Table of Contents

Executive Summary		
Chapter 1 Introduction		
1.1	Overview	1
1.2	Stakeholder engagement	2
1.3	Purpose of this report	2
1.4	Director-General's Requirements	2
1.5	Structure of this EA	5
Chapter 2	Site and context	9
2.1	Geographical context	9
2.2	Land ownership	9
2.3	Topography and soils	9
2.4	Coal resource	10
2.5	Climate	10
2.6	Land use	10
	2.6.1 Regional land use patterns	10
	2.6.2 Local setting	10
Chapter 3	Current operations	15
3.1	Approval history	15
3.2	Approvals and tenements	16
3.3	Key features of the current operations	17
3.4	Status of mine development	17
3.5	Environmental framework	18
	3.5.1 Environmental management strategy	18
	3.5.2 Best endeavours to acquire	20
Chapter 4	Modification description	23
4.1	Overview	23
4.2	Increased extraction rate	24
4.3	Conceptual mine plan staging	24
4.4	Coal handling and processing	24
4.5	Re-definition of ROM coal stockpile areas	24
4.6	On-site gravel production	25
4.7	Coal transport	25
4.8	Plant and equipment	25
4.9	Water management	25
	4.9.1 Saline discharges to the Hunter River	25

	4.9.2	Ancillary water management infrastructure	26	
4.10	Workfo	Workforce		
4.11	Rehabil	Rehabilitation and final landform		
4.12	Develo	Development of project design		
4.13	Alterna	tives considered	29	
	4.13.1	Overview	29	
	4.13.2	Extraction rate increase	30	
	4.13.3	Alterations to the water management system	31	
	4.13.4	Gravel crushing	32	
Chapter 5	Sta	tutory approvals	41	
5.1	Introdu	ction	41	
5.2	Environ	mental Planning and Assessment Act 1979	41	
	5.2.1	Part 3A modification	41	
	5.2.2	Permissibility	41	
	5.2.3	State Environmental Planning Policies	41	
5.3	Other N	ISW legislation and policies	42	
	5.3.1	Protection of the Environment Operations Act 1997	42	
	5.3.2	Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002	43	
	5.3.3	Mining Act 1992	43	
	5.3.4	Coal Mine Health and Safety Act 2002	43	
	5.3.5	Roads Act 1993	43	
	5.3.6	Threatened Species Conservation Act 1995	43	
	5.3.7	Water Management Act 2000	44	
	5.3.8	Other policies	44	
5.4	Commo	onwealth legislation	45	
Chapter 6	Sta	keholder engagement	47	
6.1	Overvie	ew	47	
6.2	Stakeho	older identification	47	
6.3	Consult	ation methods	48	
	6.3.1	Community consultative committee	48	
	6.3.2	Local community	49	
	6.3.3	Service providers	50	
	6.3.4	Xstrata Mangoola workforce	51	
	6.3.5	Government agencies and public authorities	51	
6.4	Stakeho	older consultation results	52	
6.5	Outcom	nes of stakeholder engagement	54	

