



Jellinbah Group



LAKE VERMONT MEADOWBROOK
EXTENSION PROJECT
ENVIRONMENTAL IMPACT STATEMENT
TABLE OF CONTENTS

arc

ENVIRONMENTAL SOLUTIONS



Table of contents

ES	Executive summary.....1	2	Consultation Process2-1
ES.1	Project proponent3	2.1	Environmental objectives and performance outcomes.....2-1
ES.2	Project summary.....3	2.1.1	Consultation objectives 2-1
ES.3	Public consultation process4	2.1.2	Consultation strategy 2-2
ES.4	Project description.....4	2.2	Description of existing values2-2
ES.4.1	Construction4	2.2.1	Stakeholder identification 2-2
ES.4.2	Operations.....6	2.2.2	Stakeholder engagement and community consultation 2-8
ES.4.3	Rehabilitation7	2.3	Potential impacts.....2-10
ES.5	Environmental assessment8	2.4	Mitigation and management measures2-25
ES.5.1	Climate8	2.4.1	Ongoing consultation 2-25
ES.5.2	Land8	2.4.2	SIMP monitoring..... 2-25
ES.5.3	Water.....9	3	Project Description3-1
ES.5.4	Flooding.....12	3.1	Proposed development.....3-1
ES.5.5	Geomorphology.....14	3.1.1	Project title 3-1
ES.5.6	Flora and fauna.....14	3.1.2	Project objectives and rationale 3-1
ES.5.7	Biosecurity.....20	3.1.3	Project capital expenditure 3-2
ES.5.8	Air quality20	3.1.4	Nature and scale of the Project 3-3
ES.5.9	Noise and vibration22	3.1.5	Project timing 3-6
ES.5.10	Waste management23	3.1.6	Project location regional and local context .. 3-7
ES.5.11	Hazards and safety24	3.1.7	Workforce 3-15
ES.5.12	Cultural heritage.....25	3.2	Site description.....3-18
ES.5.13	Social environment.....25	3.2.1	Tenure..... 3-18
ES.5.14	Economic environment26	3.2.2	Existing infrastructure 3-24
ES.5.15	Transport27	3.2.3	Topography, landforms and catchments... 3-28
ES.6	General environmental management commitments28	3.2.4	Geology and economic resources..... 3-28
1	Introduction.....1-1	3.2.5	Soils and land use 3-35
1.1	Project proponent1-4	3.2.6	Protected areas 3-37
1.1.1	Environmental record..... 1-4	3.3	Construction3-40
1.1.2	Environmental, health, safety and community policies..... 1-4	3.3.1	Infrastructure corridor..... 3-41
1.2	Lake Vermont Mine1-7	3.3.2	Access/coal haulage roads..... 3-41
1.3	Project overview.....1-9	3.3.3	Mine infrastructure area (MIA) 3-44
1.4	Environmental impact assessment process.. 1-10	3.3.4	Underground drifts and portal 3-46
1.4.1	Terms of reference 1-10	3.3.5	Ventilation systems 3-47
1.4.2	EIS preparation 1-10	3.3.6	Electricity supply infrastructure..... 3-47
1.4.3	Public submissions..... 1-11	3.3.7	Water supply and management infrastructure 3-47
1.5	Project approvals.....1-13	3.3.8	Construction materials and equipment..... 3-49
1.5.1	Commonwealth legislation..... 1-16	3.3.9	Construction disturbance area 3-50
1.5.2	Queensland legislation: environmental values 1-17	3.4	Operations.....3-50
1.5.3	Queensland legislation: cultural heritage .. 1-26	3.4.1	Mine resource, schedule and sequence 3-50
1.5.4	Queensland legislation: development and planning..... 1-27	3.4.2	ROM coal handling and processing 3-73
1.5.5	Queensland legislation: natural resources. 1-31	3.4.3	Product coal handling and transport 3-76
1.5.6	Queensland legislation: human health and wellbeing 1-33	3.4.4	Reject management..... 3-76
1.5.7	Queensland legislation: land and government 1-35	3.4.5	Ongoing resource definition and exploration activities..... 3-77
1.5.8	Legislative requirements summary 1-36	3.4.6	Hazardous substances 3-77
		3.4.7	Operations disturbance areas 3-78
		3.5	Infrastructure3-79
		3.5.1	Transport 3-79



3.5.2	Energy.....	3-80	5.4.2	Landform and topography.....	5-29
3.5.3	Telecommunications	3-80	5.4.3	Land use and land use suitability.....	5-30
3.5.4	Sewage treatment.....	3-80	5.4.4	Contaminated land	5-31
3.5.5	Water supply and management.....	3-81	5.4.5	Existing resource tenements	5-32
3.6	Project alternatives	3-84	5.4.6	Native Title.....	5-32
3.6.1	Mining method alternatives.....	3-84	5.4.7	Cumulative impacts	5-32
3.6.2	Longwall mining layout and alternatives....	3-85	5.4.8	Visual amenity	5-34
3.6.3	Open-cut mining layout and sequence	3-86	5.5	Monitoring and management	5-38
3.6.4	Infrastructure corridor alignment	3-87	5.5.1	Subsidence.....	5-38
3.6.5	Infrastructure and MIA.....	3-87	5.5.2	Land disturbance	5-39
3.6.6	Workforce accommodation	3-88	5.5.3	Erosion and stability	5-39
3.6.7	Not proceeding with the Project	3-89	5.5.4	Topsoil management	5-40
3.7	Ecologically sustainable development	3-89	5.5.5	Land use suitability	5-40
3.7.1	Precautionary principle	3-90	5.5.6	Land contamination.....	5-41
3.7.2	Intergenerational equity	3-92	5.5.7	Visual amenity and lighting	5-41
3.7.3	Conservation of biological diversity and ecological integrity	3-92	6	Rehabilitation	6-1
3.7.4	Valuation	3-93	6.1	Relevant policy and legislation	6-1
4	Climate	4-1	6.1.1	Progressive rehabilitation.....	6-1
4.1	Existing climate.....	4-1	6.1.2	Financial provisioning	6-2
4.1.1	Rainfall.....	4-4	6.2	Key influencing ecosystem processes and functions.....	6-2
4.1.2	Temperature	4-4	6.2.1	Topography, hydrology and climate	6-2
4.1.3	Humidity.....	4-5	6.2.2	Waste rock and coal reject geochemistry	6-2
4.1.4	Wind speed and direction	4-5	6.2.3	Topsoil resources.....	6-3
4.1.5	Atmospheric stability	4-6	6.2.4	Current land use and land suitability.....	6-4
4.2	Project vulnerability to natural and induced hazards	4-6	6.3	Rehabilitation planning	6-5
4.2.1	Bushfire	4-6	6.3.1	Rehabilitation objectives	6-5
4.2.2	Cyclone	4-7	6.3.2	Post-mining land use	6-5
4.2.3	Extreme rainfall	4-7	6.3.3	Rehabilitation areas.....	6-5
4.2.4	Flood.....	4-7	6.3.4	Rehabilitation milestones and completion criteria	6-5
4.2.5	Extreme temperatures	4-8	6.3.5	PRCP schedule and progressive rehabilitation	6-8
4.3	Climate change projection	4-8	6.4	General rehabilitation methods.....	6-8
4.4	Mitigation and management measures	4-9	6.4.1	Topsoil management and surface preparation	6-8
5	Land and visual amenity	5-1	6.4.2	Revegetation.....	6-13
5.1	Environmental objectives and performance outcomes.....	5-1	6.5	Specific rehabilitation areas.....	6-13
5.2	Local planning context.....	5-2	6.5.1	Waste rock emplacements	6-13
5.3	Description of existing values	5-3	6.5.2	Water management infrastructure	6-15
5.3.1	Local topography and landforms.....	5-3	6.5.3	Underground mining	6-15
5.3.2	Geology	5-5	6.5.4	Mine infrastructure	6-19
5.3.3	Land systems	5-5	6.5.5	Coal reject disposal.....	6-20
5.3.4	Soil characteristics.....	5-6	6.6	Monitoring and maintenance	6-23
5.3.5	Current local land use.....	5-9	6.6.1	Monitoring.....	6-23
5.3.6	Areas of state interest.....	5-10	6.6.2	Maintenance.....	6-23
5.3.7	Areas of regional interest.....	5-15	6.7	Closure and relinquishment.....	6-24
5.3.8	Reserve land.....	5-16	7	Groundwater	7-1
5.3.9	Native title.....	5-18	7.1	Environmental objectives and performance outcomes.....	7-1
5.3.10	Existing resource tenure.....	5-18	7.2	Description of existing values	7-2
5.3.11	Quarry resources.....	5-18	7.2.1	Environmental values and water quality objectives.....	7-2
5.3.12	Contaminated land.....	5-18	7.2.2	Geology.....	7-3
5.3.13	Visual amenity	5-21			
5.4	Potential impacts.....	5-25			
5.4.1	Subsidence	5-25			



