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Subject Morwell Mine Fire Submission

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Content of submission (you can choose multiple): Origin and circumstances of fire, Measures taken by Hazelwood Coal Mine to prevent fire, Application and administration of regulatory regimes, Response to fire by Hazelwood Coal Mine, Response to fire by Emergency Services, Response to fire by Public Health Officials, Response to fire by Other Government Agencies, Other (please state)

If Other please state here: Adequacy of regulatory regime.

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## *Submission to Hazelwood Mine Fire Inquiry*

### EXECUTIVE SUMMARY

The fire that burned in the Hazelwood coal mine in early 2014 was one of the worst environmental disasters in Victorian history. It created a choking reminder of the real price of relying on coal for electricity.

Our submission identifies a range of failures by both government regulators and mine management and some areas that need further investigation from the Inquiry. The submission covers four broad areas:

1. The adequacy of rehabilitation efforts in reducing fire risk
2. Fire prevention systems and fire-fighting response;
3. Public health implications; and
4. Other environmental issues.

Additionally Environment Victoria has commissioned two independent mine rehabilitation experts and auditors to provide their assessment of the adequacy of rehabilitation work at the Hazelwood mine. These submissions are attached as appendices to our submission.

**1. The adequacy of rehabilitation efforts in reducing fire risk:** Brown coal is a known fire risk. The best approach to fire prevention in a coal mine is to properly rehabilitate areas of the mine that are not being used. As the Hazelwood mine fire exposed, there are significant problems with the standard and extent of rehabilitation at the mine site.

Firstly, this submission outlines that rehabilitation requirements imposed on GDF Suez by the Victorian Government are currently too vague and lacking in detail to be effectively enforced.

Secondly, there has been an absence of communication between the government and GDF Suez about the status of rehabilitation work: a Freedom of Information request by Environment Victoria has revealed that at no time since 2009 has the Minister or the Department engaged in any substantive correspondence with mine management, nor has the regulator conducted any assessment of progressive rehabilitation at the site. The fact that the fire took hold in areas of the mine that had allegedly been rehabilitated suggests that any rehabilitation work that had been undertaken was not performed adequately.

The \$15 million rehabilitation bond, used in the same way a tenant pays a security deposit on a rental property, has been known since 1993 to be far too low to create any incentive for progressive rehabilitation. Financial assurance calculations used in Queensland mines suggest a bond of as much as \$483 million would be more appropriate for Hazelwood. The severe underestimate of rehabilitation costs and the level of the bond potentially creates a massive financial liability for Victorian taxpayers if GDF Suez does not properly rehabilitate the mine before it concludes its operations.

**2. Fire prevention systems and fire-fighting response:** The mine fire raised serious questions over the state of fire fighting equipment in the mine. Persistent anecdotal evidence does not match

the official responses given by mine management: a key question for the inquiry is whether the fire-fighting sprinkler system was still operational when the fire took hold.

The Inquiry should also investigate whether the mine fire was actually caused by a nearby grassfire, as commonly assumed. The potential for exposed coal to self-ignite in hot, dry weather is well known, and there are flow-on consequences from what is determined to be the origin of the fire. These relate to greenhouse gas emissions liability and insurance claims by residents.

### **3. Public health implications of the mine fire:**

The health effects of the smoke from the mine fire were a public health disaster that was not properly mitigated by the Government's response. As reported through the media, there was significant confusion amongst residents about what action should be taken, with the result that many people suffered for much longer than they should have.

By not having an existing response plan for a known hazard, the Victorian Government has failed the community. The Inquiry should consider the need for a mine fire response plan, comparable to bushfire readiness plans, which will minimise the public health impacts of any future mine fires.

**4. Other environmental impacts from the mine fire:** Environment Victoria asserts that GDF Suez should be held liable for the greenhouse gas emissions from the fire, as the emissions came from a facility entirely within their control. The Inquiry should also investigate the elevated chromium levels found in the Morwell Wetlands in the weeks after the fire started.

**Attachments:** The submission also contains, as Appendices, two reports prepared by independent certified mine auditors. These reports further highlight the need for mine rehabilitation to be thoroughly examined by the Inquiry.

We call on the Inquiry to further investigate these matters and to make strong recommendations to ensure Victorian communities are never again exposed to this type of risk, and to ensure Victorians are not further burdened by the legacy of coal mining.

## **KEY RECOMMENDATIONS**

Environment Victoria submits that the Board of Inquiry should:

1. Investigate the failure of the Government regulators to engage in any kind of communication with GDF Suez relating to mine rehabilitation since 2009;
2. Direct the Department to require GDF Suez to set out clear timelines and standards for progressive rehabilitation of the Hazelwood mine (and other Victorian coal mines), including exactly how and when these will be met;
3. Request that the Minister for Energy conduct a re-assessment of the Hazelwood mine rehabilitation bond;
4. Request that the Victorian Auditor-General's Office investigate the adequacy of current mine rehabilitation bonds all Victorian coal mines and assess the State Government's potential financial liability with respect to mine rehabilitation costs;

5. Investigate the status of the ring mains, associated sprinkler systems and any other fire-fighting procedures in the mine;
6. Investigate possible causes of the mine fire other than embers from the nearby grassfire, including the possibility of spontaneous ignition;
7. Request that the long-term health study also address the underlying health impacts of living near coal-fired power stations;
8. Ensure the Government develop an emergency response plan for communities living near coal mines, with clear roles and responsibilities, as well as pollution trigger points for evacuation;
9. Investigate and commission further research into the elevated chromium levels found by the EPA in the Morwell Wetlands;
10. Direct the Minister to require mine management to conduct an independently-verified audit of the greenhouse gas emissions caused by the mine fire, so that GDF Suez can be held liable for the carbon price associated with those emissions.

## **1. INTRODUCTION**

Environment Victoria is one of Australia's leading independent environment groups. With over 80 member groups and tens of thousands of individual supporters, we've been representing Victorian communities on environmental matters for over 40 years.

We have been working on climate change for over two decades, with a specific focus on addressing the contribution of our electricity generation to greenhouse gas emissions.

We have worked deeply on issues related to the Hazelwood power station and mine over the past decade, including monitoring the environmental impact of existing operations, examining the impact of the West field mine expansion, and advocating for the replacement of the power station as one of the most-emissions intensive in Australia.

We thank the Inquiry for the opportunity to make a submission. Our submission examines 4 areas relevant to the Inquiry's terms of reference:

- 1) Whether the mine operators had met their regulatory requirements for rehabilitating the mine site and minimizing any fire risk
- 2) Whether fire prevention systems and the fire fighting response plan were adequate once the fire took hold in the pit
- 3) Whether the public health response to the incident was adequate; and
- 4) Other environmental impacts as a result of the mine fire.

In preparing our submission we have visited the Latrobe Valley and met with local stakeholder groups to hear their views. This has included meeting with current and former mine employees, unions representing workers, local residents groups and environment groups.

We have also engaged the services of two independent consultants who are professional mine auditors, and asked them to prepare a desktop study on the adequacy of rehabilitation efforts at the Hazelwood mine. These two studies are attached to this submission as appendices.

## **2. WERE PREVIOUSLY USED AREAS OF THE MINE ADEQUATELY REHABILITATED TO MINIMISE ANY FIRE RISK?**

In response to the fire GDF Suez has publicly stated that sections of the mine to which the fire spread had been "covered with soil and grassed in line with a mine rehabilitation program."<sup>1</sup> This was apparently confirmed by the then-Minister for Energy & Resources, Nicholas Kotsiras, who told media that the Government regulators had approved that section of rehabilitated land.<sup>2</sup>

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<sup>1</sup> [http://www.abc.net.au/reslib/201402/r1239761\\_16426002.pdf](http://www.abc.net.au/reslib/201402/r1239761_16426002.pdf)

<sup>2</sup> <http://www.latrobevalleyexpress.com.au/story/2130633/exposed-coal-batter-ticked-off-by-state/?cs=1462>

This raises the question: How can the coal under a supposedly rehabilitated piece of land still catch on fire? The adequacy of mine rehabilitation efforts is therefore a key issue for the Board of Inquiry to investigate.

### 2.1. The inadequacy of rehabilitation requirements and regulation

Under its mining licence (MIN 5004), GDF Suez is required to carry out “progressive rehabilitation as per the rehabilitation plan”, or as directed by the Inspector of Mines (Condition 15.1). The *Environmental Performance Report to the EPA (May 2007)*<sup>3</sup> states that the results of progressive rehabilitation are reported annually to the Department.<sup>4</sup> This annual reporting to the Department refers to the Mine Rehabilitation Master Plan which, based on conversations Environment Victoria has had with representatives of the Department, no longer exists.

In response to a Freedom of Information request made by Environment Victoria 20 March 2014, DSDBI asserts that since 2009 (when the current Work Plan was approved):

- There has been no correspondence between GDF Suez and either the Department or the Minister relating to mine rehabilitation;
- No annual reports on progressive rehabilitation have been provided to the Department;
- There have been no reports or briefings by the Department containing assessments of rehabilitated areas of the mine.<sup>5</sup>

If this is the case it is of great concern and suggests that the regulator has turned a blind eye to progressive rehabilitation of the mine site – a clear condition of the Hazelwood mining licence. If the regulator is not auditing compliance against the Work Plan and mine licence, who is?

This indicates that the only detail around progressive rehabilitation requirements is that outlined in the Work Plan. This is also of great concern to Environment Victoria, as the Work Plan contains so little detail that it is impossible to enforce in any meaningful or effective way. For example, there is no prescribed standard around the depth of soil/clay cover of the coal seams (a key factor in the effectiveness of rehabilitation work), nor are there any timelines for when the progressive rehabilitation should occur. Conversations with representatives of the Department<sup>6</sup> have confirmed that the current Work Plan is the only regulatory document to which the Department refers when determining compliance by GDF Suez.

Following the outbreak of the Hazelwood fire, a spokeswoman from the Minister for Energy’s office said that GDF Suez had complied with the rehabilitation requirements in the Work Plan.<sup>7</sup> Given the vagueness of the requirements, it would be difficult to show either strict compliance or non-compliance. The spokeswoman added that DSDBI regularly reviewed compliance with work plan, including visits by mine inspectors. This is at odds with the response Environment Victoria received

<sup>3</sup> International Power (2007), *Environmental Report to the EPA, For 12 Months Ending December 2006*.

<sup>4</sup> The report refers to the Department of Primary Industries, which was split in 2012 between the Department of Environment and Primary Industries and the Department of State Development, Business and Innovation (DSDBI). Responsibility for energy and resources went to DSDBI.

<sup>5</sup> Letter from DSDBI Freedom of Information Branch, dated 7 May 2014.

<sup>6</sup> Personal communication, DSDBI staff, April 2014.

<sup>7</sup> <http://www.theage.com.au/victoria/mine-management-queried-in-hazelwood-fire-20140228-33rhc.html#ixzz2uqpgn6nu>

from the DSDBI Freedom of Information branch, who could find no correspondence with GDF Suez since 2009 that relates to mine rehabilitation. Either site visits by mine inspectors did not address progressive rehabilitation, which would be a major oversight, or the Department has failed to comply with their FOI obligations.

It should also be noted that the detailed reports that were previously submitted to the EPA annually no longer exist. Current annual reporting against environmental conditions provides much less information and therefore less opportunity for regulators to be confident in ensuring the safety of both people and the environment. This is a major deficiency that should be addressed in the wake of the Hazelwood mine fire.

## 2.2. Independent review advises improvements

This failure to regularly audit progress on progressive rehabilitation is compounded given previous warnings to government on the inadequacy of rehabilitation efforts at Latrobe Valley coal mines. For example in a report delivered to the Department in 2012 by the Technical Review Board (TRB), appointed in the wake of the Mine Warden's Inquiry into the catastrophic batter collapse at the Yallourn mine in 2007 the TRB said it was:

*"of the opinion that the measures which have been considered to date for the rehabilitation of a mine fall well short of what could reasonably be considered as adequate."<sup>8</sup>*

In relation to mine rehabilitation, the TRB recommended that:

*"steps are taken immediately to begin an assessment of the issues, the processes, the risks and their amelioration, the time lines and priorities and, most importantly, the cost liabilities required for closure of each existing mine."*

It appears that the State Government has ignored the prescient warnings of the TRB which may have contributed to another Latrobe Valley mine disaster.

## 2.3. Failure to progressively rehabilitate the site

The Minister's office has said that timing of progressive rehabilitation is "a commercial matter for the operator and is determined by factors like the level of demand for coal for power generation." (14-027). The statement adds that "the requirement set out in the work plan is that certain rehabilitation works must be completed at the end of each stage of the mine's operations."

While the work plan sets out the different stages of rehabilitation, it does not specify when these are expected to be performed. It is worth noting that Hazelwood's electricity generation has remained relatively stable over the past 6 years<sup>9</sup> and that, combined with the detailed knowledge of the location

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<sup>8</sup> <http://www.energyandresources.vic.gov.au/earth-resources/policy-and-legislation/advisory-councils-and-review-boards/technical-review-board/technical-review-board-annual-report-2011-2012/initiatives-for-going-forward>

<sup>9</sup> Based on production statistics from reports from Hazelwood owners to the EPA in 2007 and 2009, and generation figures from the Clean Energy Regulator.



of the coal reserves, it ought to be possible to determine well in advance when certain areas of the mine will be available for rehabilitation. Environment Victoria has been repeatedly told by local residents and current and former employees that the area where the mine fire took hold has not been mined for decades. It is therefore reasonable to expect that areas of the mine that will not be mined again are fully rehabilitated and the regulators enforce progressive rehabilitation.

As it stands, there is nothing in the sole regulatory document for the Hazelwood mine (the Works Plan) to ensure progressive rehabilitation will take place before the expiry of the mining licence.

Environmental performance reports produced by the then-owners of Hazelwood and provided to the EPA in 2007 and 2009 refer to "target estimates" for progressive rehabilitation. Targets are not mentioned in the Work Plan, and it is therefore difficult to understand how annual rehabilitation targets can be enforced. The fact that the targets are referred to as "estimates" further suggests that this is an optional process.

Reports to the EPA provide a table of completed progressive rehabilitation, indicating that (as of 2008) 521 Ha of land had been rehabilitated. As noted above, there are no clear criteria in the Work Plan by which success of rehabilitation can be assessed, and as noted in Appendix A to this submission (review by independent certified auditor Rob Savory), there are serious questions over the quality and effectiveness of the rehabilitation that had been carried out in certain areas of the mine – deficiencies that have likely contributed to the spread of the fire.

Finally, Environment Victoria is also concerned that the regulator does not see it as being in their interest to ensure progressive rehabilitation is completed, given that ultimately any failure to properly rehabilitate the site will leave a liability for local communities and the Victorian public to deal with.

#### **2.4. The inadequacy of final rehabilitation requirements and the rehabilitation bond**

Plans for final rehabilitation of the mine, as set out in the Work Plan, include flooding the pit of the mine. One rationale for this is that filling the pit with water will protect the exposed coal batters from fire. This may have provided little incentive for GDF Suez to invest any money in the rehabilitation of these batters while the mine continues to operate.

From a fire safety perspective this is entirely inadequate and unacceptable. The Work Plan itself notes that, based on water balance studies, this lake will not form immediately. In fact, the Work Plan cites two different figures on two different pages for how long it will take for water to cover the exposed coal batters. Page 6-2 estimates the pit will fill slowly "over a period of decades or more", whereas page 6-1 says the lake will fill "over a 500-year period."<sup>10</sup> Given this confusion it is clear that local communities and Victorian taxpayers are exposed to a significant risk for many generations if government is not properly regulating rehabilitation efforts.

Condition 20 of the mining licence establishes the final rehabilitation bond at \$15 million. The bond exists to provide an incentive to GDF Suez to ensure it meets its progressive rehabilitation

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<sup>10</sup> International Power Hazelwood (2009), *Work Plan Variation Mining Licence 5004: Phase 2 of the West Field Development of the Hazelwood Mine*, released by DSDBI on 13 March 2014.



requirements, so that at the end of the mine's life, the company has fully rehabilitated the site and can recover its \$15m. The problem is that the bond is far less than the likely costs of actual rehabilitation.

A Victorian Auditor-General's Office report from 1993 cited a figure of \$7.5m to rehabilitate the 300 ha Eastern Overburden dump alone, calculated by the SECV. The report also notes that, in NSW, rehabilitation of open cut coal mines is estimated at \$32,000 per hectare.<sup>11</sup> While we acknowledge that such costs can vary significantly based on the specific mine, this would correspond to overall rehabilitation costs for Hazelwood (at 3,554 ha<sup>12</sup>) as \$113.7m – an order of magnitude greater than the bond.

More recently, the Queensland Government has nominated a figure of \$136,000/ha, or the equivalent of \$483m to clean up the Hazelwood mine. The Minister in Victoria has ample scope under the *Mineral Resources (Sustainable Development) Act* to either re-assess an existing bond<sup>13</sup>, or to require an additional bond, if the initial bond is considered inadequate. The Victorian government has known since 1993 that a \$15m bond is almost certainly far too small to create any kind of incentive for management at Hazelwood to carry out proper progressive rehabilitation. No action has been taken in this time,<sup>14</sup> including when a significant mine expansion was approved in 2006.