Chapter 7	Envi	ironmental risk assessment	55
7.1	Method	ology	55
7.2	Prioritis	ation	55
Chapter 8	Nois	se and vibration	57
8.1	Introduc	ction	57
8.2	Existing	environment	57
	8.2.1	Acoustic environment	57
	8.2.2	Noise criteria and conditions	57
	8.2.3	Zones of predicted impact	60
	8.2.4	Existing management measures	61
8.3	Impact a	assessment	63
	8.3.1	Methodology	63
	8.3.2	Impact assessment results	65
	8.3.3	Summary of results	70
8.4	Manage	ment and monitoring	71
	8.4.1	Noise management measures	71
	8.4.2	Blast emission control measures	72
8.5	Conclus	ion	72
Chapter 9	Air	quality and greenhouse gas	77
Chapter 9 9.1	Air (77 77
•	Introduc		
9.1	Introduc	ction	77
9.1	Introduc Existing	environment	77 77
9.1	Introduce Existing 9.2.1	environment Air quality assessment criteria	77 77 77
9.1	Existing 9.2.1 9.2.2	environment Air quality assessment criteria Background conditions Current air quality monitoring and management	77 77 77 78
9.1 9.2	Existing 9.2.1 9.2.2 9.2.3	environment Air quality assessment criteria Background conditions Current air quality monitoring and management	77 77 77 78 79
9.1 9.2	Existing 9.2.1 9.2.2 9.2.3 Method	environment Air quality assessment criteria Background conditions Current air quality monitoring and management ology	77 77 77 78 79 80
9.1 9.2	Existing 9.2.1 9.2.2 9.2.3 Method 9.3.1	environment Air quality assessment criteria Background conditions Current air quality monitoring and management ology Dispersion modelling	77 77 77 78 79 80 80
9.1 9.2	Existing 9.2.1 9.2.2 9.2.3 Method 9.3.1 9.3.2 9.3.3	environment Air quality assessment criteria Background conditions Current air quality monitoring and management ology Dispersion modelling Coal transport dust	77 77 78 79 80 80 82
9.1 9.2 9.3	Existing 9.2.1 9.2.2 9.2.3 Method 9.3.1 9.3.2 9.3.3	environment Air quality assessment criteria Background conditions Current air quality monitoring and management ology Dispersion modelling Coal transport dust Blast fume emissions	77 77 78 79 80 80 82 82
9.1 9.2 9.3	Existing 9.2.1 9.2.2 9.2.3 Method 9.3.1 9.3.2 9.3.3 Impact a	environment Air quality assessment criteria Background conditions Current air quality monitoring and management ology Dispersion modelling Coal transport dust Blast fume emissions assessment	77 77 78 79 80 80 82 82
9.1 9.2 9.3	Existing 9.2.1 9.2.2 9.2.3 Method 9.3.1 9.3.2 9.3.3 Impact a 9.4.1	environment Air quality assessment criteria Background conditions Current air quality monitoring and management ology Dispersion modelling Coal transport dust Blast fume emissions assessment Predicted incremental impacts	77 77 78 79 80 80 82 82 82 82
9.1 9.2 9.3	Existing 9.2.1 9.2.2 9.2.3 Method 9.3.1 9.3.2 9.3.3 Impact a 9.4.1 9.4.2	environment Air quality assessment criteria Background conditions Current air quality monitoring and management ology Dispersion modelling Coal transport dust Blast fume emissions assessment Predicted incremental impacts Predicted cumulative impacts	77 77 78 79 80 80 82 82 82 82
9.1 9.2 9.3	Existing 9.2.1 9.2.2 9.2.3 Method 9.3.1 9.3.2 9.3.3 Impact a 9.4.1 9.4.2 9.4.3	environment Air quality assessment criteria Background conditions Current air quality monitoring and management ology Dispersion modelling Coal transport dust Blast fume emissions assessment Predicted incremental impacts Predicted cumulative impacts Assessment of impacts on more than 25% of privately-owned land	77 77 78 79 80 80 82 82 82 82 84
9.1 9.2 9.3	Existing 9.2.1 9.2.2 9.2.3 Method 9.3.1 9.3.2 9.3.3 Impact a 9.4.1 9.4.2 9.4.3 9.4.4	environment Air quality assessment criteria Background conditions Current air quality monitoring and management ology Dispersion modelling Coal transport dust Blast fume emissions assessment Predicted incremental impacts Predicted cumulative impacts Assessment of impacts on more than 25% of privately-owned land Consideration of cumulative PM _{2.5} impacts	77 77 78 79 80 80 82 82 82 82 84 86
9.1 9.2 9.3	Existing 9.2.1 9.2.2 9.2.3 Method 9.3.1 9.3.2 9.3.3 Impact a 9.4.1 9.4.2 9.4.3 9.4.4 9.4.5	environment Air quality assessment criteria Background conditions Current air quality monitoring and management ology Dispersion modelling Coal transport dust Blast fume emissions assessment Predicted incremental impacts Predicted cumulative impacts Assessment of impacts on more than 25% of privately-owned land Consideration of cumulative PM _{2.5} impacts Coal transport dust assessment	77 77 78 79 80 80 82 82 82 82 84 86 87

