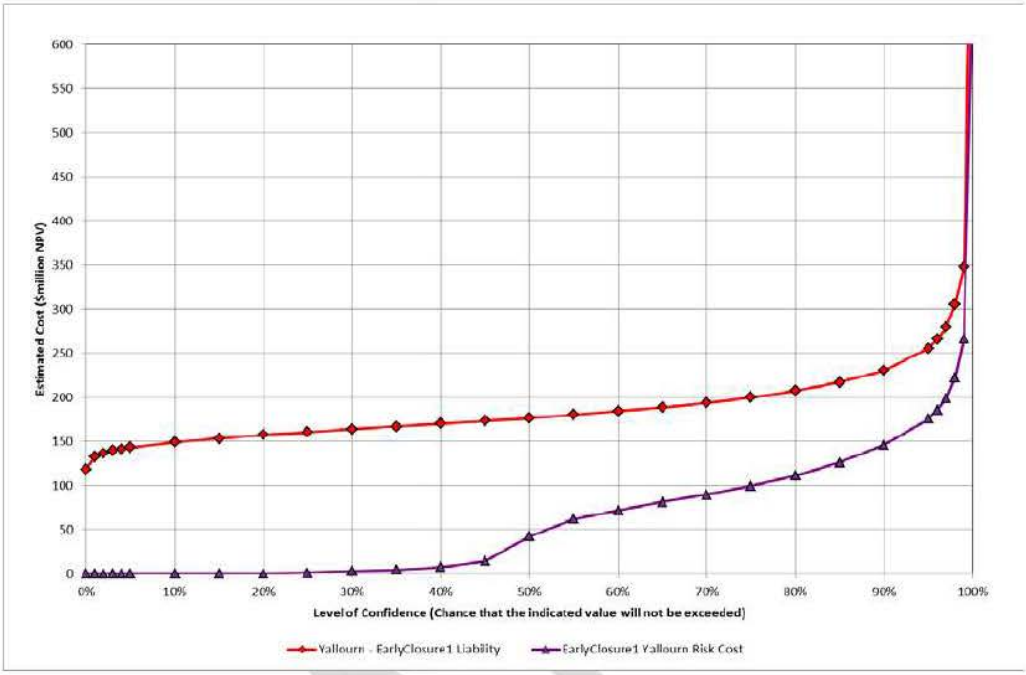


Table 5-1 Summary of Closure Costs

Confidence Level	P50	P80	P95
EoM - Liability Costs ($million NPV) *(EoM - Risk Costs)*	147.5 *(48.4)*	171.4 *(109.1)*	209.3 *(174.4)*
EC1 - Liability Costs ($million NPV) *(EC1 - Risk Costs)*	176.4 *(42.4)*	207.5 *(111.2)*	255.7 *(175.7)*

It should be noted that the end of mine life cost estimates are materially lower due to the fact that all estimates are discounted costs. That is the cost is based on expenditure in the future at a present value discounted by 3%[5].

In 80% of the 2,000 trials for EoM closure concept the estimated cost was less than $171.4 million. That can be interpreted as there being an 80% chance that the end of mine closure cost will be less than $171.4 million. Alternatively, the same result shows that according to the simulated results, there is a 20% chance that the cost will be more than $171.4 million. In addition to this cost there is a predicted $109.1 million risk cost.

[5] Based on published wage discount rate: http://www.dtf.vic.gov.au/Publications/Government-Financial-Management-publications/Financial-reporting-policy/Wage-inflation-and-discount-rates

In 80% of the 2,000 trials for early closure concept (closure tomorrow) the estimated cost was less than $207.5 million. That can be interpreted as there being an 80% chance that the rapidly filling closure cost will be less than $207.5 million. Alternatively, the same result shows that according to the simulated results, there is a 20% chance that the cost will be more than $207.5 million. In addition to this cost there is a predicted $111.2 million risk cost.

