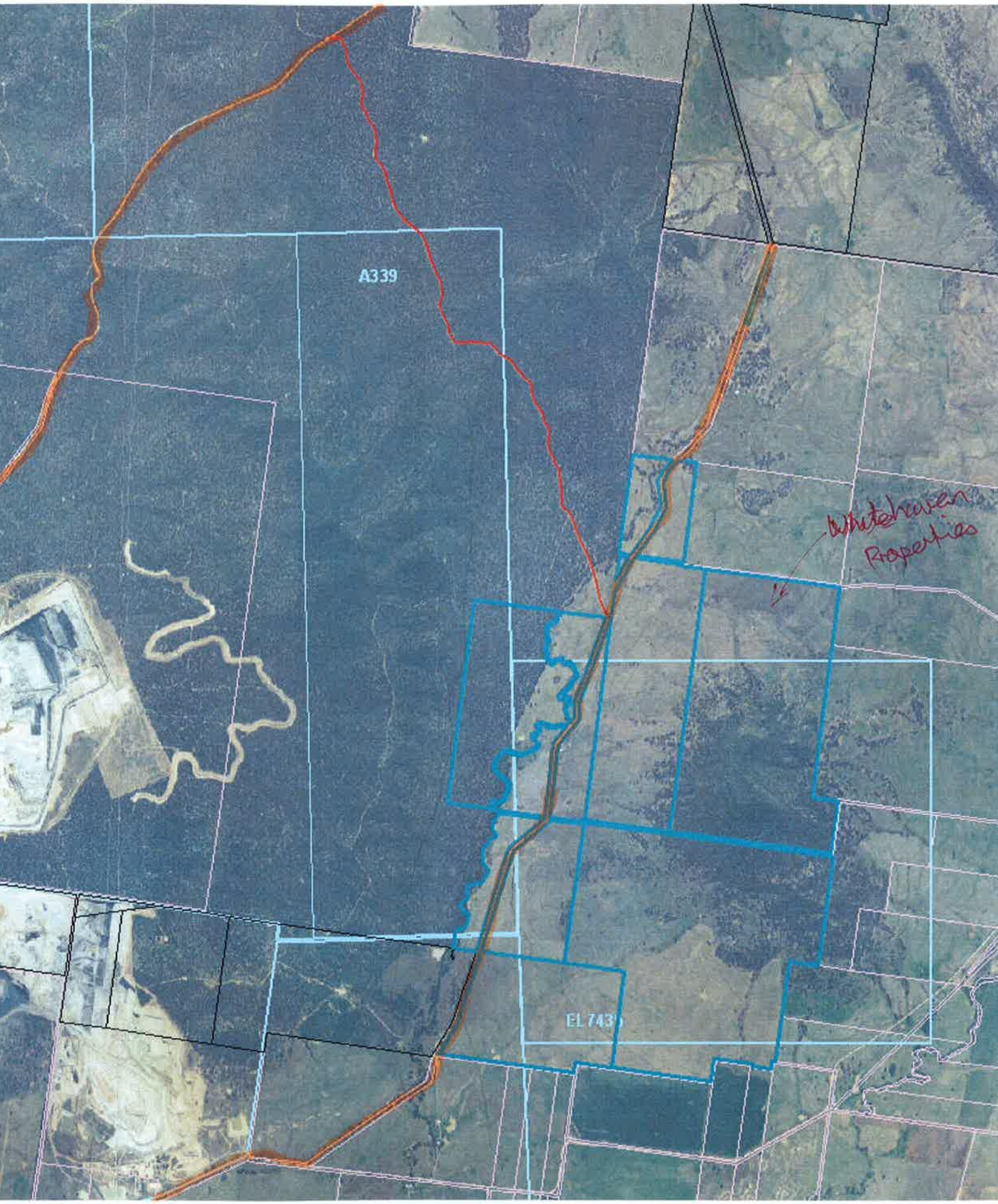
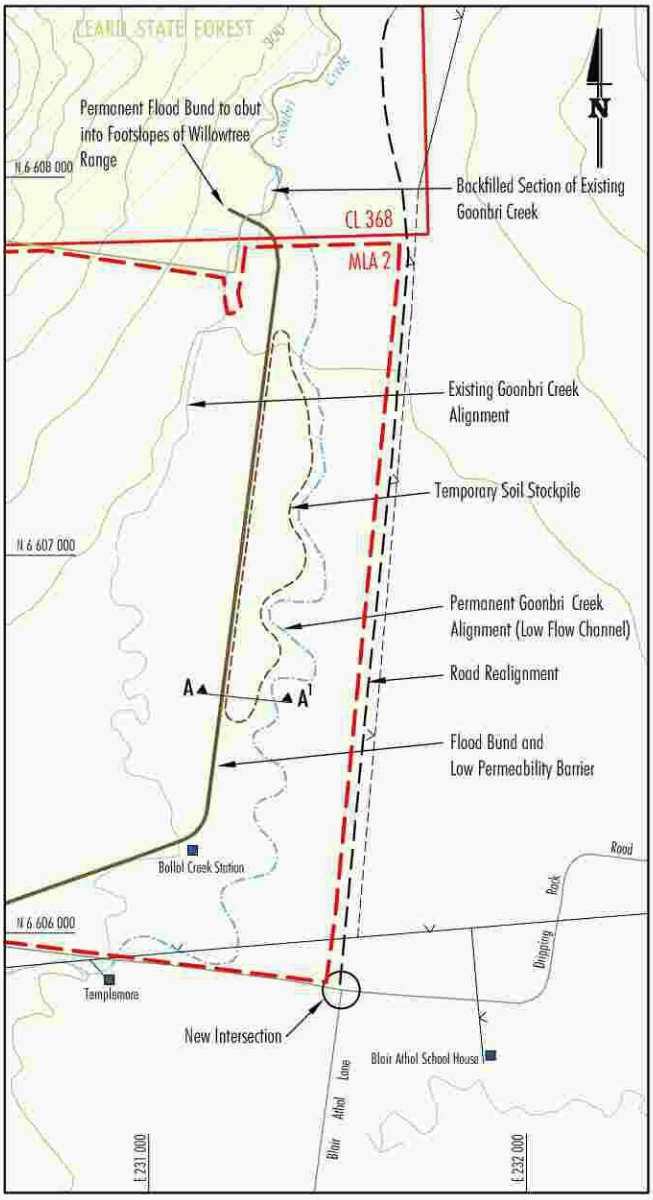
Appendix 1 – Leard Forrest Road – Alternate Route III

Map 1 - The proposed Leard Forest Rd alternative route which has been agreed by the Narrabri Shire Council and Boggabri Coal.


A339
Whitehaven
Properties
EL 743

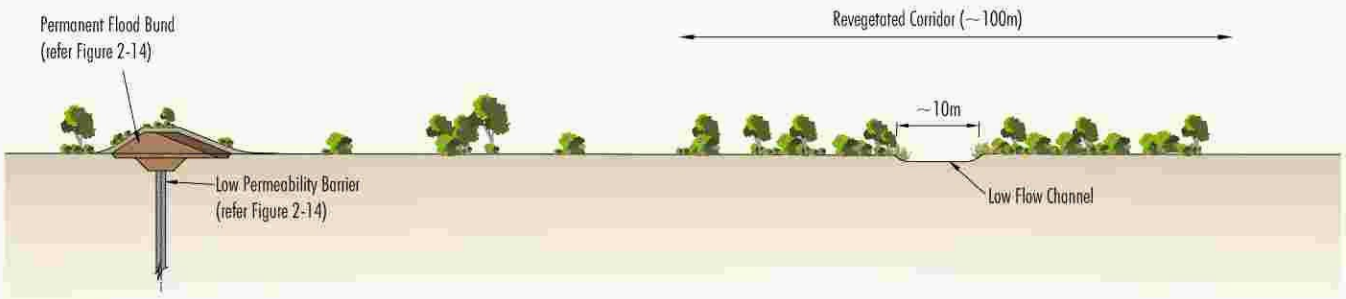
Appendix 2 – Goonbri Rd – Alternate Route I

Map 1 - The proposed Goonbri Rd alternative route by Tarrawonga Coal.



Source: Department of Lands (2010); Gilbert & Associates (2011) and Allan Watson Associates (2011)

PLAN
PERMANENT GOONBRI CREEK ALIGNMENT



SECTION A-A1
Not to Scale

TARRAWONGA COAL PROJECT

FIGURE 2-16

Permanent Goonbri Creek Alignment and Associated Flood Bund

Resource

Appendix 3 – Economic Impact Review

The review if the Economic impact assessment undertaken by Economists at Large.

Review of Tarrawonga Coal Project Socio-Economic Assessment

Prepared by

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February 2012

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Citation:

Campbell R., Turnbull J., Paas M., 2011, *Review of Tarrawonga Coal Project Socio-Economic Assessment* a report for the Maules Creek Community Council (MCCC), prepared by Economists at Large, Melbourne, Australia.

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Contents

Acknowledgement

Special thanks to Doctors for the Environment Australia www.dea.org.au for assistance with the health impacts section of this report.

Introduction

Background

The proposed Tarrawonga Coal Project is for the continuation of an open-cut mine into agricultural land and the Leard State Forest, Narrabri Shire, NSW. The proposal is for a 17-year open cut mine which will produce up to 3 megatonnes of coal per year. The proponent is currently seeking planning approval and has prepared an Environmental Assessment.

The Tarrawonga project is one of several mining proposals or mine extension projects in this traditionally agricultural area. Local community group, the Maules Creek Community Council (MCCC) is concerned that the proposed projects will affect agriculture, the community and the Leard State Forest, which contains nationally threatened ecosystems and species. Many communities in Australia are facing similar issues and are concerned that the often-touted benefits of the mining boom may be overstated and/or not accruing to local people.

This submission

The MCCC is making a submission on the Tarrawonga Environmenal Assessment. As part of their submission they have asked Economists at Large to review *Appendix M- Socio-Economic Assessment*. We consider there are a number of very significant issues in the economic assessment, which, without being addressed, would render the assessment unsuitable to contribute to decision-making. These issues are:

- **Scope of the assessment** Particularly relating to:
  - **Benefits accruing to Australia and overseas**
  - **Greenhouse gas emissions**
  - **Consideration of alternatives**
- **External costs and benefits.** Many are inappropriately given a zero value, and we offer further comment on
  - **Health impacts**
  - **Social value of employment**
- **Inappropriate use of input-output modelling in impact assessment**
- **Transparency of calculations**

We believe that all these issues need to be clarified and adjustments made to the economic assessment of the project to ensure a decision is made in line with the NSW public interest. Doing so would not only allow for the best outcome in relation to this project, but could serve as a guide for other projects in the area and nationally.

This is occurring at a time when the mining industry is perceived as lacking a "social licence to operate" in farming areas. Conflicts between farming communities and coal and coal seam gas developments are making headlines regularly, with farmers and the broader community losing confidence that such developments are in the community's best interests. Robust and transparent assessment of this project could help to address this issue.

Scope of analysis

The importance of setting the scope of a cost benefit analysis and remaining consistent with this scope cannot be overstated. As Eggert (2001) makes clear:

> *Let us now turn to … issues that challenge and bedevil practitioners of social benefit-cost analysis. The first challenge is deciding "whose benefits and costs count" …. It sometimes is called the issue of standing--that is, who has standing in the analysis of benefits and costs? This is an issue of scope. Should the analysis include only those costs and benefits affecting residents of the local community? The state or province? The nation? The world? Whether the net benefits of a project are positive or negative often depends on how narrow or broad the scope of the study is.* (p27)

The cost benefit analysis in the socio-economic assessment is carried out at a national level. This is an appropriate scope, however some shortcomings remain.

Benefits accruing to Australia and overseas

Profits of the project that accrue to overseas interests should not be included as a benefit in this cost benefit analysis, as confirmed by Bennett (2011)

> *Where the shareholders are not citizens, their mine benefits are expatriated and should not be included in the BCA. Careful attention should therefore be given to the register of shareholders and adjustments made to the producer surplus benefit calculation.* p3

This has been acknowledged in the socio-economic assessment on p17:

> *Overall the Project is estimated to have net benefits of $1,116M. Based on current ownership and tax structures, it is estimated that $790M of these benefits would flow to Australia.*

How this estimate has been made is unclear from the socio-economic assessment. We believe it is unacceptable for one of the most important calculations in the cost benefit analysis to be presented with no discussion of methodology, working or sources.

The owners of the project are:

> *Whitehaven Coal Mining Pty Ltd (Whitehaven) (70% interest) and Boggabri Coal Pty Ltd (BCPL) (a wholly owned subsidiary of Idemitsu Australia Resources Pty Ltd) (30% interest).* P1

Analysis by the MCCC suggests that Whitehaven is 80% foreign owned, while Idemitsu Australia is wholly owned by Idemitsu Japan[1]:

[1] http://www.idemitsu.com.au/

Owners	Nationality	Stake (%)
Hans Mende	USA	15.96
Mende, Hans & Ingrid	USA	14.16
AMCI International AG	USA/ Switzerland	11.32
AMCI Group	USA	9.7
Fritz Kundrun	USA	14.04
FRC Whitehaven	Netherlands	14.69
Total		79.87

Source: www.etrade.com.au date 21.12.2011

In total this means 86% of the Tarrawonga project is foreign-owned, yet the reduction in net present benefits from $1,116m to $790m represents an adjustment of only 30%. Any adjustment that affects the value of the project by over $300m should be transparently explained to the public. We urge the proponents to explain this figure transparently, which would significantly improve the public's understanding of distribution of benefits at zero extra cost.

The acknowledgement in this socio-economic assessment of the effects of foreign ownership is an improvement on other assessments such as Gillespie Economics (2010) and Gillespie Economics (2011), however throughout the socio-economic assessment, the unadjusted figure – which is of little interest to decision makers or the public – is referred to more prominently than the more relevant Australian figure. The assessment should be revised to emphasise the correct figure.

This point is also important for the neighbouring Boggabri Coal Project proposal, which is 100% owned by Idemitsu. We made the same point in submissions relating to that project and look forward to a similar correction.

Greenhouse Gas emissions

The socio-economic assessment makes no consideration of downstream greenhouse gas from coal combustion:

> *This is based on pragmatic grounds as well as the view that projects should be assessed from the view point of the nation which undertakes the projects, incurs the costs and is responsible for decision-making.*(p8)

The assumption that the end user of the coal - most likely a power station in China or India - will conduct transparent cost benefit analysis at all seems optimistic. The real problem arises, however, with the logical conclusion that the Chinese and Indian economists will take the same approach and fail to consider any GHG cost borne outside their jurisdiction – China or India. Let's consider the cost benefit analysis of such a power station in more detail:

			Included in national level CBA?
Benefits	Financial	The revenue paid to the power station from users of its electricity	Yes
	Externalities	"There may also be external benefits of electricity for economic development, education and medical care." Note that these would accrue to any type of electricity generation, not only coal.	Yes
Costs	Financial	Capital and operating costs	Yes
	Externalities	Reduced air quality, health impacts, acid rain, etc	Yes
		Climate change impacts	No – at least not those that accrue to other countries

The omission of this externality from both the cost benefit analysis of the mine and the power station results in an external cost borne by the rest of the world. The size of this externality is significant and demonstrated with even basic calculations:

Item	unit	value	Source
Coal production	tonnes/year	3,000,000	Appendix M
Mine life	years	17	Appendix M
Total output over mine life	tonnes	51,000,000	Ecolarge calculation
Coal to CO2 production ratio	ratio	3.0	Submission by Dr Ian Lowe to Boggabri Coal EIS[2]
Total C02 produced	tonnes	153,000,000	Ecolarge calculation
C02 price	dollars	30	Appendix M
Total damage	dollars	4,590,000,000	Ecolarge calculation
Present value (17 years, 7%)	dollars	2,636,070,208	Ecolarge calculation

The existence of a $2.6 billion (present value) externality that is not internalised by either the coal producing or consuming country means that the world bears this loss; neither the mine nor the power plant is likely to be economically efficient in light of this cost. Keeping this cost external is the unfortunate truth on which the profitability of coal mining and coal-fired power generation industries is largely based.

Alternative projects

The socio-economic assessment includes consideration of only two alternatives, with project and without project scenarios, and some discussion of minor alterations in section 2.7. The assessment claims that more alternatives are described in detail in section 6.9.1 of the EA. However section 6.9.1 tells us that open cut mining methods were chosen "based on TCPL's corporate objectives" (p6-37). The point of this socio-economic assessment is to evaluate the project from the perspective

[2] Available at http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=3562

of the Australian public, not from TCPL's perspective. The national scope of the assessment is made clear. As such, adequate consideration of the community's preferred alternative – an underground mine – must be made in the economic assessment.

Note that a neighbouring coal project, the Boggabri Mine Extension Project, owned by Idemitsu Australia, did engage consultants to analyse an underground mining option, WDS Consulting (2009). WDS concluded that underground mining was both technically feasible and economically viable. In depth calculations of the underground option were not included in the cost-benefit analysis of the Boggabri Mine as:

> *At the request of Idemitsu, a full financial analysis was not within* [the consultant's] *deliverable scope. Our primary financial deliverables, … are to be integrated into Idemitsu cost models for internal economic analysis.* (WDS 2009, p7-1)

Economists at Large reviewed WDS's work and conducted basic financial analysis of the data presented. We concluded that the profitability of the underground as presented in the WDS study was $500 million greater than that of the preferred option presented in the Boggabri Coal Project Economic Assessment (also by Gillespie Economics).

Table 1 Underground and open cut mining options for Boggabri Coal Project

	Boggabri Coal Project Environmental Assessment Appendix C - Underground option ($m)	Boggabri Coal Project Environmental Assessment Appendix Q - Economic assessment (open cut mining option) ($m)
Revenue	$3,730	$5,343
Other production benefits	NA	$54
Capital costs	$652	$778
Operating costs	$1,288	$3,328
Other production costs	NA	$25
NPV	$1,790	$1,266

Source: Campbell (2011)

Gillespie Economics' rationale for not including a viable underground option in their cost benefit analysis of the Boggabri Mine was that "*alternatives need to be **feasible** to the proponent*" (bold in original) (Gillespie, 2011). But cost benefit analysis of the Tarrawonga project is required to consider the benefits for the Australian community. As underground mining in the area has been found to be economically viable, the cost benefit analysis must consider how this option would affect the welfare of the Australian community.

External costs and benefits

If all external costs can be internalised by an offset programme then there is no need to estimate their values. This is reason that the Socio-Economic Assessment assigns zero values to most of the external costs arising from the project, as listed in table 2.2 (p15). However, the allocation of a zero value, with no consideration of risk, ignores the debate between physical scientists as to what extent these offsets are achievable. See for example the debates between specialists over the neighbouring Maules Creek Coal Project:

- ViPAC (2011) who question the findings of the environmental assessment's air quality study
- Water Resources Australia (2011) who dispute the findings of the environmental assessment's groundwater study

We suggest it is beyond the expertise of Gillespie Economics to adjudicate in these debates between physical scientists. The allocation of zero values to these external costs is just such a judgement. When the necessary revisions are made to the Socio-Economic Assessment, we also recommend the proponents take note of Curtis (2011), who estimates the value of the ecosystem goods and services lost due to the clearing of the Leard State Forest at some $490,000 per annum. Curtis also urges analysis of land values to consider losses of amenity and social value to the community. Curtis's background as a physical scientist, land economist and ecological economist gives his findings considerable weight.

These issues are of particular concern to the local community as all these values affect particularly the local community. We urge better quantification of the distribution of costs and benefits of the project to the local community, rather than the box ticking exercise shown in table 2.3 (p16). This table completely fails to demonstrate the risks and costs the community faces while looking to gain minimal shares of the benefits.

In addition to the uncertainty around most external values, two others are worth further comment.

- Health impacts
- Social value of employment

Health Impacts

The cost benefit analysis makes no mention of the impacts on human health of open-cut coal mining and transportation, despite this issue garnering considerable attention in the region, the media and academic writing. External impacts such as health can be measured and quantified in economic terms, as pointed out in Gillespie and James (2002):

[C]*ertain kinds of social impacts, such as social dislocation or adverse health effects, may be partially appraised in monetary terms.* (p21)

Such appraisal would be assisted by a recent NSW Department of Health report looking at morbidity and mortality in regions of the Hunter Valley affected by mining (NSW Health 2010a). They found that the regions in the Hunter most affected by mining have higher rates of emergency department attendances for asthma and other respiratory conditions; hospital admissions for respiratory

conditions and cardiovascular disease and mortality due to cardiovascular disease and all cause mortality. Analysis of presentations to GPs also suggested higher rates of asthma and other respiratory conditions in communities affected by mining, although not statistically significant (NSW Health 2010b).

There are significant limitations to these studies, including that they do not adequately take account of other population factors affecting health in these areas, and that the number of people in the affected areas are small, making comparisons difficult. However, both studies confirm the work of others, showing that exposure to pollutants, particularly particulate matter is an important causative factor in respiratory and cardiovascular disease. It is also well recognised that there is no threshold level for negative health impacts of particulate pollution. There will be people affected by particulate air pollution and this must be acknowledged.

Air monitoring data from the mines in the Hunter region revealed high levels of PM10 particles in a number of sites (NSW Department of Environment, Climate Change and Water 2010). However, as acknowledged by the Dept of Health, there is insufficient monitoring in populated areas. If those data were available, this would enable a better prediction of the cumulative health impact of the mining activities in the region (NSW Health 2010a).

In the USA quantification of the health impacts of coal is more advanced. Epstein et al (2011) estimate that the cost of lives lost in the Appalachian mining region in the US is US$74.6 billion per year. This builds on other studies such as Hendryx and Ahern (2009) who found "[a]ge-adjusted mortality rates were higher every year from 1979 through 2005 in Appalachian coal mining areas compared with other areas of Appalachia or the nation" (p.547). Hendryx and Ahern also refer to past research on coal mining regions that found elevated levels of chronic heart, respiratory, and kidney disease, and lung cancer, after control for socioeconomic factors. They found that the health impacts far outweighed the economic benefits of mines.

While it is difficult to extrapolate the health impacts of coal mining in the USA to the Australian setting due to different mining practices and different pollutant levels, there are a range of health impacts that can be extrapolated directly. These include particulate air pollution (with the level of impact being dependent on the level of pollution), noise, traffic, social and mental health impacts (Castleden et al 2011).

With long-term, empirical evidence linking significant health impacts to coal mining, it is important that the costs associated with impacts are included in consideration of this project. Clearly these are costs that accrue to the local and NSW community and should be included in the assessment.

Social value of employment

The values claimed as social value of employment are misleading. We have argued this in submissions on the Boggabri Coal Project and Maules Creek Coal Project. The proponents of the Maules Creek Coal Project commissioned Professor Jeff Bennett of the Australian National University

to review the economic assessment of that project, also by Gillespie Economics, which also included a "social value of employment". In relation to the inclusion of this value, Professor Bennett said:

> [The] *EIA's inclusion of benefits associated with employment* [is contentious]. *The argument advanced is that people outside of the mine workforce enjoy benefits associated with people having jobs in the mine. The values of this 'existence benefit' of work estimated for the case of a mine in the southern coal field are 'transferred' to the current case. A number of points argue against this approach. First, there is a conceptual issue. In a fully employed economy, it is doubtful that people employed in the new mine would be drawn from the ranks of the unemployed. So people outside the mine are unlikely to hold any existence benefits for the jobs provided by the mine in that case. Second, there is an estimation issue concerning the use of a benefit estimate transferred from another context. The conditions in the southern coalfield – the context of the source of the benefit estimate are very different from the proposed mine context…..* [The] *inclusion of the employment benefit as a component of the EIA is not recommended. Their inclusion would overstate the extent of proposal benefits.* (Bennett 2011)

These are the words of one of Australia's most senior academic economists and the lead author of one of the papers Gillespie Economics cite to justify their inclusion of this value. As even Professor Bennett has failed to dissuade Gillespie Economics from including this value, it is hard to imagine who or what might succeed. We call on Gillespie Economics to desist from including this discredited value in their work entirely.

Input-output modelling in Economic Impact Assessment

The use of input-output modelling in the economic impact assessment section of the socio-economic assessment creates a misleading impression of the impacts of the project. Input-output modelling has fallen from favour with economists for many reasons, the main ones being explained by the Australian Bureau of Statistics(ABS 2011):

> ***Lack of supply–side constraints:*** *The most significant limitation of* [input-output modelling] *is the implicit assumption that the economy has no supply–side constraints. That is, it is assumed that extra output can be produced in one area without taking resources away from other activities, thus overstating economic impacts. The actual impact is likely to be dependent on the extent to which the economy is operating at or near capacity.*
>
> ***Fixed prices****: Constraints on the availability of inputs, such as skilled labour, require prices to act as a rationing device. In assessments using multipliers, where factors of production are assumed to be limitless, this rationing response is assumed not to occur. Prices are assumed to be unaffected by policy and any crowding out effects are not captured.*

These limitations are obvious to the local community, who experience difficulties accessing tradesmen and other services. These shortcomings are also becoming obvious to other sectors of the economy, particularly manufacturing and agriculture, as they struggle with the downside of the mining boom. Yet this obvious downside is ignored by input-output modelling. As (Abelson 2011) put it:

> *I–O models lack resource constraints and fail to capture significant welfare (consumer and environmental) impacts. They always produce a positive gain to the economy, however disastrous the event.*

Had the socio-economic assessment used more appropriate methods, such as general equilibrium modelling, the benign impacts on other sectors shown in table 3.5 (p30) would look different. Instead of showing modest growth in employment of other industries, we would see that expansion of mining operations, particularly in a tight labour market, has a negative effect on other industries.

This point is reinforced by economic analysis of the China First Coal Project in Queensland, carried out for the proponents of that mine using computable general equilibrium modelling**.** AEC group (2010) found that not only would that mine not carry social value of employment, but that proceeding with that project in the current labour market was likely to result in the loss of significant numbers of jobs in the agriculture and manufacturing industries. Compare these results to those obtained through input-output modelling:

Mine Project	Forecast impact on manufacturing employment	Forecast impact on agricultural employment
Tarrawonga	14	1
Maules Creek	11	3
Boggabri	119	15
Maules Creek area total	**+144**	**+19**
China First	**-2215**	**-192**

Sources: Tarrawonga Coal proposal socio-economic assessment, Gillespie Economics 2010, Gillespie Economics 2011, AEC Group 2011.

While the China First Project is larger than the Maules Creek, Tarrawonga and Boggabri proposals combined, this comparison shows the differences between modelling methods. While general equilibrium modelling, with its more realistic assumptions shows that the China First Project will destroy thousands of jobs in agriculture and manufacturing, the input-output modelling of the Maules Creek area projects, with its lack of resource constraints and price changes, suggests an increase in employment.

We urge the NSW government to consider the wider effects of mining projects on other industries and the economy, which would be assisted by requiring more realistic modelling in economic impact assessment.

Transparency of calculations

Major values presented in the Socio-Economic Assessment Table 2.2 (p15) do not correspond with values presented in the rest of the assessment. We have calculated the present values of operating costs and revenue from values presented on pages 6 and 7 of the assessment. These values vary by over $1 billion with those presented in table 2.2 and are summarised below.

Table 4 Comparison of revenue and operating cost calculations

	Table 2.2	Calculated from text	Difference
Revenue ($M)	2,569	3,596	1,027
Operating costs ($M)	1,319	1,785	466

The point of this comparison is not to suggest that project is more valuable than was presented, but to show that the public can have no confidence in the figures presented. We urge the proponents to explain how they arrived at their present value figures and to publish their full working and modelling, as we have done in the appendix. The background to these calculations are not commercially sensitive and they could be included at no extra cost to consultants. Not explaining them serves only to weaken public confidence in their analysis. Our calculations follow standard methodology and were reviewed by several practicing economists, none of whom could reconcile the difference between the figures.

Conclusion

The socio-economic assessment of the Tarrawonga Coal Project is not suitable for decision making in its current form. It fails to clearly demonstrate the economic benefits of the project to Australia, much less the local community. Transparency regarding the calculation of benefits to Australia is crucial if the public is to have any faith in this assessment. At a global scale the vast damage from downstream emissions suggest the project is economically unjustifiable, while at a local level problems such as:

- lack of consideration of underground alternatives,
- no quantification of most external costs and risks, and
- consideration of health impacts

also bring the efficiency of the project into doubt.

Methodological flaws such as inclusion or reference to social benefits of employment and misleading use of input-output modelling need to be revised before the assessment can inform decision making around this project. Transparent reporting of calculations and assumptions is also required to improve the usefulness of this document.

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Appendix – present value calculations

Tarr Mine Revenue & Costs

	Unit	Value	Page	Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Annual Operating Costs	$AUD M	574	6	0	0	0	0	224	224	224	224	224	224	224	224	224	224	224	224	224	224	224	224	224
Annual Coal Production	Mtpa		9	0	0.0	0.0	0.0	3.0	3.0	3.0	3.0	3	3	3	3	3	3	3	3	3	3	3	3	3
Thermal Coal Price	$AUD/t	102	7																					
Semi-soft Coking Coal Price	$AUD/t	161	7																					
Weighted Price?	$AUD/t	150.4	6																					
Annual Revenue	$AUD M			-	-	-	-	451	451	451	451	451	451	451	451	451	451	451	451	451	451	451	451	451
Discount Rate		7.0%	15																					
Present Value OpCosts	$AUD M			-	-	-	-	171	160	149	139	130	122	114	106	99	93	87	81	76	71	66	62	58
Total PV OpCosts	$AUD M	1,785																						
Present Value Revenue	$AUD M			-	-	-	-	344	322	301	281	263	245	229	214	200	187	175	164	153	143	133	125	117
Total PV Revenue	$AUD M	3,596																						

***Year 0 is 2013**

Appendix 4 – Greenhouse Gas & Air Quality

1. Review of Maules Creek Mine GHG impacts by Dr Ian Lowe including cumulative impacts of the Tarrawonga Coal Mine.
2. Resume of Dr Lowe.
3. Greenhouse Gas emissions by country, produced for the United Nations by the US Government Agency the Carbon Dioxide Information Analysis Center (CDIAC).
4. TSP Reconciliation for the Maules Creek Coal Mine.

Maules Creek proposed coal mine: greenhouse gas emissions
By Dr Ian Lowe

In my earlier submission regarding the Boggabri Coal Mine, I estimated that the overall greenhouse gas (GHG) emissions resulting from the proposed mine would be about 20 to 25 million tonnes of carbon dioxide equivalent per year.

On the new data now provided, with an additional expected 13 million tonnes per year of raw coal being mined and 10.8 mt/year product being exported, the GHG burden will be significantly greater. The proponent's own estimate, which certainly does not inflate the final impact, gives the total impact as about 30 million tonnes of CO_2 equivalent per year, or some 630 million tonnes for the period 2012-2032. To put these figures in perspective, the total of the emissions from the entire country of New Zealand is about the same – 32.6 mt in 2007. The State of NSW now emits about 150 mt/year and the likely 2020 target will be lower. The response currently before the Commonwealth parliament aims at a 5 per cent reduction if there is no concerted international action, with reductions in the range 15 to 25 per cent if there is international agreement to tackle the problem of climate change seriously. So the expected reduction in emissions from NSW if the national goal is uniformly allocated will be in the range from 7.5 to 37.5 million tonnes per year. In that context, even the proponent's estimate of the local emissions, Scope 1 + Scope 2, of about 0.25 mt/year is a significant extra burden for the State. The Scope 3 emissions, unavoidably produced by the use of the coal by its customers, will be somewhere in the range from about 20 to 27 per cent of the State's total emissions budget in 2020. Put another way, the Scope 3 emissions from this mine alone are comparable in scale to the most ambitious State reduction target being canvassed at this stage. So NSW would need to double its reduction within the State to undo the damage that would be done to the global atmosphere if this mine were allowed.

The EIS includes assertions that the overall impact on the global climate would be minuscule: "an annual increase in average global temperature of 0.00003 C". This is a specious argument. First, it is based on an assumption that doubling the atmospheric concentration of carbon dioxide would raise the average global temperature by 2.5 C, where the science is now warning that the increase could be much greater. The "best guess" for a doubling of the pre-industrial level is now 2.9, with a warning that it could be in the range up to 4.4 C. The Australian Academy of Science said last year that global emissions need to peak by 2020 and then be

reduced rapidly to give a 50:50 chance of keeping the increase below 2 degrees. Allowing the atmospheric concentration to double runs a serious risk of passing a critical “tipping point” and precipitating catastrophic interference in the climate system. Even if this doesn’t happen, the crucial question is not the average **annual** increase in global temperature due to this project, but its **total** impact. Being charitable and using the proponent’s figures, 0.00003 C per year for twenty years is 0.0006 C overall if the mine stops operating in 2032. Dr Malte Meinshausen, Senior Research Fellow at the Potsdam Institute, gave evidence as an expert witness in a recent case in the Queensland Land and Environment Court about the direct measurable impacts of a temperature increase on that scale. He estimated that 0.0006 C increase in average temperature would cause an increase in sea level that would flood an additional 23,000 homes around the Pacific rim by 2080, for example.

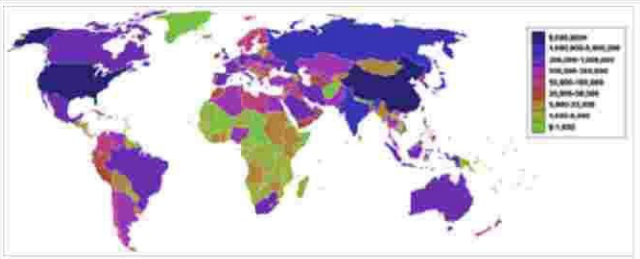
The crucial point that needs to be considered is that the science now shows that carbon dioxide released by the burning of fossil fuels remains in the atmosphere (and continues to change the global climate) for a very long time. While it has been generally accepted that a significant fraction will still be in the atmosphere 200 years after being released, there is now evidence that as much as 35 per cent of the CO_2 could still be there in 1000 years. The mine effectively would transfer into the atmosphere huge amounts of carbon that are now safely sequestered beneath the ground. So the damage to the climate and sea level from a large coal mine would stretch far into the distant future.

It should be added that the Maules Creek proposal is additional to the Boggabri mine, which has applied to be allowed to expand its output to 7 mt/yr. That should be a reminder that approval of a mine does not set limits, as in this case the proponent has come back with a request to expand its output dramatically. A proposal for another mine (Tarawonga), very near these two, is also being developed with the intent of producing a further 3 mt/yr. If all three proposals were to go ahead, the total impact of burning the coal would be greater than 60 mt/yr of CO_2-equivalent. To put the potential impacts into a global perspective, if the Maules Creek mine were a nation, it would rank 75th in the world for total emissions, ahead of the greenhouse gas emissions of 140 entire countries. If all three proposals were approved, the total greenhouse gas impact of the mining province would rank above all but 50 entire nations: more than such countries as Sweden, Hungary, Finland, Portugal and Norway, among the 165 it would exceed. So the proposals really are of global significance.

List of countries by carbon dioxide emissions

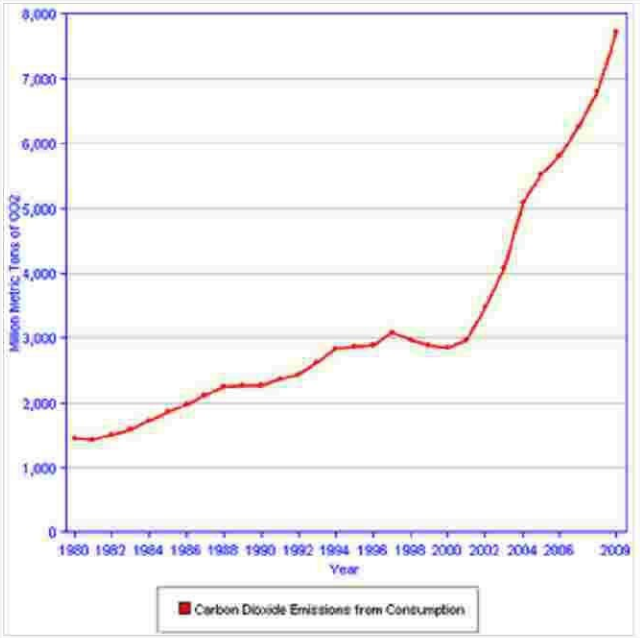
From Wikipedia, the free encyclopedia

This is a **list of sovereign states and territories by carbon dioxide emissions** due to human activity. The data presented below corresponds to emissions in 2008. The data was collected by the CDIAC for the United Nations. The data only considers carbon dioxide emissions from the burning of fossil fuels and cement manufacture, but not emissions from land use such as deforestation. The top 10 countries in the world emit 67.07% of the world total.[1][2][3][4][5][6] Other powerful, more potent greenhouse gases are not included in this data, including methane.