9.6	Conclusion	89
Chapter 10	0 Traffic and transport	97
10.1	Introduction	97
10.2	Existing environment	97
	10.2.1 Road network	97
	10.2.2 Traffic conditions	98
	10.2.3 Road safety performance	98
	10.2.4 Mangoola Coal related traffic distribution	99
	10.2.5 Rail network	99
10.3	Methodology	99
	10.3.1 Modelling scenarios	99
	10.3.2 Assessment of traffic performance	100
10.4	Road traffic impact assessment	102
	10.4.1 Employee-based traffic generation and distribution	102
	10.4.2 Heavy vehicle generation	103
	10.4.3 Intersection analysis	103
	10.4.4 Road capacity and performance	106
10.5	Rail traffic impact assessment	107
10.6	Management and monitoring	107
10.7	Conclusion	108
		108
Chapter 1	1 Surface water	111
	1 Surface water Introduction	
Chapter 1		111
Chapter 12	Introduction	111 111
Chapter 12	Introduction Existing environment	111 111 111
Chapter 12	Introduction Existing environment 11.2.1 Site water management	111 111 111 111
Chapter 12	Introduction Existing environment 11.2.1 Site water management 11.2.2 Catchments and surface hydrology	111 111 111 111 113
Chapter 12	Introduction Existing environment 11.2.1 Site water management 11.2.2 Catchments and surface hydrology 11.2.3 Values of receiving waters	111 111 111 111 113 114
Chapter 12	Introduction Existing environment 11.2.1 Site water management 11.2.2 Catchments and surface hydrology 11.2.3 Values of receiving waters 11.2.4 Downstream water users	111 111 111 111 113 114 114
Chapter 1: 11.1 11.2	Introduction Existing environment 11.2.1 Site water management 11.2.2 Catchments and surface hydrology 11.2.3 Values of receiving waters 11.2.4 Downstream water users 11.2.5 Hunter River salinity trading scheme	111 111 111 111 113 114 114 115
Chapter 1: 11.1 11.2	Existing environment 11.2.1 Site water management 11.2.2 Catchments and surface hydrology 11.2.3 Values of receiving waters 11.2.4 Downstream water users 11.2.5 Hunter River salinity trading scheme Impact assessment	111 111 111 111 113 114 114 115
Chapter 1: 11.1 11.2	Introduction Existing environment 11.2.1 Site water management 11.2.2 Catchments and surface hydrology 11.2.3 Values of receiving waters 11.2.4 Downstream water users 11.2.5 Hunter River salinity trading scheme Impact assessment 11.3.1 Site water management system	111 111 111 113 114 114 115 115
Chapter 1: 11.1 11.2	Existing environment 11.2.1 Site water management 11.2.2 Catchments and surface hydrology 11.2.3 Values of receiving waters 11.2.4 Downstream water users 11.2.5 Hunter River salinity trading scheme Impact assessment 11.3.1 Site water management system 11.3.2 Site water balance	111 111 111 113 114 114 115 115
Chapter 1: 11.1 11.2	Introduction Existing environment 11.2.1 Site water management 11.2.2 Catchments and surface hydrology 11.2.3 Values of receiving waters 11.2.4 Downstream water users 11.2.5 Hunter River salinity trading scheme Impact assessment 11.3.1 Site water management system 11.3.2 Site water balance 11.3.3 Predicted discharges	111 111 111 111 113 114 114 115 115 115 116 118
Chapter 1: 11.1 11.2	Existing environment 11.2.1 Site water management 11.2.2 Catchments and surface hydrology 11.2.3 Values of receiving waters 11.2.4 Downstream water users 11.2.5 Hunter River salinity trading scheme Impact assessment 11.3.1 Site water management system 11.3.2 Site water balance 11.3.3 Predicted discharges 11.3.4 Hunter River water quality and downstream users	111 111 111 111 113 114 114 115 115 115 116 118 120
Chapter 1: 11.1 11.2	Existing environment 11.2.1 Site water management 11.2.2 Catchments and surface hydrology 11.2.3 Values of receiving waters 11.2.4 Downstream water users 11.2.5 Hunter River salinity trading scheme Impact assessment 11.3.1 Site water management system 11.3.2 Site water balance 11.3.3 Predicted discharges 11.3.4 Hunter River water quality and downstream users 11.3.5 Bank erosion	111 111 111 111 113 114 114 115 115 115 116 118 120 120
Chapter 1: 11.1 11.2	Existing environment 11.2.1 Site water management 11.2.2 Catchments and surface hydrology 11.2.3 Values of receiving waters 11.2.4 Downstream water users 11.2.5 Hunter River salinity trading scheme Impact assessment 11.3.1 Site water management system 11.3.2 Site water balance 11.3.3 Predicted discharges 11.3.4 Hunter River water quality and downstream users 11.3.5 Bank erosion 11.3.6 Flooding	111 111 111 111 113 114 114 115 115 115 116 118 120 120