This way of interpreting the results makes it possible for decision-makers to link any of the estimated cost outcomes with its associated confidence level, and to select cost estimates that reflect their level of conservatism. For example, a decision-maker might feel that a 20% chance that an allocated cost would be exceeded is too high, and that a 5% chance would be more appropriate. In that case, the decision-maker would select the 95% confidence level estimate, which for the early closure (current footprint) is $255.7 million. On the other hand, a much less risk-averse decision-maker might select the cost ($176.4 million) that has a 50-50 chance of being exceeded.

In essence, the simulation results allow ERR (and any other stakeholder) to assess the full range of potential cost outcomes and to choose allocated costs at the confidence level that most suits their position.

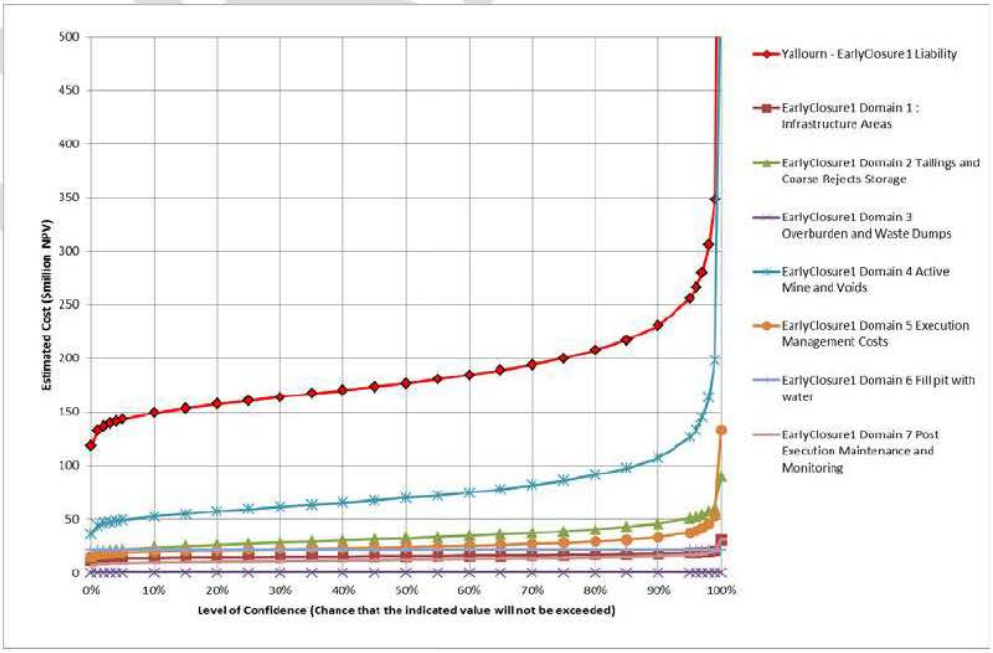
The wide range of cost estimates for each option is indicative of the degree of uncertainty inherent in the risk model. This is a function of the lack of precise data available to URS which meant that the inputs at a probability of 50% and 95% were often wide ranging.

5.2.2 Early Closure Contributor Costs

Domains

The liability costs for each domain with regards early closure is presented in **Chart 5-4**.