7.2.3	Baseline groundwater characteristics	7-5	8.4.4	Water quality management and monitoring ..	8-35	
7.2.4	Hydraulic properties	7-10	8.4.5	Receiving environment monitoring program ..	8-35	
7.2.5	Groundwater quality	7-10	8.4.6	Corrective actions	8-36	
7.2.6	Water dependent assets	7-13	8.4.7	Annual review	8-36	
7.3	Potential impacts	7-17	9	Flooding and Regulated Structures	9-1	
7.3.1	Model methodology	7-17	9.1	Environmental objectives and performance	outcomes	9-1
7.3.2	Predicted groundwater impacts	7-21	9.2	Description of existing values	9-1	
7.3.3	Impacts to groundwater-dependent ecosystems (GDEs)	7-36	9.2.1	Nearby water resources	9-1	
7.3.4	Great Artesian Basin impacts	7-38	9.2.2	Land uses and regional context	9-3	
7.3.5	Groundwater quality	7-38	9.2.3	Proximity to infrastructure	9-3	
7.3.6	Cumulative impacts	7-38	9.2.4	Flood modelling	9-3	
7.4	Mitigation and management measures	7-39	9.2.5	History of flooding	9-6	
7.4.1	Impacted groundwater bore management	7-39	9.2.6	Current flood risk	9-7	
7.4.2	Groundwater monitoring program	7-39	9.2.7	Geomorphology	9-8	
7.4.3	Groundwater trigger levels and limits	7-39	9.3	Proposed infrastructure	9-10	
7.4.4	Groundwater management plan	7-43	9.3.1	Flood protection levees	9-10	
7.4.5	Future groundwater modelling	7-43	9.3.2	Diversion drains	9-14	
7.4.6	Adaptive management	7-43	9.3.3	Underground mine dewatering infrastructure	9-14	
7.4.7	Stygofauna impact mitigation and management	7-43	9.3.4	Sediment dams	9-15	
7.4.8	Groundwater-dependent ecosystem impact mitigation and management	7-43	9.3.5	Other infrastructure	9-16	
8	Surface Water	8-3	9.4	Potential impacts	9-16	
8.1	Environmental objectives and performance outcomes	8-3	9.4.1	Flood depth and afflux impacts	9-16	
8.2	Description of existing values	8-4	9.4.2	Flood velocity impacts	9-19	
8.2.1	Environmental values	8-4	9.4.3	Geomorphology impacts	9-23	
8.2.2	Regional hydrology	8-4	9.4.4	Subsidence impacts	9-24	
8.2.3	Local hydrology	8-6	9.4.5	Water management infrastructure risk	9-27	
8.2.4	Existing uses	8-6	9.4.6	Haul road and watercourse crossings	9-32	
8.2.5	Baseline surface water characteristics	8-9	9.4.7	Waste rock emplacements	9-32	
8.2.6	Baseline water quality data	8-10	9.4.8	Cumulative impacts	9-33	
8.2.7	Controlled releases	8-12	9.4.9	Sensitivity assessments	9-33	
8.2.8	Water quality objectives	8-12	9.5	Mitigation and management measures	9-34	
8.2.9	Sediment quality objectives	8-15	9.5.1	Flood protection levees	9-34	
8.2.10	Site water balance numerical model	8-15	9.5.2	Ponding mitigation drains and bunds	9-35	
8.3	Potential impacts	8-16	9.5.3	Sediment dams	9-35	
8.3.1	Surface water quality	8-16	9.5.4	Haul road drainage	9-35	
8.3.2	Sediment dams	8-18	9.5.5	Receiving environment monitoring	9-35	
8.3.3	Mine water dams	8-18	9.5.6	Subsidence monitoring	9-36	
8.3.4	Open pit	8-18	9.5.7	Adaptation strategies	9-36	
8.3.5	Rehabilitated pit landform	8-18	10	Terrestrial Ecology	10-1	
8.3.6	Site water balance conceptual model	8-19	10.1	Environmental objectives and performance outcomes	10-1	
8.3.7	Geomorphology	8-19	10.1.1	Flora and fauna	10-1	
8.3.8	Reductions in streamflow	8-22	10.2	Regional and local setting	10-2	
8.3.9	Flooding impacts	8-25	10.3	Study area and methodology	10-3	
8.3.10	Site water demand	8-25	10.3.1	Study area	10-3	
8.3.11	Regional water availability	8-25	10.3.2	Desktop assessment	10-3	
8.3.12	Wetlands	8-26	10.3.3	Field survey	10-4	
8.3.13	Cumulative impacts	8-26	10.3.4	Groundwater dependant ecosystems methodology	10-10	
8.4	Mitigation and management measures	8-26	10.4	Terrestrial ecological values	10-12	
8.4.1	Water management system	8-26				
8.4.2	Sediment and erosion control	8-31				
8.4.3	Water Management Plan	8-35				



10.4.1	Regional Ecosystems	10-12	11.4.6	Aquatic fauna.....	11-11
10.4.2	Threatened Ecological Communities.....	10-16	11.4.7	Macroinvertebrates.....	11-11
10.4.3	Flora species of conservation significance	10-16	11.4.8	Stygofauna.....	11-11
10.4.4	Fauna species of conservation significance	10-16	11.4.9	Matters of national environmental significance	11-13
10.4.5	Environmentally Sensitive Areas	10-19	11.4.10	Matters of state environmental significance	11-13
10.4.6	Pest species	10-19	11.5	Potential impacts and avoidance, mitigation and management measures.....	11-14
10.4.7	Groundwater Dependant ecosystems.....	10-20	11.5.1	Direct impacts.....	11-14
10.5	Potential impacts to terrestrial ecology values	10-24	11.5.2	Indirect impacts	11-16
10.5.1	Direct impacts	10-24	11.5.3	Cumulative impacts	11-26
10.5.2	Indirect impacts.....	10-28	11.5.4	Facilitated impacts.....	11-26
10.5.3	Facilitated impacts	10-40	11.6	Impact assessments.....	11-27
10.5.4	Cumulative impacts	10-40	11.6.1	Matters of National Environmental Significance (MNES).....	11-27
10.6	Potential impacts to MNES	10-42	12	Biosecurity.....	12-1
10.6.1	Brigalow (Acacia harpophylla dominant and co-dominant) TEC.....	10-43	12.1	Environmental objectives	12-1
10.6.2	Poplar Box Grassy Woodland on Alluvial Plains TEC.....	10-51	12.2	Existing biosecurity risk	12-1
10.6.3	Ornamental Snake.....	10-57	12.2.1	Introduced fauna species	12-1
10.6.4	White-throated Needletail	10-69	12.2.2	Introduced flora species	12-1
10.6.5	Squatter Pigeon.....	10-72	12.2.3	Introduced aquatic flora and fauna.....	12-4
10.6.6	Australian Painted Snipe	10-81	12.2.4	Public health and agricultural pest species	12-4
10.6.7	Koala.....	10-88	12.3	Potential impacts.....	12-5
10.6.8	Greater Glider.....	10-99	12.3.1	Introduced fauna species	12-5
10.6.9	Migratory Birds.....	10-109	12.3.2	Introduced flora species	12-5
10.7	Potential impacts to MSES	10-114	12.3.3	Introduced aquatic flora and fauna.....	12-6
10.7.1	Regulated vegetation	10-117	12.3.4	Public health and agricultural pest species	12-6
10.7.2	Connectivity areas.....	10-120	12.4	Mitigation and management measures	12-6
10.7.3	Wetlands and watercourses.....	10-120	12.4.1	Introduced fauna management measures .	12-6
10.7.4	Protected wildlife habitat.....	10-120	12.4.2	Introduced flora management measures...	12-7
10.7.5	Short-beaked Echidna	10-121	12.4.3	Public health designated pest management	12-7
10.8	Mitigation and management measures	10-122	12.4.4	Pest and Weed Management Plan	12-7
10.8.1	Habitat and vegetation disturbance.....	10-123	12.4.5	Existing Lake Vermont Pest and Weed Management Plan	12-8
10.8.2	Subsidence	10-125	12.4.6	Monitoring program	12-8
10.8.3	Site operations	10-126	13	Air Quality	13-1
10.9	Proposed offsets.....	10-128	13.1	Environmental objectives and performance outcomes.....	13-1
10.9.1	Offset management strategy	10-128	13.1.1	Air quality assessment terminology	13-1
11	Aquatic Ecology	11-1	13.1.2	Air quality criteria	13-2
11.1	Environmental objectives and performance outcomes.....	11-1	13.2	Existing air environment.....	13-3
11.2	Regional and local setting	11-3	13.2.1	Local topography and climate	13-4
11.3	Study area and methodology.....	11-6	13.2.2	Atmospheric conditions.....	13-5
11.3.1	Study area	11-6	13.2.3	Sensitive receptors	13-9
11.3.2	Desktop assessment.....	11-6	13.2.4	Regional air quality	13-10
11.3.3	Field survey	11-6	13.3	Potential impacts.....	13-13
11.3.4	Survey methodology	11-4	13.3.1	Air quality modelling methodology	13-13
11.3.5	Stygofauna.....	11-5	13.3.2	Air quality emissions results	13-17
11.3.6	Groundwater-dependent ecosystems.....	11-6	13.3.3	GHG assessment methodology.....	13-30
11.4	Aquatic ecological values.....	11-9	13.3.4	GHG emissions results	13-31
11.4.1	Watercourses	11-9			
11.4.2	Wetlands	11-9			
11.4.3	Groundwater-dependent ecosystems.....	11-10			
11.4.4	Aquatic habitat.....	11-10			
11.4.5	Aquatic flora	11-10			