11.4	Management and monitoring	121
	11.4.1 Water quality monitoring	121
	11.4.2 Channel stability and in-stream habitat	122
	11.4.3 Water supply	123
11.5	Conclusion	124
Chapter 1	2 Social impacts and opportunities	125
12.1	Introduction	125
12.2	Existing environment	125
	12.2.1 Community capitals assessment	126
	12.2.2 Socio-economic profile – Xstrata Mangoola workforce and suppliers	128
	12.2.3 Existing capacity of community services	131
12.3	Impact assessment	133
	12.3.1 Population change	134
	12.3.2 Impacts on community infrastructure and services	135
	12.3.3 Social amenity	137
	12.3.4 Health and wellbeing impacts	137
	12.3.5 Sense of community	138
	12.3.6 Economic	138
	12.3.7 Environmental	139
	12.3.8 Community sustainability	139
12.4	Management and monitoring	139
12.5	Conclusion	142
Chapter 1	3 Economics	149
13.1	Introduction	149
13.2	Economic efficiency – benefit cost analysis	149
	13.2.1 Methodology	149
	13.2.2 Identification and valuation of costs and benefits	149
	13.2.3 Benefit costs analysis results	151
	13.2.4 BCA sensitivity analysis	152
13.3	Economic stimulus – regional economic impact assessment	153
	13.3.1 Methodology	153
	13.3.2 Results	153
13.4	Conclusion	154
Chapter 1	4 Visual and lighting	157
14.1	Introduction	157
14.2	Existing environment	157
	14.2.1 Local visual character	157

	14.2.2 Mining operations	157
	14.2.3 Previous visual assessments	158
14.3	Methodology	158
14.4	Impact assessment	159
14.5	Management and monitoring	160
14.6	Conclusion	161
Chapter 1	5 Agriculture	163
15.1	Introduction	163
15.2	Existing agricultural resources	163
	15.2.1 Strategic regional land use	163
	15.2.2 Regional agricultural production	164
	15.2.3 Land capability	165
	15.2.4 Agricultural resources and support infrastructure	166
	15.2.5 Water resources	167
15.3	Impact assessment	167
	15.3.1 Strategic regional land use	168
	15.3.2 Land capability	169
	15.3.3 Agricultural resources and support infrastructure	169
	15.3.4 Water for agricultural purposes	169
15.4	Management and monitoring	170
15.5	Conclusion	170
Chapter 1	6 Other matters	173
16.1	Introduction	173
16.2	Groundwater	173
	16.2.1 Background	173
	16.2.2 Impact assessment	174
	16.2.3 Conclusion	174
16.3	Ecology	175
	16.3.1 Background	175
	16.3.2 Impact assessment	175
	16.3.3 Conclusion	176
16.4	Aboriginal heritage	176
	16.4.1 Background	176
	16.4.2 Impact assessment	176
	16.4.3 Conclusion	176
16.5	European heritage	176
	16.5.1 Background	176
	16.5.2 Impact assessment	177