Chart 5-4 Domain Liability Costs - Early Closure



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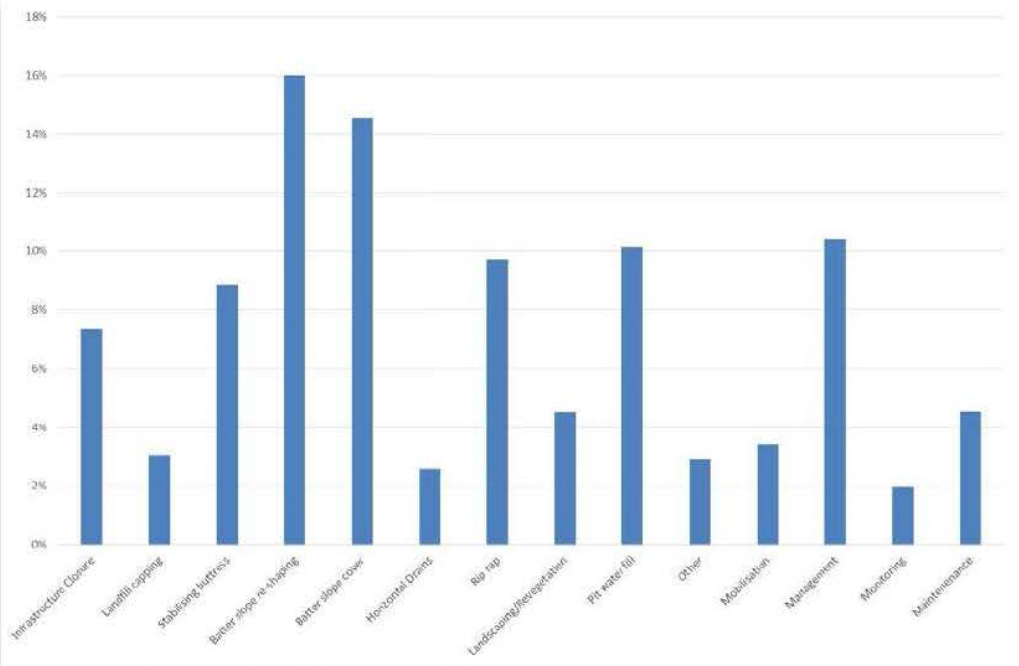
Key Contributors to Costs

The key contributor items to the overall cost for early closure is summarised in **Chart 5-5**. This shows that the major contributors to the overall closure cost are the reshaping and covering of batter slopes. Other major cost activities include pit lake filling, installation of rip rap, the YNOC stabilising buttress, closure management and infrastructure decommissioning, decontamination and demolition.

Chart 5-5 Key Contributors to Early Closure Liability Costs (P80)



5.2.3 *Early Closure Uncertainty*

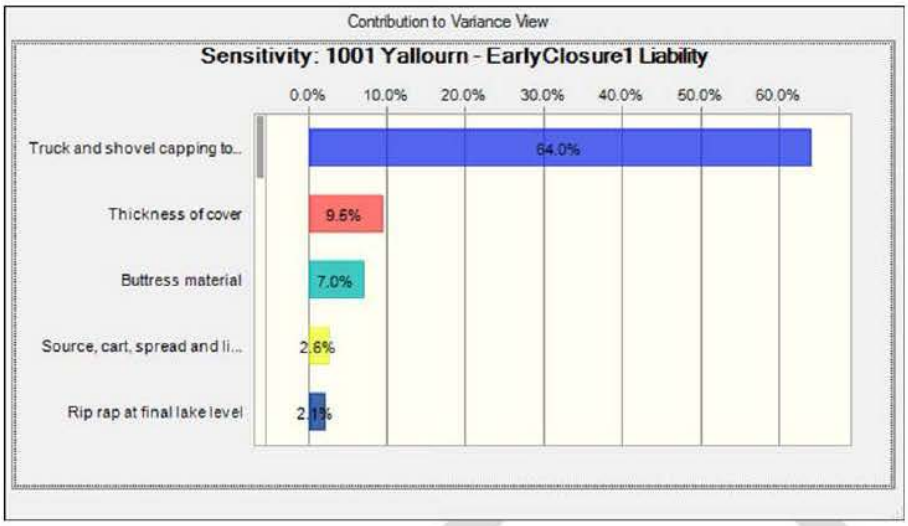
Sensitivity analysis of probabilistic models is calculated as part of the Crystal Ball Monte Carlo simulation process where the outputs show which assumptions most affect the uncertainty in the result for a given forecast (in this case the estimated early closure liability).

Chart 5-6 shows the proportion that each of the identified assumptions contributes to the total variance of the given forecast result.

In order to have an impact on the forecast result the assumption usually has to have an impact on both the quantum of the result and the spread (uncertainty) of the result. This analysis only considers the uncertainty (not magnitude) caused by assumptions. For example, an assumption that has a big impact on the quantum of the answer, but is very well known (input as a single value, or close to that) would not feature in this sensitivity analysis.

