APPENDIX U

Forestry Assessment

CLIENTS | PEOPLE | PERFORMANCE

Hansen Bailey Pty Ltd

Report for Coalpac Consolidation Project

Forestry Assessment

December 2011

This Coalpac Consolidation Project Forestry Assessment *("Report"):*

1. *has been prepared by GHD Pty Ltd ("GHD") for Hansen Bailey Pty Ltd;*
2. *may only be used for the purpose of providing an economic impact assessment of the specified parts of Ben Bullen State Forest as described in this report.*

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- *The vegetation stratification and species lists (completed by Cumberland Ecology Pty Ltd) are correct and associated area statements provided by Hansen Bailey are accurate;*
- *Economic evaluation is based on information provided to GHD from external sources, and has not been independently verified; and*
- *A limited number of inventory plots.*

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Abbreviations

ESFM	Ecologically Sustainable Forest Management
dbhob	Diameter at breast height over bark
sedub	Small end diameter under bark
SF	State Forest

Vegetation Stratification Classes

CRBA	Capertee Rough-barked Apple - Red Gum - Yellow Box Grassy Woodland
CPRS*	Cox's Permian Red Stringybark – Brittle Gum Woodland
EBMS*	Exposed Blue Mountains Sydney Peppermint – Silver Top Ash Shrubby Woodland
TSBG	Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest
TGRG*	Tableland Gully Ribbon Gum – Blackwood – Apple Box Forest
TSGN	Tableland Scribbly Gum – Narrow Leaved Stringybark Shrubby Open Forest

* these strata have been combined in this report for forest inventory / management purposes

1. GHD Scope of Work

GHD has been appointed by Hansen Bailey Pty Ltd to undertake a forestry assessment for the Coalpac Consolidation Project (the Project). The forestry assessment will support an economic impact study being prepared for a Project Approval Application under Part 3A of the *Environmental Planning and Assessment Act 1979 (*EP&A Act), to consolidate the operations and management of the Cullen Valley Mine and Invincible Colliery under a single, contemporary planning approval (Hansen Bailey 2010).

The specific GHD scope of work as described in the project brief requires:

- *A review of previous literature for the Ben Bullen State Forest to assist in determination of past forestry value (if any)*; and
- *The assessment of the maximum potential of the areas of the Ben Bullen State Forest located within the project boundary as a commercial forestry resource. This assessment is to describe the potential highest value of forestry that could be harvested sustainably per year, the net and gross dollar value of such a yield as well as any likely limitations for each (for each of present value and recovery period after mining).*

The approach utilised by GHD in undertaking this forestry assessment has included:

- Conducting enquiries with Forests NSW personnel in relation to forest management planning, harvesting activities, and the local and regional markets for forest products;
- A review of available and relevant Forests NSW Forest Management documentation;
- Field assessment, sampling and measurement of the Ben Bullen State Forest within the Project Boundary utilising initial vegetation community information prepared by Cumberland Ecology Pty Ltd and provided by Hansen Bailey;
- Conducting enquiries of local and regional processors of native forest material to verify information on timber specification and quality requirements, species utilised, financial information and volumes utilised; and
- Estimation of the available commercial forest resource within the Project Disturbance Boundary based on the above information, site physical constraints and a series of assumptions subsequently detailed.

1.1 Limitations

- Time limitations allocated for field work resulted in a smaller than optimal number of plots being established per initial vegetation class;
- As a consequence of the pattern of distribution of the vegetation types, the difficulty of locating vegetation type boundaries in the field, and limited track access within the assessment area, a fully randomised plot selection process was not possible;
- Vegetation type classifications and boundaries were revised by Cumberland Ecology Pty Ltd and Hansen Bailey after the inventory was undertaken. This has required a number of the revised vegetation types to be combined to produce a “composite” vegetation type in order to accommodate the field data obtained;

- The species list in the previously identified vegetation communities (completed by Cumberland Ecology Pty Ltd) are not definitive of all the species present or recorded at particular locations; and
- No in-depth review of previous land use or management activities has been undertaken as part of this project.

2. Background to the Project

Coalpac Pty Ltd (Coalpac) is a privately owned Australian company involved in the mining, processing and marketing of domestic thermal coal. Coalpac currently operates the Invincible Colliery and the Cullen Valley Mine. These mining operations are located adjacent to the Castlereagh Highway approximately 25 km north west of Lithgow, in the Central West of NSW.

If approved, the Project would allow coal mining operations largely within Coalpac's current mining authorities to continue for a further period of 21 years.

This proposed Project requires the following:

- The continuation of mining operations at the Cullen Valley Mine via both open cut and highwall mining methods;
- The continuation of mining operations at the Invincible Colliery, and an extension north via open cut and highwall mining methods in order to access additional coal resource;
- The consolidation and extension of the existing Cullen Valley Mine and Invincible Colliery operations;
- The continuation of coal supply to the local MPPS via a dedicated coal conveyor over the Castlereagh Highway (to be constructed), and (emergency supply to) Wallerawang Power Station (via road), with flexibility for supply to additional domestic destinations and Port Kembla for export;
- Upgrades to existing administration, transport and other infrastructure;
- The construction and operation of additional Offices at Cullen Valley Mine;
- The construction and use of the previously approved CDP at Cullen Valley Mine;
- The construction and use of a new CDP at East Tyldesley, incorporating the Cullen Valley CDP;
- The construction and use of a bridge over the Castlereagh Highway to link operations east and west of the highway and the development of required access roads to the East Tyldesley area;
- The construction and operation of a bridge and haul road across the Wallerawang - Gwabegar Railway line to permit access to mine the previously approved Hillcroft resource;
- The extraction of the Marangaroo Sandstone horizon from immediately below the Lithgow Coal Seam in the northern coal mining area of Cullen Valley Mine;
- The construction of a rail siding and associated infrastructure to permit transport of coal and sand products;
- The integration of water management infrastructure on both sites into a single system; and
- The integration of the management of mine rehabilitation and conceptual final landform outcomes for Cullen Valley Mine and Invincible Colliery.

A large proportion of the area required for the proposed Project activities falls within the Ben Bullen State Forest, publicly owned land managed as State Forest. The Project will require removal of some sections of this forest for infrastructure and open cut mining purposes.

An economic assessment and cost benefit analysis of the Project will be undertaken as part of the supporting Environmental Assessment. This forest economic assessment will provide inputs into the broader project economic assessment.

3. Description of the Project Area

3.1 Location

The area assessed as part of the forest economics assessment consists of part of the Ben Bullen State Forest (SF # 434). It straddles the Castlereagh Highway approximately 25km north west of Lithgow. The assessment area (referred to in Project documentation as the 'Project Disturbance Boundary') occurs to the north and east of the Cullen Bullen township (refer Figure 1) and is confined to areas proposed to be mined via open cut techniques. The forest assessment was undertaken over an area of approximately 750 hectares.

3.2 Topography

The assessment area occurs to the west of and immediately adjacent to the Great Dividing Range. The altitude of the sites assessed ranged between 890m and 980m above sea level.

The area is characterised by steep outcrops of remnant sandstone escarpment, separated by ridges and more gently sloping and undulating lands.

3.3 Climate

The climate is considered cool-temperate, characterised by mild summers and cold winters. Cullen Bullen (the nearest residential settlement) has an average summer temperature of 16.5 C° (with a maximum of 35.1 C°) and an average winter temperature of 5.1 C° (with a minimum of -9.4 C°) (OzArk 2007).