Numerous submissions to the Victorian Government's 2012 *Inquiry into Greenfields Mineral Exploration and Project Development in Victoria* claimed bond requirements were too onerous,<sup>15</sup> but the evidence now suggests that the existing bonds are a serious *underestimate* of likely clean-up costs. The inquiry recommended "that the Victorian Government reviews the current rehabilitation bond system in comparison with alternative existing mechanisms, taking into account the end-of-mine-life environmental legacies, whilst honouring obligations for rehabilitation of specific sites."<sup>16</sup>

If GDF Suez is allowed to continue its operations without being required to perform adequate progressive rehabilitation, the \$15m rehabilitation bond will be grossly inadequate to complete the remaining necessary remediation of the site to ensure it is clean and safe for future uses. This means this very significant cost, potentially in the order of \$500 million, will be imposed on Victorian taxpayers or the site will not be properly rehabilitated and will pose an environmental hazard. While this issue is raised here specifically in relation to the Hazelwood mine fire, if rehabilitation bonds at other Victorian coal mines are also inadequate, there is potentially a multi-billion dollar liability facing the Victorian Government, with three large coal mines in the Latrobe Valley and a fourth at Anglesea.

## 2.5. Issues that require further investigation or action

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<sup>11</sup> Victorian Auditor-General's Office (1993), *Open Cut Production in the Latrobe Valley*, Special Report No. 24, p.144. Available at: [http://www.audit.vic.gov.au/reports\\_and\\_publications/latest\\_reports/reportarchive-1990-1999/19930501-open-cut-production.aspx](http://www.audit.vic.gov.au/reports_and_publications/latest_reports/reportarchive-1990-1999/19930501-open-cut-production.aspx)

<sup>12</sup> <http://www.gdfsuezau.com/about-us/asset/Hazelwood>

<sup>13</sup> Section 79A and s.80(4)

<sup>14</sup> <https://theconversation.com/stronger-laws-needed-to-prevent-another-hazelwood-coal-mine-fire-24215>

<sup>15</sup> Parliament of Victoria, Economic Development and Infrastructure Committee, *Inquiry into greenfields mineral exploration and project development in Victoria*, May 2012, p.144.

<sup>16</sup> As above, p.145

- The failure of the Government regulators to engage in any kind of communication with GDF Suez relating to mine rehabilitation since 2009, as outlined in Section 2.1, demands further investigation.
- The Department should immediately direct GDF Suez to set out clear timelines for progressive rehabilitation of the mine, including exactly how and when these will be met.
- The Victorian Auditor-General's Office should be directed to immediately investigate the adequacy of current mine rehabilitation bonds and the State Government's potential financial liability with respect to mine rehabilitation costs.

#### **Reports by independent certified mine auditors – Appendices A and B**

As mentioned above, in developing this submission Environment Victoria sought analysis from two independent and certified mine rehabilitation auditors as to the adequacy of rehabilitation objectives and efforts at Hazelwood. These reports should be read in their entirety (see Appendices) but important points made within these reports include:

- No success criteria have been identified, nor is any evidence provided that completed rehabilitation work has been successful, even though progressive rehabilitation is to be reported to the regulators (Appendix A, p7);
- "The information necessary to plan, provide cost estimates, schedule and implement rehabilitation is insufficient and arguably absent" (Appendix A, p8);
- There is a lack of detail around the required depth of overburden and topsoil on coal batters to provide effective fire prevention (Appendix B, p7);
- Successful rehabilitation works would require "significantly greater amount of money" than the \$15m bond (Appendix A, p8);
- The types of clay proposed to be used to cover the coal batters is inappropriate for the purpose (Appendix B, pp7 and 11-12; Appendix A, p4);
- Holes drilled in the material used to cover the coal (intended to disperse water) have actually exacerbated the spread of fire (Appendix B, p13);
- The fire was "an accident waiting for a time to happen" (Appendix B, p13)

### **3. FIRE PREVENTION SYSTEMS AND FIRE FIGHTING RESPONSE**

Environment Victoria would like to start by acknowledging the excellent and difficult work undertaken by fire-fighting personnel. Mine fires such as this can burn for much longer periods, and it is a credit to the individuals on the front-line that the fire has been brought under control.

There are a number of factors, however, that hampered the ability of fire-fighters to do their work once the fire was allowed to take hold due to the inadequacy of rehabilitation efforts as outlined in the previous section.

Further, given that climate science indicates there will be increasingly hot and dry conditions in south-eastern Australia, it is critical that the inquiry investigate the possible causes of the fire and the appropriateness of the fire prevention systems within Victorian coal mines.

### 3.1. What is known about fire-fighting readiness at the mine?

Environment Victoria has spoken with former employees at the mine who have said that the appropriate fire-fighting equipment was not in place in February 2014. Specifically, the entire perimeter of the mine used to be encircled by a 3-foot diameter pipe known as the “ring mains”. The ring mains provided a water supply to a network of smaller pipes that ran down the batters from the perimeter of the mine pit onto the floor of the mine.

Under the ownership of the SECV, on hot days this sprinkler system would extensively spray the exposed coal several times a day, up to an hour at a time, to ensure the coal would not dry out and spontaneously ignite in the heat. This spontaneous ignition of brown coal is a known problem and hazard – hence the watering strategy implemented by the SECV.

The above mine-watering process is outlined in the *Environmental Performance Report for 2008*, completed by the then-owners of Hazelwood and submitted to the EPA in March 2009. Interestingly, however, the mitigation measures refer to watering down of coal benches (ie. the flat parts) but not coal batters (the steeper walls). The report also notes that “these sprays are used primarily to protect major assets such as dredges and conveyors and for practical reasons are not able to cover all exposed areas of coal”. This then raises questions about how the remaining exposed coal is to be prevented from igniting, and whether rehabilitation should be required to reduce the risk of spontaneous ignition.

The area around the Hazelwood mine has been designated as a high bushfire risk area, since at least 1996, when acknowledgement of this bushfire risk was included in the previous Work Plan for the Hazelwood mine.<sup>17</sup>

During the time of the SECV, there was also a large well-equipped standby fire-fighting team, based partly at the Hazelwood mine and partly at the Yallourn mine, funded by the mine operators, precisely to deal with situations such as the outbreak of fire in the coal pit.

As noted by David Cliff, Professor of Occupational Health and Safety in Mining at the University of Queensland, in response to the Hazelwood fire, “it would be reasonable of the regulator to ask the mine to demonstrate that a fire like the current one cannot recur.”<sup>18</sup>

### 3.2. What was the real cause of the mine fire?

Since the February 2014 mine fire it has been brought to Environment Victoria’s attention by former mine-workers that a spontaneously ignited fire has been smouldering in the Hazelwood mine since 1977. This “hotspot”, known as “Old Faithful”, is located near the northern batters and while it had been contained, the fire was never fully extinguished.

<sup>17</sup> Victorian Government Gazette, No. S 104 Thursday 12 September 1996, p.63.

<sup>18</sup> <http://theconversation.com/victorias-coal-fire-poses-a-rare-challenge-for-firefighting-23698>

While the source of the Mine fire was attributed to embers from a grass fire by the Victorian Premier and Police Commissioner as has been popularly accepted through the media, there exists a very real possibility that in fact the fire that took hold in the mine on February 9, 2014, was either a spontaneous ignition or a flare-up of the existing hotspot that then spread through the mine.

The particularly hot and dry summer that preceded the Hazelwood fire, and specifically the extremely hot and dry period in early February 2014,<sup>19</sup> could have created conditions within the mine that significantly increased the risk of an internally-caused fire.

It is essential that the Board of Inquiry investigates the specific cause of the fire, and the possibility that the fire was caused not by embers from the nearby grassfire but rather spontaneous ignition from within the coal mine.

This is an important point from a liability perspective: the Department of Environment has said the greenhouse gas emissions from the mine fire will not be included in our national emissions inventory because they were caused by a 'bushfire event'. Additionally, through conversations with Morwell residents, it is our understanding that a group of insurance companies is not paying out claims on the basis that some insurance policies do not cover smoke from bushfires. Clearly the majority of the smoke was from the mine fire, but if the cause is considered to be the bushfire, then some people's insurance claims may be rejected.

### 3.3. Issues that require further investigation or action

- Were the ring mains and other sprinkler systems still in place across the entire mine in February 2014? If not, why not?
- GDF Suez has stated that they had in place a "fully reticulated fire service water system to protect operational and *strategic non-operational areas*" (#14-028). This explicitly excludes areas in the mine that are non-operational but considered unstrategic. What areas are these? Did the fires spread to these areas? What fire fighting processes were in place in these areas? To what extent was the presence or absence of fire fighting equipment approved by government agencies?
- Were the sprinkler systems being used to dampen the coal to prevent ignition, both routinely on hot days, and specifically in the days and week before this fire? If yes, can GDF Suez produce evidence to support this?
- Was the mine fire caused by spontaneous ignition of coal in the mine, as opposed to embers from the bushfire? What evidence exists to support the claim of embers from the bushfire spreading into the mine?
- The Emergency Response Plan needs to be thoroughly reviewed. Requests by Environment Victoria to access this document were denied by WorkSafe, who is responsible for regulating the plan. This document should be available for public scrutiny.

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<sup>19</sup> In the two weeks preceding the fire, there was no rain in Morwell and the average daily maximum temperature was 33.9 degrees.



## **4. PUBLIC HEALTH RESPONSE & CLEAN UP COSTS**

### **4.1. Health impacts**

The health impacts of the fire, and the inadequacy of the Government response to the needs of residents, have been well-documented in submissions collated by the Voices of the Valley group and will not be repeated here.

Environment Victoria welcomes the recent announcement of a ten-year study into the long-term health impacts of the fire. For such a study to be effective, however, we believe it will be necessary to also conduct an assessment of the baseline health impacts of living near coal-fired power stations. Studies in other countries have shown that a significant cost is being borne by coal communities. Extrapolation of these studies to the Australian context suggests coal-fired electricity could be creating an annual health burden of \$2.6 billion.<sup>20</sup>

While it is important to understand the effect of the Hazelwood fire on community health, it is equally important to understand the effect on community health of living in an area surrounded by large coal-fired power stations on a day-to-day basis.

### **4.2. Health response**

Fires within coal mines are a known hazard – both because the combustible nature of brown coal is well known, and because there have previously been instances of fires at Hazelwood and other Latrobe Valley mines. The ambiguity and uncertainty that surrounded the response to the effects of the fire is therefore a terrible failure by government authorities.

The Government needs to commit to a clear mine fire response plan, comparable to bushfire readiness plans, so that the community has a clear understanding of what to do, when to do it, and where and how help will be provided by the authorities. This should include:

- Continuous monitoring of air pollution (including PM2.5) in a number of sites in the Latrobe Valley and public disclosure of monitoring results;
- Clear agreement about what constitutes an acceptable level of pollution, and clear directives to the community when these levels are exceeded;
- Pre-established criteria for when a town, or parts of a town, will be evacuated;
- Plans for how people will be evacuated, and where they should go;
- Clear enunciation of which agencies are responsible for implementing which elements of the mine fire response plan.

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<sup>20</sup> Australian Academy of Technological Sciences and Engineering (2009), *The Hidden Costs of Electricity: Externalities of Power Generation in Australia*, p49.

## **5. OTHER ENVIRONMENTAL IMPACTS**

### **5.1. Chromium levels**

The EPA has made available on its website a range of environmental data collected by the agency in the aftermath of the fire. While the data appear to show that existing guidelines for a range of chemicals and pollutants has not been exceeded, there are occasional instances of higher-than-recommended chemical contamination.

Of particular interest is the recording from the Morwell Wetlands on 24 February that revealed levels of chromium six times higher than the Australian and New Zealand Guidelines for Fresh and Marine Water Quality.<sup>21</sup> Environment Victoria would like the EPA to clarify what consequences these elevated levels of chromium could have on the wetland ecosystem and human health.

We also request that a follow-up analysis of the wetland be conducted to assess current chromium levels. If elevated levels persist, we believe GDF Suez should be held liable under section 27 and 39 of the *Environment Protection Act* and directed to clean up the wetlands.

### **5.2. Greenhouse gas emissions**

Thus far, there has been no public discussion by any government authorities of the volume of greenhouse gas pollution that has been emitted into the environment as a result of the Hazelwood fire. Environment Victoria considers there to be two key issues in relating to these greenhouse gas emissions:

1. The volume of emissions needs to be accounted for, so that an accurate assessment of Victoria's and Australia's contribution to climate change can be made.
2. GDF Suez, as the mine operator, should be held liable under the Clean Energy Act.

In relation to the first issue, in response to questions in the Senate the Federal Department of Environment has indicated that "emissions from this event are not within the scope of the national greenhouse gas inventory" because international guidelines do not require reporting of emissions from bushfire events.<sup>22</sup> As discussed above, this is one reason why a detailed investigation into the cause of the mine fire is required as it is possible that the mine fire started on-site and not from embers from a nearby grass fire. Further if there wasn't an existing open cut coal mine, the CO<sub>2</sub> emissions from the combustion of coal would not have happened, so it seems odd that these emissions are deemed to be 'bushfire' related.

In relation to the second issue, it should be relatively straightforward to undertake an audit of the amount of coal that was burnt in the mine fire, the CO<sub>2</sub> composition of that coal and therefore the CO<sub>2</sub> emissions to the atmosphere. GDF Suez should be required to undertake this assessment and meet their liability under the Federal Clean Energy Act 2011.

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<sup>21</sup> <http://www.epa.vic.gov.au/air-quality-latrobe-valley-mine-fire/sampling-results/water-data-morwell-wetlands>

<sup>22</sup> Senate Standing Committee on Environment and Communications Legislation Committee. Answers to questions on notice, Environment portfolio. Question date 24 February 2014, question no. 65, by Senator Milne.

**Appendix A**

**Rehabilitation Issues at the Hazelwood Mine**

**Report by:**

**Tim Anderson  
NRA Environmental Consultants**



NRA Reference: HazelwoodMine\_Rehab\_L01

7 May 2014

Environment Victoria  
PO Box 12575 A'Beckett Street  
MELBOURNE VIC 8006

*Attention: Dr Nicholas Aberle*

Dear Nick

**RE: Hazelwood Mine – Mine Rehabilitation Related**

NRA Environmental Consultants (NRA) was requested by Environment Victoria (EnvVic) to provide comment on mine rehabilitation related matters concerning the Hazelwood Mine with reference to documents provided by EnvVic. It is our understanding that the information NRA provides will be used to inform a submission to be prepared by EnvVic and, as relevant, will be included as an attachment to their submission.

NRA is an independent environmental consultancy, based in offices in Townsville and Cairns. We assist our clients to fulfil their environmental management obligations and have a reputation for providing credible, independent advice. We service projects in Australia, Papua New Guinea and South East Asia. An innovator in the arena of environmental services, NRA provides environmental management and planning services at policy, strategic and operational levels. The company was established in 1984 and continues to set the standard for high quality, independent and professional services.

The information in this report is for the exclusive use of Environment Victoria, the only intended beneficiary of our work. NRA cannot be held liable for third party reliance on this document. This disclaimer brings the limitations of the investigations to the attention of the reader. The information herein could be different if the information upon which it is based is determined to be inaccurate or incomplete. The results of work carried out by others may have been used in the preparation of this report. These results have been used in good faith, and we are not responsible for their accuracy. The information herein is a professionally accurate account of the site conditions at the time of investigations; it is prepared in the context of inherent limitations associated with any investigation of this type. NRA's opinions in this document are subject to modification if additional information is obtained through further investigation, observations or analysis. They relate solely and exclusively to environmental management matters, and are based on the technical and practical experience of environmental practitioners. They are not presented as legal advice, nor do they represent decisions from the regulatory agencies charged with the administration of the relevant Acts. Any advice, opinions or recommendations contained in this document should be read and relied upon only in the context of the document as a whole and are considered current as of the date of this document.

NRA undertook a desk-based review of information provided by EnvVic *ie*:

1. Victoria Government Gazette, No S 104, Thursday 12 September 1996. Pages 1 to 96. Hereafter referred to as **Document 1**.
2. *Work Plan Variation Mining Licence 5004 Phase 2 of the West Field Development of Hazelwood Mine* (dated April 2009). This Work Plan was presented under an Explanatory Note prepared by the *Department of State Development Business and Innovation* (which reported that the Work Plan was released by the Department on 13 March 2014). Hereafter referred to as **Document 2**.

The review focused exclusively on the information presented by EnvVic as listed above. The review focused on land systems and did not address surface and/or groundwater aspects. A site visit was not undertaken, no review of specific technical data was undertaken, and specific review of the regulatory mechanisms (past and current) for the environmental management of the mining sector in Victoria was not undertaken. Each of these tasks would be required should further characterisation of mine rehabilitation aspects beyond that provided in this report be required.

The review was undertaken by Tim Anderson. He holds a Bachelor of Agricultural Science (Hons) degree majoring in the Land Resources stream, and a Master of Agricultural Science degree (research on soil physical, chemical and biological properties in stockpiles) awarded by the University of Queensland. Tim has practised in the management of land and water resources since graduating in 1984. He has over 25 years' experience working as a qualified scientist. He has a solid technical background and considerable regulatory experience, and has worked extensively on environmental management in the resources and infrastructure sector. Tim has regulatory experience gained while working in the Queensland Department of Mines, and post-graduate qualifications relevant to mine rehabilitation and extensive industry experience. Tim was Principal Environmental Advisor to Thiess for several coal mining related projects from 1996 to 2006 and Kagara Ltd's Queensland projects from 2001 to present. He has provided expert services to mining houses, Indigenous land holders, pastoral companies, and the Queensland State Government. He is a Certified Lead Auditor (Environmental) (No. 13704), a Certified Professional in Erosion and Sediment Control (CPESC Certificate No. 2723), a Certified Environmental Practitioner (CEnvP Certificate No. 002) and a past member of the Federal Ministerial Great Barrier Reef Consultative Committee (2005-2007).