The sensitivity analysis identifies which assumptions in the model would reduce the overall uncertainty of the result, if the issue (represented by the assumption) was better understood by further investigation.

Chart 5-6 Key Contributors to the Variance - Early Closure



Key contributors to the variance associated with early closure liability cost estimates are shown to be the following.

- Active Mining Pit or other Voids (including the voids and any internal benches or mine strips):
  - Truck and shovel cover to batters and floor.
  - Buttress material.
  - Rip rap at final lake level.
- Yallourn Township Batters – Northern:
  - Thickness of cover.
- Removal and disposal of contaminated materials:
  - Source, cart, spread and lightly rip topsoil (>5km).

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6 REFERENCES

EnergyAustralia Yallourn Mine, 6 monthly Milestone Report, July to December 2014, for DEDJTR;

http://www.dpi.vic.gov.au/earth-resources/minerals/environmental-guidelines/bond-calculator

MIN5003 Bond calculator_na07_concept.xls (Yallourn);

Rawlinsons, Australian Construction Handbook 2015 Edition 33.

TruEnergy, 5 May 2011, Submission for a variation to the approved work pan for Mining Licences No 5003, No 5216 and No. 5304 to incorporate changes to Mining as a result of batter failure in November 2007 and the Maryvale Mine Footprint redesign;

TruEnergy Yallourn Pty. Ltd. Review of Yallourn Mine Rehabilitation Master Plan, 5 June 2012;

URS, Mine and Power Station Closure under Contract for Closure, Implications and Costs, 27 June 2012;

URS, Water Resource Options for a Sustainable Coal Industry, August 2007

Yallourn Energy Pty Ltd., May 2000, extract from Rehabilitation Master Plan (Page 12).

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7 LIMITATIONS

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Department of Economic Development, Job, Transport and Resources (DEDJTR) and only those third parties who have been authorised in writing by URS to rely on this Report.

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Any estimates of potential costs which have been provided are presented as estimates only as at the date of the Report. Any cost estimates that have been provided may therefore vary from actual costs at the time of expenditure.

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APPENDIX A MINE PLANS

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A.1 Mine Licence Area


Yallourn (aerial Nov 2014)
Legend
Mining Licence Boundary
Watercourse
Water Body
LOCALITY MAP
Victoria
GDA

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APPENDIX B MODEL INPUTS

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B.1 Early Closure (current footprint)

EarlyClosure1 Cost Components

YALLOURN Early Closure 1 Footprint	Total Costs
EarlyClosure1 Domain 1 : Infrastructure Areas	**15,535,688**
Disconnect and terminate services	435,000
Demolish and remove buildings	4,000,000
Remove concrete pads & footings (of buildings)	375,000
Decommission access and haul roads	90,000
Waste disposal	235,000
Removal and disposal of contaminated water from bunded areas and sui	250,000
Removal and disposal of contaminated soils	195,000
Removal of USTs	48,000
Demolish and remove conveyors	1,440,000
Decommission, decontaminate and demolish crusher and raw coal bunk	5,890,000
Decommission, decontaminate and demolish dredgers	1,000,000
Remove fire services equipment and pipework	300,000
Remove fire services reservoir	200,000
Landscaping, minor earthworks and revegetation	957,688
Water Ponds	0
Removal of power lines	120,000
Other disturbed areas	0
EarlyClosure1 Domain 2 Tailings and Coarse Rejects Storage	**30,763,482**
YNOC Slopes	9,258,812
YNOC Buttress (Township side)	14,375,000
YNOC Capping	4,940,000
Landscaping, minor earthworks and revegetation	2,189,671
EarlyClosure1 Domain 3 Overburden and Waste Dumps	**0**
Landscaping, minor earthworks and revegetation throughout domain are	0
EarlyClosure1 Domain 4 Active Mine and Voids	**70,016,298**
Maryvale Field	4,819,142
Yallourn Township Batters - Northern	1,618,420
Yallourn Township Batters -Western	22,916,853
Yallourn Township Batters -Fire Service/Floc Pond Batters	2,448,157
East Field	753,842
East Field Extension	7,660,092
Horizontal Drains	4,142,078
Rip Rap	15,732,964
Erect a security fence around site	0
Landscaping, minor earthworks and revegetation throughout domain are	4,324,750
Create public access	500,000
Lime dosing	5,100,000
EarlyClosure1 Domain 5 Execution Management Costs	**23,263,094**
Mobilisation/Demobilisation	5,815,773
Engineering Procurement & Construction Management	17,447,320
EarlyClosure1 Domain 6 Fill pit with water	**77,829,804**
O&M of dewatering facilities	0
Re-install dewatering bores, then decommission existing bores	0
Supplementary & other water charges	11,308,604
Top up water supply	66,521,200
EarlyClosure1 Domain 7 Post Execution Maintenance and Monitoring	**14,740,000**
Post execution monitoring	4,400,000
Post execution maintenance	10,115,000
Management	225,000
EarlyClosure1 Liability	**232,148,365**