Rainfall is greatest in the summer periods, often accompanied by high intensity storms. Mean annual rainfall recorded at Lidsdale weather station (#063132), (1959-2010), approximately ten kilometres south of Ben Bullen State Forest (SF) was 766 mm (Bureau of Meteorology 2011).

3.4 Geology and Soils

The area is located within the Western Coalfields of NSW and is underlain by sedimentary materials (sandstones and shales) associated with the Sydney Basin (Hansen Bailey 2010).

Soils ranged from shallow and skeletal material on the ridge tops through to deeper, heavier clay dominated profiles on the flats and lower lying country.

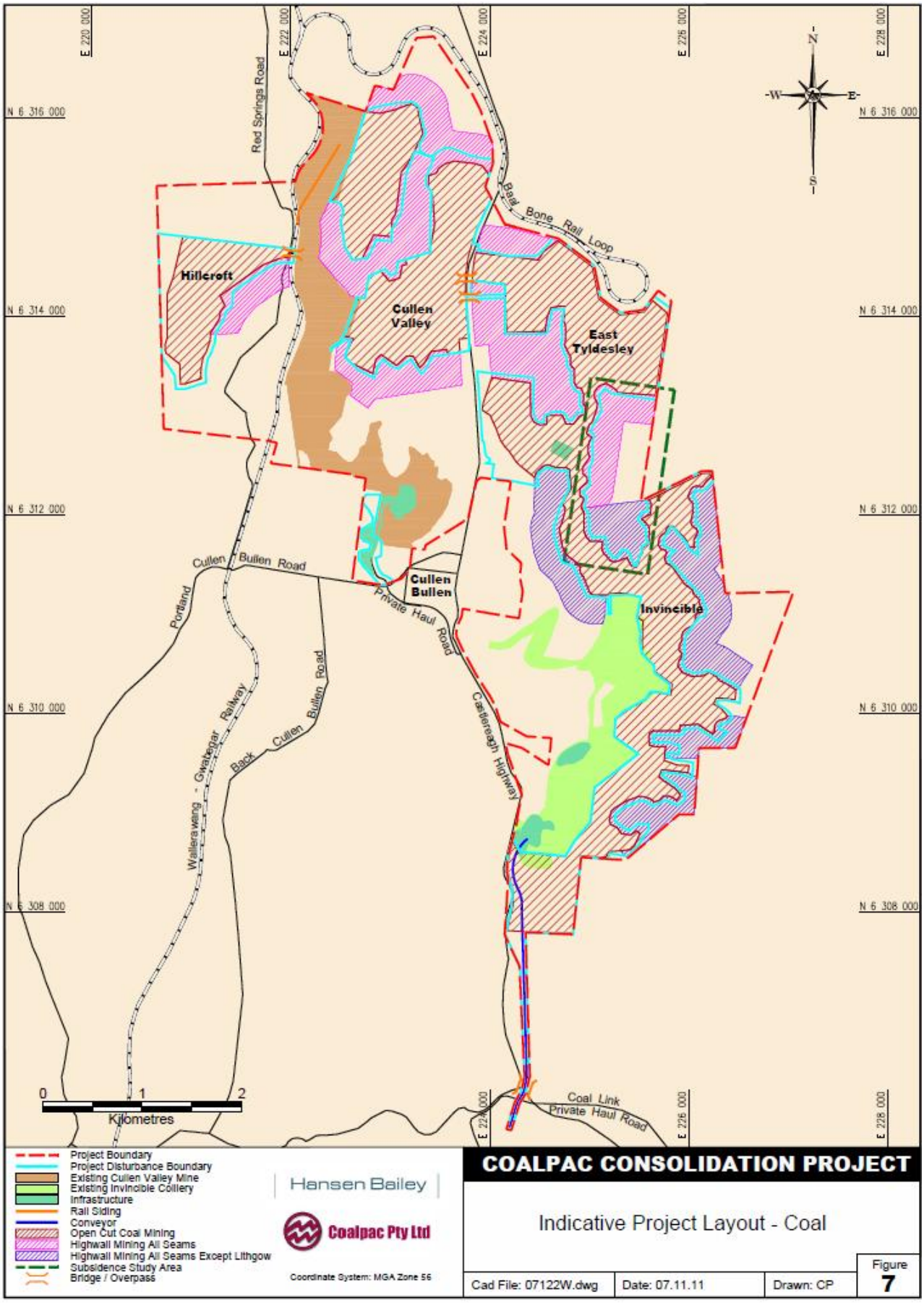

Figure 1 Indicative Project Layout

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3.5 Vegetation Communities

Thirteen native plant communities have been identified in the Project Boundary (Cumberland Ecology 2011). Six of these were considered relevant to the forest assessment and are as follows:

- Tableland Gully Ribbon Gum – Blackwood – Apple Box Forest;
- Capertee Rough-barked Apple - Red Gum - Yellow Box Grassy Woodland;
- Tableland Scribbly Gum – Narrow Leaved Stringybark Shrubby Open Forest / Woodland;
- Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest;
- Cox's Permian Red Stringybark – Brittle Gum Woodland; and
- Exposed Blue Mountains Sydney Peppermint – Silver Ash Shrubby Woodland.

A number of other vegetation communities (or derived communities) were present within the Project Boundary but were not assessed as part of this study due to their small area, absence of commercial timber species (shrublands or grasslands) or inaccessibility (Pagoda shrubland).

A map showing the revised vegetation communities is presented in Appendix A. The forest assessment and sampling strategy utilised vegetation community mapping, as described in more detail in Section 7.

3.6 Tree Species

The tree species present in the previously identified and described vegetation communities that are relevant to the forestry assessment are presented in Table 1. It should be noted that:

- This species list is not definitive of all species present or recorded at a particular location. A number of species (particularly stringybark species) were widespread and found in a variety of vegetation communities including the Tableland Scribbly Gum vegetation community.
- *Acacia falciformis* occurred as a small tree at a number of sites but was not considered to be a commercial tree species.

3.7 Fire History

No recent (within the last three years) evidence of fire was observed during field inspections (Figure 2). There was however evidence of fire across the majority of the assessment area. The most recent fire observed to have occurred was in the area to the west and immediately adjacent to the Cullen Bullen Garbage Depot.

Some fires appear to have been reasonably intense and in some cases have contributed to significant scarring of the trees. These fire scar injuries have a significant impact on wood quality of the affected trees. Fire damage has the potential to influence the commerciality of a forest estate.