	16.5.3	Conclusion	177	
16.6	Waste n	nanagement	177	
16.7	Hazards	Hazards		
16.8	Rehabili	itation	177	
	16.8.1	Background	177	
	16.8.2	Impact assessment	180	
	16.8.3	Conclusion	180	
Chapter 1	7 Stat	ement of commitments	181	
17.1	Introduc	ction	181	
17.2	Stateme	ent of commitments	181	
17.3	Amendr	ments to PA 06_0014	183	
Chapter 1	8 Just	ification and conclusion	187	
18.1	Introduc	ction	187	
18.2	Need fo	r the proposed modification	187	
18.3	Objects	of the EP&A Act	188	
18.4	Principle	es of ESD	190	
	18.4.1	The precautionary principle	190	
	18.4.2	Inter-generational equity	191	
	18.4.3	Conservation of biological diversity and ecological integrity	191	
	18.4.4	Valuation and pricing of resources	192	
18.5	Conclus	ion	192	
Reference	S			
Glossary o	f Terms			
Abbreviati	ons			

Appendices

٧c	٠lı		m	۵	2
Vι)	ш		_	_

Α	Project	approval	06	0014

- B Director-General's requirements
- C Study team
- D Land ownership surrounding Mangoola Coal
- E Noise and vibration assessment
- F Air quality and greenhouse gas assessment

Volume 3

- G Traffic and transport assessment
- H Surface water assessment
- I Social impacts and opportunities assessment

Volume 4

- J Economic assessment
- K Visual and lighting assessment

Tables

1.1	Summary of Director-General's Requirements	3
3.1	Relevant approvals, mining authorities, leases and licences which apply to Mangoola Coal	16
3.2	Current operations	17
3.3	Summary of current status of Mangoola Coal's management plans and monitoring	1/
3.3	programs	19
3.4	Landowners with acquisition rights	20
4.1	Overview of proposed modification	23
4.2	Amendments to the proposed modification in response to key issues	28
6.1	Stakeholder identification	48
6.2	Matters raised during consultation relevant to the proposed modification	52
7.1	Assessment priorities	55
7.2	Lower risk matters	56
8.1	Noise impact assessment criteria (PA 06_0014)	58
8.2	Traffic noise criteria, dB(A)	59
8.3	Airblast overpressure assessment criteria	59
8.4	Ground vibration impact assessment criteria	60
8.5	Comparison of residential dwellings within acquisition and management zones for the	