13.4	Regulatory obligations—NGER and the Safeguard Mechanism	13-44	16.3	Objectives and performance outcomes	16-1
13.5	Mitigation and management measures ..	13-44	16.4	Risk assessment methodology	16-2
13.5.1	Additional air quality controls	13-45	16.4.1	Risk assessment scheme	16-3
13.5.2	GHG mitigation and management	13-45	16.4.2	Sensitive receptors	16-7
13.5.3	Monitoring and reporting.....	13-46	16.5	Anthropogenic risks.....	16-7
14	Noise and Vibration	14-1	16.5.1	Site worker health and safety.....	16-7
14.1	Environmental objective and outcomes....	14-1	16.5.2	Hazardous and dangerous substances	16-9
14.1.1	Noise assessment terminology.....	14-1	16.6	Project risk from natural hazards.....	16-12
14.1.2	Acoustic quality objectives.....	14-2	16.6.1	Geophysical risk.....	16-12
14.2	Proposed noise criteria for the Project	14-4	16.6.2	Cyclone and severe wind hazard risk.....	16-13
14.3	Description of existing values	14-5	16.6.3	Flood risk	16-13
14.3.1	Operational noise.....	14-5	16.6.4	Heat and heatwave risk	16-13
14.4	Potential impacts.....	14-9	16.6.5	Bushfire risk	16-13
14.4.1	Upset conditions	14-9	16.6.6	Climate change risk.....	16-13
14.4.2	Operational noise.....	14-10	16.6.7	Dangerous wildlife and disease vectors ..	16-14
14.4.3	Blasting.....	14-12	16.7	Project siting and layout	16-14
14.4.4	Cumulative noise.....	14-17	16.8	Risk analysis, evaluation and controls.....	16-15
14.4.5	Impact assessment summary	14-19	16.9	Mitigation and management measures ..	16-15
14.5	Mitigation and management measures ..	14-19	16.9.1	Safety and health management system (SHMS)	16-16
14.5.1	Monitoring.....	14-19		16-16
14.5.2	Response to a noise exceedance.....	14-20	16.9.2	Emergency response plan (ERP)	16-19
15	Waste Management	15-1	16.9.3	Bushfire management plan (BMP)	16-21
15.1	Environmental objective and outcomes....	15-1	16.9.4	Monitoring and improvement	16-22
15.2	Waste generation	15-1	17	Cultural Heritage	17-1
15.2.1	Non-mineral waste	15-1	17.1	Environmental objective and outcomes....	17-1
15.2.2	Mineral waste.....	15-2	17.2	Description of existing values	17-1
15.2.3	Mine-affected wastewater	15-5	17.2.1	Indigenous cultural heritage.....	17-1
15.3	Existing waste generation.....	15-5	17.2.2	Non-Indigenous cultural heritage.....	17-3
15.4	Regional waste management facilities.....	15-5	17.3	Potential impacts.....	17-6
15.5	Potential impacts.....	15-6	17.3.1	Indigenous cultural heritage.....	17-6
15.6	Waste management	15-7	17.3.2	Non-Indigenous cultural heritage.....	17-6
15.6.1	Waste management principles.....	15-7	17.4	Mitigation and management measures	17-7
15.6.2	Waste management hierarchy.....	15-8	17.4.1	Indigenous cultural heritage.....	17-7
15.6.3	Waste generation and management.....	15-10	17.4.2	Non-Indigenous cultural heritage.....	17-7
15.6.4	Decommissioning and rehabilitation	15-17	18	Social	18-1
15.6.5	Natural resource use efficiency: Water....	15-17	18.1	Environmental objectives	18-1
15.6.6	Natural resource use efficiency: Energy...	15-18	18.2	Description of existing values	18-1
15.7	Non-mineral waste management	15-18	18.2.1	SIA study areas	18-2
15.7.1	General waste management	15-18	18.2.2	Existing social environment	18-4
15.7.2	Regulated waste management.....	15-19	18.3	Potential impacts.....	18-9
15.7.3	Sewage management.....	15-19	18.3.1	Cumulative social impacts	18-10
15.7.4	Non-mineral waste management plan.....	15-21	18.4	Mitigation and management measures ..	18-20
15.8	Mineral waste management.....	15-22	18.4.1	Community and stakeholder engagement	18-20
15.8.1	Waste rock management	15-22		measures	18-20
15.8.2	Coal reject management	15-22	18.4.2	Workforce management measures.....	18-21
15.8.3	Rejects management plan.....	15-23	18.4.3	Housing and accommodation measures ..	18-21
15.9	Performance monitoring and review	15-23	18.4.4	Local business and industry procurement	18-30
15.10	Mitigation and management measures ..	15-24		measures	18-30
16	Hazards and safety	16-1	18.4.5	Health and community wellbeing measures	18-35
16.1	Introduction.....	16-1		18-35
16.2	Scope.....	16-1	18.4.6	SIMP monitoring.....	18-42
			19	Economics.....	19-1
			19.1	Environmental objectives and outcomes ..	19-1



19.2	Description of existing values	19-2		
19.3	Potential impacts.....	19-2		
19.3.1	Potential beneficial economic impacts of the Project	19-2		
19.3.2	Potential adverse economic impacts of the Project	19-4		
19.3.3	Potential cumulative impacts.....	19-5		
19.4	Cost-benefit analysis.....	19-8		
19.5	Mitigation and management measures	19-8		
20	Transport.....	20-1		
20.1	Environmental objectives and outcomes ..	20-1		
20.2	Project transport tasks.....	20-1		
20.3	Road transport.....	20-2		
20.3.1	Description of existing infrastructure and values	20-2		
20.3.2	Potential impacts.....	20-6		
20.3.3	Mitigation and management measures ...	20-11		
20.4	Rail transport.....	20-12		
20.4.1	Description of existing infrastructure and values	20-12		
20.4.2	Potential impacts.....	20-12		
20.4.3	Mitigation measures	20-12		
20.5	Sea transport	20-12		
20.5.1	Description of existing infrastructure and values	20-12		
20.5.2	Potential impacts.....	20-12		
20.5.3	Mitigation measures	20-12		
20.6	Air transport	20-14		
20.6.1	Description of existing infrastructure and values	20-14		
20.6.2	Potential impacts.....	20-14		
20.6.3	Mitigation measures	20-14		
21	Matters of National Environmental Significance.....	21-1		
21.1	Introduction.....	21-1		
21.1.1	Title of the action	21-1		
21.1.2	Proponent	21-1		
21.1.3	Objective of the action	21-2		
21.1.4	Location of the action.....	21-5		
21.1.5	Background to the development of the action	21-19		
21.1.6	Environmental impact assessment process	21-22		
21.2	Description of the action	21-26		
21.2.1	Project overview.....	21-26		
21.2.2	Project timing	21-27		
21.2.3	Construction.....	21-28		
21.2.4	Operations.....	21-37		
21.2.5	ROM coal handling and processing	21-64		
21.2.6	Product coal handling and transport.....	21-66		
21.2.7	Reject management	21-66		
21.2.8	Ongoing resource definition and exploration activities	21-67		
21.2.9	Hazardous substances.....	21-67		
21.2.10	Operations disturbance areas	21-68		
21.3	Infrastructure	21-69		
21.3.1	Transport	21-69		
21.4	Energy.....	21-71		
21.4.1	Electricity Supply	21-71		
21.4.2	Fuel Supply	21-71		
21.5	Telecommunications.....	21-71		
21.6	Sewage treatment	21-71		
21.7	Water supply and management.....	21-72		
21.7.1	Water supply	21-72		
21.7.2	Water management	21-72		
21.8	Feasible alternatives and consequence of not proceeding.....	21-74		
21.8.1	Mining method	21-75		
21.8.2	Longwall mining layout and alternatives ..	21-76		
21.8.3	Open-cut mining layout and sequence.....	21-77		
21.8.4	Infrastructure corridor alignment.....	21-77		
21.8.5	Infrastructure and MIA	21-78		
21.8.6	Workforce Accommodation	21-79		
21.8.7	Not proceeding with the Project	21-80		
21.9	Surface water	21-80		
21.9.1	Context and conceptualisation.....	21-80		
21.9.2	Baseline surface water characteristics	21-85		
21.9.3	Controlled releases.....	21-88		
21.9.4	Surface water quality objectives	21-89		
21.9.5	Sediment quality objectives	21-91		
21.9.6	Potential impacts.....	21-91		
21.9.7	Avoidance, mitigation, management measures and monitoring	21-101		
21.9.8	IESC checklist	21-111		
21.9.9	Significant impact assessment.....	21-112		
21.10	Flooding.....	21-115		
21.10.1	Flood characteristics and context.....	21-115		
21.10.2	Flood modelling	21-115		
21.10.3	History of flooding	21-118		
21.10.4	Current flood risk.....	21-120		
21.10.5	Geomorphology.....	21-120		
21.10.6	Proposed structures	21-122		
21.10.7	Potential impacts.....	21-128		
21.10.8	Mitigation, management measures and monitoring	21-145		
21.11	Groundwater	21-147		
21.11.1	Context and conceptualisation.....	21-147		
21.11.2	Baseline groundwater characteristics	21-150		
21.11.3	Water dependent assets	21-159		
21.11.4	Potential impacts.....	21-163		
21.11.5	Mitigation, management measures and monitoring	21-182		
21.11.6	IESC checklist	21-186		
21.11.7	Significant impact assessment.....	21-186		
21.12	Terrestrial ecology	21-188		
21.12.1	Methodology	21-188		
21.12.2	Terrestrial ecology values.....	21-245		
21.12.3	Potential impacts to terrestrial ecology values	21-250		