Figure 2 Example of a fire scar affecting forest commerciality

Table 1 Vegetation Communities and Tree Species present

Vegetation Community	GHD Forest Assessment Code	Dominant / Indicator Tree Species	Co-dominant Tree Species described in previous Vegetation Community Characterisation
Tableland Gully Ribbon Gum – Blackwood – Apple Box Forest	TGRG	*Eucalyptus viminalis, E. bridgesiana*,	*E. cannonii, E. sieberi, E. blaxlandii*
Capertee Rough-barked Apple - Red Gum - Yellow Box Grassy Woodland	CRBA	*E. blakelyi, E. bridgesiana, E. melliodora*	*E. dalrympleana, E. rubida, E. mannifera, E. praecox*
Tableland Scribbly Gum – Narrow Leaved Stringybark Shrubby Open Forest / Woodland	TSGN	*E. rossii*	
Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest	TSBG	*E. mannifera, E. dives, E. rossii,*	*E. bridgesiana*
Cox's Permian Red Stringybark – Brittle Gum Woodland	CPRS	*E. macroryncha, E. mannifera*	*E. rossii, E. dives*
Exposed Blue Mountains Sydney Peppermint – Silver Ash Shrubby Woodland	EBMS	*E piperita, E. sieberi*	*E. cannonii,*

4. Previous Land Uses

No in-depth review of previous land use or management activities has been undertaken as part of this assessment. However, the field assessments undertaken allowed the following observations to be made in relation to the management of lands and forest within the Ben Bullen SF assessment area and the adjoining lands.

4.1 Grazing

Evidence of previous livestock grazing throughout Ben Bullen SF was found at numerous locations, principally in the form of old fencing material. A number of vegetation communities within the Project Boundary contain grassy understorey species and a range of herbs, forbs and shrubs which would have been capable of supporting limited numbers of livestock.

Observed fire damage may have been associated with past grazing practices utilising fire to manipulate and stimulate the regrowth of palatable understorey vegetation.

4.2 Timber Harvesting

Widespread evidence of low intensity historical timber harvesting (primarily the selective removal of individual trees) was observed within the assessment area (Figure 3). Timber harvesting activities have been concentrated in areas which are easily accessible in terms of tracking and slope, and which contain sufficient individuals of commercial tree species. Significant parts of the Project Boundary do not match these criteria and have therefore not been impacted upon by harvesting.

The products sought in previous timber harvesting operations (based on the stumps observed) appear to fall into three main categories:

1. *Mining timbers (mine props)* – relatively small diameter (generally less than 25 cm diameter at breast height). Harvested from straight trees or straight sections of tree which meet minimum length requirements. Favoured species appear to have been Stringybark and Sydney Peppermint;
2. *Larger sawlog material* – primarily Stringybark, Sydney Peppermint, Ribbon Gum and Silvertop Ash; and
3. *Firewood* – a variety of species, both standing and fallen trees have been removed for firewood. The extent of this activity has generally been limited to within 20 metres of current access tracks.

Figure 3 Evidence of Timber Harvesting (firewood cutting)

5. Current Land Use

5.1 Grazing

An area enclosed by a relatively intact and serviceable fence immediately to the east of the Castlereagh Highway appears to be the only part of the assessment area inspected within Ben Bullen SF capable of containing and supporting livestock. No evidence of recent grazing was observed.

5.2 Commercial Timber Harvesting

Ben Bullen SF is managed as part of the Forests NSW Macquarie Region. The forest is classified as 'Zone 4 - General Management' (refer Appendix B).

No evidence of recent commercial timber harvesting operations was observed.

Under NSW silvicultural guidelines, commercial timber harvesting undertaken in the forest would involve single tree selection or group selection. The forest is managed as a series of uneven aged stands and no specific rotation age was applicable.

5.3 Firewood Removal

The Ben Bullen SF is available for domestic firewood collection by members of the public based on a minor forest product permit system managed by Forests NSW https://firewood.sf.nsw.gov.au.

Widespread removal of firewood has occurred and continues to occur throughout large parts of the assessment area. An informal network of tracks and trails occurs throughout many of the more accessible areas. Based on the observations made during the site assessment it is concluded that firewood currently constitutes the most significant volume of forest product extracted from Ben Bullen SF.

6. Regional Forest Products Industry

The regional forest products industry is dominated by softwood plantation production within the Macquarie region. Products from softwood plantations are processed in regional centres such as Oberon, Bathurst, Tumut, and Sydney. Over the past three years log exports have also become a significant market for softwood timber. A number of regional softwood processing facilities are capable of processing an annual intake in excess of 600,000 m^3.

The native forests of NSW are managed on the basis of sustainable economic use and ecologically sustainable forest management (ESFM) principles maintaining a permanent native forest estate whilst balancing the requirements of timber production, non- wood products, tourism, water catchment, recreation and nature conservations. Native forest management west of the Great Dividing Range is managed by the State Forest's Western Region, based at Dubbo (Forests NSW, 2008).

The native forest industry in the Western Region is a relatively minor contributor to the regional economy and largely based on the White Cypress Pine industry; with nine timber mills being reliant on their sawlog supply from State forests (Forests NSW, 2008). These mills vary in their intake from 400 m^3 to 20,000 m^3 per annum. A number of these mills and additional mobile sawmills also source resource from private property owners.

Native forest timber products produced in the Western Region include White Cypress Pine sawlogs and posts, hardwood sawlogs, posts, pit props, firewood, broombush and craftwood.

The native forest industry located in the Lithgow area including Ben Bullen SF is considered small in scale. The industry draws upon material sourced from a number of native forest areas over a wide geographic range.

6.1 Native Forest Products & Stumpages

Potential products which may be harvested from Ben Bullen SF include sawlogs for construction purposes, mine prop material for use in underground mining operations, firewood and fuel wood. A range of stumpage values for each product type is presented in Table 2. The term 'allocated stumpage' represents the value used in subsequent economic calculations.

Table 2 Native Forest Product Stumpages

Product	Lower Range ($/m^3 ex GST)	Upper Range ($/m^3 ex GST)	Allocated Stumpage ($/m^3 ex GST)
High Quality Sawlog (Stringybark/Silver Top Ash)	N/A	41.75#	41.75
High Quality Sawlog (Other Species)	19.85#	29.35#	24.60
Low Quality Sawlog (All Species)	N/A	12.94#	12.94
Mine Props (Stringybark/Silver Top Ash/Peppermint)	N/A	20.2#	20.2
Fire Wood (All Species)	8[1]	25[1]	12.5
Fuel Wood (All Species)	8.3[2]	12.5[2]	12.5

Information Sources:
State Forests NSW Stumpage Matrix (as at 30 June 2011)
1 State Forest Firewood Internet Sales (as at 30 June 2011)
2 State Forest personal communication (as at 30 June 2011)

Notes on Allocated Stumpages:

High Quality Sawlog (Stringybark/Silvertop Ash)	Applied SF Matrix
High Quality Sawlog (Other Species)	Applied the mean of the range from SF Matrix
Low Quality Sawlog (All Species)	Applied SF Matrix
Mine Props	Applied SF Matrix
Fire Wood/Fuel Wood Wood.	Applied lower range Fire Wood and High Range Fuel

Whilst individual one cubic metre firewood permits cost $25/m^{3,} this figure was not considered achievable on a high volume scale across a range of firewood quality species. This report has assumed that fire wood/fuel wood be treated as an interchangeable utilisation option and attributed one figure to both options.

Product Specifications:

Conversion of m^3 to metric tonnes: 1 m^3 = 1.2 tonnes

Minimum Sawlog Diameter: 20 cm sedub

Minimum Sawlog Length: 2.4 metres

Minimum Pit Prop Diameter: 10 cm sedub

Minimum Pit Prop Length: 3.0 metres

6.2 Native Forest Processing

The nearest native forest sawmillers holding timber licences and permits to source material from State Forests are located at Lithgow and Rhylstone (Kandos).

Pit props are sold directly to the mines and sourced by independent forestry contractors.