## Comments

### Background to Mine Rehabilitation

Rehabilitation can be defined as the return of a disturbed site to a form, productivity level and environmental condition that conforms to an agreed land use that may not necessarily be the original use (adapted from Bell 1996).

The nature of disturbance, resulting landform and growing medium associated with some mining activities, the complexity of ecosystems, and relatively limited experience within environmental science disciplines mean that re-instatement to pre-disturbance condition and/or matching the condition of surrounding land, is not realistic for the vast majority of mining projects.

The technical approach to rehabilitation is straightforward; broadly, the rehabilitation work required is a function of:

- the characteristics of each land area (pre- and post-disturbance), and
- the desired rehabilitation outcome for each land area.

Specific rehabilitation tasks will be followed by:

- the monitoring of performance against nominated performance expectations
- necessary corrective actions
- ultimate validation of performance.

Planning and design are critical to achieving successful outcomes. Rehabilitation (planning, design and implementation) is directly dependent on the mine plan and schedule; for example, the evaluation of materials types, quantities and rates of production.

The ultimate test of rehabilitation success is the attainment of an agreed land use target (*eg* for conservation use or primary production), and the resilience of the rehabilitated landscape (*ie* its ability to resist degradation and retain function). A judgement of successful rehabilitation must be based on documented evidence.

Progress towards attaining the rehabilitation objectives should be assessed by the measurement of rehabilitation indicators. When developing rehabilitation completion criteria based on agricultural land use, prior land use and suitability and surrounding land uses should be considered. Time periods required to demonstrate success will vary depending on the land use but 5 years is considered realistic as agricultural systems, by their nature, are managed systems (*ie* they will receive regular inputs, such as fertilisers, cultivation and ongoing management). When developing rehabilitation completion criteria based on the establishment of native vegetation or ecosystems, the types of habitats or vegetation communities that will be established will be nominated. The appropriate attributes which must be manipulated and managed during the development period will vary for each situation, with a 15 year monitoring and validation timeframe considered appropriate to provide a justified level of confidence of success.

Experience in Queensland (and more widely in Australia and abroad) reveals that there are no simple solutions to achieving demonstrated, successful, on-the-ground rehabilitation performance. Haymont (2012) reported that for some parts of Australia, there are very significant areas of mining disturbance that clearly cannot be relinquished. Successful rehabilitation outcomes for mining related activities are scarce and it is clear that the task is plagued by complexity.

## Hazelwood

### **Document 1**

It is understood that **Document 1** is superseded by **Document 2** for a variety of matters concerning mine rehabilitation. It is not known (and cannot be determined by NRA without additional work) what, if any, components of **Document 1**, with the exception of the mining licence, remain current from a regulatory perspective.

The Mining Licence NO 5004 presented in **Document 1** is understood to remain current. The licence records the mine lease area of 2725ha<sup>1</sup> and specifies a rehabilitation bond of \$15M. In terms of mine rehabilitation specifications, the licence defers to subordinate documents (approved Work Plan (incorporating a Rehabilitation Plan)). The following provides a brief commentary on each of the remaining documents contained in **Document 1**.

1. The *Morwell Mine Rehabilitation Concept Plan* (December 1994) stated “*the aim of the Rehabilitation Master Plan is to provide an overall vision for the ultimate rehabilitation of all disturbed land at Morwell Mine in compliance with policy requirements.*”

The Concept Plan referred to the *5-Year Rolling Implementation Plans* which were intended to provide the scheduling of ongoing rehabilitation to a five year projection. These were to be revised annually or as required. These plans were to contain sufficient detail to enable field works to be carried out to achieve the ultimate concept of the Rehabilitation Master Plan [sic].

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<sup>1</sup> **Document 2** reports an increase in the mine lease area through the amalgamation of four new mining licences into Mining Licence NO 5004.

It included under the *Final Land Use* aspect:

- “*identification of potential future land use opportunities based on the return of the land to its pre-mined capability for agricultural and silvicultural uses.*”
- *built-in flexibility of the plan to adapt to changing conditions.*”.

It included under the *Ecological Management* aspect:

- “*Objectives for the re-establishment of a sustainable ecological regime for the area.*”
- *Indication of conservation areas.*”.

It included under the *Critical Decision Points* aspect:

- “*A list of key decisions and timing which have a significant effect on rehabilitation.*”.

Further reporting that “*Point H (Critical Decision Points) will be formulated when key decisions are required. At this stage, key decisions on the long term future of the mine are yet to be made.*”.

It is considered that *Morwell Mine Rehabilitation Concept Plan* presented a reasonable approach at the conceptual level, although the undertakings to return land to ‘*pre-mined capability for agricultural and silvicultural uses*’ are considered not appropriate (as such an outcome may not be possible to achieve).

2. The *Land Capability Analysis Hazelwood Power Corporation Mine and Environs* (dated May 1995) notes that “*disturbed land forms have little in common with the pre-disturbed condition*” and that “*the final land uses may or may not reflect pre-disturbance conditions*”. This logic, which is considered appropriate, is not consistent with the earlier *Morwell Mine Rehabilitation Concept Plan*.

The report presents recommended land uses for disturbance areas together with limitations. The land ratings undertaken were reported as ‘*broad level analysis*’. For some disturbance areas, a specific use or combination of uses is nominated, though not for all disturbance areas. No specifications are provided for grazing capacity, which is an important attribute. It is noted that a limitation of dispersive clays exist noting that “*disturbed 'soil' is often a mixture of a number of soil horizons including heavy clays and coal from overburden to considerable depths*”. Landforms having these properties would be expected to be potentially difficult to manage from a rehabilitation perspective.

3. The *Hazelwood Power Corporation (HPC) 5 Year Rolling Mine Rehabilitation Plans Summer – Autumn 1996* in isolation does not provide sufficient information for implementation purposes. The drawings provided are in part illegible. The rehabilitation works proposed appear to primarily, though not exclusively, involve revegetation. Specifications that define important attributes for rehabilitation planning and implementation are not apparent. These include, though are not limited to, depth of soil respreading, seeding rates and planting densities. In terms of practicalities of rehabilitation planning and implementation, beyond the apparent absence of key specifications (eg depth of soil respreading), there is no apparent materials balance related information; for example, volumes of soil required for respreading and haul distance related information; neither does there appear to be specific information on the bulk earthworks effort (the need for reshaping is stated and the drawings indicate the work area and possibly the final landform). Information that provides the necessary detail may be available in other documents that have not been provided to NRA.
4. The *Hazelwood Power Corporation Mining Licence Application Work Plan Submission 1 June 1995*. It is understood that the Work Plan is not intended to present specific detail necessary to implement rehabilitation, with this information to be documented in other documents (refer above).

The Work Plan includes statements concerning rehabilitation, some as follows:

- *“Hazelwood Power Corporation has made a strong commitment to rehabilitate land disturbed by mining operations in accordance with community expectations.”*
- *“The Mine has a long standing policy to ensure that all land disturbed by mining is stabilised and landscaped to blend into or complement natural features.”*
- *“The areas surrounding the Mine will ultimately be used for grazing, conservation, active and passive recreation, wetlands habitat and forestry.”*
- *“Progressive rehabilitation of the Mine overburden batters and external overburden dumps occurs each summer as operations move clear of the area.”*
- *“A Rehabilitation Concept Master Plan has been produced for the Mine. Its purpose is to provide an overall vision for the ultimate rehabilitation of all land disturbed by mining activities.”*
- *“A 5-Year Rolling Implementation Plan has been prepared for the Mine. Its purpose is to schedule ongoing rehabilitation to a five year projection and is revised annually or as required.”*
- *“Revegetation, in keeping with the Rehabilitation Concept Master Plan, is aimed at returning the land disturbed by mining to its pre-mining state. That is, forest cleared last century to open woodland for agriculture.”*
- *“Former wetland areas, drained to allow mining development, have been able to be reinstated and developed (as advised by consultants) into viable eco-systems.”*
- *“Each year's rehabilitation project work is audited and reported against financial and quantitative performance targets to management and the Rehabilitation Consultative Group.”*

As stated previously, statements *“returning the land disturbed by mining to its pre-mining state”* are not considered appropriate.

The Work Plan reports that certain areas (wetland areas) had been reinstated and developed into viable ecosystems; though, neither success criteria nor data was presented or referenced in the Work Plan to support the statement.

### **Document 2**

It is understood that **Document 2** is a variation to the Work Plan. It is not known if this is the sole variation to the Work Plan. As stated above, it is not known (and cannot be determined by NRA without additional work) what, if any, components of **Document 1**, with the exception of the mining licence, remain current from a regulatory perspective.

**Document 2** refers to a rehabilitation plan that is updated every five years (*“IPRH has progressively rehabilitated the Hazelwood Mine overburden batters and external overburden dumps under a plan that is updated every five years. The mine closure and rehabilitation concept for Phase 2 will be integrated with rehabilitation plans for the entire mine.”*). The periodicity of updates to the rehabilitation plan discussed in **Document 2** differs from that applicable to the ‘5 Year Rolling Plan’ discussed in **Document 1** (ie every 5 years cf annually).

In terms of rehabilitation, **Document 2** states *“The mine closure and rehabilitation concept for Phase 2 will be integrated with rehabilitation plans for the entire mine.”* As stated previously, it is not known, nor is it made clear in **Document 2**, to what extent the information in **Document 2** replaces that presented in **Document 1** concerning the specifics of rehabilitation (ie ‘Concept Plan’ and ‘Rolling 5 Year Plan’).

Apart from the obvious implications, the following points are made to bring to attention some of the challenges associated with the apparent lack of integration observed between **Document 1** and **Document 2**; together with items of relevance to rehabilitation.

1. The rehabilitation goals and objectives listed in **Document 2** introduce differences to the relevant statements made in **Document 1**.

*“The strategic rehabilitation and mine closure goal for the ultimate completion of the Hazelwood Mine, including West Field, is to:*

*Provide a technically feasible, safe, stable and sustainable landscape that reflects the aspirations of stakeholders within the practical constraints of rehabilitation for the mine.*

*This goal requires the following objectives to be met:*

- *A safe and stable self-supporting structure.*
  - *To maximise the opportunities for establishment of a self-sustaining ecosystem.*
  - *To minimise the use of natural resources.*
  - *To minimise the cost of recovery of resources.”.*
2. As stated above the periodicity of updates to the rehabilitation plan discussed in **Document 2** differs from that applicable to the ‘5 Year Rolling Plan’ discussed in **Document 1** (ie every 5 years cf annually).
  3. **Document 2** reports for Phase 1 and Phase 2 mining areas – *“The topsoil analysis indicates that much of the topsoil is of poor quality and structure and unsuited to storage. ....Stockpiling of topsoil to date has proven to effectively destroy the topsoil. Further investigations are being considered to try and effectively stockpile topsoil for later use, until this can be successfully undertaken there is no value in stockpiling.”.* The implication being that where the soil is not suitable, an alternate suitable growing medium will need to be provided where rehabilitation involves a revegetation component.
  4. With reference to rehabilitation material/ecosystem function, **Document 2** states *“Material mined comprises approximately 20% overburden (less than 7% of which is topsoil) and 80% coal. As the area of exposed coal batters exceeds the area from which topsoil is removed, final rehabilitation will require revegetation with coal and overburden-tolerant species and will result in a modified ecosystem.”.* Further reporting states:
    - *“Revegetation options are constrained by a shortage of topsoil.”*
    - *“The IPRH site-specific species planting guide may be augmented by vegetation trials to identify vegetation that is either coal/overburden tolerant or adaptable to inundation. Such trials will not commence before completion of the RRR project revegetation works program (nominally 2011) to balance resource demands.”*
    - *“IPRH will undertake further investigations to continue the process of optimising outcomes for mine closure and rehabilitation, including: ....*
      - *Establish trial plots to determine the ratio of coal to overburden required to achieve optimal revegetation treatments (i.e., moisture content, nutrient level, organic matter, fertiliser application and stability).*
      - *Establish controlled test plots to determine the indigenous species most responsive to the planned revegetation treatment.*
      - *Assess planting techniques to determine which ones achieve optimal coverage of tree species, particularly those species that regenerate following fire.”.*
  5. **Document 2** reports limitations to progressive rehabilitation and presents a ‘base case’ for mine closure stating that it is unreasonable to prejudge community aspirations that may prevail at the time of closure.

6. There appears to be no specific information provided in **Document 2** for:
- Material balance (volumes of material required eg cover material if required (it appears that some of the overburden material is dispersive and without specific information to the contrary, it is reasonable to suggest that a cover layer may be required for specific problematic areas); growing media; material availability and haulage distance). This information is necessary to plan and implement rehabilitation (as well as estimate costs and time periods).
  - Depth of soil replacement (or in the absence of soil, an alternate suitable growing medium). The detail provided is considered to be conceptual and without specific evidence of efficacy, is considered unproven, for example, *“Overburden faces from above the completed coal benches will be pushed down to create final shape. This same overburden will be placed over the coal batters in sufficient quantities to allow plant growth to achieve long term stability.”*.
7. **Document 2**, Appendix A - *International Power Hazelwood Code of Practice Revegetation Guide 2004* states:
- *“International Power Hazelwood and its predecessor the former SECV have been establishing indigenous trees, shrubs and grasses on overburden dumps and other grossly disturbed sites for more than a decade. Through trial and error, and more recently, monitoring of these plantings, a broad range of indigenous plants that are reliable for planting on disturbed areas, including those without topsoil, have been identified.*
  - *However, each disturbed area requires detailed assessment prior to plant selection. The soils, aspect, elevation, slope, drainage and other conditions must be taken into account when compiling plant lists for revegetation. While plantings on grossly disturbed sites have produced successful results, there is still much to learn, and failures of recalcitrant species can and do occur. Long-term survivability is of utmost importance. It is suggested that each new disturbed landform is assessed and compared to other similar sites where plantings have proven successful.”*

This information highlights the need for work to determine vegetation species to be incorporated into the species mix for specific disturbance areas.

The Guide provides no specific information on species mix (it does provide a species list divided into groupings), rates of application, planting densities and/or fertiliser regime, success criteria and monitoring methods to validate performance. It does provide information on seed collection periods.

8. **Document 2**, Appendix B - *IPRH Rehabilitation Progress Report 2008* states:
- *“The requirements for Final Rehabilitation are as follows:*
    - *The post-mining landscape is safe and stable.*
    - *The quality of surrounding water resources is protected.*
    - *The post-mining land use is sustainable and agreeable to both the local community and Government.*
    - *Success criteria are agreed to by stakeholders, monitored and reported.”*

It appears that success criteria have not been nominated. These may be nominated in other documents not made available to NRA.

- *“A total of approximately 625 ha of disturbed land has been rehabilitated to date.”*  
No information is provided to demonstrate the success or otherwise of this rehabilitation; though the report states *“The rehabilitation works are reported progressively to the Victorian Government Regulators and the public through the IPRH Environmental Review Committee (ERC) which meets quarterly. There is also a short annual (mid-year) report to DPF”*.

- The report refers to reports presented in **Document 1** (ie the Concept Plan), the inference being that the Concept Plan remains current. With reference to some areas of rehabilitation work on Eastern Overburden Dump, the report states “*The cleared site will then require considerable re-working to repair erosion scars and to stabilise the batters. The area will have to be topsoiled, sown to pasture grass and revegetated with native trees.*”. The implication being the longevity of rehabilitation works is uncertain, and should soil resources be limited (as appears to be the case based on statements made in **Document 2**) then alternate suitable growing medium will be required.
- There is no documentation provided to support statements that infer and/or allude to successful rehabilitation such as :
 

*“The west side of the dump facing the main Morwell-Hazelwood road has also been landscaped using flatter batters, covered with topsoil and sown to pasture crop. Clumps of Upperstorey trees were planted and fencing installed. However, the site was subsequently overdumped and most of the previously rehabilitated land features, including trees, were disturbed. The site has since been revegetated again and is recovering well.”.*

In conclusion and based on the documents provided (noting that other documents not available to NRA may exist and may provide additional relevant information), the following points are provided:

1. The specific agreed rehabilitation outcomes for each disturbance area appear absent or ill-defined. Specifications that NRA considers to be guiding information critical to rehabilitation change from document to document.
2. Success criteria for final rehabilitation appear not to be defined (*IPRH Mine Rehabilitation Progress Report 2008* which is presented as Appendix B in **Document 1** notes that agreed success criteria is a requirement for final rehabilitation). Without well-defined and measurable success criteria, it is not possible to validate the achievement of agreed outcomes through monitoring.
3. There appears to be insufficient information to quantify the disturbance areas. Refinement of disturbance areas based on disturbance type appears deficient.
4. The information necessary to plan, provide cost estimates, schedule and implement rehabilitation is insufficient and arguably absent. There is uncertainty in the documents as to the most successful methods for rehabilitation at this site.
5. Based on the information provided, it is not possible to provide an estimate for the rehabilitation costs without severe qualifications that would make the estimate potentially meaningless.
6. It is noted that the lease area in 1996 was 2725 ha which increased by an area (not known to NRA) at a later date. Of the lease area it appears reasonable to estimate the area disturbed by mining to be in the order of no less than 1000 ha. The disturbance types include areas (some overburden piles) that appear to have problematic physical properties. Further soil resources appear to be a limiting factor in terms of the rehabilitation program. The preceding points (1, 2, 3, 4 and 5) restrict the cost estimation of rehabilitation works for the site. Further, NRA has no information on specific assessment and calculations undertaken to determine the \$15M security bond reported in **Document 1. Attachment 1** presents an extract from the spreadsheet issued by the Queensland Government relevant to calculating rehabilitation costs in Queensland. Although site-specific information should always apply, the information in the spreadsheet is of relevance in terms of the components of rehabilitation and the order of magnitude of costs. NRA’s opinion, noting the obvious limitations stated above and assuming that the minimal rehabilitation target was to have vegetative cover (other than weeds) that has no anthropogenic use and effectively reverts to bushland with receiving waters not significantly impacted, is that a significantly greater amount of money would be required for the Victoria Government to undertake rehabilitation works at the Hazelwood Mine than allowed for by \$15M.