Countries by carbon dioxide emissions via the burning of fossil fuels (blue the highest).

Some dependencies and territories whose independence has not been generally recognized are also included as they are in the source data. Certain entities are mentioned here for purposes of comparison. These are indicated *in italics* and are not counted in the ordering of sovereign states. (See also: carbon cycle) On 6 October 2010, the International Energy Agency released its own data set (calculated using slightly different methods than CDIAC) for 2008 emissions that listed about 140 countries.[7]



China CO2 emission in millions of metric tons from 1980 to 2009.

Contents

List of countries by 2008 emissions

Rank	Country	Annual CO2 emissions[8][9] (in thousands of metric tonnes)	Percentage of global total
	World	29,888,121	100%
1	China[10]	7,031,916	23.33%
2	United States	5,461,014	18.11%
-	European Union (27)	4,177,817.86[11]	14.04%
3	India	1,742,698	5.78%
4	Russia	1,708,653	5.67%
5	Japan	1,208,163	4.01%
6	Germany	786,660	2.61%
7	Canada	544,091	1.80%
8	Iran	538,404	1.79%
9	United Kingdom	522,856	1.73%
10	South Korea	509,170	1.69%

11	Mexico	475,834	1.58%
12	Italy[12]	445,119	1.48%
13	South Africa	435,878	1.45%
14	Saudi Arabia	433,557	1.44%
15	Indonesia	406,029	1.35%
16	Australia	399,219	1.32%
17	Brazil	393,220	1.30%
18	France[13]	376,986	1.25%
19	Spain	329,286	1.09%
20	Ukraine	323,532	1.07%
21	Poland	316,066	1.05%
22	Thailand	285,733	0.95%
23	Turkey	283,980	0.94%
24	Taiwan	258,599[14]	0.86%
25	Kazakhstan	236,954	0.79%
26	Egypt	210,321	0.70%
27	Malaysia	208,267	0.69%
28	Argentina	192,378	0.64%
29	Netherlands	173,750	0.58%
30	Venezuela	169,533	0.56%
31	Pakistan	163,178	0.54%
32	United Arab Emirates	155,066	0.51%
33	Vietnam	127,384	0.42%
34	Uzbekistan	124,905	0.41%
35	Czech Republic	116,996	0.39%
36	Algeria	111,304	0.37%
37	Belgium	104,880	0.35%
38	Iraq	102,936	0.34%
39	Greece	97,814	0.32%
40	Nigeria	95,756	0.32%
41	Romania	94,660	0.31%
42	Philippines	83,157	0.28%
43	North Korea	78,371	0.26%
44	Kuwait	76,743	0.25%
45	Chile	73,109	0.24%
46	Syria	71,598	0.24%
47	Qatar	68,478	0.23%
48	Austria	67,726	0.22%
49	Colombia	67,700	0.22%
50	Belarus	62,816	0.21%
51	Libya	58,331	0.19%

52	Finland	56,512	0.19%
53	Portugal	56,310	0.19%
54	Hungary	54,638	0.18%
55	Bulgaria	50,539	0.17%
56	Norway	49,920	0.17%
57	Serbia	49,934	0.17%
58	Trinidad and Tobago	49,772	0.17%
59	Sweden	49,050	0.16%
60	Morocco	47,906	0.16%
61	Turkmenistan	47,840	0.16%
62	Azerbaijan	47,139	0.16%
63	Bangladesh	46,527	0.15%
64	Denmark	46,025	0.15%
65	Oman	45,749	0.15%
66	Ireland	43,604	0.14%
67	Peru	40,535	0.13%
68	Switzerland	40,392	0.13%
69	Hong Kong	38,573	0.13%
70	Israel	37,664	0.12%
71	Slovakia	37,557	0.12%
72	New Zealand	33,095	0.11%
73	Singapore	32,295	0.11%
74	Cuba	31,419	0.10%
75	Bosnia and Herzegovina	31,276	0.10%
76	Ecuador	26,826	0.09%
77	Tunisia	25,013	0.08%
78	Angola	24,371	0.08%
79	Yemen	23,384	0.08%
80	Croatia	23,304	0.08%
81	Bahrain	22,479	0.07%
82	Dominican Republic	21,617	0.07%
83	Jordan	21,382	0.07%
84	Estonia	18,291	0.06%
85	Slovenia	17,158	0.06%
86	Lebanon	17,099	0.06%
87	Lithuania	15,130	0.05%
88	Sudan	14,052	0.05%
89	Bolivia	12,835	0.04%
90	Myanmar	12,776	0.04%
91	Jamaica	12,204	0.04%
92	Guatemala	11,914	0.04%
93	Macedonia	11,815	0.04%

94	Sri Lanka	11,764	0.04%
95	Mongolia	10,895	0.04%
96	Brunei	10,594	0.04%
97	Luxembourg	10,502	0.03%
98	Kenya	10,392	0.03%
99	Zimbabwe	9,076	0.03%
100	Honduras	8,672	0.03%
101	Ghana	8,592	0.03%
102	Cyprus	8,328	0.03%
103	Uruguay	8,328	0.03%
104	Costa Rica	8,016	0.03%
105	Latvia	7,591	0.03%
106	Ethiopia	7,107	0.02%
107	Côte d'Ivoire	7,015	0.02%
108	Panama	6,912	0.02%
109	Tanzania	6,465	0.02%
110	Netherlands Antilles	6,219	0.02%
111	Kyrgyzstan	6,208	0.02%
112	El Salvador	6,113	0.02%
113	Armenia	5,548	0.02%
114	Cameroon	5,302	0.02%
115	Georgia	5,203	0.02%
116	Senegal	4,976	0.02%
117	Botswana	4,840	0.02%
118	Equatorial Guinea	4,815	0.02%
119	Moldova	4,774	0.02%
120	Cambodia	4,602	0.02%
121	Nicaragua	4,331	0.01%
123	Albania	4,117	0.01%
124	Paraguay	4,118	0.01%
125	Benin	4,067	0.01%
126	Namibia	3,968	0.01%
127	Mauritius	3,953	0.01%
128	Uganda	3,748	0.01%
129	Nepal	3,542	0.01%
130	New Caledonia	3,150	0.01%
131	Tajikistan	3,146	0.01%
132	Democratic Republic of the Congo	2,816	0.01%
133	Réunion	2,816	0.01%
134	Malta	2,560	0.01%
135	Gabon	2,472	0.01%

136	Suriname	2,439	0.01%
137	Haiti	2,435	0.01%
138	Mozambique	2,314	0.01%
139	Aruba	2,288	0.01%
140	Iceland	2,230	0.01%
141	Guadeloupe	2,200	0.01%
142	Bahamas	2,156	0.01%
143	Papua New Guinea	2,109	0.01%
144	Palestinian territories	2,057	0.01%
145	Mauritania	1,999	0.01%
146	Montenegro	1,951	0.01%
147	Republic of the Congo	1,936	0.01%
148	Martinique	1,918	0.01%
149	Madagascar	1,911	0.01%
150	Zambia	1,889	0.01%
151	Burkina Faso	1,856	0.01%
152	Laos	1,533	0.01%
153	Guyana	1,525	0.01%
154	Togo	1,419	< 0.01%
155	Guinea	1,393	< 0.01%
156	Barbados	1,353	< 0.01%
157	Macau	1,335	< 0.01%
158	Sierra Leone	1,335	< 0.01%
159	Fiji	1,254	< 0.01%
160	Malawi	1,228	< 0.01%
161	Swaziland	1,093	< 0.01%
162	Maldives	920	< 0.01%
163	French Guiana	913	< 0.01%
164	French Polynesia	891	< 0.01%
165	Niger	851	< 0.01%
166	Afghanistan	814	< 0.01%
167	Bhutan	733	< 0.01%
168	Faroe Islands	708	< 0.01%
169	Rwanda	704	< 0.01%
170	Seychelles	682	< 0.01%
171	Somalia	649	< 0.01%
172	Liberia	609	< 0.01%
173	Mali	594	< 0.01%
174	Greenland	576	< 0.01%
175	Cayman Islands	557	< 0.01%
176	Andorra	539	< 0.01%
177	Djibouti	524	< 0.01%

178	Chad	495	< 0.01%
179	Antigua and Barbuda	447	< 0.01%
180	Belize	425	< 0.01%
181	Gibraltar	422	< 0.01%
182	Eritrea	414	< 0.01%
183	Gambia	411	< 0.01%
184	Saint Lucia	396	< 0.01%
185	Bermuda	389	< 0.01%
186	Cape Verde	308	< 0.01%
187	Guinea-Bissau	282	< 0.01%
188	Central African Republic	260	< 0.01%
189	Saint Kitts and Nevis	249	< 0.01%
190	Grenada	246	< 0.01%
191	Sahrawi Arab Democratic Republic	238	< 0.01%
192	Palau	213	< 0.01%
193	Saint Vincent and the Grenadines	202	< 0.01%
194	Solomon Islands	198	< 0.01%
195	Timor-Leste	191	< 0.01%
196	Burundi	180	< 0.01%
197	Tonga	176	< 0.01%
198	Samoa	161	< 0.01%
199	Turks and Caicos Islands	158	< 0.01%
200	Nauru	143	< 0.01%
201	Dominica	128	< 0.01%
202	São Tomé and Príncipe	128	< 0.01%
203	Comoros	125	< 0.01%
204	British Virgin Islands	103	< 0.01%
205	Marshall Islands	99	< 0.01%
206	Vanuatu	92	< 0.01%
207	Montserrat	77	< 0.01%
208	Cook Islands	70	< 0.01%
209	Saint Pierre and Miquelon	66	< 0.01%
210	Federated States of Micronesia	62	< 0.01%
211	Anguilla	59	< 0.01%
212	Falkland Islands	59	< 0.01%
213	Kiribati	29	< 0.01%
214	Wallis and Futuna	22	< 0.01%
215	Saint Helena, Ascension and Tristan da Cunha	11	< 0.01%
216	Niue	4	< 0.01%

See also

- Asian brown cloud
- Avoiding Dangerous Climate Change
- Avoiding Mass Extinctions Engine (AMEE)
- Carbon cycle
- Climate change
- Comparisons of life-cycle greenhouse gas emissions
- Emission standard
- Environmental impact of aviation
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- List of countries by carbon dioxide emissions per capita
- List of countries by electricity production from renewable source
- List of countries by greenhouse gas emissions
- List of countries by greenhouse gas emissions per capita
- List of countries by ratio of GDP to carbon dioxide emissions
- World energy resources and consumption
- List of U.S. states by carbon dioxide emissions
- C90 List of countries producing 90% of carbon

Notes and references

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8. ^ United Nations Statistics Division, Millennium Development Goals indicators: Carbon dioxide emissions (CO_2), thousand metric tonnes of CO_2 (http://mdgs.un.org/unsd/mdg/SeriesDetail.aspx?srid=749&crid=) (collected by CDIAC)
9. ^ Human-produced, direct emissions of carbon dioxide only. Excludes other greenhouse gases; land-use, land-use-change and forestry (LULUCF); and natural background flows of CO_2 (See also: Carbon cycle)
10. ^ excluding Taiwan, Macau and Hong Kong
11. ^ UNFCCC Greenhouse Gas Inventory Data - Detailed data by Party (http://unfccc.int/di/DetailedByParty/Event.do?event=go)
12. ^ including San Marino
13. ^ Including Monaco
14. ^ CDIAC: Fossil-Fuel CO2 Emissions by Nation (http://cdiac.ornl.gov/trends/emis/top2008.tot)

External links

The contents of this article comes from the latest figures from the millennium indicators as of 2009-07-14:

- *United Nation Statistics Division (http://mdgs.un.org/unsd/mdg/SeriesDetail.aspx?srid=749)*
- *GHG data from UNFCCC (http://unfccc.int/ghg_data/ghg_data_unfccc/items/4146.php)* - United Nations Framework Convention on Climate Change GHG emissions data

- Breathing Earth (http://www.breathingearth.net) - A visual real-time simulation that uses this CO_2 emissions data
- Global CO_2 Emissions (http://www.nextgenpe.com/news/global-co2-emissions) - Global CO_2 emissions graphic
- Google - public data (http://www.google.com/publicdata/explore?ds=d5bncppjof8f9_&ctype=l&strail=false&nselm=h&met_y=en_atm_co2e_kt&hl=en&dl=en) "CO_2 emissions (kt)"
- Google - public data (http://www.google.com/publicdata/explore?ds=d5bncppjof8f9_&ctype=l&strail=false&nselm=h&met_y=en_atm_co2e_pc&hl=en&dl=en) "CO_2 emissions (metric tons per capita)"

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Categories: Carbon dioxide | Lists of countries | Greenhouse gas emissions | Climate change-related lists | International rankings

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MCCC Maules Creek Coal PAC Submission - Reconciliation of the TSP Emissions

Introduction

This document contains the MCCC cumulative dust deposition/dispersion reconciliation using figures obtained in volume two of the Maules Creek Coal Project EA, prior to the availability of the Tarrawonga expansion data. It should be read in conjunction with the new Tarrawonga TSP reconciliation contained in the main report.

Key Issue and Concern - Dust Deposition

The reconciliation of all Total Suspended Particles (TSP) has identified 10,760 tonnes of dust emissions per annum that cannot be accounted for as dust deposition within the forest. Scenario one and two of the reconciliation has identified two potential receiver scenarios for the 10,760 tonnes as either an airborne particulate matter emission or a combined airborne and dust deposition scenario.

The MCCC reconciliation shows that the 5,006 tonnes of PM10-30 that fall beyond the Leard Forest area will require a minimum of 20,857 Ha or 208 square Km in year 5 to remain within legal guidelines. This is approximately one sixth of the Maules Creek district or an area that extends 14.5 km from the edges of the Forest.

The preliminary wind spatial modeling by Vipac in the MCCC main submission for the Maules Creek Project (see diagram in Appendix 3 of this report) shows that the area to the north of the project will experience significant "dustfall" and could account for much of the dust deposition. The air quality modeling does not identify all likely receivers of these high levels of deposition.

Key Issue and Concern - Background Air Quality

Furthermore, background average PM10 levels leave very little room for additional dust emissions. OEH has shown that background airborne particulate levels already exceed the OEH maximum average 24 hr criterion of 50 micrograms/m^3. This suggests that existing background levels are already beyond the 5 day exceedance limit. **Therefore we do not see any scope for additional PM 10 emissions either within or outside the project area.**

Key Issue and Concern - Airborne Particulates

OEH state that the additional proposed dust emissions from the Maules Creek Project during highly dispersive weather conditions would impact the region as a whole and this would be a highly significant addition to the regional dust load.

In particular, dust depositions will greatly exceed these levels during inversion periods. Temperature and wind inversion periods due to the terrain will reduce mixing heights from 3000 m to below 500 m thereby concentrating total suspended particulates by a factor of 6 and increasing dust deposition accordingly.

The MCCC reconciliation of dust emissions during inversion conditions (Stability Class F) with mixing heights under 500 m, which excludes background dust levels described by OEH above, shows that 104,400 Ha is required to ensure airborne particulate matter concentrations remain within legal guidelines. This area is roughly 13 times the area of the Leard State Forest and far exceeds the Zone of Affectation and Zone of Management shown in the EA. To put this in context 104,400 Ha is 1,044 Km2 and this is roughly 8% of the Narrabri Shire Council Area of 13,028 Km2.

In addition to the large area described above that is required to adequately disburse the dust emissions, it is also likely that the 25% rule will mean that many of the properties in the Maules Creek area and potentially beyond will be affected to a more or less degree.

In conclusion, the local impacts to the residents of Maules Creek are greatly enhanced due to airborne particulates and dust deposition during high probability inversion events. In addition regional cumulative impacts during highly dispersive conditions are of major concern. Given that the background levels already exceed DECCW air quality criteria, any additional emissions from the Maules Creek Project will further exceed mandated air quality levels.

We submit that until modeling and mitigation proposals can be shown to ensure that emissions remain within guidelines no approvals should be made. The project should not go ahead until verifiable scientific assurances can be made to ensure that mandated air quality standards can be met.

Due to perceived shortfalls in supervision and compliance in existing operations, and in the face of likely exceedances a strategy for monitoring is not supported.

Consideration of underground mining should be given serious consideration as substantially fewer dust emissions are produced.

Data Sources and Assumptions

Baseline figures were obtained from table 7.2, page 34, which estimated TSP emissions for each stage of the Project (kg TSP/year). See Appendix 1 of this report. Total emissions for year 5, 10, 15 and 21 for the Maules Creek Coal Project and Boggabri Coal were included, and for year 5 of the Tarrawonga project. Emission rates of TSP in table 7.2 have been developed using emission factors developed both within NSW and by the US EPA and take into account pit retention effects and source modelling that reduces emission rates for particular machinery depending on location of activity.

The distribution of particle size information was obtained from page 28 of the Air Quality Impact Assessment utilising derived information from various sources. PM 2.5 at 4.7% of TSP, PM 2.5 - 10 at 34.4% of TSP, and PM 10 - 30 at 60.9% of TSP. (PM 10 total includes PM 2.5 and is expressed as a total percentage of 39.1%).

Table 4.1: DECCW air quality standards / goals for particulate matter concentrations

Pollutant	Averaging period	Standard / Goal	Agency
Total suspended particulate matter (TSP)	Annual mean	90 µg/m^3	NHMRC
Particulate matter with an equivalent aerodynamic diameter less than 10 µm (PM10)	24-hour maximum	50 µg/m^3	NSW DECCW impact assessment criteria; NEPM reporting goal, allows five exceedances per year for bushfires and dust storms;
	Annual mean	30 µg/m^3	NSW DECCW impact assessment criteria;

Notes: µg/m^3 – micrograms per cubic metre, µm – micrometre;

Total Suspended Particulate matter (TSP) air quality standards were obtained from table 4.1, page 11 of the Air Quality Impact Assessment using DECCW air quality standards/goals and are shown above. DECCW deposited dust criteria (insoluble solids fallout) were obtained from table 4.2 of the same page and are shown below.

Table 4.2: DECCW criteria for dust (insoluble solids) fallout

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

For simplicity, an average increase in deposited dust within the Leard Forest of 4g/m²/month, was adopted by the reconciliation compiled by the MCCC over the total area of the forest of 8,134 hectares. This is considerably conservative compared to the modelled cumulative impacts of annual average dust deposition as described within the Aston EA[1].

Consideration should be given to the MCCC reconciliation under stability class F (and G) conditions as represented in table 5.2, page 19 of the EA , which predicts a frequency of occurrence of 41%, of light winds with clear skies at night and as such, dispersion is slow; and conducive to the formation of

[1] The MCCC reconciliation does not take into account dispersion meteorology modelling, and as such should be used as a tool for considering total dust emissions in metric measurements over the time periods and scales specified.

ground based inversion layers.

Table 5.2: Frequency of Occurrence of Stability Classes for CALMET (2010)

Stability Class	Frequency of Occurrence
A	4.7
B	20.1
C	16.6
D	11.2
E	6.4
F	41.0
Total	100

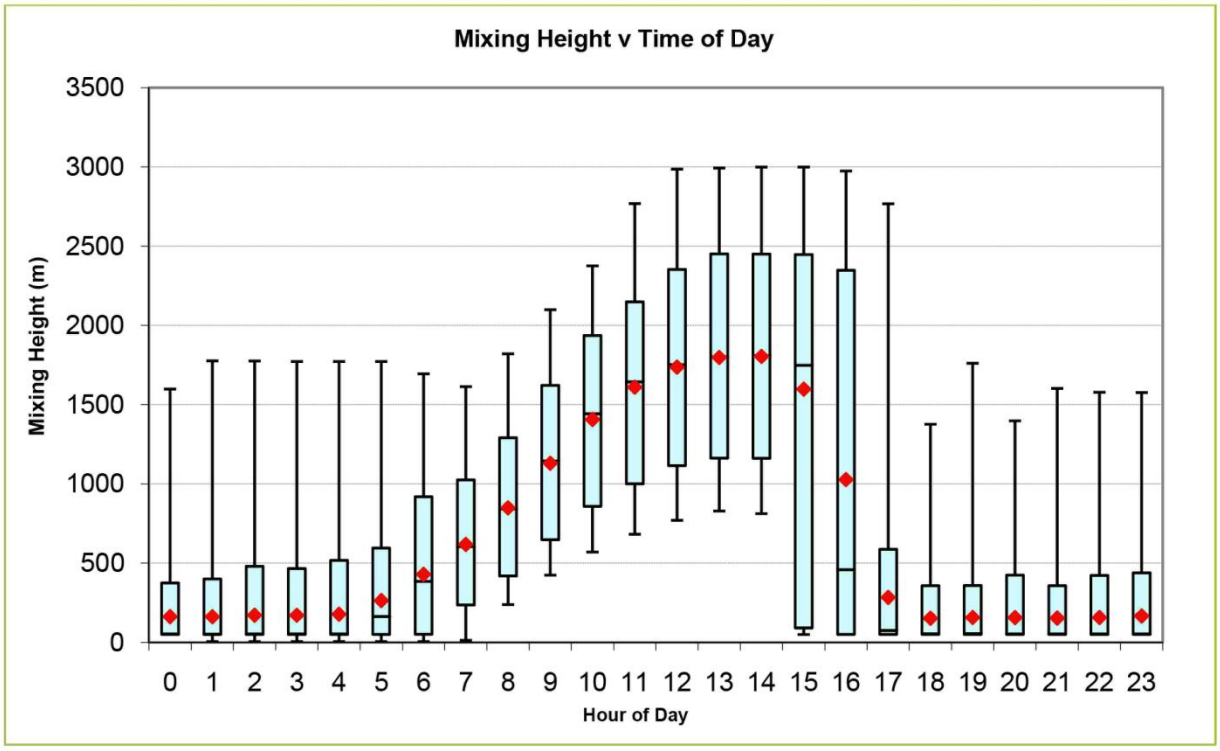


Figure 5.5: Mixing Height by Hour of the Day (generated by CALMET)

Figure 5.5 , page 20 demonstrates mixing height versus time of day and suggests a frequency of 50% of mixing heights being below 500m (13 hrs being approx below 250m), generally occurring at night coinciding with the formation of inversion layers within the Maules Creek valley floor.

Scenario one makes the assumption that all PM 10-30 not accounted for within the forest area falls as dust deposition beyond the forest at a deposition rate of 2g/m²/month , and that all PM 10 remains airborne as a concentration measured in micrograms/m³ using an annual mean of 30micrograms/m³.

Scenario two assumes that all TSP not accounted for within the forest area remains airborne as a concentration measured in micrograms/m³ using an annual mean of 90 micrograms/m³, the higher figure taking into account the larger particle sizes as a component of total TSP.

Airborne particulate matter concentrations have been calculated back to 24 hour weights and volumes to simulate average daily concentrations.

Conversion factors used in the spreadsheet are presented below.

- 1 microgram/m^3 is equal to 1 kilogram/km^3
- 30 microgram/m^3 is equal to 30 kilogram/km^3 used in PM 10 calculations
- 90 microgram/m^3 is equal to 90 kilogram/km^3 used in total TSP calculations (PM 2.5 - 30)
- 2g/m^2/month is equal to 240kg/ha/year
- 4g/m^2/month is equal to 480kg/ha/year
- 1 hectare is equal to 100m squared
- 1km^2 is equal to 100 hectares
- 1km^3 is equal to one cubic kilometre

Table 1 - TSP deposition/dispersion Reconciliation

		Year 5	Year 10	Year 15	Year 21	**Ref No.**
Aston		6584	7862	7589	7656	
Tarrawonga		827				
Boggabri Coal		7219	7512	7396	7396	
Total tonnes TSP		**14630**	15374	14985	15052	**1**
Distribution of TSP particle size emissions within total tonnes						
PM $_{2.5}$	4.70%	687.6	723	704	707	
PM $_{2.5-10}$	34.40%	5032.7	5289	5155	5178	
PM $_{10-30}$	60.90%	8909.7	9362	9126	9167	
Total tonnes TSP		**14630**	15374	14985	15052	
Distribution of TSP particle sizes within total tonnes merging PM $_{2.5}$ and PM $_{2.5-10}$ shown as PM $_{10}$						
PM $_{10}$	39.10%	5720.3	6012	5859	5885	
PM $_{10-30}$	60.90%	8909.7	9362	9126	9167	
Total tonnes TSP		**14630**	15374	14985	15052	
Dust deposition within Leard Forest using 4g/m^2/month criteria using PM $_{10-30}$ as deposition						
Leard Forest at 8134ha at 480kg/ha/year		3904	3904	3904	3904	
Total tonnes TSP used within Leard Forest		**3904**	3904	3904	3904	**2**
PM $_{10}$ not used within Leard Forest		**5720.3**	6012	5859	5885	**6**
PM $_{10-30}$ not used within Leard Forest		**5005.7**	5458	5222	5263	**4**
Total tonnes TSP not accounted for within Leard Forest deposition at 480kg/ha/year						

Total tonnes TSP		**10726**	11470	11081	11148	**3**

An explanation of the reconciliation for year five of the projects follows in sequential order, with other years similar in outcomes. (refer to **Ref No.** column in TSP deposition/dispersion reconciliation)

1. Total Tonnes of TSP from the combined Projects equals 14,630 tonnes. (See Appendix 1)
2. Total deposition of dust (PM 10-30) within the Forest equals 3,904 tonnes
3. Total TSP that did not fall within the Forest equals 10,726 tonnes
4. Scenario One dust deposition outside Forest equals 5,006 tonnes of PM 10-30

6. 5,720 tonnes of PM 10 /year remains airborne at legal concentration of 30 micrograms/m^3 per day

The conclusions reached using scenario one and two for the three coal projects within the Leard Forest using year five TSP emissions as an example, identify 14,630 tonnes of TSP as the gross annual emissions of all mining activities combined.

To put this in perspective, the Baan Baa Silo pictured below has a capacity of 15,000 tonnes of wheat. Given that coal dust is only 67% of the bulk density of whole wheat (Powderandbulk.com 2011. *Engineering Resources – Bulk Density Chart.),* it would take approximately 1.5 Baan Baa silos to contain the 14,630 tonnes of annual dust emissions from the mines in the Leard Forest area.

Baan Baa Wheat Silo (http://www.flickr.com/photos/flying_donkey/4613949395/)

In order to ascertain the amount of dust emissions allowed to be deposited in the Leards Forest, a generous allowance of 3,904 tonnes has been allocated by the MCCC to an area of 8,134 hectares (the size of the forest), for dust deposition at the rate of 4g/m²/month or 480 kg/ha/year, before calculating the possible impacts the remaining 10,726 tonnes could have beyond the forest boundaries.

Scenario One

Scenario one allocates the remaining 10,726 tonnes as a dust deposition and airborne particulate matter scenario, using the PM 10 component (5,720 tonnes or 39.1%) as airborne at a concentration of 30 microgram/m³, and the dust deposition component (5,006 tonnes or 60.1%) at a deposition rate of 2g/m²/month.

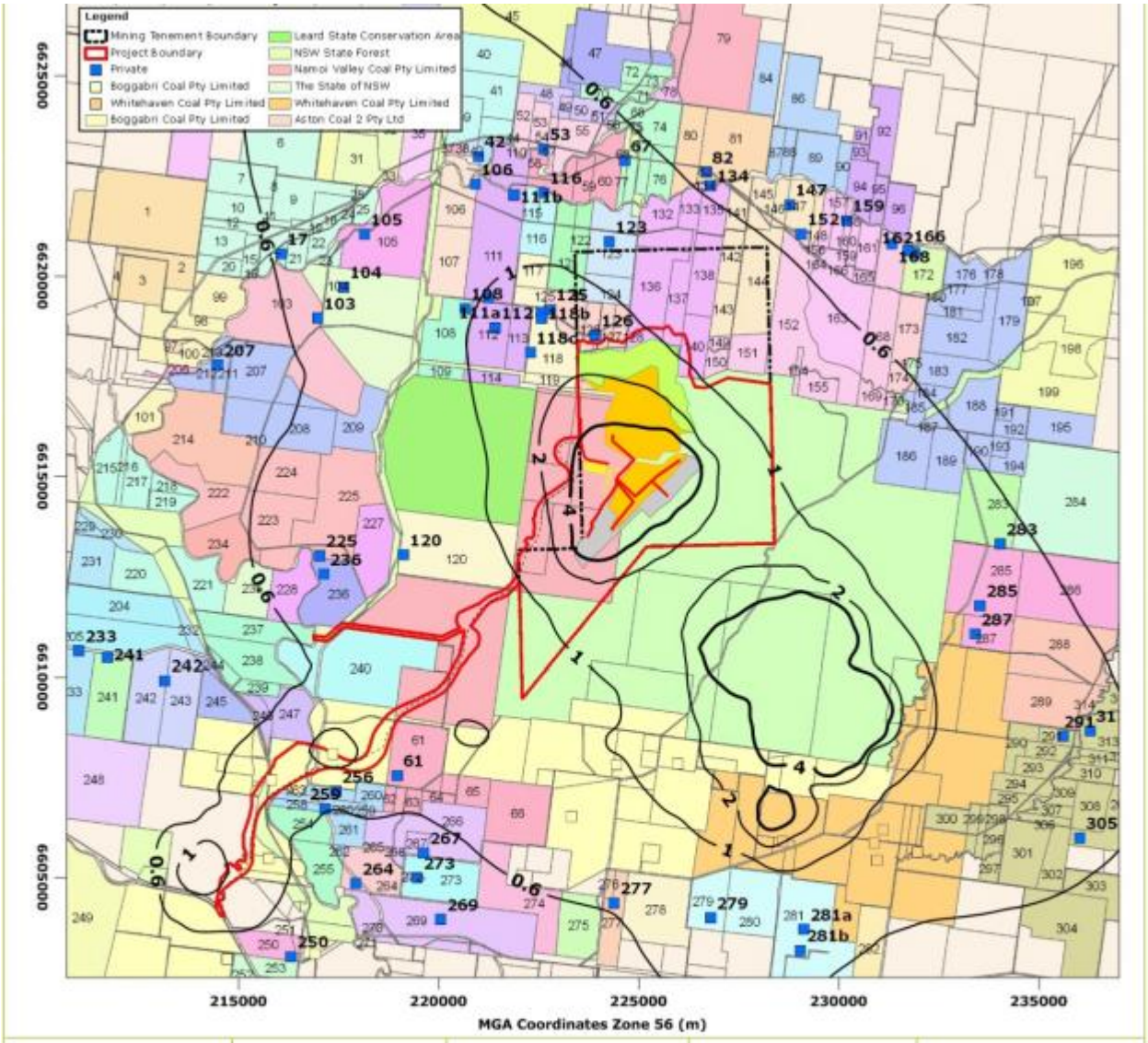


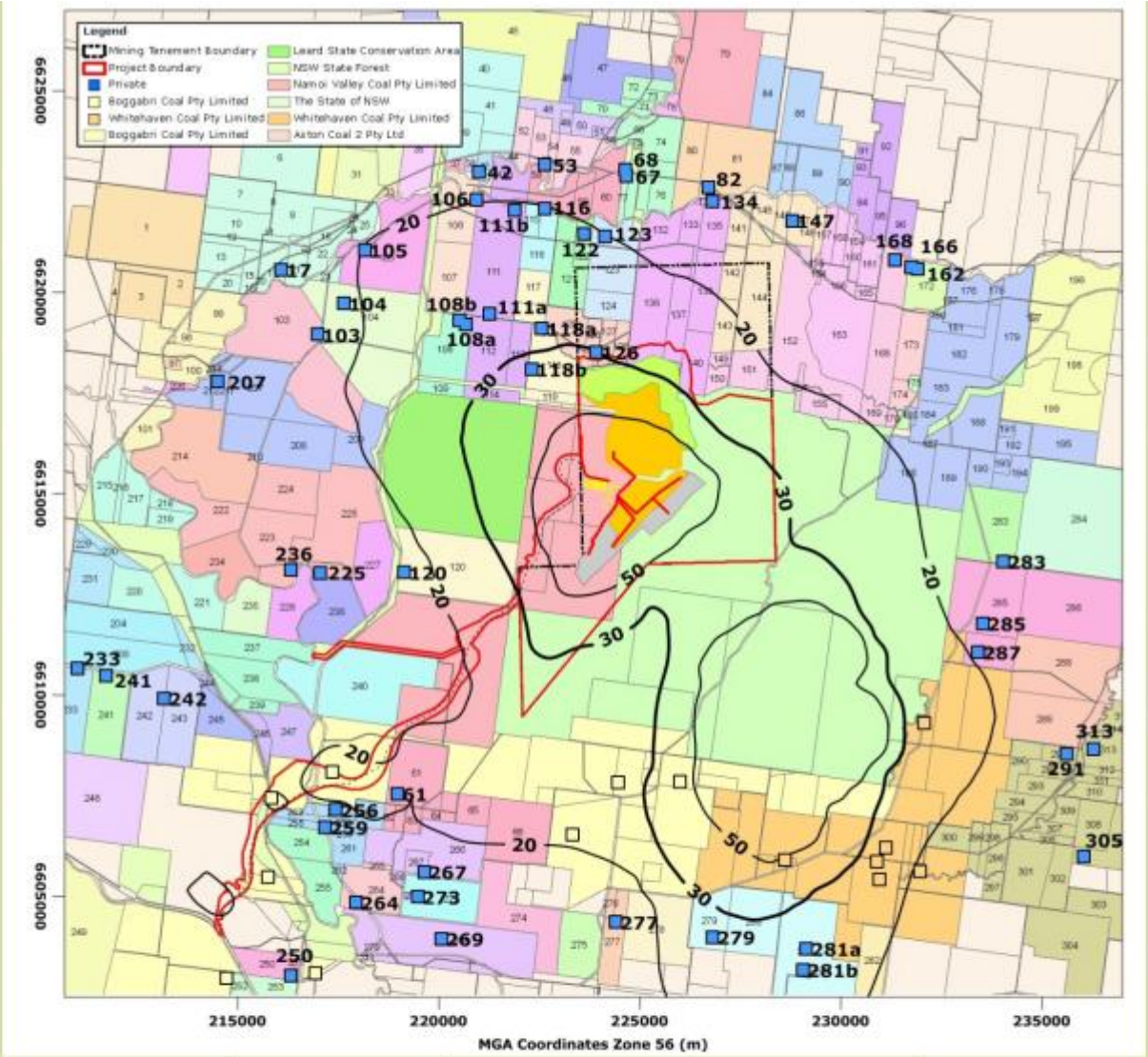
Figure 8.25: Model predictions for annual average dust deposition:

Year 5 – Cumulative

The dust deposition component PM 10 – 30 (5,006 tonnes or 60.1%), requires an additional area of 20,857 hectares or 14.5 kilometres squared to be accounted for beyond the forest area. Figure 8.25, page 75 of the EA shown above (Model predictions for annual average dust deposition: year 5 cumulative), does not account for this dust.

The airborne PM 10 component (5,720 tonnes or 39.1%), requires an area of 17,400 hectares or 13.2 kilometers squared at a mixing height of 3,000m over a 24 hour period. Figure 8.9, page 55 of the EA (Model predictions for annual average PM 10 concentrations: year 5 cumulative, could account for this dust during adequate dispersion conditions.

The airborne PM 10 component (5,720 tonnes or 39.1%), requires an area of 104,400 hectares or 32.3 kilometers squared at a mixing height of 500m (stability class F) over a 24 hour period.



Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Maules Creek	Year 5	-	Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
ISCMOD	$\mu g/m^3$	30	CALMET	J. Beaney

Figure 8.9: Model predictions for annual average PM_{10} concentrations: Year 5 – Cumulative

Figure 8.9, page 55 of the EA shown above (Model predictions for annual average PM 10 concentrations: year 5 cumulative), does not account for this dust during inversion events that occur 41% of the time generally and 69% over winter (Bridges Acoustics, 2011).

The scenario one reconciliation completed by the MCCC raises serious questions as to the validity of the year 5 cumulative models as presented within the EA. The allocated 10,726 tonnes/year or 29.4 tonnes a day needs to be accounted for within the air quality impact assessment as provided by PAE Holmes.