B.2 End of Mine Life

EoM Closure Cost Components

YALLOURN End of Mine Life Footprint	Total Costs
EoM Domain 1 : Infrastructure Areas	**14,535,688**
Disconnect and terminate services	435,000
Demolish and remove buildings	4,000,000
Remove concrete pads & footings (of buildings)	375,000
Decommission access and haul roads	90,000
Waste disposal	235,000
Removal and disposal of contaminated water from bunded areas and sumps	250,000
Removal and disposal of contaminated soils	195,000
Removal of USTs	48,000
Demolish and remove conveyors	1,440,000
Decommission, decontaminate and demolish crusher and raw coal bunker	5,890,000
Decommission, decontaminate and demolish dredgers	0
Remove fire services equipment and pipework	300,000
Remove fire services reservoir	200,000
Landscaping, minor earthworks and revegetation	957,688
Water Ponds	0
Removal of power lines	120,000
Other disturbed areas	0
EoM Domain 2 Tailings and Coarse Rejects Storage	**30,763,482**
YNOC Slopes	9,258,812
YNOC Buttress (Township side)	14,375,000
YNOC Capping	4,940,000
Landscaping, minor earthworks and revegetation	2,189,671
EoM Domain 3 Overburden and Waste Dumps	**0**
Landscaping, minor earthworks and revegetation throughout domain area	0
EoM Domain 4 Active Mine and Voids	**98,490,075**
Maryvale Field	13,113,018
Yallourn Township Batters - Northern	2,529,156
Yallourn Township Batters -Western	27,318,744
Yallourn Township Batters -Fire Service/Floc Pond Batters	4,573,207
East Field	3,321,264
East Field Extension	11,333,394
Horizontal Drains	4,686,622
Rip Rap	21,189,790
Erect a security fence around site	0
Landscaping, minor earthworks and revegetation throughout domain area	4,824,880
Create public access	500,000
Lime dosing	5,100,000
EoM Domain 5 Execution Management Costs	**28,757,849**
Mobilisation/Demobilisation	7,189,462
Engineering Procurement & Construction Management	21,568,387
EoM Domain 6 Fill pit with water	**77,829,804**
O&M of dewatering facilities	0
Re-install dewatering bores, then decommission existing bores	0
Supplementary & other water charges	11,308,604
Top up water supply	66,521,200
EoM Domain 7 Post Execution Maintenance and Monitoring	**14,740,000**
Post execution monitoring	4,400,000
Post execution maintenance	10,115,000
Management	225,000
EoM Liability	**265,116,898**

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APPENDIX C UNIT RATES AND PARAMETERS