21.12.4	Assessment of impact to listed threatened species and communities	21-270	21.18	Consideration of the action against the objectives of the EPBC Act	21-422
21.13	Aquatic ecology	21-372	21.18.1	The objects of the EPBC Act.....	21-423
21.13.1	Existing environment.....	21-372	21.19	Environmental offsets.....	21-424
21.13.2	Aquatic ecological values	21-377	21.19.1	Regulatory framework.....	21-424
21.13.3	Potential impacts.....	21-379	21.19.2	Significant impacts.....	21-424
21.13.4	Significant impact assessment, mitigation, management and monitoring	21-393	21.19.3	Offset requirements	21-426
21.14	Stygofauna.....	21-403	22	Proposed Environmental Management and Monitoring Commitments	22-2
21.14.1	Background ecology	21-403	23	Proposed Environmental Authority Conditions	23-1
21.14.2	Methodology	21-403	23.1	Schedule A – General Conditions	23-1
21.14.3	Aquifer characteristics.....	21-406	23.2	Schedule B – Air	23-6
21.14.4	Stygofauna community	21-406	23.3	Schedule C – Water	23-9
21.14.5	Potential impacts.....	21-406	23.4	Schedule K – Enhanced Releases.....	23-28
21.14.6	Mitigation, management and monitoring	21-407	23.5	Schedule D – Groundwater	23-38
21.15	Groundwater dependent ecosystems ...	21-407	23.6	Schedule E – Sewage Treatment	23-48
21.15.1	Survey methodology	21-407	23.7	Schedule F – Acoustic.....	23-50
21.15.2	Results	21-407	23.8	Schedule G – Land.....	23-54
21.15.3	Potential impacts.....	21-408	23.9	Schedule H – Waste	23-63
21.15.4	Mitigation, management and monitoring	21-414	23.10	Schedule I – Regulated Structures.....	23-64
21.16	Social and economic matters	21-414	23.11	Schedule J – Watercourse Diversions.....	23-77
21.16.1	Public consultation	21-414	23.12	Definitions	23-82
21.16.2	Projected social and economic costs and benefits.....	21-416	Attachments	23-94	
21.17	Consideration of the action in terms of ecologically sustainable development ..	21-418	24	References.....	2
21.17.1	Precautionary principle	21-419	25	Abbreviations, Acronyms and Glossary.....	1
21.17.2	Intergenerational equity	21-420	25.1	Abbreviations and Acronyms.....	1
21.17.3	Conservation of Biological Diversity and Ecological Integrity	21-421	25.2	Units	1
21.17.4	Valuation	21-422	25.3	Glossary.....	2



List of Figures

Figure ES. 1:	Project location	2
Figure ES. 2:	Project layout	5
Figure 1.1:	Regional Location	1-2
Figure 1.2:	Jellinbah Group Environmental Policy	1-5
Figure 1.3:	Thiess Global Environmental Policy	1-6
Figure 1.4:	Indicative EIS Process Flowchart	1-11
Figure 2.1:	Land ownership of the Project site	2-6
Figure 3.1:	Project location	3-4
Figure 3.2:	Project layout	3-5
Figure 3.3:	Brigalow Belt Bioregion	3-8
Figure 3.4:	Isaac Connors Sub-catchment of the Fitzroy Basin	3-9
Figure 3.5:	Isaac Connors groundwater management area	3-10
Figure 3.6:	Regional planning interest areas	3-12
Figure 3.7:	Queensland agricultural land audit—important agricultural area	3-13
Figure 3.8:	Native title determinations	3-14
Figure 3.9:	Land ownership	3-19
Figure 3.10:	Coal tenements	3-22
Figure 3.11:	Petroleum tenements	3-23
Figure 3.12:	Existing road network	3-25
Figure 3.13:	Rail, sea and air transport facilities	3-27
Figure 3.14:	Project watercourses and topography	3-29
Figure 3.15:	Geology of the Project site	3-30
Figure 3.16:	Surface geology of the Project site	3-32
Figure 3.17:	West–east cross-sections of Project geology	3-33
Figure 3.18:	North–south cross-section of Project geology	3-34
Figure 3.19:	Soil management units for the Project	3-36
Figure 3.20:	IAs and agricultural and classes within the Project area	3-38
Figure 3.21:	Referable wetlands	3-39
Figure 3.22:	Conceptual cross-sections of the Project access/haulage road	3-42
Figure 3.23:	Conceptual designs of the Phillips Creek and One Mile Creek Crossings	3-43
Figure 3.24:	Proposed layout of the mine infrastructure area	3-45
Figure 3.25:	Conceptual diversion drain cross-section	3-49
Figure 3.26:	Indicative mine progression plans—underground mining	3-53
Figure 3.27:	Indicative mine progression plan—open-cut pit mining	3-54
Figure 3.28:	Lake Vermont Meadowbrook Complex—life of mine production profile	3-55
Figure 3.29:	Mine stage plan—Project Year 2	3-56
Figure 3.30:	Mine stage plan—Project Year 7	3-57
Figure 3.31:	Mine stage plan—Project Year 12	3-58
Figure 3.32:	Mine stage plan—Project Year 17	3-59
Figure 3.33:	Mine stage plan—Project Year 22	3-60
Figure 3.34:	Mine stage plan—Project Year 27	3-61
Figure 3.35:	Mine stage plan—end of all mining	3-62
Figure 3.36:	Longwall Mining Method Schematic	3-63
Figure 3.37:	SIS Gas Drainage Underground Installation Example	3-65
Figure 3.38:	Example SIS gas drainage relocatable skid	3-66
Figure 3.39:	Example venturi skid equipment	3-67
Figure 3.40:	Example flare installation	3-68
Figure 3.41:	Vertical goaf gas wells—example installation	3-69
Figure 3.42:	Post-closure flood model in relation to open-cut infrastructure	3-72
Figure 3.43:	CHPP module schematic	3-75
Figure 3.44:	Lake Vermont Mine infrastructure	3-76
Figure 4.1:	Regional weather station locations	4-2
Figure 4.2:	Mean monthly rainfall in the Project area surrounds	4-4
Figure 4.3:	Mean monthly maximum and minimum temperatures in the Project area surrounds	4-5