Table 2 Scenario One (PM 10 – 30 Deposition beyond the Forest, PM 10 remains airborne)

	Year 5	Year 10	Year 15	Year 21	**Ref**
2g/m²/month of PM_{10-30} deposited beyond Leard Forest at legal deposition equates to 240kg/ha/year					
PM_{10-30} available for deposition in tonnes	**5006**	5458	5222	5263	**4**
Hectares beyond forest required for deposition	**20857**	22745	21758	21928	**5**
PM_{10} remains airborne at legal average concentration of 30 micrograms/m³					
PM_{10} available for airborne dispersal	**5720**	6012	5859	5885	**6**
Average available daily PM_{10} tonnes	**15.6712**	16.4712	16.0520	16.1232	
Km³ required for 30micrograms/m³/day	**522.4**	549	535.1	537.5	**7**
Km³ required for 3000m mixing height	174	183	178	179	
Hectares required for 3000m mixing height	**17400**	18300	17800	17900	**8**
Km³ required for 500m mixing height	1044	1098	1068	1074	
Hectares required for 500m mixing height	**104400**	109800	106800	107400	**9**

Notes:

4. Scenario One dust deposition outside Forest equals 5,006 tonnes of PM 10-30
5. 5,006 tonnes at 2g/m²/month covers 20,857 hectares/ year beyond Forest boundry
6. 5,720 tonnes of PM 10 /year remains airborne at legal concentration of 30 micrograms/m³ per day
7. 5,720 tonnes/year requires 522 km³ at legal concentrations per day
8. 522 km³ at 3000m dispersion/mixing height requires 17,400 hectares at legal concentrations per day
9. 522 km³ at 500m dispersion/mixing height requires 104,400 hectares at legal concentrations per day (stability class F inversion layer)

Scenario Two

Scenario two allocates the remaining 10,726 tonnes as a total TSP airborne particulate matter scenario, at a concentration of 90 microgram/m³, and nil dust deposition beyond the forest.

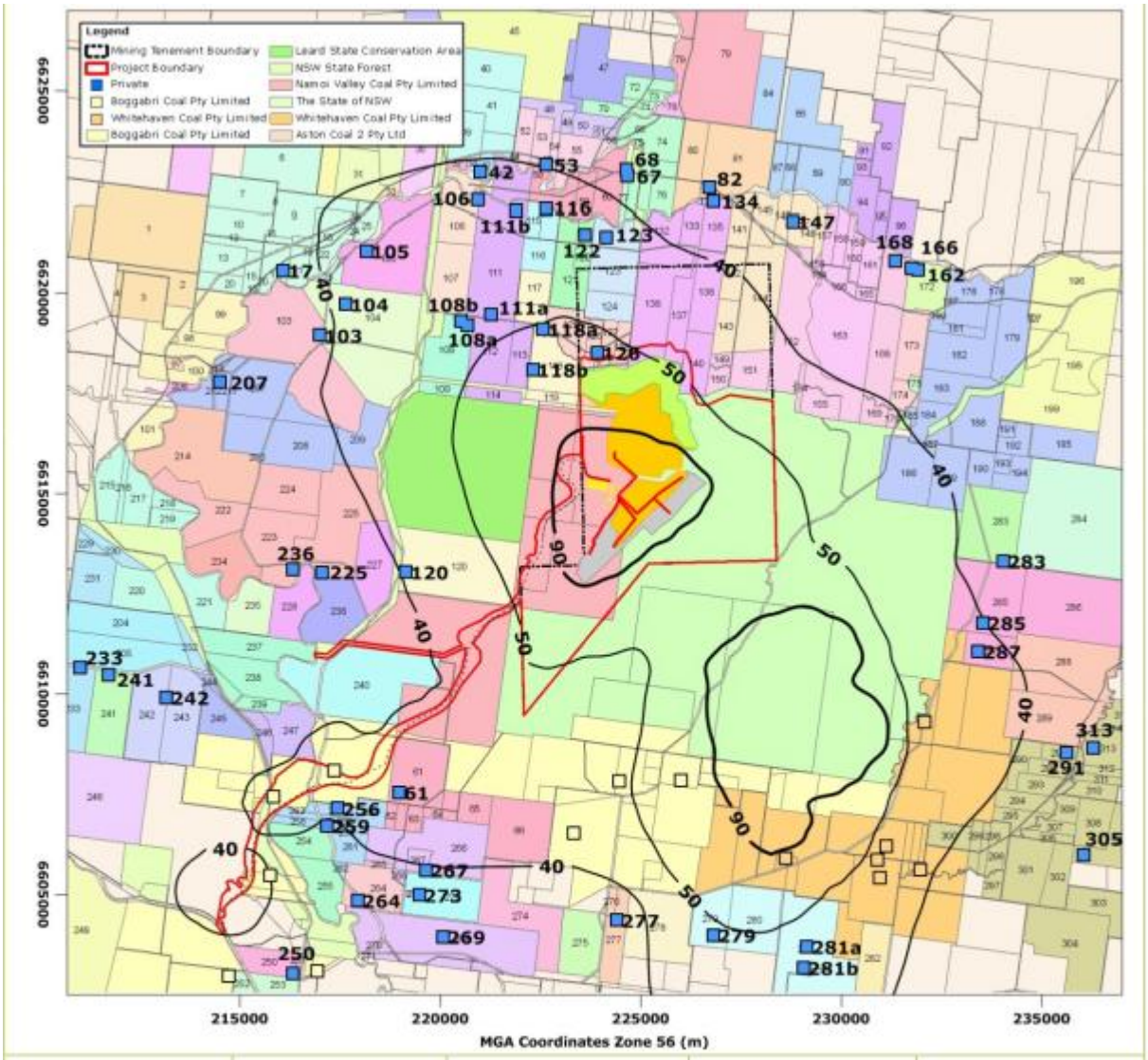


Figure 8.17: Model predictions for annual average TSP concentrations: Year 5 – Cumulative

The TSP of 10,726 tonnes requires an area of 10,800 hectares or 10.4 kilometers squared at a mixing height of 3000 m over a 24 hour period. Figure 8.17, page 65 of the EA shown above (Model predictions for annual average TSP concentrations: year 5 cumulative), **could** account for this dust during adequate dispersion conditions.

The TSP of 10,726 tonnes requires an area of 65,200 hectares or 25.5 kilometers squared at a mixing height of 500 m (stability class F) over a 24 hour period. Figure 8.17, page 65 of the EA (Model predictions for annual average TSP concentrations: year 5 cumulative), **does not** account for this dust during inversion events that occur 41% of the time.

Therefore the scenario two reconciliation raises serious questions as to the validity of the year 5 cumulative models as presented within the EA. The allocated 10,726 tonnes/year or 29.4 tonnes a day needs to be accounted for within the air quality impact assessment as provided by PAE Holmes.

Table 3 Scenario 2 (Nil Dust Deposition beyond the Forest)

	Year 5	Year 10	Year 15	Year 21	**Ref No.**
Total TSP (PM_{10} and PM_{10-30}) remains airborne at legal concentrations of 90 micrograms/m^3					**10**
PM_{10} available for airborne dispersal in tonnes	5720	6012	5859	5885	**6**
PM_{10-30} available for airborne dispersal in tonnes	5006	5458	5222	5263	**4**
Total TSP available for dispersal in tonnes	**10726**	11470	11081	11148	**11**
Average daily TSP airborne emissions in tonnes	**29.4**	31.4	30.4	30.5	
Km^3 required for 90 micrograms/m^3/day	**326.5**	349.2	337.3	339.4	**12**
Km^2 required at 3000m mixing height	108.7	116.3	112.3	113	
Hectares required at 3000m mixing height	**10800**	11600	11200	11300	**13**
Km^2 required at 500m mixing height	652	698	674	678	
Hectares required at 500m mixing height	**65200**	69800	67400	67800	**14**

Notes

9. Scenario Two dust deposition beyond Forest NIL tonnes
10. 10726 tonnes of PM 10 and PM 10-30 /year remains airborne at legal concentrations of 90 micrograms/m^3 per day
11. 10726 tonnes of PM 10 and PM 10-30 /year requires 326.5 km^3 at legal concentrations per day
12. 326.5 km^3 at 3000m dispersion/mixing height requires 10800 hectares at legal concentrations per day

13. 326.5 km³ at 500m dispersion/mixing height requires 65200 hectares at legal concentrations per day (stability class F inversion layer)

Key Issue and Concern – Meteorological and Air Quality Modelling

Appendix B, page 2 and 3 of the EA describes the meteorological model

> "CALMET as a meteorological pre-processor that includes a wind field generator containing objective analysis and parameterised treatments of slope flows, terrain effects and terrain blocking effects. The pre-processor produces fields of wind components, air temperature, relative humidity, mixing height and other micro meteorological variables to produce the three-dimensional meteorological fields that can be utilised to generate meteorological files suitable for dispersion modelling using ISCST3" (ISMOD).

The MCCC notes that, of the seven critical values used to develop the outer and inner grid of CALMET, contain TERRAD inputs of 10 km and 3 km respectively. TERRAD is the radius of influence of terrain features. (Barclay J. and Scire J. 2011)

The MCCC believes that the terrain feature of the Nandewar Ranges to the north of the project with a maximum elevation of 1,508 m, and the associated Mooki Thrust to the east and Turkey Ridge to the west of Maules Creek provide ample reasons to include a larger TERRAD input that includes these geographic features.

Pollution discharge and dilution is dependent on atmospheric conditions that are highly variable on a daily and seasonal basis and the influence of the excluded terrain features within the CALMET model is highly significant. By default this omission excludes localised terrain effects such as temperature inversion, radiation or nocturnal 'drainage' flow, katabatic or 'down-slope' air movements. Anabatic or 'up-slope' air movement, and lastly atmospheric stability whether stable, unstable or neutral. (OEH, 2011. *Local Government Air Quality Toolkit*)

Katabatic flow coupled with inversions can play a significant role in pollutant dynamics over areas such as Maules Creek. (OEH, 2011.) Cold stable air formed over the Nandewar Ranges and the Mooki Thrust plateau overnight, flows down into the Maules Creek basin where it remains trapped by the Leard Forest. The mass of cold, stable air is also under a temperature inversion and will trap and suppresses the dispersion of the TSP emissions generated by the mines. As the sun heats the ground it warms the ground above it and begins to break down the temperature inversion and restore the air to a neutral stability. (OEH, 2011)

Volume 2, section H, page 37 of the EA provides a satellite photo of the Maules Creek basin in figure 4.10. (See Appendix 2 of this report) It is clearly identified within this photo, the areas that are subjected to inversion and katabatic effects due to surrounding terrain features. The northern view sector and eastern view sector by their natural geographic features should be included within dispersion calculation modelling for this reason.

The MCCC firmly believes that CALPUFF should be used for modelling the *cumulative* effects of the mining projects, and that the 'TERRAD' input should include the terrain features as identified above.

In the Maules Creek situation, due to complex terrain and the need to accurately predict short-term concentrations, a more complicated type of model should be used. This assumes the dispersing

pollutant behaves like a set of discrete 'puffs' or expanding clouds of pollutant in the atmosphere, rather than a continuous plume as in the Gaussian model. (OEH, 2011)

The VIPAC Peer Review EIS Air Quality for the Maules Creek Coal Mine qualified many of the concerns of the MCCC. Page 4 of the peer review states that;

> "It is noted that in the report wind roses are shown for the winds generated by TAPM for Maules Creek site looks appropriate with a predominance of southerly winds not apparent from other AWS data shown in the report. However visualisation of the wind fields show considerable spatial variability that would not be accounted for with a Gaussian model." See Appendix 3 of this report for a visual snapshot of the example hour mentioned above by Vipac.
>
> "This data clearly shows how variable the winds are spatially. As shown in the example hour higher wind speeds would tend to carry dust off the mine site, however in other areas the wind speeds are low. In this situation dust would be carried off site and later encounter low wind speeds resulting in significant dustfall to the north of the project and into the Maules Creek valley floor, which a Gaussian model such as ISCMOD as used in the Maules Creek Coal Project air quality impact assessment cannot simulate."

In addition, it should be noted that the High Volume Air Sampling (HVAS) results provide within the Air Quality Impact Assessment for PM10 concentrations at the Tarrawonga, Boggabri Coal and Maules Creek HVAS stations utilise a one in six day sampling cycle to determine average 24 hour PM10 concentrations. This protocol reveals trends in particulate pollution over longer periods of months, seasons and years but may miss acute events that occur on days when sampling is not done. A sharp peak of emissions will not register if it does not coincide with a day of sampling.

Furthermore, it is important to consider the averaging period for air pollution monitoring data. Table 5.5, page 24 of the Air Quality Impact Assessment (shown below) presents the data in yearly averages.

Table 5.5: PM_{10} monitoring results from Boggabri Coal Mine HVAS and Tarrawonga Coal Mine HVAS- µg/m³

HVAS	2007 [a]	2008	2009	2010 [b]
Boggabri Coal Mine	14	11	19	17
Tarrawonga Coal Mine	13	13	21	20

[a] *Data available from May 2007*
[b] *Data available to April 2010*

Existing pollution and meteorological patterns result in the maximum measured concentrations becoming lower with longer averaging times; for example, a maximum yearly or monthly average is typically much lower than a maximum weekly or daily average.

This leads to the conclusion that the data assessed by PAE Holmes to determine PM10 concentrations may not provide an accurate account of past occurrences of dust emissions. Air quality data for the same pollutant can only be compared for similar averaging periods. Data from different averaging periods cannot be directly compared. A one in six day sampling cycle by definition only provides sampling 16.6% of the time that results in 83.4% of days or time unaccounted for. Another way to analyse the data would be to assign an accuracy rate of 16.6% or 83.4% inaccurate.

The NSW Office of Environment and Heritage (OEH) has stated within their submission to the Maules Creek Coal Project that high background concentrations of PM 10 exist within the region. Page 5 of the submission, Issue 6: states;

> "Project-alone increment is likely to exceed the 24-hr PM 10 criterion at nearby receptors to the north. Ambient monitoring shows high background concentrations of PM 10 (24-hr averages) in the region that exceed the OEH criterion of 50 micrograms/m³."

This observation alone would indicate that there is no scope for additional dust emissions.

The "25% rule" requires identifying privately owned land where more than 25% of the land is predicted to experience dust levels above the relevant DECCW criteria. This applies to privately owned land with or without a residence, including vacant land. The reconciliation for TSP deposition/dispersion has raised serious questions as to where the TSP emissions of the three projects will impact. The size of the areas identified are substantial at a sub-regional scale, considering the community of Maules Creek is landlocked by the Mooki Thrust and the volcanic Nandewar Ranges.

Conclusion

A full audit of total cumulative TSP emissions needs to be completed for the three coal projects that take into account the inversion layers that occur 41% of the time within the Maules Creek basin. The Year 5 TSP emissions of 14,630 tonnes or 40 tonnes per day are not adequately accounted for in any of the model prediction maps as presented within the Maules Creek Coal Project Environmental Assessment. This dust must either disperse or accumulate within the local environment, and, the MCCC believes that accumulation will be a real possibility when wind direction, velocity, inversion layers and the blocking effect of the Nandewar Ranges are taken into consideration.

The MCCC dust deposition/dispersion reconciliation of TSP in conjunction with the VIPAC peer review of the Maules Creek Coal Project lead the MCCC to the view that the zones of management and/or affectation for both the Maules Creek Coal Project and the Boggabri Coal Project need to be greatly enhanced spatially to include the Maules Creek valley and the Nandewar Ranges used as a boundary. The extent of affectation from the Tarrawonga Project is unknown at this time.

Recommendations

- A full audit of total cumulative TSP emissions needs to be completed for the three coal projects that take into account the inversion layers that occur 41% of the time within the Maules Creek basin.
- Existing background air quality conditions exceed OEH guidelines and there is no scope for additional dust emissions.
- That if coal mining is to occur, Underground Mining is the most viable means of maintaining air quality.
- If open cut mining is approved that an area of 104,400 hectares (32.3 kilometers x 32.3 kilometers) as identified in scenario one be used as the minimum area for the zone of

affectation before any project approvals are granted. The residents in this area should be included in the Zone of Affectation until it is proven otherwise by developing a dust emission accounting as requesting by OEH.

- If open cut mining is approved that the Zone of Management be of significantly greater extent compared to the zone of affectation, possibly as much as a 30 kilometer radius from the projects central point, before any project approvals are granted, or until it is proven otherwise that this area should not be included by real time monitoring of the cumulative effects of the three projects upon commencement of maximum production.
- That CALPUFF should be used for modeling of all dust emissions from Coal Mines in the Leard Forest Area

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Key Issues and Concerns – Health Impacts

The sheer quantity of dust pollution from the mines in the Leards Forest, the frequency of inversion layers, background dust levels, predominantly southerly winds and topography of the Nandewar Range do not bode well for community health.

It is incumbent on the planning process to ensure that public health is protected. The objectives of the EP&A Act say;

> *"To encourage the proper management, development and conservation of natural resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment."*

The MCCC is of the opinion that the dust pollution from the proposed Aston Resources project of 6,584 tonnes with cumulative emissions of 14,603 tonnes per annum from all the projects does not "*promote the social ... welfare of the community*" or promote a "*better environment"*. In fact it is likely that the environment will become dangerous to health and therefore social welfare will be reduced. The Health Impacts outlined in the MCCC main submission re the impacts to air quality clearly outline those dangers.

Appendix 5 – Ecology and Biodiversity

1. Review of the Tarrawonga Coal Mine Ecology and Biodiversity Impacts.
2. Resume of Dr Wendy Hawes.

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To: Phil Laird
Maules Creek Community Council Inc

From : Wendy Hawes, Terrestrial Ecologist

21 Feb 2012

COMMENTS: REGARDING TARRAWONGA COAL MINE MODIFICATION PROJECT PROPOSAL IN REGARDS TO FLORA AND FAUNA

Hi Phil
I've looked at the various reports associated with the Environmental Assessment (EA) that relate to flora and fauna for the Tarrawonga Coal Mine Modification Project and following are my comments re this document.

General Comments

This is a much better written document than the EIAs for previous mining projects in the area. However, as for Maules Creek Coal Project much of the mitigation of the ecological impacts associated with the proposed Tarrawonga project is contingent upon procedures and methods detailed in various management plans and strategies identified within the BA including:

- Biodiversity Management plan
- Farm Management
- Rehabilitation Management Plan
- Goonbri Creek Management Plan
- Offset Area Management Plan
- Biodiversity Offset Strategy
- Biodiversity Management Plan

Even though the BA outlines some of the objectives and broad content of these plans, like most things the 'devil is in the detail'. All of these plans and/or strategies are yet to be developed consequently, it is impossible to adequately assess the efficacy of mitigation actions in regard to this development.

Vegetation Clearance and Landscape Context

As outlined in the document, this project will remove 557ha of vegetation comprising 397ha of native vegetation and 160ha of derived non-native grassland. The majority of the native vegetation to be cleared is described as being in moderate to good condition, with some areas in excellent condition (Tarrawonga Flora Assessment). Included in the clearing is 13ha of the Critically Endangered Ecological Community *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland* listed under State and Commonwealth legislation.

Under this proposal native vegetation (145ha) will be removed from Leard State Forest a large relatively intact remnant (approximately 7,492ha) within the Brigalow Belt South Bioregion, which has since European settlement been extensively cleared for agriculture. Less than 40% of native vegetation remains within this bioregion, the majority of remnants occurring as small patches and linear remnants on private land and along roads within a highly developed agricultural matrix of exotic pastures, cropping and irrigation. As a result of their small size and the surrounding landuse many of these remnants are in poor condition as a consequence of ongoing degradation as a result of weed invasion, inappropriate grazing regimes, fertilizer and herbicide application, firewood collection and regrowth control. Therefore, although Leard State Forest has historically been subject to forestry activities (which ceased some 20 years ago), its size and condition within this landscape make it a block of remnant vegetation of high conservation value and important for the maintenance of ecological function within the locality and region. This fact is supported in the BA report.

Large relatively intact remnants support meta-populations of biota essential for the on-going maintenance of species populations and the genetic diversity in small adjoining and/or remote remnants. Large intact remnants provide a buffer against the risk of local extinction in highly fragmented landscapes such as that within the Brigalow Belt South. The size and diversity of habitat within large blocks are important as they provide refugia and have the built-in resilience to ensure the on-going survival of our native biodiversity. This is because small populations within highly fragmented remnants, such as that outside Leard State Forest, will be at escalating risk of extinction with changing climate, due to increasing frequency of extreme stochastic events (floods, bushfires, disease and increasing temperatures).

The EA acknowledges the importance of such large remnants in sustaining populations of flora and fauna in a changing climate. Despite this acknowledgement, if approved, this development proposes to add to the cumulative losses within this remnant. This proposal along with other proposed mining operations will significantly reduce the resilience of existing flora and fauna populations. Proposed mitigation for this loss is that the area will be progressively cleared. At any given time this will only be the area required to accommodate the mine's need for the following 12 months. However the

area of clearing that this might involve is not specified, consequently the appropriateness of this as a mitigating action cannot be assessed.

The impact incremental loss of habitat and therefore connectivity in the landscape is complex. It has been demonstrated (Pearson et al 1996[1]) that for species with poor movement ability (ie those that require contiguous habitat for movement) the loss of as little as 30% of habitat will lead to a loss in connectivity and declines in populations. For those species with intermediate movement ability this threshold is 40% and for highly mobile species 70%. What this modeling indicates is that 70% of habitat must be retained within a landscape to ensure no loss of connectivity and maintain populations of flora and fauna (McIntyre *et al* 2002[2]).

Leard State Forest comprises 7,472ha. Various coal mine projects existing and currently proposed (Boggabri Coal Extension, Maules Creek Coal and Tarrawonga), if approved, will clear 2,934ha within Leard State Forest (approximately 39% of the forest area). It will effectively divide Leard into two remnant patches a 3,081ha area to the east and 1,318ha area to the west. This will fragment existing habitat and split resident populations of flora and fauna with low to moderate movement ability (eg small lizards, woodland birds, gliders, possums) into two or more populations. This has long term implications for genetic integrity and long-term viability of these species.

Given the Tarrawonga project will in the short to medium term lead to a loss of a further 145ha within Leard SF and 252ha of adjoining habitat it is highly likely the Tarrawonga Coal Mine Modification Project will contribute to a significant loss of biodiversity both in the locality and in the region.

Relocation of Goonbri Creek

Part of the proposal involves the relocation of Goonbri Creek. In year 12, Tarrawonga project proposes to relocate 3km of Goonbri Creek which lies within the mine footprint. This is a simplistic engineering solution which belies the ecological complexity of the ecosystems involved.

The justification within the EA is that Goonbri Creek is ephemeral and has degraded sections therefore it's relocation will have little ecological impact. Evidence offered in support is that the fish survey only found two fish species, one native and one introduced and a depleted aquatic macro-invertebrate community. However, this conclusion is falsely based given the techniques employed in the fish survey (ie visual inspection, incidental catches in macro-invertebrate nets and opportunistic sightings)

[1] Pearson SM, Turner MG, Gardner RH & O'Neill (1996) An organism-based perspective of habitat fragmentation. In *Biodiversity in managed landscapes theory and practice.* Eds Szaro RC & Johnston DW pp 77-95 Oxford University Press. New York

[2] McIntyre S, McIvor JG and Heard KM (eds) (2002) *Managing and Conserving Grassy Woodlands.* CSIRO Publishing

are extremely problematic. It is important to note that a number of threatened fish species including the Purple Spotted Gudgeon (discounted from this assessment) has been found to survive for long periods in very small pools along highly degraded creeklines.

While in engineering terms it is possible to re-route Goonbri Creek as described, ie dig a sinuous channel, insert some logs, create a number of pools and add water. In ecological terms this physical appearance of a creek is not a functioning ecological system. Ephemeral creek channels, incised, degraded or otherwise are complex, functioning ecosystems. The flora and fauna they support are well adapted to their wetting and drying cycles. What will be lacking from this man-made creek facade will be the natural sediments within the existing creekline that is the refugia for many of the plants and animals (insects, worms, shrimps, yabbies, frogs and fish). These sediments are the storehouse of both flora and fauna in various life cycle stages (eg seeds, rhizomes, eggs, larvae and adults in stasis) needed for a functioning ecosystem next time the creek flows/floods. Just because they are not visible to the human eye or can't be caught in a dip net on a number of limited occasions doesn't mean they are not present. The riparian and streambank soil and vegetation has an equally important and similar function.

It is not known how long it will take for these organisms to move into and inhabit, if they can, this man-made environment. What is known is that at the end of the 3 years allowed for construction and rehabilitation of the 'permanent Goonbri Creek alignment' the riparian vegetation will at best be structurally grassland with young trees providing a shrub component. It will not support the diversity of habitat features within the riparian vegetation, (ie tree hollows, tall shrubs, overhanging tree canopy, a mix of tree and shrub age classes) targetted for removal.

This proposal will change habitat values, vegetation type and structure, flora and fauna populations, soil moisture status, in-stream sediments and significantly modifying the hydrological regime of Goonbri Creek. Goonbri Creek forms part of the *Aquatic Ecological Community of the Natural Drainage System of the Lower Darling* an endangered ecological community (EEC) under the *Fisheries Management Act 1994* this proposal will therefore impact on this EEC.

Rehabilitation of Mined Areas

Currently there is no Rehabilitation Management Plan for the proposed mining area making it difficult to comment the likely success or otherwise of the proposed rehabilitation as a mitigation to the adverse impacts of the proposal. The following comments are based on what little information is provided in the EA.

The conclusion of the EA is that on-going rehabilitation of mined sites will minimised the impacts on both flora and fauna populations. While there may be some truth in this conclusion for some species, progressive rehabilitation will not prevent significant and

irreversible changes in flora and fauna assemblages both within the project boundary and in adjoining remnant vegetation as a result of clearing.

Vegetation Communities

To date Tarrawonga has undertaken 27.5ha of rehabilitation and this site is used as a demonstration of successful mine rehabilitation, which in another 70 to 150 years it may be. But from the results given in the EA, what was previously native forest and/or woodland communities are at best after 4 years, structurally a grassland and/or shrubland. Only 10-16 native groundcover species have been recorded with no indication given of their relative cover percentage. Trees are on average 1.8m tall and effectively shrubs. The native fauna species recorded are, as would be expected, cosmopolitan species commonly found in cleared agricultural land.

In total (approved and proposed) Tarrawonga mine will involve the clearance of 1113ha of habitat (Tarrawonga Fauna Assessment). As outlined in the EA, progressive rehabilitation means that by year 12 437ha of rehab area will be six years old and '*expected to support multiple structural layers; litter, grass, herb, shrub with tree regrowth (2 to 4m tall)'.* At year 12 this is still structurally a shrubland and will have little to offer species dependent on the presence of mature trees, mixed age stands and/or tree overstorey.

This information points to the misleading nature of parts of the EA report. For example Figure 5-3 shows a cross section of the rehabilitated mine landform complete with pictures of post-mining vegetation communities. The vegetation shown in these photos, with the exception of the agricultural land, are mature age well-structured forest and woodland communities. Stochastic events notwithstanding, such communities will only be present on these areas with continuous management 70-100 years post-mining. The reality is that when mining and management of these areas ceases in 17 years time the communities will be predominantly single age shrublands.

Additionally, the EA and Figure 5-2 indicate that only vegetation within Leard State Forest will be rehabilitated with aim of reinstating pre-mining forest and woodland vegetation types (149ha). Existing shrubby woodland and forest areas outside of the Leard State Forest and east of the existing mine footprint will be rehabilitated to agricultural land (210ha) and grassy woodland (752ha). It is difficult to see how reconstructed landscape will mitigate many of the adverse impacts of the proposal for forest dependent flora and fauna even in the long-term.

The proposed reshaping and re-spreading of topsoil to a depth of 1.5m on agricultural areas and 0.2m on other disturbed areas is likely to be less than ideal for many native flora species and in particular the species comprising the CEEC. Given the lack of a Rehabilitation Management Plan it can only be assumed the proposed rehabilitation of the CEEC will occur on the 0.2m soil depths.

The rehabilitation process, as presented, fails to adequately address the complex nature of natural ecosystems and the highly variable requirements of flora species including

but not limited to: aspect, soil type, depth, pH, hydrology and nutrient status, light requirements, humidity and relationships with soil biota. Stockpiling of topsoil depending upon the storage method and time is likely to make the existing native seedbank unviable. It is likely the sowing of a cover crop of introduced sterile grasses for soil erosion mitigation will significantly impede native groundcover establishment.

Fauna Habitat Values

The EA acknowledges that young rehabilitated vegetation will provide only limited habitat for some fauna species. The vegetation communities and habitat provided by the Project Area will not be restored for many years, if ever and certainly not in the life of the mine (17 years). Features which will be lacking include: mature (more than 30 years) and old growth trees (more than 100 years), hollow-bearing trees (more than 140 years), soil biota (time frame unknown) and surface rock and areas of outcropping (geological timeframe). There will therefore be a suite of species which currently exist within Leard State Forest, (eg those that require mature trees and/or the cover of tree canopy for survival) for which the rehabilitation areas are unlikely to provide habitat except in the very long-term.

Loss of hollow-bearing trees

The EA indicates that as part of the rehabilitation plan artificial nest boxes will be installed in parts of Leard State Forest lacking hollows to supplement those lost in the clearing process. There is no indication within the EA of numbers of nest boxes that likely to be installed except that it will be based on an assessment of the requirements within remaining vegetation. According to the figures given in the EA the proposal is likely to remove more than 58,600 hollow bearing trees comprising;

- 53,803 hollow bearing trees within Dry Sclerophyll Forest habitat, and
- 4,800 hollow bearing trees within the Riparian/Floodplain habitat.

As indicated in the EA hollow bearing trees often support a range of hollow sizes (small, medium and large) consequently the number of hollows removed is significantly higher. Figures presented in the EA suggests greater than 153,000 hollows will be removed by this proposed development comprising;

- 79,616 small hollows (less 5cm diameter)
- 48,516 medium hollows (5-10 cm diameter)
- 24,880 large hollows (greater 10cm diameter)

No assessment of hollow bearing trees was undertaken within the Grassy Woodland habitat, but the EA reports trees in this habitat range from 10-80cm diameter at breast height (dbh). It is therefore likely a number of trees within this community, ie those in the 40-80cm dbh range would also be hollow bearing.

It can take up to 140 years for a tree hollow to form and remaining tree hollows in adjoining habitat are likely to already be occupied. The installation of nest boxes to replace this lost habitat is impractical and costly. Franks has estimated the value of an

old growth hollow-bearing tree at over $2 million, based on the cost of installing and maintaining an equivalent number of artificial nestboxes for the life of a tree (www.hollowloghomes.com.au).

Risks associated with rehabilitation

Rehabilitation of native vegetation is a risky undertaking, highly subject to the adverse effects of temperature, rainfall, weed invasion, insect attack, grazing by native and non-native herbivores and individual plant vigour. The time-frame to recreate a fully functioning ecosystem is unknown. To be successful it will require far more consideration and planning than is evident in the EA and on-going intensive management long-after the mine closes in 17 years time.

Final void

The rehabilitation excludes the final void which will be left open to fill with water. This is not considered environmentally responsible. A potential issue with this proposal will include of leakage of toxic substances into groundwater from chemical substances remaining in the void post-mining (oil, petrol, diesel etc). Toxic substances will also potentially impact on fauna using this water resource for breeding, drinking and/or feeding. This notwithstanding, the creation of a large permanent body of water in an area naturally watered only intermittently by ephemeral streams will significantly change the flora and fauna assemblages of the area from which existed pre-mining. This is an outcome inconsistent with the stated aims of the rehabilitation in the EA.

Proposed Biodiversity Offset

In summary this offset proposes;

- Voluntary Conservation Agreement over the property 'Willeroi' (1,660ha) approximately 20km NE of the project area and adjoining the eastern boundary of Mt Kaputar National Park
- Development of a Goonbri Creek Enhancement Plan for the area of Goonbri Creek below the planned creek relocation site by fencing and replanting
- Farm Management Plan for agricultural lands managed by Whitehaven Industries in the vicinity of Leard State Forest which includes enhancements of one or more farm dams
- Maintenance of landscape connectivity through the rehabilitation of habitat on Boggabri Coal Extension offset properties.

These offsets, in the absence of the clearing required for the Tarrawonga Coal Mine Modification Project, would have biodiversity benefits for the locality and region. However, in the context of an offset for the loss of 557ha of existing habitat comprising 145ha of a large contiguous remnant block and 13ha of CEEC, it has significant shortfalls. These include:

- In the short to medium term there will be a significant net loss of native vegetation and habitat in the locality and region, as in this time-frame no new and/or replacement habitat will be established, but clearing for the current project will occur (ie large areas of habitat and significant numbers of flora and fauna will be lost).
- As indicated in the EA while there may be some similarities in the overstorey species, the difference in altitude, soils and climate between Leard State Forest (260-370 AHD) and 'Willeroi' (450-850AHD) mean the vegetation communities on 'Willeroi', and the habitats they form, are not representative of those to be cleared in and around Leard State Forest. As outlined in the EA the vegetation on the project area is representative of 'lower Western Slopes' assemblages while those on 'Willeroi' are representative of 'upper Western Slopes 'assemblages'.
- It is difficult to see how increasing the resilience the species' assemblage in Mt Kaputar, by managing for conservation, will offset the adverse impacts of the proposed mining development on a largely different species' assemblage in Leard State Forest.

  In reality the only biodiversity benefits to be derived from this proposal will be short-term benefits from the control of weeds (in particular Coolatai Grass) and medium to long-term from the rehabilitation of a 305ha area of derived grassland on 'Willeroi'. With exception of migratory and highly mobile species the benefits arising from these actions will only accrue for species within Mt Kaputar NP and the adjoining remnant of which 'Willeroi' forms part. No benefits (short or long-term) from these actions will accrue for sedentary species or species with moderate to low movement abilities within Leard State Forest.
- Even if rehabilitation and replanting within the Boggabri offset properties, along Goonbri Creek and on 'Willeroi' is successful important habitat features will be absent for long periods of time eg tree hollows. Based on figures in the EA the project will remove over 153,000 tree hollows. While it may take many years to replace lost tree hollows some habitat features or aspects of biodiversity may never be retrieved eg soil biota, groundcover diversity, stygofauna. Consequently there will be long-term biodiversity losses.
- In the life of the proposal (17 years) the only likely gain is the rehabilitation of it is unlikely there will be any significant gains in habitat, but there is a high likelihood of local species extinctions as a consequence of the time-lag between the clearing event and the establishment of suitable habitat to support displaced flora and fauna.

Threatened Species and Endangered Ecological Communities

In the case of fauna it is the conclusion of the EA that because a large area of Leard State Forest will remain, individual animals not killed by the immediate clearing operation will be able to move into this remaining habitat and utilize its resources eg tree hollows, foraging habitat etc. This very simplistic approach belies the fact that in nature ecological niches are rarely vacant. Any existing habitat will already be occupied. Displaced fauna cannot simply move. Displaced fauna will increase both intra and inter specific competition for the reduced food resources, mates and roosting/breeding sites. Increased competition will lead to increased stress within populations, potentially increasing disease factors and disrupting breeding cycles. In human terms consider the impact of leveling 39% of any town or city suburb including all houses, schools, supermarkets and food outlets. Then expecting the displaced families to move in with the neighbours and share their houses, schools and food resources.

In the case of Box-Gum Woodland the project will remove 13ha of this community which constitutes the CEEC within the Project Area. Although not a large area it is estimated that less than 10% of this community remains in all types of condition nationally. Consequently even small areas of this community can be important for the maintenance of genetic diversity both locally and regionally.

For both flora and fauna the large remnant that is Leard State Forest supports meta-populations which provide for the restocking of the small remote remnants within the more highly developed agricultural matrix.

A number of threatened species whose distribution matches the Project Area have been excluded from assessment based on a lack of suitable habitat present within the study area and/or lack of records/sightings. However, given the vegetation communities and habitats described in the EA it does appear habitat for these species exists within the project area and/or adjoining habitat. Therefore an assessment of the impact of the Tarrawonga Project on these species should be undertaken. These species include:

Terrestrial Species

- *Bush Stone-curlew* - TSC Act – this species inhabits grasslands, grassy woodlands and grassy open forests including those with sparse grassy groundcover. According to the report these habitats are present within the project area and in the adjoining Leard State Forest.

- *Black-breasted Buzzard* – TSC Act – this species is associated with a range of inland habitats including riparian woodland and grasslands. Habitat for this species is present within the study area.

- *Stripe-faced Dunnart* – TSC Act – inhabits tussock grasslands on a range of soil types (including clay) often along drainage lines. Sheltering in soil cracks,

under fallen logs and rocks. Habitat for this species exists within the study area.