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C.1 General

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	GENERAL PARAMETERS USED IN COSTING				
		NPV Discount Rate	3.0%	As per Vic gov wage inf;lation and discounts file	
	Final Void			**EoM**	**Early Closure 1**
	Overall Pit Slope Angle (V:H)				
	Angle	degrees		18.4	18.4
	Vertical	ratio		1	1
	Horizontal	ratio		3	3
	Final lake level	RL m		37	37
	YNOC				
	Ground Surface	RL m		84	84
	Batter Lengths	m		4000	4,000
	Mayvale Field				
	Ground Surface	RL m		70	88
	Batter Lengths	m		5600	2,000
	Yallourn Township Batters - Northern				
	Ground Surface	RL m		57	57
	Batter Lengths	m		1200	1200
	Yallourn Township Batters -Western				
	Ground Surface	RL m		95	95
	Batter Lengths	m		5800	5,800
	Yallourn Township Batters -Fire Service/Floc Pond Batters				
	Ground Surface	RL m		47	47
	Batter Lengths	m		2800	2800
	East Field				
	Ground Surface	RL m		40	40
	Batter Lengths	m		2700	1,600
	East Field Extension				
	Ground Surface	RL m		70	70
	Batter Lengths	m		4840	4,840
	Average Batter Height	m		20	20
	Execution Phase General Rates				
	Mobilisation/Demobilisation	% of total execution costs		5%	
	Engineering Procurement & Construction Management	% of total execution costs		15.00%	
	Monitoring & Maintenance Phase Rates			**P50**	**P95**
	Post execution monitoring - initial phase				
	surface water	$/yr		$ 50,000	$ 75,000
	groundwater	$/yr		$ 100,000	$ 125,000

	geotechnical	$/yr		$ 75,000	$ 150,000
	ecological (inc. rehabilitation)	$/yr		$ 50,000	$ 75,000
	fire	$/yr		$ 50,000	$ 100,000
	Total monitring - initial	$/yr		$ 325,000	
	Post execution monitoring - subsequent				
	surface water	$/yr		$ 25,000	$ 40,000
	groundwater	$/yr		$ 50,000	$ 60,000
	geotechnical	$/yr		$ 35,000	$ 75,000
	ecological (inc. rehabilitation)	$/yr		$ 25,000	$ 40,000
	fire	$/yr		$ 50,000	$ 100,000
	Total monitring - subsequent	$/yr		$ 185,000	
	Post execution maintenance - initial phase				
	fire	$/yr		$ 200,000	$ 400,000
	rehabilitation	ha		400	500
	rehabilitation fail rate	% / yr		3%	
	rehabilitation rate	$/ha		$ 3,500	
	rehabilitation	$/yr		$ 42,000	
	erosion repair	$/yr		$ 400,000	$ 900,000
	lease costs	$/yr		$ 100,000	$ 200,000
	security services	$/yr		$ 100,000	$ 200,000
	securit maintenance	$/yr		$ 20,000	$ 50,000
	Council rates	$/yr		$ 100,000	$ 500,000
	site services (demountables, power, water)	$/yr		$ 50,000	$ 80,000
	Total maintenance - initial	$/yr		$ 1,012,000	
	Post execution maintenance - subsequent				
	fire	$/yr		$ -	$ -
	rehabilitation	ha		400	500
	rehabilitation fail rate	% / yr		3%	
	rehabilitation rate	$/ha		$ 3,500	
	rehabilitation	$/yr		$ 42,000	
	erosion repair	$/yr		$ 50,000	$ 100,000
	lease costs	$/yr		$ 100,000	$ 200,000
	security services	$/yr		$ 50,000	$ 100,000
	securit maintenance	$/yr		$ 20,000	$ 50,000
	Council rates	$/yr		$ 75,000	$ 300,000
	site services (demountables, power, water)	$/yr		$ -	$ -
	Total maintenance - subsequent	$/yr		$ 337,000	
	Management	% of total monitoring/maintenance costs		3%	
	Timelines			EoML	Early Closure 1
	Year of current assessment			2015	2015
	Year number			1	1
	Mine Shutdown			2026	2015
	Duration of void lake fill			17	17
	Year closure execution to commence			2027	2015
	Year number			13	1
	Duration of Closure Execution phase	years		3	3