Firewood is sold directly to the public under the minor forest products permits (Forestry Act Section 30 I). In addition large wholesale firewood contractors negotiate direct agreements with State Forests.

As a consequence of increased demand for softwood pulpwood by the Visy cardboard manufacturing plant at Tumut and recent trends to export low quality sawlogs from softwood plantations in the Macquarie region, the competition for softwood fuel wood to maintain industrial boiler systems has increased.

7. Forest Assessment

7.1 Sampling Methodology

GHD completed a field inventory of the site between 20th June 2011 and 23rd June 2011.

An initial site familiarisation was conducted with the assistance of the Coalpac Environmental Manager Greg Lamb.

The assessment area was initially stratified and mapped into a series of vegetative communities by Cumberland Ecology Pty Ltd. These stratified vegetation types and their corresponding area statements were used as the basis of GHD's sampling methodology. GHD has not independently verified the accuracy of the vegetation stratification or the associated area calculations.

A series of fixed area (0.05 hectare) circular plots were established within each of the major stratification types considered to contain potentially commercial timber with the plot radius being adjusted for slope conditions.

As a consequence of the pattern of distribution of the vegetation types, the difficulty of locating vegetation type boundaries in the field, and limited track access within the assessment area, a fully randomised plot selection process was not considered appropriate. Instead plots were located by navigating into the vegetation type along the track system and then selecting a side of the access road to sample and a distance from the access road (between 20 and 100 metres) using random numbers. In some instances it was necessary to traverse more than 100 metres to access the targeted vegetation type, random numbers were utilised to determine the final plot location.

At each sample point every tree of the eucalypt species with a diameter at breast height over bark (dbhob) of 15 cm or greater was assessed for species, dbhob, log quality and length, crown break and tree height.

7.1.1 Stratification of Reference Area

A summary of the stratification and sampling intensity achieved within the 2.5 days available for field assessment is presented in Table 3. A map showing the location of sampling plots is presented in Appendix C.

It should be noted that the vegetation community information and stratification data presented in Table 3 is based on the revised stratification information rather than the initial information used in the assessment. Five vegetation communities were sampled. As a result of the revised stratification it has been necessary to produce a 'composite' vegetation community in order to accommodate the sampling data and undertake subsequent analysis.

Table 3 Vegetation Stratification Summary

Vegetation Stratification (GHD Code)	Key Vegetation Community Features	Hectares present within the assessment area	% of assessment area	Number of sample plots
Tableland Slopes Brittle Gum - Broad leaved Peppermint Grassy Forest (TSBG)	Open forest with canopy height 20 to 25m. Occurs on gentle foot slopes with westerly or northerly aspect. Sparse shrub layer.	185.8	23.1%	5
Tableland Gully Ribbon Gum - Blackwood -Apple Box Forest (TGRG)*	Tall open forest in the low points of steep sided gullies and on some steep eastern slopes. Canopy height 20 to 30m. Small tree layer, sparse shrubs and 'macropod lawn'.	93.9	11.7%	3
Exposed Blue Mountains Sydney Peppermint -Silver Ash Shrubby Woodland (EBMS)*	Woodland to open forest located at the top of gullies, below escarpments and in wetter sheltered aspects. Small tree layer, with bracken.	370.4	46.2%	7
Tableland Scribbly Gum - Narrow Leaved Stringybark - Shrubby Open Forest (TSGN)	Open forest to woodland located at the highest points in the landscape on low fertility soils. Shrub layer present..	112.5	14.0%	3
Cox's Permian Red Stringybark – Brittle Gum Woodland (CPRS)*	Low growing open woodland on exposed escarpment slopes and ridges. Inconsistent understorey.	23.7	3.0%	0
Capertee Rough Barked Apple - Red Gum - Yellow Box Grassy Woodland (CRBA)	Grassy woodland located on valley floors and lower hillsides in broad flat areas. Canopy height 10 to 22m. Variety of shrubs and herbs in understorey	16.2	2.0%	3
		802.6	**100%**	**21**

** denotes that these strata have been combined in this report for forest inventory / management purposes*

7.2 Tree Volume Estimations

The following Bi & Hamilton (1998) equation was used to estimate stem volume:

$$V = a + bD^2H + b_2D^2H^2 + a_1D + a_2H \qquad (1)$$

Where:

V = Underbark stem volume

a = Coefficient b

b = Coefficient a

D = Diameter at breast height over bark

H = Total tree height

The Cao and Burkhart equation (Bi 1999) was used to allocate log volumes within a stem.

$$R_h = 1 + a_1 \frac{(1-h)^{a2}}{TH^{a3}} \qquad (2)$$

Where:

R_h = Volume ratio at relative height h

$a_{1,2,3}$ = Coefficients

The Cao and Burkhart equation (2) was used to predict stem or log volumes to any height limit. The stem volume of trees was estimated using equation 1.

7.2.1 Assumptions

The following assumptions regarding losses or discounts have been factored into volume and value estimations.

Harvest Smash

A discount of 5% of merchantable volume has been applied to accommodate harvest smash and additional docking to waste. No value has been attributed to waste.

Pipe and Decay

Pipe and decay was observed throughout the Project Boundary and was evident on the majority of cut stumps and logs witnessed during the assessment (Figure 4). These observations were discussed with local sawmillers, however the millers were reluctant to nominate an average level of defect that could be attributed to the volume estimations. High quality logs that exceed maximum defect levels prepared by State Forests are downgraded to Low Quality logs at the mill yard. This practice provides the sawmiller with some degree of relief from the effects of defects. A number of stumps were assessed during the inventory process in an attempt to quantify likely defect levels, whilst acknowledging that defect at a stump level may not continue through the entire log section. A defect level of 20% has been assumed across all products.

Figure 4 Internal Decay (CRBA)

Net Productive Areas

Gross productive areas are subject to discounting due to the effects of certain areas being unavailable to harvest as a consequence of factors such as watercourse buffers, rock outcrops, biodiversity and heritage buffers and steep topography precluding the use of ground based harvesting equipment. It was beyond the scope of this project to identify potential net areas available for harvesting coupes in order to estimate the effects of exclusions; we have assumed a gross area to net area discount factor that we have applied to all areas. This figure is based on a notation contained within the Ecologically Sustainable Forest Management plan for the Western Region, NSW DPI (2008). We acknowledge that in certain vegetation stratifications such as the Exposed Blue Mountains Sydney Peppermint - Silver Ash Shrubby Woodland the percentage of area affected by steep topography and unavailable to harvest may exceed this nominated figure.

A gross productive area discount of 10% has been applied across all vegetation types.

8. Volume and Value Estimations

Volume and Value estimations have considered two scenarios:

1. A Salvage Scenario, where all accessible timber products within the Project Boundary are recovered during a pre-clearing salvage harvest operation; and
2. A Sustained Yield Scenario, where the current status of management of the forest is ongoing, with a planned sustainable harvest scheduled to occur within an immediate timeframe and under the forest's current condition. Subsequent to this harvest, it is envisaged that the forest would not be re-harvested within a nominal 50 year life cycle or rotation.

8.1 Salvage Scenario

The following table outlines the estimated volume of timber products potentially available from a salvage harvesting operation.

Note: a discounted productive area has been applied to estimate volumes, and volume reductions due to harvest smash and defects have also been applied.