- *Pale-headed Snake* – TSC Act – inhabits eucalypt and cypress open forests and woodlands. Habitat for this species exists within the study area.

- *Anomalopus mackayi* – TSC Act and EBPC Act – inhabits open grassy woodland and grasslands on lower slopes and floodplains. Sheltering in soil tunnels, under fallen logs and timber. Habitat for this species exists within the study area.

The Aquatic Ecological Community of the Natural Drainage System of the Lower Darling

As described in the determination this community includes "*all native fish and aquatic invertebrates within all* ***natural creeks****, rivers, streams, and associated lagoons, billabongs, lakes, flow diversions to anabranches, and* ***the floodplains*** *of the Darling River*". Areas of floodplain of the Namoi River associated with Goonbri Creek within the project area have been erroneously excluded from this community.

One of the threats to this community is the alienation of floodplain areas which are important source of nutrients essential for ecosystem function within the aquatic environment. Goonbri Creek and its floodplain would contribute important nutrients to the riverine system as a result of overland flows during various flood events. Potentially the proposed mining area will remove areas of floodplain for open cut mining and modify floodplain flows and remove part of a functioning aquatic ecosystem through relocation of 3km of Goonbri Creek. These actions will lead to losses from this EEC. The impact of these actions must therefore be assessed in regards to their impact on this TEC.

R E S U M E

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PERSONAL DETAILS

BORN:	24 February 1957
DRIVERS LICENCE:	Current Class C Gold

EDUCATIONAL RECORD

1969-1974:	WARILLA HIGH SCHOOL - Higher School Certificate
1975-1977:	UNIVERSITY OF NEW ENGLAND - Bachelor of Science (In zoology and ecology)
1978-1979:	UNIVERSITY OF NEW ENGLAND - Master of Science (Prelim)
1988:	INVERELL COLLEGE OF TAFE - Computer Studies 1
1989:	INVERELL COLLEGE OF TAFE - Text Editing
2008:	UNE PARTNERSHIPS – Certificate IV in Training and Assessment

CURRENT MEMBERSHIPS

The Envirofactor Pty Ltd - Director

Accredited Expert: Biodiversity and Threatened Species - NSW *Native Vegetation Regulation 2005*

Goonoowigall Conservation Area Consultative Group - DECCW

Border Rivers Community Consultative Advisory Committee (Scientific Rep) – DECCW

National Parks and Wildlife Northern Tablelands Region Advisory Committee (NCC/NPA Rep) - DECCW

Nature Conservation Council Rep – Inverell Bushfire Management Committee

Ecological Society of Australia

Australian Conservation Foundation

Birds Australia

Gould League

Australian Network for Plant Conservation

Australian Professional Engineers, Scientists and Managers Association

TECHNICAL REPORTS

Hawes W (1979) Preliminary Study of the Ecology and Behaviour of the Blue Bonnet Parrot (*Psephotus haematogaster haematorrhous*) Master of Science (Preliminary) Thesis. University of New England.

Hawes W (1992) *Rehabilitation of Degraded North West Croplands with Perennial Grasses*. Department of Conservation and Land Management.

Hawes W (1992) Flora and Fauna Survey In *Boobera Lagoon - Environmental Audit*. Department of Land and Water Conservation.

Hawes W (1994) Wildlife as a Natural Resource In *2000 and beyond.....Keeping the Land in Trust*. Macintyre Development Unit 2000. Nornews Ltd, NSW.

Hawes W, Boschma D and Rose A (1995) *Report on the Current Land Condition of the former "Moree Common"*. Department of Conservation and Land Management.

Hawes W, O'Keefe P and J Kewley (2000) Acacia *sp. "Myall Creek" (*Miller s.n. *25 May 2000). Site Inspection and Sample Collection*. Department of Land and Water Conservation.

SCIENTIFIC CONTRIBUTIONS

Blakers M, Davies S J J F and Reilly P N (1984) *The Atlas of Australian Birds*. Royal Australasian Ornithologists Union. Melbourne University Press.

Department of Land and Water Conservation (1999) *Interim Guidelines - for targeted and general flora and fauna surveys under the Native Vegetation Conservation Act 1997.* Centre for Natural Resources NSW Dept of Land and Water Conservation, Parramatta.

Department of Land and Water Conservation (2000) *Guidelines for Mapping Native Vegetation.* Centre for Natural Resources, Parramatta.

Department of Land and Water Conservation (undated) *Collecting field information for assessment of clearing applications under the NVC Act 1997.* Departmental document.

Ede AJ and W Hawes (1998) *Guidelines for Native Vegetation Assessment and Reporting – Barwon Region.* Dept of Land and Water Conservation. Departmental document.

Ede AJ and W Hawes (2004) *Draft Guidelines for the Environmental Assessment of Existing and New Structures/Developments under Part 8 of Water Act 1912 – Barwon Region.* Dept Infrastructure Planning and Natural Resources. Departmental document.

Gray E, Ede AJ and W Hawes (2000) *Assessment Notes and Short Reporting Guidelines – Barwon Region.* Department of Land and Water Conservation. Departmental document (Update of 1998 document).

Hawes W (2008) *Draft National Recovery Plan - White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland*. Department of Environment and Climate Change *in press.*

Nadolny C *et al (*2003) *Grassy Vegetation in North-western NSW and Guidelines for its Management for Conservation*. Armidale Tree Group, Armidale, NSW.

Nadolny C, Hunter JT and W Hawes (2010) *Native Grassy Vegetation in the Border-Rivers-Gwydir Catchment: diversity, distribution, use and management.* A report to the Border Rivers-Gwydir Catchment Management Authority.

Oliver I and D Parkes (2003) *A Prototype Toolkit for Scoring the Biodiversity Benefits (and Disbenefits) of Land use change.* Vers 5.1. Centre for Natural Resources. Department of Sustainable Natural Resources, Parramatta.

Oliver I, Ede A, Hawes W and A Grieve (2005) The NSW Environmental Services Scheme: Results for the biodiversity benefits index, lessons learned, and the way forward. *Ecological Management. & Restoration*. **6** 197-205.

Turner K and PL Smith (1996) *Guidelines for assessing the significance of native vegetation removal on threatened species, populations, or ecological communities, or their habitats.* Dept of Land and Water Conservation publication.

FLORA AND FAUNA SURVEY EXPERIENCE

2010	Targetted Survey for Threatened Flora Species – Tuttle's Lane, Glen Innes – PowerServe Pty Ltd - TE
2009	Split Rock Dam Stage 1 Upgrade Flora and Fauna Survey – State Water - TE
2008	TSR Flora Survey for Identification of HCV sites – Lachlan CMA and Forbes/Young RLPBs – NWES & TE Copeton Dam Upgrade Flora and Fauna Survey – State Water -TE
2007	Border Rivers-Gwydir High Conservation Vegetation Mapping – Vegetation typing – DECC - TE
2006	Dept Environment and Climate Change - "5 Corners" Fauna Survey – NWES & TE
2005	Dept Environment and Conservation - Biodiversity Conservation in the NSW Sheep-Wheat Belt Project (Plant and Bird Surveys) – TE Bat Survey – Dept of Lands Hillgrove Derelict Mine Project – The Envirofactor (TE)
2004-2003	Habitat Manipulation in Grassy Woodlands Project (Reptile Survey) – CNR
2003-2002	Nandewar Regional Biodiversity Assessment Survey – NSW NPWS
2002	Threatened Flora Survey "Balaclava" Glen Innes - DLWC "Minbalup" Community Biodiversity Survey – NWES and Greening Australia
2001	Vegetation Condition Rating Project and Reptile Survey – Centre for Natural Resources (CNR) Flora and Fauna Survey, Peery National Park – Australian Museum, Australian Herpetological Society, Birds Australia
2001	Bat Survey – Ironbark Nature Reserve – NWES
2000	King Conrad Mine Fauna Survey – NWES and DLWC Fauna Survey, Sturt National Park – Australian Museum, Australian Herpetological Society, NWES
1998	Threatened Flora Survey "Fairview" Walgett– DLWC Threatened Flora Survey "Fairlands" Boggabilla - DLWC
1996	Pilliga Fauna Survey – DLWC Ecologists in conjunction with Harry Parnaby (Australian Museum) Gwydir Wetlands Fauna Survey – Northwest Ecological Services (NWES) and Dept Land and Water Conservation (DLWC)
1992	Environmental Audit Boobera Lagoon (Flora and Fauna Survey) – Dept Conservation and Land Management

RELEVANT TRAINING

Department of Natural Resources	Aboriginal Sites Identification Aerial Photo Interpretation Four Wheel Drive Training Introduction to Arcview Laboratory Techniques and Safety Risk Management Assessment Soil Data System Sponsorship Workshop Train the Trainer Vegetation Management Legal Enforcement Workshop Wetland Plant Identification
WorkCover	OHS General Induction for Construction Work in NSW
Farming For The Future	Facilitation Training
State Forests	Frog and Bat Identification and Survey Skills
University of New England	Identification of Western Grasses Tree and Shrub Identification

EMPLOYMENT HISTORY

THE ENVIROFACTOR PTY LTD

APR 2004 - PRESENT DIRECTOR/TERRESTRIAL ECOLOGIST

Design & undertake flora/ fauna surveys and threatened species assessments for research, urban and rural infrastructure development to meet legislative requirements under planning state and federal planning legislation. Examples include:

- *Identification of HCV vegetation within the Lachlan CMA area – GBW CMN*
- *Ecologist's Inspection of the Gwydir Highway Upgrade (Inverell) – Cut & Fill*
- *Flora and Fauna Impact Assessment – Proposed Boral Concrete Batching Plant (Tamworth)*
- *Flora and Fauna Impact assessment - Gwydir Highway Rehabilitation (Inverness), Spencer's Gully Bridge and Sawpit Gully Bridge Construction and Road Realignment, Guyra Road Realignment, Mackie Lane Widening (Inverell Shire Council)*
- *Flora and Fauna Reports for Rural Subdivisions at Sandy Hollow, Scone, Merriwa, Muswellbrook-*
- *Review of Environmental Factors for Copeton Dam and Split Rock Dam Security Upgrades – State Water*
- *Review of Environmental Factors – Boomi, Boronga, Welbondonga, Euraba & Dolgelly Artesian Water Supply Projects, Kensington Artesian Water Supply Project, Cryon Water Management Project, Tholloo Joint Water Supply Scheme, Wingadee Joint Water Supply Scheme (Office of Water)*
- *Statement of Environmental Effects for Rural Subdivisions at Inverell and Armidale*
- *Flora and Fauna Assessment for Telstra Cable Installation (Croppa Creek, Lowana and Copeton)*

Critical expert review - *Flora Survey and Analysis Report of Box Gum Woodland at Muswellbrook (DEWHA)*

Expert advice for legislative compliance – *Assessment of the presence of the endangered ecological community, Myall Woodlands at Warren NSW (DEWHA)*

Develop National Recovery Plan for the Critically Endangered Ecological Community – *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland (DECCW)*

Develop and deliver environmental education packages:

-*Staff field training for Multiple Ecological Communities Stewardship Program – Central West CMA*
- *Biodiversity and Threatened Species Training Workshop – Border Rivers-Gwydir CMA*
- *High Conservation Roadside Vegetation – Border Rivers-Gwydir CMA*

Provide specialist ecological advice for the preparation and development of:

- *Commonwealth and State Scientific Committees' – Threatened Ecological Community listings including: Box Gum Woodland, Myall Woodland Coolibah/Black Box Woodland, Inland Grey Box Woodland and Native Grasslands*
- *Commonwealth Environmental Stewardship Program*

Project management, costing, OH&S risk assessments/safe work practices, equipment maintenance, data collection, analysis, interpretation and reporting. Client and government agency liaison.

DEPARTMENT OF NATURAL RESOURCES
Inverell Resource Centre (IRC)

OCT 1992 – JUNE 2006 TERRESTRIAL ECOLOGIST

Provide specialist ecological advice on vegetation management, biodiversity, habitat assessment and threatened species to:

- *Departmental staff including Vegetation Management, Compliance and Water Licensing Officers administering State Environmental Planning Policy No 46 (SEPP 46), Native Vegetation Conservation Act 1997 (NVC Act), Water Act 1912 and Water Management Act 2000*
- *Local Government, Private Consultants, Community Groups and Landholders.*

EMPLOYMENT HISTORY (continued)

Act as an expert witness in departmental compliance actions in respect to environmental harm and biodiversity issues, as well as, prepare remediation plans for areas illegally cleared.

Provide specialist ecological advice for the preparation and development of:

- *Commonwealth and State Scientific Committees' - Endangered Ecological Community listings*
- *Natural Resources Commission statewide biodiversity & vegetation targets*
- *DNR Director General's requirements for EIS, SEEs and REFs*
- *Catchment Management Authority (CMA) targets/plans- Vegetation Benchmarks for Property Vegetation Plan Developer (PVP Developer)*
- *Consultant Briefs for Flora and Fauna surveys*
- *Plans of Management for public and private land eg Boobera Lagoon Management Plan, Moree Common, Goonoowigall Bushland, Inverell Bushfire Management Plan*
- *Property Agreements.*

Critical review of flora, fauna and threatened species components of EIS', SEEs and REFs for departmental comment.

Assist in the development of:

- *Decision support systems - Biodiversity Benefits Index, Terrestrial & Aquatic Threatened Species database, PVP Developer*
- *Staff assessment guidelines – see Scientific Contributions*
- *Flora and fauna survey guidelines.*

Develop & deliver workshops, education material & presentations on native vegetation management and biodiversity for:

- *Departmental staff – Vegetation Management Officers, Water Licensing Staff, Compliance Staff*
- *NGOs – Grassy Box Woodland Conservation Management Network, Australian Network for Plant Conservation, UNE, "5 Corners" Voluntary Conservation Area*
- *Landholders*
- *Other agency staff – CMA Community Support Officers, Rural Fire Control Officers, Rural Lands Protection Board Rangers*

Design and conduct flora and fauna surveys, OH&S risk assessments, implementation of safe working practices, staff recruitment & management. Data collection, analysis and reporting.

MAR 1995 (6 Months) — ACTING PROPERTY MANAGEMENT PLANNER - MOREE

Responsible for the maintenance of the Farming for the Future program. Liaison with landcare groups. Organising & delivery of property planning workshops.

AUG 1990 - AUG 1995 — EDUCATION OFFICER – BARWON

Liaison with educators and community groups regarding their environmental education needs. Develop and deliver specific education programs for schools, tertiary institutions and community groups. Organise functions focusing on the environment & education for specific events (*eg* Landcare Month, World Environment Day, Water Week). Responsible for the resources, operation & financial allocations associated with the IRC Environmental Education Centre. Team leader of the Northwest Schools Landcare Competition coordination committee. Organise outside sponsorship to fund specific events.

AUG 1989 - SEPT 1992 — TECHNICAL ASSISTANT - BARWON

Assist with the implementation, maintenance, sampling and recording data of field trails. Collection and preparation of samples and undertaking laboratory (physical and chemical) soil tests for conservation earthworks and research programs. Assist in the operation and maintenance of equipment and stores for use in the laboratory and field. Assist in soil survey. Undertake data entry, analysis and interpretation. Report and submission writing.

EMPLOYMENT HISTORY (continued)

1988 - 1989 **INVERELL COLLEGE OF TAFE**

TEACHER: (Casual) Design and deliver an outreach course, "Meeting Procedures", for community groups

1984-1987 **J.C. HAWKINS (BVSc)**
Inverell
VETERINARY ASSISTANT: Office administration, accounts, client liaison, surgical assistant, records maintenance and hospital/office cleaning.

1978-1983 **COMMUNITY YOUTH SUPPORT SCHEME**
Coonamble and Inverell

PROJECT OFFICER: Co-ordinating activities for young unemployed people (16-25 years). Liaison with employers and community organisations. Counselling and conflict resolution. Submission writing for government funding.

REFEREES

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Department of Environment, Climate Change and Water

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Julian Prior

Senior Lecturer

Ecosystem Management
University of New England

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Appendix 6 – Soils and Rehabilitation

1. Review of the Soils and Rehabilitation of the Tarrawonga Coal Mine by SoilFutures Pty Ltd..
2. Resume of Rob Banks.

SoilFutures Consulting

Soil Information for Smart Managers

ABN 86 110 466 736

PO BOX 582 Gunnedah, NSW 2380 - ph : (02) 6742 7489, Mob:0427 431 512 e-mail: soilfutures@clearmail.com.au

Robert Banks BSc (Hons), Dip Bus, Certified Professional Soil Scientist

Mr Phillip Laird
"Middle Creek"
Maules Creek NSW

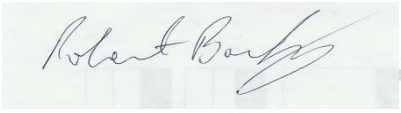
Wednesday, January 11, 2012

Dear Phil

I have read the Tarrawonga soils sections of the EA and I believe that a good job has been done on the soil particularly with respect to any agricultural land and the planning required to rehabilitate it back to the agricultural land capability which it had prior to development. As for the forested lands or lands of lesser agricultural value, I think that the same problem has come up with understanding the requirements of the natural systems which they are seeking to replace. I think that a soil available water holding capacity model should be applied to the "non-agricultural lands" as has been done in my reviews of Boggabri Coal and Maules Creek Mine EA. This will enable the correct soil depths to be determined for re-establishing the forest in a way that it will emulate the native systems that they are replacing in their rehabilitation plans.

All in all, a much better job, and hopefully done by people who will actually take note of any responses to the EA from your group.

Yours Sincerely



Robert Banks

Director

SoilFutures Consulting Pty Ltd

RESUME - ROBERT BANKS

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GUNNEDAH NSW 2380

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EDUCATION/QUALIFICATIONS

1986 - 1990	Macquarie University, Sydney NSW Bachelor of Science with Honours Plant Ecology, Soils and Geomorphology
January 2005 – June 2005	Gunnedah TAFE, Gunnedah NSW Diploma of Business (Frontline Management)
	Other Qualifications: Chainsaw Operators Safety Awareness Certificate (DLWC No.590) Confined Space Awareness Training Certificate (DLWC)

WORK HISTORY AND EXPERIENCE

1990 – 2004 Department of Infrastructure Planning and Natural Resources (DIPNR, and its predecessors, DLWC, CaLM and Soil Conservation Service)

Senior Soil Scientist, Soil Surveyor

- Full time position as Soil Surveyor contributing to the State Soil Landscapes Survey program
- Conducted an environmental and cultural audit of Boobora Lagoon for CaLM at Boggabilla with the Gammillaroi people from Toomela Mission (1992).
- Providing technical input and setting directions for collaborative research projects within the Liverpool Plains relating to soils and salinity information. Part of this job resulted in the creation of the original Land Management Units for the Liverpool Plains. These have since been redrafted by Robert as Soil Landscape Mapping became available for the whole Liverpool Plains.
- Responsible for conducting soil surveys and participate in multidisciplinary team research projects at a local and national scale.
- Responsible for soils input to many areas of NW NSW ranging from identification of salinity risk, developing sustainable agronomic practices to advising engineers and planners on soil related hazards.
- Development of NSW State Salinity Policy (Working group member)
- Development of Federal and State Carbon Credit Policy (Working Group member)

- Completed Soils and Land Information System in-service course
- Completed Presentation Skills workshop
- Completed Extension Skills workshop
- Assisted Landcare and Total Catchment Management, CMA, CMB Groups
- Land resource consultancies
- Projects of national and regional significance including Soil and Regolith Attributes for CRA/RFA Modeling Resolution, Northern Floodplains Regional Planning NHT project, and Australian Soil Resource Information System
- Scientific supervisor for 7 soil surveyor staff in Barwon Region
- Training programs for 14 overseas soils students and at least as many Australian Students
- Supervision and training of Honours Students from UNE, Macquarie University and Sydney University
- Extension of soil management information in NW NSW.
- Presented at over 300 field days in NW NSW on wide variety of soil management issues to landholders and soil managers in the region

October–November 1991

Hamburg University, Hamburg, Germany

- Invited to present lectures in Australian soils and geomorphology at Institute for Boedenkunde (Soil Science), Hamburg (3 weeks), University of Hamburg and Ingolstadt on National soil science tour of Germany and Austria. This was followed by a 1 week work tour at Cambridge University and Rothamstead, England at the request of the Department of Conservation and Land Management (CaLM).

December 1993–July 1994 and November 1996–June 1997

Two 7-month secondments to Hong Kong Geotechnical Engineering Office, Hong Kong (Aerial Photograph Interpretation and Soil Consultant)

- Assisted in negotiating contract for 4-year study of landslide hazard in Hong Kong, employing up to 14 Australian consultants at any one time from October 1993 – November 1997.
- Assisted in design and implementation of Aerial Photograph Interpretation (API) procedures for the systematic investigation of features of the Territory (SIFT) program. This was conducted to identify dangerous cut slopes, fill slopes and retaining walls of Hong Kong and asses risk to human life
- Participated in hazard identification procedure through API and field investigation.
- Acted as soil/geomorphology consultant in for Lantau Island Landslide Investigation team
- Responsible for training local staff in API and other remote sensing tools
- Production of 108 1:1000 maps and reports over various areas of the Territory
- Completion of SIFT project as outlined above and reporting to Legislative Council that in excess of 50 000 dangerous features required remediation in the Territory of Hong Kong

August 1999

2-week secondment to Tasmania's Department of Primary Industries Water and Energy, Launceston Tasmania

- Helped to design and implement sampling strategy for Electromagnetic Induction surveys over different geomorphic zones of the Midlands of Tasmania to identify degree of salinity risk for irrigation development

September 2001

Soil Research in Western Queensland as part of Dr John Ley's wind erosion team based at Gunnedah Research Centre

- Lead a soils investigation team to sample clay pan environments
- Investigated the role of soil engineering, inherent salinity and sodicity properties of clay pan soils to develop a soil based model for development of surfaces and wind erosion features in clay pan environments in Western Queensland. At the time of the project, these soil parameters had not been seriously considered in their environmental context.

September 2004– current

SoilFutures Consulting Pty Ltd, Gunnedah, NSW.

Principal Consultant and Director

- Started a new company to capitalise on expertise gained through service as NSW Government Soil Scientist offering sound soils advice for special developments in NSW.

Activities of Company have included to date:

- Development and use of Electromagnetic Induction (EM) technology in salinity investigation for broadacre applications (suitability for alternative crops), as well as for water storage suitability assessment.
- Crop suitability soil surveys for citrus and plantation timber developments
- GIS and scientific paper contribution to KLC Environmental
- Design of effluent management and disposal system for abattoir development application, and for Peel Council Effluent Re-use scheme for proposed Equine Centre
- Salinity studies for urban development in Tamworth Shire
- Development of property dryland tree plantation and cell grazing designs, and successful funding submissions for on ground action for client who wished to bring tree cover to 30% and enable better pasture management on property.
- Tree and Soil sampling for CRC for Plant Based Solutions for Salinity (Adelaide). Identifying and sampling rare woody species. which may have potential for development for timber products. Soil sampling was involved for this project to determine soil characteristics which plants favoured in their natural or plantation habitat.
- Presentation of soil management and salinity information at 32 field days for the Liverpool Plains Land Management Committee, the Australian Grasslands Society, Gunnedah TAFE and the Namoi Catchment Management Authority
- Tree planting and water use design for urban development
- Provision of general soil advice to land managers, planners, other

environmental scientists and to University of New South Wales Groundwater Unit.

- Significant Wetland mapping for the Western CMA – GIS subcontractor to Wetlands and Woodlots
- Mining Exploration for limestone mining potential in the Gunnedah Shire
- Training of DNR staff Soil Coring OH&S, and safe operation
- Technical expertise on soil test results provided to GHD-Hassall for municipal effluent disposal projects (7 separate locations in NSW).
- Contracted by Namoi Catchment Namoi Authority to complete soil landscape mapping for entre Namoi Catchment. This job consisted of mapping unmapped areas and producing seamless soil landscape and geomorphic coverage for the Namoi Catchment, involved management of seven separate subcontractors, working as a team, and overseeing and compiling all soil profile and landscape description data.
- Completed soil landscape mapping at 1:100 000 Scale for the Hunter REMS CCC, to allow effective native vegetation modeling to be developed.
- Represented Caroona Coal Action Group at Senate Inquiry on Food Production Security. May 2009.
- Expert Witness, for Caroona Coal Action Group in Mining Magistrates Court May 2009.
- Expert Witness For client suing insurer over foundation issues claim on house November 2009. Slater and Gordon Lawyers, Gunnedah
- 2 EM31 surveys for clients seeking to construct irrigation storages October – November 2009
- Expert Witness Report on Gully erosion along proposed subdivision boundary. April 2010. McCabe Terril HBM Legal Group.
- Setting EPA sampling sites and doing baseline soil sampling and EPA reporting for Tamworth Regional Council Effluent Irrigation Scheme. February - June 2010
- Irrigation development suitability soil Studies for Doyle Group in SE QLD, November, 2009 – present. Ongoing
- Effluent irrigation Development Study using EM31 as a tool for potential monitoring – salt loading and nutrient budgeting for Gunnedah Leather Processors, Gunnedah – June 2010 – present – on going

ACCREDITATION

Certified Professional Soil Scientist (CPSS), Level 2, Experienced Professional

- Accreditation through Australian Soil Science Society for practitioners of Soil Science. Level 2 CPSS must have at least 5 years experience in soil science, have achieved academic and professional excellence and must maintain annual professional training of at least 50 hours.

PROFESSIONAL MEMBERSHIPS

Member of Australian Soil Science Society Incorporated (ASSSI)

COMMUNITY ACTIVITIES

Member of the Liverpool Plains Land Management Committee (2004 – 2009)

- Voluntary position as both landholder and soils expert on community committee which has been establish to encourage and fund sustainable land management in the Liverpool Plains, and to direct the activities of professional staff who work for the committee.

REFEREES

Mr Greg Chapman
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Dr Anthony Ringrose-Voase
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GPO Box 1666
Canberra ACT 2601
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PUBLICATIONS

Banks, R.G. (1994), Soil Landscapes of the Curlewis 1:100 000 Sheet Map, Department of Conservation and Land Management, Sydney

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Banks R.G Various Dates 2004 – 2009 – Privately produced scientific reports and documents available on request for viewing only on request from SoilFutures Consulting Pty Ltd as these documents are deemed *commercial – in confidence.*

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International Congress on Modeling and Simulation, Hamilton, New Zealand, December 1999, Volume 1. (Eds L. Oxley and F. Scrimgeour) pp. 43-48. University of Waikato, Hamilton, New Zealand.

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Appendix 7 – Health Impact Assessment

1. Summary of the impacts of Coal Mining by Dr Steve Robinson and Murray Pakes.
2. Report by Dr D van Steenis describing coal opencasting and health impacts.
3. Affidavit of Professor Mathew Peters evidence to the Land and Environment Court.
4. Report by Kim Hann regarding ammonium Nitrate Blast Fumes.

Urgent Reform of Coal Industry operating standards required

“I am appalled at the very dated health standards causing much unnecessary death and disease in the Hunter” stated UK Industrial air pollution expert, Dr Dick van Steenis, when he toured the Hunter region last week. He noted some parts had death rates as much as 37% above the national average and was positive the poorly regulated coal mining and power generation industries are to blame. Compounding the problems from coal is the temptation to use power stations and bulldozers as defacto hazardous waste disposal units reducing the cost to coal companies but causing enormous escalation of health damage.
Dr van Steenis visited coal communities and lectured in Gloucester, Liverpool Plains, Singleton, Muswellbrook, Newcastle and ending at the Environmental Defenders Office in Sydney. The following is a synthesis of his observations and recommendations.

Dust problems, PM10 and PM2.5 – SIZE IS IMPORTANT
Open cut mining produces dust particles at several stages in production. Both the size of the particle and the content are critical to causing health damage.
For dust to enter lung tissue it must be less than 3microns in diameter. Larger coarse particles breathed in will get caught in the hairs and mucous of the nose and bronchi. The convention is to describe coarse dust particles between the size of 10microns and 4 microns as PM10. Fine dust particles are conventionally measured as PM2.5. (A human hair is about 100microns in diameter). Whilst even much smaller ultra fine particles are produced in large numbers they are probably too small to cause major health effects. It is PM2.5 and PM1 particles that are the critical ones for human health. PM10 particles cause nuisance effects of dirtying all surfaces and if they get into the water supply such as rainwater tanks their toxins will be dissolved and can then produce health effects. The processes that produce PM2.5 tend to be different to the processes that produce PM10 and their levels bear no relation to one another. This fact is critical to understanding the deadly uselessness of the Australian dust monitoring system which is all built around measuring PM10 levels – there is no standard for PM2.5, and it is not measured or reported.

World-wide PM2.5 legislation
USA commenced legislation for PM2.5 levels in 1997 and they have noted a 6% reduction in mortality rates and a reduction in the associated health bill. Canada, Japan and France have followed suit. In contrast, in other polluting countries such as Australia the mortality rates and health expenses are rising.

OPEN CUT MINING DUST PRODUCTION

The mechanical processes of mining produces some PM2.5 but the majority of the dust is at least PM10. PM2.5 is produced in greatest numbers by processes that involve burning. At an open cut mine it is primarily the bulldozers and blasting which are the culprits plus any burning that may occur of a coal seam. Each large bulldozer

can emit the same number of fine particles as 900,000 Volvo P70 petrol cars. Even a small open cut mine is likely to have at least five of these heavy mining vehicles operating and large mines many more. Typically a bulldozer does not have a particle trap on the exhaust and the hot exhaust fumes are thrown into the air, rise and travel several kilometers. The cooling of the night air causes the particles to fall leading to coughing and asthma in children and young animals at night. (Most of a cars exhaust fumes have fallen to the ground within 100metres). If the diesel fuel is a low grade or mixed with oil refinery waste it causes the particles to reduce to PM1 size and will contain many more toxins.
Blasting usually only occurs about once per week but the gases produced are very toxic. Blast gases are not normally monitored despite their toxicity.
The processing, stockpiling, loading and transport of coal from over 30 mines to Newcastle and the loading onto ships are processes that cause coal to rub against hard surfaces and produce more dust. Water suppresses only coarse particles and dries out on long journeys so that the quantity of emissions from the uncovered coal rail wagons does not reduce even after several hundred kilometers. Every community beside the rail line is at risk as are the Newcastle suburbs within 3 kilometers of the coal loaders. (Wheat carried by rail and coal carried by road is covered. Why not oblige coal rail wagons to be covered?)

Water contamination from Open Cut Mining
Coal is washed in the processing plant and this requires about 200litres for every ton of coal. The dirty slurry is usually diverted to a dam which would need to be lined by 17feet of clay to absorb all the toxins and not leak them into the ground water. We know of nowhere that this has been done. Dirty water from Gunnedah area mines drains into the Murray-Darling system contaminating an enormous food bowl area. We are told areas of land at Ravensworth are still unsafe for stock 30 years after ‘rehabilitation’.

POWER STATION DUST PRODUCTION

When pure coal is burned most of the particles are PM5 and do not enter the lungs, however about 20% of the particles are smaller and can enter the lungs. If impurities are added the particles are reduced to PM2.5 and PM1. Several people informed us hazardous waste including medical hazardous waste is being added to the coal at Liddell Power Station making it function as an incinerator even though the operating temperature is far too low for the waste to be properly broken down to safe basic particles. Mercury is just one toxin released by such plants. Dr van Steenis stated this is the most dangerous operation he encountered in his tour and in his opinion should be closed down. (If a power station is to operate as an incinerator as well it needs to be by the plasma gasification process which Dr van Steenis suggested should be built at Liddell since this process needs electric power and hazardous waste will continue to be widely produced and needs to be eliminated.)
Much of the coal in the Hunter Region is high in sulphur content and this will make particles acid and increase their toxicity. More than 200 different substances can be emitted so Power Stations need extensive emission control devices. Older power stations such as those in our valley are usually missing much of the controls which

could make them safe. Flue Gas Desulphurisation (FDG) is usually absent in older power stations as is means of elimination of very toxic nitrogen oxide gases. The bag filters which these older power stations have do not capture the smaller most deadly PM1 particles which are typically present when toxic waste is being added.
The haze, which greeted us as we travelled south from the Liverpool Plains into the Hunter, is comprised of PM2.5 and the density of haze has been demonstrated to be directly proportional to asthma increased mortality rates in the USA.
The high smoke stacks cause the dust particles to fall more further than with bulldozers. Every 100feet of the smoke stack distances the point that the fallout occurs a further 10km, with maximum levels again at night as the air cools. Thus both Singleton and Muswellbrook townships are in the drop zone of Liddell, Bayswater and Redbank Power stations. Prevailing winds tend to be up and down the valley and just a few hours of PM2.5 fallout can trigger heart attacks and asthma. Hunter Valley horse studs around Scone fear the dust is affecting their foals.

Damage from Power plants is detailed in a report “Death, Disease and Dirty Power” available on the web.

HEALTH DAMAGE FROM PM2.5 COAL PARTICLES

When a fine dust particle lodges in the lung the body’s immune system mounts a defence. Macrophages transport bits of coal to the lymph nodes but most of the particle is walled off with fibrous tissue whilst the T lymphocytes neutralize some of the toxins. The body has a limited supply of these immune cells so that numbers drop throughout the rest of the body leading to increased susceptibility to infections and vaccines.

Respiratory system effects

Just a few hours exposure to acidic particles will trigger a further attack of asthma in the predisposed. Children living 1.5km from a mine have a 33% risk of asthma, at 3km the risk is 22% and at 5km it is 12%. Particularly nasty toxins called Polycyclic Aromatic Hydrocarbons (PAH) and dioxins can damage the genes causing mutations which will produce new proteins that in turn lead to new cases of asthma. The fibrosis leads to Chronic Obstructive Pulmonary Disease (**COPD** – Australia’s fourth biggest killer) with evidence of permanent damage in children as young as 12 years old in areas with high PM2.5 rates. Lung cancer increases in these same areas due to gene damage.
In Singleton Dr Tuan Au has commenced testing the lung function of children and has already tested nearly 700 children with the aim of following them for five years.

Cardiovascular system effects

The platelets and other blood components become more viscous leading to clots in arteries whose walls have been roughened. Lipids are changed resulting in more fatty deposits in the vessel wall. Heavy metals in the coal such as nickel affect the electrical conductivity of the heart and cadmium attacks the elastic lining of vessels leading to aneurysm formation. The net effect is an increase in deaths from heart

attacks and strokes. Blood vessels in the placenta are damaged leading to low birth weight babies.

Neurological system effects
Mercury breaks down the blood-brain and blood-bowel barriers letting in other toxins such as PAH which lead to a reduction in intelligence and an increase in autism and other damage which releases challenging (antisocial) behaviours.
Lead from coal and released from the roofs by acid rain running into rural rainwater tanks leads to brain damage. Arsenic is also found in coal.
The chemical toxins cause lethargy and depression with clusters of increased suicide noted downwind of one incinerator. Rare neurological syndromes occur in clusters such as a group of people with Motor Neurone disease presenting in one street in Muswellbrook. Immune disease such as Multiple Sclerosis increase.

Metabolic and other effects
Thyroid function is often suppressed and combined with the lethargy arising from chemical toxins this can result in over-eating and excessive weight gain. Diabetes 2 rates increase. Eye diseases and skin rashes and infections all increase.

All the above damage to physical health is compounded by the psychological stress and depression arising from enforced changes to life plans, loss of quality of life, grief at the changed landscape, perceived powerlessness etc. Noise impairs concentration and sleep. Low frequency machinery noise (28Hz) may resonate in body cavities and people's rooms and interfere with nerve conduction.

More detailed descriptions of all the above are found in Dr Dick van Steenis's papers such as "Coal opencasting and health" and in the recent report from Physicians for Social Responsibility titled "Coal's assault on human health". This latter document notes that in 51 metropolitan areas in USA where legislation forced the reduction of PM2.5 levels there were significant increases in life expectancy. A detailed reference list of 370 scientific papers supporting the above is available on request.

FINANCIAL IMPLICATIONS

Professor Mike Hendryx has shown the costs from health damage from coal in USA is five times the value of the coal. In Australia a recent CSIRO report by Tom Biegler et al titled "The Hidden Cost of Electricity" similarly highlights the enormous burden coal imposes on this country's economy. The NSW Government is currently having difficulty paying its health bills, one of the contributory factors is likely to be a consequence of ignoring for years the hard evidence that exists about PM2.5 levels and health damage. Dr van Steenis frequently made the point that long term unpolluted water availability, sustainable food production and good health should be our Government's priority. What analysis is done to assess the future cost of health care that will be required to address the consequences of allowing PM2.5 dust to fall on residential subdivisions during the planning assessment process? Where does the health of the people of NSW rank vs economic considerations during the planning assessment process for open cut coal mines?