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	Duration of post execution maintenance/monitoring - initial phase	years		5	5
	Duration of post execution maintenance/monitoring - subsequent phase	years		15	15
				P50	P95
	Effective duration of post execution maintenance/monitoring - subsequent phase	years		15	25
	Other Costs and Parameters (not in Bond Calculator)			P50	P95
	Bulking factor for earthworks			1.15	1.2
	Summary adopted earthworks rates				
	Externally sourced topsoil	$/m^3		$20	
	Externally sourced cover & cap material	$/m^3		$10	
	Internally sourced buttress / fill material	$/m^3		$5	
	Reshaping	$/m^3		$4.00	
	Horizontal bores for slope stabilisation			P50	P95
	No required	#/ha slope		1	1.5
	Installation cost	$/bore		$20,000	$50,000
	Dewatering bores				
	Connection pipeworks	$/m		$50	$70
	Rip Rap				
	thickness	m		0.75	
	vertical height	m		4	
	YNOC Cap				
	thickness	m		1	1.5
	rate (load, haul, dump, compact)	$/m^3		13	
	rate (load, haul, dump, compact)	$/m^2		13	
	Create public access				
	Cost per area	$/area		$ 250,000	$ 500,000
	Annual dewatering costs				
	Yallourn	$/annum		0	0
	Bulk Water Entitlement				
	Current Yallourn BWE	GL/yr		36.5	
	Supplementary Water Purchase Costs (see background to costs at bottom of this worksheet)				
	Allocation Purchase	$/ML		$ 2,000	$ 5,000
	Allocation Purchase	$/GL		$ 2,000,000	
	Annual groundwater fee	$/ML/yr		$ -	
	Annual groundwater fee	$/GL/yr		$ -	
	Annual Bulk Water Entitlement	$		$ 665,212	
	Total annual fees	$/yr		$ 665,212	