Please contact the undersigned should there be any points of clarification required.

Yours sincerely

**NRA Environmental Consultants**

Tim Anderson  
Principal Scientist

Enc: Attachment 1 - Extract from Rehabilitation Cost Calculator in use in Queensland  
(sourced 7 May 2014 from <http://www.business.qld.gov.au/business/running/environment/licences-permits/financial-assurance-rehabilitation/financial-assurance-security-deposit>).

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### **References**

Bell L.C. 1996. Rehabilitation of Disturbed Land. In *Environmental Management in the Australian Minerals and Energy Industries—Principles and Practices*. Ed D.R. Mulligan. University of New South Wales Press, Sydney.

Haymont R. 2012. *Critical Analysis and Mine Closure: Why do things still go wrong in a swirl of feasibility, regulation and planning?* In *Mine Closure 2012*. Eds A. Fourie and M. Tibbett, Brisbane, Queensland. 2012.

**Appendix B**

**To what extent did inadequate and/or delayed rehabilitation of exposed coal batters at the Hazelwood mine contribute to the rapid spread of the 2014 fire?**

**Report by:**

**Rob Savory  
Rob Savory Environmental Audits**

## To what extent did inadequate and/or delayed rehabilitation of exposed coal batters at the Hazelwood coal mine contribute to the rapid spread of the 2014 fire?

Key documentation - a review by Rob Savory Environmental Audits  
5<sup>th</sup> May 2014

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## 1. SCOPE

Dr Rob Savory (the Auditor) was commissioned by Environment Victoria to undertake an assessment of the circumstances surrounding the rapid spread of the Hazelwood coal mine fire.

### Scope

- To determine the reasons, both historical and recent, as to why the January 2014 coal mine fire spread so rapidly particularly into parts of the mine that had been previously rehabilitated.
- Assessment of the rehabilitation requirements in the 1995 Work Plan and in the 2009 Work Plan Variation, specifically with respect to coal fire risk reduction.
- Assessment of the quality and timeliness of the rehabilitation that has been completed to date, specifically with respect to coal fire risk reduction.
- Assessment of the quality of various environmental audits that have been undertaken, specifically with respect to emergency identification and preparedness.

## 2. DISCLAIMER

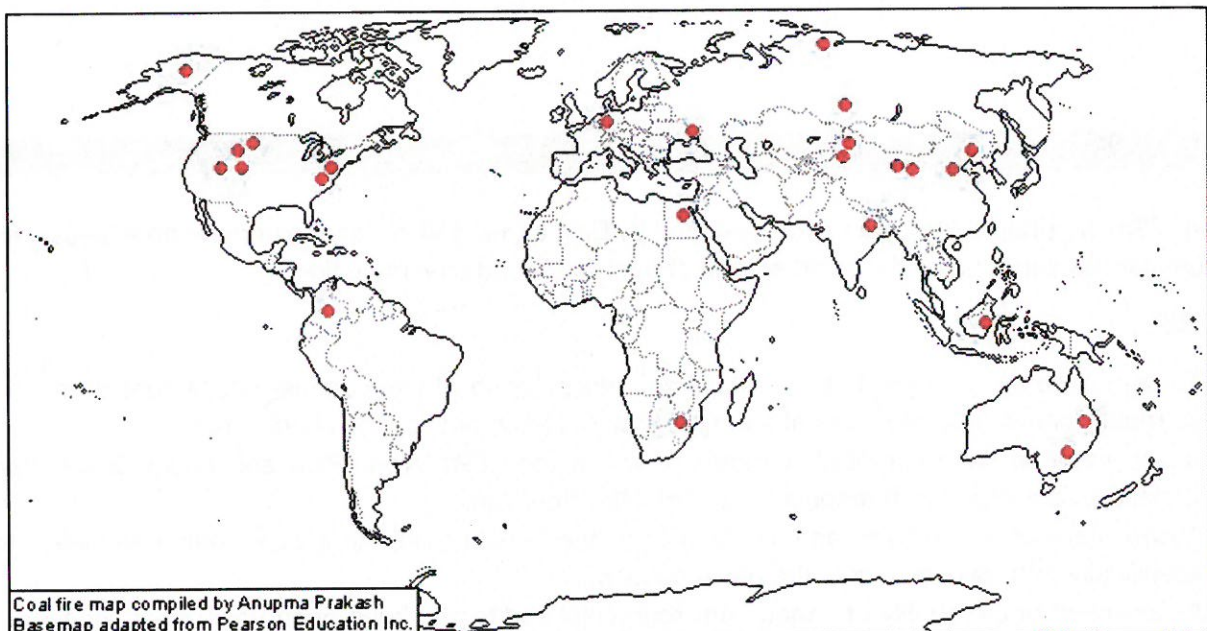
- In order to undertake a balanced and fair audit, the Auditor requested a site inspection of the Hazelwood coal mine. His telephone call to the Operations Manager was not returned. Consequently, this has become a desk audit of available documentation and images. These include:
  - A. Regulatory documents
  - B. Documents prepared for or by mine management and approved by the regulator
  - C. Documents prepared by mine management
  - D. Media reports
  - E. Images from the internet

(The Auditor is aware of the unreliability of some media reports and has not placed great weight on the three newspaper reports downloaded from the Internet.)

- The responsibility for fire emergency preparedness / prevention / control lies in two separate spheres of regulatory authority, namely Environmental authority and Health & Safety authority. The Auditor has been provided with numerous documents relating to environmental matters (rehabilitation) butnot with any significant H&S-related documents.
- In light of the above, this report obviously provides an incomplete assessment of all the factors which resulted in the rapid spread of the Hazelwood mine fire. Nonetheless, the Auditor believes that the key issues have been identified.
- The Auditor was constrained by the fact that the lead time provided by Environment Victoria for preparation and delivery of this report was just one week.

## 3. OVERVIEW OF COAL MINE FIRES WORLDWIDE

Coal mine fires are a common enoughphenomenon and their prevention and control is widely documented.



Not included on this map is the burning Strongman open-cut coal mine in the South Island of New Zealand where the Auditor installed the photo-monitoring points and conducted annual compliance audits.

#### 4. A BRIEF HISTORY OF THE HAZELWOOD COAL MINE

- April 1949 – Site excavation commenced
- November 1958 – Coal supplies commenced to the Morwell Power Station
- July 1964 – Coal supplies commenced to Hazelwood Power Station
- January 1977 – First mine fire.
- September 1996 – Hazelwood Mining Licence 5004 issued to International Power
- April 2009 – Work Plan Variation approved
- January 2014 – Second mine fire



#### 5. DETAILED AUDIT OF DOCUMENTATION AND IMAGES RELATING TO THE 2014 FIRE

##### A. Mining Licence 5004

###### Document A1.

SUBJECT	Conditions in the Hazelwood Mining Licence 5004 12 <sup>th</sup> Sept 1996 Prepared by regulator at that time: Victorian Ministry for Agriculture & Resources
Coal fire risk identification.	
Coal fire risk mitigation / reduction / prevention.	<b>15.1</b> Progressive reclamation will be conducted as per the rehabilitation plan. In addition, any further rehabilitation work will be carried out at the direction of an Inspector.
Coal fire emergency preparedness.	<b>4.5</b> Where the licence covers private land, such fire fighting equipment and appliances shall be kept on site in working order as may be required by the Country Fire authority. With respect to public land, the Forest Fire regulations 1992 require the provision of fire fighting equipment and the provision of spark on engine powered equipment <b>4.6 Burning</b> any timber on site shall be done in accordance with any requirements of the local municipality, DNRE and the Country fire authority.
<b>Auditor's comments</b>	➤ The risk of a coal mine fire is not specifically identified.

## B. Documents prepared by the mining company and accepted/approved by the regulator

### Document B1

SUBJECT	Statements and commitments in the <b>Mining Licence Application – Work Plan Submission 1 June 1995</b> Prepared by Hazelwood Power Corporation
Coal fire risk identification.	<p><b>7.4 Bushfire Mitigation Program.</b> In recognition of the fact that the mine is situated in a high bushfire risk area and <i>the potential consequences on the mine infrastructure of a bushfire</i>, HPC contributes to funding of a Bushfire Mitigation Program in the area surrounding the mine. The Bushfire Mitigation Program conforms with the "Latrobe Valley Open Cut Mines – Fire Service Policy and Code of Practice".</p>
Coal fire risk mitigation / reduction / prevention	<p><b>6.2 Progressive rehabilitation.</b> Progressive rehabilitation of the mine overburden batters and external overburden dumps occurs each summer as operations move clear of the area. A 5-Year Rolling Implementation Plan has been prepared for the mine. Its purpose is to schedule on-going rehabilitation to a 5 year projection and is revised annually or as required. The rehabilitation work is subdivided into several projects, usually by location. Each project could typically contain the following elements:</p> <ul style="list-style-type: none"> <li>• Bulk earthworks <i>for landscaping</i></li> <li>• Topsoil reclamation/spreading</li> <li>• Drainage</li> <li>• Wetlands development</li> <li>• Sowing to pasture</li> <li>• Planting trees</li> <li>• Fencing</li> <li>• Noxious weed eradication</li> <li>• Maintenance</li> </ul>
Coal fire emergency preparedness.	<p><b>5.7 Fire protection policy.</b> HPC adheres to the "Latrobe Valley Open Cut Mines – Fire Service Policy and Code of Practice" issued April 1994 for the mine, bunkers and their surroundings to ensure adequate:</p> <ul style="list-style-type: none"> <li>• Management accountability</li> <li>• Preparedness and planning</li> <li>• Training of personnel</li> <li>• Installed fire protection systems</li> <li>• Fire extinguishing capability</li> <li>• Emergency procedures</li> </ul> <p>The Fire Service policy and Code of Practice contains the essential requirements and operating procedures for fire protection services for the mine and its surrounding area. An extensive network of water reticulation and sprays has been established in the mine for fire protection.</p> <p><b>7.6 Fire Instructions.</b> As part of Fire Prevention management, HPC has promulgated a set of Instructions for mine personnel; these instructions are updated prior to every fire season – Usually in December. Prior to the fire season each year, all mine personnel are required to fire training conducted by the mine's fire service section. The Fire Instructions are incorporated as part of the mine's Emergency Control Plan.</p>
<b>Auditor's comments</b>	<ul style="list-style-type: none"> <li>➤ While the risk of a fire is identified, the concern is for the mine infrastructure, not for the coal resource or for the nearby community in Morwell.</li> <li>➤ Rehabilitation earthworks are primarily for landscaping, not fire prevention.</li> <li>➤ 5.7 and 7.6 are outside the scope of this report..</li> </ul>

## Document B2.

SUBJECT	Information in the <b>Morwell Mine rehabilitation concept Master Plan</b> December 1994 Prepared by: DPS Pty Ltd for Hazelwood Power Corporation
Coal fire risk identification.	
Coal fire risk mitigation / reduction / prevention	<p><b>4. Mine rehabilitation policy</b> <b>(i) Operational phase.</b></p> <ul style="list-style-type: none"> <li>• Where physically practical, screen operational work areas to minimise visual intrusion, and</li> <li>• Minimise disturbance of waterways, vegetation and landforms in non-operational areas</li> </ul> <p><b>5. Purpose of the Morwell Mine rehabilitation master plan</b> The Master Plan will encompass the following aspects: <b>F. Fire protection.</b> An explanation of the way in which fire protection has been taken into account. Point F is to be governed by the internal documents "Open cut fire protection policy" and "trees and Fire Protection"</p>
Coal fire emergency preparedness.	
<b>Auditor's comments</b>	<ul style="list-style-type: none"> <li>➤ The Mine Rehabilitation Policy contains no mention of fire-proofing the coal batters.</li> <li>➤ The internal documents "Open cut fire protection policy" and "Trees and Fire Protection" are not available to the Auditor.</li> </ul>

## Document B3.

SUBJECT	Conditions in the <b>5 Year rolling mine rehabilitation plans.</b> <b>Summer-autumn 1996</b> (Undated) Prepared by Hazelwood Power Corporation
Coal fire risk identification.	
Coal fire risk mitigation / reduction / prevention.	<p><b>Area 2 and 3.</b> An existing batter areas is to be cleared of poisoned blackberries and sown with grass seed. <b>Area 5.</b> Stage 3 of the Eastern Batters is to be shaped, grassed and drainage provided.</p>
Coal fire emergency preparedness.	
<b>Auditor's comments</b>	<ul style="list-style-type: none"> <li>➤ The risk of a coal mine fire has not been identified.</li> </ul>

## Document B4.

SUBJECT	<p style="text-align: center;">Commitments in  <b>Work Plan Variation – Mining Licence 5004 - Mining of Phase 2 of the West Field development of Hazelwood Mine April 2009</b>  Prepared by Coffey Natural Systems Ltd for International Power Hazelwood  Accepted by Mining Registrar [REDACTED] and by Delegate of the Department Head,  (Mineral Resources, Department of Strategic Development and Business Development)  on 11-05-2009</p>
Coal fire risk identification.	<p><b>9 HEALTH AND SAFETY MANAGEMENT PLAN</b>  <b>9.2 Hazard risk assessment</b>  To ensure that the work plan contains information as prescribed in Schedule 13 of Mineral resources Development Regulations 2002, IPRH undertook a risk assessment to identify major occupational health and safety mining hazards associated with the development of the West Field (West 2003). The assessment was aimed at achieving compliance with the requirements for a safety assessment as per the Occupational Health and safety (Mines) Regulations 2002. <i>A Major Mining Hazard (MMH) is defined under these Regulations as "a mining hazard that has the potential to cause an incident that causes or poses a significant risk of causing, more than one death."</i>  The first step ... generated an initial list of [BLANKED OUT] mining hazards for further assessment and consideration as potential MMHs.</p>
Coal fire risk mitigation / reduction / prevention	<p><b>5.2.2 Miner overburden disposal.</b> <i>The stacker will emplace overburden over the former batters in the South East field.</i>  <b>5.2.3 Coal recovery</b> <i>Working coal batters will be laid back to a slope of 1H:1V until final batters are excavated when they will be flattened to approximately 3H:1V.</i>  <b>6.2 Rehabilitation objectives</b></p> <ul style="list-style-type: none"> <li>• A safe and stable self-supporting structure.</li> <li>• To maximise the opportunities for establishment of a self-sustaining ecosystem.</li> <li>• To minimise the use of natural resources</li> <li>• To minimise the cost of recovery of resources.</li> </ul> <p><b>6.3 Rehabilitation issues</b></p> <ul style="list-style-type: none"> <li>• Mine stability</li> <li>• Natural equilibrium</li> <li>• <i>Batter stability: Batter stability is achieved by free-draining horizontal bores that drain water captured in cracks and fractures within the coal seams.</i></li> <li>• Infrastructure</li> <li>• Rehabilitation material / ecosystem function</li> <li>• Resource recovery</li> <li>• Public safety</li> </ul> <p><b>6.2 Progressive Rehabilitation Staging / Sequencing</b>  (2) The permanent coal batters will be shaped to final slope as part of the "normal" mining operation (nominally 2.5-3H:1V).  (3) Overburden faces from above the completed coal benches will be pushed down to create a final shape. This same overburden will be placed over the coal batters in sufficient quantities to allow plant growth to achieve long-term stability. Benches are already covered in overburden materials (as part of "normal" operations) to allow vehicle passage and reduce the risk of fire.</p>
Coal fire emergency preparedness.	<p><b>5.4.4 Water management – Mine Fire Service System</b>  Fire management for the West Field will be a continuation of existing methods and generally comply with the Latrobe Valley open Cut Protection Policy. The two main reasons why the IPRH cannot strictly comply with the Policy are:</p> <ul style="list-style-type: none"> <li>• At any point in time IPRH may not have all duplicate power supplies in service as they occasionally need maintenance and operational rearranging.</li> <li>• IPRH has one conveyor installation that supplies Energy Brix where IPRH do not have duplicate water supplies because of the costs. This does not however materially increase the risk to IPRH's other operating plant as the other installation is physically separate.</li> </ul>



Auditing	<p><b>7.2 Phase 2 Mining – Environmental Management System (EMS)</b>  <i>IPRH's EMS is consistent with the principles of AS/NZS ISO 14001 and was certified on 2 February. It has been recertified in 2000, 2003 and 2006.</i></p>
Other	<p><b>5.4.1 Firehole management</b>  <i>The State Electricity Commission of Victoria (SECV ) identified the fireholes in the West Field Phase 1 and 2 areas when planning the Driffield Mine Development proposed in the 1980s. IPRH uses the SECV data to design, drill sample and test programs in areas of potential fireholes.[Detail follows]</i></p> <p><b>5.4.2 Mine stability and subsidence – Stability Management Plan</b>  <i>The following “Critical Control” to be applied at various locations “Horizontal bores to be installed so as to intersect major cracking in coal batters”</i></p>
Auditor's comments	<ul style="list-style-type: none"> <li>➤ This document does not state whether or not the hazard assessment committee considered that a coal fire was a Major Mining Hazard.</li> <li>➤ Passing reference to a fire risk on the benches, but not on the coal batters.</li> <li>➤ Neither the Rehabilitation Objectives nor the Rehabilitation Issues include the fact that covering the coal batters with overburden is, in part, for fire-proofing.</li> <li>➤ No detail regarding the required depth of overburden and topsoil on the coal batters.</li> <li>➤ Clearly neither the consultant who prepared this Work Plan nor the regulators who signed off on it had any concept of fact that the recommended horizontal bores drilled into the coal batters would considerably exacerbate the spread of a mine fire.</li> <li>➤ The final batter slope of 1H:3V or 33% is equivalent to approx 20°. There is no requirement for overburden (angle of repose of approx 35°) placed on the batters by the stacker to be compacted by track-rolling in order to (i) reduce the potential for erosion and (b) protect the coal from fire by sealing it off from the atmosphere. (See Images Section E).</li> <li>➤ See Document C2 re ISO 14001 audits.</li> <li>➤ A firehole is a paleofeature in a coal seam. It is where there was a fire in the organic matter (eg. peat) <u>at the time when the coal was being laid down</u>. The fire burned out and the remaining hole was subsequently filled with the sedimentary deposits that constitute today's overburden. It has nothing to do with modern day coal mine fires.</li> </ul>