Table 4 Estimated Volume per Stratification Class - Salvage

Veg class	Stratification area	High Quality (Stringy bark)	High Quality (other)	Low Quality (mine props)	Low Quality (salvage log)	Firewood/ Fuelwood	Total Volume
	(ha)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)
TSBG	185.8	1,246	84	462	833	4,937	**7,562**
TGRG + EBMS + CPRS	488.1	3,814	308	1,724	5,354	14,121	**25,321**
TSGN	112.5	192	22	358	255	3,172	**4,000**
CRBA	16.2	35	47	49	134	472	**736**
Totals	**802.6**	**5,287**	**461**	**2,593**	**6,576**	**22,702**	**37,619**

Table 5 outlines the estimated gross value of timber products potentially available from a salvage harvesting operation by applying the attributed stumpage values outlined in Table 2.

Table 5 Value Estimates - Salvage

Veg class	High Quality (Stringy bark)	High Quality (other)	Low Quality (mine props)	Low Quality (salvage log)	Firewood/ Fuelwood	Total Value
	($)	($)	($)	($)	($)	($)
TSBG	52,002	2,065	9,338	10,777	61,711	**135,893**
TGRG + EBMS + CPRS	159,255	7,579	34,831	69,276	176,510	**447,450**
TSGN	7,998	549	7,238	3,306	39,648	**58,739**
CRBA	1,472	1,145	980	1,731	5,902	**11,230**
Totals	**220,728**	**11,339**	**52,387**	**85,089**	**283,771**	**653,314**

Table 6 outlines estimated operational costs associated with conducting a salvage harvesting operation.

Table 6 Cost Estimates - Salvage

Veg class	Planning	Road construction	Road construction supervision	Harvest supervision	Road rehabilitation	Rehabilitation supervision	Total costs
	($)	($)	($)	($)	($)	($)	($)
TSBG	6,000	24,000	3,600	8,725	8,000	2,400	**52,725**
TGRG + EBMS + CPRS	6,000	24,000	3,600	29,217	8,000	2,400	**73,217**
TSGN	6,000	24,000	3,600	4,615	8,000	2,400	**48,615**
CRBA	6,000	12,000	3,600	850	4,000	2,400	**28,850**

Table 7 outlines estimated net value of conducting a salvage harvesting operation.

Table 7 Estimated Net Value - Salvage

Veg class	Estimated Gross Value ($)	Estimated Operational Costs ($)	Estimated Net Value ($)
TSBG	135,893	52,725	**83,169**
TGRG + EBMS + CPRS	447,450	73,217	**374,233**
TSGN	58,739	48,615	**10.125**
CRBA	11,230	28,850	**-17,619**

8.2 Sustainable Yield Scenario

The following table outlines the estimated volume of timber products potentially available from a sustainable yield harvesting operation. It assumes that all trees greater than 40 cm dbhob and all trees that contain a salvage log or mill prop are harvested within the next two years on a nominal 50 year harvest cycle.

Note: a discounted productive area has been applied to estimate volumes, and volume reductions due to harvest smash and defects have also been applied.

Table 8 Estimated volume per stratification class – Sustainable Yield

Veg class	Stratification area (ha)	High Quality (Stringy bark) (m^3)	High Quality (other) (m^3)	Low Quality (mine props) (m^3)	Low Quality (salvage log) (m^3)	Firewood/ Fuelwood (m^3)	Total Volume (m^3)
TSBG	185.8	650	0	462	833	1529	**3,474**
TGRG + EBMS + CPRS	488.1	3,325	201	1,724	5,354	7,439	**18,044**
TSGN	112.5	0	0	358	255	792	**1,406**
CRBA	16.2	0	30	49	134	120	**332**
Totals	**802.6**	**3,975**	**231**	**2,593**	**6,576**	**9,880**	**23,255**

Table 9 outlines the estimated gross value of timber products potentially available from a sustainable harvesting operation by applying the attributed stumpage values outlined in Table 2.

Table 9 Value Estimates – Sustainable Yield

Veg class	High Quality (Stringy bark)	High Quality (other)	Low Quality (mine props)	Low Quality (salvage log)	Firewood/ Fuelwood	Total value
	($)	($)	($)	($)	($)	($)
TSBG	27,128	0	9,338	10,777	19,108	**66,351**
TGRG + EBMS + CPRS	138,812	4,957	34,831	69,276	92,992	**340,867**
TSGN	0	0	7,238	3,306	9,902	**20,445**
CRBA	0	728	980	1,731	1,496	**4,935**
Totals	**165,940**	**5,685**	**52,387**	**85,089**	**123,498**	**432,599**

Table 10 outlines estimated operational costs associated with conducting a sustainable harvesting operation.

Table 10 Cost Estimates – Sustainable Yield

Veg class	Planning	Road construction	Road construction supervision	Harvest supervision	Road rehabilitation	Rehabilitation supervision	Total costs
	($)	($)	($)	($)	($)	($)	($)
TSBG	6,000	20,000	3,600	11,909	8,000	2,400	**51,909**
TGRG +EBMS +CPRS	6,000	20,000	3,600	61,864	8,000	2,400	**101,864**
TSGN	6,000	20,000	3,600	4,820	8,000	2,400	**44,820**
CRBA	6,000	10,000	3,600	1,137	4,000	2,400	**27,137**

Table 11 outlines estimated net value of conducting a salvage harvesting operation.

Table 11 Estimated Net Value – Sustainable Yield

Veg class	Estimated Gross Value ($)	Estimated Operational Costs ($)	Estimated Net Value ($)
TSBG	66,351	51,909	**14,442**
TGRG + EBMS + CPRS	340,867	101,864	**239,003**
TSGN	20,445	44,820	**-24,375**
CRBA	4,935	27,137	**-22,202**

8.3 Factors Influencing Net Value

8.3.1 Product and Area Losses

As discussed in Section 7.2.1 a number of losses or discounts have been factored into the above estimations to account for harvest smash and additional docking during the felling process, losses due to the effects on internal defects and rot; the level of defect is largely unknown until the tree is harvested.

Area losses have been applied due to Code of Forest Practice requirements regarding the exclusion of water courses and areas of high heritage and biodiversity value. In addition ground based harvesting equipment is limited by steep slopes and rock outcrops. Area losses are also likely to be affected by restrictions imposed by mine development. For example, even though an area may be subject to highwall mining, the mine development processes may inhibit access to certain above ground areas.

8.3.2 Access Tracks and Roads

A number of key access tracks follow existing drainage lines and are likely to be non-compliant with the Ecologically Sustainable Management of State Forests documents (Forests NSW 2008). Relocation and construction of harvest tracks so as to avoid drainage features would be required for any significant harvesting and removal of forest product.

The key north-south access track in the eastern section of the reference area crosses over a ridge saddle at a gradient that is unsuited to timber trucks, this section of track would need to be re-aligned and reconstructed. Access to the forested areas to the east of the current mining operation may also prove challenging.

Estimated costs associated with this activity have been included in the Operational Costs, these operational costs assume that all harvesting will be conducted during dry weather conditions and that gravelling of roads and tracks will not be required.