LEGAL ASPECTS

Tim Robertson, a barrister specializing in environmental law, noted at the EDO that with the escalation in open cut coal mining in the Upper Hunter, dust levels are now apparently frequently exceeding existing mandated levels (PM10 levels which are decades out of date); that this is a serious problem, and that something needs to be done. He indicated that Air Pollution is more difficult to assign responsibility for than water or land pollution because it is more difficult to prove the source of the pollution.(Note that biopsies of lung tissue for dust samples for analysis may assist in overcoming this difficulty as coal has area specific levels of constituents ie sulphur.) He stated that the laws relating to Air Pollution in NSW can be difficult to understand; one aspect is that it is only a crime if the process producing it has been demonstrated to be inefficient.

A law professor who also spoke at the EDO indicated that any potential class action would be greatly assisted by data of lung function in a group of children (or horses for that matter) prior to damage from coal dust (the establishment of baseline data). Any person believing they have been damaged by coal dust should investigate the possibility of registering their case with The Dust Diseases Tribunal in order to be suitably compensated. There may be potentially 50,000+ such people. One successful case may lead to a flood; note that in the UK claims for damage from breathing coal dust (COPD) were expected to be 600 million pounds. The total ended up at 4.1 billion pounds.

WHAT CAN BE DONE TO REDUCE THE DAMAGE

1) Call a moratorium on any new development until a plan involving the following points is enacted
2) Conduct a Health Study in already affected areas investigating mortality rates, low birth weight incidence, genetic malformations, post mortem lung damage. Document asthma, heart attack, stroke and cancer rates in coal communities.
3) Require a Health Study as part of any application to mine. By not assessing the health risks associated with mining activities, there is potential legal exposure that could prove costly to the taxpayer – aside from being hazardous to their health.
4) Extend baseline lung function measurement in children beyond the study commenced in Singleton.
5) Legislate buffer zones, particularly downwind of any new development. Note asthma incidence in studies in the UK reveal that at 4.8km from open cut coal mines the rate is 13%.
6) Legislate for PM2.5 levels to be the monitoring standard in future. There seems little point in monitoring dust particles that are less dangerous, while ignoring the dust particles that are more dangerous. The technology to do so is freely available. Where the mandatory levels are breached, appropriate

action needs to be taken immediately. In the USA, plants can be shut within an hour for this reason; in Australia it is self assessment, with no local compliance officers in the Upper Hunter.

7) Purchase PM2.5 Beta Attenuated Monitors that are accurate to 1% and that are factory calibrated and sealed. If this is not done by the State, it should be done at a community level. Place monitors in all affected school yards as well as upwind and downwind of sources. Continuous monitoring needs to be done with results posted on the web. This needs to be done to get an accurate picture of the levels of PM2.5 dust that are currently being generated, and this dust can be sent for analysis. In this way the facts become apparent as to the level of dust being generated as well as its source. This monitoring needs to be done independently from the source of contamination.
8) Ensure heavy mining vehicles use high grade diesel fuel with no additions and their exhaust have particle traps fitted
9) Monitor Blast gases. CSIRO research reveals toxic gases with known adverse health effects from this source only become equivalent to background levels at 5km from the blast site.
10) Cover Coal Rail Wagons
11) For existing at risk families, purchase HEPA air filters for all houses at risk. These cost $500 each retail for the best filters which should be placed in schools and close to the bedroom of any affected child.
12) Check all affected rain water tanks for contamination. Advise accordingly.
13) Recommend that affected adult individuals (subject to approval from their healthcare practitioner) take Selenium 200 microgram for one month and then 100microgram daily (dosage to be confirmed by healthcare practitioner). This boosts T lymphocyte production and lowers heavy metal contaminants. Subject to individual medical advice take 1gram daily of Vitamin C which reduces mutations. Consider also taking Vitamin E.

In addition, where power stations are present:

14) Tighten hazardous waste surveillance.
15) Close power stations such as Liddell which are burning hazardous waste and replace them with a plasma gasification plant.
16) Ensure all power stations have the maximum emission protection devices

Dr Steve Robinson email <treesteve@gmail.com>
Murray Pakes

On behalf of the consortium of community groups organizing Dr van Steenis visit to the Hunter.

Coal opencasting and health

Dr Dick van Steenis

My work has been peer reviewed by professors in the UK and USA and describes just a small portion of the health damage and cumulative effects caused by opencast mining. For 16 years I have researched industrial air pollution (including opencasting) with its consequential health damage namely illness and premature deaths. Published research confirms that both PM1 & PM2.5 particulates produced by opencasting of coal, especially if toxic waste is present due to known or unknown tipping, CAUSE new cases of asthma to develop in children and adults as well as exacerbating those who already have it. There will also result increased incidence of chronic pulmonary obstructive disease, heart attacks, generalised premature deaths, strokes, type 2 diabetes, clinical depression and in addition other conditions resulting from any toxic waste and machinery emission ingredients contaminating the area which would include cancers, hormone disorders, birth defects, low birth-weight babies, skin rashes, behaviour disorders, infections (including eye) and immune system disruption etc. due to pollutants such as organic compounds (including PAHs), heavy metals, dioxins (rife in North East Derbyshire), and even radio-active matter. Fuel quality used by equipment & vehicles is also critical as fuel used is normally of inferior quality compared to city diesel.

Studies in NE Derbyshire (1994-2000) comprising school medical records, school asthma inhaler use, microscopy of dust outside and within buildings, and PM 2.5 monitor readings with filter analysis at 5 schools covering a 3 year period, all confirm a rise in asthma to affect 33% of primary school children living within one mile, a cumulative rise to 21 % at two miles and even 12% at three miles. Welsh Office studies at Gwaun Cae Gurwen also discovered 33% of children in three schools to have developed asthma at one mile, based on peak flow readings. West Glamorgan studies found coal particles plus diesel particles in the filters partly upwind of the opencast, over the top of a large mountain. Peakflow measurements and asthma inhaler use worsened as particulate levels rose in direct proportion, and this happened irrespective of home conditions and social factors. A Lanarkshire study (1998) proved that hospital admissions for asthma rose with opencasting of coal, again within three miles or so, with cumulative rises year after year, falling when the opencasting ceased. A Liverpool University study even showed a rise in asthma in schools within 2km of moving coal at the docks, irrespective of smoking habits and unemployment. Coal dust from moving coal can be reduced by some 80% by foaming with GE DusTreat DC9112E used in USA.

Hospital admissions for asthma in the Tinsley area, since opencasting began at Orgreave, rose to 11 per 1000 population as against 3 per 1000 at Sheffield City Centre and 1 per 1000 in Worcestershire. All three areas have motorways. GP doctors in the area of SE Sheffield, namely Handsworth area etc., have noted a large rise in asthma incidence in their area since Orgreave opencasting began. They are clear of the M1. The rise at Tinsley is not confined only to asthma, also diabetes, due to possible dioxin or arsenic contamination contained in PM2.5 particulates (which produce oxidative radicals). In London 0.5 miles away from the millennium dome site, the asthma incidence rose from 11.9% of school children in early 1996 to some 50% in November 1998, with the only change being the “opencasting” of that waste site development at Greenwich, containing no doubt nickel, phenols etc.

Findings of microscopy and particle analysis, presented at the Royal

Microscopical Society in London in July 1998, revealed that asthma caused by opencasting involves:

(A). Cut quartz particles of which 36% were found to be smaller than PM 0.3, which are second to asbestos in terms of serious effects on the lungs. The body walls off these particles, causing fibrosis (called silicosis). These PM1 sized silica particles also enhance peripheral thrombosis.

(B). Coal particles around PM 1 in size cause an inflammation in the lungs. Repeated doses then lead to fibrosis, called pneumoconiosis in miners. Macrophages can only cope with a small amount of PM1 & PM2.5 particles at a time. The immune system T-lymphocytes have to assist the macrophages leaving the immune system unprotected from vaccines and infections. Excess particles become walled off causing COPD, even at age 10 years. A recent study in Austria using lung spirometry proved PM1 inhalation was even worse than PM2.5, probably due to greater surface area. PM1 particulate has been shown to promote early atherosclerosis and oxidative stress.

It only needs an increase of 14.3ug/m3 of PM2.5s for 3 hours to cause a heart attack in a vulnerable patient. Peak levels of PM2.5 in Derbyshire exceeded 150ug/m3 in 2000. Peak levels of PM1 measured at Hollingdean (Brighton) brown field site development by 4 bulldozers June 2007 reached 1100ug/m3 of PM1 (safe level around 6ug/m3) and 375 ug/m3 of PM2.5 (safe level around 7ug/m3). Remember only particles smaller than PM3 (3 microns) get into the depths of your lungs. The UK measures PM10 with monitors checking PM4 to PM10, NONE of which get into the lungs. TEOM instruments can be adjusted downwards. It must be stated that readings of PM2.5s rise and fall entirely separately from PM10s. PM10 monitors are thus totally useless in the UK for commenting on health damage, confirmed in the Austrian study. At Hollingdean (Brighton) the week average readings amounted to PM10s=116ug/m3, PM2.5s=163ug/m3 & PM1s =253ug/m3 DEFRA's few PM2.5 monitors are inappropriately sited and readings are being "adjusted" and do not cover all the time.

Fuel emission particles of acidic carbon may include heavy metal and/or PAH contaminants. These particles cause inflammation within the lungs and beyond lasting several days (maximum effects on the heart arising second day) plus heart attacks, strokes, cancers years later from the any metals or PAHs . Analysis of PM2.5s in Derbyshire discovered high cadmium levels plus substantial levels of arsenic and mercury from a brown field site, mixed in with coal dust. PAHs (polycyclic aromatic hydrocarbons) emitted in the vehicle exhaust fumes are carcinogenic**, and cause mutation of a gene leading to asthma.(Perera). Just 8.5 ug/m3 of PM2.5s lead to a drop of 60ml in peak flow.** Even healthy human volunteers revealed significant increases in white cells, histamine etc, in the lungs just 6 hours after inhaling road diesel exhaust, with increased white cells and platelets in the peripheral blood .A rise of just 14.3ug/m3 of PM2.5s for 3 hours has been proved to increase heart attacks (p=0006). The fuel used by heavy equipment in the UK is normally industrial diesel, which is toxic. A single earth-moving machine could release as many as 145 million billion ultra fine particles per minute, equivalent to some 900,000 Volvo V70 petrol cars.

An American study involving x-rays annually for twenty years, showed 55% of opencast workers had developed lung damage, proven by x-ray by year twenty. In USA, train drivers have been paid compensation for asthma or COPD caused by inhalation of emissions from diesel fuels. The USEPA brought in laws to improve this off-road diesel quality including reducing sulphur content by 99%.

In the Dolk Report in the Lancet 1998, the graph confirmed a concentric critical distance of 3 miles radius around waste sites for a rise in birth defects. In Wales in February 2008 the Minerals Planning Policy Draft Minerals Technical Advice No. 2:Coal was published for consultation with responses closing 23 May 2008. They insist on a health impact assessment (done by Cardiff University for Kenfig Hill proposal which led to refusal) and a 350m buffer zone (now 500m). But a true buffer zone to protect public health should really be 4.8km (3 miles). In NSW (Australia) 2010 a study revealed illness rates at 2 miles from an opencast coalmine were double rates at 3 miles.

All my medical evidence concerns PM2.5 particles and below. These are man-made, and are the ones that enter the lung. PM10 printouts in the UK cannot be relied upon. The DETR has admitted that the figures are massaged down and are hence not accurate or reliable. The same applies to the few PM2.5 TEOM machines. This is confirmed by the Environment Agency who also has admitted that their data is not always "accurate, complete, up-to-date or valid." The highest PM 2.5 figures in the UK have been not from the highways, but from sites such as the opencasting of brownfield land in Brighton and of shifting a burning coal tip in Standish and around the Castle Cement plant at Clitheroe (recordings of up to 250ug/M3 were found in a hospital and 600ug/m3 of PM2.5s downwind outside in the open).

Experience gained at Arkwright proves that the alleged ability to control dust by opencasters is a complete fallacy. I was present when the television filmed the emissions at Arkwright with separate clouds of coal-dust and vehicle emissions. PM2.5s and PM1s rise, and can stay suspended in the air for up to one week, totally dependent on the weather as to where and when they ground. Maximum grounding takes place at l l pm and 4am, confirmed by monitoring.

PM2.5 measurements in the latter half of September 1998 have revealed higher levels at Grassmoor and Hasland, Derbyshire some 2.1 miles from Arkwright opencast than at Tupton and Wingerworth at about 3.1 miles from Arkwright. Levels at Grassmoor were as high as 42.5ug/m3. Peaks of PM2.5s in Oct. 1998 reached 80ug/M3 in the Hasland area and 150ug/m3 in 2000. This confirms the cause of the higher asthma incidence at Grassmoor and one could now expect those exposed to that sort of level, to have their lives shortened by several years. Interestingly those in Arundel live some six years longer. Analysis of the filter heads confirmed that coal dust was the main ingredient.

The NHS is paying the bill. With cost limited frozen budgets now affecting both hospitals and PCTs, which patients will be denied treatment to pay for those made ill or who die, through opencasting? Costs of illness & death in Virginia USA by Hendryx 2008 revealed the scale of health damage, confirmed in a report by Epstein et al. in 2011 (Ann.N.Y.Acad, Sci.1219. pp73-98).

The Douglasdale (Scotland) 2009 Coal Health Study proved COPD incidence had risen 60% between 2004-2008 while other areas had no rise. A 2003 profile revealed 52% rise in disability living allowance claimants compared with

a clear area, 27% rise in those too ill to work cf. Scottish average, 19% rise in low birthweight babies and a 23% rise in cancer. In the Hunter Valley, NSW (Australia) death rates by 2009 were 37% higher than the Australian average. I lectured there in Dec 2009 and found opencast mines, 2 coal-fired power stations and 1 power station/incinerator. Lung tests on 700 children revealed lung damage in 20%. Heart attack rates at A&E and inpatient hospital levels were very high. Horses at one stud were infected with retroviruses as the T-lymphocytes of the immune system handle the inhaled PM2.5/PM1s leaving the immune system unable to cope with infections.

What knowledge of medicine and toxicology has a Mineral Planning Authority got? What training has an environmental services department in medicine and toxicology? What postgraduate tuition in toxicology have public health directors received and from whom? COMEAP have conflicts of interest while their references are dated. Dr. Pless-Mulloli admitted 1997 at CwmBran that her Newcastle report was "all fraud" and "political" and proves nothing due to a fraudulent protocol and methodology. There was no before-during-after data. There were no peak flow measurements. Ages 1 to 11 were supposed to fill in forms. Figures were “adjusted” and “cleaned” and discarded to suit. The controls were chosen with equally bad pollution. GPs were not involved. In one area GP data revealed 28 children were asthmatic but the report stated none. A PM10 reading of MINUS 4.9ug/m3 was rewritten as PLUS 0.5ug/m3 etc. There was allegedly no coal or diesel in PM10 particulates collected though Dr. Tim Jones did find these in Welsh opencast emissions . Article 8 of the Human Rights Convention should be used in the courts to force disclosure of relevant health authority data, in consideration of public health risks of imposition by government agencies. Article 16 states that use of one's rights (to opencast etc) must never ruin somebody else's rights. Article 2 provides for right to life. The WHO 1997 report insists on mapping out health data to form public health policy, which only I have done in the UK in this opencasting of coal issue.

References and data were obtained from Dr D Williams, Mr P Ordidge, Royal Microscopical Society Conference July 1998, Epidemiology July 1995, West Glamorgan HA, Lanarkshire HA, Ken Coates MEP, English Partnerships (and CPL data), USEPA Research & Harvard School of Public Health, Respiratory Morbidity in Merseyside School Children exposed to coal dust and air pollution, in Archives of Disease in Childhood 1994;70:305-312 & Doctor Salvi et al AM J RESPIR CRIT CARE MED 1999; 159: 702-709. Also Proc R Coll Physicians Edinb 1999; 29;1115- "Health Effects of Respirable Dust from Opencast Coal Mining" by Doctors Munro and Crompton. This article backs up my research. What Car magazine of June 1999 contains an article analysing vehicle particle emissions from PM0.01 to PM 1. The PM 0.01 to PM0.1 particles tend to rise up into the atmosphere causing dimming. I append 360 references.

Form 40 (version 1)
UCPR 35.1

AFFIDAVIT OF MATTHEW PETERS AFFIRMED 28 MARCH 2011

COURT DETAILS

Court	Land and Environment Court
Division	Class 1
Registry	Sydney
Case number	10090 of 2011

TITLE OF PROCEEDINGS

Applicant	**Ironstone Community Action Group Inc**
First respondent	**NSW Minister for Planning**
Second respondent	**Duralie Coal Pty Ltd**

FILING DETAILS

Filed for	**Ironstone Community Action Group Inc,** Applicant
Legal representative	Kirsty Ruddock, Environmental Defender's Office (NSW)
Legal representative reference	1115836
Contact name and telephone	Elaine Johnson (02) 9262 6989

AFFIDAVIT

Name	Professor Matthew Peters
Address	C22 – Concord Hospital, The University of Sydney NSW 2006
Occupation	Clinical Associate Professor Concord Clinical School The University of Sydney
Date	28th March 2011

I affirm:

1 I am a Clinical Associate Professor at Concord Clinical School at Concord Hospital, at The University of Sydney.

2 I have been asked by the Applicant to describe, with reference to Particulate Matter $(PM)_{10}$ and $PM_{2.6}$, the following: the emissions the Project Application 08_0203 (**the Project**) will generate, the relationship between an increase in the concentration of atmospheric $PM_{2.5}$ and the impacts on human health, the relationship between an increase in the concentration of atmospheric PM_{10} and the impacts on human health, and finally what is the likely impact of the Project on the health and well being of the communities surrounding the Project, the Hunter Valley, and the Greater Sydney Metropolitan Region, and the demand for amenities or services in this area.

3 In response to that request I have prepared the report which is annexed to this affidavit and marked **"MP1"**.

4 The views expressed in that report are my own and correctly state my opinion in relation to the matters set out in the report. I believe no further qualifications are required as to the opinions set out in the report other than those expressed in the report.

5 A copy of my curriculum vitae is attached to my report. My curriculum vitae accurately summarises my scientific qualifications and experience, including my expertise in the area of respiratory health.

6 I have been provided with a copy of Division 2 of Part 31 of the Uniform Civil Procedure Rules 2005 and the Expert Witness Code of Conduct in Schedule 7 of the Uniform Civil Procedure Rules 2005. I have read the expert witness code of conduct and agree to be bound by it. I believe that my report complies with the code.

7. I have been engaged as an expert in these proceedings by the Applicant on the basis that the Applicant is currently fundraising for these proceedings and should

the funds be raised, I may be paid my normal fee in full or part, depending on the amount raised.

8. I believe that the information set out in this affidavit is true and correct to my own knowledge.

AFFIRMED at Canberra

Signature of deponent

Signature of witness

Name of witness Clayton Prater

Address of witness 28/8 Norman St East Sydney 2010

Capacity of witness Justice of the peace / ~~Solicitor~~ #150264

Note: The deponent and witness must sign each page of the affidavit. See UCPR 35.7B.

This and the following 27 pages is the Annexure marked "MP1" referred to in the Affidavit of Matthew Peters, affirmed this 28th day of March 2011, before me:

Clayton Frasers

PROFESSOR MATTHEW J. PETERS
M.D. FRACP
CONSULTANT THORACIC PHYSICIAN

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March 15, 2011

TO THE NSW LAND AND ENVIRONMENT COURT

Re: Potential for Adverse Health Issues associated with Proposed Hunter Valley Coal Mine Expansion

I am a Respiratory Physician by training and have a particular expertise and interest in Public Health. I have been asked to prepare this report at short notice because an expert previously briefed was unable through circumstances out of his control to prepare a report in time. As a result, there is some lack of detail in areas of the report but it does represent an accurate overview of the issues raised.

I approach this review as an expert in Respiratory and General Medicine Medicine rather than in Epidemiology or environmental toxicology. This report is furnished in accordance with the Code of Practice for expert witnesses that I have read.

What is PM2.5 and what are the general concerns?

The disposition of any inhaled particle depends on its size. Particles that are very large are trapped in the upper airway and never reach the lung. Very small particles behave essentially as a gas – they remain suspended in air and are inhaled and then exhaled without ever being in contact with lung or airway surface. The convention is that they cause no harm. Between these sizes are particles that are small enough to make passage through the upper airway into the lungs but large enough to impact on smaller airways or to settle in the alveoli of the lungs. The critical size below which an effect will be seen is likely to be between 4 and 10μm.

Historically, the greatest interest and concern has been with PM10 particles with a median aerodynamic diameter less than 10 μm. This has been relatively easy to measure and health harms have been documented. However particles near to or larger than 10μm are not likely to be respirable and studies that have determined effects of PM10 may have been measuring an effect of smaller particles. Most current concern is with PM2.5 - particles with a median aerodynamic diameter less than 2.5μm. These penetrate further into the lung and given that the alveolar surface is similar to the size of a tennis court allow both for local effects and for absorption of substances into the circulation and from there systemic effects.

An inert particle of that size might do little harm but particles a derived from carbonaceous sources are likely to contain a variety of toxic hydrocarbons and in the course of their passage from source to the person inhaling them, they may have absorbed aldehydes, aromatic hydrocarbons or other chemical compounds that might have been generated within the particle when exposed to oxygen and sunlight. There is clear evidence across a number of health concerns that elemental carbon is a particularly toxic component of PM2.5.

Separate form the effects of the components of the particle, respirable particles in the PM2.5-PM10 range can act as vehicles for allergens. That is, an allergen may itself be too small to be inhaled but by becoming adsorbed to the surface of a larger particle it is effectively delivered on a plate to the lung.

What is likely to be generated by the expansion of the coal-mine activity?

At least the following activities will generate PM2.5 and PM10 dust.

1. Removal of the overburden preparatory to open cut mining
2. Mining activity including harvesting and transfer of mined coal
3. Diesel engines on trucks, rail engines, generators used to mine or move coal
4. Temporary storage of waste or low-quality mined material
5. The construction of permanent or temporary roads or access
6. The traffic of vehicles on permanent or temporary roads or access tracks that are substantially or in large part
7. Off-site. Local or nearby coal-fired power generation used to service the power needs of the mine

Coal is a complex organic product. The mined material will not only include carbon but there will be complex organic compounds the nature and extent of which I am not expert to comment on. These will have an effect on total risk.

Geography of the Greater Sydney Basin as it relates to cola-mine development in the Hunter Valley

It is possible that this is covered in other reports you may have received but a brief point is worth making. Convectional flows of pollutants that are generated in the Sydney basin, or that enter its airflow, are such that pollution tends to settle or persist in Southwestern Sydney. A factor in this is the usual sea-breeze and then overnight air cooling especially in summer. Demographically, this is an area where there are more young people now and this is likely to remain so or increase.

Describe the relationship between an increase in the concentration of atmospheric PM2.5 and impacts to human health.

There are no known health benefits from this exposure

Because of the constraints of time, I will concentrate on PM2.5. My own opinion is that the evidence is becoming ever stronger that this is where the greatest risk lies. This is both because the number of known ill consequences of PM2.5 exposure is increasing and in many cases, a better understanding of the exposure-harm relationship has led to upgrade of risk estimates. This has been recently reviewed. [1]

The following can be reasonably concluded as proven health risks of exposure to high PM2.5 levels.

Increase in total mortality

Authoritative reviews from the US and Europe[2,3,4] indicate that population mortality is increased substantially even with modest increases in PM of 10μg/m^3

Follow-up of the large American Cancer Society study in 2002 showed that there was a relationship between PM2.5 and elevated risks for cardiopulmonary and lung cancer deaths. When long-term average PM2.5 increased by 10μg/m^3, there was a 4% increased risk of death from natural causes, 6% increased risk of death from cardiopulmonary disease, and an 8% increased risk of death from lung cancer[5]. As these are common causes of death in the community, the numerical impact of these increases is important.

COPD

Globally, indoor and outdoor air pollution match smoking as risk factors for Chronic Obstructive Pulmonary Disease(COPD). This is biased by solid fuel burning in India, China and other parts of Asia. The dominant cause of COPD in Australia is tobacco smoking not airborne pollution but atmospheric pollution does correlate with exacerbations of COPD and respiratory mortality is a component of the increased death rate seen in the large mortality studies.

Lung Cancer

As with COPD, the dominant cause of lung cancer in Australia is smoking rather than pollution. However, within the incremental mortality estimates referred to above, there is a substantial component of lung cancer deaths and the ACS study supports that risk.

Asthma

For each increase in PM2.5 of 20μg/m^3, that represented the interquartile range, there was an approximate 6% increase in the risk of hospital admission with asthma in Hong Kong.[6] This peaked with a lag of about 4 days, adding to plausibility. Elemental carbon levels have been shown to correlate with risk of several respiratory symptoms in asthmatic children 21.[7] More generally, PM2.5 elemental carbon levels are associated with cough during the cold and flu season among children 2 years or younger.[8]

Cardiovascular events

As previously described, cardiac deaths are increased with higher PM2.5. There is expert consensus that particulate pollution increases cardiovascular events [9]and there is evidence also that this effect is more marked in patients with diabetes. Diabetes, an important cardiovascular risk factor is also increased with PM2.5 levels [10] and is increasing generally in the community such that there will be progressively more in the community at risk of pollution-related cardiac events.

Harms associated with prenatal exposure

Exposures of pregnant women, particularly in the third trimester of pregnancy, to higher levels of certain PM2.5 chemical constituents are associated with lower birth weight. Amongst the constituents of particles that are specifically associated with harm is elemental carbon – as would naturally be increased from coal-mine particles[11].

In your opinion, what is the likely impact of the Project on the health and well-being of the communities surrounding the Project, the Hunter Valley, and the Greater Sydney Metropolitan Region, and the demand for public amenities or services in the area?

Based on reading of the majority of reasonable studies and in the reviews that have consolidated data from smaller studies, there are inevitable health harms from increasing atmospheric pollution with PM2.5. There remain genuine uncertainties about the linearity of risk. Even if the additional mining and associated activity only increased PM2.5 by a certain percentage, there is no certainty at all, that the increment in health harm would be limited to the same percentage increase. There is a quite reasonable concern that increases in background PM2.5 or PM10 related to mine expansion would set the community at even greater risks from episodic high exposures such as during bushfires[12] or during adverse climatic or environmental conditions.

Summary

There is strong evidence for a range of adverse health effects from exposure to particulate air pollution within the range experienced by many communities. These effects may be exacerbated for social and demographic reasons in communities that will experience greater exposures. This together represents a real but clearly avoidable risk to Public Health.

Yours sincerely,

Matthew Peters MD FRACP

References

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Our Ref: KR:EJ:1115836
Your Ref:

25 March 2011

Clinical Associate Professor Matthew Peters
Medicine, Concord Clinical School
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By email: Matthew.Peters@sswahs.nsw.gov.au

Dear Matthew

Ironstone Community Action Group Inc v Minister for Planning and Duralie Coal Pty Ltd
Land and Environment Court Proceedings No. 10090 of 2011

We act for Ironstone Community Action Group (**ICAG**) in relation to the above Land and Environment Court proceedings. ICAG is a community-based association seeking to protect the local community and environment in the Barrington Tops area.

On 7 February 2011, ICAG commenced Class 1 proceedings challenging the approval by the NSW Minister for Planning of the Duralie Coal Extension Project (**Project**) under Part 3A of the *Environmental Planning and Assessment Act 1979* (NSW) (**EPA Act**).

Our client wishes to retain your services to act as an expert witness to assist the Court impartially on matters relevant to your area of expertise. In this respect, we draw your attention to Division 2, Part 31 of the *Uniform Civil Procedure Rules 2005* (**UCP Rules**) and the Expert Witness Code of Conduct (**Code of Conduct**) (**enclosed**), which govern the use of expert evidence in the Land and Environment Court.

Clause 2 of the Code of Conduct states that:

1. An expert witness has an overriding duty to assist the court impartially on matters relevant to the expert witness's area of expertise.

2. An expert witness's paramount duty is to the court and not to any party to the proceedings (including the person retaining the expert witness).

3. An expert witness is not an advocate for a party.

25/3/11

Background

The Project is an extension of the existing Duralie Coal Mine, in the Gloucester Valley near Stroud. The proponent is Duralie Coal Pty Ltd (**DCPL**), which is a wholly owned subsidiary of Gloucester Coal Pty Ltd. DCPL lodged Major Project Application No. 08_0203 with the Department of Planning, dated 13 October 2008 (**Project Application**). The Project was approved by the NSW Minister for Planning on 26 November 2010.

On 5 November 2009, the Director-General of the Department of Planning (**Director-General**) issued modified environmental assessment requirements for the Project under s 75F of the EPA Act.

In accordance with s 75H of the EPA Act, an Environmental Assessment (**EA**) dated 27 January 2010 was prepared on behalf of DCPL by Resource Strategies Pty Ltd. The EA details the Project, describes the environment within and surrounding the Project site, presents the mitigation measures DCPL intends to incorporate in the operation of the Project, and assesses potential impacts that the operation of the Project will have on the local environment.

In November 2010, the Director-General issued an Environmental Assessment Report under s 75I of the EPA Act.

On 26 November 2010, the Minister for Planning (**Minister**) determined to approve the Project under s75J of the EPA Act, subject to conditions of consent (**Project Approval**).

Objects of the EPA Act

The objects of the EPA Act are set out in s5 of that Act, and include the protection of the environment, encouragement of ecologically sustainable development (**ESD**), and the proper management, development and conservation of resources for the purpose of promoting the social and economic welfare of the community and a better environment.

Ecologically Sustainable Development

We would argue that the Court must consider public interest as a mandatory relevant consideration when making its determination under Part 3A of the EPA Act. ESD is an element of the public interest and includes the following principles:

- the precautionary principle;
- intergenerational equity; and
- the conservation of biological diversity and ecological integrity.

Great Lakes LEP

We would also argue that the Court must consider the aims and objectives of the Great Lakes Local Environmental Plan (**LEP**), and the objective of Zone 1(a) (Rural Zone) in the Great Lakes LEP. The aims and objectives of the Great Lakes LEP relevantly provide as follows:

2 What are the aims and objectives of this plan?

(1) The aims of this plan are:
(a) ...
(b) to protect and enhance the environmental qualities of the area, and
(c) ...
(d) to promote the well-being of the area's population.

The objective of Zone 1(a) (Rural Zone) relevantly provides as follows:

Zone No 1(a) (Rural Zone)

The objective of the zone is to restrict development to those uses which are unlikely to:

(a) ...
(b) ...
(c) ...
(d) create unreasonable or uneconomic demands for the provision or extension of public amenities or services

The proceedings

The Class 1 Application filed on 7 February 2011 in relation to the Project Approval seeks orders from the Court to the effect that the Project Application should be refused.

A copy of ICAG's Statement of Facts and Contentions is **attached**. In summary, ICAG submits that the Project Application should be refused based on the impacts the Project will likely have on:

1. Biodiversity;
2. Threatened species;
3. Water quality; and
4. Air quality.

The work we require

We request that you undertake the following work:

1. Review Division 2, Part 31 of the UCP Rules and the Code of Conduct.

2. Review the following documents:

   General Project Documents
   Section 4 - Environmental Assessment (pages 4-39 to 4-44)
   Appendix D - Air Quality Assessment

   Other Relevant Documents
   Australian Government (2008) National Pollutant Inventory "*Emission estimation technique manual for Railway yard operations*" Version 2.0 (**enclosed**)

   Australian Government (2008) National Pollutant Inventory "*Emission estimation technique manual for Explosives detonation and firing ranges*" Version 2.0 (**enclosed**)

Australian government (2008). National Pollutant Inventory "*Emission estimation technique manual for Combustion engines*" Version 3.0 (**enclosed**)

3. Drawing on your experience and the documents briefed to you, prepare an expert report (refer below to 'The requirements for your work').

4. Attend a conference with your instructing solicitors and barristers. We will advise you of the date and time of this conference shortly.

5. Review the expert report(s) prepared by the expert(s) engaged by the Minister and DCPL.

6. Confer with the other parties' experts at a joint conference and produce a joint expert report which sets out the matters agreed on, the matters where agreement cannot be reached, and the reasons for agreement and disagreement as a result of the joint conference(s).

7. Appear at one or more days of the hearing as required. The hearing is listed for 5 days commencing on Monday, 9 May 2011. We will notify you of the day(s) that you will be required to attend.

The requirements for your work

As stated above, an expert witness has an overriding duty to the Court and not to any party to the proceedings. In undertaking your work, you must comply with Division 2 of Part 31 of the UCP Rules and the Code of Conduct.

Your report must contain an acknowledgment that you have read the Code of Conduct and that you agree to be bound by it, as required by Rule 31.23(3) of the Rules and clause 2 of the Code. Otherwise your report will be inadmissible as evidence.

We ask that you draft your report addressing the following issues:

Air quality and human health

1. Using the documents above, and with reference to Particulate Matter $(PM)_{10}$ and $PM_{2.5}$, describe the emissions the Project will generate.

2. Describe the relationship between an increase in the concentration of atmospheric $PM_{2.5}$ and impacts to human health.

3. Describe the relationship between an increase in the concentration of atmospheric PM_{10} and impacts to human health.

4. In your opinion, and taking into account your response to the questions above, what is the likely impact of the Project on the health and well-being of the communities surrounding the Project, the Hunter Valley, and the Greater Sydney Metropolitan Region, and the demand for public amenities or services in the area?

Format of your report

Division 2, Part 31 of the UCPR Rules sets out information that your report must contain, such as:

- your qualifications,
- the facts, and assumptions of fact, on which the opinions in the report are based and your reasons for each opinion expressed,
- if a particular issue falls outside your area of expertise, clear acknowledgement that it falls outside your field of expertise,
- any literature or other materials utilised in support of the opinions,
- details of any examinations, tests or other investigations on which you have relied, including details of the qualifications of the person who carried them out,
- a brief summary of the report,
- if you believe that the report may be incomplete or inaccurate without some qualification, the qualification must be stated in the report,
- if you consider that your opinion is not a concluded opinion because of insufficient research or insufficient data or for any other reason, this must be stated when the opinion is expressed, and
- if you change your opinion on a material matter after providing an expert's report to us, you must provide us with a supplementary report to that effect.

Please format your report as follows:

- address your report to the Court,
- Sign and date your report,
- Include a summary of your qualifications and experience as an appendix to your report,
- Use 12 point type and at least 2cm page margins,
- Supply a PDF version of your report for printing and binding,
- Number each paragraph of your report,
- Number <u>all</u> pages, including attachments and annexes, continuously from the first page to the last page (excluding any cover page to your report), and
- Annex this letter of instruction to your report.

Timing

The timing for expert evidence in this matter is as follows:

- Please provide us with a draft report by Friday, **25 March 2011**
- Finalised report to be filed with the Court by Friday, **25 March 2011**
- Experts to confer and file a joint report with the Court by Friday, **22 April 2011**
- The matter will be heard by the Court on **9-13 May 2011**

Fees

As discussed, the client is currently fundraising for these proceedings and we are not currently in a position to advise as to what funds are available for payment of fees. We will keep you updated on the client's position in relation to its ability to pay you fees in this matter.

We are grateful for your assistance in this matter.

Yours sincerely
Environmental Defender's Office (NSW) Ltd

Elaine Johnson
Solicitor

Chris Ball
Scientific Officer

Encl.

CURRICULUM VITAE

Matthew John PETERS

PERSONAL DETAILS

Date of Birth:	15th January, 1959.	
Nationality:	Australian	
Marital Status	Married	
Children	Emma	25
	Courtenay	24
	Dominic	22
	Madeleine	15
	Sophie	14

Residential Address

38A Mary St
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NSW 2110

Professional Address

Department of Thoracic Medicine
Concord Repatriation General Hospital
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Concord NSW 2139

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EDUCATIONAL QUALIFICATIONS

High Schooling:	St Joseph's College, Hunters Hill Marist Brothers High School, Eastwood Dux of School 1976.
M.B. B.S.	Sydney University 1982.
M.D.	Sydney University 1991.
Thesis	**The Role of Formylpeptides in the Pathophysiology of Acute Exacerbations of Chronic Airflow Limitation**

Research Performed -1987-1990.

Supervisors: Professor N Berend & Dr A B X Breslin.