### C. Other documents prepared by the mining company

#### Document C1.

SUBJECT	Information in the <b>Land Capability Analysis – Mine and Environs May 1995</b> Prepared by DPS Pty Ltd for Hazelwood Power Corporation																	
Coal fire risk identification.	n/a																	
Coal fire risk mitigation / reduction / prevention	n/a																	
Coal fire emergency preparedness.	n/a																	
Other matters		<table border="1"> <thead> <tr> <th data-bbox="521 1655 699 1686">Land Unit</th> <th data-bbox="703 1655 1458 1686">Landuse limiting characteristics</th> </tr> </thead> <tbody> <tr> <td data-bbox="521 1693 699 1720">GS</td> <td data-bbox="703 1693 1458 1720"><i>Dispersive, swell-shrink clay, USG B Horizon</i></td> </tr> <tr> <td data-bbox="521 1727 699 1753">MS</td> <td data-bbox="703 1727 1458 1753"><i>Dispersive, swell-shrink clay, USG B Horizon</i></td> </tr> <tr> <td data-bbox="521 1760 699 1787">SS</td> <td data-bbox="703 1760 1458 1787"><i>Dispersive, swell-shrink clay, USG B Horizon</i></td> </tr> <tr> <td data-bbox="521 1794 699 1821">GSd</td> <td data-bbox="703 1794 1458 1821">-</td> </tr> <tr> <td data-bbox="521 1827 699 1854">Po/GSo</td> <td data-bbox="703 1827 1458 1854"><i>Dispersive clays</i></td> </tr> <tr> <td data-bbox="521 1861 699 1888">MSo</td> <td data-bbox="703 1861 1458 1888"><i>Dispersive clays</i></td> </tr> <tr> <td data-bbox="521 1895 699 1921">MSc</td> <td data-bbox="703 1895 1458 1921"><i>Dispersive clays</i></td> </tr> </tbody> </table>	Land Unit	Landuse limiting characteristics	GS	<i>Dispersive, swell-shrink clay, USG B Horizon</i>	MS	<i>Dispersive, swell-shrink clay, USG B Horizon</i>	SS	<i>Dispersive, swell-shrink clay, USG B Horizon</i>	GSd	-	Po/GSo	<i>Dispersive clays</i>	MSo	<i>Dispersive clays</i>	MSc	<i>Dispersive clays</i>
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Po/GSo	<i>Dispersive clays</i>																	
MSo	<i>Dispersive clays</i>																	
MSc	<i>Dispersive clays</i>																	
Auditor's comments	<ul style="list-style-type: none"> <li>➤ Dispersive clays (aka sodic clays) are ones which rapidly break down and disperse when wetted. Coal batters protected with such material would be highly susceptible to gully erosion (See Section E, Image E2 )</li> <li>➤ Swell-shrink clays (aka montmorillonitic clays) are ones which crack when they dry out. Coal batters protected with such material would be exposed to fire and oxygen (See Section E, Image E3).</li> </ul>																	

## Document C2.

<b>Environmental Performance Report for 12 months ending December 2006</b> May 2007 Prepared by International Power Hazelwood mine	
Coal fire risk identification.	
Coal fire risk mitigation / reduction / prevention	<b>3.6 Rehabilitation of disturbed land</b> A total of 17 ha of rehabilitation works on disturbed land (Overburden Dumps / Mine Void permanent batters) was completed against a target estimate of 28ha during 2006. The total amount of land rehabilitated since the mine's inception is 467ha. When losses due to expansion of the mine into the new West field are taken into account, the net figure is 476ha.
Coal fire emergency preparedness.	SEE 'Audits'
Audits	<b>ISO 14001 Recertification audit in October 2006</b> Undertaken in late 1997 by NATA Certification Services International The auditor considers that the EMS operated by IPRH complies with the requirements of AS/NZS ISO 14001:2004 and will be making recommendations for ongoing formal third party certification. Congratulations!!". <b>Compliance audit</b> Undertaken by [REDACTED] an EPA appointed environmental auditor (Date not provided) "The site inspection also identified a number of housekeeping and storage requirements which could be improved".
<b>Auditor's comments</b>	<ul style="list-style-type: none"> <li>➤ Rehabilitating only 60% of the target is hardly satisfactory. No explanation for this is provided.</li> <li>➤ <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <p style="text-align: center;"><b>ISO 14001 Section 4.4.7 Emergency Preparedness and Response</b></p> <p>"The organisation shall establish and maintain procedures to identify potential for ... emergency situations, and for preventing and mitigating the environmental impacts that may be associated with them."</p> </div> <p>Both the NATA auditor and the EPA-appointed auditor [REDACTED] have failed to note the fact that the mine EMS did not identified the risk of a major mine fire.</p> </li> </ul>

## Document C3.

<b>Environmental Performance Report for 12 months ending December 2008</b> March 2009 Prepared by International Power Hazelwood mine	
Coal fire risk identification.	
Coal fire risk mitigation / reduction / prevention	<b>11.2.9 Total rehabilitation completed during 2008</b> 16 ha (net) Completed against Target of 16ha.
Coal fire emergency preparedness.	
<b>Auditor's comments</b>	➤ 100% of the modest rehabilitation target has been met.

## Document C4

SUBJECT	Environmental Report – Year ending December 2009 Prepared by International Power Hazelwood mine
Coal fire risk identification.	
Coal fire risk mitigation / reduction / prevention	<b>3. Mine rehabilitation</b> <i>Mine rehabilitation works planned for 2009 were deferred due to a shortage of plant and labour resources and mobile plant (trucks/loaders etc) by the contractor RTL. This was primarily due to requirements by the contractor to supply mobile plant elsewhere in the region</i>
Coal fire emergency preparedness.	
<b>Auditor's comments</b>	➤ Failure of the company to undertake any rehabilitation during the year ended December 2009 (target not stated), reflects a management attitude whereby Rehabilitation (aka "Weeds & Seeds") is placed at the bottom of the operations priority list.

## D. Media reports

## Document D1.

SUBJECT	'Time to extinguish 'Old Faithful' Report Rebecca Symons in the Latrobe Valley Express - 20 March 2014
Coal fire risk identification.	<i>It is still unknown when the Hazelwood mine fire will be reclassified from controlled to safe as firefighters focus their efforts on extinguishing a 37 year-old fire in the Hazelwood mine's northern batter. Latrobe Valley incident controller Bob Barry said that while the unit would look at scaling back appliances in the next few days, it was important that 'Old Faithful', a burning remnant of the 1977 mine fire, was checked over as it had been producing smoke since 9 February.</i>
Coal fire risk mitigation / reduction / prevention	
Coal fire emergency preparedness.	
<b>Auditor's comments</b>	➤ The fact that there had been a fire in the mine in 1977 and the fact that "Old Faithful" was still burning, should have alerted senior management and the board of International Power Hazelwood to the potential for future mine fires during periods of extreme weather.

## Document D2.

SUBJECT	Area of Vic mine fire declared safe The Australian / AAP 21 March 2014
Coal fire risk identification.	
Coal fire risk mitigation / reduction / prevention	
Coal fire emergency preparedness.	
Other	<i>The Hazelwood mine fire began on February 9 when a deliberately lit fire spotted into the mine</i>
<b>Auditor's comments</b>	➤ Noting the date when the fire started.

## Document D3.

SUBJECT	Fire enquiry hears community concerns at first meetings Report Rebecca Symons in the Latrobe Valley Express - 14 April 2014
Coal fire risk identification.	
Coal fire risk mitigation / reduction / prevention	
Coal fire emergency preparedness.	<i>Mr Gaulton and his table believed there was limited access to the mine when the fire ignited allowing it to take control and vegetation surrounding the mine should not have been there, as was outlined in procedures created following the 1977 Hazelwood mine fire.</i>
<b>Auditor's comments</b>	➤ The procedures created following the 1977 Hazelwood mine fire are not to hand.

E. Images from the internet

Image E1.



**Auditor's comments:** The fire is burning on a coal batter that appears not to have been covered with protective overburden.

Image E2.



**Auditor's comments:** Coal burning in what appears to be a series of erosion gullies that have developed in the protective overburden. This may be due to the dispersive (sodic) nature of the clay material. The upper batter slope appears to be steeper than 3H:1V. Some of the overburden appears to have moved to the lower part of the batter.

Image E3.



**Auditor's comments:** Flames rising through cracks in the montmorillonite-type clay capping.

Image E4.



**Auditor's comments:** These batters have been rehabilitated but it appears that the slope is much steeper than 3H:1V - in fact, steeper than the angle of repose of the protective overburden.

## 6. SUMMARY AND CONCLUSIONS

### Physical reasons for the rapid spread of the January 2014 coal mine fire

- Exposed coal batters.
  - NOTE: Due to operational sequencing, some coal batters would inevitably have been exposed on the day of the fire.
  - Some coal batters have remained exposed due to rehabilitation delays (details of the hectareage of the required 'progressive rehabilitation' not available to the Auditor).
- The documents contain no mention of procedures for applying the overburden and the topsoil to coal batters in a way that would reduce the fire risk.
- Some coal batters have been covered with unconsolidated overburden consisting of cracking and/or dispersive clay material. This material would have been ineffective for fire-proofing.
- Batters have been drilled with horizontal bores in order to drain water captured in cracks and fractures within the coal seams. These drill holes would have exacerbated the spread of the fire.
- Dry grass and other vegetation in rehabilitated areas.
- Extreme weather conditions at the time.

### Responsibility for the fire spreading so rapidly across the mine

The detailed assessment of available documentation leads the Auditor to believe that the catastrophic mine fire of January 2014 was inevitable, 'an accident waiting for a time to happen'.

### Problems inherited from the past

- The Auditor is keenly aware of the fact that in both Australia and New Zealand, many of the 1950s and 1960s minesite earthworks were completed to standards which were acceptable at that time but which fall far below today's rigorous environmental standards. By the nature of the mining industry, companies are now stuck with various problems from the past. This undoubtedly applies to some of the older parts of the Hazelwood coal mine (eg. the steep batters in Image E4), a fact that should be taken into account by the Inquiry into the fire.

### Senior management

- It can be assumed that the H&S hazard risk assessment conducted by Qest in 2003 did not identify a mine fire as Major Mining Hazard, ie. 'having the potential to cause more than one death'.
- The main reason for the Hazelwood fire was a lack of proper risk assessment. In light of the fact that there had been a fire in the Hazelwood mine in 1977, it beggars belief that there is no evidence of fire risk assessment in the documentation provided, for example as per the following table:

Potential Severity	Probability of Occurrence			
	Frequent	Occasional	Remote	Unlikely
Catastrophic	Extreme Risk (9)	Extreme Risk (8)	High Risk (7)	* High Risk (6)
Critical	Extreme Risk (8)	High Risk (7)	Medium Risk (5)	Medium Risk (5)
Moderate	High Risk (7)	Medium Risk (5)	Medium Risk (4)	Low Risk (3)
Minor	Medium Risk (4)	Low Risk (3)	Low Risk (2)	Low Risk (1)

Quite clearly, the potential for a fire such as the one in January 2014 falls into the High Risk zone.

- “Old Faithful” has been allowed to continue burning for years.
- There is evidence that rehabilitation, in particular the earthworks associated with covering the coal batters with overburden, had very low priority.
- Overall responsibility for the fire spreading as rapidly as it did must therefore be sheeted back to senior management (past and present) and to the board of International Power Hazelwood Mine.

#### Junior management

- The Auditor can only speculate that responsibility for ensuring that the rehabilitated coal batters were properly fire-proofed fell between two stools: The environmental rehabilitation staff were focused on planting their grasses and trees, while the H&S staff were focused on preventing mine accidents associated with vehicles, plant and hazardous substances.

#### Consultant Coffey Natural Systems Ltd

- The *Work Plan Variation*, prepared by Coffey Natural Systems Ltd for International Power Hazelwood, is a deeply flawed document.
  - The *Work Plan Variation* goes into detail about the management of ‘fireholes’. Fireholes are paleofeatures resulting from fires that burned in the peat when the coal was being laid down during the Permian, 250 million years ago. As far as coal fires today, only a brief mention of fire risk on the benches is included in this key document.
  - The *Work Plan Variation* does not provide any detail regarding the required overburden/topsoil placement on coal batters and
  - The *Work Plan Variation* includes a procedure for batter stabilisation that involves the drilling of horizontal bores into cracks in the coal seams, a practice that would only exacerbate the spread of fire.

NOTE: The Original Draft of the *Work Plan Variation* provided to the Auditor was prepared by Coffey Natural Systems. It is of course possible that mine management made alterations to the original draft version before it was forwarded to the regulator for approval.

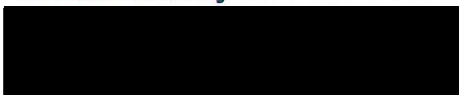
#### Government regulators

- The fact that Coffey’s *Work Plan Variation* was signed off by the Mining Registrar (Resources) and by the Delegate of the Department Head raises questions that the Auditor is not prepared to speculate on.

#### Auditors

- The Hazelwood coal mine was ISO 14001-audited and re-audited on a number of occasions by NATA. On each occasion, the EMS passed Section 4.4.7 requirements regarding *Emergency Preparedness and Response*. In the Auditor’s opinion this certification amounts to incompetence (at best) or gross dereliction of duty (at worst).
- Likewise, the EPA-appointed environmental auditor [REDACTED] who was engaged by International Power Hazelwood. His site inspection “identified a number of housekeeping and storage requirements which could be improved (Sic)”. [REDACTED]

Dr Rob Savory





## 7. AUDITOR'S QUALIFICATIONS AND EXPERIENCE

Rob Savory is an Independent (Third Party) Environmental Auditor to the mining and upstream petroleum industries.

### A. Qualifications

BSc, MSc, PhD, RABQSA Certified Lead Auditor (Environmental Compliance), MEIANZ.

### B. Relevant experience in the mining industry

- Environmental Coordinator, BHP/Groote Eylandt Mining Company, NT (Sacked) 1989 to 1993
- Principal Environmental Officer (and equivalent titles), Qld DME / DNR / EPA 1995 to 2002
- Director, Queensland Environmental Auditors, Brisbane 2002 to 2004
- Director, QNZ Environmental Auditors Ltd, Kaiapoi, NZ. 2005 to 2011
- Director, Rob Savory Environmental Audits, McCracken, SA. 2011 to 2014
- Guest lecturer, University of Adelaide (Mining Engineering) 2011

### ➤ **Coal**

External auditor to Solid Energy NZ's coal mines & coal handling facilities:

North Island: Rotowaro O/C mine, Huntly East U/G mine, Huntly West coal stockpile.

South Island: Stockton O/C mine, Ngakawau coal loadout, Spring Creek U/G mine, Terrace U/G mine, Reefton coal loadout, **Strongman O/C mine**, New Vale O/C mine, Ohai O/C mine, Port of Lyttleton.



**Strongman open cut-coal mine, South Island NZ.**

- Annual environmental audits against Resource Consent conditions (6 years):
- Annual hazchem audits against HSNO Act requirements and the company standard (2 years)

### ➤ **Gold**

- Regulatory supervision of Gympie Gold operations for six years.
- Due diligence audit of Gympie Eldorado Gold Mine (in receivership).
- Regulatory supervision of Shamrock mine operations for about six years.
- Regulatory supervision Warroo mine, Inglewood.
- Contaminated site investigations:
  - Three abandoned mines and one tailings dam in the Croydon goldfields.
  - Chariah tailings dam, Charters Towers.

### ➤ **Rehabilitation**

- Planning and personal on-site supervision of rehabilitation of the following abandoned mines:
  - Agricola gold mine, Kenilworth.
  - Jibbinbar arsenic mine, Stanthorpe.

**C. Experience in the petroleum industry**

➤ **Upstream crude oil and gas operations**

- Consultant to Beach Energy - Eromanga Qld oilfields (six-monthly trips for the past 10 years):
- Audits of Origin Energy's Kincora operations, Roma.
- Audit of Santos' Tickalara to Lytton oil pipeline in Qld.
- Signing off on the rehabilitation status of old seismic lines.
- Various audits of Mosaic Oil, Oilwells of Kentucky and Energy World operations.

➤ **CSG operations**

- Audit of Origin Energy's Spring Gully operations, Roma.
- Environmental impact assessment of Qld Gas Company proposed pipelines, Chinchilla.

**D. Experience with asbestos**

- Planning and supervising the removal & disposal of asbestos from the Mount Morgan powerhouse.
- Identification of broken packages of asbestos lagging in old shed at Runanga rail loadout, NZ.