9. Conclusions

Of the vegetation communities identified in the Project Boundary, five were considered of sufficient size to require forest assessment:

- Tableland Gully Ribbon Gum – Blackwood – Apple Box Forest (TGRG);
- Capertee Rough-barked Apple - Red Gum - Yellow Box Grassy Woodland (CRBA);
- Tableland Scribbly Gum – Narrow Leaved Stringybark Shrubby Open Forest / Woodland (TSGN);
- Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest (TSBG); and
- Exposed Blue Mountains Sydney Peppermint – Silver Ash Shrubby Woodland (EBMS).

A number of other vegetation communities identified within the Project Boundary were not assessed because they were considered too small or insufficiently economic to contribute to the timber volume estimations and to justify assessment.

The potential products which could be harvested from Ben Bullen SF include:

- High Quality Sawlog (Stringybark/Silvertop Ash);
- High Quality Sawlog (Other Species);
- Low Quality Sawlog (All Species);
- Mine Props; and
- Fire Wood/Fuel Wood

Volume and Value estimations have considered two scenarios, and are based on the potential products presented above:

1. A Salvage Scenario, where all accessible timber products on the project site are recovered during a pre-clearing salvage harvest operation; and
2. A Sustained Yield Scenario, where the current status of management of the forest is ongoing, with a planned sustainable harvest scheduled to occur within an immediate timeframe and under the forest's current condition. Subsequent to this harvest, it is envisaged that the forest would not be re-harvested within a nominal 50 year life cycle or rotation.

The volume calculations included assumptions regarding losses or discounts and have been factored into volume and value estimations. These include harvest smash (5% smash discount), stem pipe and decay (20% defect level discount), and net productive areas (10% of the area not available due to slope and terrain conditions).

A summary of the estimated net value for each vegetation class for the two management scenarios can be seen in Table 12 and Table 13.

Table 12 Estimated Net Value - Salvage

Veg class	Estimated Gross Value ($)	Estimated Operational Costs ($)	Estimated Net Value ($)
TSBG	135,893	52,725	**83,169**
TGRG + EBMS + CPRS	447,450	73,217	**374,233**
TSGN	58,739	48,615	**10.125**
CRBA	11,230	28,850	**-17,619**

Under the salvage scenario, the Capertee Rough-barked Apple - Red Gum - Yellow Box Grassy Woodland (CRBA) community, is not considered to be viable to harvest after factoring in the estimated operational costs of harvesting.

Table 13 Estimated Net Value – Sustainable Yield

Veg class	Estimated Gross Value ($)	Estimated Operational Costs ($)	Estimated Net Value ($)
TSBG	66,351	51,909	**14,442**
TGRG + EBMS + CPRS	340,867	101,864	**239,003**
TSGN	20,445	44,820	**-24,375**
CRBA	4,935	27,137	**-22,202**

Under the sustained yield scenario, the Capertee Rough-barked Apple - Red Gum - Yellow Box Grassy Woodland (CRBA) community and the Tableland Scribbly Gum - Narrow Leaved Stringybark - Shrubby Open Forest (TSGN) is not considered to be viable to harvest after factoring in the estimated operational costs of harvesting.

10. Site Photographs

A series of photographs are presented which show each of the vegetation classes sampled as well as other key features of the assessment area.

Figure 5 Existing Road (TGRG)

Figure 6 Capertee Rough-barked Apple - Red Gum - Yellow Box Grassy Woodland

Figure 7 **Exposed Blue Mountains Sydney Peppermint – Silver Ash Shrubby Woodland**

Figure 8 Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest

Figure 9 Tableland Gully Ribbon Gum – Blackwood – Apple Box Forest

Figure 10 Tableland Scribbly Gum – Narrow Leaved Stringybark Shrubby Open Forest

11. References

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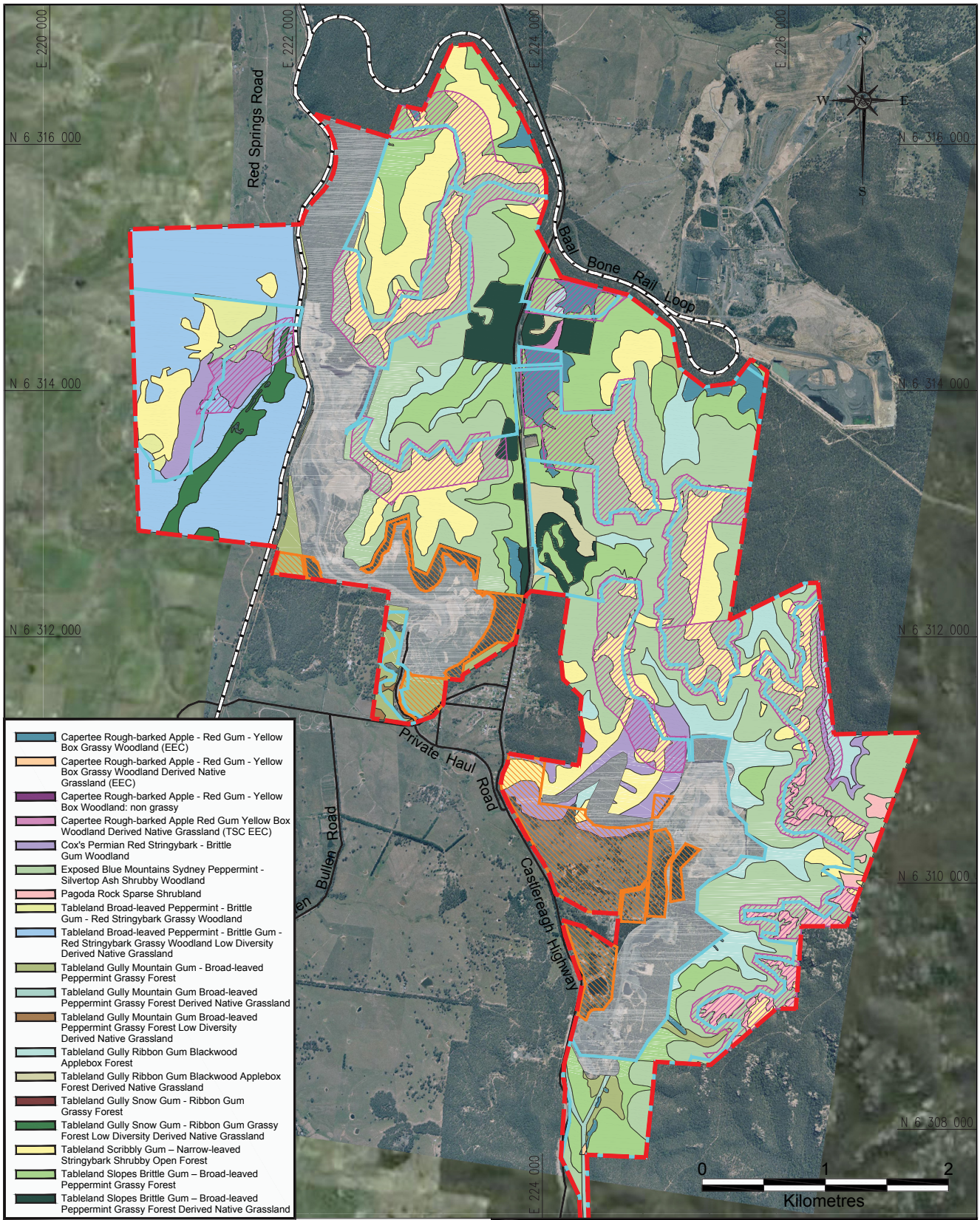
Appendix A