Medical Registration:

NSW Medical Board - Effective 3 March 1982

Post-Graduate Qualifications:

Fellow of Royal Australasian College of Physicians -1988.

Awards and Fellowships Received

Thoracic Society of Australia and New Zealand 'Young Investigator Award' - 1990.

Asthma Foundation of New South Wales Travelling Fellowship -1990.

Thoracic Society of Australia and New Zealand/Allen and Hanburys Respiratory Research Fellowship - 1991-1993.

POST-GRADUATE MEDICAL TRAINING

1982	Intern	CONCORD HOSPITAL
1983	Junior RMO	CONCORD HOSPITAL
1984	Registrar Geriatric Medicine	CONCORD HOSPITAL
1985	Basic Physician Trainee Passed RACP(Pt 1) written and clinical examinations	CONCORD HOSPITAL
1986	Registrar Thoracic Medicine Dr G E Marlin Dr C R Jenkins Dr J Rutland	CONCORD HOSPITAL
1987	Registrar Thoracic Medicine Dr A B X Breslin Dr M Dally	CONCORD HOSPITAL
1988	Registrar Intensive Care Medicine(6/12) Dr P J Lawrence Dr G Thanakrishnan	CONCORD HOSPITAL
	Registrar Thoracic Medicine Dr A B X Breslin Dr M Dally	

1989/90 Clinical Superintendent (Medicine) CONCORD HOSPITAL

Responsibilities Administration
Physician Training Program
Relief Consultant Physican in General Medicine

1991-3 Royal Brompton National Heart and Lung Hospital and
National Heart and Lung Institute London, UK

My Prinicipal activities in this time were Clinical and Laboratory Research. In addition to this I ran, independently, an Asthma-biased General Thoracic Medicine Clinic. I was an independent bronchoscopist – Generally for Research procedures but the occasional non-research bronchoscopy as well.

1993-present Senior Staff Specialist and Head of Department
Department of Thoracic Medicine
Concord Repatriation General Hospital

Clinical Associate Professor
Concord Clinical School
University of Sydney

2010-present Professor of Respiratory Medicine
Australian School of Advanced Medicine
Macquarie University

COMMITTEE POSITIONS AND APPOINTMENTS

At Concord Hospital

Drug Committee	1994-1997
Medical QA Committee	1994-2000
Secretary, Division of Medicine	1995-1998
Director Physician Training	1996-2000
Chairman Medical Staff Council	2000-2002

Sydney University

Tutor, Lecturer, Examiner	1986-2008
Assessment Co-Ordinator - Respiratory Block	1997-2000
Chair Respiratory Block	1998-2000

Royal Australasian College of Physicians

Therapeutics Advisory Committee	1995-1996

Service to Professional Bodies

Thoracic Society of Australia and New Zealand

Member	Clinical Care and Resources Subcommittee	1995-1999
Secretary	NSW Branch	1994-1998
President	NSW Branch	1998-2000
Hon Secretary	Federal Body	2000-2004

Australian Lung Foundation

Board Member	2004-2010

Other Advocacy Roles

Member - Smoke-Free Olympics Task Force

Member - Tobacco Control Coalition

Current External Positions

Chairman - Action on Smoking and Health

Chairman - Global Lung Cancer Coalition

Board Member - Australian Lung Foundation

Chairman - Cancer Institute NSW Oncology Group (Lung)

Post-Graduate Research Students

Students who have Successfully Completed Post-Graduate Studies

Dr He Wang Ph D Degree awarded 1998

'Cellular Mechanisms in Silica-Induced Lung Inflammation and Neoplasia'

Ms K L Reid M Sc(Med) Degree awarded 1999

'The Role of Swallowing Dysfunction in Acute Exacerbations of Chronic Airflow Limitation'

Ms J Maclean M Sc (Med) Degree Awarded 1999

'Chronic Airflow Limitation and Dysphagia: A Clinical Picture of Dysphagia During an Acute Exacerbation'

Dr L Morgan Ph D Degree awarded 2005

Measurement of Mucociliary Clearance in vivo in Man

Dr Tommy Chung Ph D Degree awarded 2008

Reversible myocardial dysfunction

Ms N Clayton M Sc Degree awarded 2008

The effect of COPD on laryngopharyngeal sensitivity ans swallow function

Dr Paul T Kelly PhD- University of Otago – awarded 2010

Co-supervised students whose Studies are in Progress

1. Claude Farah (PhD)
2. Regina Leung (M Sc)
3. Leigh Seccombe (PhD)

Clincial Trials Experience

1995-present
Including Phase 2 through phase 4 studies

Therapy areas

Respiratory infections
Asthma
COPD
Lung Cancer
DVT prophylaxis
Smoking Cessation

GCP training

Last conducted in July 2009. GCP training has been a part of all clinical trials conducted.

Date safety Monitoring Committees

2008.

Baxter BioScience

ARALAST Fr. IV-1 BAL Study

Protocol 460502 - A safety/BAL study examining alpha-1 anti-trypsin replacement in patients with alpha-1 antitrypsin deficiency

2009.

CSL (Limited)

Protocol covered by confidentiality agreements.

PEER-REVIEWED PUBLICATIONS

1. Berend N; Peters MJ; Armour CL; Black JL; Ward HE. Effect of inhaled formyl methionyl leucyl phenylalanine on airway function. Thorax. 1988 Jan; 43(1): 36-40

2. Peters MJ; Breslin AB; Berend N The effect of anticholinergic and beta agonist pretreatment on bronchoconstriction induced by N formyl methionyl leucyl phenylalanine.Eur Respir J. 1989 Nov; 2(10): 946-9

3. Peters MJ; Jones MG; Moulton J; Breslin AB Sarcoidosis presenting as recurrent alcohol induced pancreatitis. Med J Aust. 1990 Jul 16; 153(2): 104-5

4. Peters MJ; Panaretto K; Kemsley L; Breslin AB; Berend N Effect of neutral endopeptidase inhibition on f Met Leu Phe induced bronchoconstriction in the rabbit. J Appl Physiol. 1991 Feb; 70(2): 877-81

5. Peters MJ; Panaretto K; Breslin AB; Berend N Effects of prolonged inhalation of N formyl methionyl leucyl phenylalanine in rabbits. J Appl Physiol. 1991 Jun; 70(6): 2448-54.

6. Peters MJ; Breslin AB; Kemp AS; Chu J; Berend N Haematological effects of inhalation of N formyl methionyl leucyl phenylalanine in man. Thorax. 1992 Apr; 47(4): 284-288.

7. Peters MJ; Breslin AB; Berend N Effects of inhalation of N formyl methionyl leucyl phenylalanine in the well elderly and in patients with chronic bronchitis Thorax. 1992 Apr; 47(4): 279-83

8. Belvisi M G, Miura M, Peters M J, Ward J K, Tadjikarimi S, Yacoub M H et al. Effect of isoenzyme-selective cyclic nucleotide phosphodiesterase inhibitors on human tracheal smooth muscle tone. Br J Pharmacol 1992; 107: 53P.

9. Adcock IM; Peters M; Gelder C; Shirasaki H; Brown CR; Barnes PJ Increased tachykinin receptor gene expression in asthmatic lung and its modulation by steroids. J Mol Endocrinol. 1993 Aug; 11(1): 1-7

10. Adcock IM; Peters MJ; Brown CR; Gelder CM; Barnes PJ Transcription factor interactions in human lung. Biochem Soc Trans. 1993 Aug; 21 (Pt 3)(3): 277S

11. Adcock IM; Shirasaki H; Gelder CM; Peters MJ; Brown CR; Barnes PJ The effects of glucocorticoids on phorbol ester and cytokine stimulated transcription factor activation in human lung. Life Sci. 1994; 55(14): 1147-53

12. Adcock IM; Brown CR; Gelder CM; Shirasaki H; Peters MJ; Barnes PJ Effects of glucocorticoids on transcription factor activation in human peripheral blood mononuclear cells. Am J Physiol. 1995 Feb; 268(2 Pt 1): C331-8

13. Adcock IM; Lane SJ; Brown CR; Peters MJ; Lee TH; Barnes PJ. Differences in binding of glucocorticoid receptor to DNA in steroid resistant asthma. J Immunol. 1995 Apr 1; 154(7): 3500-5

14. Adcock IM; Peters MJ; Brown CR; Stevens DA; Barnes PJ. High concentrations of beta-adrenergic agonists inhibit DNA binding of glucocorticoids in human lung in vitro. Biochem-Soc-Trans. 1995 May; 23(2): 217S

15. Peters MJ, AdcockIM, Brown CR, Barnes-PJ. Beta-adrenoceptor agonists interfere with glucocorticoid receptor DNA binding in rat lung. Eur-J-Pharmacol. 1995 Apr 28; 289(2): 275-81

16. Yates DH, Peters MJ, Keatings V, Thomas PS, Barnes PJ. Reduced dose salbutamol in comparison with standard dosage for symptom relief in asthma. Eur Respir J 1995 Nov; 8(11): 1847-51.

17. Wang H, Leigh J, Bonin A Peters MJ. Silica induced morphological changes similar to apoptosis in bronchoalveolar lavage cells and granulomatous cells. Ann Occup Hyg 1997, 41(Suppl 1).

18. Wang H, Leigh J, Bonin A Peters MJ. Silica induced micronuclei in pulmonary macophages *in vitro*. Ann Occup Hyg 1997, 41(Suppl 1).

19. Leigh J, Wang H, Bonin A, Peters M, Ruan X Silica-induced Apoptosis in Alveolar and Granulomatous Cells in Vivo. Environ Health Perspect 1997 Sep;105S(Suppl 5):1241-5

20. Storey GR, Morgan L, Peters MJ, Kennedy PJ, Van der Wall H, Allman KC. Bone scintigraphy in an uncommon presentation of metastatic lung carcinoma. *Clin Nucl Med* 1997 (10):719-720

21. Leigh J , Wang H, Bonin A, Peters MJ.. In vivo genotoxicity of silica evidenced by progressive development of micronuclei in alveolar macrophages. Excerpta Medica Supp 53. *Adv Prev Occ Resp Dis* 1998(Suppl 53) 520-525.

22. Leigh J , Wang H, Bonin A, Peters MJ, Ruan X. Time course of neutrophil apoptosis in silica-induced chronic inflammation Excerpta Medica Supp 53. *Adv Prev Occ Resp Dis* 1998(Suppl 53) 890-895.

23. Morgan L, Pearson MA, Mackey DW, Rutland J, De Iongh RU, Peters MJ, van der Wall H. Accuracy in gamma camera measurements of point source velocities. Nuc Med Comm 2000; 21: 553-556.

24. Morgan LC, Peters HE, Clarke CW, Peters MJ. Lung Cancer in NSW: Current Trends and Influence of Age and Sex. Med J Aust 2000; 172: 578-582.

25. Bruce W, Van der Wall H, Peters M, Liaw Y, Morgan L, Storey G. Occurrence of pulmonary thromboembolism immediately after arthroplasty. Nucl Med Commun. 2001;22(11):1237-42

26. Clarke S, Barnsley L, Peters M, Morgan L, Van der Wall H. Hypertrophic pulmonary osteoarthropathy without clubbing of the digits. Skeletal Radiol. 2001;30(11):652-5

27. Peters M. Tobacco control in Australia: bullseye on the wrong target. Intern Med J. 2002;32(1-2):4-5.

28. Morgan LC, Peters MJ. The pharmacotherapy of smoking cessation. Med J Aust 2002; 176: 486-490.

29. Wang H, Leigh J, Bonin A, Peters M. Apoptosis of pulmonary neutrophils induced by low dose titanium dioxide and silica. Ann.Occ. Hyg.2002; 46 (Suppl 1):210-214.

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33. Morgan LC, de Iongh RU, Mackey F, Pearson M, van der Wall H, Peters MJ, Rutland J. Scintigraphic measurement of tracheal mucus velocity in vivo. Eur Resp J 2004; 23: 518 - 522.

34. Bruce W, Van der Wall H, Peters M, Morgan L, Hian Liaw Y, Storey G. Novel imaging strategy for the detection of fat embolism after arthroplasty. ANZ J Surg. 2004 Sep;74(9):723-6.

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36. Seccombe LM, Peters MJ. Oxygen supplementation for chronic obstructive pulmonary disease patients during air travel. Curr Op Pulm Med 2006, 12: 140-144.

37. Peters M. How to treat: Lung Cancer. Australian Doctor; 23 June 2006; 31-36.

38. Kelly PT, Swanney MP, Frampton C, Seccombe LM, Peters MJ, Beckert L. Normobaric hypoxia inhalation test vs response to airline flight in healthy passengers.. Aviation Space Medicine 2006 Nov;77(11):1143-7.

39. Zwar N, Bell J, Peters M, Christie McD, Mendelsohn C. Nicotine and nicotine replacement therapy– the facts. Aust Pharmacist 2006; 25:969-973.

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41. Kuna P, Peters MJ, Manjra AI, Jorup C, Naya IP, Martinez-Jiminez NE, Buhl R. Effect of budesonide/formoterol maintenance and reliever therapy on asthma exacerbations. Int J Clin Pract 2007; 61:725–736.

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43. Chung T, Emmett L, Mansberg R, Peters M, Kritharides L. Platelet activation in Acute Pulmonary Embolism Journal of Thrombosis and Haemostasis 2007;5:918-24.

44. Chung T, Emmett L, Mansberg R, Peters M, Kritharides L. Natural history of right ventricular dysfunction after acute pulmonary embolism.. J Am Soc Echcoardiography 2007;20:885-94.

45. Kelly PT, Seccombe LM, Rogers PG, Peters MJ. Directly measured cabin pressure conditions during Boeing 747-400 commercial aircraft flights. Respirology 2007; 12: 511-515.

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49. Peters MJ. Budesonide/eformoterol combination therapy as maintenance and reliever treatment in asthma. Medicine Today 2008; 9: 57-60.

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51. Peters MJ. Single-Inhaler Combination Therapy for Maintenance and Relief of Asthma: A New Strategy in Disease Management. Drugs 2009; 69:137-150.

52. Kelly PT, Swanney MP, Seccombe LM, Peters MJ, Beckert L. Predicting the response to air travel in passengers with non-obstructive lung disease: are the current guidelines appropriate? Respirology 2009;14:567-573.

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59. Reddel H, Gibson PG, Peters MJ, Wark PA, Sand IB, Hoyos CM, Jenkins CRJ. Down-titration from high-dose combination therapy in asthma: removal of long-acting β_2-agonist. Resp Med 2010; 104:1110-1120.

60. Seccombe LM, Peters MJ. Patients with lung disease. Fit to Fly?. Australian Family Physician 2010; 39:112-115.

61. Chung S, Seccombe LM, Jenkins CR, Frater C, Ridley R, Peters MJ. Glossopharyngeal insufflation causes lung injury in trained breath-hold divers. Respirology 2010 (Accepted for publication)

62. Leung RWM, Alison JA, McKeough ZJ, Peters MJ. Ground walk training improves functional exercise capacity more than cycle training in people with chronic obstructive pulmonary disease (COPD): a randomised trial. J Physiotherapy 2010; 56: 105-112.

63. Chung SC, Peters MJ, Chen S, Emmett L, Ing AJ. Effect of unilateral endobronchial valve insertion on pulmonary ventilation and perfusion. Respirology 2010; 15: 1072-1078.

64. Leung RWM, Alison JA, McKeough ZJ, Peters MJ. A study design to investigate the effect of short-form Sun-style Tai Chi in improving functional exercise capacity, physical performance, balance and health related quality of life in people with Chronic Obstructive Pulmonary Disease (COPD) Contemporary Clinical Trials 2010 (In press)

65. GUIDELINES

1. Campbell, D., de Campo, M., Elwood, M., Fong, K., Irwig, L., Manser, R., Peters, M., Pedersen, K., St John, J. Lung Cancer Screening By Helical Computed Tomography. VIC: National Cancer Control Initiative, 2003.

2. Zwar N, Richmond R, Borland R, Peters M, Stillman S, Litt J, Bell J, Caldwell B. Smoking cessation pharmacotherapy: an update for health professionals. Melbourne: Royal Australian College of General Practitioners 2007.

3. Clayton JM, Hancock KM, Butow PN, Tattersall MH, Currow DC; Australian and New Zealand Expert Advisory Group, Adler J, Aranda S, Auret K, Boyle F, Britton A, Chye R, Clark K, Davidson P, Davis JM, Girgis A, Graham S, Hardy J, Introna K, Kearsley J, Kerridge I, Kristjanson L, Martin P, McBride A, Meller A, Mitchell G, Moore A, Noble B, Olver I, Parker S, Peters M, Saul P, Stewart C, Swinburne L, Tobin B, Tuckwell K, Yates P. Clinical practice guidelines for communicating prognosis and end-of-life issues with adults in the advanced stages of a life-limiting illness, and their caregivers. Med J Aust. 2007; 186(Suppl):S77, S79, S83-108.

Ammonium Nitrate Blast Fumes

Forward

With the rapid expansion of open-cut coal mining operations, which includes both the doubling in production volume of existing mines and the opening of an even greater number of new open-cut coal mines, the concern over the frequency, volume and cumulative impacts of blast fumes on the health of those affected by mining operations is of increasing concern. Open–cut blasts with "as much as nine hundred thousand kg (two million lb) of explosive may generate reddish-orange product clouds. The color is due to the NO_2 in the cloud (Turcotte, Yang, Lee, Short, and Shomaker, 2002)" (as quoted in *Behavior of Nitrogen Oxides in the Product Gases from Explosive Detonations*, Richard J. Mainiero, James H. Rowland III, Marcia L. Harris, and Michael J. Sapko.)

It must be noted that, according to the publication *Mining Australia*, (September 2011) in an article entitled "*Blast Fume Events: Addressing a Noxious Issue*", it was stated that: "Current World Health Organisation guides lines for NOx are a one hour level of 200µg m3 (approximately 200 parts per billion), and an annual average of 40µg m3. However, typical concentrations of NOx in post blast clouds can measure anywhere between 5.6 to 580 parts per million, exceeding the safe limits by around 30 to 3000 times. This is clearly far too high."

Blast Fume Cloud Composition

Most of the ammonium nitrate blast fume cloud is composed of the following:

- Dust, soil and rock particulate matter that is released by the forces exerted on the surrounding rock during the blasting operations
- Water Vapour
- Carbon Dioxide
- Carbon Monoxide
- Oxides of Nitrogen (NOx)

Properties of the Gases

Oxides of Nitrogen

- The colour can range from a yellowish-orange to reddish-brown.
- The odour could be typically described as a “burnt powder smell”.
- These gases are an irritant to the eyes, nose and throat.
- They are soluble in water.
- They form an acid solution when mixed with water.
- It is important to note that a concentration of 0.07% can be fatal within 30 minutes.

Carbon Monoxide

- This is a colourless gas.
- It is an odourless gas.
- It is a tasteless gas.
- It is hazardous, because it replaces oxygen in the blood, so it is classified as an “asphyxiate”.
- It can only be detected with specialised equipment
- A concentration of 0.4% can result in instant collapse, followed by death.

Constituents of the Gases

Nitrogen Oxides

Oxides of Nitrogen are a combination of nitrogen-based gases, which include the following -

- Nitric Oxide (NO)
- Nitrous Oxide (N_2O)
- Nitrogen Dioxide (NO_2)
- Dinitrogen Trioxide (N_2O3)
- Dinitrogen Tetroxide (N_2O4)
- Dinitrogen Pentoxide (N_2O5)

Nitrogen oxides (NO_X) are a mixture of gases that are composed of nitrogen and oxygen. Two of the most toxic of these gases are nitrogen dioxide and nitric oxide. It should be noted that nitrogen oxides are released into the air from a range of activities, which also includes the blasting of explosives.

Blast Fume Cloud

Properties and Hazards of the Gases

Properties of Nitrogen Dioxide (NO_2)

Nitrogen Dioxide is a reddish-brown gas, which liquefies below 21.1 degrees Celsius. It has an irritating and harsh odour. This is extremely toxic. It does not burn but supports the combustion of carbon, phosphorous and sulphur. It decomposes in water to form nitric oxide and nitric acid, and reacts with alkalies such as sodium hydroxide to form nitrates and nitrites.

Health hazards from Exposure to Nitrogen Oxides: Summary

Low Level exposure can-

- Irritate the eyes, nose, throat and lungs;
- Cause coughing and shortness of breath;
- Cause nosebleeds and headaches;
- Cause tiredness and nausea;
- Cause a build up of fluid in the lungs (which may take 1 -2 days)

Exposure to high concentrations can-

- Swelling of tissues in the throat, and upper respiratory tract;
- Cause rapid burning to exposed body parts (eyes, nose, throat, lungs);
- Reduced oxygenation of body tissues
- Muscle spasms;
- A build up of fluid in the lungs (pulmonary oedema)
- Result in acquired or type II methaemoglobinemia.
- Death

Detailed Notes:

The effects of Nitrogen-Based Gases on the Human Body

Nitrogen Oxide (NO)

- Nitrogen gases including Nitrogen Oxide, are classified as “simple asphyxiates”.
- This means Nitrogen will displace Oxygen and create Oxygen deficiencies (<19.5%), without significant physiological effects, including to the bloodstream and body tissues.
- Breathing is stimulated and controlled by Carbon Dioxide (CO_2), when present in the lungs.
- As the Carbon Dioxide ($CO_{2)}$ level increases, the brain sends a message to increase respiration.
- When the Carbon Dioxide (CO_2) level drops, the rate of respiration will also decrease in order to maintain the proper balance.
- Everyone should understand that one deep breath of 100% Nitrogen Oxides (NOx) can be fatal.
- 100% Nitrogen Oxide exposure can reduce Carbon Dioxide and Oxygen to dangerously low levels and, in the absence of a Carbon Dioxide signal to the brain, the stimulus to breath no longer exists.
- This means that affected individuals are likely to stop breathing altogether.

Nitrogen Dioxide (NO_2)

Nitrogen dioxide is the most hazardous component of NOx emissions, as it is associated with PM 1 particulates. Potential symptoms of overexposure to Nitrogen Dioxide (and Nitric Oxide) include coughing, mucoid frothy sputum, decreased pulmonary function, chronic bronchitis, chest pain, pulmonary oedema, methemoglobinemia, cyanosis and eye, nose and throat irritation. Inflammation of the lungs may cause only slight pain or pass unnoticed, but the resulting oedema several days later may cause death. 100 PPM is dangerous for even a short exposure, and 200 PPM (or more) may be fatal. NO_2 appears to diminish function of t- lymphocytes leaving the recipient more likely to go down with infections. The PM 1 & PM 2.5 particulates also result in these t-lymphocytes being tied up in the lungs with the macrophages leaving the immune system at risk. Hence repeated exposure over a long term pre-disposes individuals to developing chronic and / or terminal auto-immune diseases.

Nitric Oxide (NO)

Properties and health effects of Nitric Oxide (NO) are the same as Nitrogen Oxide exposure. This is because Nitric Oxide, when exposed to air, immediately converts into nitrogen dioxide. Nitric Oxide is colourless in appearance, but turns into reddish-brown Nitrogen Oxide gas, as per the reaction referred to previously.

Nitrous Oxide (N_2O)

Nitrous Oxide is a colourless gas, which has a slightly sweetish odour. This gas supports combustion. It is a very stable and inert gas at room temperature. This gas is also known as “laughing gas”. The health effects are not as severe as Nitrogen Dioxide or Nitric Oxide. Potential symptoms of overexposure to Nitrous Oxide are drowsiness, headache, reproductive effects, and asphyxia.

What is Pulmonary Oedema?

Pulmonary Oedema is a fluid accumulation within the lungs. It leads to impaired gas exchange and may lead to respiratory failure. It is most likely to develop over time and symptoms may include:-

- difficulty in breathing
- coughing up blood
- excessive sweating
- anxiety
- pale skin
- pink frothy sputum

If left untreated it may lead to complications such as Hypoxia (a lack of oxygen in the blood stream, so that body tissues become deprived of oxygen). This is why it is vital that anyone who experiences exposure to a blast fume cloud seeks medical attention, as medical diagnosis is the best way to determine whether or not an individual is at risk of pulmonary oedema.

What is Methaemoglobinemia?

According to PubMed Health, *"Methaemoglobinemia is a blood disorder in which an abnormal amount of haemoglobin builds up in the blood. Haemoglobin is the oxygen-carrying molecule found in red blood cells. In some cases of methaemoglobinemia, the haemoglobin is unable to carry oxygen effectively to body tissues."*

Symptoms such as headache, dizziness, weakness and dyspnoea occur when methaemoglobin concentrations are at 30 – 40%. At levels of approximately 60%, stupor, convulsions, coma and respiratory paralysis occur and the blood turns a chocolate brown colour. Death is likely to result at higher levels of exposure.

Methaemoglobinemia can result from an intense, high level, short-term exposure to oxides of nitrogen – such as those that are released in an incomplete combustion of an open-cut mining overburden blast set-up, whereby post-blast gases create a red fume.

Kim Hann, September 2011

(With special thanks to the world-renowned Industrial Pollution expert Dr Dick van Steenis for the provision of toxicological information on the various components of the Blast Fume.)

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Appendix 13 – Environmental Trust

Draft Leard Forest Environmental Trust Report

Leard Forest Environmental Trust

Submission by: Maules Creek Community Council

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Contents

Overview

The Maules Creek Community Council (MCCC) has had ongoing dialogue with the NSW Department of Planning (DoP), Boggabri Coal and Aston Resources regarding the community's concerns regarding coal mining in the Leard State Forest ("The Forest").

In order to get community support for projects the MCCC has been vocal in calling for a "net benefit" to all the stakeholders in the projects including the environment and the local community.

Negotiations between the mining companies and the Narrabri Shire Council regarding to the Voluntary Planning Agreement (VPA) while beneficial to residents are seen by the community as driven by the Narrabri Shire Council and its strategic plan. The VPA arrangements are explicitly excluded from this proposal.

The Proposed Coal Projects using Open Cut mining methods place significant socio-economic and environmental risks upon the Maules Creek Community.

Environmental public rights and amenity will be removed from the neighbouring community due to the negative and unavoidable consequences from the cumulative impacts of a large scale industrial coal complex.

The proposed Leards Forest Environmental Trust ("the Trust") is designed to offset the cost of environmental impact to The Forest. The Trust will operate in tandem with the Maules Creek Community Fund to help environmental values to be balanced against direct and indirect costs from the projects so as to achieve an overall net benefit. The Maules Creek Community Fund is documented separately.

This document is based on the World Bank "Mining Foundations, Trusts and Funds Sourcebook" 2010 (reference required) which describes leading practice in developing and delivering net benefits to impacted community's from mining developments. The following table identifies the key components of the Fund based on the World Bank model.

Fund Design Category	Type
Programming Approach	Grant Making
Financing Structure	Annual Budget
Geographic Focus	Namoi Valley
Community Participation	Board Membership
Influence of Mining Company	Board Membership
Influence of Government	DoP consent condition

Establishment, Structure and Purpose of the Fund

The fund will be established by Boggabri Coal and Maules Creek Coal as a Discretionary Trust in mutual agreement and as part of the consent conditions for mining activities in The Forest. Other mines seeking new approvals to operate inside The Forest will have DoP consent conditions to contribute to The Trust. Mines outside the The Forest but in the near vicinity (say within 15 kms) will be invited to contribute to The Trust.

The Trust will be governed by a board of trustees that will be made up of;

- Two members from the local area, one of these must be from Maules Creek.
- Two members from the mining companies.
- One representative from local government.
- Two members from well respected Environmental Groups. ACF, Landcare.

The purpose of the fund is to offset the cost of environmental impact to The Forest by developing Renewable Energy (RE) Projects and on ground works.

As identified in the Boggabri Coal EA and in communications with Aston Resources environmental offsets are being developed by the mining companies in the form of purchasing existing habitat, often some distance from the Leard State Forest. These offset lands are already in existence and no new habitat area is being created. Due to mining there is a reduction in habitat. The offset lands already operate as habitat for the current "occupiers" of native fauna and flora. While purchase of offsets some distance away may protect that habitat in perpetuity and enable planning consent, the significant impact to the current fauna and flora occupiers of the Forest is not taken into account.

The impacts to the Forest will be established by a consulting Environmental Economist to determine funding sufficient to provide a Net Benefit for the "environment" as a stakeholder.

The Trust is proposed to provide for impacts to The Forest and its habitat only and is not a means to redress impacts to ground water, health issues, community impacts, loss of recreational use, non use values or any other impact that does not relate to the native vegetation and habitat of The Forest.

The Trust will commence from the time of mining consent. Funding will be apportioned equally over the 21 year lease of the project. Should a mining project extend beyond the 21 year period it is anticipated that the Trust will carry on into the new lease periods.

The Trust will manage its resources so as to be able to carry on its role beyond the life of the mines.

Programs

The Leards Forest Environmental Trust will work in three ways to achieve a net benefit to the environment for native vegetation and habitat impacts.

Firstly, by developing RE Projects to reduce our dependence on fossil fuels.

Secondly, by funding on ground works and training to assist land owners in the Namoi Valley improve existing native habitat on their lands, sequester carbon in the landscape and reduce their environmental footprint.

Thirdly, to co-ordinate with local landowners the management of remnant vegetation outside the offset area based on an incentive program. The goal is to extend the value provided by the mining company offsets.

Programs are delivered via a grants program. The annual grant funding to be split 50% to RE Projects and 50% to "on ground" works in the Namoi Valley.

Renewable Energy Projects

It is proposed that The Trust provide ongoing funding for RE Projects within the Namoi Valley.

The Trust will leverage its resources and the people of the area to achieve this goal and it will be done in 2 ways;

1. Employ a full time project manager and engage consultants to develop a Feasibility Study and Project Plans to enable a large scale RE project to be developed in the Namoi Valley. To use mining industry contacts and additional resources to bring such a project to fruition.

2. Encourage local people to adopt renewable energy via a Namoi Valley wide scheme such as a local feed in tariff, buying group, interest rate subsidy or direct equipment purchase subsidy.

The expectation is that the RE Project outlined in point 1 above will be a source of ongoing funding for on ground works once mining in the district has been completed. Thereby a strong legacy will remain for future generations

The RE Projects would enable individual mining companies to achieve "Name Plate" recognition for additional resourcing should such an opportunity be desired.

On Ground Works and Training

The on ground works and training to meet the objectives of the Namoi Catchment Plan with an emphasis on habitat conservation and carbon sequestration.

The on ground works to be supervised by the Namoi CMA and are allocated using a competitive tendering process. Administration costs to be limited to 10% of the available funds.

The Namoi CMA has a strong track record in managing on ground works and providing education programs. The Trust would be able to leverage existing programs, staff and technical expertise to achieve its on ground works goals.

This relationship would be reviewed every five years.

Identification and Geography of the Beneficiaries

The beneficiaries of the on ground works funds are located within the Namoi Valley Catchment.

Governance and Ownership

There is flexibility as to whether the RE Project is to be owned and operated outright by The Trust or operated by a third party or simply owned via an equity placement.

The Trust must provide quarterly reporting as to the progress of the RE Project.

The On Ground works are to be administered by the Namoi CMA.
Annual Reporting via CMA

Quarterly Board Meetings to review the operational status of the Trust and Annual Meetings to fulfill corporate responsibilities would be the minimum requirements of The Trust.

The Trust must provide annual reports as to the nature of the grants made, the financial position of the trust and the appropriate corporate governance reports.

Financing and Sustainability

In order to show a Net Benefit to the environment a value of the Leards Forest will be determined by consulting environmental economists. This value will be peer reviewed and individual companies will contribute to the Trust Funds annually based on estimates of the particular mining companies impact to the Forest apportioned over 21 year lease.

Recommendation: An environmental economist be formally engaged to provide official values for inclusion in the Trust documents.

Management Operations/Human Resources

Ideally much of the day to day management operations can be taken by organizations with expertise in the appropriate area.

Trust Accounts and Administration – Local Accountancy Firm
Processing of Onground Works Grants applications – Namoi CMA
Development of RE Project would require engagement of project management and third party consultants.

Quarterly Board Meetings to review the operational status of the Trust and Annual General Meetings to fulfill corporate responsibilities would be the minimum requirements of The Trust.

Seek feedback from Grantees and third party audits to ensure funds are being targeted in accordance with the objectives of the fund.

Environmental Resilience – A holistic approach

Under the broader context of a whole of catchment approach, the key assets of Biodiversity, Landscape, Water and People will be subjected to significant shocks and drivers from the expansion of the resources industry within Leards Forest that will ultimately lead to a breakdown of Social-Ecological systems and therefore environmental resilience within the Maules Creek Catchment.

The Namoi Catchment Management Authority (CMA) has developed a Catchment Action Plan (CAP) that sets strategic targets and activities for natural resource management within the Namoi Catchment.

Namoi CMA has chosen to adopt a "Resilience Thinking" approach to the CAP to ensure that the CAP is both contemporary and vigorous. The resilience assessment is a justified perspective on where the catchment should not go. All stakeholders in natural resource management within the Namoi Catchment are encouraged to adopt the Catchment Action Plan and develop immediate priorities for natural resource management intervention.

The Maules Creek Community Council envisages that the Leard Forest Environmental Trust should be used for both renewable energy projects and Catchment level interventions that help maintain desirable natural resource outcomes as specified within the Namoi CAP. Catchment Targets are described in Appendix 3.

The combined outcomes of targeted environmental projects within the Namoi Catchment and a focus on renewable energy projects within North West NSW provide a framework for environmental sustainability at a small economic cost to corporate enterprise.

A targeted financial mechanism (The Leard Forest Environmental Trust), provides an opportunity for the implementation of a holistic approach by the minerals industry to demonstrate commitment to utilise the concept of Enduring Value within a local catchment, therefore gaining a social license to operate.

The Five Capitals Model – a framework for sustainability, interlinks natural, human, social, manufactured and financial capital to provide a basis for understanding sustainability in terms of the economic concept of wealth creation or 'capital'. Any organisation will use the five types of capital to deliver its products or services. A sustainable organisation will maintain and where possible enhance these stocks of capital assets, rather than deplete or degrade them. The model allows business to broaden its understanding of financial sustainability by allowing business to consider how wider environmental and social issues can affect long-term profitability.

By linking together the concepts of Environmental Resilience, The Five Capitals Model, Enduring Value and The Leard Forest Environmental Trust, a holistic approach to minimise the negative consequences of coal mining within the Namoi Catchment can be found. The internalisation of environmental costs and assigning an economic value to them adds to the principle of the Triple Bottom Line.

The Trust provides a genuine commitment to the sustainability of the local environment by using an economic solution to provide achievable environmental outcomes.

Conclusion

The World Bank Sourcebook 2010 analysis of Leading Practice for community funds has been followed extensively in developing the proposed Funds for mining companies in the Maules Creek area. (See Appendix 2 – World Bank Areas of Leading Practice) The Maules Creek Community Fund and the Leards Forest Environmental Trust approach as described above and in accompanying documents would be in the best interest of the mining companies, the community, the environment and society at large.

Firstly, the mining companies could develop their projects with the support of the community. In addition, the mining companies would be seen to be working for the environment and the community along with their customers, shareholders and employees and thereby developing their social license.

Secondly, the community could take some ownership of the mining projects over the life of mining in the Leards Forest Coal Complex. The economic lifecycle of community members would not be disrupted and the population of the area would be maintained or even increased with a greater number of people from whom to draw as mine workers.

Thirdly, due to reduced agricultural demands a more comprehensive and voluntary environmental offset strategy in the local area could be developed, including areas in as yet unidentified farmland. The Leards Forest Environmental Trust would provide a provision for environmental impacts to the Leards Forest in direct proportion to its economic costs.

Finally a the principles of "inbuilt resilience" ensure that the mining industry will compliment and not "crowd out" the local community as the primary and secondary effects can be taken into account. Society at large will benefit as a leading practice model is developed for industries to exist together.

The MCCC submissions made to the Department of Planning in response to the Boggabri Coal Continuation Project recommended among other things that for projects to go ahead they need to add to the triple bottom line. We stand by all our recommendations made in those submissions and in addition urge that should mining approvals be granted, the Community Fund and Environmental Trust be considered as part of the consent conditions so that there is a net benefit to all stakeholders.