**E. Awards**

- *Australia Day Award* - Queensland DME (Rehabilitation of the Agricola gold mine, 1997)
- *Excellence Award*- AMEEF (Team award, water management of Gympie gold mine, 1999)

**Attachment 1:  
Extract from Rehabilitation Cost  
Calculator**

**Table of Values**  
Prepared by GSSE/SLR, 2013

#	Activity / Description	Unit	Rate	Information and Instructions	Justification and Assumptions for Rates
<b>1</b>	<b>Roads, Tracks and Park-up areas</b>				
x1.01	Remove bitumen (roads, parking areas) and dump in a void on-site	m <sup>2</sup>	\$ 10.00	Enter the total area of any bitumen car parks (or similar).	Demolition cost.
x1.02	Remove stabilised material (blue metal, aggregate etc) from roadways and dump in a void on-site (Select Haul Distance from list)	m <sup>3</sup>	Select from List	Enter the total volume of any stabilised area (or similar).	972 FEL \$200 per hour, rear dump haulage at \$0.50 per tonne/km, with necessary trucks to achieve 150 cubic metres per hour.
x1.03	Remove stabilised material (blue metal, aggregate etc) from roadways and dump in a void on-site (haul distance < 1km)	m <sup>3</sup>	\$ 3.90	Enter the total volume of any stabilised area (or similar).	972 FEL \$200 per hour, rear dump haulage at \$0.50 per tonne/km, with necessary trucks to achieve 150 cubic metres per hour.
x1.04	Remove stabilised material (blue metal, aggregate etc) from roadways and dump in a void on-site (haul distance > 1 km but < 2 km)	m <sup>3</sup>	\$ 5.85	Enter the total volume of any stabilised area (or similar).	972 FEL \$200 per hour, rear dump haulage at \$0.50 per tonne/km, with necessary trucks to achieve 150 cubic metres per hour.
x1.05	Remove stabilised material (blue metal, aggregate etc) from roadways and dump in a void on-site (haul distance > 2 km but < 5 km)	m <sup>3</sup>	\$ 6.75	Enter the total volume of any stabilised area (or similar).	972 FEL \$200 per hour, rear dump haulage at \$0.50 per tonne/km, with necessary trucks to achieve 150 cubic metres per hour.
x1.06	Remove stabilised material (blue metal, aggregate etc) from roadways and dump in a void on-site (haul distance > 5 km)	m <sup>3</sup>	\$ 8.00	Enter the total volume of any stabilised area (or similar).	972 FEL \$200 per hour, rear dump haulage at \$0.50 per tonne/km, with necessary trucks to achieve 150 cubic metres per hour.
x1.07	Unsealed roads / vehicle park-up areas – Minor earthworks, final trim and deep rip	ha	\$ 900.00	Enter the total area of unsealed roads (or similar).	D11N dozer @ \$375 per hour, ~2.5 hrs per ha.
x1.08	Unsealed roads / vehicle park-up areas – Minor earthworks, final trim and deep rip (pasture grass)	ha	\$ 3,000	Enter the total area of unsealed roads (or similar).	\$900 / ha for minor push and ripping, \$860 / ha for amelioration with agricultural lime (or similar) and \$1240 / ha for native tree/shrub/grass seed.
x1.09	Unsealed roads / vehicle park-up areas – Minor earthworks, final trim and deep rip, ameliorate and seed (native tree/shrub/grass)	ha	\$ 3,855	Enter the total area of unsealed roads (or similar).	\$900 / ha for minor push and ripping, \$860 / ha for amelioration with agricultural lime (or similar) and \$2095 / ha for native tree/shrub/grass seed.
x1.10	Unsealed roads / haul roads / vehicle park-up areas with windrows and/or small earthen bunds – Minor earthworks, final trim and deep rip	ha	\$ 1,500	Enter the total area of unsealed roads (or similar).	D11N dozer @ \$375 per hour ~4 hrs per ha. Minor push and trim 2 hrs per hectare. Deep rip @ ~5 m spacing 2 hrs per hectare.
x1.11	Unsealed roads / haul roads / vehicle park-up areas with windrows and/or small earthen bunds – Minor earthworks, final trim and deep rip, ameliorate and seed (pasture grass)	ha	\$ 3,600	Enter the total area of unsealed roads (or similar).	\$1500 / ha for minor push and ripping, \$860 / ha for amelioration with agricultural lime (or similar) and \$1240 / ha for pasture grass seed.
x1.12	Unsealed roads / haul roads / vehicle park-up areas with windrows and/or small earthen bunds – Minor earthworks, final trim and deep rip, ameliorate and seed (native tree/shrub/grass)	ha	\$ 4,455	Enter the total area of unsealed roads (or similar).	\$1500 / ha for minor push and ripping, \$860 / ha for amelioration with agricultural lime (or similar) and \$2095 / ha for native tree/shrub/grass seed.
<b>2</b>	<b>Contaminated Materials</b>				
x2.01	Undertake Phase 1 contamination assessment - assumes potential contamination is localised. If there are multiple work areas on site, additional studies should be included.	Item	\$ 15,000	Assessment required where it has been identified that there is significant potential of contaminated land.	Unit cost for a standard assessment.
x2.02	Removal and off-site treatment of hydrocarbon contaminated water from workshops, bunded areas and sumps.	L	\$ 0.35	This includes the removal of contaminated water from bunded areas and sump using a vacuum truck and disposing of the water to a licensed facility.	Assumes this requires a specialist to treat.
x2.03	Remove material (carbonaceous / metaliferous spillage or otherwise) from footprint of the process facility (leach pads) / stockpile area (ROM product) / roads and dump in a void on-site (Select Haul Distance from list)	m <sup>3</sup>	Select from List	Enter the total area of any process facility / stockpile area (or similar).	972 FEL \$200 per hour. Rear Dump Haulage at \$0.50 per tonne/km. With necessary trucks to achieve 150 cubic metres per hour.

x2.04	Remove material (carbonaceous / metaliferous spillage or otherwise) from footprint of the process facility (leach pads) / stockpile area (ROM product) / roads and dump in a void on-site (haul distance < 1km)	m <sup>3</sup>	\$	3.90	Enter the total area of any process facility / stockpile area (or similar).	972 FEL \$200 per hour. Rear Dump Haulage at \$0.50 per tonne/km. With necessary trucks to achieve 150 cubic metres per hour.
x2.05	Remove material (carbonaceous / metaliferous spillage or otherwise) from footprint of the process facility (leach pads) / stockpile area (ROM product) / roads and dump in a void on-site (haul distance > 1 km but < 2 km)	m <sup>3</sup>	\$	5.85	Enter the total area of any process facility / stockpile area (or similar).	972 FEL \$200 per hour. Rear Dump Haulage at \$0.50 per tonne/km. With necessary trucks to achieve 150 cubic metres per hour.
x2.06	Remove material (carbonaceous / metaliferous spillage or otherwise) from footprint of the process facility (leach pads) / stockpile area (ROM product) / roads and dump in a void on-site (haul distance > 2 km but < 5 km)	m <sup>3</sup>	\$	6.75	Enter the total area of any process facility / stockpile area (or similar).	972 FEL \$200 per hour. Rear Dump Haulage at \$0.50 per tonne/km. With necessary trucks to achieve 150 cubic metres per hour.
x2.07	Remove material (carbonaceous / metaliferous spillage or otherwise) from footprint of the process facility (leach pads) / stockpile area (ROM product) / roads and dump in a void on-site (haul distance > 5 km)	m <sup>3</sup>	\$	8.00	Enter the total area of any process facility / stockpile area (or similar).	972 FEL \$200 per hour. Rear Dump Haulage at \$0.50 per tonne/km. With necessary trucks to achieve 150 cubic metres per hour.
x2.08	Load, cart and disposal of low level contaminated material (Hydrocarbons, Nitrates, Lead, Copper etc) off-site to a licensed landfill. Add \$50 / m <sup>3</sup> for cartage to regional landfill	m <sup>3</sup>	\$	200.00	Allows for disposal fee and cartage.	Assumes a suitable location for low level contaminant disposal is available regionally.
x2.09	Load, cart and dispose of high level contaminated material (PCB's, Dioxins, Mercury etc) off-site to a licensed local landfill. Add \$50 / m <sup>3</sup> for cartage to regional landfill	m <sup>3</sup>	\$	700	Allows for disposal fee and cartage.	Assumes a suitable location for high level contaminant disposal is available regionally.
x2.10	Onsite remediation of hydrocarbon contaminated soils (Select Volume from list) - manual land farming	m <sup>3</sup>	Select from List		Where an assessment has been made to confirm that bioremediation is possible the total volume of material can be included for onsite land farming.	-
x2.11	Onsite remediation of hydrocarbon contaminated soils (<50m <sup>3</sup> ) - manual land farming	m <sup>3</sup>	\$	55.00	Where an assessment has been made to confirm that bioremediation is possible the total volume of material can be included for onsite land farming.	Assumes the use of appropriately available excavator / bobcat
x2.12	Onsite remediation of hydrocarbon contaminated soils (>50m <sup>3</sup> but <100m <sup>3</sup> ) - manual land farming	m <sup>3</sup>	\$	44.00	Where an assessment has been made to confirm that bioremediation is possible the total volume of material can be included for onsite land farming.	Allows for economies of scale.
x2.13	Onsite remediation of hydrocarbon contaminated soils (>100m <sup>3</sup> but <500m <sup>3</sup> ) - manual land farming	m <sup>3</sup>	\$	33.00	Where an assessment has been made to confirm that bioremediation is possible the total volume of material can be included for onsite land farming.	Allows for economies of scale.
x2.14	Onsite remediation of hydrocarbon contaminated soils (>500m <sup>3</sup> ) - manual land farming	m <sup>3</sup>	\$	30.00	Where an assessment has been made to confirm that bioremediation is possible the total volume of material can be included for onsite land farming.	Allows for economies of scale.
x2.15	Mobilisation of mobile treatment unit for hydrocarbon contaminated soil treatment	Item	\$	100.000	Required if treatment of hydrocarbon contamination is required to be fast tracked	Required if treatment of hydrocarbon contamination is required to be fast tracked.
x2.16	Onsite remediation of hydrocarbon contaminated soils - using a mobile treatment unit	m <sup>3</sup>	\$	120.00	Where an assessment has been made to confirm that bioremediation is possible the total volume of material can be included for onsite land farming.	Additional cost as the treatment process is fast tracked.
x2.17	Remove and dispose of asbestos (Select Volume from list)	m <sup>3</sup>	Select from List		Where an assessment/estimation has been made to confirm the volume of asbestos to be removed.	-
x2.18	Remove and dispose of asbestos (<750 m <sup>3</sup> )	m <sup>3</sup>	\$	50.00	Enter total area of asbestos to be removed.	Remove, contain, transport and dispose of asbestos materials. This rate is for smaller volumes only (<750 m <sup>3</sup> ).

x2.19	Remove and dispose of asbestos (>750 m <sup>3</sup> )	m <sup>3</sup>	\$	40.00	Enter total area of asbestos to be removed.	Remove, contain, transport and dispose of asbestos materials. This rate is for large volumes only (>750 m <sup>3</sup> ).
x2.20	Removal and disposal of plastic liner (i.e dam, leach pad etc)	m <sup>2</sup>	\$	1.00	This rate includes cutting, removal and disposal of liner.	
<b>3</b>	<b>Mining and Exploration Works</b>					
x3.01	Active pit area – benches blasted and doze to approved grade (i.e as required under the project approval)	m <sup>3</sup>	\$	1.57	Enter total volume of material to be blasted and dozed.	Bulk drilling 8 x 9 pattern @ \$0.20 per cubic metre, explosives (can vary on contract and type) in a 0.225 m hole = \$0.70 per cubic metre. Stemming loss offsets initiation cost so total of \$0.90 per cubic metre. D11 Dozer @ \$375 per hour. Productivity ~550 cubic metres per hour
x3.02	Drill and blast faces to make safe	m <sup>3</sup>	\$	0.90	Enter total volume of material to be blasted.	Bulk drilling 8 x 9 pattern @ \$0.20 per cubic metre, explosives (can vary on contract and type) in a 0.225 m hole = \$0.70 per cubic metre. Stemming loss offsets initiation, cost so total of \$0.90 per cubic metre.
x3.03	Highwall treatment - trench and safety berm construction	m	\$	90.00	Enter total length of highwall.	Construction of a trench and a 2 m safety berm.
x3.04	Security fence around steep section of high wall	m	\$	55.00	Enter total length of highwall.	2.1 m cyclone wire (or similar) security fence.
x3.05	Purchase and erect warning signs	Item	\$	250.00	Assume one sign every 100 m of highwall.	Compliance with AS 1319-1994. Safety signs for the occupational environment.
x3.06	Seal small adits (width <2m) – install 0.5 m concrete plug 3 m back from adit and backfill with appropriate material.	Item	\$	25,000	This item includes backfilling the adit with suitable material.	Price can vary dependent on methodology, size and location, assume average cost of \$25k.
x3.07	Seal portals / adits (width >2 m) – backfill the adit for at least 50 m against a concrete bulk head with drainage slots. If concrete bulk head not required, reduce rate by 25%	Item	\$	250,000	This rate includes constructing a concrete bulk head at least 50m into the adit and then backfilling with material.	Actual costs range between \$95k and \$450k dependent on location and methodology, assume an average cost of \$250k.
x3.08	Seal and rehabilitate ventilation fan shafts	Item	\$	150,000	This includes sealing & rehabilitation of the ventilation fans for the whole mine is to be included.	Price can vary depending on methodology, size and location, assume an average cost of \$150k.
x3.09	Shaft filling – includes filling of shafts using stockpiled materials	m <sup>3</sup>	\$	30.00	This item includes a rate for the total volume of material that would be needed to backfill the shaft with suitable material.	Assumes material excavated from the shaft is stockpiled beside the hole.
x3.10	Maintenance and monitoring of sealed adits/portals and shafts (5 years)	Item	\$	25,000	Where adits / portals require periodic assessment to ensure satisfactory rehabilitated.	Accounts for ongoing inspections and maintenance requirements.
x3.11	Bore holes – cap and seal open bore holes –0.05 - 0.2 m, backfill with cuttings	Item	\$	300.00	This rate includes backfill of holes with removed material.	Manual activity carried out by operator.
x3.12	Bore holes – cap and seal open large diameter exploration and/or monitoring bore holes etc 0.2 - 0.4 m	Item	\$	2,500	This rate includes engineering (i.e., grouting, capping, sealing etc) rather than just backfill.	Requiring some level of engineering and sign-off.
x3.13	Bore holes – cap, seal and rehabilitate open bore holes - pre-drainage, goaf drainage etc	Item	\$	25,000	This rate includes excavating to 1.5 m to cut the pipe and cap and then backfill (or similar).	Requires excavating to 1.5 m to cut the pipe and cap, and then backfill.
x3.14	Bore holes – grout (with concrete) cap, seal and rehabilitate bore holes (i.e., where sealing aquifers)	Item	\$	35,000	This rate includes installation of multi-skin sleeves to prevent aquifer mixing.	Includes multi skin sleeves to prevent aquifer mixing.
x3.15	Bore holes – cap, seal and rehabilitate service boreholes for UG operations (>0.4 m)	Item	\$	45,000	This rate includes significant engineering such as installation of a concrete bulkhead followed by capping/sealing/grouting.	Requiring some level of engineering and sign-off.
x3.16	Install gate or grill over the adit (Where site might be used by bats)	Item	\$	10,000	This rate includes installation of gate or grill.	Cost for standard installation.
<b>4</b>	<b>Bulk Earthworks / Structural Works</b>					
x4.01	Major bulk pushing to achieve grades nominated in the approval/permit (Select Push Length from list)	m <sup>3</sup>	Select from List		This item includes the volume of material requiring major reshaping using a dozer to make safe an area and enable the establishment of rehabilitation.	