Map of Vegetation Communities

Cumberland Ecology / Hansen Bailey



- Capertee Rough-barked Apple - Red Gum - Yellow Box Grassy Woodland (EEC)
- Capertee Rough-barked Apple - Red Gum - Yellow Box Grassy Woodland Derived Native Grassland (EEC)
- Capertee Rough-barked Apple - Red Gum - Yellow Box Woodland: non grassy
- Capertee Rough-barked Apple Red Gum Yellow Box Woodland Derived Native Grassland (TSC EEC)
- Cox's Permian Red Stringybark - Brittle Gum Woodland
- Exposed Blue Mountains Sydney Peppermint - Silvertop Ash Shrubby Woodland
- Pagoda Rock Sparse Shrubland
- Tableland Broad-leaved Peppermint - Brittle Gum - Red Stringybark Grassy Woodland
- Tableland Broad-leaved Peppermint - Brittle Gum - Red Stringybark Grassy Woodland Low Diversity Derived Native Grassland
- Tableland Gully Mountain Gum - Broad-leaved Peppermint Grassy Forest
- Tableland Gully Mountain Gum Broad-leaved Peppermint Grassy Forest Derived Native Grassland
- Tableland Gully Mountain Gum Broad-leaved Peppermint Grassy Forest Low Diversity Derived Native Grassland
- Tableland Gully Ribbon Gum Blackwood Applebox Forest
- Tableland Gully Ribbon Gum Blackwood Applebox Forest Derived Native Grassland
- Tableland Gully Snow Gum - Ribbon Gum Grassy Forest
- Tableland Gully Snow Gum - Ribbon Gum Grassy Forest Low Diversity Derived Native Grassland
- Tableland Scribbly Gum – Narrow-leaved Stringybark Shrubby Open Forest
- Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest
- Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest Derived Native Grassland

- Project Boundary
- Project Disturbance Boundary
- Approved Coalpac Operations
- Highwall Mining
- Existing Conservation & Offset Areas

Hansen Bailey

Coalpac Pty Ltd

Coordinate System: MGA Zone 56
Source: Cumberland Ecology 2011

COALPAC CONSOLIDATION PROJECT

Vegetation Communities

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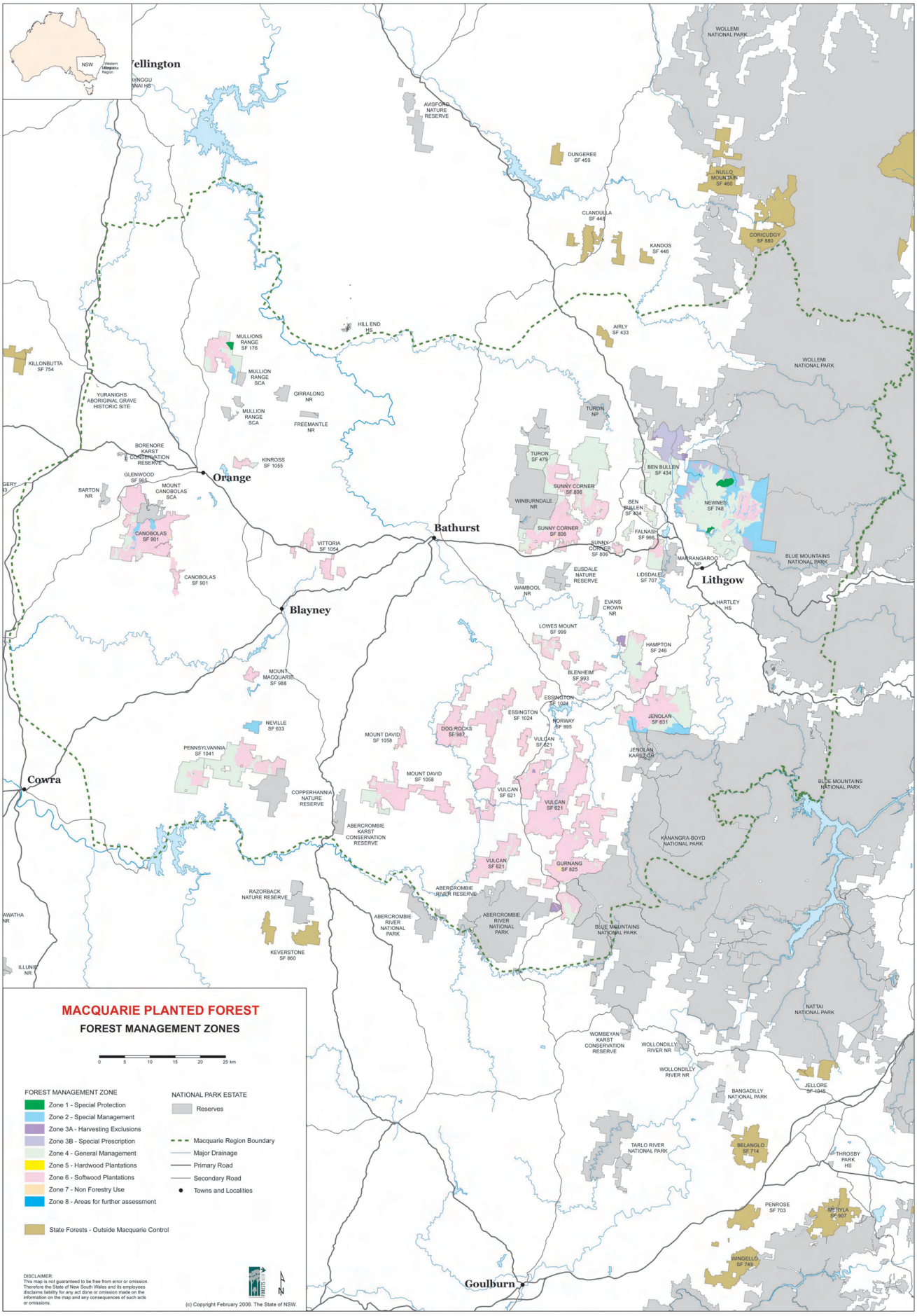
Appendix B