Key Recommendations

1. That "if" Boggabri Coal or Maules Creek Coal gain approval that due to community and environmental impacts the consent conditions should be for underground mines.
2. Among the Dept of Planning consent conditions the companies should make provision for the impacts to the environment and the local community by forming the Leard Forest Environmental Trust and the Maules Creek Community Fund.
3. That clearly defined No Go Zones be identified by the NSW Dept of Planning and that these areas are adjacent to and include the Kaputar National Park, Leards Forest Conservation Area, Maules Creek, Middle Creek, Horesarm Creek and the Namoi River.
4. Consulting Environmental Economists be engaged to determine the value of The Forest. Our suggestion is that Dr Ian Curtis be resourced to value the forest. That the value be peer reviewed and that the value form the basis for the provision identified in the Trust documentation.
5. A working group be formed to develop the strategic plans, guidelines, and rules for the Fund and the Trust. This would include a detailed analysis of the households and farm properties within the provision area.
6. Trustees for both the Fund and the Trust be appointed.
7. An Arbitrator be identified to resolve issues that arise for the operation of the Fund.

Appendix 1 – World Bank Categorization Model

Programming Approach	Grant Making ---------- Operational
Financing Structure	Annual Budget ---------- Endowed
Geographic Focus	Targeted Community----Mine Area of Influence –Broader Community
Community Participation	No Participation ----------Board Membership
Influence of Mining Co	No Influence ----------Board Membership
Influence of Gov't	No Influence ----------Legal Requirement

Appendix 2 – World Bank Areas of Leading Practice for Foundations, Trusts and Funds

- A clearly defined strategic vision, outlining its role as a development actor in the local environment;
- A single purpose, ie, either community investment, compensation or government payments, but not a combination;
- A representative multi-stakeholder governing body;
- An endowed fund to enable sustainability;
- High levels of co-financing and collaboration;
- Transparent practices and associated accountability;
- Efficient administration structures to maximise development delivery;
- Flexibility to adapt to changing development practices and operating conditions;
- Incentive schemes to retain high calibre staff; and
- Impact based monitoring and evaluation.

Foundations, trusts and funds can be used as mechanisms for the distribution of social and economic contributions and payments from companies and governments to communities. They are highly flexible instruments and can be adapted to suit a variety of situations. Establishment of an FTF can facilitate co-financing and act as a strong development commitment to beneficiary communities. Use of an FTF can provide opportunities for representative governance structures which may not be possible under different conditions.

They also provide opportunities to develop sustainable community development programs from the mining sector. When they are applied with a clear vision and clarity of purpose, with transparency and accountability, and are managed by highly skilled staff, they can become the success story of a mining operation.

Appendix 3 – Year 2020 Namoi Catchment Targets

- Increase In Native Vegetation Extent
- Maintain Sustainable Populations Of A Range Of Native Fauna Species
- Actions Supporting Recovery Of Viable Threatened Species, Populations And Communities
- Reduction In New Invasive Species And The Spread Of Key Emerging Invasive Plants And Animals Is Limited
- Improvement In Soil Health
- Improvement In The Condition of Those Riverine Ecosystems That Have Not Crossed Defined Ecological And Geomorphic Thresholds
- Improvement In The Ability Of Groundwater Systems To Support Groundwater Dependant Ecosystems And Designated Beneficial Users
- Improvement In The Condition Of Regionally Important Wetlands And The Extent Of Those Wetlands In Maintained
- Natural Resource Management Decisions Contribute To Social Wellbeing
- There Is An Increase In The Adaptive Capacity Of Natural Resource Managers

Critical thresholds have been defined for the above themes and aligned with NSW State Plan Targets.

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Appendix 14 – Community Fund

Draft Maules Creek Community Fund Report

Maules Creek Community Fund

Submission by: **Maules Creek Community Council**

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Contents

Overview

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In order to get community support for projects the MCCC has been vocal in calling for a "net benefit" to all the stakeholders in the projects including the environment and the local community.

Negotiations between the mining companies and the Narrabri Shire Council regarding to the Voluntary Planning Agreement (VPA) while beneficial to residents are seen by the community as driven by the Narabri Shire Council and its strategic plan. The VPA arrangements are explicitly excluded from this proposal.

The Proposed Coal Projects using Open Cut mining methods place significant socio-economic and environmental risks upon the Maules Creek Community.

Environmental public rights and amenity will be removed from the neighbouring community due to the negative and unavoidable consequences from the cumulative impacts of a large scale industrial coal complex.

The Maules Creek Community Fund ("the Fund") is designed to offset the cost of community impact due to coal mining in the immediate area. The Fund will operate in tandem with the Leards Forest Environmental Trust to help local community members balance direct and indirect costs from the projects so as to achieve an overall net benefit. The Leards Forest Environmental Trust is documented separately.

This document is based on the World Bank "Mining Foundations, Trusts and Funds Sourcebook" 2010 which describes leading practice in developing and delivering net benefits to impacted community's from mining developments. The following table identifies the key components of the Fund based on the World Bank model.

Fund Design Category	Type
Programming Approach	Net Benefit
Financing Structure	Annual Budget
Geographic Focus	Area of Influence
Community Participation	Board Membership
Influence of Mining Company	Board Membership
Influence of Government	DoP consent condition

Establishment, Structure and Purpose of the Fund

The fund will be established by Boggabri Coal and Maules Creek Coal as a Discretionary Trust as part of the consent conditions for mining activities in The Forest. Other mines seeking new approvals to operate inside The Forest will have DoP consent conditions to contribute to The Fund. Mines outside the The Forest but in the near vicinity (say within 5 kms) will be invited to contribute to The Fund.

The Fund will be governed by a board of trustees that will be made up of;

1. Two members from the local area, one of these must be from Maules Creek.
2. Two members from the mining companies.
3. One representative from local government.

The purpose of the Fund is to capture benefit to the impacted community and its members with an emphasis on quality of life to offset impacts on the community, living standards, amenity and property values. These impacts are summarized in Appendix 5.

The fund does not include compensation for serious environmental issues such as major disruptions to groundwater, impacts to human health or impacts to the native vegetation and habitat in The Forest.

Determining The Level of Provision:

Impacts to amenity will increase in line with cumulative production and some method is required to allow for this.

Options for determining a adequate level of compensation.

The question as to how much compensation is required is left open with a number of options available;

1. **Impacts to Property Price:** As described by Dr Ian Curtis in his report to the MCCC, property prices can be used as an indicator to determine impacts to amenity.

2. **Direct Negotiation:** Engage in direct negotiations to agree between the parties on suitable compensation.

3. **Choice Modelling:** Use Choice Modelling as described by Gillespie Economics in the Maules Creek Economic Impact Assessment to establish a level of compensation.

The Fund will commence from the time of mining consent. Funding will be apportioned equally over the 21 year lease of the project. Should a mining project extend beyond the 21 year period it is anticipated that the Fund will carry on into the new lease periods.

The Fund will expire at the end of mining in the local area.

Programs

Community members could participate in a grants or direct payment system to the value of the impact described by the contour maps (see below) and in accordance with the rules set out by the Trustees. The Fund will make a lump sum payment on July 30th of each year from July 2013 onwards.

Community members who are morally unable to accept monies from coal mining are able to "opt out" of the disbursements or allocate the funds to a charity or the Leards Forest Environmental Trust.

Identification and Geography of the Beneficiaries

The beneficiaries of the Fund will be local residents who experience impacts to amenity due to visual, acoustic, light and particulate pollution.

Cumulative noise modelling that provides noise contours (or a composite map of all impacts) could be a de facto indicator for each property of the compensation required to offset amenity impacts, property devaluation etc. While the absolute values of the contours are not significant for this analysis, the contours show how amenity impacts reduce as distance from the project increases. A sample Noise Contour Map is shown in Appendix 4.

Note that the map shown in Appendix 4 is a sample only as composite impacts to amenity would go beyond the boundaries of this map.

Governance and Ownership

The Fund must provide an annual report prior to disbursements.

Quarterly Board Meetings to review the operational status of the Fund and Annual Meetings to fulfill corporate responsibilities would be the minimum requirements of The Fund.

The Board should seek feedback from beneficiaries and require third party audits to ensure funds are being disbursed appropriately.

Financing and Sustainability

Company contributions to be paid into the Fund's trust account at the end of each quarter.

Disbursements to beneficiaries to be limited to the contributions paid with the interest on the bank account to cover costs of administration, taxes and charges.

Management Operations/Human Resources

Ideally much of the day to day management operations can be taken by organizations with expertise in the appropriate area.

1. Trust Accounts and Administration – Local Accountancy Firm
2. Dispute Resolution – Fund Trustees

Community Resilience – A holistic approach

Under the broader context of a whole of catchment approach, the key assets of Biodiversity, Landscape, Water and People will be subjected to significant shocks and drivers from the expansion of the resources industry within Leards Forest that will ultimately lead to a breakdown of Social-Ecological systems and therefore community resilience within the Maules Creek catchment.

The concept of In-Built Resilience needs to be addressed in a targeted manner that preserves the Social-Ecological balance within the Maules Creek catchment. The environmental requirements stipulated by the DoP for project approval fail to consider the community beyond the boundaries of the Zones of Affectation .

The project's environmental requirements fail because they rely on modelling of average conditions and ignore the thresholds of major disturbances. Resilience is defined as the capacity of a system to absorb disturbance and still retain its basic function and structure (Walker and Salt 2006). Sustainability and approaches that try to optimise systems fail to recognise secondary effects and feedbacks that impact upon the bigger system.

The interrelated multiple variables of Social, Economic and Biophysical assets are defined as drivers of, and critical functions of, a healthy community and any breakdown of any of the above three functions will impact directly upon the resilience of the Maules Creek catchment.

A targeted financial mechanism (The Maules Creek Community Fund), provides an opportunity for the implementation of a holistic approach by the minerals industry to demonstrate commitment to utilise the concept of Enduring Value within a local community, therefore gaining a social license to operate.

By linking together the concepts of Community Resilience and The Maules Creek Community Fund, a holistic approach to minimise the negative consequences of coal mining within the Maules Creek Catchment can be found. The internalisation of environmental and social costs and assigning an economic value to them adds to the principle of The Triple Bottom Line.

The Fund provides a genuine commitment to the sustainability of the local community by using an economic solution to provide local people realistic options for now and the next generation. The unquantifiable consequences of large scale coal mining such as loss of amenity, public nuisance, personal health including both physical and mental, reduced property valuations and equity, unsaleable agricultural land due to proximity of mining, disrupted retirement and farm succession plans, loss of self managed superannuation (farm valuations), and finally the social consequences of all of the above will have negative consequences for the Maules Creek catchment if large scale coal mining procedes.

Conclusion

The World Bank Sourcebook 2010 analysis of Leading Practice for community funds has been followed extensively in developing the proposed Funds for mining companies in the Maules Creek area. (See Appendix 2 – World Bank Areas of Leading Practice) The Maules Creek Community Fund and the Leards Forest Environmental Trust approach as described above and in accompanying documents would be in the best interest of the mining companies, the community, the environment and society at large.

Firstly, the mining companies could develop their projects with the support of the community. In addition, the mining companies would be seen to be working for the environment and the community along with their customers, shareholders and employees and thereby developing their social license.

Secondly, the community could take some ownership of the mining projects over the life of mining in the Leards Forest Coal Complex. The economic lifecycle of community members would not be disrupted and the population of the area would be maintained or even increased with a greater number of people from whom to draw as mine workers.

Thirdly, due to reduced agricultural demands a more comprehensive and voluntary environmental offset strategy in the local area could be developed, including areas in as yet unidentified farmland. The Leards Forest Environmental Trust would provide a provision for environmental impacts to the Leards Forest in direct proportion to its economic costs.

Finally a framework using "inbuilt resilience" as a guide will ensure that the mining industry will compliment and not "crowd out" the local community as the primary and secondary effects can be taken into account. Society at large will benefit as a leading practice model is developed for industries to exist together.

The MCCC submissions made to the Department of Planning in response to the Boggabri Coal Continuation Project recommended among other things that for projects to go ahead they need to add to the triple bottom line. We stand by all our recommendations made in those submissions and in addition urge that should mining approvals be granted, the Community Fund and Environmental Trust be considered as part of the consent conditions so that there is a net benefit to all stakeholders.

Key Recommendations

1. That "if" Boggabri Coal or Maules Creek Coal gain approval that due to community and environmental impacts the consent conditions should be for underground mines.
2. Among the Dept of Planning consent conditions the companies should make provision for the impacts to the environment and the local community by forming the Leard Forest Environmental Trust and the Maules Creek Community Fund.
3. That clearly defined No Go Zones be identified by the NSW Dept of Planning and that these areas are adjacent to and include the Kaputar National Park, Leards Forest Conservation Area, Maules Creek, Middle Creek, Horesarm Creek and the Namoi River.
4. Consulting Environmental Economists be engaged to determine the value of The Forest. Our suggestion is that Dr Ian Curtis be resourced to value the forest. That the value be peer reviewed and that the value form the basis for the provision identified in the Trust documentation.
5. A working group be formed to develop the strategic plans, guidelines, and rules for the Fund and the Trust. This would include a detailed analysis of the households and farm properties within the provision area.
6. Trustees for both the Fund and the Trust be appointed.
7. An Arbitrator be identified to resolve issues that arise for the operation of the Fund.

Appendix 1 – World Bank Categorization Model

Programming Approach	Grant Making ---------- Operational
Financing Structure	Annual Budget ---------- Endowed
Geographic Focus	Targeted Community----Mine Area of Influence –Broader Community
Community Participation	No Participation ----------Board Membership
Influence of Mining Co	No Influence ----------Board Membership
Influence of Gov't	No Influence ----------Legal Requirement

Appendix 2 – World Bank Areas of Leading Practice for Foundations, Trusts and Funds

- A clearly defined strategic vision, outlining its role as a development actor in the local environment;
- A single purpose, ie, either community investment, compensation or government payments, but not a combination;
- A representative multi-stakeholder governing body;
- An endowed fund to enable sustainability;
- High levels of co-financing and collaboration;
- Transparent practices and associated accountability;
- Efficient administration structures to maximise development delivery;
- Flexibility to adapt to changing development practices and operating conditions;
- Incentive schemes to retain high calibre staff; and
- Impact based monitoring and evaluation.

Foundations, trusts and funds can be used as mechanisms for the distribution of social and economic contributions and payments from companies and governments to communities. They are highly flexible instruments and can be adapted to suit a variety of situations. Establishment of an FTF can facilitate co-financing and act as a strong development commitment to beneficiary communities. Use of an FTF can provide opportunities for representative governance structures which may not be possible under different conditions.

They also provide opportunities to develop sustainable community development programs from the mining sector. When they are applied with a clear vision and clarity of purpose, with transparency and accountability, and are managed by highly skilled staff, they can become the success story of a mining operation.

Appendix 3 - Key Definitions

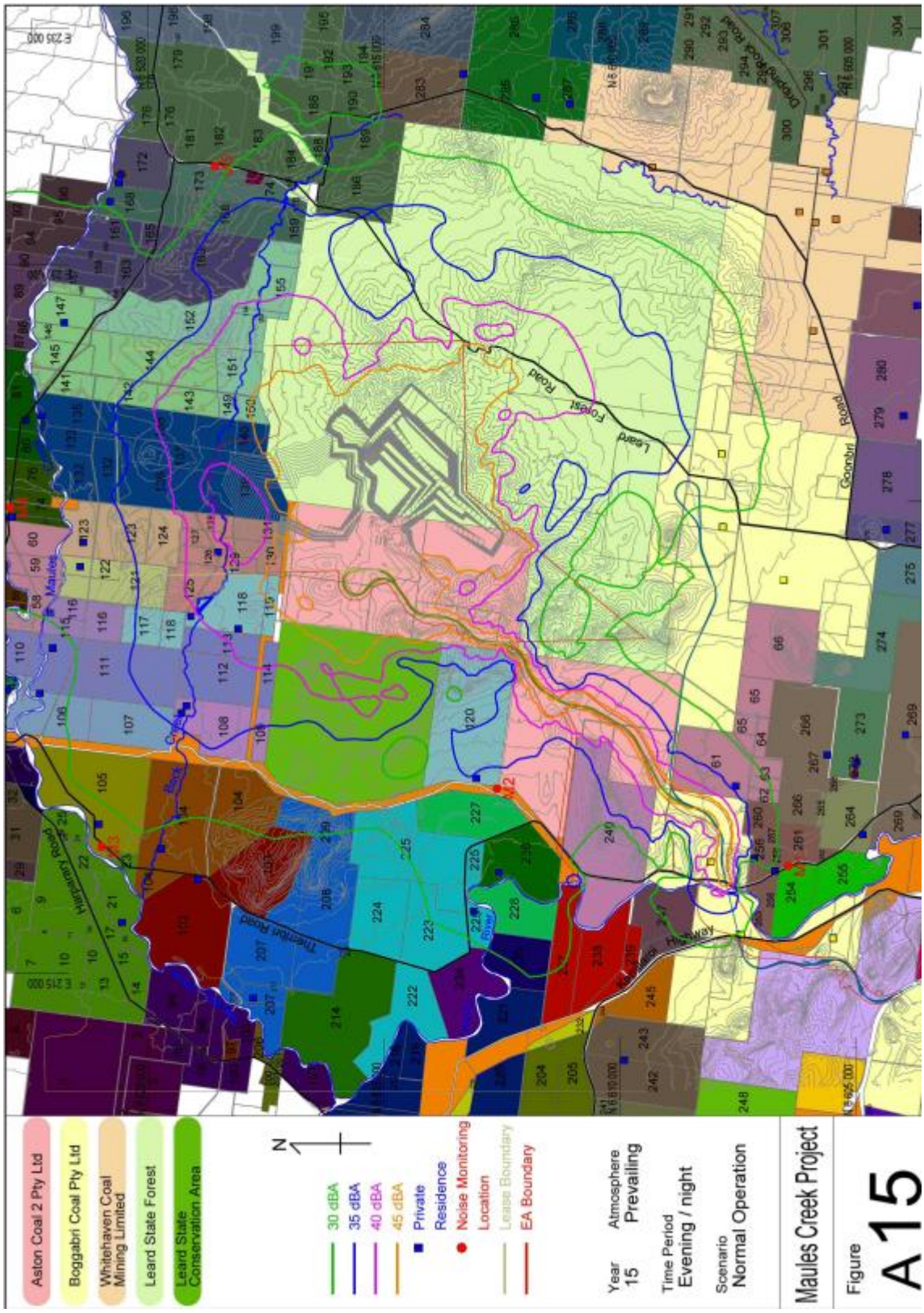
Householder – owner/occupier of an *existing* house inside the local area as at the time the Aston Resources DGR's were issued. Note there may be more than 1 house on a farm property.

Farm Business – Farm Business with a ABN. Only one farm business per property.

Local Area - see attached sample map Appendix 4.

Provision Rights - pass with the sale of a property or at the time of property intergenerational change.

Appendix 4 – Cumulative Noise Contour Map of Maules Creek



See Appendix 3 for definition of the local area.

Appendix 5 – Reasons for Compensation

Damage to capital value for homeowners and business owners due to secondary negative impacts to amenity, perceived or otherwise:
Due to the well documented issues the health impacts of coal dust there is a reluctance for "new" people to move into the Maules Creek District and for existing residents to expand to the property next door. This is having a severe impact on the normal life in the community. Retirement plans are on hold, new investments in infrastructure and equipment is being deferred and even general maintenance of farms and houses in the district is suffering.

The damage to the capital value itself can be described in several ways including realised property prices, increases in property disposal periods, reduction in the pool of available purchasers, increase in the relative power of the mines in the negotiation and the future disposal options.

Damage to lifestyle for residents due to negative impacts to amenity, perceived or otherwise:
Further direct impacts to quality of life due to noise, light, traffic etc also take their toll.

Damage to the community social capital due to depopulation:
Key community members are moving away and there are fewer people with whom to transact with. For example the Captain of the Bushfire Brigade, a primary school teacher and Hall Committee Treasurer and the local plumber have all been recently bought out. The loss of these key people is a cost to the remaining residents who need to pick up additional duties.

Damage to the local agricultural economy due to reduced farm businesses:
There is a certain amount of economic activity that occurs within the Maules Creek community that is being lost due to a reduction in farms. For example, farm businesses can provide contract harvest and other work for neighbouring farmers, supply weaner cattle to neighbours to fatten, purchase seed and other inputs from neighbours, purchase/loan surplus equipment from/to neighbours, provide advice and expertise and were part of the underlying demand in the agricultural economy that is the foundation for the local community.

This depopulation threatens community viability and the threat is set to increase as additional farm land will likely be purchased for ZOA, offsets etc.

Net Benefit:

The effect is to make the community less attractive to prospective new community members and is placing stress on the physical and mental health of existing members.

These day to day issues would not occur without the mines and for the mines to be excluded as a factor for people moving to or leaving the district, a level of provision sufficient to put the district on par or slightly above similar districts is sought. When this is done then a genuine "Net Benefit" to the community may have achieved.

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Curtis I. (2011) *Assessment of the Environmental and Social Values and Community Concerns of the Maule Creek Community Council.*

Appendix 10 – Environmental Services

1. Impact to the Community and to the environmental services of the Leard State Forest.
2. Resume of Dr Ian Curtis.

Maules Creek & Leard Forest Coal Mines

Assessment of the Environmental and Social Values and Community Concerns of the Maules Creek Community Council

Evaluation of the Potential Loss for Compensation Purposes

Researched and prepared by:

Curtis NRA® Australia

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Disclaimer

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Overrider

As the social discipline of economics has had many paradigm shifts during the last 150 years, any peer review of this report must be undertaken with the express consent of the author, and a surety given that the reviewer is indeed a peer of the dominant discipline of the author, namely Land Economics, or Ecological Economics. Many universities in Australia now offer courses in land economics, among them, Melbourne University, and the University of Western Sydney. It may be sufficient to satisfy any concerns that the methodologies used herein have been published in both the relevant peer reviewed journals, the Elsevier Journal of Ecological Economics, and the Australian and New Zealand Property Journal. The author's PhD thesis has been downloaded 3580 times to 89 distinct countries with countless citations.

Contents

1.0 Executive Summary

The community of Maules Creek, 20km NE of Boggabri in central western NSW is being impacted by several open cut coal mines nearby, such that they feel threatened by the flow on and cumulative effects, health and environmental, of the activities. Representations to the mining companies proposing that the mining be conducted underground, have been generally rejected as too costly.

Also, of immediate and on-going concern, but difficult to quantify without sufficient time to prepare a longitudinal study, is the effect on property values in Maules Creek.

The mining complex will impact by clearing all native vegetation from about 4700 hectares of land, some of which is a critically endangered ecological community.

Accordingly, the community of Maules Creek do not see any Net Social Benefit (NSB) accruing to them, or any tangible attempt to internalise what are significant negative exernalities.

The ecosystem goods and services lost due to the clearing of the forest have been valued at some $490,000 per annum. These ecosystem goods and services fall into one of four categories:

- Stabilisation Services
- Regeneration Services
- Production of Goods
- Life fulfilling Services

Some of which are vital, others necessary, useful or desirable.

It is proposed that the Maules Creek Community be compensated, and the negative externalities internalised, by the establishment of two funds to be run for the lifetime of the mines, and after. It is proposed that one fund be designed to offset the environmental impacts; and the other to accommodate impacts to amenity, predicted detrimental changes to property prices and cumulative impacts".

Both of the mechanisms proposed for the funds are based on an empirical database, namely, real property values.

2.0 Introduction

Curtis NRA was engaged by Maules Creek Community Council Inc (MCCC) in a letter dated 18th September 2011, and emailed 19th September.

The principal of Curtis NRA, Dr Ian Curtis, visited Boggabri on Wednesday/Thursday 21/22nd September, and met with members of the MCCC, followed by a meeting with the environmental manager and the general manager of Boggabri Mines.

The purpose of the meeting was to discuss how the impacts of the mines on both the community and the environment, including clearing of the native vegetation in Leard State Forest could be compensated. These impacts are termed 'negative externalities', and they have been quantified a number of times in the various Environmental Assessments required to gain approval. In strict economic terms, the only way to internalise a negative externality is to internalise it, by compensating the affected parties.

The MCCC do not see any Net Social Benefit (NSB) accruing to their community, which is the most directly affected, by a combination of noise; airborne particulate matter (with associated health risks); traffic disruption; loss of ecological services through clearing of native vegetation; reduction in property values; and, loss of quality of life in what was predominantly a quiet rural setting.

The MCCC propose that two funds be established and funded by the all of the mines in the complex to compensate them for the losses. Such a plan would see a NSB for the community and landholders. The funds proposed are an 'Environment Fund', and a 'Community Fund', the former designed to offset the loss of ecological services and environmental 'goods', by instituting environmental projects possibly in conjunction with the Namoi CMA; and the latter for the proper management of cumulative impacts.

3.0 The Land and the Landowners

The Maules Creek community is located about 20kms north east of the town of Boggabri in Central Western NSW, in a geographical and climatic region described as the North Western Central Slopes and Plains. Under the Interim Bio-geographic Regionalisation of Australia (IBRA), the larger region is known as the 'Brigalow Belt South' (BBS) after Thackway & Cresswell 1995, which extends south from the Queensland border. Under IBRA, the protection levels in this bioregion are in the range 0.01% – 5%, while anecdotally, it is thought to be around 1% – 2%.

The land around Maules Creek is generally flat, and comprises deep black soils of basaltic origin. Agricultural pursuits include cropping, and cattle grazing where the land is more undulating as it approaches the foothills of Mt Kaputar. The area is quite scenic, as can be imagined from reading this excerpt from a recent tourist brochure:

"After you cross the Harparary Bridge, take the Maules Creek Road and head for 'the hills'. Maules Creek is situated at the foothills of the Mt Kaputar National Park and is truly amazing countryside. The rugged enchanting landscape hides a deep rich black soil, perfectly suited to farming. As a result the region harbours some of the country's leading cattle. Water flows from the mountains, trickling through Melaleuca lined creeks to arrive as clear as crystal. Many beautiful locations along the river provide captivating hideaways to have a picnic or just enjoy the presence of nature. The size and grandeur of the Nandewar Ranges viewed from the Maules Creek area is spectacular."

Present population[1] is about 183 people comprising some 73 families, a few of which have been landholders there upwards of 100 years, to 150 years. Every person is affected by the current and proposed mining activities to varying extents, as can be seen from the 15yr Noise Assessment map (Figure 1 in Section 5), with Private Residences shown as solid blue squares. Up to fifteen landholders whose properties directly abutted the mine have been bought out, resulting in the loss of some vital skill sets and community contributions.

Anecdotal evidence from one current and continuing landholder located well up the valley from the mine throws some level of doubt about the veracity of the Noise Assessment, as the low drone from machinery could be heard overnight due to an inversion sitting low over the valley. The air quality and noise consultants present at the recent Aston Resources open day (22nd September 2011) in Boggabri confirmed this and agreed that the modelling shows that there would be an inversion layer over Maules Creek 41% of the time generally and 69% in winter. This is a serious concern for human comfort and health.

[1] 2006 Census

4.0 Leard State Forest

Leard State Forest is 8134 hectares in extent, and is described as 'Grassy Box Woodland' in more or less original condition, with little sign of any recent cypress pine thinning activity by NSW State Forests.

Grassy Box Woodland consists of a diverse mix of species including grass and herbaceous species, however dominated by White Box (Eucalyptus Albens), Yellow Box (E. Melliodora), and Blakeley's Red Gum (E. Blakelyi). Shrubs are generally absent; hence the appearance of the community is described as 'park-like'.

Other species that can occur in association with this ecological community are: Western Grey Box (E. microcarpa); Coastal Grey Box (E. mollucanna); Fuzzy Box (E conica); Apple Box (E. Bridgesiana); Red Box (E. Polyanthemos); Red Stringybark (E. Macrorhyncha); Long-leaved Box (E. Goniocalyx); New England Stringybark (E. Calignosa); Brittle Gum (E. Mannifera); Candlebark (E. Rubida); Argyle Apple (E. Cinera); White Cypress Pine (Callitris glaucophylla); Black Cyprus Pine (C. enderlichi); Kurrajong (Brachyciton populneus), and Drooping Sheoak (Allocasuarina verticillata).

Once widespread in the eastern states of Australia, Grassy Box Woodlands and Derived Grasslands[2] are now rare, with less than 5% remaining in good condition. Accordingly Grassy Box Woodlands are listed as 'critically endangered' under the Environment Protection and Biodiversity Conservation (EPBC) Act 1999, and also the NSW Threatened Species Conservation Act. Moreover, in 2008 to 2010, under the Federal Government's 'Caring for Our Country' initiative, five rounds of 'reverse auctions' were conducted in a Market-Based Incentive program (MBI), resulting in some 27,000 hectares being protected under 201 independent land managers. The National Heritage Trust has also allocated twenty million dollars for recovery plans for this, and one other ecological community.

More information about this ecological community can be found on the 'Grassy Box Woodland Conservation Network website www.gbwcmn.net.au/about

[2] Derived Grasslands are described as formerly Grassy Box Woodlands with the trees removed.

5.0 The Coal Mines

The coal mines currently operating in and bordering Leard State Forest are currently overall in the ownership of minority foreign owned corporations. As shareholdings are complex, including a number of nominee companies, the best guess has been about 36.3% foreign owned. The main players are:

1. **Boggabri Coal**: 100% Japanese owned by Idemitsu.
2. **Aston Resources**: 35% owned by Nathan Tinkler.
3. **Tarrawonga**: 30% Idemitsu, 70% Whitehaven.

The Tarrawonga Modification lies to the south of Boggabri coal mine, with the Tarrawonga extension further south. The Goonbi Coal Project lies to the east of The Tarrawonga Modification (see Figure 2).

All of the coal mines involved have undertaken to, or been required to put strict controls in place to ensure the cumulative effects of their operations are manageable under an Environmental Management Strategy. In some cases Environmental Management Plans (EMPs) have been prepared and put in place, and in other cases, prepared prior to being put in place.

The operating mines have undertaken a range of offset measures, including revegetation surrounding the mines, and the purchase of offset land of approximate commensurability to that cleared, although there is the concern that much of the offset land is ‘derived grasslands’. Boggabri Mine claim to have had their contribution to offsetting increased several times by Government, and it currently stands at 6:1. Nevertheless, it will be many decades before ‘derived grasslands’ will again resemble a forest with equivalent biomass and biodiversity to that removed.

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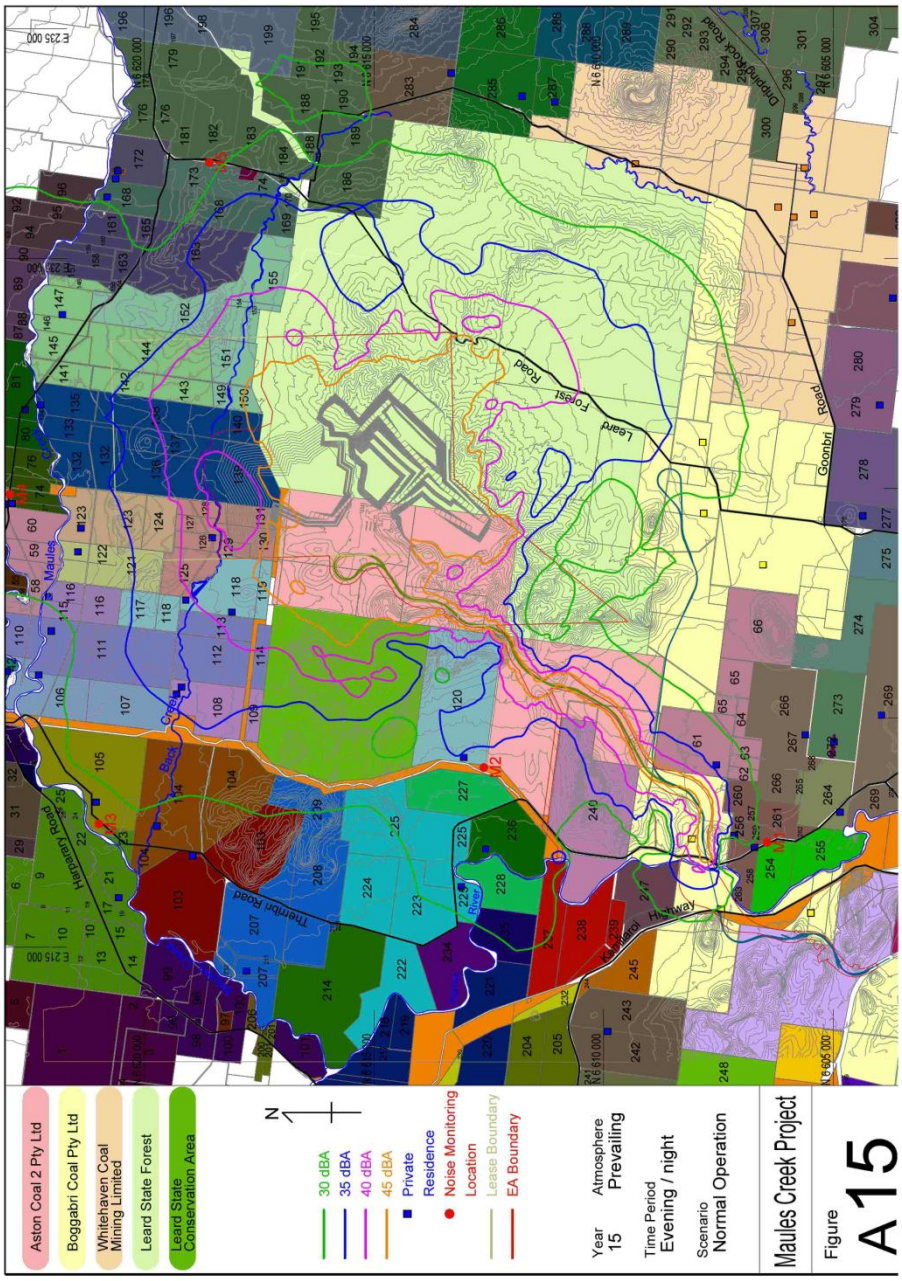

Fig 1. 15yr Noise Assessment

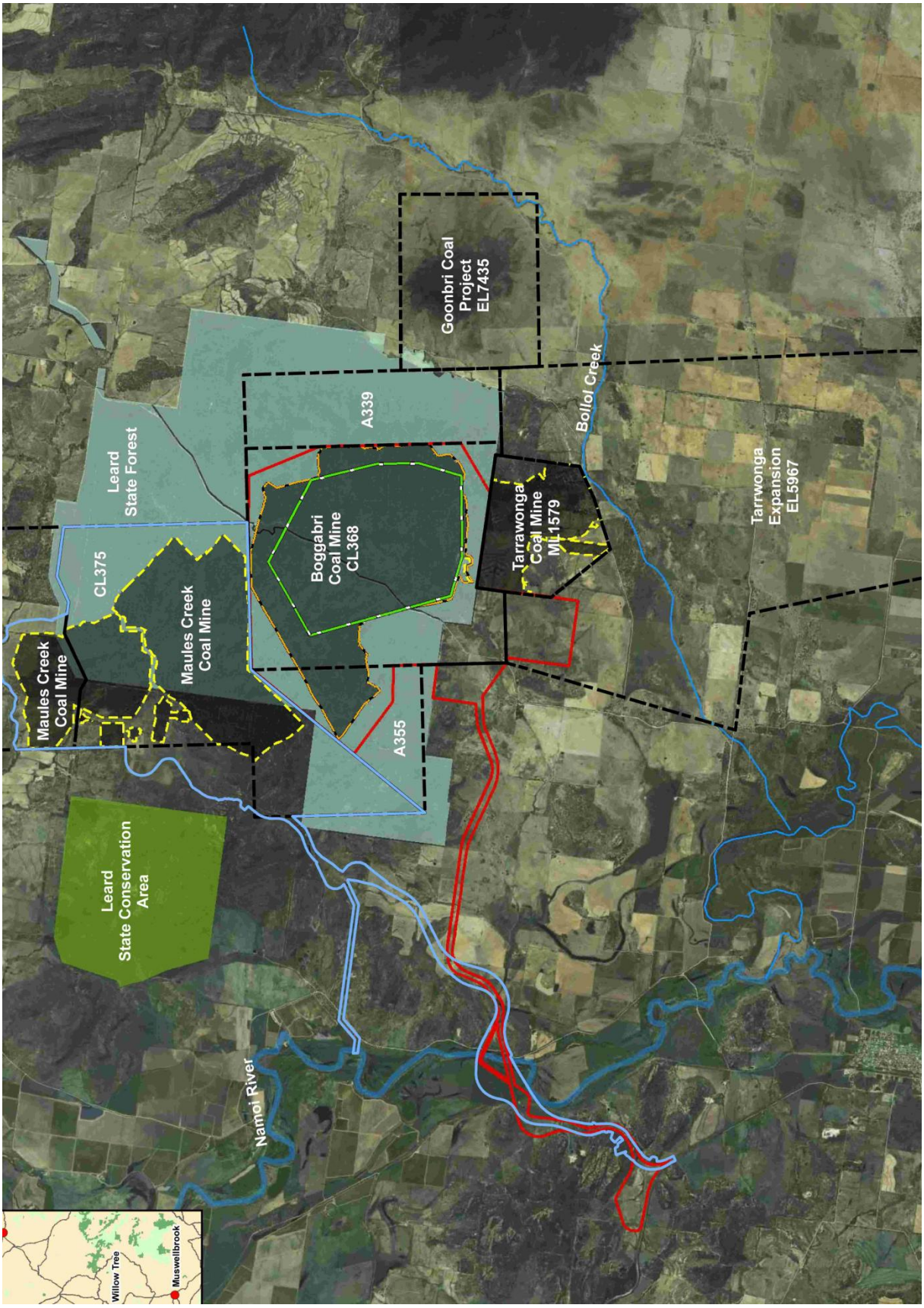

Fig 2. The current and proposed mines in and adjacent to Leard State Forest

6.0 Environmental and Social Impacts

6.1 Impacts on Leard State Forest

There is a level of uncertainty regarding the extent of clearing in Leard Forest, and how much of this is the critically endangered ecological community, and how much other habitat for mammals. Cumberland Ecology, in a report forming part of Aston Resources EIA, state that:

"based upon current proposals within Leard State Forest, the combined impact of mining would remove 3081.8 ha of forest and woodland, which is 60% of the extant forest and woodland. Such mining would also be likely to remove 1217.1 of 2153.1 ha of Box Gum Woodland and Derived Native Grassland, equating to 57% of the CEEC within Leard State Forest."