x4.02	Major bulk pushing to achieve grades nominated in the approval/permit – <50m push length	m <sup>3</sup>	\$	0.67	This item includes the volume of material requiring major reshaping using a dozer to make safe an area and enable the establishment of rehabilitation.	D11 Dozer @ \$375 per hour. Productivity ~550 cubic metres per hour.
x4.03	Major bulk pushing to achieve grades nominated in the approval/permit – 50m-100m push length	m <sup>3</sup>	\$	1.30	This item includes the volume of material requiring major reshaping using a dozer to make safe an area and enable the establishment of rehabilitation.	D11 Dozer @ \$375 per hour. Productivity ~300 cubic metres per hour.
x4.04	Major bulk pushing to achieve grades nominated in the approval/permit – 100m-150m push length	m <sup>3</sup>	\$	1.50	This item includes the volume of material requiring major reshaping using a dozer to make safe an area and enable the establishment of rehabilitation.	D11 Dozer @ \$375 per hour. Productivity ~250 cubic metres per hour.
x4.05	Major bulk pushing to achieve grades nominated in the approval/permit – >150m push length	m <sup>3</sup>	\$	1.90	This item includes the volume of material requiring major reshaping using a dozer to make safe an area and enable the establishment of rehabilitation.	D11 Dozer @ \$375 per hour. Productivity ~200 cubic metres per hour.
x4.06	General reshaping and pushing/trimming to achieve final landform design	ha	\$	3.900	This rate can be applied to general disturbance areas that are located on graded landforms that may require some level of re-contouring for stability purposes.	Calculated as 2 x minor earthworks (\$1,500 / ha) + final trim, rock rake & deep rip (\$900 / ha).
x4.07	Structural works and/or water management (i.e., construction of contour banks, drop structures, run-off channels etc)	ha	\$	1,600	This item includes the catchment area requiring earthworks (banks, & drains, etc) to manage all surface water within the disturbance footprint. This rate is based on an average per hectare cost to install all required soil conservation earthworks. This rate is based on an average per hectare cost to install all required soil conservation earthworks.	Combination of dozer and excavator work. Small dozer (D6 or similar) @ \$180 per hour plus small excavator @ \$180 per hour for ~4.5 hours each per hectare.
x4.08	Construction of water course entry points - required for large catchments	Item	\$	100,000	Construct rock drains (or similar) where run-off channels enter water courses - prevents erosion of gully head (assumes competent material is locally available).	Construct rock drains (or similar) where run-off channels enter water courses - prevents erosion of gully head (assumes competent material is locally available).
x4.09	Shot-creting cuttings and steep slopes	m <sup>2</sup>	\$	185.00	Enter area of steep slopes of weathered rock, roadway cuttings, etc that arent required to be cut back and stabilised.	This rate is used to rehabilitation steep slopes of weathered rock, roadway cuttings, etc that arent required to be cut back and stabilised.
<b>5</b>	<b>Rehabilitation</b>					
x5.01	Reshaping, capping / sealing of high risk material presenting environmental difficulties (ARD / AMD / PAF, carbonaceous, saline material etc)	ha	\$	136,000	This includes sourcing, carting and spreading of a suitable volume material to cap hostile material. The material must have appropriate chemical & physical properties.	Indicative work may include reshaping and/or dewatering prior to capping (~\$3.9k / ha), drainage layer / capillary break (~\$28k / ha), placing / spreading and compacting low permeability material (~\$14k / ha), drainage layer / capillary break (~\$28k / ha), engineering design specifications / inspections (~62k / ha) - does not include topsoil and revegetation.
x5.01a	Materials for reshaping, capping / sealing of high risk material presenting environmental difficulties (ARD / AMD / PAF, carbonaceous, saline material etc)	Item		Insert cost of materials	Include additional cost to import materials (i.e., shale / clay, competent drainage materials etc) and / or additional requirements (i.e., geofabric / composite lining etc).	

x5.02	Reshaping, capping / sealing of low risk material presenting environmental difficulties (ARD / AMD / PAF, carbonaceous, saline material etc)	ha	\$	108.000	This includes sourcing, carting and spreading of a suitable volume material to cap hostile material. The material must have appropriate chemical & physical properties.	Indicative work may include reshaping and/or dewatering prior to capping (~\$3.9k / ha), drainage layer / capillary break (~\$28k / ha), placing / spreading and compacting low permeability material (~\$14k / ha), engineering design specifications / inspections (~\$2k / ha) - does not include topsoil and revegetation.
x5.02a	Materials for reshaping, capping / sealing of low risk material presenting environmental difficulties (ARD / AMD / PAF, carbonaceous, saline material etc)	Item		Insert cost of materials	Include additional cost to import materials (i.e., shale / clay, competent drainage materials etc) and / or additional requirements (i.e., geofabric / composite lining etc).	-
x5.03	Tailings dam - Source local material, cart and spread to cap or backfill, cap thickness determined by approval / permit (Select Haul Distance from List)	m <sup>3</sup>		Select from List	This includes sourcing, carting and spreading of a suitable volume material to cap the tailings storage. The material must have appropriate chemical & physical properties.	-
x5.04	Tailings dam - Source local material, cart and spread to cap or backfill, cap thickness determined by approval / permit (haul distance <1 km)	m <sup>3</sup>	\$	5.40	This includes sourcing, carting and spreading of a suitable volume material to cap the tailings storage. The material must have appropriate chemical & physical properties.	Assumes tailings dam is stable enough to be capped, 972 FEL \$200 per hour, 3 x 8 Wheel trucks @ \$140 per hour, GPS D6 Dozer @ \$200 per hour, productivity 300 tph or ~240 cubic metres per hour +\$2.00 due to difficulty in capping tailings dam. Does not include topsoil or vegetation.
x5.05	Tailings dam - Source local material, cart and spread to cap or backfill, cap thickness determined by approval / permit (haul distance >1 km but <2 km)	m <sup>3</sup>	\$	6.10	This includes sourcing, carting and spreading of a suitable volume material to cap the tailings storage. The material must have appropriate chemical & physical properties.	Assumes tailings dam is stable enough to be capped, 972 FEL \$200 per hour, 3 x 8 Wheel trucks @ \$140 per hour, GPS D6 Dozer @ \$200 per hour, productivity 250 tph or ~200 cubic metres per hour +\$2.00 due to difficulty in capping tailings dam. Does not include topsoil or vegetation.
x5.06	Tailings Dam - Source local material, cart and spread to cap or backfill, cap thickness determined by approval / permit (haul distance >2 km but <5 km)	m <sup>3</sup>	\$	7.15	This includes sourcing, carting and spreading of a suitable volume material to cap the tailings storage. The material must have appropriate chemical & physical properties.	Assumes tailings dam is stable enough to be capped, 972 FEL \$200 per hour, 3 x 8 Wheel trucks @ \$140 per hour, GPS D6 Dozer @ \$200 per hour, productivity 200 tph or ~160 cubic metres per hour +\$2.00 due to difficulty in capping tailings dam. Does not include topsoil or vegetation.
x5.07	Tailings Dam - Source local material, cart and spread to cap or backfill, cap thickness determined by approval / permit (haul distance >5 km)	m <sup>3</sup>	\$	8.85	This includes sourcing, carting and spreading of a suitable volume material to cap the tailings storage. The material must have appropriate chemical & physical properties.	Assumes tailings dam is stable enough to be capped, 972 FEL \$200 per hour, 3 x 8 Wheel trucks @ \$140 per hour, GPS D6 Dozer @ \$200 per hour, productivity 150 tph or ~120 cubic metres per hour \$2.00 due to difficulty in capping tailings dam. Does not include topsoil or vegetation.
x5.08	Fill dams, voids etc - Source local material, cart and spread to cap or backfill, cap thickness determined by approval / permit (Select Haul Distance from List)	m <sup>3</sup>		Select from List	This includes sourcing, carting and spreading of a suitable volume material to cap the dam, void etc. The material must have appropriate chemical & physical properties.	-
x5.09	Fill dams, voids etc - Source local material, cart and spread to cap or backfill, cap thickness determined by approval / permit (haul distance <1 km)	m <sup>3</sup>	\$	3.90	This includes sourcing, carting and spreading of a suitable volume material to cap the dam, void etc. The material must have appropriate chemical & physical properties.	972 FEL \$200 per hour, rear dump haulage at \$0.50 per tonne/km, with necessary trucks to achieve 150 cubic metres per hour.
x5.10	Fill dams, voids etc - Source local material, cart and spread to cap or backfill, cap thickness determined by approval / permit (haul distance >1 km but <2 km)	m <sup>3</sup>	\$	5.85	This includes sourcing, carting and spreading of a suitable volume material to cap the dam, void etc. The material must have appropriate chemical & physical properties.	972 FEL \$200 per hour, rear dump haulage at \$0.50 per tonne/km, with necessary trucks to achieve 150 cubic metres per hour



x5.11	Fill dams, voids etc. - Source local material, cart and spread to cap or backfill, cap thickness determined by approval / permit ( haul distance >2 km but <5 km)	m <sup>3</sup>	\$	6.75	This includes sourcing, carting and spreading of a suitable volume material to cap the dam, void etc. The material must have appropriate chemical & physical properties.	972 FEL \$200 per hour, rear dump haulage at \$0.50 per tonne/km, with necessary trucks to achieve 150 cubic metres per hour
x5.12	Fill dams, voids etc. - Source local material, cart and spread to cap or backfill, cap thickness determined by approval / permit ( haul distance >5 km)	m <sup>3</sup>	\$	8.00	This includes sourcing, carting and spreading of a suitable volume material to cap the dam, void etc. The material must have appropriate chemical & physical properties.	972 FEL \$200 per hour, rear dump haulage at \$0.50 per tonne/km, with necessary trucks to achieve 150 cubic metres per hour.
x5.13	Trim, rock rake & deep rip (includes levelling / landscaping and rip in 1 direction)	ha	\$	960.00	This item includes the area requiring minor reshaping, rock raking and deep ripping to enhance revegetation program. It will generally include doing minor reshaping works to tidy up the site.	D11N dozer @ \$350 per hour, push / trim 1 hr per hectare
x5.14	Deep rip hard stand / lay down areas (includes ripping in 2 directions)	ha	\$	960.00	This item includes the area requiring minor reshaping, rock raking and deep ripping to enhance revegetation program. It will generally include doing minor reshaping works to tidy up the site.	D11N dozer @ \$350 per hour, deep rip @ 5 m spacing 1 hr per hectare
x5.15	Source, cart and spread topsoil (@ 0.2 m) (Select Haul Distance from List)	m <sup>3</sup>	Select from List		Includes sourcing, carting and spreading of a suitable volume of topsoil to cover the entire disturbance footprint.	
x5.16	Source, cart and spread topsoil (@ 0.2 m) haul distance <1 km	m <sup>3</sup>	\$	3.40	Includes sourcing, carting and spreading of a suitable volume of topsoil to cover the entire disturbance footprint.	972 FEL \$200 per hour, 3 x 8 Wheel trucks @ \$140 per hour, GPS D6 Dozer @ \$200 per hour, productivity 300 tph or ~240 cubic metres per hour.
x5.17	Source, cart and spread topsoil (@ 0.2 m) haul distance >1 km but <2 km	m <sup>3</sup>	\$	4.10	Includes sourcing, carting and spreading of a suitable volume of topsoil to cover the entire disturbance footprint.	972 FEL \$200 per hour, 3 x 8 Wheel trucks @ \$140 per hour, GPS D6 Dozer @ \$200 per hour, productivity 250 tph or ~200 cubic metres per hour.
x5.18	Source, cart and spread topsoil (@ 0.2 m) haul distance >2 km but <5 km	m <sup>3</sup>	\$	5.15	Includes sourcing, carting and spreading of a suitable volume of topsoil to cover the entire disturbance footprint.	972 FEL \$200 per hour, 3 x 8 Wheel trucks @ \$140 per hour, GPS D6 Dozer @ \$200 per hour, productivity 200 tph or ~160 cubic metres per hour.
x5.19	Source, cart and spread topsoil (@ 0.2 m) haul distance >5 km	m <sup>3</sup>	\$	6.85	Includes sourcing, carting and spreading of a suitable volume of topsoil to cover the entire disturbance footprint.	972 FEL \$200 per hour, 3 x 8 Wheel trucks @ \$140 per hour, GPS D6 Dozer @ \$200 per hour, productivity 150 tph or ~120 cubic metres per hour.
x5.20	Direct seeding / fertiliser (pasture grass species)	ha	\$	1,240	This rate includes acquiring a diverse mix of native tree & shrub species appropriate for the area (including understorey), mixing and treating the seed (ie smoke and heat) and applying the seed by hand at a rate between 4 - 10kg/ha (as applicable). This rate also includes undertaken soil sampling ahead of the rehabilitation program. This item includes a single application of fertiliser during the initial seeding program.	Source and spread fertiliser and seed.
x5.21	Direct seeding / fertiliser (native tree/shrub/grass species)	ha	\$	2,095	This includes direct seeding of non native pasture grass species with the principal aim of return the land to a stable, sustainable grazing land use. It is different to using pasture grasses in for temporary erosion and sediment control. This rate also includes undertaking soil sampling ahead of the rehabilitation program. This item includes a single application of fertiliser during the initial seeding program.	Source and spread fertiliser and seed.
x5.22	Planting mature trees (>15 cm)	Item	\$	20.00	This includes the seedling, fertiliser tablet, weed mat and guard - small tubestock.	4 m centres.

x5.23	Planting tube stock (<15 cm)	Item	\$	10.00	This includes the seeding, fertiliser tablet, weed mat and guard - small tubestock.	4 m centres.
x5.24	Hydro-seeding with mulch and bitumen tack	m <sup>2</sup>	\$	1.80	Areas that require additional stabilisation.	Utilising locally sourced mulch material.
x5.25	Single application of fertiliser (pasture)	ha	\$	420.00	If additional fertilising is required - assumes a rate of ~2 - 2.5 t / ha.	These rates have fluctuated over the last few years however in light of current conditions (lower fuel prices, reduced demand etc) the existing costs should continue to be the standard rates.
x5.26	Single application of fertiliser (trees)	ha	\$	140.00	If additional fertilising is required - assumes a rate of ~2 - 2.5 t / ha.	These rates have fluctuated over the last few years however in light of current conditions (lower fuel prices, reduced demand etc) the existing costs should continue to be the standard rates.
x5.27	Amelioration - lime (or similar)	ha	\$	860.00	This includes adding a soil ameliorant prior to preparation of seed bed for rehabilitation or assist stabilising dispersive soils.	For ameliorants such as agricultural lime which is ~\$345 / t and assumes ~2.5 t / ha.
x5.28	Amelioration - gypsum	ha	\$	250.00	This includes adding a soil ameliorant prior to preparation of seed bed for rehabilitation or assist stabilising dispersive soils.	For ameliorants such as gypsum which is ~\$100 / t and assumes ~2.5 t / ha.
x5.29	Amelioration - recycled gypsum	ha	\$	125.00	This includes adding a soil ameliorant prior to preparation of seed bed for rehabilitation or assist stabilising dispersive soils.	For ameliorants such as gypsum which is ~\$50 / t and assumes ~2.5 t / ha
x5.30	Topdressing amelioration with biosolids	ha	\$	1,015	Enter area required for treatment with biosolids.	Sourced locally.
x5.31	Construct no-climb stock fence around rehabilitated areas	m	\$	9.50	Where steep faces will remain a 6' chain mesh fence needs to be constructed around the perimeter of the void to restrict access to the site.	1.2 m high, 0.05 x 0.1 m (or similar) mesh .
x5.32	Construct standard stock fence around rehabilitated areas	m	\$	4.00	This item include the construction of a standard stock fence around the site to prevent stock and unauthorized person entering the site while it is being rehabilitated.	Standard 3 wire stock fence.
x5.33	Supply from external sources virgin excavated natural material (VENM) for filling voids and/or capping etc	m <sup>3</sup>	\$	72.50	Enter volume of material to be imported onto site suitable for use in filling voids and / or capping.	Allow 16 size grader and water cart to mix and spread imported material @ 150m <sup>3</sup> /hr. Allowed nominal rate of \$60/m <sup>3</sup> for imported fill material.
x5.34	Supply from external sources a combination of virgin excavated natural material (VENM) and spoil from large excavation for filling voids and/or capping etc	m <sup>3</sup>	\$	80.80	Enter volume of material to be imported onto site suitable for use in filling voids and / or capping.	Assume to import material and mix with trucked material on site. Assume local material can be free dug out of existing stockpile or bench easy digging. Assume no compaction and moisture conditioning of capping material. Allow load and haul with 65t excavator and 40t ADT fleet @ 250m <sup>3</sup> /hr. Allow 16 size grader and water cart to mix and spread imported material @ 150m <sup>3</sup> /hr. Allowed nominal rate of \$60/m <sup>3</sup> for imported fill material.
<b>6</b>	<b>Maintenance of Subsidence Impacted and/or Rehabilitated Areas (up to 5 years)</b>					
x6.01	Maintenance of established rehabilitated areas	ha	\$	2,000	Enter total area of rehabilitation requiring ongoing maintenance.	Includes general maintenance - weed management, re-seeding, amelioration, minor rehabilitation repair.
x6.02	Minor earthworks and ripping or Maintenance of mine subsidence areas	ha	\$	1,500	Enter total area requiring minor earthworks. Enter only total area experiencing surface expression of subsidence effects (i.e. cracking, sink holes).	D11N dozer @ \$375 per hour. 4 hrs per hectare.
x6.03	Create cut-through to re-establish natural water courses/drainage channels following subsidence	Item	\$	3,000	Enter total number of cut-throughs of the surface expression of chain pillars to re-establish natural drainage pathways.	Based on works completed in the Hunter Valley.
x6.04	Existing rehabilitation repair - minor	ha	\$	1,200	Enter total area requiring minor repairs.	Areas requiring minor repair - rills, minor topsoil replacement.