Figure 4.4:	Seasonal wind speeds and direction recorded at Clermont Airport	4-6
Figure 5.1:	Local topography and watercourses	5-4
Figure 5.2:	Soil management units.....	5-7
Figure 5.3:	Current land use of the Project area	5-11
Figure 5.4:	Queensland agricultural land audit–IAAs.....	5-12
Figure 5.5:	IAAs and agricultural land classes within the Project area.....	5-14
Figure 5.6:	Areas of regional interest.....	5-17
Figure 5.7:	Visual amenity viewshed analysis methodology.....	5-24
Figure 5.8:	Predicted subsidence after underground mining	5-27
Figure 5.9:	Viewshed analysis results of potentially impacted sensitive receptors.....	5-37
Figure 6.1:	Current land use of Project area	6-6
Figure 6.2:	Proposed post-mining land use.....	6-3
Figure 6.3:	Project rehabilitation areas.....	6-7
Figure 6.4:	Stage Plan 2036.....	6-9
Figure 6.5:	Stage Plan 2051.....	6-10
Figure 6.6:	Stage Plan 2056.....	6-11
Figure 6.7:	Stage Plan 2065.....	6-12
Figure 6.8:	Indicative ponding and drainage plan	6-18
Figure 6.9:	Current/planned co-disposal areas and South Pit final void - Lake Vermont Mine	6-21
Figure 6.10:	Volume and disposal location of reject - Lake Vermont Mine and the Project combined	6-22
Figure 7.1:	Project groundwater monitoring bores	7-6
Figure 7.2:	Groundwater levels for Tertiary sediments	7-7
Figure 7.3:	Groundwater levels for Leichhardt seam.....	7-8
Figure 7.4:	Groundwater levels for Vermont seam.....	7-9
Figure 7.5:	Location of HES wetlands in relation to Project subsidence	7-16
Figure 7.6:	Conceptual groundwater model	7-18
Figure 7.7:	Post-mining conceptual groundwater model.....	7-22
Figure 7.8:	Groundwater inflow rate to Meadowbrook open-cut	7-24
Figure 7.9:	Predicted maximum Quaternary alluvium drawdown.....	7-26
Figure 7.10:	Predicted water level drawdown and recovery for Tertiary sediments	7-27
Figure 7.11:	Predicted water level drawdown and recovery for Rewan Group.....	7-28
Figure 7.12:	Predicted water level drawdown and recovery for Leichardt seam	7-30
Figure 7.13:	Predicted water level drawdown and recovery for Vermont seam	7-31
Figure 7.14:	Difference Between Base-Case and Fracture to Surface Drawdown - Layer 2	7-33
Figure 7.15:	Difference Between Base-Case and Fracture to Surface Drawdown - Rewan Group	7-34
Figure 7.16:	Difference Between Base-Case and Fracture to Surface Drawdown - Leichhardt Seam	7-35
Figure 7.17:	Location of HES wetlands in relation to predicted Tertiary sediment drawdown	7-37
Figure 8.1:	Catchments draining through the Project area.....	8-7
Figure 8.2:	Existing and approved watercourse diversions in the vicinity of the Project.	8-8
Figure 8.3:	Frequency of daily flows recorded at Phillips Creek at Tayglen.....	8-10
Figure 8.4:	Map of monitoring locations used in collection of baseline data	8-11
Figure 8.5:	Mine affected water release history of Lake Vermont Mine	8-17
Figure 8.6:	Indicative cross drainage and flow diversion drains.	8-23
Figure 8.7:	Changes in One Mile Creek catchment	8-24
Figure 8.8:	Water management system schematic.....	8-29
Figure 8.9:	Proposed catchment and land use boundaries (Project Year 20–26)	8-32
Figure 8.10:	Proposed catchment and land use boundaries (Project Year 27–28)	8-33
Figure 8.11:	Proposed catchment and land use boundaries (Project Year 29–30)	8-34
Figure 9.1:	Project watercourses and topography.....	9-2
Figure 9.2:	Isaac River catchment regional model (XP-RAFTS regional configuration).....	9-4
Figure 9.3:	Local creeks catchment model (XP-RAFTS local configuration)	9-5
Figure 9.4:	Conceptual levee cross-section.....	9-10
Figure 9.5:	Proposed MIA levee alignment with chainage in metres	9-12
Figure 9.6:	Proposed open-cut mining area levee alignment with chainage in metres.....	9-13
Figure 9.7:	Conceptual diversion drain cross-section	9-14
Figure 9.8:	1% AEP approved conditions local flood depths and heights	9-17
Figure 9.9:	1% AEP developed condition flood depth and heights local flooding	9-18



Figure 9.10: 1% AEP afflux (2051 conditions minus approved conditions)..... 9-20

Figure 9.11: 1% AEP 2051 conditions local flood velocity..... 9-21

Figure 9.12: 1% AEP 2051 velocity difference (2051 conditions minus approved conditions) 9-22

Figure 9.13: Residual ponding areas and proposed mitigations 9-26

Figure 9.14: Post-closure conditions 0.1% AEP depth 9-28

Figure 9.15: Post-closure conditions 0.1% AEP velocity..... 9-29

Figure 10 1: Waterways and topography..... 10-2

Figure 10 2: Flora survey sites..... 10-8

Figure 10 3: Fauna survey sites 10-9

Figure 10 4: GDE assessment targeted for field assessment 10-11

Figure 10 5: Ground-truthed vegetation communities within the study area..... 10-15

Figure 10 6: Threatened ecological communities within the study area 10-17

Figure 10 7: Location of GDE Type 1 and GDE Type 2 areas 10-21

Figure 10 8: Boomerang Creek GDE dry season scenario 10-22

Figure 10 9: Boomerang Creek GDE flooding regime..... 10-22

Figure 10 10: Groundwater dependent wetland on perched groundwater lenses dry season scenario 10-23

Figure 10 11: Groundwater dependent wetland on perched groundwater lenses flooding regime 10-23

Figure 10 12: Project impact footprint..... 10-25

Figure 10 13: Location of known and potential GDEs relative to groundwater drawdown 10-33

Figure 10 14: Brigalow TEC significant impact areas..... 10-50

Figure 10 15: Poplar Box TEC significant impact areas 10-56

Figure 10 16: Ornamental Snake habitat mapping 10-59

Figure 10 17: Predicted subsidence extent in Ornamental Snake habitat..... 10-62

Figure 10 18: Ornamental Snake significant impact areas 10-68

Figure 10 19: Squatter Pigeon habitat mapping 10-76

Figure 10 20: Australian Painted Snipe habitat mapping..... 10-83

Figure 10 21: Koala habitat mapping 10-90

Figure 10 22: Koala significant impact areas..... 10-98

Figure 10 23: Greater Glider habitat mapping..... 10-102

Figure 10 24: Greater Glider significant impact areas 10-108

Figure 10 25: Proposed stage 1 - 3 offset area and connectivity 10-134

Figure 10 26: Potential MSES offset areas 10-137

Figure 11.1: Fitzroy River Basin 11-4

Figure 11.2: Brigalow Belt Bioregion 11-5

Figure 11.3: Aquatic ecology study area and survey sites 11-1

Figure 11.4: Mapped potential GDEs from Commonwealth assessment 11-7

Figure 11.5: Groundwater Dependent Ecosystem survey sites 11-8

Figure 11.6: Stygofauna survey bores..... 11-12

Figure 11.7: Waterway Barrier Works risk mapping of waterways within the study area 11-15

Figure 11.8: Map of mitigated subsidence-induced ponding and location of mitigation measures..... 11-18

Figure 11.9: Change in downstream flood hydrograph - Boomerang/ One Mile Creek 50% AEP 11-19

Figure 11.10: Change in downstream flood hydrograph - Boomerang/ One Mile Creek 2% AEP 11-19

Figure 11.11: Map showing records of Fitzroy River Turtle within the Fitzroy River Basin 11-29

Figure 11.12: Map showing records of Southern Snapping Turtle within the Fitzroy River Basin..... 11-34

Figure 13.1: Surrounding terrain in the Project area 13-4

Figure 13.2: Moranbah weather stations..... 13-7

Figure 13.3: Annual distribution of the TAPM/CALMET generated winds for the Project site 13-8

Figure 13.4: Proportion of stability class by hour of day 13-8

Figure 13.5: Box and whisker plot of mixing height data at the Project by hour of day..... 13-9

Figure 13.6: Sensitive receptors..... 13-12

Figure 13.7: Project location in respect of existing and proposed mining projects..... 13-16

Figure 13.8: Predicted annual average TSP ($\mu\text{g}/\text{m}^3$) cumulative emissions Year 7 13-20

Figure 13.9: Predicted maximum monthly dust deposition ($\text{mg}/\text{m}^2/\text{day}$) cumulative emissions Year 7 13-20

Figure 13.10: Predicted annual average PM_{2.5} ($\mu\text{g}/\text{m}^3$) cumulative emissions Year 7..... 13-21

Figure 13.11: Predicted 24-hour maximum PM_{2.5} ($\mu\text{g}/\text{m}^3$) cumulative emissions Year 7 13-21

Figure 13.12: Predicted annual average PM₁₀ ($\mu\text{g}/\text{m}^3$) cumulative emissions Year 7..... 13-22

Figure 13.13: Predicted 24-hour maximum PM₁₀ ($\mu\text{g}/\text{m}^3$) cumulative emissions Year 7 13-22



Figure 13.14: Predicted 6th highest PM10 ($\mu\text{g}/\text{m}^3$) cumulative emissions Year 7 13-23

Figure 13.15: Predicted annual average TSP ($\mu\text{g}/\text{m}^3$) cumulative emissions Year 22 13-27

Figure 13.16: Predicted maximum monthly dust deposition ($\text{mg}/\text{m}^2/\text{day}$) cumulative emissions Year 22 13-27

Figure 13.17: Predicted annual average PM2.5 levels ($\mu\text{g}/\text{m}^3$) cumulative emissions for Year 22 13-28

Figure 13.18: Predicted 24-hour maximum PM2.5 levels ($\mu\text{g}/\text{m}^3$) cumulative emissions for Year 22 13-28

Figure 13.19: Predicted annual average PM10 levels ($\mu\text{g}/\text{m}^3$) cumulative emissions for Year 22 13-29

Figure 13.20: Predicted 24-hour maximum PM10 levels ($\mu\text{g}/\text{m}^3$) cumulative emissions for Year 22 13-29

Figure 13.21: Predicted 6th highest PM10 24hr levels ($\mu\text{g}/\text{m}^3$) cumulative emissions for Year 22 13-30