Clearly therefore, the overall footprint of the combined mining activities is in the vicinity of 4300 hectares plus edge effects. Edge effects can encompass both human induced and other biophysical effects, including microclimate variables across the ecotone. Wider corridors or larger gaps are shown to have a more significant impact than narrow corridors or smaller gaps due to depth of penetration of the various effects into the forest. The effects are more pronounced in closed canopy environments closer to the edge, ie. rainforest, however they still exist and extend further into an open forest environment than a closed forest environment (Goosem and Turton 2000).

Photosynthetically active radiation (PAR) reaching the forest floor has a significant relationship with distance from clearing, leading to possible emergence of alien species at the edge. Soil surface temperatures both on the surface and at 10cm depth are highest at the edge and extend inwards depending on the orientation of the corridor and season (declination of the sun). Air temperatures and vapour pressure deficits have more pronounced gradients for open canopy forests than closed canopy forests, which has implications for regeneration. Overall, linear clearing impacts on microclimate decrease with distance from the edge. Wide clearings or gaps without canopy retention allow greater invasion of weeds, and result in greater penetration of disturbance indicator species (Goosem and Turton 2000).

Owing to the irregular, however predominantly circular shape of the impact footprint, it is difficult to do more than estimate the extent of the edge effects. Based on an estimate of maximum edge effects of 100% at the edge, reducing to 0% at 200 metres from the edge, the likely total impact footprint would be in the vicinity of 4700 hectares.

6.2 Other Environmental and Social Impacts

Other environmental and social impacts relate to the physical presence of the mines and their flow on effects by way of noise and dust pollution; increased heavy traffic on the gravel side roads; possibilities of contaminated watercourses and interference with groundwater recharge; loss of community, etc. However, these impacts are beyond the scope of this report, and they have been amply explored by both the Mining Company's consultants, and the community's responses, both independently and through their consultants.

The remaining concern, and the most cogent issue facing the community, is the unknown effect the mining complex and cumulative impacts will have on their property values. Clearly, the sale of prime agricultural land adjacent to, or nearby an operating coal mine complex with a life of 21 yrs is difficult at best, and the obvious first indication would be slower than normal disposal rates, possibly resulting in the dropping of prices, or low offers. This effect is most concerning for those nearing retirement, and looking to either sell to move closer to the coast, or to put succession plans in place. Over the 21+ year life of the mines, this prospect will be very real for the large majority of the community.

7.0 Valuation Law and Practice

In Australia, all of the principles and practice of valuation have been derived from judgements handed down by the Supreme Court, the High Court and the Privy Council. Some relevant law and practice as it applies to this particular situation would be helpful in discussion, particularly when the possibility exists of loss of property values due to the presence of the mines and their associated negative externalities.

The definition of 'unimproved value' in the Commonwealth Act and used in connection with, and defined by the taxing laws of Australia and the States and New Zealand is:

"The capital sum which the fee simple of the land might be expected to realise if offered for sale on such reasonable terms as a bona fide' seller would require, assuming that, at the time the value is required to be ascertained for the purpose of this act, the improvements did not exist." (Lambert 1932:15).

This assumed that the increased value attaching to any particular piece of land which is due to the successful working of other people's land in the district, or the progressive works affected by the state, the general prosperity of the country, all form a portion of the 'unimproved value'. (Curtis 2003).

The courts insist that:

"The value of a particular piece of land is the value of civilised government at that spot, it is the value which the presence of the community gives to the land and which the community unconsciously assesses. It is something which is already in existence and must be discovered not invented.....it will be seen, therefore, that unimproved value is in reality the capital value of the economic rent of a piece of vacant land or other natural resource". (Herps (1942:107; Curtis 2003).

The above was supported by a judgement of the Privy Council in Fiji on July 1 1957, where it was ruled that land is to be valued as situated in the community with the amenities that have grown up around it (Tetzner vs The CSR Co Ltd). (Curtis 2003)

7.1 The Value of the Ecosystem Goods and Services generated by Leard Forest

Table 1. The now commonly accepted suite of ecosystem goods and services (Curtis 2003; 2004, adapted and modified after Costanza 1997 and Cork and Shelton 2000).

Group	Type
Stabilisation Services	Gas regulation (atmospheric composition) Climate regulation (temperature, rainfall) Disturbance regulation (ecosystem resilience) Water regulation (hydrological cycle) Erosion control and soil/sediment retention Biological control (populations, pest/disease control) Refugia (habitats for resident and transient populations)
Regeneration Services	Soil formation Nutrient cycling and storage (incl carbon sequestration) Assimilation of waste and attenuation, detoxification Purification (clean water, air) Pollination (movement of floral gametes) Biodiversity
Production of Goods	Water supply (catchment) Food production (that sustainable portion of GPP) Raw materials (that sustainable portion of GPP, timber, fibre etc.) Genetic resources (medicines, scientific and technological resources
Life Fulfilling Services	Recreation opportunities (nature-based tourism) Aesthetic, cultural and spiritual, (existence values) Other non-use values (bequest and quasi option values)

Every use of land has an opportunity cost, that being the existing use or other uses to which the land could be put (the use foregone) (Edwards 1987; McNeeley 1988; Frank 1991). The value of a conservation area should be at least as much as the cost of preserving it, or measured by the cost of the foregone opportunities, as the area cannot be developed or redeveloped (Allison *et al.,* 1996). McNeeley (1988:33) described marginal opportunity cost as a 'very useful tool in making decisions about allocation of resources'. Moreover, McNeeley (1988:33) argued that marginal opportunity cost: *"…can be used as a means by which those who will lose from having restrictions placed on their use of biological resources can be compensated to recover the value of their lost opportunity".*

Marginal opportunity cost can be expressed in terms of the annual net revenue foregone, in which case it would be capitalised, resulting in a land value in restricted and unrestricted use (McNeeley 1988). These concepts clearly link the natural production function of land with land valuation procedures. As ecosystem goods and services are the production function of land in its natural state (the *Usus Fructus per annum*), and as ecosystem goods and services are essential for planetary life support (Ke Chung and Weaver 1994), it could be argued that the provision of ecosystem goods and services are the 'highest and best use' of land. It follows that apart from the economic valuation procedures described in Coleman (1996), Tamlin (1996) and Reed (2003), the value of non-market environmental attributes can be derived indirectly by using prices from a related market which does exist (Allison *et al.,* 1996), namely, the property market. For the first time, now, the production

function of land set aside for conservation can be valued in much the same way as more traditional uses of land, such as agriculture or urban development. Clearly, for conservation to be a viable alternative land use it must be competitive with other uses to which land could be put, otherwise no one will pay for it.

Individuals in the community constantly reveal their preferences to purchase property for a multitude of uses. The pecuniary measures of these preferences are used as comparable sales by state agencies charged with the responsibility of valuing property and determining unimproved values as a basis for levying rates and taxes. The collective values thus underpin the costs of administration and provision of infrastructure in the bioregion (Lambert 1932; Herps 1942; Murray 1954; Blackwell 1994). Unimproved values are assessed on the principle of the highest and best legal use, yet assume that improvements do not and have never existed.

Valuer General for Ireland, member of the Royal Society and founder of Political Arithmetric, Sir William Petty (1623 – 1687) was first credited with capitalisation of the *Usus Fructus per annum* or productivity function of the land (Murray 1954, 1969; Roll 1961).

The Oxford Dictionary defines *Usufruct* as: *1.Law. "The right of temporary possession, use, or enjoyment of the advantages of property belonging to another, so far as may be had without causing damage or prejudice to this. Usufruct is the power of disposal of the use and fruits, saving the substance of the thing"* (Simpson and Weiner 1989).

Sir William Petty believed that capitalisation of all of the profit and benefits produced by land held in the public domain was a logical economic step to take to determine capital value, or vice versa (Murray 1954, 1969; Roll 1961). However, Petty was uncertain as to how to determine the rate of return from land other than using the surplus from production as rent, but came up with an ingenious solution. Petty determined that the rights to land of three generations of humans would be a reasonable estimate, and as three life expectancies in England in the 17th Century were 120 years, he computed the value of land at twenty one year's purchase of its annual rent, or in money-capital terms, a capitalisation rate of 4.76% (Roll 1961).

In this study, the surrogate market is the broader property market in the bioregion in which the mines are located. However, like all farm budgets, it is also necessary to determine 'what' and 'how much' is being produced in the context of ecosystem goods and services. Two models were chosen to properly reflect the type and status of the Leard State Forest, namely 'Open Forest' and 'State Forest'. The capitalisation rate is determined by a study of the market relevant to scarcity and risk and by using ecological models based upon the relationship between vegetation cover and species richness, land use characteristics and level of protection. The models are proprietary, however, they are based on the collective work of Holdridge (1967), Lugo

(1988), Brown and Lugo (1982), Mooney (1988) and McArthur and Wilson (1967). The LOP model uses Level Of Protection to set the capitalisation rate. As the level of protection decreases, the capitalisation rate increases reflecting risk (Figure 3). The LUC model uses Land Use Characteristics to set the capitalisation rate. As human and climate induced modification increases, so does the capitalisation rate in order to reflect scarcity of ecosystem goods and services (Figure 4). Both models are also used to determine 'how much' ecosystem goods and services are being produced, which are expressed as a range. The relationship between vegetation cover and species richness is generally 3:2, except for Mediterranean climate ecosystems, where it is generally 1:1 (Mooney 1988). As both alienated and un-alienated land provide ecosystem services it is important to be able to estimate the extent to which the land contributes to the overall contribution. Depending on the level of disturbance, other human activities on the land can co-exist with the provision of ecosystem services.

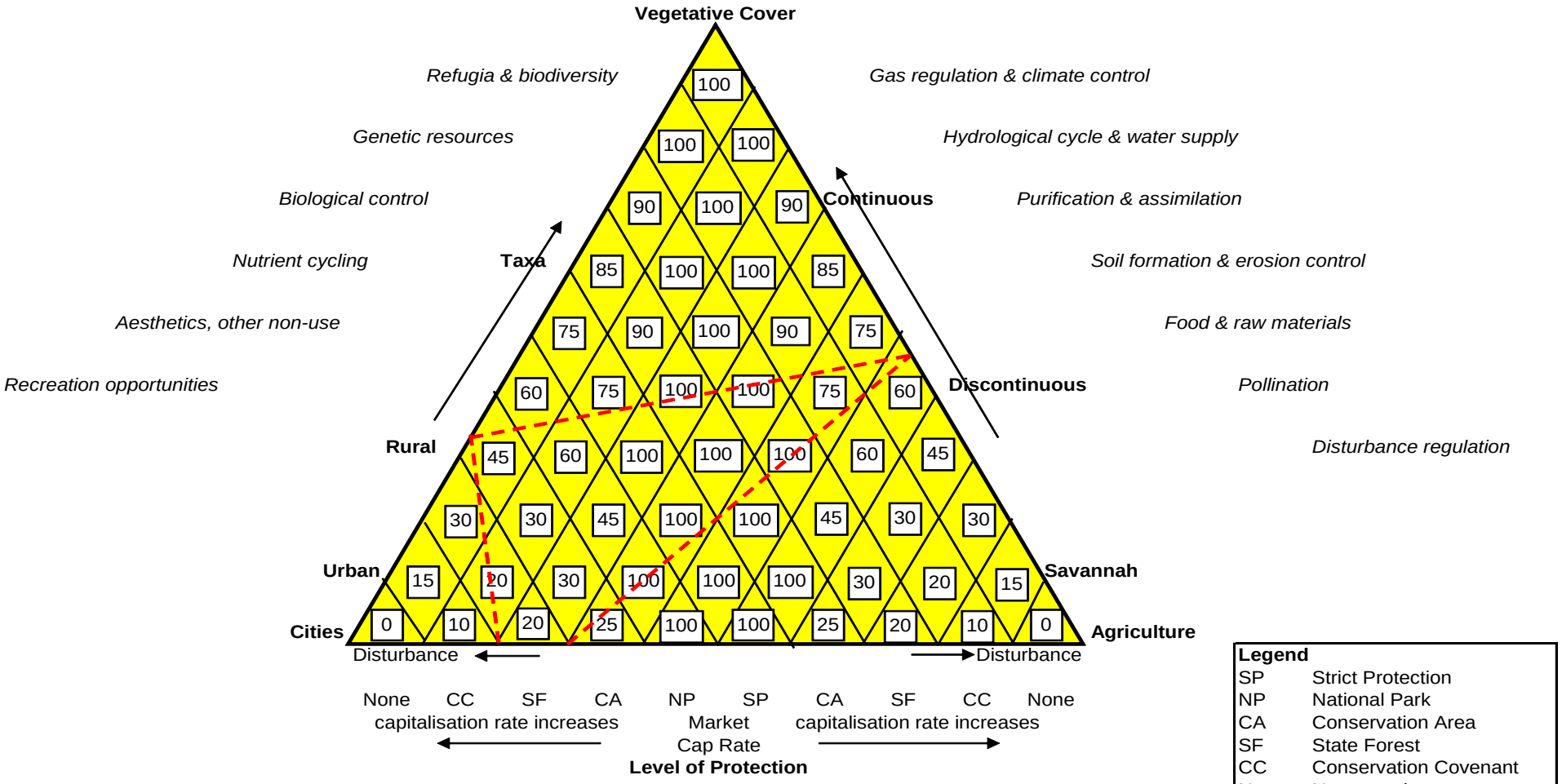

Figure D4. Triangulation model to assess extent of ecosystem services intact under a given level of protection or no protection
Scoring: Calculate the mean of the values within the diamonds included in the selection as well as those the dotted line passes through.
This example, State Forest: 66%

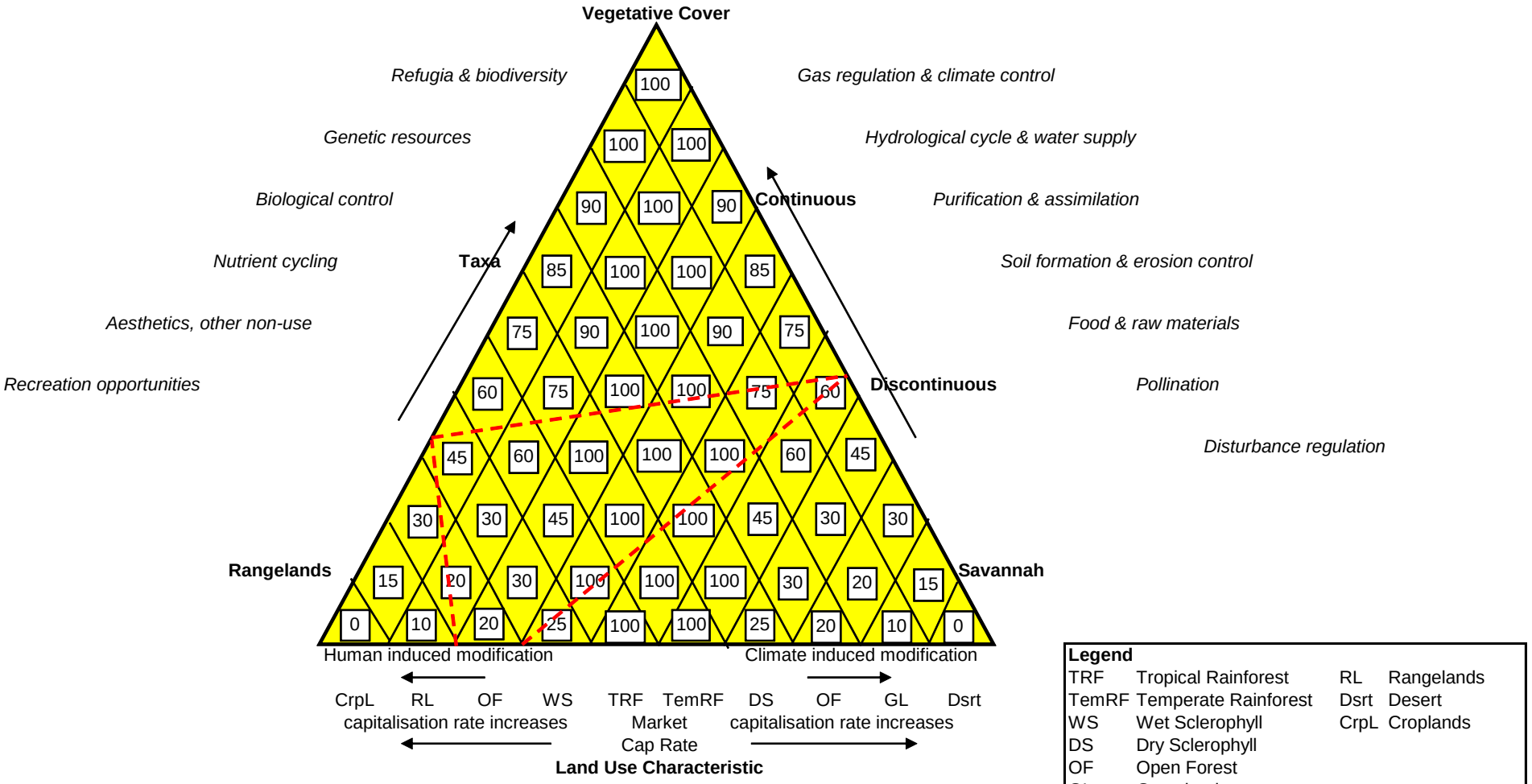

Figure D16. Triangulation model to assess extent of ecosystem services intact under a given land use characteristic
Scoring: Calculate the mean of the values within the diamonds included in the selection as well as those the dotted line passes through.
This example, Open Forest: 67%

The local government areas (LGAs) that are contained wholly within or that administer parts of the bioregion were ascertained from public records and maps. These local governments were consulted as to the total rateable value of alienated land within their jurisdiction, and the total area of that land. A dollar value per hectare was calculated for each LGA (total rateable value/total area). Statistical analysis can be performed on the resulting set of dollar values for the LGAs, and the range, mean, median, mode, standard deviation and skewness calculated. Owing to the variability in the data (range), due to varying degrees of urbanisation, development, use, distance from services, and average parcel size, the data set can be expected to have a high degree of positive skewness. The measure of central tendency most commonly accepted for this type of skewed data set is the 'median', however, in this study it is appropriate to express the values as a range, and those measures will include both the mean and the median. These measures will provide the fairest approximation of all of the uses to which land is put in the bioregion on a *broadacre* basis and will take into account all of the various principles and factors that affect the value of land.

The median and mean unimproved values per hectare of the alienated (rateable) land in the bioregion are then used as a surrogate for the median and mean unimproved value per hectare of the un-alienated (public or unrateable land). This is consistent with valuation practice (McNamara 1983). However adoption of the mean or median unimproved value as a surrogate value implies that the value is for the average or 'median' use in the region and not the single 'highest and best' use. It is thus a conservative estimate, allowing that other uses of land can co-exist with the provision of ecosystems services.

Table 2. The current real property valuation calculations for each shire in the Brigalow Belt Bioregion (as supplied to the relevant Shire Councils by the NSW Valuer General).

LGA	Total VG valuation (for rating purposes)	Gross Shire Area	$ value per hectare
Moree Plains SC	$2,487,348,445	17,928 square km	$1,387
Narrabri SC	$1,243,634,158	13,028 square km	$...955
Warrumbungles SC	$ 951,005,400	12,380 square km	$ 768
Gwydir SC	$1,298,654,520	9,122 square km	$1,424
Liverpool Plains SC	$1,435,730,378	5,086 square km	$2,823

The mean of this data set is $1,471 per ha, and the median is $1,387 per ha. Thus the range of the values to be used is $1,387 to $1,471 per ha.

Using the LOP and LUC models for 'open forest' and 'state forest', the level of contributions compared to the highest level, which is a closed canopy tropical rainforest, are 66% and 67%.

The impact area in Leard Forest, including edge effects, is 4700 ha.

Capitalisation rates for this 'land use characteristic' would normally be 7 – 8 %, while for this 'level of protection' they would be, say 9%, that is higher than for say, a Wet Tropics World Heritage Area rainforest, as the higher capitalisation rate reflects an elevated risk. In the case of this State Forest, clearly there has been no protection afforded by its EPBC listing, or the native vegetation clearing laws, and the very fact it is being cleared demonstrates that it is at risk. Under these circumstances, a capitalisation rate of 11% will be adopted for the purpose of this report.

Applying the capitalisation rate to the range of capital values, results in an annual range of $152.57 to $161.81 per hectare.

The algorithm then is:

Impact area X % contribution X $ annual value

The value of ecosystem goods and services for the impact area in Leard Forest is in the range of:

$476,858 to $505,737 per annum

8.0 The Communities Aspirations for an Impact Mitigation Mechanism ('s')

The community propose two funds to manage the negative impacts and achieve a level of self-managed internalisation of these externalities in their lives and businesses, they are as follows. These will most likely be modified as a result of this report, however, they are included here as an outline of their expectations.

Principles for Community Fund

1. The objective of the fund is to capture benefit to the impacted community and its members with an emphasis on quality of life to offset impacts on health, living standards, amenity and property prices.
2. The community fund be contributed to by all mines in the Leards Forest Coal Complex.
3. The contribution be paid on a per tonne basis.
4. The contribution be linked to the coal price
5. The fund be administrated by a trust with 5 trustees. 2 Mining, 1 NSC GM, 2 community.
6. Accounts to be administered by reputable accounting firm and independently audited.
7. Broad Objectives to be determined by the trustees after scoping submission process and projects to be tendered for on a competitive basis.

Principles for Leards Forest Environmental Trust (LFET)

1. The objective of the fund is to offset the cost of environmental impact to the Leard Forest.
2. The cost of forest impacts to be determined by consulting environmental economists. Fund calculated to pay for total forest impacts over 21 year. Impacts included in calculations are;
    a. Carbon Sequestration value of the forest.
    b. BioBanking (NSW) or Bush Broker (Vic) value of the Leard Forest Ecosystem.
    c. Value of the timber in the forest.
    d. Recreational Value
    e. Non-use value.

3. The LFET be contributed to by all mines in the Leards Forest Coal Complex
4. The contribution be paid on a per tonne basis.
5. The contribution be linked to the coal price
6. The fund be administrated by a trust with 7 trustees. 2 Mining, 1 NSC GM, 2 community, 2 environmental groups.
7. Broad Objectives to be determined by the trustees after scoping submission process and projects to be tendered for on a competitive basis.

Proposals

In both proposals, linking compensation to the revenue from the mining and sale of coal should be avoided. Some landholders would be offended that they were, somehow involved in an extractive industry, while others may see such an arrangement as a de facto partnership that may inappropriately reflect or impact on them in the future.

Leard Forest Environmental Trust

Call out 2 above to be replaced by the utilisation of the now assessed value of the ecosystem goods and services lost, which encompass:

- stabilisation services;
- regeneration services &
- life fulfilling services.

These would need to be replaced or supplemented by local environmental projects.

Call outs 4 & 5 deleted as obsolete.

The mines would be required to contribute collectively a sum equivalent to the value of the ecosystem goods and services lost due to clearing the forest, as assessed in Section 7.1 above.

The fund would thus have disposable annual income of some $490,000 for the life of the mines (21yrs+), increasing at the cost of inflation and a lump sum on closure estimated to be equivalent to 50 yrs discounted net annual value. The final lump sum will thus allow sufficient time for full return of the offset areas and derived grassland to the delivering of a full suite of ecosystem goods and services with sufficient biomass and diversity to be self-sustaining.

The fund would be administered as envisaged by the MCCC.

Maules Creek Community Fund

Call outs 4 & 5 deleted

The Community Fund needs to be funded by the Mines on the basis of the core concerns of the community, namely loss or reduction of property values, which, as stated in Sect 9, are and will be due to:

- general reduction in quality of life;
- loss of general amenity values;

- loss of, or reduction in property values, including forced sales due to delays in realisation, succession issues, and cumulative impacts apparent to prospective buyers.

As all of these issues generally relate to where the individual properties are located in juxtaposition to the mines, and as such can be all be located in, and around the Maules Creek Community, centred on the School and the Community Hall.

As cited in Section 7 above:

The courts insist that:

"The value of a particular piece of land is the value of civilised government at that spot, it is the value which the presence of the community gives to the land and which the community unconsciously assesses. It is something which is already in existence and must be discovered not invented.....

And, also from Section 7:

"This assumed that the increased value attaching to any particular piece of land which is due to the successful working of other people's land in the district, or the progressive works affected by the state, the general prosperity of the country, all form a portion of the 'unimproved value'".

Accordingly, the mechanics of the Community Fund should be geared to two mechanisms:

1. gross unimproved property values in the Maules Creek Community, The current Valuer General's assessment for each property could be used as a baseline for future analysis of sales, when there are sufficient sales for a longitudinal study, and;
2. certified valuations of all of the affected properties in Maules Creek. The valuations to all be conducted by a reputable firm of licensed valuers knowledgeable in rural property, and based upon both the underlying characteristics of the properties, and the productivity or potential productivity, at the date of valuation.

All of the mines would be required to contribute to the fund, which could be set at a minimum of 10% to a maximum of 25% of the gross improved values of all of the properties in Maules Creek Community. These percentages could represent the potential range of loss in value. This sum should be paid as a lump sum, with the interest accruing used to compensate individual property owners and families for health or social issues or loss of property value when realised (or when there is sufficient evidence for a longitudinal study). The capital sum after mine closure and

rehabilitation can be used for other works, including rebuilding the community and providing a sinking fund for those disadvantaged.

Call outs 4 & 5 deleted as obsolete.

10.0 Conclusion

The proposal set out above relies on data that is available in the public arena, and utilises an empirical database as the baseline for compensation for the loss of the forest, and both an empirical database and a certified valuation to argue the case for compensation for loss in property values, other community impacts and uncertainties. In the author's opinion, properly applied, this model will be hard to challenge, as it satisfies the economic criterion of the utilisation of human preferences to establish compensation (what people pay for land), ecological models based on the literature and utilising canopy cover and species richness as the parameters, and real estate valuation principles and practice, which are derived from judgements handed down in the Supreme Court, High Court, and the Privy Council.

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Qualifications	*ASLE & AVLE(Econ): Land Economics* *Bachelor of Science* *Bachelor of Science with Honours* *Doctor of Philosophy*
Majors	*Land Economics, Geology, Environmental Sciences (EIA)* *Resource & Ecological Economics*
Educated	*St Ignatius College Riverview; Metropolitan Business College, Sydney University Extension Board, UTS, James Cook University, Macquarie University*
Professional Associations	*Environment Institute of Australia and New Zealand (MEIANZ). Australia and New Zealand Institute for Ecological Economics (ANZSEE). International Society of Ecological Economics (ISEE).*

Capability Statement

- *Able to work autonomously or as part of a collective enterprise*
- *Original and lateral thinker, uses both deductive and inductive reasoning as the occasion warrants*
- *Innovative, intuitive approach to problem solving*
- *Methodologically receptive. Not encumbered by any particular paradigm that may limit discourse*
- *Prolific producer, highly organised and addicted to time-lines*
- *Receptive to diverse stakeholders in contentious issues*
- *Highly literate and excellent verbal and written communication skills*
- *Committed to ecologically sustainable outcomes*

Year/years	***Relevant or principal activity ~ Host Organisation***
2011	***Default judgement handed down by Justice Cathy Davani in favour of the customary landholders in the Lake Murray and Middle Fly Region of the Western Province of Papua New Guinea on Tuesday 21st June, 2011, in the sum of K226 million (AUD$94 million). (see below CELCOR appointment & Publications).*** *Numerous small appointments, Statements of Environmental Effects (SEE), Local Government Objections etc.* ***Various Clients.***
2009/2010 ***T/as:*** *Curtis NRA Australia* ***ABN 68364350351***	*Appointed by* ***CELCOR (PNG)*** *in conjunction with the* ***EDO (NSW)****, on the direction of the National Court of Papua New Guinea, to assess the pecuniary value of the environmental damage and consequent reduction in ecosystem services provided by customary land due to a large scale unauthorised logging activity in the Western Province of Papua New Guinea.* ***Ian Curtis has gone sailing during the recession we 'didn't have!' Cruising on his classic Herreshoff 35' cutter ketch, 'Noctiluca'.*** *Contracted to* ***Flanagan Consulting Group (FCG) North Queensland****, as business development strategist in the Natural Resources Sector 2008. Proposed and prepared FCG's contribution as North Queensland delivery*

agent, to the Parsons Brinkerhoff (PB) bid for inclusion on the Defence Environment and Heritage Panel. 2008. Subsequently appointed to the Panel

2007/2008

Coordinated all sub-consultants, managed and contributed to the FCG bid as 'Investigations Manager', in conjunction with PB, to deliver the EIS for the proposed new Townsville Marine Precinct at the mouth of the Ross River. 2008.

*Appointed on contract as Regional Manager, North Queensland, **SMEC Australia**. Engineering and Environmental Consultants. Various projects as Project Director 2007 – 2008:*

*Appointed Service Provider on a $4m contract for **DEWHA Australian Govt's** Tasmanian Forest Conservation Fund to deliver the Market-based Voluntary Conservation Agreement component. Over 28900 hectares of priority forest secured under protection at a cost to Govt of ~ $35 million. Consortium with **KPMG**, **SEMF** and **Corporate Communications, Tasmania.** 2006 – 2007.*

2004/2007 T/as:

Curtis NRA Australia

ABN 68364350351

*Prepared and delivered a report "Environmental Gains and Capital Improvements on Restoration Island since 1995". **Longboat Investments Pty Limited.** 2007 COMPLETED*

*Appointed on contract for two years to the **Nature Conservation Trust of New South Wales.** Developed policy and procedures and implemented the successful roll out of the Revolving Fund model for conservation gains. Identified landscape corridors and linkages and directly negotiated terms of purchase with landholders, initiated covenant development, and on-sold to new trustees. 2005-2007.*

*Investigated the regional ecological significance and economic implications for several private landholdings in the North West Growth Centre of Sydney under the NSW State Government's Metrostrategy. Report to the **Clifton Coney Group.** 2005 COMPLETED*

*Assessed the pecuniary environmental impact of the unauthorised removal of timber and associated impacts from an endangered regional ecosystem (under the Vegetation Management Act 1999) in the Shire of Eacham, Atherton Tablelands. 2005. **Private landholding.** Matter settled by mediation July 2007*

*Collaborated with **Arup Project Management** and **WBM Oceanics** in an expression of interest to **DEH Australian Govt** for the Stewardship component of their 'Maintaining Australia's Biodiversity Hotspot's' program: Subsequently invited to tender 19 April 2005. SELECTED AS PREFERRED TENDERER, PROGRAM DEFERRED*

*Presented two interactive seminars to executives of **Powerlink Qld** and **Energex** as to the current scientific thinking involved with pecuniary evaluation of environmental impacts due to edge effects and fragmentation. 2005 COMPLETED*

*Evaluated the monetary environmental impact of the Calvale-Tarong transmission line through Allies Creek State Forest, Mundubberra, Southern Inland Burnett Region, Queensland, 2005. **Powerlink Queensland.** COMPLETED & PUBLISHED*

*Reviewed and recommended potential market-based incentives to protect biodiversity on private and other lands under the Conservation Partnerships Program, 2004. **Brisbane City Council.** Payments for environmental services provided by private landholders were quantified in dollar terms. COMPLETED*

http://www.curtisnra.com.au

2001-2003	*Research into the value of ecosystem goods and services provided in the terrestrial domain (published) PhD Thesis* ***James Cook University****, Cairns Campus. Main Journal paper cited 52 times (Google Scholar). Thesis downloads: 3034 times to 74 distinct countries (as at May 2011).*
	Honorary Research Fellow, ***Rainforest CRC,*** *Learning Advisor, Academic Support Division,* ***James Cook University*** *and tutor and occasional lecturer,* ***School of Tropical Environment Science and Geography, James Cook University, Cairns Campus***
	Collaborated in the development of a 'Visitor Monitoring System' (VMS) for the Wet Tropics World Heritage Area in Queensland. Report to the Wet Tropics Management Authority. ***Rainforest Cooperative Research Centre***
	Developed a set of socio-economic indicators: 'How the Wet Tropics World Heritage Area functions in the life of the community'. Report to the Wet Tropics Management Authority. ***Rainforest Cooperative Research Centre***
	Conceived and facilitated a six round (web-hosted) Delphi Philosophical Inquiry with a panel of 50 scientists and economists to determine the need for inclusion of ecosystem services in the market system and to weight the environmental attributes. ***James Cook University***
1999-2001	*Solar radiation modelling in the Daintree and assessment of it's potential as an energy source (published).* ***James Cook University****, Cairns Campus*
	Environmental and energy audit of North Queensland Hotels and Resorts and quantification of greenhouse gas emissions (published). ***James Cook University****, Cairns Campus*
	Freelance land economist: Planning for James Cook University Cairns Campus to incorporate the adjoining 13ha site as a Science & Technology Park. ***Stafford Moor & Farrington/Herring Daw/Babcock Brown***
1995-1998	*Geological investigation of the proposed Cairns regional land-fill site at Springmount Road, Mareeba.* ***James Cook University***
	Co-authored an environmental impact study for an eco-tourism development on Restoration Island, Cape York. Approval August 1996, ratified by the Planning & Environment Court in February 1998. ***Longboat Investments P/L***
1994-1995	*Undertook corporate advisory work including corporate divestment, equity raisings, mergers & acquisitions, and preparation of appropriate information memoranda.* ***Corporate Advisory Services Pty Limited***
1991-1993	*Freelance land economist, industrial futures analyst, AGL industrial parks* ***Australian Gaslight Company***
	Freelance land economist: Relocation and redevelopment of a number of obsolete ambulance stations resulting in a new for old exchange overall. ***Stafford Moor & Farrington/Sydney Health***
1988-1991	*Managing Partner of the North Sydney professional office of international property consultants* ***Hillier Parker****, with a staff of 30, including architects, engineers and quantity surveyors. A key role was the provision of timely advice to institutional clients as to the most appropriate time to refurbish prime and fringe CBD, retail and hi-tech industrial investments in order to maximise occupancy and yield. NSW State Partner in Sydney City office responsible for industrial real estate agency and consultancy activities in NSW*
1985-1988	*Industrial Director,* ***Richardson & Wrench Ltd****, Sydney City HO. Primary responsibilities for the industrial and tourism and leisure divisions*
1964-1985	*Various consultancy activities and employment, including private investment and development; including the acquisition and planning for an ecotourism*

*resort on **Restoration Island**, Cape York Peninsula; Establishment of a **Scuba-diving destination in Rabaul**, PNG Islands; Management of several tourism related businesses in Rabaul, including a 40 room resort hotel; Owner/builder/operator of 'what is now' **Bloomfield Wilderness Lodge** on Cape York Peninsula, Principal of **Curtis Industrial Brokers** in Sydney; NSW Industrial Manager of **Raine & Horne Limited** in Sydney; **L J Hooker franchisee in Cairns**; and 8 years as a valuer and sales and leasing negotiator in the industrial department of **L J Hooker Limited**, Sydney City HO*

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