x6.05	Existing rehabilitation repair - moderate	ha	\$	1,700	Enter total area requiring moderate repairs.	Areas requiring moderate repair - fills, significant topsoil replacement.
x6.06	Existing rehabilitation repair - major	ha	\$	2,500	Enter total area requiring major repairs.	Areas requiring major repair - fills, gullies, topsoil replacement, some level of additional surface water management.
x6.07	Existing rehabilitation repair - total failure of landform	ha	\$	40,000	Enter total area requiring total landform re-construction.	Areas that require extensive rehabilitation repair - re-design and re-construction of landform.
x6.08	Pest management on buffer lands, non-disturbed, and rehabilitated areas	ha	\$	150.00	This item covers the costs associated with the management of pests on the site.	Baiting feral animals.
<b>7</b>	<b>Water Management</b>					
x7.01	On-site treatment of contaminated water due to high salt (includes removal of metals etc, brine disposal and cost of mobile water treatment unit)	ML	\$	3,600	Enter total volume of water to be treated.	Assumes volumes are in excess of 1,000 ML.
x7.02	On-site treatment of contaminated water due to low pH (includes removal of metals etc, neutralisation treatments and cost of mobile water treatment unit)	ML	\$	1,500	Enter total volume of water to be treated.	Assumes volumes are in excess of 1,000 ML.
x7.03	Clean water dams / sediment control structures to be retained after closure - make safe and minor earthworks	Item	\$	2,500	Enter number of minor water management structures (i.e. small sediment dams) to remain after closure	Long Reach Excavator \$330 per hour. Productivity 80 cubic metres per hour. Average dam cleanout estimated at 500 m <sup>3</sup> (20 x 25 x 1 = 500).
x7.04	Remove sediments from the floor of the dam to enable it to be converted into clean water structure (Select Haul Distance from list)	m <sup>3</sup>	Select from List		This includes removal of 500 mm of contaminated sediment and placement in the TSF to enable either backfilling of the structure or conversion to clean water dam.	
x7.05	Remove sediments from the floor of the dam to enable it to be converted into clean water structure (haul distance <1km)	m <sup>3</sup>	\$	5.10	This includes removal of 500 mm of contaminated sediment and placement in the TSF to enable either backfilling of the structure or conversion to clean water dam.	Long Reach Excavator \$330 per hour. Productivity 80 cubic metres per hour equals \$4.10 per m <sup>3</sup> loading plus \$1.00 / t / km haulage.
x7.06	Remove sediments from the floor of the dam to enable it to be converted into clean water structure (haul distance >1km but <2km)	m <sup>3</sup>	\$	6.10	This includes removal of 500 mm of contaminated sediment and placement in the TSF to enable either backfilling of the structure or conversion to clean water dam.	Long Reach Excavator \$330 per hour. Productivity 80 cubic metres per hour equals \$4.10 per m <sup>3</sup> loading plus \$2.00 / t / km haulage.
x7.07	Remove sediments from the floor of the dam to enable it to be converted into clean water structure (haul distance >2km but <5km)	m <sup>3</sup>	\$	8.60	This includes removal of 500 mm of contaminated sediment and placement in the TSF to enable either backfilling of the structure or conversion to clean water dam.	Long Reach Excavator \$330 per hour. Productivity 80 cubic metres per hour equals \$4.10 per m <sup>3</sup> loading plus \$3.50 / t / km haulage.
x7.08	Remove sediments from the floor of the dam to enable it to be converted into clean water structure (haul distance >5km)	m <sup>3</sup>	\$	10.10	This includes removal of 500 mm of contaminated sediment and placement in the TSF to enable either backfilling of the structure or conversion to clean water dam.	Long Reach Excavator \$330 per hour. Productivity 80 cubic metres per hour equals \$4.10 per m <sup>3</sup> loading plus \$5.00 / t / km haulage.
x7.09	Water pumping/transfer between pits	ML	\$	115.00	Enter the volume of water that is required to be pumped/transferred on site.	D10 size motorised pontoon pump. Fuel - \$1.00 / L @ 1500L / day + Maintenance and support = \$600 / day + Equipment rental = \$300 / day = ~\$2400 / day. Water moved - 250 L / s = 20 ML / day.
<b>8</b>	<b>Creek Diversions</b>					
x8.01	Repairs and/or stabilisation of new or compromised water course diversion	m	\$	2,500	This item includes the length (m) requiring stabilisation of recently constructed diversions that have not been completely stabilised. It assumes a suitably qualified engineer has designed and signed off on construction of the diversion.	Assumes material is suitable for revegetating and has a reasonable chance of stabilising.

x8.02	Long term maintenance of water course diversion – Channel constructed through backfilled material	m	\$	1,500	This item includes the length (m) requiring ongoing maintenance of diversions constructed through unconsolidated overburden. This will include earthworks repairs and stabilisation following flow events. It assumes a suitably qualified engineer has designed and signed off on construction of the diversion.	Assumes maintenance has been kept up and significant works are not required.
x8.03	Long term maintenance of water course diversion – Channel constructed through competent material	m	\$	750.00	This item includes the length (m) requiring ongoing maintenance of diversions constructed through competent ground. This will include earthworks repairs and stabilisation following flow events. It assumes a suitably qualified engineer has designed and signed off on construction of the diversion.	Assumes maintenance has been kept up and significant works are not required.
x8.04	Installation of rock armouring	ha	\$	60,000	Enter area of diversions requiring rock armouring to ensure long term stability.	Assumes competent material is locally available.
<b>9 Termination of Services and Demolition Works</b>						
x9.01	Disconnect and terminate all services (Water, electricity, gas etc at point of attachment to site)	Item	\$	35,000	For disconnection of all services, at building boundaries, physical cut at the distribution centre.	For disconnection of all services, at building boundaries, physical cut at the distribution centre.
x9.02	Disconnect and terminate services at remote areas (pump stations, remote workshops, sewage treatment plant etc)	Item	\$	5,500	Used for infrastructure remote from primary connection.	Used for infrastructure remote from primary connection.
x9.03	Removal of low/medium voltage powerlines including disconnection, rolling up the wires and removing the poles - does not include the removal of substations	km	\$	15,000	This rate is for low (<1kV) to medium voltage (>72 kV) powerlines.	Applies to low (<1kV) and up to 72 kV power lines.
x9.04	Removal of powerlines including disconnection, rolling up the wires and removing the poles) - does not include the removal of substations	km	\$	1,000,000	This rate is for high voltage (>72 kV) powerlines that are typically owned by the supply authority. Assumes 3 towers / km.	Applies to high voltage (>72 kV) powerlines assuming 3 towers / km.
x9.05	Demolish and/or remove substations in an enclosed building	Item	\$	20,000	Apply this rate for the total number of substations within the domain.	Simple structure to demolish, assumes single story building.
x9.06	Demolish and remove switchyard - does not include decontamination, removal of oil etc	m <sup>2</sup>	\$	55.00	Includes all switchgear and transformers etc.	Includes all switchgear and transformers etc.
x9.07	Demolish and remove small buildings (camps, administration buildings, accommodation, bath house etc)	m <sup>2</sup>	\$	77.00	Assumes no greater than 2 stories high.	Assumes no greater than 2 stories high.
x9.08	Demolish and remove light industrial buildings (light vehicle workshop, warehouse/store, transfer station etc)	m <sup>2</sup> /floor	\$	115.00	Must be calculated per floor/level (Assume 1 floor/level = 3-4 m).	Must be calculated per floor/level (Assume 1 floor/level = 3-4 m).
x9.09	Demolish and remove industrial buildings (workshops, tyre change and servicing area etc - not CHPP)	m <sup>2</sup> /floor	\$	176.00	Must be calculated per floor/level (Assume 1 floor/level = 3-4 m).	Must be calculated per floor/level (Assume 1 floor/level = 3-4 m).
x9.10	Demolish and remove processing equipment (i.e. washery, crushers, mills, furnaces, agglomeration, electrowinning, floatation, sizing stations, rotary breakers etc) - include the area of each floor of the structure	m <sup>2</sup> /floor	\$	265.00	Must be calculated per floor/level (Assume 1 floor/level = 3-4 m).	Must be calculated per floor/level (Assume 1 floor/level = 3-4 m).
x9.11	Remove stacker or reclaim (i.e., radial, luffing etc) - does not include remove rails, ballast and conveyor etc	Item	\$	1,000,000	Apply this rate for the removal of each radial and/or luffing (or similar) stacker or reclaim.	Just removal of the stacker or reclaim unit - does not include terminate services, remove rails and ballast etc.
x9.12	Demolish and remove bucket wheel stacker/reclaimer or wing stacker - does not include remove rails, ballast and conveyor etc	Item	\$	2,500,000	Apply this rate for the removal of each bucket wheel stacker reclaim.	Just removal of the bucket wheel stacker/reclaim unit - does not include terminate services, remove rails and ballast etc.
x9.13	Remove rails and ballast for stacker and/or reclaim - does not include the conveyor system	m	\$	75.00	Apply this rate for removing the rails and ballast/footings when rail mounted stacker reclaimers are present.	Includes both rails, does not include the conveyor system.
x9.14	Collapse, cut and remove ~5000 t coal silo	Item	\$	100,000	Enter the number of large coal silos to be removed.	Demolition expert estimate to collapse structure and remove.

x9.15	Collapse, cut and remove ~3000 t coal silo	Item	\$	85,000	Enter the number of medium coal silos to be removed.	Demolition expert estimate to collapse structure and remove.
x9.16	Collapse, cut and remove ~1250 t coal silo	Item	\$	65,000	Enter the number of small coal silos to be removed.	Demolition expert estimate to collapse structure and remove.
x9.17	Demolish and remove on-ground conveyors and gantries (scrap only - does not include dismantling for reuse at another site)	m	\$	285.00	Enter the length of conveyors that are on the ground.	Estimate for on-ground conveyor.
x9.18	Demolish and remove overhead conveyors and gantries (scrap only - does not include dismantling for reuse at another site)	m	\$	370.00	Enter the length of conveyors that are elevated >5 m off the ground.	Estimate for overhead conveyor.
x9.19	Demolish and remove wire rope Doppelmayr overhead conveyors (scrap only - does not include dismantling for reuse at another site)	m	\$	565.00	If conveyors are wire rope rather than rigid structures.	Assumes every 150m is a support tower - included in cost.
x9.20	Demolish reclaim tunnel, cut rio and expose reclaim conveyor, then collapse into the reclaim tunnel void (Does not include excavation to expose reclaim tunnel, removal of conveyor or backfilling void)	m <sup>2</sup>	\$	80.00	Apply this rate to the area of the roof of the reclaim tunnel to be "punched in" to expose the conveyor for removal - does not include excavation of material to expose the structure.	Does not include conveyor removal or backfill.
x9.21	Remove and demolish conveyor from reclaim tunnel (Does not include excavation and demolition of reclaim tunnel roof)	m	\$	150.00	This rate applies to conveyors in reclaim tunnels that do not have canopies or protection from the elements.	Due to no canopy or infrastructure attached.
x9.22	Demolition of reclaim tunnel concrete (Assumes complete removal of concrete structure and local disposal)	m	\$	950.00	If a reclaim tunnel is to be completely removed.	Assumes this area will be used for another land-use that requires the structure to be dug up and re-buried somewhere else.
x9.23	Dismantle on-ground conveyors for reuse/resale	m	\$	750.00	If the intention is to re-use the conveyor in another location, the cost is ~2.5x the demolition cost.	Approximately 2.5 times the cost of demolition - Baal Bone experience.
x9.24	Dismantle overhead conveyors for reuse/resale	m	\$	1,000	If the intention is to re-use the conveyor in another location, the cost is ~2.5x the demolition cost.	Approximately 2.5 times the cost of demolition.
x9.25	Demolition and removal of vent fans, electrical substation and winch	Item	\$	25,000	This includes the removal of the fan and all surface infrastructure associated with a ventilation shaft.	Recent experience southern NSW - does not include filling and capping the shaft.
x9.26	Demolish and remove above ground small tank clean (Thickener etc 3 - 9 m diameter)	Item	\$	10,000	This includes removing all thickener or flocc tanks etc from the site including an associated pipework and pumps, etc.	Assume tank is clean - contents removed. If tank is full allow extra 30% for excavator and 2 men to dig out and dispose.
x9.27	Demolish and remove above ground medium tank clean (Thickener etc 10 - 15 m diameter)	Item	\$	30,000	This includes removing all thickener or flocc tanks etc from the site including an associated pipework and pumps, etc.	Assume tank is clean - contents removed. If tank is full allow extra 30% for excavator and 2 men to dig out and dispose.
x9.28	Demolish and remove above ground large tank clean (Thickener etc 15 - 30 m diameter)	Item	\$	45,000	This includes removing all thickener or flocc tanks etc from the site including an associated pipework and pumps, etc.	Assume tank is clean - contents removed. If tank is full allow extra 30% for excavator and 2 men to dig out and dispose.
x9.29	Demolish and remove above ground extra large tank clean (Thickener etc >20 m diameter)	Item	\$	85,000	This includes removing all thickener or flocc tanks etc from the site including an associated pipework and pumps, etc.	Assume tank is clean - contents removed. If tank is full allow extra 30% for excavator and 2 men to dig out and dispose.
x9.30	Demolish and remove above ground very extra large tank clean (Thickener etc >50 m diameter)	Item	\$	100,000	This includes removing all thickener or flocc tanks etc from the site including an associated pipework and pumps, etc.	Requires a detailed assessment from demolition expert due to specialised equipment required for removal.
x9.31	Removal of small underground tank (<5000 L) - including pipes, bunds etc.	Item	\$	21,000	Apply this rate only for small underground tanks.	Assume tank is clean - contents removed. If tank is full allow extra 50% for pumping, excavator and 2 men to dig out and dispose.
x9.32	Removal of large underground tank (>5000 L) - including pipes, bunds etc	Item	\$	30,000	Apply this rate only for large underground tanks.	Assume tank is clean - contents removed. If tank is full allow extra 50% for pumping, excavator and 2 men to dig out and dispose.
x9.33	Remove small underground pipe - ~300 mm pipes	m	\$	25.00	Apply this rate for small underground pipes that will be removed.	300 mm pipes - 0.5 m deep.
x9.34	Remove medium underground pipe - ~500 mm pipes	m	\$	60.00	Apply this rate for medium underground pipes that will be removed.	500 mm pipes - 1 m deep.

x9.35	Remove large underground pipe - 1 m pipes	m	\$	165.00	Apply this rate for large underground pipes that will be removed.	1 m pipes - 2 m deep.
x9.36	Remove above ground pipe - supported	m	\$	12.00	Apply this rate for all above ground pipes that will be removed.	300mm pipes.
x9.37	Remove rail, road, water course overpass	Item	\$	350,000	Provisional sum for significant civil structure.	Indicative cost for removal of an overpass structure.
x9.38	Remove bitumen (aprons, sealed areas) for dumping in a void on-site	m <sup>2</sup>	\$	10.00	Apply this rate to all bitumen sealed areas within the domain.	Demolition expert estimate however economies of scale could reduce this number.
x9.39	Remove bitumen (airstrip) for dumping in a void on-site	m <sup>2</sup>	\$	20.00	Apply this rate for airstrips.	Assumes increased thickness for airstrip.
x9.40	Remove concrete pads & footings (<0.3 m thickness) and dumping in void	m <sup>2</sup>	\$	15.00	Enter the total area of the buildings where concrete footings are estimated to be <0.3 m thick.	Busting up slab and loading into void or crushing area for conversion to road aggregate.
x9.41	Remove concrete pads & footings (>0.3 m thickness) and dumping in void	m <sup>2</sup>	\$	65.00	Enter the total area the workshops and buildings where concrete footings are estimated to be >0.3 m thick.	Busting up slab and loading into void or crushing area for conversion to road aggregate.
x9.42	Crush concrete to make road aggregate - 75 mm	tonne	\$	17.00	Apply this rate if the option to produce aggregate is required for waste concrete.	Does not include haulage of materials - assumes crushing plant is readily available.
x9.43	Crush concrete to make road aggregate - 50 mm	tonne	\$	20.00	Apply this rate if the option to produce aggregate is required for waste concrete.	Does not include haulage of materials - assumes crushing plant is readily available.
x9.44	Crush concrete to make road aggregate - 30 mm	tonne	\$	22.00	Apply this rate if the option to produce aggregate is required for waste concrete.	Does not include haulage of materials - assumes crushing plant is readily available.
x9.45	Remove fence (cyclone/wire fence)	m	\$	20.00	Apply this rate for the removal of security fencing (or similar) that will be removed.	-
<b>10</b>	<b>Rail Infrastructure</b>					
x10.01	Remove rail loop and spur, ballast etc	m	\$	55.00	This item includes the pulling up and removal of railway line and sleepers from site (cost per metre).	Demolition expert experience.
x10.02	Collapse, cut and remove rail loading bins	Item	\$	65,000	Enter the number of rail loading bins/hoppers present on site.	Demolition expert estimate to collapse structure and remove.
x10.03	Remove train loading facilities	m <sup>2</sup>	\$	265.00	Apply this rate to area of infrastructure (not including bins/hoppers) used for rail loading.	Demolition expert experience.
x10.04	Reshape rail spur and load out areas	ha	\$	2,500	Enter the total area of the rail spur that is required to be reshaped.	Assumes loop is elevated and requires moderate re-contouring.
<b>11</b>	<b>Third Party Project Management</b>					
x11.01	Mobilisation & Demobilisation (third party contractor rates apply) (Select Distance to Site from list)	Item	Select from List		This is to cover the cost of the "third party" contractor bringing equipment to the site to undertake the rehabilitation works. It needs to reflect the true costs of getting the equipment to and from the site.	-
x11.02	Mobilisation & Demobilisation (third party contractor rates apply) (Distance to site <150km)	Item	\$	200,000	This is to cover the cost of the "third party" contractor bringing equipment to the site to undertake the rehabilitation works. It needs to reflect the true costs of getting the equipment to and from the site.	Demolition machinery only - assumes that earthworks equipment would be locally available.
x11.03	Mobilisation & Demobilisation (third party contractor rates apply) (Distance to site >150km but <500km)	Item	\$	300,000	This is to cover the cost of the "third party" contractor bringing equipment to the site to undertake the rehabilitation works. It needs to reflect the true costs of getting the equipment to and from the site.	Demolition machinery only - assumes that earthworks equipment would be locally available.
x11.04	Mobilisation & Demobilisation (third party contractor rates apply) (Distance to site >500km but <1000km)	Item	\$	500,000	This is to cover the cost of the "third party" contractor bringing equipment to the site to undertake the rehabilitation works. It needs to reflect the true costs of getting the equipment to and from the site.	Demolition machinery only - assumes that earthworks equipment would be locally available.

x11.05	Mobilisation & Demobilisation (third party contractor rates apply) (Distance to site >1000km)	Item	\$ 750,000	This is to cover the cost of the "third party" contractor bringing equipment to the site to undertake the rehabilitation works. It needs to reflect the true costs of getting the equipment to and from the site.	Demolition machinery only - assumes that earthworks equipment would be locally available.
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