Figure 14.1: Identified potential sensitive receptors near to the Project 14-7

Figure 14.2: Noise contours for Project Year 7, daytime scenario (D2) 14-13

Figure 14.3: Noise contours for Project Year 22, daytime scenario (D2) 14-14

Figure 14.4: Noise contours for Project Year 7, night-time scenario (N1) 14-15

Figure 14.5: Noise contours for Project Year 22, night-time scenario (N1) 14-16

Figure 14.6: Project location in respect of existing and proposed mining projects 14-18

Figure 15.1: Waste and resource management hierarchy (after DSDMIP 2019) 15-8

Figure 15.2: Water resource use material flow analysis for construction phase 15-17

Figure 15.3: Water resource use material flow analysis for operational phase 15-18

Figure 15.4: Electricity resource use energy flow analysis 15-18

Figure 17.1: Identified scar tree locations 17-2

Figure 17.2: Non-Indigenous cultural heritage sites 17-5

Figure 18.1: SIA study area 18-3

Figure 19.1: Map of the Project's EIA Catchment 19-1

Figure 20.1: Existing road network 20-3

Figure 20.2: Indicative workforce projections 20-7

Figure 20.3: Rail, sea and air transport facilities 20-13

Figure 21.1: Jellinbah Group Environmental Policy 21-3

Figure 21.2: The CIMIC Global Environmental Policy 21-4

Figure 21.3: Project location 21-6

Figure 21.4: Brigalow Belt Bioregion 21-7

Figure 21.5: Isaac-Connors sub-catchment of the Fitzroy Basin 21-8

Figure 21.6: Isaac-Connors Groundwater Management Area 21-9

Figure 21.7: Regional planning interest areas 21-10

Figure 21.8: Queensland Agricultural Land Audit – Important Agricultural Area 21-11

Figure 21.9: Native Title determinations 21-13

Figure 21.10: Project layout 21-14

Figure 21.11: Project watercourses and topography 21-15

Figure 21.12: Geology of the Project site 21-17

Figure 21.13: Surface geology of the Project site 21-18

Figure 21.14: West–east geological cross-sections of the Project site 21-20

Figure 21.15: North–south geological cross-sections of the Project site 21-21

Figure 21.16: EIS process flowchart 21-24

Figure 21.17: Conceptual cross-sections of the Project access/haulage road 21-30

Figure 21.18: Conceptual designs of the Phillips Creek and One Mile Creek Crossings 21-31

Figure 21.19: Proposed layout of the mine infrastructure area 21-33

Figure 21.20: Indicative mine progression plan— underground mining 21-41

Figure 21.21: Indicative mine progression plan – open-cut pit mining 21-42

Figure 21.22: Lake Vermont Meadowbrook Complex— Life of Mine Production Profile 21-43

Figure 21.23: Mine stage plan – Project Year 2 21-44

Figure 21.24: Mine stage plan – Project Year 7 21-45

Figure 21.25: Mine stage plan – Project Year 12 21-46

Figure 21.26: Mine stage plan – Project Year 17 21-47

Figure 21.27: Mine stage plan – Project Year 22 21-48

Figure 21.28: Mine stage plan – Project Year 27 21-49

Figure 21.29: Mine stage plan – end of all mining 21-50

Figure 21.30: Longwall mining schematic 21-51

Figure 21.31: SIS gas drainage underground installation example 21-53

Figure 21.32: Example SIS gas drainage relocatable skid 21-54



Figure 21.33: Example venturi skid equipment..... 21-55

Figure 21.34: Example flare installation..... 21-56

Figure 21.35: Vertical goaf gas wells— example installation 21-57

Figure 21.36: Conceptual diversion drain cross-section 21-59

Figure 21.37: Post-closure flood model in relation to open-cut infrastructure 21-62

Figure 21.38: CHPP module schematic 21-65

Figure 21.39: Lake Vermont Mine Infrastructure 21-66

Figure 21.40: Existing road network 21-70

Figure 21.41: Catchments draining through the Project area..... 21-83

Figure 21.42: Existing and approved watercourse diversions..... 21-84

Figure 21.43: Frequency of daily flows recorded at Phillips Creek at Tayglen..... 21-86

Figure 21.44: Map of monitoring locations used in collection of baseline data 21-88

Figure 21.45: Maximum subsidence extent and depth..... 21-98

Figure 21.46: Changes in One Mile Creek catchment 21-99

Figure 21.47: Water management system schematic..... 21-104

Figure 21.48: Proposed catchment and land use boundaries (Project Year 20–26) 21-107

Figure 21.49: Proposed catchment and land use boundaries (Project Year 27–28) 21-108

Figure 21.50: Proposed catchment and land use boundaries (Project Year 29–30) 21-109

Figure 21.51: Isaac River catchment regional model (XP-RAFTS regional configuration) 21-116

Figure 21.52: Local creeks catchment model (XP-RAFTS local configuration) 21-119

Figure 21.53: Conceptual levee cross-section..... 21-123

Figure 21.54: Proposed MIA levee alignment with chainage in metres 21-124

Figure 21.55: Proposed open-cut mining area levee alignment with chainage in metres..... 21-125

Figure 21.56: Conceptual diversion drain cross-section 21-126

Figure 21.57: 1% AEP approved conditions local flood depths and heights 21-129

Figure 21.58: 1% AEP developed condition flood depth and heights local flooding 21-130

Figure 21.59: 1% AEP afflux (2051 conditions minus approved conditions)..... 21-131

Figure 21.60: 1% AEP 2051 conditions local flood velocity..... 21-132

Figure 21.61: 1% AEP 2051 velocity difference (2051 conditions minus approved conditions) 21-133

Figure 21.62: Residual ponding areas and proposed mitigations 21-138

Figure 21.63: Post closure conditions 0.1% AEP depth..... 21-140

Figure 21.64: Post closure conditions 0.1% AEP velocity 21-141

Figure 21.65: Project groundwater monitoring bores 21-152

Figure 21.66: Groundwater levels for tertiary sediments..... 21-153

Figure 21.67: Groundwater levels for Leichhardt coal seam 21-154

Figure 21.68: Groundwater levels for Vermont coal seam 21-155

Figure 21.69: Location of HES wetlands and Tertiary sediment drawdown 21-161

Figure 21.70: Subsidence impacts on surface features..... 21-162

Figure 21.71: Conceptual groundwater model 21-164

Figure 21.72: Post-mining conceptual groundwater model..... 21-168

Figure 21.73: Groundwater inflow rate to Meadowbrook open-cut 21-170

Figure 21.74: Predicted maximum Quaternary alluvium drawdown..... 21-173

Figure 21.75: Predicted water level drawdown and recovery for Tertiary sediments 21-174

Figure 21.76: Predicted water level drawdown and recovery for Rewan group 21-175

Figure 21.77: Predicted water level drawdown and recovery for Leichhardt coal seam..... 21-176

Figure 21.78: Predicted water level drawdown and recovery for Vermont coal seam 21-177

Figure 21.79: Difference Between Base-Case and Fracture to Surface Drawdown - Layer 2 21-179

Figure 21.80: Difference Between Base-Case and Fracture to Surface Drawdown - Rewan Group 21-180

Figure 21.81: Difference Between Base-Case and Fracture to Surface Drawdown - Leichhardt Seam 21-181

Figure 21.82: Threatened flora species records within the Project locality..... 21-191

Figure 21.83: Conservation significant fauna species records within the Project locality 21-192

Figure 21.84: Migratory species records within the Project locality..... 21-194

Figure 21.85: Flora survey sites..... 21-243

Figure 21.86: Fauna survey sites 21-244

Figure 21.87: Ground-truthed vegetation communities within the study area..... 21-247

Figure 21.88: Threatened Ecological Communities within the study area 21-249

Figure 21.89: Project impact footprint..... 21-251



Figure 21.90: Brigalow TEC significant impact areas.....	21-282
Figure 21.91: Poplar Box TEC significant impact areas	21-291
Figure 21.92: Ornamental Snake habitat mapping	21-294
Figure 21.93: Ornamental Snake significant impact areas.....	21-305
Figure 21.94: Squatter Pigeon habitat mapping	21-313
Figure 21.95: Australian Painted Snipe habitat mapping.....	21-326
Figure 21.96: Koala habitat mapping	21-336
Figure 21.97: Koala significant impact areas.....	21-347
Figure 21.98: Greater Glider habitat mapping.....	21-351
Figure 21.99: Greater Glider significant impact areas	21-360
Figure 21.100: Aquatic ecology study area and survey sites	21-373
Figure 21.101: Waterway Barrier Works risk mapping of waterways within the study area	21-381
Figure 21.102: Map of mitigated subsidence-induced ponding and location of mitigation measures.....	21-383
Figure 21.103: Change in downstream flood hydrograph - Boomerang/One Mile Creek 50% AEP	21-384
Figure 21.104: Change in downstream flood hydrograph - Boomerang/One Mile Creek 2% AEP	21-384
Figure 21.105: Map showing records of Fitzroy River Turtle within the Fitzroy River Basin	21-396
Figure 21.106: Stygofauna baseline sampling sites.....	21-405
Figure 21.107: GDE areas targeted for field assessment	21-409
Figure 21.108: Confirmed location of GDE Type 1 and Type 2 areas.....	21-410
Figure 21.109: Boomerang Creek GDE dry season scenario	21-411
Figure 21.110: Boomerang Creek GDE flooding regime.....	21-411
Figure 21.111: Groundwater dependent wetland on perched groundwater lenses dry season scenario	21-412
Figure 21.112: Groundwater dependent wetland on perched groundwater lenses flooding regime	21-412
Figure 21.113: Location of GDE areas relative to predicted groundwater drawdown	21-413
Figure 21.114: Brigalow TEC significant impact areas.....	21-428
Figure 21.115: Poplar Box TEC significant impact areas	21-429
Figure 21.116: Ornamental Snake significant impact areas.....	21-430
Figure 21.117: Greater Glider significant impact areas	21-431
Figure 21.118: Koala significant impact areas.....	21-432
Figure 21.119: Proposed stage 1 - 3 offset area and connectivity.....	21-433