Forest NSW Map of the Macquarie Region


MACQUARIE PLANTED FOREST
FOREST MANAGEMENT ZONES
0 5 10 15 20 25 km
FOREST MANAGEMENT ZONE
Zone 1 - Special Protection
Zone 2 - Special Management
Zone 3A - Harvesting Exclusions
Zone 3B - Special Prescription
Zone 4 - General Management
Zone 5 - Hardwood Plantations
Zone 6 - Softwood Plantations
Zone 7 - Non Forestry Use
Zone 8 - Areas for further assessment
State Forests - Outside Macquarie Control
NATIONAL PARK ESTATE
Reserves
Macquarie Region Boundary
Major Drainage
Primary Road
Secondary Road
Towns and Localities
DISCLAIMER:
This map is not guaranteed to be free from error or omission. Therefore the State of New South Wales and its employees disclaims liability for any act done or omission made on the information on the map and any consequences of such acts or omissions.
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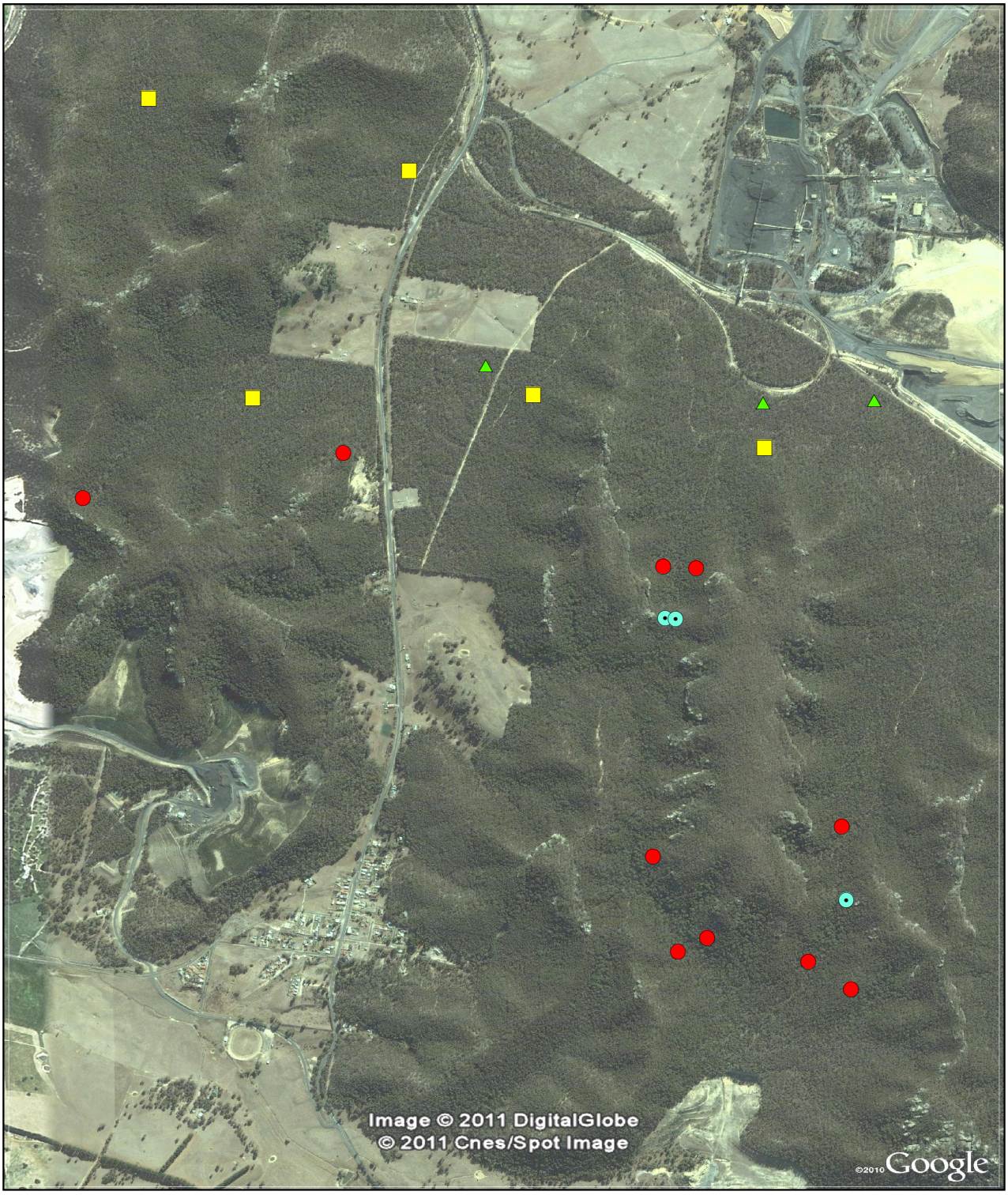
Orange
Bathurst
Blayney
Cowra
Lithgow
Goulburn
WOLLEMI NATIONAL PARK
BLUE MOUNTAINS NATIONAL PARK
KANANGRA-BOYD NATIONAL PARK
NATTAI NATIONAL PARK
BANGADILLY NATIONAL PARK
TARLO RIVER NATIONAL PARK
ABERCROMBIE RIVER NATIONAL PARK
ABERCROMBIE KARST CONSERVATION RESERVE
WOMBEYAN KARST CONSERVATION RESERVE
JENOLAN KARST CR
BORENORE KARST CONSERVATION RESERVE
COPPERHANNIA NATURE RESERVE
RAZORBACK NATURE RESERVE
EUSDALE NATURE RESERVE
AVISFORD NATURE RESERVE
MULLIONS RANGE SF 176
MULLION RANGE SCA
GIRRALONG NR
FREEMANTLE NR
KILLONBUTTA SF 754
YURANIGHS ABORIGINAL GRAVE HISTORIC SITE
KINROSS SF 1055
GLENWOOD SF 965
MOUNT CANOBOLAS SCA
BARTON NR
CANOBOLAS SF 901
VITTORIA SF 1054
HILL END HS
DUNGEREE SF 459
CLANDULLA SF 448
KANDOS SF 446
NULLO MOUNTAIN SF 465
CORICUDGY SF 880
AIRLY SF 433
TURON NP
TURON SF 475
WINBURNDALE NR
SUNNY CORNER SF 806
BEN BULLEN SF 434
NEWNES SF 748
FALNASH SF 965
LIDSDALE SF 707
MARRANGAROO NP
WAMBOOL NR
EVANS CROWN NR
HARTLEY HS
LOWES MOUNT SF 999
HAMPTON SF 246
BLENHEIM SF 993
ESSINGTON SF 1024
NORWAY SF 995
JENOLAN SF 631
MOUNT MACQUARIE SF 988
NEVILLE SF 633
PENNSYLVANNIA SF 1041
MOUNT DAVID SF 1058
DOG ROCKS SF 987
VULCAN SF 621
GURNANG SF 825
KEVERSTONE SF 860
ILLUNIE NR
AWATHA NR
WOLLONDILLY RIVER NR
JELLORE SF 1045
BELANGLO SF 714
THROSBY PARK HS
PENROSE SF 703
MERYLA SF 907
WINGELLO SF 749

Appendix C

Location of Sampling Plots



LEGEND

Vegetation

- Capertee Rough Barked Apple-Red Gum-Yellow Box Grassy Woodland
- Composite vegetation community**
- Tableland Slopes Brittle Gum-Broad Leaved Peppermint Grassy Forest
- Tableland Scribbly Gum-Narrow Leaved Stringybark-Shrubby Open Forest

** Composite vegetation community consists of:
- Exposed Blue Mountains Sydney Peppermint-Silvertop Ash Scrubby Woodland
- Tableland Gully Ribbon Gum-Blackwood-Applebox Forest
- Cox's Permian Red Stringybark-Brittle Gum Woodland

1:25,000 @ A4

0 200 400 600 800 1,000

Metres

Horizontal Datum: WGS 1984
Grid: GCS WGS 1984

N

CLIENTS|PEOPLE|PERFORMANCE

Coalpac
Coalpac Forestry Economic Assessment

Sample plot locations

Job Number 23-13972
Revision 0
Date 12 Dec 2011

Appendix C

G:\23\13972\GIS\ArcView\Maps\SamplePlotLocations_20111205.mxd

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Data source: Google, Google Earth Pro Imagery, 2011. Created by:ccharalambou

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C	S Dahl	M Mylek		A Cole		13/12/11
D	M Mylek	A Cole		A Cole		16/12/11