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Management Precinct	Activity	Unit	FROM BOND CALCULATOR	Adopted Rates- green/yellow highlight means value used in model		Distribution	Comment on Changes to Bond Calculator Rate
				P50	P95		
Main Work Shop and	Disconnect and terminate services	item	$5,000.00	$5,000	$6,000	Lognormal Distribution applied	
	Demolish and remove industrial buildings such as workshops and large sheds	m2	$160.00	$160	$200	Lognormal Distribution applied	
	Remove Concrete pads, footings and foundations (>300mm thickness)	m2	$15.00	$15	$35	Lognormal Distribution applied	
	Demolish and remove overland conveyors, transfer stations & gantries (scrapping only - does not include dismantling for re-use at another site).	m	$100.00	$100	$250	Lognormal Distribution applied	Used the same rate for all conveyors
	Decomission, decontaminate and demolish dredgers	ea		$1,000,000	$2,500,000	Lognormal Distribution applied	URS Estimate- Loy Yang BC had $50,000 - considered too low
	Pipework removal	m		$5	$10	Lognormal Distribution applied	Estimate taken from Loy Yang Bond Calc Sheet
Access & Haul Roads							
	Reshape, deep rip and ameliorate sealed unsealed roads	Ha	$2,500.00	$2,500	$3,500	Lognormal Distribution applied	
Removal and disposal of							
	Removal and disposal of oil contaminated water from bunded areas and sumps.	L	$0.25	$0.25	$0.40	Lognormal Distribution applied	
	Load, cart and dispose of low-level contaminated soil off site to a licensed landfill. Assumes cartage to a local landfill. Add $50/m3 for cartage to regional landfill.	m3	$390.00	$390	$700	Lognormal Distribution applied	
	Removal of underground fuel storage tank (UST) above 5,000L and below 15,000L capacity (include all site facilities and is to include pipes, bunds, etc)	@	$48,000.00	$48,000	$50,000	Lognormal Distribution applied	
	Source, cart, spread and lightly rip topsoil (>2km-5km)	$/m3	$2.75	$2.75	$3.25	Lognormal Distribution applied	
	Source, cart, spread and lightly rip topsoil (>5km)	$/m3	$3.60	$20	$45	Lognormal Distribution applied	based on commercial rates as no topsoil stockpiled at any site; $7.50/m3 excavate, deposit & spread - double for commerical rates - $15/m3; haulage at $0.57/m3/km - @10km $5.70/m3, 23km $17.10/m3
	Average topsoil thickness	m		0.1	0.15	Lognormal Distribution applied	URS Estimate of topsoil thickness - loose cubic metres
	Direct seeding (native tree species OR using native grasses), with single application of fertiliser	$/ha	$3,500.00	$3,500	$4,000	Lognormal Distribution applied	
	Overall topsoil and revegetation rate	$/ha		$23,500			Combined vegetation rate - no distribution applied
Landscaping, minor earthworks and revegetation throughout domain area.	Shaping or levelling of minor excavations, batters and stockpiles, final trim, rock rake and deep rip	$/ha	$1,300.00	$1,300	$1,700	Lognormal Distribution applied	
	Structural water management works, banks, drains, rock lined waterways, sediment dams	$/ha	$2,000.00	$2,000	$2,500	Lognormal Distribution applied	
Active Mining Pit or other Voids (including the voids and any internal benches or mine strips)	Truck and shovel capping to batters and floor	m3	$1.35	$10	$30	Lognormal Distribution applied	Hazelwood had $6.67/m3, but there are no sources on site, other than re-excavating any ex-pit overburden dumps which would require segregation of materials
	Buttress material	m3		$5	$10	Lognormal Distribution applied	Assume on-site source (East Field Overburden Dump)and rate includes rehab of source area
	Major bulk pushing (Clay Batter) to achieve grades nominated in the approval/permit (i.e. < 18o) <50m	m3	$1.30	$1.55	$3.00	Lognormal Distribution applied	Estimated range from range of BC rates
	Major bulk pushing (Stiff Clay or Soft Rock with ripping) to achieve grades nominated in the approval/permit (i.e. < 18o) 50-100m	m3	$1.95	$4.00	$5.00	Lognormal Distribution applied	Range based on Project Support report of 2014 which had ($2.58/m3 cut & push down batters plus $1.62/m3 spread/compact)
	Erect a 6' chain mesh security fence around the top face where the final pit will include steep faces	m	$50.00	$50	$55	Lognormal Distribution applied	consistent with rawlinsons given project scale
	Reshaping volume per m exposed batter height per lineal m of batter slope	m3 / bench / lineal m slope		100	110	Lognormal Distribution applied	URS Estimate - based on assumed average 1:1 batter slopes and balance of cut to fill - see "Batter Slopes" tab
	Final cover material over pit slope to control fire and minmise surface water infiltration	m		0.75	1	Lognormal Distribution applied	URS Estimate - based on discussion with DEDJTR
	Rip rap at final lake level	$/m2		$60	$90	Lognormal Distribution applied	Rawlinsons has $121/m2 for revetment walls 450mm thick dry place embedded in mortar - take 25% of this rate but for 0.75m thick
Ash Dams	Cap material - load, haul place	$/m3		$10	$30	Lognormal Distribution applied	As per Truck and Shovel rate above
	Cap material - compact	$/m3		$3	$4	Lognormal Distribution applied	Based on Rawlinsons of $3.60/m3 to compact
Other Management Issues	Removal of powerlines (this includes disconnection, rolling up the wires and removing the poles). It does not inlcude the removal of substations.	km	$12,000.00	$20,000	$40,000	Lognormal Distribution applied	URS estimate

URS GOVERNMENT OIL & GAS INFRASTRUCTURE POWER INDUSTRIAL

URS is a leading provider of engineering, construction, technical and environmental services for public agencies and private sector companies around the world. We offer a full range of program management; planning, design and engineering; systems engineering and technical assistance; construction and construction management; operations and maintenance; and decommissioning and closure services for power, infrastructure, industrial and commercial, and government projects and programs.

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