List of Tables

Table ES. 1:	Identified Class III risks and additional control measures	24
Table 1.1:	Relevant Commonwealth and State government legislation and policies.....	1-14
Table 1.2:	Threshold values	1-17
Table 1.3:	ERAs of the Project.....	1-20
Table 1.4:	Notifiable activities applicable to the Project	1-21
Table 1.5:	Human rights considerations	1-35
Table 1.6:	Summary of legislative considerations.....	1-37
Table 2.1:	Affected persons	2-2
Table 2.2:	Interested persons	2-3
Table 2.3:	Stakeholder analysis summary.....	2-7
Table 2.4:	Consultation register.....	2-8
Table 2.5:	Summary of stakeholder engagement and key matters raised	2-11
Table 3.1:	Overview of the Lake Vermont Meadowbrook Complex.....	3-15
Table 3.2:	Landholders underlying and/or adjacent to the Project	3-20
Table 3.3:	Coal and petroleum tenements	3-21
Table 3.4:	Bowen Basin regional stratigraphy	3-31
Table 3.5:	MIA Dam sizing.....	3-48
Table 3.6:	Approximate disturbance areas associated with construction.....	3-50
Table 3.7:	Provisional mine schedule—annual coal and waste production	3-51
Table 3.8:	Major underground equipment and mobile fleet.....	3-64
Table 3.9:	Major open-cut mining equipment list	3-74
Table 3.10:	Indicative list of hazardous substances.....	3-78
Table 3.11:	Disturbance associated with Project operations.....	3-79
Table 4.1:	Source of meteorological data	4-1
Table 4.2:	Long-term meteorological data summary	4-3
Table 4.3:	Summary of SILO modelled extreme temperatures for the Project area	4-8
Table 4.4:	Climate change projection summary under RCP8.5.....	4-9
Table 5.1:	Soil management units and landform characteristics.....	5-8
Table 5.2:	Soil sodicity and erodibility	5-9
Table 5.3:	Pre-mining land use suitability rating	5-15
Table 5.4:	Project site development interpreted from historical air photography	5-21
Table 5.5:	Visual amenity sensitive receptors	5-23
Table 5.6:	Potential contaminating activities.....	5-33
Table 5.7:	Resource tenements and regional interests	5-34
Table 5.8:	Project features with potential to impact visual amenity.....	5-35
Table 6.1:	Predicted topsoil volumes available for rehabilitation	6-4
Table 6.2:	Post mining land use outcomes	6-1
Table 6.3:	Identified rehabilitation areas.....	6-6
Table 6.4:	Modelled salinity of the rehabilitated pit measured as TDS	6-15
Table 6.5:	Annual rejects disposal location.....	6-22
Table 7.1:	Stratigraphy of the Project area and surrounds.....	7-4
Table 7.2:	Hydraulic conductivity summary statistics.....	7-10
Table 7.3:	Mean groundwater quality data—pH, electrical conductivity, major ions	7-11
Table 7.4:	Groundwater quality data—metals	7-12
Table 7.5:	Summary of groundwater bore information.....	7-13
Table 7.6:	Model layers and thickness.....	7-20
Table 7.7:	Predicted and design allowance inflow rates to underground workings.....	7-23
Table 7.8:	Predicted inflows to the open-cut pit	7-24
Table 7.9:	Meadowbrook Project groundwater monitoring bores.....	7-41
Table 7.10:	Lake Vermont North groundwater monitoring bores.....	7-42
Table 8.1:	EPP (Water) guideline values adopted for the upper Isaac River catchment waters	8-13
Table 8.2:	ISQG Values adopted for the Meadowbrook Project (ANZECC & ARMCANZ 2000)	8-15
Table 8.3:	Summary of event data from mine affected water releases (Lake Vermont Mine)	8-17



Table 9.1: Historical (calibration) flood events, Isaac River catchment 9-7

Table 9.2: MIA Dam sizing..... 9-14

Table 9.3: Sediment dam sizing 9-15

Table 9.4: Summary of consequence category assessment (dams) 9-32

Table 10 1: Summary of fauna survey effort 10-5

Table 10 2: Ground-truthed vegetation communities within the study area 10-12

Table 10 3: Conservation significant fauna species recorded within the study area..... 10-18

Table 10 4: State declared introduced flora 10-19

Table 10 5: Proposed disturbance of vegetation communities 10-26

Table 10 6: Risk assessment for potential impacts to GDEs and residual risk scores 10-35

Table 10 7: Brigalow TEC extent of disturbance to each patch 10-45

Table 10 8: Brigalow TEC significant impact assessment..... 10-48

Table 10 9: Poplar Box TEC extent of disturbance to each patch 10-52

Table 10 10: Poplar Box TEC significant impact assessment..... 10-54

Table 10 11: Ornamental Snake habitat amenity assessment criteria 10-60

Table 10 12: Proposed Project footprint within Ornamental Snake habitat 10-61

Table 10 13: Ornamental Snake significant impact assessment..... 10-65

Table 10 14: White-throated Needletail significant impact assessment 10-72

Table 10 15: Squatter Pigeon habitat description and occurrence 10-75

Table 10 16: Proposed Project footprint within Squatter Pigeon habitat 10-78

Table 10 17: Squatter Pigeon significant impact assessment 10-80

Table 10 18: Australian Painted Snipe habitat description..... 10-84

Table 10 19: Proposed disturbance of Australian Painted Snipe habitat 10-85

Table 10 20: Australian Painted Snipe significant impact assessment 10-86

Table 10 21: Koala habitat description and occurrence 10-91

Table 10 22: Estimated tree density per hectare for dominant RE’s within the study area 10-92

Table 10 23: Proposed disturbance of Koala habitat..... 10-93

Table 10 24: Koala significant impact assessment..... 10-95

Table 10 25: Greater Glider habitat amenity assessment criteria 10-100

Table 10 26: Proposed disturbance of Greater Glider habitat..... 10-101

Table 10 27: Greater Glider significant impact assessment..... 10-105

Table 10 28: Migratory species significant impact assessment 10-113

Table 10 29: Summary of impacts to MSES 10-115

Table 10 30: Endangered and Of Concern Regional Ecosystems impact summary 10-118

Table 10 31: Short-beaked Echidna significant impact assessment 10-122

Table 10 32: Summary of impacts to MSES 10-130

Table 10 33: MNES impacts and proposed offset areas 10-133

Table 10 34: Proposed MSES offset delivery strategy 10-136

Table 11.1: Aquatic ecology survey site locations and ecological indicators assessed..... 11-2

Table 11.2: Likelihood of occurrence assessment outcomes for conservation significant species 11-3

Table 11.3: Aquatic fauna survey effort..... 11-5

Table 11.4: Significant impact assessment for the Fitzroy River Turtle 11-32

Table 11.5: Significant impact assessment for the Southern Snapping Turtle 11-36

Table 11.6: Prescribed wetlands significant impact assessment 11-38

Table 11.7: Significant residual impact assessment for waterways providing fish passage 11-40

Table 12.1: Introduced fauna species 12-2

Table 12.2: State declared introduced flora 12-3

Table 12.3: Monitoring objectives, criteria and actions 12-9

Table 13.1: Project objectives 13-2

Table 13.2: Frequency distribution of surface atmospheric stability conditions..... 13-6

Table 13.3: Sensitive receptors..... 13-10

Table 13.4: Dust emissions reported to NPI for 2019/2020 13-13

Table 13.5: Ambient background concentrations..... 13-13

Table 13.6: Predicted annual average TSP and dust deposition rates for Project Year 7 13-18

Table 13.7: Predicted 24 hour and annual average PM2.5 and PM10 for Project Year 7 13-19

Table 13.8: Predicted annual average TSP and dust deposition rates for Project Year 22 13-24

Table 13.9: Predicted 24-hour and annual average PM2.5 and PM10 for Year 22 13-25