Tables

	current operations and proposed modification due to operational noise impacts	65
8.6	Private land with >25% land area above 40 dB(A)	66
8.7	Low frequency (site only) assessment at select representative locations	67
8.8	Daytime road traffic noise levels for Wybong Road	67
8.9	Receptors within the noise and vibration acquisition zone for the proposed	
	modification	70
8.10	Noise impact assessment criteria dB(A)	71
9.1	Air quality assessment criteria	77
9.2	Dust mitigation measures	81
9.3	Model predictions where predicted incremental impacts exceed assessment criteria	83
9.4	Analysis of predicted cumulative impacts	85
9.5	Properties with dust impacts on more than 25% of land	86
9.6	Comparison of total CO ₂ -e emissions	88
10.1	Level of service definitions	100
10.2	SIDRA intersection analysis for the proposed modification	104
10.3	SIDRA intersection analysis for the cumulative and 'do-nothing' scenarios (2017) during the 6:00 am to 7:00 am period	ng 105
10.4	Road capacity and performance comparison	106
11.1	Predicted annual average water balance for Scenarios 1 and 2	117
11.2	Mangoola Coal catchment areas under the current operations and proposed modification	118
12.1	Summary of results for key locations of interest	131
12.2	Current capacity for provision of community services in key towns the region and perceived regional issues and needs	132
12.3	Workforce scenarios	134
12.4	Estimated population change	135
12.5	Summary of Xstrata Mangoola strategies (existing and proposed)	140
13.1	Proposed modification – present value of costs and benefits (\$M)	151
13.2	Estimated incremental annual economic impact on the regional and NSW economies the proposed modification	
14.1	Visual and lighting impacts of proposed modification	159
15.1	Total area of agricultural production in Muswellbrook LGA	164
15.2	Total number of agricultural production in Muswellbrook LGA	164
15.3	Muswellbrook LGA employment in the agriculture, forestry and fishing sectors	164
15.4	Land capability classes	165
15.5	SRLUP criteria for SAL and CIC	168
17.1	Statement of commitments	181
C.18.1	Study team	C.5

Figures

1.1	Mangoola Coal location	7
1.2	Key features of the proposed modification	8
2.1	Land ownership and residential receptors	12
2.2	Surrounding land uses	13
3.1	Current operations	21
3.2	Existing environmental monitoring networks	22
4.1	Proposed conceptual mine plan – Year 2	33
4.2	Proposed conceptual mine plan – Year 5	34
4.3	Proposed conceptual mine plan – Year 10	35
4.4	Conceptual final landform	36
4.5	Location of proposed Hunter River discharge point	37
4.6	Location of proposed ROM coal stockpiles	38
4.7	Coal handling and processing system	39
6.1	Matters identified by stakeholders relating specifically to the proposed modification	49
8.1	Worst case noise contours – Year 2	73
8.2	Worst case noise contours – Year 5	74
8.3	Worst case noise contours – Year 10	75
8.4	All years worst case noise contours - comparison of current operations and proposed modification	76
9.1	Year 2 - PM_{10} annual average and 24 hour (98.6 percentile) incremental impacts (mine only)	90
9.2	Year 5 - PM_{10} annual average and 24 hour (98.6 percentile) incremental impacts (mine only)	91
9.3	Year 10 - PM_{10} annual average and 24 hour (98.6 percentile) incremental impacts (minonly)	e 92
9.4	All years - PM10 annual average and 24 hour (98.6 percentile) incremental impacts (mine only)	93
9.5	All years worst case - PM10 annual average and 24 hour incremental impacts -	
	comparison of current operations and proposed modification	94
9.6	Predicted total (cumulative) impact for annual average PM ₁₀	95
10.1	Surrounding road network and traffic survey locations	109
12.1	Location of residence of the current Mangoola Coal workforce	143
12.2	Estimated annual household expenditure for the current Mangoola Coal workforce	144
12.3	Mangoola Coal workforce participation in community	145
12.4	Use of health and education services by the Mangoola Coal workforce	146
12.5	Estimated annual household expenditure for the Mangoola Coal workforce (Scenario C	()147
13.1	ROM extraction with the proposed modification compared to the base case	150
14.1	Visual assessment locations	162

Figures

15.1	Land capability	171
15.2	Agricultural resources surrounding Mangoola Coal	172

Photographs

16.1	2011 rehabilitation area which has resulted in successful revegetation of native ground	
	cover from the topsoil seed bank (photograph taken in March 2013)	178
16.2	2012 rehabilitation area shown in the foreground, with the 2011 rehabilitation area shown in the background (photograph taken in March 2013)	178
16.3	Birds using habitat trees (felled trees that have been re-erected) on the rehabilitated slope (photograph taken in March 2013)	179