Table 13.10:	Scopes 1, 2 and 3 emissions	13-31
Table 13.11:	Summary of energy content and emissions factors	13-32
Table 13.12:	Comparison of estimated Project annual State and National GHG emissions.....	13-33
Table 13.13:	Estimated Project annual Scope 1 and 2 GHG emissions and energy use	13-34
Table 13.14:	Estimated Project and Lake Vermont Mine annual Scope 1 and 2 GHG emissions	13-37
Table 13.15:	Estimated annual Scope 3 GHG emissions for the Project.....	13-40
Table 13.16:	Cumulative annual Scope 3 GHG emissions for the Project and Lake Vermont Mine	13-43
Table 14.1:	Acoustic quality objectives as per Schedule 1 of the EPP (Noise).....	14-2
Table 14.2:	Noise limits and associated notes for the existing Lake Vermont Mine	14-3
Table 14.3:	Blasting noise limits for the existing Lake Vermont Mine	14-3
Table 14.4:	Noise limits proposed for the Project	14-4
Table 14.5:	Airblast overpressure and ground vibration limits proposed for the Project	14-5
Table 14.6:	Identified sensitive receptors for the Project	14-6
Table 14.7:	SRs excluded from modelling and the rationale for exclusion	14-8
Table 14.8:	Summary of background noise levels	14-9
Table 14.9:	Meteorological Scenarios.....	14-11
Table 14.10:	Predicted A-weighted noise levels (Leq dBA).....	14-12
Table 15.1:	Estimated annual mineral waste generation in relation to coal output	15-4
Table 15.2:	Waste streams and potential impacts	15-6
Table 15.3:	Risk of causing harm level determination	15-10
Table 15.4:	Anticipated waste generation and management strategies	15-11
Table 15.5:	Treated effluent for irrigation quality release limits	15-20
Table 15.6:	Performance indicators for waste management	15-24
Table 16.1:	Consequence of impacts	16-3
Table 16.2:	Likelihood criteria.....	16-4
Table 16.3:	Risk analysis matrix	16-4
Table 16.4:	Risk level actions	16-4
Table 16.5:	Consequence classification	16-5
Table 16.6:	Hazard identification for site workers’ health and safety.....	16-7
Table 16.7:	Anticipated hazardous materials and dangerous goods	16-10
Table 16.8:	Identified Class III risks	16-17
Table 16.9:	Emergency Response Plan key elements	16-21
Table 17.1:	Identified non-Indigenous cultural heritage sites	17-4
Table 18.1:	Summary of Project social impacts	18-11
Table 18.2:	Workforce management measures.....	18-23
Table 18.3:	Housing and accommodation management measures.....	18-28
Table 18.4:	Local business and industry procurement measures.....	18-31
Table 18.5:	Health and community wellbeing measures.....	18-36
Table 19.1:	Summary of beneficial economic impacts of the Project	19-3
Table 19.2:	Summary of potential adverse economic impacts of the Project	19-4
Table 19.3:	Summary of potential adverse cumulative impacts.....	19-7
Table 20.1:	Level of service definitions.....	20-5
Table 20.2:	Predicted Project workforce generated traffic	20-8
Table 20.3:	Predicted Project generated heavy vehicle traffic	20-8
Table 21.1:	Bowen Basin regional stratigraphy	21-16
Table 21.2:	Relevant Commonwealth and State government legislation and policies.....	21-25
Table 21.3:	MIA Dam sizing.....	21-35
Table 21.4:	Approximate disturbance areas associated with construction.....	21-37
Table 21.5:	Provisional mine schedule— annual coal and waste production.....	21-38
Table 21.6:	Major underground equipment and mobile fleet.....	21-52
Table 21.7:	Major open-cut mining equipment list	21-63
Table 21.8:	Indicative list of hazardous substances.....	21-67
Table 21.9:	Approximate disturbance areas associated with operations.....	21-68
Table 21.10:	EPP (Water) guideline values adopted for the upper Isaac River catchment waters	21-89
Table 21.11:	ISQG Values adopted for the Meadowbrook Project.....	21-91
Table 21.12:	Assessment of significant impact on changes to hydrological characteristics.....	21-113
Table 21.13:	Assessment of significant impact on changes to water quality	21-114



Table 21.14: Historical (calibration) flood events, Isaac River catchment..... 21-118

Table 21.15: MIA Dam sizing..... 21-126

Table 21.16: Sediment dam sizing 21-127

Table 21.17: Summary of consequence category assessment (dams) 21-143

Table 21.18: Stratigraphy of the Project area and surrounds..... 21-148

Table 21.19: Hydraulic conductivity summary statistics..... 21-150

Table 21.20: Mean groundwater quality data - pH, electrical conductivity, major ions..... 21-156

Table 21.21: Groundwater quality data - metals 21-158

Table 21.22: Summary of groundwater bore information..... 21-159

Table 21.23: Model layers and thickness..... 21-165

Table 21.24: Predicted and design allowance inflow rates to underground workings..... 21-169

Table 21.25: Predicted inflows to the open-cut pit 21-170

Table 21.26: Meadowbrook Project groundwater monitoring bores..... 21-183

Table 21.27: Lake Vermont North groundwater monitoring bores..... 21-184

Table 21.28: Assessment of significant impact on geohydrological characteristics 21-187

Table 21.29: Assessment of significant impact on changes to groundwater quality..... 21-188

Table 21.30: EPBC Act listed Threatened flora and fauna species known records 21-190

Table 21.31: EPBC Act listed migratory species known records 21-193

Table 21.32: Criteria adopted for likelihood of occurrence determination..... 21-195

Table 21.33: Flora species of conservation significance likelihood of occurrence 21-196

Table 21.34: Fauna species of conservation significance likelihood of occurrence..... 21-204

Table 21.35: Summary of fauna survey effort 21-240

Table 21.36: Ground-truthed vegetation communities within the study area..... 21-245

Table 21.37: Conservation significant fauna species recorded within the study area..... 21-250

Table 21.38: Proposed disturbance of vegetation communities 21-254

Table 21.39: Proposed disturbance of major habitat types within the study area 21-256

Table 21.40: Vegetation within subsidence footprint excluding ponding areas..... 21-260

Table 21.41: Brigalow TEC extent of disturbance to each patch 21-273

Table 21.42: Brigalow TEC impact avoidance and mitigation measures 21-277

Table 21.43: Brigalow TEC significant impact assessment..... 21-280

Table 21.44: Poplar Box TEC Extent of Disturbance to each Patch..... 21-284

Table 21.45: Poplar Box TEC impact avoidance and mitigation measures 21-286

Table 21.46: Poplar Box TEC significant impact assessment..... 21-289

Table 21.47: Ornamental Snake habitat amenity assessment criteria 21-295

Table 21.48: Proposed disturbance of Ornamental Snake habitat..... 21-296

Table 21.49: Ornamental Snake impact avoidance and mitigation measures..... 21-299

Table 21.50: Ornamental Snake significant impact assessment..... 21-302

Table 21.51: White-throated Needletail impact avoidance and mitigation measures..... 21-308

Table 21.52: White-throated Needletail significant impact assessment 21-310

Table 21.53: Squatter Pigeon habitat description and occurrence 21-314

Table 21.54: Proposed Project footprint within Squatter Pigeon habitat 21-315

Table 21.55: Squatter Pigeon impact avoidance and mitigation measures..... 21-317

Table 21.56: Squatter Pigeon significant impact assessment..... 21-321

Table 21.57: Australian Painted Snipe habitat description..... 21-325

Table 21.58: Proposed disturbance of Australian Painted Snipe habitat 21-327

Table 21.59: Australian Painted Snipe impact avoidance and mitigation measures 21-328

Table 21.60: Australian Painted Snipe significant impact assessment 21-332

Table 21.61: Koala habitat description and occurrence 21-337

Table 21.62: Estimated tree density per hectare for dominant RE’s within the study area..... 21-337

Table 21.63: Proposed disturbance of Koala habitat..... 21-338

Table 21.64: Koala impact avoidance and mitigation measures..... 21-340

Table 21.65: Koala significant impact assessment..... 21-344

Table 21.66: Greater Glider habitat amenity assessment criteria 21-349

Table 21.67: Proposed disturbance of Greater Glider habitat..... 21-353

Table 21.68: Greater Glider impact avoidance and mitigation measures 21-355

Table 21.69: Greater Glider significant impact assessment..... 21-357

Table 21.70: Impact assessment of other threatened species 21-361



Table 21.71:	Migratory Species impact avoidance and mitigation measures	21-368
Table 21.72:	Migratory species significant impact assessment	21-372
Table 21.73:	Likelihood of occurrence assessment outcomes; conservation significant aquatic spp.....	21-375
Table 21.74:	Aquatic fauna survey effort.....	21-376
Table 21.75:	Significant impact assessment for the Fitzroy River Turtle	21-398
Table 21.76:	Significant impact assessment for the Southern Snapping Turtle	21-402
Table 21.77:	Stygofauna baseline survey sampling sites	21-404
Table 21.78:	Stakeholder analysis summary	21-415
Table 21.79:	MNES significant impact summary.....	21-424
Table 21.80:	MNES impacts and proposed offset areas	21-427